wintering habitats, and the continued activity by many fishes during the winter, need to be considered when making management decisions regarding fish habitat. How habitat is affected by land-use activity in stream catchments is discussed with reference to impacts from water withdrawal, varying discharge regimes, and erosion or sedimentation. Even stream enhancement practices can deleteriously affect stream habitat if project managers are unaware of winter habitat requirements and stream conditions. Maintenance of habitat complexity, at least at the scale of stream sub-basin, is recommended to ensure the diversity of winter habitats for fish communities.

Lentic Habitats (Estuaries, Lakes, Ponds, Wetlands)

1576. **Achieving restoration success: Myths in bottomland hardwood forests.**
Stanturf, J. A.; Schoenholtz, S. H.; Schweitzer, C. J.; and Shepard, J. P.
Restoration Ecology 9(2): 189-200. (2001)
NAL Call #: QH541.15.R45R515; ISSN: 10612971.
Notes: doi: 10.1046/j.1526-100X.2001.009002189.x.
Descriptors: afforestation/ functions/ Wetlands Reserve Program/ afforestation/ ecosystem function/ floodplain forest/ restoration ecology/ United States
Abstract: Restoration of bottomland hardwood forests is the subject of considerable interest in the southern United States, but restoration success is elusive. Techniques for establishing bottomland tree species are well developed, yet problems have occurred in operational programs. Current plans for restoration on public and private land suggest that as many as 200,000 hectares could be restored in the Lower Mississippi Alluvial Valley alone. The ideal of ecological restoration is to reestablish a completely functioning ecosystem. Although some argue that afforestation is incomplete restoration, it is a necessary and costly first step but not an easy task. The 1992 Wetlands Reserve Program in Mississippi, which failed on 90% of the area, illustrates the difficulty of broadly applying our knowledge of afforestation. In our view, the focus for ecological restoration should be to restore functions, rather than specifying some ambiguous natural state based on reference stands or pre-settlement forest conditions. We view restoration as one element in a continuum model of sustainable forest management, allowing us to prescribe restoration goals that incorporate land-owner objectives. Enforcing the discipline of explicit terms of predicted values of functions, causal mechanisms and temproal response trajectories, will hasten the development of meaningful criteria for restoration success. We present our observations about current efforts to restore bottomland hardwoods as nine myths, or statements of dubious origin, and at best partial truth.

1577. **Addressing wetland issues: The Kansas NRCS approach.**
Soffran, L. M. and McDowell, J. L.
In: Proceedings of the 2004 Self-Sustaining Solutions for Streams, Wetlands, and Watersheds Conference. D'Ambrosio J.L. (eds.)
St Paul, MN; pp. 215-220 ; 2004.
Notes: Sponsors: American Society of Agricultural Engineers, ASAE; Ohio State University; Ohio Department of Natural Resources; EPA Great Lakes Grants Program; National Fish and Wildlife Foundation; U.S. Enviromental Protection Agency.; ISBN: 1892769441
Descriptors: HGM/ hydrogeomorphic/ minimal effects/ mitigation/ wetland functions/ wetlands/ agriculture/ biodiversity/ geomorphology/ water levels
Abstract: Frequently a wetland in Kansas has been manipulated to improve farming operations or provide a reliable water source for livestock. When a wetland has been converted in violation of wetland provisions, restoration or enhancement of the remaining wetland is the primary approach used to regain the lost wetland acreage and functional capacity units. In Kansas, the Natural Resources Conservation Service (NRCS) has adopted the Hydrogeomorphic (HGM) Model procedure for assessing wetland functions and values. Four interim HGM models are being used for minimal effects determinations and for mitigations of converted wetlands. The Playa Depression Model is used in the High Plains Playa region of Kansas. A Depression Model is being applied to non-riverine type depressions in the remainder of the state east of the playa region boundary. A Slope Model is used for hillside seeps, and a Riverine Model applies to wooded and herbaceous riverine settings. Structures are frequently constructed as a component of wetland restoration and creation, and land entered into the Wetland Reserve Program or Conservation Reserve Program. The structural design may include a dike or other type of water impoundment structure. A water level control structure may be included in the design when the objective is shallow water wetlands for wildlife.

1578. **Agricultural chemicals and prairie pothole wetlands: Meeting the needs of the resource and the farmer - U.S. perspective.**
Grue, C. E.; Tome, M. W.; Messmer, T. A.; Henry, D. B.; Swanson, G. A.; and DeWeese, L. R.
Transactions of the North American Wildlife and Natural Resource Conference 54: 43-58. (1989)
NAL Call #: 412.9 N814; ISSN: 0078-1355
Descriptors: agricultural activity/ prairie wetland ecosystems/ ecology/ agrichemicals/ semiaquatic habitat/ grassland/ chemical pollution/ United States, north central region/ wetland conservation

1579. **Agricultural ponds support amphibian populations.**
Knutson, Melinda G.; Richardson, William B.; Reineke, David M.; Gray, Brian R.; Parmelee, Jeffrey R.; and Weick, Shawn E.
Ecological Applications 14(3): 669-684. (2004)
NAL Call #: QH540.E23; ISSN: 1051-0761
Descriptors: wetlands/ Ambystoma tigrinum/ Caudata/ agricultural ponds/ agriculture/ communities/ conservation/

ecosystems/ freshwater ecology/ habitat management/ habitat use/ Minnesota, Houston County/ Minnesota, Winona County/ land zones/ Minnesota/ nitrogen/ phosphorus/ ponds/ productivity/ reproduction/ reproductive success/ species diversity/ wildlife/ tiger salamander
Abstract: In some agricultural regions, natural wetlands are scarce, and constructed agricultural ponds may represent important alternative breeding habitats for amphibians. Properly managed, these agricultural ponds may effectively increase the total amount of breeding habitat and help to sustain populations. We studied small, constructed agricultural ponds in southeastern Minnesota to assess their value as amphibian breeding sites. Our study examined habitat factors associated with amphibian reproduction at two spatial scales: the pond and the landscape surrounding the pond. We found that small agricultural ponds in southeastern Minnesota provided breeding habitat for at least 10 species of amphibians. Species richness and multispecies reproductive success were more closely associated with characteristics of the pond (water quality, vegetation, and predators) compared with characteristics of the surrounding landscape, but individual species were associated with both pond and landscape variables. Ponds surrounded by row crops had similar species richness and reproductive success compared with natural wetlands and ponds surrounded by non-grazed pasture. Ponds used for watering livestock had elevated concentrations of phosphorus, higher turbidity, and a trend toward reduced amphibian reproductive success. Species richness was highest in small ponds, ponds with lower total nitrogen concentrations, tiger salamanders (Ambystoma tigrinum) present, and lacking fish. Multispecies reproductive success was best in ponds with lower total nitrogen concentrations, less emergent vegetation, and lacking fish. Habitat factors associated with higher reproductive success varied among individual species. We conclude that small, constructed farm ponds, properly managed, may help sustain amphibian populations in landscapes where natural wetland habitat is rare. We recommend management actions such as limiting livestock access to the pond to improve water quality, reducing nitrogen input, and avoiding the introduction of fish.

1580. **Agricultural production and wetland habitat quality in a coastal prairie ecosystem: Simulated effects of alternative resource policies on land-use decisions.**
Musacchio, L. R. and Grant, W. E.
Ecological Modelling 150(1-2): 23-43. (2002)
NAL Call #: QH541.15.M3E25; ISSN: 03043800.
Notes: doi: 10.1016/S0304-3800(01)00459-8.
Descriptors: ecosystem management/ land use/ migratory waterfowl/ natural resource policy/ systems modeling/ wildlife habitat/ agricultural ecosystem/ ecological modeling/ ecosystem management/ land use/ waterfowl/ wetland/ United States/ Anas/ Anatidae/ Anser/ Anser caerulescens caerulescens/ Anser sp./ Bos taurus/ Oryza sativa
Abstract: We describe an integrated systems model of the coastal prairie ecosystem in Texas, USA to simulate the effect of alternative federal resource policy scenarios (crop subsidies) for rice (Oryza sativa) on land-use decisions of farmers and the subsequent impact on lesser snow goose (Anser caerulescens caerulescens) habitat. We evaluate the ability of the model to predict shifts in land use, agricultural production, economic viability of farms, and the resulting wetland habitat quality for geese, in view of the uncertainty concerning representation of farmers' land-use decision making processes (management styles). We then simulate shifts in land use, rice and cattle production, farm profitability, and level of wetland habitat use by geese that might result from three alternative federal resource policy scenarios and three alternative farmers' management styles. We found changes in land-use allocation, rice and cattle production, and farm profitability resulting from the policy scenarios affected habitat use by geese. Policy financial incentives, market price for rice, level of rice production, and farm size were important factors that affected wetland habitat use by geese. The management styles of farmers affected the quality of wetland habitat when policy scenarios required rice to be grown with conventional production methods. In this case, farmers, particularly those who were concerned about maintaining farming as a way of life, continued rice production and maintained wetland habitat for geese even when crop subsidies decreased over time. The public benefited from the decision making of these farmers because the important indirect use value (wildlife habitat and water quality) and existence value (biodiversity and cultural history) of rice agriculture was maintained as an agroecosystem.

1581. **Agricultural wetland management for conservation goals: Invertebrates in California ricelands.**
O'Malley, Rachel Emerson
In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 857-885.
Notes: ISBN: 0471292583.
NAL Call #: QL365.4.A1I58
Descriptors: Invertebrata/ farming and agriculture/ agricultural wetlands management for conservation/ conservation measures/ agricultural wetlands conservation goals/ habitat management/ agricultural wetlands/ cultivated land habitat/ California/ agricultural wetlands conservation value and management

1582. **Agricultural wetlands and waterbirds: A review.**
Czech, H. A. and Parsons, K. C.
Waterbirds 25(2 [supplement]): 56-65. (2002)
NAL Call #: QL671; ISSN: 1524-4695.
Notes: Literature review. Managing Wetlands for Waterbirds: Integrated Approaches.
Descriptors: agricultural ecosystem/ wetlands/ habitat changes/ habitat utilization/ aquatic birds/ habitat/ agriculture/ breeding sites/ foraging behavior/ rice fields/ Aves/ ecology/ community studies/ conservation, wildlife management and recreation
Abstract: Waterbird use of agricultural wetlands has increased as natural wetlands continue to decline worldwide. Little information exists on waterbird use of wetland crops such as taro, hasu, and wild rice. Several reports exist on waterbird use of cranberry bog systems. Information exists on waterbird use of rice fields, especially by herons and egrets. Rice fields encompass over 1.5 million km^2 of land and are found on all continents except

Antarctica. Rice fields are seasonally flooded for cultivation and to decoy waterfowl, and drawn down for sowing and harvest. A wide variety of waterbirds including wading birds, shorebirds, waterfowl, marshbirds, and seabirds utilize rice fields for foraging and to a lesser extent as breeding sites. In some areas, especially Asia, waterbirds have come to rely upon rice fields as foraging sites. However, few reports exist on waterbird use of rice ecosystems outside of the Mediterranean Region. Species that are commonly found utilizing agricultural wetlands during the breeding season, migration, and as wintering grounds are listed. General trends and threats to waterbirds utilizing agricultural wetlands, including habitat destruction and degradation, contaminant exposure, and prey fluctuations are presented.

1583. **Agriculture and wildlife: Ecological implications of subsurface irrigation drainage.**
Lemly, A. Dennis
Journal of Arid Environments 28(2): 85-94. (1994)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963.
Notes: Literature review.
Descriptors: farming and agriculture/ subsurface irrigation drainage/ wetland fauna/ semiaquatic habitat/ chemical pollution/ agricultural irrigation/ wetlands/ United States, western region

1584. **Agronomy implications of waterfowl management in Mississippi ricefields.**
Manley, S. W.; Kaminski, R. M.; Reinecke, K. J.; and Gerard, P. D.
Wildlife Society Bulletin 33(3): 981-992. (2005)
NAL Call #: SK357.A1W5; ISSN: 00917648.
Notes: doi: 10.2193/0091-7648(2005)33[981:AIOWMI]2.0.CO;2.
Descriptors: agronomic benefits/ habitat management/ Mississippi Alluvial Valley/ Oryza sativa/ red rice/ rice/ straw disposal/ wetlands/ winter flooding/ winter weeds/ agronomy/ environmental economics/ rice/ waterfowl/ wildlife management/ Mississippi/ Anatidae/ Oryza rufipogon/ Oryza sativa/ Poaceae
Abstract: Ricefields are important foraging habitat for waterfowl and other waterbirds in several North American wintering areas, including the Mississippi Alluvial Valley (MAV). Rice growers are likely to adopt management practices that provide habitat for waterfowl if agronomic benefits also occur. Therefore, we conducted a replicated field experiment during autumn through spring 1995-1997 to study effects of postharvest field treatment and winter-water management on agronomic variables including biomass of residual rice straw, cool-season grasses and forbs (i.e., winter weeds), and viability of red rice (oryza sativa var.). The treatment combination of postharvest disking and flooding until early March reduced straw 68%, from 9,938 kg/ha after harvest to 3,209 kg/ha in spring. Treatment combinations that included flooding until early March were most effective in suppressing winter weeds and decreased their biomass in spring by 83% when compared to the average of other treatment combinations. Effects of treatment combinations on spring viability of red rice differed between winters, but no significant effects were found within winters. Autumn disking followed by flooding until early March reduced rice straw and suppressed winter weeds the most, but with additional costs. To obtain the most agronomic benefits, we recommend that rice growers forgo autumn disking and flood fields until early March, which will provide moderate straw reduction, good weed suppression, and predicted savings of $22.24-62.93/ha (U.S.) ($9.00-25.47/ac). Maintenance of floods on ricefields until early March also benefits waterfowl and other waterbirds by providing foraging habitat throughout winter.

1585. **Altering succession and improving habitat at created wetlands in Wyoming.**
Mckinstry, Mark Calvert. University of Wyoming, 2004.
Notes: Degree: PhD; Advisor: Anderson, Stanley H.
Descriptors: wetlands/ succession/ Wyoming/ waterfowl/ habitat use/ aquatic vegetation/ plant biomass/ habitat improvement
Abstract: In northeast Wyoming over 1,500 wetlands have been created through bentonite mining. These wetlands ranged in age from one to over 50 years old and represent one of the largest wetland creation projects in the world. They also served as a large experiment in self designing ecosystems. I found that waterfowl used wetlands in this region that (1) are located within complexes of >5 within 1 km, (2) have variable depths to accommodate various feeding strategies, and (3) have abundant submersed and emergent vegetation. I evaluated 48 wetlands in three age classes to determine aquatic plant succession. These wetlands were dominated by wind-dispersed emergents and generally have low species richness and plant biomass. During the reclamation process no attempt was made to introduce aquatic plants into these wetlands, most of which were isolated from other wetlands and sources of propagules by 50 km or more. I designed several experiments using greenhouse microcosms and field trials to identify plants that could be propagated at these wetlands using bentonite substrates or bentonite mixed with native topsoil. Plant species for experimental trials were selected based on their adaptations to the high salinity, ph, and alkalinity common among these wetlands. Generally, all plants (10 species of both submersed and emergent plants) had higher growth weights and survival in microcosms with the topsoil or topsoil and bentonite mixed soil, suggesting that reclamation should include the addition of topsoil into these wetlands. Several plants did well under various treatments and in field trials, including some that are of high value to wildlife (Potamogeton pectinatus, Vallisneria americana, Scirpus validus, Scirpus maritimus, Eleocharis palustris). I also evaluated the use of salvaged-wetland soil in six newly-created wetlands as a technique to introduce propagules of native aquatic plants. The use of salvaged-wetland soil increased (1) the number of plant species present at a wetland over time (richness), (2) the total vegetation coverage in a treated wetland over time, and (3) the total plant biomass in a treated wetland. I recommend that future reclamation include the use of topsoil and salvaged-wetland soil to improve aquatic plant growth as well as plantings of select wetland species to improve plant diversity and biomass at these wetlands.

1586. **Alternative uses of wetlands other than conventional farming in Iowa, Kansas, Missouri, and Nebraska.**
Leventhal, E.
Washington, DC: Environmental Protection Agency; EPA/171/R-92/006, 1992.
Descriptors: wetlands/ land use/ agriculture/ economic analysis/ sociological aspects/ environmental impact/ ecosystem disturbance/ United States/ conservation, wildlife management and recreation
Abstract: Conversion of wetlands in Iowa, Kansas, Missouri, and Nebraska into agricultural dry lands in the past several decades has occurred as a means to obtain profit from what landowners would otherwise consider unprofitable land. The activity has resulted in substantial losses of wetlands valued for their unique ability to mitigate flood and storm damage, control erosion, discharge and recharge groundwater, improve water quality, and support a wide diversity of fish, wildlife, and vegetation. Utilizing fish, wildlife, and vegetation from wetlands for profit is a way for wetland owners to recognize the value their wetlands add to their property. Landowners then have an incentive to preserve rather than convert their wetlands. [Sponsored by Environmental Protection Agency, Kansas City, KS. Region VII.]

1587. **Amphibian colonization and use of ponds created for trial mitigation of wetland loss.**
Pechmann, J. H. K.; Estes, R. A.; Scott, D. E.; and Gibbons, J. W.
Wetlands 21(1): 93-111. (2001)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: amphibians/ migration/ wetland creation/ habitat creation/ mitigation/ ponds
Abstract: Created ponds were built as an experiment in mitigating the loss of a wetland to construction. We monitored amphibian breeding population sizes and juvenile recruitment at these created ponds for 8.5 years and compared the populations to those observed at the original wetland, Sun Bay (≤ 600 m from the created ponds), and at an undisturbed reference wetland, Rainbow Bay. Some amphibians continued breeding migrations to Sun Bay even after it was filled with soil. Few of the anuran colonists of the created ponds had been previously captured at Sun Bay, but many of the salamander colonists had been collected. The created ponds became permanent, whereas Sun Bay and Rainbow Bay were temporary ponds. Juveniles of two salamander species and 10 species of frogs and toads metamorphosed and emigrated from the created ponds during the study. By the final years of the study, the community structure of adult and juvenile amphibians differed among the three created ponds, as well as between these ponds and the prior amphibian community at the filled wetland and the contemporaneous community at the reference wetland. Mean size at metamorphosis was smaller at the created ponds than at the reference site for two species of frogs, whereas the opposite was true for two salamanders. We conclude that the created ponds provided partial mitigation for the loss of the natural amphibian breeding habitat. Differences between the created ponds and the natural wetlands were likely related to differences in their hydrologic regimes, size, substrates, vegetation, and surrounding terrestrial habitats and to the limited availability of colonists of some species.

1588. **Amphibian occurrence and aquatic invaders in a changing landscape: Implications for wetland mitigation in the Willamette Valley, Oregon, USA.**
Pearl, Christopher A.; Adams, Michael J.; Leuthold, Niels; and Bury, R. Bruce
Wetlands 25(1): 76-88. (2005)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetland mitigation/ breeding occurrence/ landscape characteristics
Abstract: Despite concern about the conservation status of amphibians in western North America, few field studies have documented occurrence patterns of amphibians relative to potential stressors. We surveyed wetland fauna in Oregon's Willamette Valley and used an information theoretic approach (AIC) to rank the associations between native amphibian breeding occurrence and wetland characteristics, non-native aquatic predators, and landscape characteristics in a mixed urban-agricultural landscape. Best predictors varied among the five native amphibians and were generally consistent with life history differences. Pacific tree frog (Pseudacris regilla) and long-toed salamander (Ambystoma macrodactylum) occurrence was best predicted by the absence of non-native fish. Northern red-legged frog (Rana a. aurora) and northwestern salamander (Ambystoma gracile) were most strongly related to wetland vegetative characteristics. The occurrence of rough-skinned newts (Taricha granulosa), a migratory species that makes extensive use of terrestrial habitats, was best predicted by greater forest cover within 1 km. The absence of non-native fish was a strong predictor of occurrence for four of the five native species. In contrast, amphibians were not strongly related to native fish presence. We found little evidence supporting negative effects of the presence of breeding populations of bullfrog (Rana catesbeiana) on any native species. Only the two Ambystoma salamanders were associated with wetland permanence. Northwestern salamanders (which usually have a multi-year larval stage) were associated with permanent waters, while long-toed salamanders were associated with temporary wetlands. Although all the species make some use of upland habitats, only one (rough-skinned newt) was strongly associated with surrounding landscape conditions. Instead, our analysis suggests that within-wetland characteristics best predict amphibian occurrence in this region. We recommend that wetland preservation and mitigation efforts concentrate on sites lacking non-native fish for the conservation of native amphibians in the Willamette Valley and other western lowlands.

1589. **Amphibian occurrence and wetland characteristics in the Puget Sound Basin.**
Richter, Klaus O. and Azous, Amanda L.
Wetlands 15(3): 305-312. (1995)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: breeding habitat/ hydrology/ land use/ predation/ vegetation class

Abstract: We studied the pattern of amphibian distributions within 19 wetlands of the Puget Sound Basin in King County, Washington State from 1988 through 1991. Amphibian richness was compared to wetland size, vegetation classes, presence of bullfrog and fish predators, hydrologic characteristics of water flow, fluctuation, and permanence, and land use. Low velocity flow and low fluctuation were correlated with high species richness. Seasonal persistence of water was unrelated to species richness. Wetland size, distance to other wetlands favorable for breeding, fish and bullfrog predators, and the number of vegetation classes found at a wetland were unrelated to total number of species. Increasing mean water-level fluctuation and percent watershed urbanization were correlated with low species richness. Small and structurally simple wetlands often have high value amphibian habitat, and traditional reliance on wetland size and broad vegetation classes without site-specific studies should be avoided when assessing habitat value for amphibians.

1590. **An analysis of economic incentives in wetlands policies addressing biodiversity.**
Fernandez, L.
Science of the Total Environment (1-3): 107-122. (1999)
NAL Call #: RA565.S365; ISSN: 0048-9697.
Notes: Special issue: Managing for biodiversity for the protection of nature; doi: 10.1016/S0048-9697(99)00311-3.
Descriptors: wetlands/ biodiversity/ policies/ restoration/ environmental protection/ economic analysis/ environmental economics/ legislation/ nature conservation/ environmental restoration/ simulation/ California/ resources management/ wildlife habitat/ costs/ evaluation process
Abstract: This paper offers an economic analysis of economic incentives within the Habitat Conservation Plan and Wetlands Mitigation Bank policies. Both policies are relatively new policies for protection and restoration of ecosystems such as wetlands that support biodiversity. The components of the policies such as the measures of success, conversion of biological units into economic units, and timing of the actions by policymakers and landowners influence the incentives to carry out protection and restoration. A stochastic optimal control model is developed which incorporates ecological uncertainty of wetlands restoration. The model helps in examining the decisions of how much to invest in a wetlands mitigation bank or habitat conservation plan. The model is calibrated with data from California bioeconomic parameters. Numerical simulation of the model provides a sensitivity analysis of how model parameters of restoration costs, stochastic biological growth, discount rate, and the market value of credits affect the trajectory of investment and the optimal stopping state of wetlands quality when the investment ends. The analysis reveals that more restoration will occur when there is a reduction in restoration costs, an increase in biological uncertainty or an increase in the value of wetlands credits. Continued restoration is harder to justify at a higher discount rate and cost.

1591. **Analysis of wetland trends and management alternatives for Georgia.**
Woolf, S. W. and Kundell, J. E.
Atlanta: Environmental Resources Center, Georgia Institute of Technology; Report No. Erc 01-85, 1985. 154 p.
Descriptors: wetlands/ coastal marshes/ Georgia/ land use/ salt marshes/ alternative planning/ drainage/ erosion/ estuaries/ flood control/ forest management/ marshes/ soils/ urban runoff/ vegetation/ water management/ waterfowl
Abstract: Georgia is experiencing ' Sunbelt ' population growth and expansions in agricultural and forestry production resulting in increased pressure to convert wetlands to other uses. An analysis was undertaken of data generated by the Fish & Wildlife Service 's National Wetland Inventory, Georgia Department of Natural Resource 's Landsat Land use study, and Soil Conservation Service 's National Resources Inventory. Wetland acreage, distribution, types, and trends were identified for Georgia. A review of case law and statutory law was conducted and wetland management activities of federal, state, and local governments were determined. Alternative management strategies were identified for Georgia. (Woolf-U. GA)

1592. **Anthropogenic correlates of species richness in southeastern Ontario wetlands.**
Findlay, C. S. and Houlahan, J.
Conservation Biology 11(4): 1000-1009. (Aug. 1997)
NAL Call #: QH75.A1C5 ; ISSN: 0888-8892
Descriptors: wetlands/ plant populations/ community composition/ man-induced effects/ anthropogenic factors/ species diversity/ plants/ roads/ forestry/ Vertebrata/ Canada, Ontario/ species richness/ forest practices/ vertebrates/ conservation/ mechanical and natural changes/ water and plants
Abstract: We examined the relationship between the richness of four different wetland taxa (birds, mammals, herptiles, and plants) in 30 southeastern Ontario, Canada wetlands and two anthropogenic factors: road construction and forest removal/conversion on adjacent lands. Data were obtained from two sources: road densities and forest cover from 1:50,000 Government of Canada topographic maps and species lists and wetland areas from Ontario Ministry of Natural Resources wetland evaluation reports. Multiple regression analysis was used to model the relationships between species richness and wetland area, road density, and forest cover. Our results show a strong positive relationship between wetland area and species richness for all taxa. The species richness of all taxa except mammals was negatively correlated with the density of paved roads on lands up to 2 km from the wetland. Furthermore, both herptile and mammal species richness showed a strong positive correlation with the proportion of forest cover on lands within 2 km. These results provide evidence that at the landscape level, road construction and forest removal on adjacent lands pose significant risks to wetland biodiversity. Furthermore, they suggest that most existing wetland policies, which focus almost exclusively on activities within the wetland itself and/or a narrow buffer zone around the wetland perimeter, are unlikely to provide adequate protection for wetland biodiversity.

1593. **Anthropogenic effects on the biodiversity of riparian wetlands of a northern temperate landscape.**
Mensing, D. M.; Galatowitsch, S. M.; and Tester, J. R.
Journal of Environmental Management 53(4): 349-377. (1998)
NAL Call #: HC75.E5J6; ISSN: 0301-4797
Descriptors: wetlands/ assessment/ land use/ fish/ aquatic invertebrates/ riparian vegetation/ effects/ biodiversity/ landscape/ land resources/ resource conservation/ resource management/ riparian forests/ biological indicators/ human activity/ forestry practices/ birds/ Amphibia/ Minnesota/ disturbance/ vertebrates/ Chordata/ animals
Abstract: The present study explores the relationships between riparian wetland communities and anthropogenic disturbances, including urban, forestry and cultivated land. Small stream riparian wetlands in central Minnesota, USA, provided an opportunity to detect these relationships because land use within the region is heterogeneous, resulting in disturbance gradients at the scales of stream reach and landscape. The research tested 2 hypotheses: organismal groups (wet meadow vegetation, shrub carr vegetation, aquatic macro-invertebrates, amphibians, fish and birds) respond differently to various types of anthropogenic disturbance; and the observed biological responses are dependent on the spatial scale of the disturbance. It was shown that birds were the best indicators of landscape condition within the near vicinity of small stream riparian wetlands, and fish community composition corresponded to broader landscape land use patterns. It is suggested that the type of anthropogenic disturbance and the spatial scale at which the disturbance occurs will have variable consequences to different organismal groups. If the effectiveness of the proposed indicators is verified, then managers can strategically monitor the biota and accurately interpret the results. The strength and interpretability of bird and fish relationships to land use of riparian wetlands suggest that indicator and criteria development are warranted.
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1594. **Anuran call surveys on small wetlands in Prince Edward Island, Canada restored by dredging of sediments.**
Stevens, C. E.; Diamond, A. W.; and Gabor Shane, T. S.
Wetlands 22(1): 90-99. (2002)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: anuran call survey/ marsh monitoring program/ NAWMP/ small wetlands/ wetland restoration/ abundance estimation/ amphibians/ habitat restoration/ species occurrence/ wetland/ Canada/ Bufo americanus/ Pseudacris crucifer/ Rana clamitans/ Rana pipiens/ Rana sylvatica
Abstract: In 1990, the North American Waterfowl Management Plan (NAWMP) implemented a small-wetland restoration program in Prince Edward Island (PEI), Canada. Wetlands were restored by means of dredging accumulated sediment and organic debris to create open water and emulate pre-disturbance conditions. Three call surveys were conducted in the spring and summer of 1998 and 1999 to estimate abundance and occurrence of spring peepers (Pseudacris crucifer), wood frogs (Rana sylvatica), northern leopard frogs (Rana pipiens). American toads (Bufo americanus), and green frogs (Rana clamitans) on restored and reference wetlands. Numbers of species calling and abundance indices of northern leopard frogs, green frogs, and spring peepers were significantly higher on restored versus reference wetlands. The number of species calling in restored wetlands was positively correlated with proximity to freshwater rivers; in refernce wetlands, the number was positively associated with proximity with forested perimeters and area of open water. Occurrence of calling green frogs in restored wetlands was positively correlated with percent cattail and, in reference wetlands, with proximity to other wetlands. Our results suggest that small wetland restoration projects may be a good conservation tool for anurans. We recommend further research on reproductive success and on local population trends in restored wetlands to determine if restoration is beneficial for anurans on PEI.

1595. **Aquatic invertebrate and plant responses following mechanical manipulations of moist-soil habitat.**
Gray, M. J.; Kaminski, R. M.; Weerakkody, G.; Leopold, B. D.; and Jensen, K. C.
Wildlife Society Bulletin 27(3): 770-779. (1999)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: aquatic invertebrates/ hydrophytes/ Mississippi/ moist-soil management/ waterfowl habitat/ wetland management
Abstract: Managers mow, disk, and till moist-soil habitats to set back succession and increase interspersion of emergent vegetation and water for migrant and wintering waterbirds. We evaluated effects of autumn applications of these manipulations on aquatic invertebrates and moist-soil plants during 2 subsequent winters and growing seasons, respectively, at Noxubee National Wildlife Refuge, Mississippi. Greatest seed mass was in tilled and disked plots in 1993 (P≤0.008) and in tilled plots in 1994 (P≤0.008). Plant species diversity generally was greatest in tilled plots in both years (P≤0.05). Mowed and control plots produced greatest aquatic invertebrate mass in winter 1992-93 (P≤0.025) and diversity in both winters (P≤0.01). Invertebrate mass and plant standing crop generally did not differ among treatments in winter 1993-94 and both years, respectively. We recommend autumn tilling in small moist-soil habitats to increase plant species diversity and seed yield. For large-scale management, disking may be more practical than tilling and would likely yield similar plant responses. We recommend autumn mowing if moist-soil habitats exist in early seral stages and contain desirable seed-producing plants that are robust and do not readily topple following flooding to create open water areas for waterbirds.

1596. **Aquatic invertebrate responses to timber harvest in a bottomland hardwood wetland of South Carolina.**
Batzer, D. P.; George, B. M.; and Braccia, A.
Forest Science 51(4): 284-291. (2005)
NAL Call #: 99.8 F7632; ISSN: 0015-749X
Descriptors: wetlands/ lowland forests/ hardwood forests/ logging/ clearcutting/ Aedes/ Culicidae/ community structure/ indicator species/ environmental impact/ South Carolina
This citation is from AGRICOLA.

1597. **Aquatic macroinvertebrate assemblages in mitigated and natural wetlands.**
Balcombe, C. K.; Anderson, J. T.; Fortney, R. H.; and Kordek, W. S.
Hydrobiologia 541(1): 175-188. (2005)
NAL Call #: 410 H992; ISSN: 00188158.
Notes: doi: 10.1007/s10750-004-5706-1.
Descriptors: invertebrates/ macroinvertebrates/ mitigation wetland/ wetland construction/ wetlands/ wildlife/ biodiversity/ biomass/ composition/ ecosystems/ ocean habitats/ quality assurance/ wetlands/ human disturbances/ macroinvertebrates/ mitigation/ quality habitat/ lakes/ macroinvertebrate/ species richness/ wetland/ West Virginia/ Annelida/ Anura/ Invertebrata/ Isopoda/ Oligochaeta (Metazoa)/ Physidae/ Planorbidae
Abstract: Many wetlands have been constructed in West Virginia as mitigation for a variety of human disturbances, but no comprehensive evaluation on their success has been conducted. Macroinvertebrates are extremely valuable components of functioning wetland ecosystems. As such, benthic and water column invertebrate communities were chosen as surrogates for wetland function in the evaluation of 11 mitigation and 4 reference wetlands in West Virginia. Mitigation wetlands ranged in age from 4 to 21 years old. Overall familial richness, diversity, density and biomass were similar between mitigation and reference wetlands ($p > 0.05$). Within open water habitats, total benthic invertebrate density was higher in reference wetlands, but mass of common taxa from water column samples was higher in mitigation wetlands ($p < 0.05$) Planorbidae density from benthic samples in emergent habitats was higher in reference than mitigated wetlands. Benthic Oligochaeta density was higher across open water habitats in mitigation wetlands. All other benthic taxa were similar between wetland types. Among the most common water column orders, Isopoda density was higher in reference wetlands, but Physidae density was higher in mitigation wetlands. Within mitigation wetlands, emergent areas contained higher richness and diversity than open areas. These data indicate that mitigation and reference wetlands generally support similar invertebrate assemblages, especially among benthic populations. The few observed differences are likely attributable to differences in vegetative community composition and structure. Mitigation wetlands currently support abundant and productive invertebrate communities, and as such, provide quality habitat for wetland dependent wildlife species, especially waterbirds and anurans. © Springer 2005.

1598. **Aquatic macroinvertebrate diversity of playa wetlands: The role of landscape and island biogeographic characteristics.**
Hall, D. L.; Willig, M. R.; Moorhead, D. L.; Sites, R. W.; Fish, E. B.; and Mollhagen, T. R.
Wetlands 24(1): 77-91. (2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ macrofauna/ species diversity/ biogeography/ community composition/ ecology/ fauna/ biodiversity/ aquatic organisms/ life history/ regression analysis/ Texas/ Texas, Southern High Plains/ landscape ecology/ island biogeography
Abstract: Wetland habitats continue to be lost at a unsettling rate, especially freshwater emergent wetlands that are isolated geographically. These are the predominant wetlands found in arid and semi-arid environments, where they serve as foci of regional biodiversity. This is especially true of the playa wetlands of the Southern High Plains of Texas, USA. The factors that determine and maintain biotic diversity in these wetlands are understood poorly. Consequently, this study examined the effect of island biogeographic and landscape features on the diversity of aquatic macroinvertebrates in playa wetlands. Macroinvertebrates were collected from playas three times during the spring and summer of 1994 and categorized as resident or transient taxa based on life history strategies. Diversity was estimated using taxonomic richness (richness) and Fisher's log-series alpha (alpha). Surrounding land-use practices influenced resident richness, whereas playa surface area affected resident and transient richness, as well as resident alpha . However, relationships differed among sampling dates. Regression analyses suggested that transient richness and alpha were influenced more by insular characteristics than by landscape features. The converse was true for resident richness and alpha . Therefore, both insular and landscape characteristics affected the diversity of macroinvertebrates in playa wetlands, but impacts were dependent on life-history strategy and time since inundation (i.e., sampling date). Consequently, conservation and management efforts targeting macroinvertebrates in playa wetlands will need to focus on the wetlands and characteristics of adjacent watershed features.

1599. **Assessing conservation trade-offs: Identifying the effects of flooding rice fields for waterbirds on non-target bird species.**
Elphick, C. S.
Biological Conservation 117(1): 105-110. (2004)
NAL Call #: S900.B5; ISSN: 00063207.
Notes: doi: 10.1016/S0006-3207(03)00264-7.
Descriptors: agriculture/ California, Central Valley/ landbird/ passerines/ raptors/ arable land/ avifauna/ conservation management/ ecological impact/ flooding/ nontarget organism/ trade-off/ waterfowl
Abstract: I examined how winter flooding of post-harvest rice fields - a management practice used to benefit waterbirds - affects field use by other birds. In addition to waterbirds previously studied, I recorded 56 bird species in rice fields. Of these, five were more abundant in flooded fields, ten were more abundant in unflooded fields, no difference was detected for 19, and the remainder were too rare to draw any conclusions. Species that were more common in unflooded fields were all carnivorous or granivorous in winter, whereas species that were more common in flooded fields were mostly insectivores commonly associated with aquatic habitats. The net effects of the responses by individual species were fewer raptor species in flooded fields, but no difference in the species richness of other landbirds. Winter flooding potentially has negative effects for some birds, but has no discernible effects on most species studied and may benefit some passerines.

1600. **Assessing drought-related ecological risk in the Florida Everglades.**
Smith, S. M.; Gawlik, D. E.; Rutchey, K.; Crozier, G. E.; and Gray, S.
Journal of Environmental Management 68(4): 355-366. (2003)
NAL Call #: HC75.E5J6 ; ISSN: 03014797.
Notes: doi: 10.1016/S0301-4797(03)00102-6.
Descriptors: drought/ Everglades/ fire/ risk assessment/ wading birds/ drought/ environmental management/ environmental stress/ wader/ water management/ drought stress/ environmental impact assessment/ risk assessment/ birds/ ecosystem/ models, theoretical/ natural disasters/ water supply/ United States
Abstract: In the winter-spring of 2001, South Florida experienced one of the worst droughts in its recorded history. Out of a myriad of ecological concerns identified during this time, the potential for catastrophic peat fire and negative impacts to wading bird reproduction emerged as critical issues. Water managers attempted to strike a balance between the environment and protection of water supplies for agriculture and urban interests. It became evident, however, that a broad-scale, integrated way to portray and prioritise ecological stress was lacking in the Florida Everglades, despite this being considered a necessary tool for addressing issues of environmental protectioh. In order to provide a framework for evaluating various water management operations using real-time information, we developed GIS-based indices of peat-fire risk and wading bird habitat suitability. These indices, based on real physical, chemical, and biological data, describe two ecological conditions that help define the physical and biological integrity of the Everglades. In addition to providing continuous, updated assessments throughout the drought period, we incorporated predictive models of water levels to evaluate how various water management alternatives might exacerbate or alleviate ecological stress during this time.

1601. **Assessing salt marsh harvest mouse movements during high tides, San Pablo Bay, California.**
Hulst, Miriam D.; Hall, Linnea S.; Morrison, Michael L.; and Bias, Michael L.
Transactions of the Western Section of the Wildlife Society 37: 88-91. (2001)
NAL Call #: SK351.W523; ISSN: 0893-214X
Descriptors: conservation measures/ ecology/ distribution within habitat/ brackish habitat/ abiotic factors/ physical factors/ land and freshwater zones/ Reithrodontomys raviventris (Muridae): habitat management/ salt marsh levee/ diked areas/ restoration/ zonation/ winter high tides/ water movements/ California/ Sonoma County/ San Pablo Bay National Wildlife Refuge/ Muridae/ Rodentia, Mammalia/ chordates/ mammals/ vertebrates

1602. **Avian and amphibian use of fenced and unfenced stock ponds in northeastern Oregon forests.**
Bull, E. L.; Deal, J. W.; and Hohmann, J. E. USDA Forest Service Rocky Mountain Research Station; PNW-RP-539, 2001. 9 p.
NAL Call #: A99.9 F7625Uni no. 539
http://www.treesearch.fs.fed.us/pubs/2964
Descriptors: amphibians/ birds/ livestock grazing/ northeastern Oregon/ stock ponds
Abstract: The abundance of birds and amphibian larvae was compared between fenced and unfenced stock ponds in 1993 to determine if fencing improved the habitat for these species in northeastern Oregon. Stock ponds that were fenced had significantly higher densities of bird species, guilds, and taxonomic groups than stock ponds that were unfenced. No differences in the relative abundance of larvae of Pacific treefrogs (Pseudacris regilla) or long-toed salamanders (Ambystoma macrodactylum) were found between fenced and unfenced ponds. Fencing at least a portion of stock ponds in forested areas provides habitat for a greater diversity and abundance of birds.

1603. **Avian communities in forested riparian wetlands of southern Michigan, USA.**
Inman, Rainy L.; Prince, Harold H.; and Hayes, Daniel B.
Wetlands 22(4): 647-660. (2002)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: biodiversity/ biogeography: population studies/ modeling/ mathematical and computer techniques/ avian community/ breeding status/ floodplain/ forested riparian wetlands/ plant species dominance/ plant species richness/ plant species structure/ species composition/ vegetation composition/ vegetation structure/ wetlands ecology
Abstract: Descriptive studies are an important first step in developing assessment models for regional wetland subclasses. Objectives of this study were to gather benchmark information on the composition and structure of vegetation from minimally impacted riparian forested wetland sites in Michigan, USA, and to determine if species composition of the breeding bird community and relative densities of individual species varied among riparian and adjacent upland forest zones. Plant species richness, dominance, and structure differed greatly between floodplain wetlands and uplands and were similar among zones within floodplain forests. Of 54 breeding bird species recorded through point count surveys (1998-99), 39 were observed in both floodplain and upland forests, while 11 were found only in floodplains and 4 solely in the uplands. Detectable patterns of avian density across riparian and upland forest zones were evident for 31 breeding species. Most species preferred areas closest to the river over other zones, although a few species were more prevalent within interior floodplains or uplands as compared to riverside forests. Forested riparian wetlands in this region act as essential breeding habitats for many avian species not often found in upland areas and are especially important for obligate riparian species and rare or declining breeding birds observed within our sites. These results are consistent with many studies across North America, where riparian forests have been found to support disproportionately large numbers of breeding bird species as compared to more xeric forests and other upland habitats.

1604. **Avian communities of created and natural wetlands: Bottomland forests in Virginia.**
Snell Rood, Emilie C. and Cristol, Daniel A.
Condor 105(2): 303-315. (May 2003)
NAL Call #: QL671.C6; ISSN: 0010-5422
Descriptors: Aves/ habitat management/ created vs. natural forest wetland communities/ community structure/ semiaquatic habitat/ forest and woodland/ created vs. natural forest wetlands/ Virginia/ Chowan River Basin/ community structure in created vs. natural forest wetlands/ conservation significance
Abstract: The federal government requires those who destroy wetlands to preserve, restore, or create new ones with the goal of no net loss of wetlands. In the summer of 2000, we tested whether forested wetlands created an average of 8 years earlier had developed avian communities similar to natural wetlands of the same age in southeastern Virginia. We compared six created wetlands to five natural (reference) wetlands that had undergone ecological succession after clearcutting. We also created a trajectory of expected avian community development by comparing 20 reference wetlands, logged 1-25 years earlier, to mature forested wetlands that had not been logged for 50 years or more. Created wetlands had significantly lower avian richness and diversity, and a different community composition, than reference wetlands. These differences were likely due to the fact that created wetlands supported low numbers of the expected passerine species. In addition, natural wetlands supported species of higher conservation concern, as measured by Neotropical migratory status, trophic level, habitat specificity, and wetland dependency. The trajectory of avian community development indicated that the created wetlands were developmentally behind reference wetlands or were following a different developmental trajectory altogether. We hypothesize that the differences between created and reference forested wetlands were due to unnatural patterns of hydrology or retarded vegetation development on created wetlands. It should not be assumed that created forested wetlands can provide full ecosystem replacement for natural forested wetlands.

1605. **Avian response to nutrient enrichment in an oligotrophic wetland, the Florida Everglades.**
Crozier, Gaea E. and Gawlik, Dale E.
Condor 104(3): 631-642. (Aug. 2002)
NAL Call #: QL671.C6; ISSN: 0010-5422
Descriptors: Aves/ community structure/ wetland community response to nutrient enrichment/ semiaquatic habitat/ oligotrophic wetland/ fertilizer and pesticide pollution/ fertilizers and pesticides/ phosphates/ Florida/ North Everglades/ community response to nutrient enrichment
Abstract: We studied the effects of nutrient enrichment on the bird community in an oligotrophic wetland, the Florida Everglades. Among the non-wading birds surveyed in 1996 and 1997, Boat-tailed Grackles (Quiscalus major) and Common Moorhens (Gallinula chloropus) were consistently more abundant in enriched sites, whereas Common Yellowthroats (Geothlypis trichas) were consistently more abundant in unenriched sites. The abundance of Red-winged Blackbird (Agelaius phoeniceus) was not significantly different between enriched and unenriched sites. Among wading birds, Wood Storks (Mycteria americana) and Great Egrets (Ardea alba) were significantly more abundant in enriched than unenriched areas in a dry year, 1991. Great Egrets and all wading species combined were significantly more abundant in enriched than unenriched areas in the wet year, 1995. Great Blue Herons (Ardea herodias) and White Ibises (Eudocimus albus) did not differ in abundance between enriched and unenriched areas in the dry or wet year. A significant interaction between water depth and nutrient status in the wet year indicated that wading bird abundance increased with water depth only in nutrient-enriched areas presumably because the enriched areas had greater food availability than unenriched areas at the same water depth. Bird abundance appeared to increase in nutrient-enriched areas; however, this increase was accompanied by a shift in species composition typically found in the unenriched Everglades and was a fundamental change in the Everglades' distinctive structure.

1606. **Avian response to vegetative pattern in playa wetlands during winter.**
Smith, L. M.; Haukos, D. A.; and Prather, R. M.
Wildlife Society Bulletin 32(2): 474-480. (2004)
NAL Call #: SK357.A1W5; ISSN: 00917648
Descriptors: Hemi-marsh/ Playas/ Southern High Plains/ waterfowl/ wetlands/ Calcarius mccownii
Abstract: Breeding-bird communities inhabiting northern prairie wetlands have been shown to have higher densities and diversities in wetlands with a well-interspersed 50:50 vegetative cover:water ratio than in those wetlands with a higher or lower proportion of cover. Potential reasons for such a response include increased food or visual isolation and spacing of breeding birds. We manipulated coverwater ratios (75:25, 50:50, 25:75) in Southern Great Plains playas and examined avian response (i.e., species richness, non-waterfowl bird density, and waterfowl density) to these patterns in winter. We found the highest species richness and generally the highest waterfowl densities in the 50:50 cover:water treatment. Because the amount of vegetative food was similar among treatments and waterfowl inhabiting playas during winter are forming pair bonds, it is most likely that the optimal edge and visual isolation provided in the 50:50 cover:water treatment contributed to its high use and richness. Nonwaterfowl bird density was not different among the treatments. Many nonwaterfowl birds using playas in winter, such as McCown's longspur (Calcarius mccownii), occur as nonbreeding feeding flocks, are not forming pair bonds, and likely are not responding to particular cover:water treatments. Playa wetland biologists should create a well-interspersed 50:50 cover:water ratio to optimize waterfowl use and avian species richness.

1607. **Avian use of natural and created salt marsh in Texas, USA.**
Darnell, Traci M. and Smith, Elizabeth H.
Waterbirds 27(3): 355-361. (2004)
NAL Call #: QL671; ISSN: 1524-4695
Descriptors: Aransas National Wildlife Refuge/ artificial salt marsh island/ intertidal area/ natural salt marsh island
Abstract: Bird use of three created salt marsh islands, constructed from dredged material near the Aransas National Wildlife Refuge, Texas, USA, was compared with that of natural marsh to provide feedback prior to additional

marsh construction. Habitat associations of four bird groups (shorebirds, perching birds, wading birds, and gulls and terns) were similar in all sites, but relative contributions of each group to total avian abundance differed. Differences in site-use by birds were largely explained by differences in ratios of available habitat types, which were products of their geomorphic designs. Created marsh designs differed substantially from the natural marsh, where the unvegetated exposed-substrate and shallow-water habitats preferred by waterbirds were prominent features. The oldest created site (four years old) differed most from the natural marsh. Intertidal areas in the site were almost completely overgrown by vegetation, resulting in dominance of the avian assemblage by perching birds (especially grackles, Quiscalus spp.) rather than waterbirds. In the newer created sites (two years old), where vegetation had not completely overgrown the intertidal areas, avian assemblages were more typical of the natural marsh. However, vegetation cover was expanding in these sites, causing a reduction in waterbird habitat area. Efforts to ensure availability of unvegetated habitat in created sites will improve their structural similarity to natural marsh in the study area, and will likely increase their functional similarity for avian species.

1608. **Avifauna associated with ephemeral ponds on the Cumberland Plateau, Tennessee.**
Scheffers, B. R.; Harris, J. B. C.; and Haskell, D. G.
Journal of Field Ornithology 77(2): 178-183. (2006)
NAL Call #: 413.8 B534; ISSN: 02738570.
Notes: doi: 10.1111/j.1557-9263.2006.00039.x.
Descriptors: aerial invertebrates/ avian diversity/ hardwood forest/ point count/ vernal pool/ wetland
Abstract: Although ephemeral ponds act as small hotspots of plant, invertebrate, and salamander diversity, the importance of such ponds for birds has been little studied. We hypothesized that ephemeral ponds on the Cumberland Plateau in Tennessee would support a greater abundance, richness, and diversity of birds than the surrounding hardwood forests. In 2004, we recorded all birds seen or heard in 10 min within 50-m radius circles at 25 ephemeral ponds. We repeated the counts at control sites located 150 m from each pond in the surrounding forest. To quantify potential food availability, we captured aerial invertebrates using sweep nets at four points around a subsample of eight ephemeral ponds and at an equal number of control sites. We found significantly greater bird abundance, richness, and species diversity at ephemeral ponds than at control sites, and that pond area was not associated with either bird abundance or richness. Bird community composition at pond and control sites was similar. Aerial invertebrates were significantly more abundant at ephemeral ponds than at adjacent forest sites, providing one possible explanation for greater bird abundance at ephemeral ponds. ©2006 Association of Field Ornithologists.

1609. **Avifauna of agricultural wetlands on three farms in eastern South Dakota.**
Kirschenmann, Thomas R.; Hubbard, Daniel E.; and Rickerl, Diane H.
South Dakota Academy of Science: Proceedings 79: 183. (2000)
NAL Call #: 500 SO82; ISSN: 0096-378X
Descriptors: birds/ communities/ ecosystems/ farmland/ status/ wetlands/ lowlands/ Aves/ numerical studies
Abstract: In this study, the authors evaluated the avian use of wetlands on three farms each using a different agricultural management system: a conventional system (CON), an organic system (ORG), and transitional no-till system (TNT). Waterfowl pair abundance varied for individual species on individual wetland classes (temporary, seasonal, and semipermanent water regimes) both between systems and between years in 1993 and 1994. Total waterfowl pair abundance was generally higher in temporary wetlands on the ORG and/or TNT farming systems depending on year; however, it was higher in seasonal and semipermanent wetlands on the CON farming system. Species richness was typically higher on the ORG system for individual wetland classes when all wetland classes were combined. Abundance of non-waterfowl breeding birds, both individual species and total birds was typically higher on the ORG and/or TNT farming systems. The authors conclude that they could not detect any consistent trends in avian use between systems. Due to the inherent variation between the wetland numbers, sizes and habitat conditions among the farms, the influence of the type of systems, if any, were observed.

1610. **The avifauna of an agricultural wetland complex in the western Gulf Coastal Plain of Louisiana, USA.**
Musumeche, Michael J.; Huner, Jay V.; Mikuska, Tibor; Richard, Gregory; and Leonard, Billy
Proceedings of the Louisiana Academy of Sciences 64: 22-37. (2002); ISSN: 0096-9192
Descriptors: conservation measures/ ecology/ man-made habitat/ land zones/ Aves: habitat management/ seasonal abundance relationships/ checklists/ seasonal checklist/ population dynamics/ seasonal abundance/ semiaquatic habitat/ agricultural wetland/ species survey and seasonal abundance/ cultivated land habitat/ Louisiana/ St. Landry Parish/ birds/ chordates/ vertebrates

1611. **The avifauna of constructed treatment wetlands in south Florida used for Everglades restoration.**
Chimney, Michael J. and Gawlik, Dale E.
Florida Field Naturalist 35(1): 9-21. (2007); ISSN: 0738-999X
Descriptors: habitat/ land zones/ semiaquatic habitat/ stormwater treatment wetlands/ annotated checklists/ community structure/ man-made habitat/ Florida/ Aves/ birds/ chordates/ vertebrates
Abstract: Constructed treatment wetlands invariably create wildlife habitat (Kadlec and Knight 1996, U.S. Environmental Protection Agency 1999, Knight et al. 2001). Habitat improvement can be dramatic, especially when these systems are built on degraded areas such as farm fields (Hickman 1994). The South Florida Water Management District (SF-WMD) and the U.S. Army Corps of Engineers have built a complex of large treatment

wetlands, known as Stormwater Treatment Areas (STAs), on reclaimed farmland in south Florida as part of a multi-billion dollar effort by State and Federal governments to protect and restore the Everglades (Chimney and Goforth 2001, Sklar et al. 2005, SFWMD 2006). Current plans call for the STAs to encompass more than 17,000 ha. These wetlands were designed to treat and reduce high phosphorus concentrations in stormwater runoff from the Everglades Agricultural Area (EAA) before this water enters the northern portion of the remaining Everglades, the Water Conservation Areas (WCAs) (Fig. 1). The STAs have attracted a high abundance and diversity of wildlife species, including many birds. This paper presents a checklist of the avifauna found in two of the STAs and compares STA bird community composition and species richness with regional and other treatment wetlands.

1612. **Balancing wildlife needs and nitrate removal in constructed wetlands: The case of the Irvine ranch water district's San Joaquin Wildlife Sanctuary.**
Fleming Singer, Maia S. and Horne, Alexander J.
Ecological Engineering 26(2): 147-166. (2006)
NAL Call #: TD1.E26; ISSN: 0925-8574
Descriptors: conservation measures/ ecology/ habitat utilization/ habitat/ land zones/ Aves: disturbance by man/ wetland construction for nitrate removal vs wildlife requirements/ habitat management/ community structure/ habitat preference/ semiaquatic habitat/ California/ Irvine/ San Joaquin Wildlife Sanctuary/ Aves/ birds/ chordates/ vertebrates
Abstract: The San Joaquin Wildlife Sanctuary (SJWS), Irvine, CA, is a 32 ha series of shallow ponds created to maximize nitrate removal rates while maintaining 90% open water and episodically exposed shoreline for avian habitat. Design elements created non-ideal denitrification conditions by diminishing an organic carbon source (emergent vegetation) and increasing sediment exposure to oxygen. SJWS aqueous nitrogen and avian data (1999-2002) were analyzed to discern whether design and operating conditions allowed for simultaneous nitrate removal and diverse, abundant avian habitat. Average TIN removal efficiency was 80% while average TN removal efficiency was 60%; the difference reflects Org-N production in the marsh. Based on Chl-a measurements, roughly 40% of Org-N produced in the system was present as algae. The highest annual nitrate removal rates occurred April-May (350-500 mg/m^2/d) and September-October (250-425 mg/m^2/d). First order rate constants ranged 30.7-47.5 m year-1. Seasonal plantings of barnyard grass (Echinocloa crus-galli) were intended to serve as a carbon amendment for denitrification, however, there was no difference in nitrate removal between amended and non-amended conditions, likely because data averaging obscured a small, localized enhancement signal. Average avian species richness was high, ranging between 65 and 76 species month-1, while average relative abundance was mid-range, at 65-83 birds ha-1 month-1. Birds observed included common and rare species.

1613. **Behavior of migrant shorebirds in playas of the Southern High Plains, Texas.**
Davis, Craig A. and Smith, Loren M.
Condor 100(2): 266-276. (1998)
NAL Call #: QL671.C6; ISSN: 0010-5422
Descriptors: activity budget/ fall/ feeding/ playas/ sleeping/ spring/ shorebirds/ Southern High Plains/ Texas
Abstract: Playas in the Southern High Plains (SHP) are important for migrant shorebirds, but the functional role of playas to migrant shorebirds is not clearly understood. We conducted diurnal time-activity budgets on American Avocets (Recurvirostra americana), Long-billed Dowitchers (Limnodromus scolopaceus), Least Sandpipers (Calidris minutilla), and Western Sandpipers (C. mauri) in spring and fall 1993 and 1994 in 69 play as on the SHP of Texas. During both seasons, Least and Western Sandpipers spent 70-80% of their time feeding. Long-billed Dowitchers spent 77% of their time feeding in spring, but spent more time sleeping and less feeding in fall. American Avocets spent 41-50% of their time feeding and 34-40% of their time sleeping during each season. All four species spent minimal time engaged in locomotion, body maintenance, alert, and aggressive behaviors. American Avocets and Long-billed Dowitchers fed most during the midday and late periods and slept most during the early period. Least Sandpipers fed most during the early period, whereas feeding activities of Western Sandpipers remained 70-80% throughout the day. Each of these species use different behavioral strategies in response to such factors as migration distances, energetic needs, differential predation, nocturnal foraging, and diet. Playas appear to serve as important intermediate stopover sites for shorebirds during migration.

1614. **Benthic invertebrates at foraging locations of nine waterbird species in managed wetlands of the northern San Joaquin Valley, California.**
Safran, R. J.; Isola, C. R.; Colwell, M. A.; and Williams, O. E.
Wetlands 17(3): 407-415. (1997)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ San Joaquin Valley/ invertebrates/ forages/ water depth/ site selection/ water birds/ benthic fauna/ midges/ aquatic habitat/ oligochaetes/ ecology/ zoobenthos/ aquatic birds/ habitat selection/ food availability/ Invertebrata/ California
Abstract: The ecologies of waterbirds are closely tied to the distribution and abundance of food resources. For many species of waterfowl and shorebirds, benthic invertebrates (especially Chironomidae) are an important dietary component that influences habitat selection. Consequently, we sampled benthic invertebrates and measured water depth at foraging locations of nine waterbird species and paired random sites in the Grasslands of the northern San Joaquin Valley, California, USA from January to April 1994 and 1995. Our resulting habitat-selection models indicate significant differences in benthic invertebrate densities or biomasses at foraging and random locations for three of nine species and significant differences in water depths between foraging and random locations for four of nine species. Additionally, we observed significant interspecific differences in water depths at foraging locations - shorebirds used shallow habitats (<10 cm), whereas most waterfowl species foraged in deep water (>20 cm).

Waterfowl foraged over a wider range of water depths than shorebirds, indicating greater behavioral flexibility in habitat use. Our results indicate that selection of foraging habitat by smaller bodied waterbirds, including dowitchers, dunlin, western sandpiper, and least sandpiper is strongly influenced by water depth, which mediates the availability of benthic invertebrates. Additionally, foraging site selection of more mobile taxa that are able to forage in a wide range of water depths, including northern shoveler and American green-winged teal, is influenced by invertebrate biomass. The broad range of water depths used by waterfowl and the relatively restricted depths used by shorebirds indicate that water depth can be manipulated to benefit a multitude of waterbird species.

1615. **Best management practices and drought combine to silence the Illinois chorus frog in Arkansas.**
Trauth, Joy B.; Trauth, Stanley E.; and Johnson, Ronald L.
Wildlife Society Bulletin 34(2): 514-518. (June 2006)
NAL Call #: SK357.A1W5.
Notes: Commentary.
Descriptors: amphibiotic species/ droughts/ environmental protection/ habitat/ life span/ nature conservation/ rare species/ recruitment/ reproduction/ vulnerability/ wetlands/ wildlife
Abstract: A primary threat to amphibians in North America is the loss of wetland areas used for reproduction, especially small, temporary, and isolated wetlands. The Illinois chorus frog (Pseudacris streckeri illinoensis) is particularly vulnerable and exists today in a highly fragmented distribution limited to a few isolated populations in Arkansas, Illinois, and Missouri. Precision land-leveling combined with seasonal drought conditions has resulted in a significant population decline and range contraction for this species in Arkansas. Distributional surveys conducted from 1987 through 2004 indicate a 61% range contraction from a maximum of 59 km^2 to a current range of approximately 23 km^2. Additionally, there has been a lack of recruitment the past 2 years for a species that typically possesses a 2–3-year lifespan. Because the Clean Water Act will only protect isolated vernal pools if the continued existence of a threatened or endangered species is jeopardized, the future of this subspecies of chorus frog in Arkansas is both tenuous and problematic. In the absence of immediate protection and habitat modification through the reintroduction of depressions, we argue extirpation of this species in Arkansas may be imminent. The increasing use of precision land-leveling may have implications for other amphibian species worldwide.

1616. **Best management practices to enable the coexistence of agriculture and the Everglades environment.**
Izuno, F. T.; Rice, R. W.; and Capone, L. T.
HortScience 34(1): 27-33. (1999)
NAL Call #: SB1.H6; ISSN: 0018-5345
Descriptors: agriculture/ swamps/ ecosystems/ crop management/ environmental protection/ geographical variation/ drainage/ habitats/ farms/ pumps/ fertilizers/ low input agriculture/ Florida
This citation is from AGRICOLA.

1617. **Biological diversity of created forested wetlands in comparison to reference forested wetlands in the Bay watershed.**
Perry, M. C.; Osenton, P. C.; and Stoll, C. S.
In: Proceedings of the conference: Conservation of biological diversity: A key to the restoration of the Chesapeake Bay ecosystem and beyond. Therres, G. D. (eds.); pp. 261-268; 2001.
Descriptors: wetlands/ ecosystems/ forests/ amphibiotic species/ aquatic reptiles/ aquatic birds/ aquatic mammals/ population structure/ species diversity/ biodiversity/ dominant species/ nature conservation/ habitat improvement/ comparative studies/ watersheds/ Anura/ Scaphiopus holbrookii/ Peromyscus leucopus/ Microtus pennsylvanicus/ Plethodon cinereus/ Rana sylvatica/ Hemidactylium scutatum/ Maryland/ eastern spadefoot toad/ habitat community studies/ conservation, wildlife management and recreation
Abstract: Amphibians, reptiles, birds, and mammals were surveyed at six created forested wetlands in central Maryland and at six adjacent reference forested wetlands during 1993-1996 to determine comparative biological diversity of these habitats. Amphibians and reptiles were caught in pitfall and funnel traps associated with 15.4-m (50-ft) drift fences. Birds were surveyed with a complete count while walking through each area. Mammals were surveyed by capture in live traps. More species and total individuals of amphibians were caught on the reference wetlands than on the created wetlands. The red-backed salamander (Plethodon cinereus), the four-toed salamander (Hemidactylium scutatum), the eastern spadefoot (Scaphiopus holbrooki), and the wood frog (Rana sylvatica) were captured on the reference wetlands, but not on the created sites. The wood frog was captured at all reference sites and may represent the best amphibian species to characterize a forested wetland. Reptiles were not caught in sufficient numbers to warrant comparisons. Ninety-two bird species were recorded on created sites and 55 bird species on the reference sites. Bird species on the created sites represented those typically found in nonforested habitats. Mammal species were similar on both sites, but overall the reference sites had three times the number caught on created sites. The meadow vole (Microtus pennsylvanicus) was the dominant species captured on created sites, and the white-footed mouse (Peromyscus leucopus) was the dominant species on reference sites, with little habitat overlap for these two species. Although species richness and total number of animals were high for created forested wetlands, these survey results show major differences from species expected for a forested wetland. The created forested wetlands appear to provide good habitat for wildlife, but are probably not providing the full functions and values of the forested wetlands that they were constructed to replace.

1618. **Biological responses to wetland restoration: Implications for wildlife habitat development through the Wetlands Reserve Program.**
Rewa, C.
In: A comprehensive review of Farm Bill contributions to wildlife conservation, 1985-2000/ Heard, L. P; Hohman, W. L.; Halloum, D. J.; and Wildlife Habitat Management Institute (U.S.); Series: Technical Report USDA-NRCS-WHMI.

Madison, MS: U.S. Department of Agriculture, 2000; pp. 95-116.
NAL Call #: aS604.6 C66 2000
Descriptors: Wetlands Reserve Program/ wetlands/ riparian areas/ wildlife habitats/ California/ Mississippi

1619. **Bird community patterns of spring-seasonal and semi-permanent wetlands in the Sacramento Valley, California.**
Harris, P. Dawn
Corvallis, Oregon: Oregon State University, 2001.
Descriptors: seasonal wetlands/ restoration/ birds/ California/ community patterns/ Sacramento Valley

1620. **Bird-habitat relationships in a Texas estuarine marsh during summer.**
Weller, M. W.
Wetlands 14(4): 293-300. (1994)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: birds/ habitats/ estuarine environment/ marshes/ flooding/ species diversity/ wildlife management/ salt marshes/ plant populations/ rainfall/ habitat utilization/ summer/ habitat selection/ environment management/ marine birds/ ecological zonation/ Texas/ Aves/ San Bernard National Wildlife Refuge
Abstract: Birds were surveyed during summer 1985 in five adjacent saline vegetation zones and during summers 1986 and 1991 in 6 adjacent vegetation zones on the San Bernard National Wildlife Refuge on the upper Texas Coast. Although 66 bird species were recorded, numbers and species varied among years, and only 17 were nesting species. A few bird species used all vegetation types at some time, but most were limited by vegetation structure or water presence. Olney's three-square bulrush (Scirpus olneyi), saltgrass (Distichlis spicata), and mudflats were especially favored feeding and resting areas in response to periodic flooding and had the greatest frequency of use as well as species richness. Reduced rainfall and water depths during 1986 were reflected in a change toward birds favoring drier conditions. Heavy rainfall in 1991 decreased diversity but increased usage and favored freshwater and swimming birds. Although tidally influenced wetlands often are considered uniform, dynamic water and salinity regimes observed along this coast must be considered in the design of any management or conservation program.

1621. **Birds in North American Great Lakes coastal wet meadows: Is landscape context important?**
Riffell, S. K.; Keas, B. E.; and Burton, T. M.
Landscape Ecology 18(2): 95-111. (2003)
NAL Call #: QH541.15.L35 L36; ISSN: 09212973.
Notes: doi: 10.1023/A:1024411218155.
Descriptors: birds/ Great Lakes coastal wetlands/ landscape context/ Michigan/ principal component analysis/ regression analysis/ wet meadows/ wetland conservation and management/ abundance/ avifauna/ conservation status/ landscape/ patch use/ species richness/ wetland management
Abstract: Landscape context can influence species richness, abundance, or probability of patch-use by birds. Little is known, however, about the effects of landscape context on birds in wetland-dominated landscapes. This lack of knowledge is alarming because many wetlands are threatened by development and other human impacts, while serving critical functions as migratory, breeding and foraging habitat. To address this lack of knowledge, we censused birds in North American Great Lakes coastal wet meadows located along the northern Lake Huron shoreline in Michigan (USA) during 1997 and 1998. Using a suite of multivariate techniques, we first accounted for effects of area and within-patch habitat characteristics before testing for effects of landscape context. Most bird variables were significantly related to landscape context, and two major patterns were apparent. First, avian species richness, abundance, and probability of patch-use by some species were higher for wet meadows located in complex contexts (adjacent to many patch types) compared to simpler contexts (adjacent to only one patch type). Second, these variables were higher for wet meadows located in wetland contexts compared to contexts that were terrestrial and road-impacted, dominated by open water habitats, or dominated by forested wetland habitats. Conservation plans for wetlands have focused on saving large wetlands and creating the vegetative habitat structure required by birds, but they should go further and explicitly consider the landscape context of wetlands as well. Specifically, wetlands located in complex and/or wetland contexts should have a higher conservation value than similar wetlands located in simpler, more terrestrial contexts.

1622. **Black duck pair and brood abundance before and after wetland stabilisation.**
Seymour, N. R.; Thabane, L.; and Lane, M.
Wildfowl 53: 119-125. (2002)
NAL Call #: SK351.W575; ISSN: 09546324
Descriptors: distribution/ ducks/ habitat/ wildlife management/ abundance/ habitat management/ stabilization/ waterfowl/ wetlands
Abstract: Changes in the abundance of Black Duck pairs and broods in four manipulated wetlands and 52 reference wetlands were compared. There was an increase in the number of pairs and broods at manipulated sites following manipulation, while unstabilised sites experienced a decline in bird numbers during the same period. However, there were no significant differences in brood sizes or hatching success either at manipulated or reference sites. The results have implications for current management practices regarding stabilisation processes as a means to increase species abundance.

1623. **Black tern colonization of a restored prairie wetland in northwestern Minnesota.**
Delehanty, David J. and Svedarsky, W. Daniel
Prairie Naturalist 25(3): 213-218. (1993)
NAL Call #: QH540.P7; ISSN: 0091-0376
Descriptors: wetlands/ birds/ behavior/ colonization/ ecosystems/ nests-nesting/ prairies

1624. **Bottomland hardwood forest management for black bears in Louisiana.**
Weaver, K. M.; Tabberer, D. K.; Moore, L. U.; Chandler, G. A.; Posey, J. C.; and Pelton, M. R.
In: Proceedings of the 44th Annual Conference Southeastern Association of Fish and Wildlife Agencies. Richmond, Va.; Vol. 44: Southeastern Association of Fish

and Wildlife Agencies; pp. 342-350; 1990.
NAL Call #: SK1.S6
Descriptors: telemetry/ forest practices/ techniques/ Louisiana/ Northeast Region
Abstract: Recommendations were outlined for bear habitat management based on a review of the literature and preliminary evidence from ongoing studies that were developed in concert with the Tensas River National Wildlife Refuge Forest Habitat Management Plan.

1625. **Bottomland hardwoods of the Mississippi Alluvial Valley: Characteristics and management of natural function, structure, and composition.**
Hamel, Paul B. and Foti, Thomas L.
Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station; GTR-SRS-042, 2001. 109 p.
NAL Call #: aSD143.G46 no. 42
http://www.srs.fs.usda.gov/pubs/2474
Descriptors: bottomland hardwoods/ forest history/ mammals/ Mississippi Alluvial Valley/ old growth/ songbirds/ wetland restoration
Abstract: A symposium entitled "Bottomland hardwoods of the Mississippi Alluvial Valley: characteristics and management of natural function, structure, and composition" convened on October 28, 1995, as part of the Natural Areas Conference, October 25-28, 1995, In Fayetteville, AR. The symposium's goal was to provide information that managers need to begin restoring the composition, structure, and function of off rest ecosystems in the Mississippi Alluvial Valley. Included in the proceedings from that symposium are 8 of 13 presentations. These peer-reviewed contributions address historical conditions of forests in the Mississippi Alluvial Valley (two papers), historical changes that are reflected in today's forests (one paper), the effect of historic and prehistoric rainfall patterns (one paper), forest fauna in the region (two papers), the effect of herbivory on forest vegetation (one paper), and management of bottomland hardwood forests for multiple outputs (one paper). A ninth paper, concerning characteristics of old-growth forests, is a posthumous submission authored by Dr. James T. Tanner; and the tenth paper was published in another venue. The intended audience of these proceedings includes managers of private, State, and Federal lands, as well as land management planners from a range of jurisdictions.

1626. **Breeding bird communities of recently restored and natural prairie potholes.**
Delphey, P. J. and Dinsmore, J. J.
Wetlands 13(3): 200-206. (1993)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ droughts/ aquatic birds/ reclamation/ community composition/ comparative studies/ environmental restoration/ Aves/ Iowa/ natural wetlands/ environmental restoration/ aquatic birds/ reclamation/ comparative studies
Abstract: We compared the breeding bird communities of natural and recently restored prairie potholes in northern Iowa in 1989 and 1990. Species richness of breeding birds was higher ($P < 0.05$) at natural wetlands, although duck pair counts and species richness were not significantly different between wetland types ($P > 0.1$). Common yellowthroat (Geothlypis trichas), red-winged blackbird (Agelaius phoeniceus), marsh wren (Cistothorus palustris), and swamp sparrow (Melospiza georgiana) were each more abundant at natural than at restored wetlands during at least one year ($P < 0.05$). Brown-headed cowbirds (Molothrus ater) parasitized a significantly greater proportion of red-winged blackbird nests at natural than at restored wetlands. Incomplete development of typical vegetation structure evidently depresses bird species richness at recently restored prairie potholes. Drought the year before and during the first year of our study undoubtedly affected our results. Similar studies should be conducted during periods of relatively high precipitation to complement our results.

1627. **Breeding ducks and their habitats in the High Plains of Texas.**
Ray, James D.; Sullivan, Brian D.; and Miller, Harvey W.
Southwestern Naturalist 48(2): 241-248. (2003)
NAL Call #: 409.6 So8 ; ISSN: 0038-4909
Descriptors: roadside survey: applied and field techniques/ central flyway/ breeding areas/ impoundments: habitat/ occupancy rates/ playa lakes: habitat/ ponds: habitat/ species density
Abstract: The High Plains of Texas is one of the southernmost nontraditional breeding areas for many duck species in North America. Because of a paucity of information on breeding ducks there, we conducted roadside surveys of breeding ducks and their habitats during May and June from 1988 through 1992. Breeding pairs of 15 species were observed on 6 types of ponds (natural and man-made wetlands containing surface water). Mallard (Anas platyrhynchos) density ranged from 9.1 to 23.1 pairs/100 km^2, and density for all species combined ranged from 14.8 to 46.7 pairs/100 km^2 (all years and survey periods included). Occupancy rates were highest on playa lakes and impoundments, though all pond types had occupancy rates exceeding 26% (all surveys and years). Duck pairs per occupied pond were highest on playa lakes (>7 and >4 on May and June surveys, respectively), followed by impoundments (> 5 and > 2) and entrenched draws (>2 and >3). Although the density of breeding pairs in the High Plains of Texas (47 pairs/100 km^2) is generally lower than in prominent nesting areas (e.g., >200 in the San Luis Valley. CO; >600 in central Montana; >2,000 in California; >4,000 in the Prairie Pothole Region), information reported here further confirms the use of the Playa Lakes Region by breeding ducks and illustrates its importance as a major habitat area for waterfowl in the Central Flyway.

1628. **Breeding ecology and nesting habitat associations of five marsh bird species in western New York.**
Lor, Socheata and Malecki, Richard A.
Waterbirds 29(4): 427-436. (Dec. 2006)
NAL Call #: QL671
Descriptors: birds/ wildlife habitat/ breeding/ nesting/ marshes/ New York
Abstract: Nesting habitats and nest success of five species of marsh birds were studied during 1997 and 1998 at the Iroquois National Wildlife Refuge (NWR) and the adjacent Oak Orchard and Tonawanda State Wildlife Management Areas (WMA) located in western New York. Nest searches

located 18 American Bittern (Botaurus lentiginosus), 117 Least Bittern (Ixobrychus exilis), 189 Pied-billed Grebe (Podilymbus podiceps), 23 Sora (Porzana carolina), and 72 Virginia Rail (Rallus limicola) nests. Average nest densities in 1998, our best nest searching year, ranged from 0.01/ha for Soras (N = 8) to 0.28/ha for Pied-billed Grebes (N = 160). Mayfield nest success estimates for Least Bittern were 80% (N = 16) in 1997 and 46% (N = 37) in 1998. Nest success estimates were 72% (N = 55) for Pied-billed Grebe, 43% (N = 6) for Sora, and 38% (N = 20) for Virginia Rail. Nests of all five species were located in 70% emergent vegetation with a mean water depth of 24-56 cm and an average vegetation height that ranged from 69-133 cm. Logistic regression models were developed for each species using habitat variables at nest and random site locations. Each model was ranked with Akaike's Information Criterion for small sample size (AICc). In general, our best models indicated that increased emergent vegetation and horizontal cover with shallow water depths improved the odds of encountering marsh bird nests in the wetlands of western New York. We suggest that managing wetlands as a complex, at different stages of succession, would best benefit marsh bird species.

1629. **Breeding season bird use of restored wetlands in eastern Maryland.**
Muir Hotaling, N. E.; Kuenzel, W. J.; and Douglass, L. W.
Southeastern Naturalist 1(3): 233-252. (2002)
NAL Call #: IPSP11706; ISSN: 15287092
Descriptors: Aves/ Maryland/ breeding/ surveys/ wetland restoration/ birds/ habitat selection
Abstract: We evaluated breeding season (May-July) bird species richness, abundance, and diversity in 21 restored wetlands and several associated habitats (woodlots, cultivated and uncultivated fields, and hedgerows) on Maryland's Eastern Shore over two years. Ninety-seven bird species were encountered over all habitats, while 72 of these species were found in wetlands. Of those birds found in wetlands, 35 species (49%) were wetland dependent and 13 species (18%) were breeding. Wetland-dependent, shorebird, and total species richness and bird abundance were lowest in fields and highest in restored wetlands. Total avian abundance and species richness in woodlots were similar to values in restored wetlands, but species composition differed. The density of individuals and of species was highest in hedgerows and restored wetlands. Bird abundance, species richness, and diversity were higher in restored wetlands in the second year of the study. Richness showed no regression relationship ($p > 0.05$) with either site age or cover-to-water ratio. Restored emergent marshes in eastern Maryland provide habitat for wetland birds, but benefits must be weighed against the loss of bird use in habitats converted into a wetland.

1630. **Breeding-season survival of mallard females in the Prairie Pothole Region of Canada.**
Devries, J. H.; Citta, J. J.; Lindberg, M. S.; Howerter, D. W.; and Anderson, M. G.
Journal of Wildlife Management 67(3): 551-563. (2003)
NAL Call #: 410 J827; ISSN: 0022541X
Descriptors: abdominal implants/ Alberta/ Anas platyrhynchos/ known fate models/ mallard/ Manitoba/ NAWMP/ Prairie Pothole Region/ predation/ radiotelemetry/ Saskatchewan/ survival probability/ breeding season/ female/ habitat restoration/ radiotelemetry/ survival/ waterfowl/ wetland/ Canada/ Anas platyrhynchos
Abstract: As part of the Prairie Habitat Joint Venture (PHJV) Habitat Assessment Project, we radiomarked and tracked daily 2,249 female mallard ducks (Anas platyrhynchos) in the Prairie Pothole Region (PPR) of Canada. We conducted our study at 19 different 54- to 78-km^2 sites for 1 year per site from 1993 to 1998. We estimated female survival probability during the 90-day period following arrival on the breeding area and employed information-theoretic approaches to select among competing models that described factors affecting survival probability. We investigated the relationship between female survival and 3 periods of the nesting season, female age (yearling vs. older), upland habitat treatments, longitude, and habitat variables. Our model estimates of female survival probability ranged between 0.62 (SE = 0.028) and 0.84 (SE = 0.018) and averaged 0.76 (SE = 0.004) for the 90-day period. The best approximating model indicated that female survival was (1) lowest when most females were nesting, and (2) depended on longitude and percent wetland habitat such that survival was lowest at western sites with low wetland densities. Management efforts to reduce wetland loss, especially in western regions of the Canadian PPR, may positively influence female survival. Upland habitat restorations designed to improve nest survival may not have a concurrent impact on female survival unless a significant portion of the nesting population is affected.

1631. **Breeding waterbird wetland habitat availability and response to water-level management in Saint John River floodplain wetlands, New Brunswick.**
Connor, K. J. and Gabor, S.
Hydrobiologia 567(1): 169-181. (2006)
NAL Call #: 410 H992; ISSN: 00188158.
Notes: doi: 10.1007/s10750-006-0051-1.
Descriptors: brood-rearing habitat/ floodplain/ waterbird/ waterfowl/ wetland
Abstract: Wetland management by the Eastern Habitat Joint Venture (EHJV) has focused primarily on water level control to increase the amount of available brood-rearing habitat for waterfowl along the Saint John River floodplain in New Brunswick. Impounded wetlands make up approximately 13% of the Saint John River Floodplain complex. Study objectives included an evaluation of waterfowl brood, and wetland obligate bird use of impoundments and seasonally flooded wetlands within the Saint John River floodplain. Historical water level data and a GIS wetlands inventory were used to estimate the duration of flooding on seasonally flooded wetland habitats, and the distribution and relative amount of brood-rearing habitat throughout the breeding period by region. Aerial brood surveys and call response surveys were used to estimate the relative abundance of waterfowl broods and breeding wetland obligate birds respectively. The overall density of waterfowl broods was greater on impoundments than on seasonally flooded wetlands during both years of study but varied by site. Mean species richness of wetland obligate birds was significantly greater on impoundments than on seasonally flooded wetland habitat. Generally, use of seasonally flooded wetlands by wetland obligate birds during late summer declined while the use of

impoundments increased. Current habitat management for waterfowl appears to be compatible with habitat requirements of wetland obligate birds by increasing the availability of interspersed open water and emergent vegetation throughout the breeding season. A watershed-based analysis of wetland habitat suggests future wetland management should focus on enhancing current impoundments within the Saint John River floodplain. Resources must be secured for maintenance and water level manipulation within existing managed wetlands rather than the construction of additional impoundments. Further evaluation of the distribution of wetland habitat types in the province is essential to identifying focus areas for waterbird conservation throughout NB. © Springer 2006.

1632. **Carbon, plant, and temperature control of nitrate removal from wetland mesocosms.**
David, Mark B.; Gentry, Lowell E.; Smith, Karen M.; and Kovacic, David A.
Transactions of the Illinois State Academy of Science 90 (3-4): 103-112. (1997)
NAL Call #: 500 IL6; ISSN: 0019-2252
Descriptors: biochemistry and molecular biophysics/ conservation/ pollution assessment control and management/ wildlife management: conservation/ agricultural non point source pollution/ bioprocess engineering/ carbon availability/ constructed wetlands/ nitrate/ pollution/ temperature/ tile drainage waters
Abstract: Constructed wetlands have been developed to remove agricultural non-point source pollution from tile drainage waters in the Midwest, but their effectiveness and function are not known. This study investigated the interaction of C availability and temperature on NO_3- removal from water columns in a constructed wetland. Experimental mesocosms (20.32 cm diameter PVC pipes) were buried upright to a depth of 15 cm into wetland sediments to enclose a 7.5 L water column (23 cm depth). Six mesocosms were placed in areas with bare soil and six were placed in areas supporting reed canary grass (Phalaris arundinacea). Treatments were either NO_3- additions (10 mg NO_3-N L^{-1} increase in concentration in water column) or NO_3- Plus glucose additions (10 mg NO_3--N L^{-1} and 50 mg C L^{-1} increases in water column) to the mesocosms during April and June. In April, (11- 12 degree C water temperature) over a 7 day time span, NO_3 cntdot concentrations in the overlying water decreased approximately 50% in non-grass treatments, with or without glucose additions. All or nearly all of the NO_3- was removed from the grass mesocosms in April, and glucose additions did not increase the removal rate. In June (27 degree C water temperature) NO_3- concentrations decreased to zero for all treatments in 48 hours or less. Presence of grass did not affect the rate of NO_3- decrease; however, glucose additions increased the rate to < 24 hours. When calculated on a mass basis in the NO-3 only mesocosms, removal of NO_3- was 0.25 and 0.42 g NO_3—N m^{-2} d^{-1} in the April non-grass and grass treatments, respectively, and 1.6 and 1.4 g NO_3--N m^{-2} d^{-1} in the June corresponding treatments. Calculated Q_{10} values of NO_3- removal per day for non-grass and grass treatments were 3.3 and 2.2, respectively. Depending on amounts and seasonal timing of inputs of NO_3- to the wetlands, mesocosm results suggest that large amounts of NO-3- can be removed from the overlying water by a combination of sediment and plant mechanisms.

1633. **Carrying capacity and diel use of managed playa wetlands by nonbreeding waterbirds.**
Anderson, J. T. and Smith, L. M.
Wildlife Society Bulletin 27(2): 281-291. (1999)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: wetlands/ management/ habitat utilization/ carrying capacity/ flooding/ ecosystem management/ migratory species/ playas/ activity patterns/ nighttime/ daytime/ diurnal variations/ aquatic birds/ nature conservation/ Southern High Plains/ waterfowl/ monitoring/ habitats/ species diversity/ soil management/ seeds/ invertebrates/ Aves/ Texas/ New Mexico/ birds/ winter/ moist-soil management practices
Abstract: Playa wetlands on the Southern High Plains of Texas and New Mexico provide essential wintering habitat for migratory waterbirds. Moist-soil management practices have been implemented in playas, yet no variations on the timing of management have been attempted. In addition, previous evaluation of wetland management has considered only diurnal use by waterfowl and has not considered invertebrates. We compared waterbird diversity, waterfowl abundance, and waterfowl carrying capacity based on seeds and invertebrates among playas varying in flooding date (September vs. November) and management regimes (moist-soil managed vs. unmanaged) during nocturnal and diurnal periods during the winters of 1994-1995 and 1995-1996. Waterbird species richness and diversity were greater in November flooded, moistsoil managed than in September flooded, managed; September flooded, unmanaged; and November flooded, unmanaged playas. Waterfowl were more abundant in November flooded, moist-soil managed playas than in the other treatments, and counts were 10.5 times higher during nocturnal than diurnal counts. Evaluation of moist-soil management using diurnal counts only showed no waterfowl-use benefit. Carrying capacity, based on seed biomass, was greater in managed than in unmanaged playas. Potential use days, using invertebrate abundance, was higher in playas flooded in September than in November. Moist-soil management of playas is effective in increasing waterbird diversity and waterfowl abundance. If the main purpose is to evaluate effectiveness of wetland management for waterfowl, then monitoring of nocturnal and diurnal use is essential.

1634. **Carrying capacity of wetland habitats used by breeding greater snow geese.**
Masse, H.; Rochefort, L.; and Gauthier, G.
Journal of Wildlife Management 65(2): 271-281. (Apr. 2001)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wetlands/ carrying capacity/ grazing/ wildlife management/ Canada, Nunavut/ population number/ breeding sites/ herbivores/ food availability/ ecosystem management/ environment management/ Chen caerulescens atlantica/ Canada, Nunavut, Bylot I./ greater snow goose/ management/ population dynamics/ conservation, wildlife management and recreation

Abstract: Because geese can damage their arctic breeding habitats through overgrazing, there is debate about limiting the rapid growth of the greater snow goose (Chen caerulescens atlantica) population and setting a population goal. To answer these questions, we assessed the nutritional carrying capacity of freshwater wetland habitats for breeding greater snow geese at the Bylot Island colony, Nunavut, Canada. Specifically, we (1) mapped the different types of wetlands on the island; (2) estimated net aboveground primary production of these habitats; (3) compared total food availability with predicted total food requirements of the current population; and (4) validated our predictions of plant biomass consumed by comparing them to the intensity of goose grazing measured. Freshwater wetlands represented 173 ± 6 km^2 or 11% of the total area of the south plain of Bylot Island. Streams and wet polygons were the most important habitats in terms of availability of suitable forage plants for geese. The average net aboveground primary production ranged from 21.0 ± 4.6 along lakes to 46.0 ± 9.8 g/m^2 in polygon channels. We estimated the total food supply available for geese in wetlands at 2,625 ± 461 tons in 1997 but only 1,247 ± 473 tons in 1996, a year of low plant production. We predicted a summer food requirement for goslings at 8.1 ± 0.6 kg/bird, for breeding adults at 7.9 ± 2.3, and for nonbreeding adults at 4.7 ± 1.5, and we predicted the total summer food requirements of the goose population at 1,201 ± 160 tons. The predicted amount of biomass removed (32 ± 7%) agreed well with the actual amount of biomass removed measured in mid-August (39 ± 11%) in 1997, but not in 1996 (67 ± 27% vs 26 ± 17%, respectively), possibly because the goose population was lower that year due to poor breeding success. In 1997, the goose population was at 46 ± 10% of the theoretical short-term carrying capacity (341,000 geese) of the wetlands of Bylot Island. We recommend keeping the goose population below this theoretical carrying capacity.

1635. **Cattail distribution and abundance in North Dakota.**
Ralston, S. T.; Linz, G. M.; Bleier, W. J.; and Homan, H. J.
Journal of Aquatic Plant Management 45: 21-24. (Jan. 2007).
http://skralston.com/Scott/Downloads/Ralston%20JAPM21-24.pdf
Descriptors: wildlife habitat/ cattails/ habitat management/ North Dakota
Abstract: Wetlands in the Prairie Pothole Region (PPR) of North Dakota provide important habitats for a plethora of invertebrate and vertebrate animals. Since 1991, glyphosate-based (N-phosphonomethyl-glycine) herbicides have been used to manage dense cattail (Typha spp. L.) stands on 29,522 ha of wetlands in the PPR to disperse blackbird roosts. Limited information exists on the abundance and distribution of this important habitat. We took aerial photographs and used geospatial analysis tools to identify wetland basins and cattail coverage on randomly selected sample sites within the PPR. We found that average wetland density and size were 13 wetlands/km 2 and 1.1 ha, respectively. Average wetland size was 1.1 ha; whereas, wetlands with cattails averaged 2.4 ha. Cattail was most commonly found in palustrine systems, semi-permanent wetlands, and wetlands with surface water throughout the growing season. Our data showed that current cattail management activities annually impact <1% of the total wetland acreage. The affects of these management actions on wildlife populations, however, are largely unknown.
This citation is from AGRICOLA.

1636. **Cattle grazing mediates climate change impacts on ephemeral wetlands.**
Pyke, Christopher R. and Marty, Jaymee
Conservation Biology 19(5): 1619-1625. (2005)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: climatic changes/ grazing/ feeding behavior/ amphibiotic species/ environmental impact/ wetlands/ resource management/ vulnerability/ rare species/ hydrology/ environmental effects/ precipitation/ reproduction/ conservation/ temperature effects/ Ambystoma californiense/ Caudata/ California/ California tiger salamander
Abstract: Climate change impacts depend in large part on land-management decisions; interactions between global changes and local resource management, however, rarely have been quantified. We used a combination of experimental manipulations and simulation modeling to investigate the effects of interactions between cattle grazing and regional climate change on vernal pool communities. Data from a grazing exclosure study indicated that 3 years after the removal of grazing, ungrazed vernal pools dried an average of 50 days per year earlier than grazed control pools. Modeling showed that regional climate change could also alter vernal pool hydrology. Increased temperatures and winter precipitation were predicted to increase periods of inundation. We evaluated the ecological implications of interactions between grazing and climate change for branchiopods and the California tiger salamander (Ambystoma californiense) at four sites spanning a latitudinal climate gradient. Grazing played an important role in maintaining the suitability of vernal pool hydrological conditions for fairy shrimp and salamander reproduction. The ecological importance of the interaction varied nonlinearly across the region. Our results show that grazing can confound hydrologic changes driven by climate change and play a critical role in maintaining the hydrologic suitability of vernal pools for endangered aquatic invertebrates and amphibians. These observations suggest an important limitation of impact assessments of climate change based on experiments in unmanaged ecosystems. The biophysical impacts of land management may be critical for understanding the vulnerability of ecological systems to climate change.

1637. **Changes in piping plover nesting habitat availability at Great Plains alkaline wetlands, 1938-1997.**
Root, Brian G. and Ryan, Mark R.
Wetlands 24(4): 766-776. (2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: alkaline wetland/ fire frequency/ flooding impact/ ground water hydrology/ livestock grazing intensity/ long term recovery/ nesting habitat availability/ surface water level/ total beach habitat/ vegetation encroachment
Abstract: Alkaline wetland beaches provide crucial habitat for breeding piping plovers (Charadrius melodus) in the northern Great Plains of the United States and Canada. Vegetation encroachment has been identified as a potential

threat that decreases alkaline beach habitat availability, but the long-term status of these breeding habitats has not been evaluated. We measured vegetation changes at two North Dakota alkaline wetland complexes from 1938 to 1997. Total beach habitat, including lower beaches that were impacted by flooding, varied substantially among years based on changes in surface-water levels. Quantities of upper-beach habitats, which were not affected by inundation, were negatively correlated with precipitation amounts during the previous five-year periods. We measured declines in upper-beach habitat averaging 0.89 ha/yr and 0.20ha/yr at our two wetland complexes from 1938 to 1997, suggesting that long-term changes in factors other than precipitation (e.g., ground-water hydrology, livestock grazing intensity, or fire frequency) may be negatively affecting beach availability. Vegetation reduction may be critical to long-term recovery of threatened piping plovers in the Great Plains.

1638. **Changes in species diversity in peatlands drained for forestry.**
Vasander, Harri; Laiho, Raija; and Laine, Jukka
In: Northern forested wetlands: Ecology and management/ Trettin, Carl C.; Jurgensen, Martin F.; Grigal, David F.; and Gale, Margaret R.
Boca Raton, Fla.: CRC Press, Inc., 1997; pp. 109-119.
Notes: ISBN: 1566701775. Meeting paper: International Symposium on the Ecology and Management of Northern Forested Wetland, Traverse City, Michigan, USA; Cochrane, Ontario, Canada; August 24-31, 1994.
Descriptors: biodiversity/ forestry/ freshwater ecology: ecology, environmental sciences/ northern forested wetland/ peatland drainage/ species diversity

1639. **Changes in vernal pool edaphic settings through mitigation at the project and landscape scale.**
Wacker, M. and Kelly, N. M.
Wetlands Ecology and Management 12(3): 165-178. (2004)
NAL Call #: QH541.5.M3 W472; ISSN: 09234861
Descriptors: California/ HGM/ mitigation/ regulation/ vernal pools/ wetlands
Abstract: Vernal pool mitigation is a highly controversial process that has been frequently criticized for its inability to adequately replicate the ecosystem functions of the original intact wetlands. We analyzed past mitigation practices in two rapidly growing counties in California's Great Central Valley to determine if mitigation procedures are re-arranging the vernal pool landscape by substituting more common or less ecologically significant pool types (as defined by soil type and geomorphology) for rarer or ecologically richer pool types. Results indicate that most development projects impacting vernal pools conduct at least a portion of their mitigation requirements at a site with similar edaphic settings. However, when examined at a landscape-scale across all development projects, the more common edaphic settings such as Northern Hardpan and Low Terrace pools are increasing while more rare types such as Northern Claypan and Volcanic Mudflow pools are decreasing. Results also show that Drainageway pools, a less-specialized pool type with generally lower species richness, are becoming more common through mitigation. These results are confirmed by an analysis of landscape diversity, which showed that overall landscape diversity was lower at mitigation sites than at project sites. Despite these results, the ecological significance of vernal pool mitigation practices remains unclear for several reasons. The lack of maps showing exact locations of vernal pools at project sites make it difficult to precisely determine vernal pool acreage and distribution among edaphic settings. Additionally, more research is needed to determine precise relationships between edaphic settings and species distributions and the effects of mitigation area management practices on species distribution and persistence.

1640. **Chironomidae (Diptera) and vegetation in a created wetland and implications for sampling.**
Streever, W. J.; Evans, D. L.; Keenan, C. M.; and Crisman, T. L.
Wetlands 15(3): 285-289. (1995)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ sampling/ vegetation patterns/ artificial wetlands/ ecosystems/ vegetation cover/ habitat improvement (physical)/ habitat improvement (biological)/ ecological associations/ invertebrates/ habitats/ Diptera/ Chironomidae/ Florida/ artificial wetlands/ vegetation cover/ habitat improvement (physical)/ habitat improvement (biological)/ ecological associations/ invertebrates/ habitats/ vegetation patterns/ Diptera/ Chironomidae
Abstract: Although invertebrate communities are used in the evaluation of created freshwater wetlands, spatial patterns of invertebrate community structure are frequently ignored. Invertebrate distributions are generally associated with plant community distribution in natural aquatic ecosystems. In this study, 180 core samples were collected to examine associations between chironomoid (Diptera) genera and emergent vegetation communities in a single created freshwater herbaceous wetland in central Florida. Three of the five common genera were significantly more abundant ($p < 0.05$, Wilcoxon Rank Sum Test) in areas with greater than 50% cover by emergent vegetation than in open water, but no differences were found between areas dominated by Pontederia cordata and areas dominated by mixed emergent vegetation. Samples from an area of open water and an area with over 80% cover by P. cordata showed significant differences in abundances of all common chironomid genera ($P < 0.05$, Wilcoxon Rank Sum Test). Results suggest that sampling designs for studies comparing benthic invertebrate communities from natural and created wetlands should consider the possible associations between vegetation and invertebrate communities.

1641. **Coastal wetlands of the Upper Great Lakes: Distribution of invertebrate communities in response to environmental variation.**
Gathman, Joseph P.; Burton, Thomas M.; and Armitage, Brian J.
In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 949-994.
Notes: ISBN: 0471292583.
NAL Call #: QL365.4.A1I58
Descriptors: Invertebrata/ community structure/ population density/ coastal wetland fauna/ distribution within habitat/

semiaquatic habitat/ wetland communities/ environmental variables/ abiotic factors/ coastal wetlands/ water movements/ Great Lakes/ North America

1642. **Collaborative planning for wetlands and wildlife: Issues and examples.**
Porter, Douglas R. and Salvesen, David.
Washington, DC: Island Press; 293 p. (1995)
NAL Call #: QH76.C65 1995; ISBN: 1559632879.
Descriptors: Wetland conservation---United States---Planning
This citation is from AGRICOLA.

1643. **Colonization of herpetofauna to a created wetland.**
Toure, T'shaka A. and Middendorf, George A.
Bulletin of the Maryland Herpetological Society 38(4): 99-117. (2002)
NAL Call #: QL640.M3; ISSN: 0025-4231
Descriptors: behavior/ terrestrial ecology: ecology, environmental sciences/ dipnetting/ applied and field techniques: drift fence array/ applied and field techniques: frog cell/ applied and field techniques: funnel trapping/ applied and field techniques: pitfall trapping/ applied and field techniques/ clay substrates/ colonization/ conservation biology/ created wetlands: habitat/ flooded areas/ forests: habitat/ hydroperiods/ species diversity/ terraced sites/ vegetation density/ waterbodies
Abstract: The colonization by amphibians and reptiles of a newly created wetland was investigated at a site along Sands Road in Davidsonville, Anne Arundel County, MD. This 52-hectare artificial wetland was constructed in a gradient design that resulted in four distinct terraced sites that temporarily retain rainwater. This palustrine wetland site, surrounded by an emergent, young, shrub-scrub, forested area, is characterized by the appearance of shallow temporarily flooded areas over a clay substrate that remains wet even during the driest periods of the year with a groundwater depth less than 1.5 m. The adjacent natural forest bordering the Patuxent River served as a natural indicator of amphibian and reptile activity and a source for site colonization. The created wetland site was monitored over two field seasons (March through September 1995-96) using linear transects, frog calls, drift fence arrays, pitfall and funnel traps, and dipnets. Sampling, conducted for 54 days revealed a total of twenty-eight species (16 amphibians and 12 reptiles). The colonization of this created wetland compared favorably in diversity to adjacent, natural forest. Factors best explaining differences in herpetofaunal activity, across the different sites within the created wetland, were density of vegetation surrounding the waterbody and hydroperiod.

1644. **Colonization of restored wetlands by amphibians in Minnesota.**
Lehtinen, Richard M. and Galatowitsch, Susan M.
American Midland Naturalist 145(2): 388-396. (2001)
NAL Call #: 410 M58; ISSN: 0003-0031
Descriptors: aquatic vegetation cover/ colonization/ habitat suitability/ restored wetlands/ water chemistry
Abstract: Twelve wetlands (7 recently restored; 5 reference) in central and southern Minnesota were monitored during the 1998 breeding season to assess colonization of recently restored wetlands by amphibians, compare the amphibian fauna to that of reference wetlands and identify important factors influencing the probability of colonization. Eight amphibian species rapidly colonized recently restored wetlands and established breeding populations. Reference wetlands were inhabited by twelve species, including four not found in restored wetlands (Ambystoma laterale, Notophthalmus viridescens, Pseudacris crucifer and Rana clamitans). Most local habitat variables, such as water chemistry or aquatic vegetation cover, were not influential in determining species richness patterns in recently restored wetlands. Size and spatial isolation of restored wetlands, however, were important predictors of species richness. Habitat suitability also influenced the probability of colonization for some species. The results of this study indicate that restored wetlands are valuable habitat for at least a subset of the amphibian fauna of this region and that wetland size, isolation and habitat suitability all influence colonization success.

1645. **Comparing ecological functions of natural and created wetlands for shorebirds in Texas.**
Brusati, Elizabeth D.; DuBowy, Paul J.; and Lacher, Thomas E.
Waterbirds 24(3): 371-380. (2001)
NAL Call #: QL671; ISSN: 1524-4695
Descriptors: fecal analysis: analytical method/ fixed point observations: survey method/ inshore transects: survey method/ offshore transects: survey method/ chick provisioning/ diet/ estuaries: habitat/ food resource partitioning/ foraging ecology/ habitat choice/ habitat differences/ intercolony differences/ piscivory/ prey choice/ satellite imagery/ sea surface temperature/ stable isotope ratios/ water masses: delineation
Abstract: We compared shorebird behavior, abundance and prey availability between natural and created wetlands along the Gulf of Mexico, Texas, USA. Locations included Aransas National Wildlife Refuge, the Nueces River Delta, and Mustang Island. Few significant differences existed in invertebrate density or biomass between sites; greater differences were found seasonally than between natural and created sites. Non-metric multidimensional scaling of avian abundance separated Mustang Island from Nueces Delta. Cluster analysis of behavior of Black-bellied Plover (Pluvialis squatarola), Long-billed Curlew (Numenius americanus), "peeps" (Calidris minutilla, C. pusilla), and Willet (Catoptrophorus semipalmatus), showed no clear differences in their behavior on natural and created sites. Mustang Island sites were more similar to each other than to Nueces Delta. All created sites had natural hydrology and tidal circulation, which appear to facilitate invertebrate and avian recruitment.

1646. **Comparison of avian communities on restored and natural wetlands in North and South Dakota.**
Ratti, J. T.; Rocklage, A. M.; Giudice, J. H.; Garton, E. O.; and Golner, D. P.
Journal of Wildlife Management 65(4): 676-684. (2001)
NAL Call #: 410 J827; ISSN: 0022541X
Descriptors: avian community/ birds/ habitat/ North Dakota/ South Dakota/ waterfowl/ wetland restoration/ avifauna/ habitat restoration/ habitat use/ waterfowl/ wetland/ United States

Abstract: We compared avian use of 39 restored and 39 natural wetlands in North and South Dakota during spring and summer of 1997 and 1998. Wetlands were widely distributed, but restored- and natural-wetland pairs were from the same geographic locale and had similar characteristics, including wetland size. We conducted paired comparisons between restored and natural wetlands for wetland-bird density, waterfowl-breeding pairs, and wetland-avian abundance, species richness, and diversity. We also compared abundance, species richness, and diversity of birds on upland areas adjacent to wetlands. Canada goose (avian scientific names in Appendix A), mallard, redhead, and ruddy duck had higher densities on restored wetlands. We failed to detect differences in overall avian abundance, species richness, or diversity, between restored and natural wetlands. We conclude that restored wetlands in the Prairie Pothole Region supported similar avian communities with equal or higher abundances than those of natural wetlands.

1647. **A comparison of natural and created depressional wetlands in central Oklahoma using metrics from indices of biological integrity.**
Hartzell, Dena; Bidwell, Joseph R.; and Davis, Craig A.
Wetlands 27(4): 794-805. (Dec. 2007)
NAL Call #: QH75.A1W47
Descriptors: Aves/ constructed wetlands/ depressional wetlands/ IBI/ macroinvertebrates/ natural wetlands/ seasonal differences/ vegetation
Abstract: Created wetlands and water bodies that have wetland characteristics (old farm ponds) appear to provide many of the habitat attributes of natural systems. To compare the biological and physical characteristics of natural and created wetlands, we evaluated water chemistry and a suite of metrics associated with the plant, macroinvertebrate, and avian assemblages at 12 natural and six created systems in central Oklahoma. The natural wetlands had significantly shallower depths and higher turbidity levels than the created wetlands. Of 43 metrics across the three biotic assemblages, seven were significantly different between the two wetland types. The proportions of hemipteran insects from the family Corixidae and insectivorous bird species were both greater in natural than created wetlands. The proportion of perennial plant species, the proportion of invertebrates in the shredder feeding guild, the number of Ephemeroptera, Trichoptera, Sphaeridae, and dragonfly (ETSD) taxa, the proportion of individuals in the dominant bird taxa, and the proportion of avian edge species were all greater in created wetlands than in natural wetlands. The community similarity (based on Jaccard's similarity index) in the two wetland types was 38% for plants, 56% for macroinvertebrates, and 65% for birds. For some individual metrics, assemblage members had similar attributes (e.g., proportion of omnivorous taxa) although the specific taxa often differed between natural and created wetlands. These differences may influence the performance of certain assessment methods when they are applied to created wetlands.

1648. **Comparison of wetland structure and function on grazed and ungrazed salt marshes.**
Reader, Judy and Craft, Christopher
Journal of the Elisha Mitchell Scientific Society 115(4): 236-249. (1999)
NAL Call #: 500 EL4; ISSN: 0013-6220
Descriptors: estuarine ecology: ecology, environmental sciences/ backmarsh elevation/ benthic community/ biomass: aboveground, belowground/ carbon: nitrogen ratio/ grazing effects/ herbivory/ nitrogen:phosphorus ratio/ primary productivity/ salinity/ salt marshes/ soil development/ species composition/ species density/ streamside elevation/ tidal inundation/ wetlands: function, structure
Abstract: Macrophyte productivity, soil development, and benthic invertebrate communities were compared on grazed and ungrazed salt marshes to examine the effects of grazing by feral ponies on wetland structure and function. The marshes had similar geomorphology (embayment), elevation (streamside and backmarsh), tidal inundation (1 m), salinity (25-35 ppt), soil type (Carteret series), and plant species composition (Spartina alterniflora Loisel) but differed with respect to the presence or absence of ponies. Over a two year period, above and belowground (0-30 cm depth) biomass were significantly lower in the grazed marsh (aboveground = 196-400 g/m^2, belowground = 828-1049 g/m^2) than the ungrazed marsh (aboveground = 588-671 g/m^2; belowground = 4,921-6,730 g/m^2). Reduction in Spartina biomass at the grazed marsh resulted in less soil organic carbon, nitrogen, and phosphorus than at the ungrazed marsh. There was no difference in C:N ratios at the two marshes, but N:P ratios were higher in the ungrazed marsh (9:1-19:1) than the grazed marsh (6:1-11:1), suggesting that more N is available for marsh organisms at the ungrazed site. Total benthic infauna density did not differ between the grazed (31,265 organisms/m^2) and ungrazed (45,511 organisms/m^2) marshes. However, the density of subsurface deposit feeders was significantly lower in the grazed marsh (10,370 organisms/m^2) than in the ungrazed marsh (16,877 organisms/m^2), perhaps as a result of lower soil organic matter and reduced food availability. Our findings suggested that herbivory by feral ponies co-ops primary productivity that would otherwise enter the detritus based salt marsh food web. This hypothesis should be tested using manipulative studies (e.g. exclosures) that exclude the ponies from areas of the marsh.

1649. **Composition of breeding bird communities in Gulf Coast Chenier Plain marshes: Effects of winter burning.**
Gabrey, S. W. and Afton, A. D.
Southeastern Naturalist 3(1): 173-185. (2004)
NAL Call #: IPSP11706; ISSN: 15287092
Descriptors: breeding birds/ waterfowl/ prescribed burning/ marshes/ winter burns/ Agelaius/ Agelaius phoeniceus/ Ammodramus maritimus/ Anatidae/ Aves/ Emberizinae/ Icteridae/ Quiscalus major/ Spartina patens
Abstract: Marsh managers along the Gulf Coast Chenier Plain frequently use winter burns to alter marsh vegetation and improve habitat quality for wintering waterfowl. However, effects of these burns on marsh avifauna are not well documented. We recorded abundances of breeding bird species and vegetation structure in burned and

unburned control marshes during one breeding season before (1996) and two breeding seasons after (1997, 1998) experimental winter burns. We used non-metric multidimensional scaling analysis to assess the extent and direction of changes in bird community compositions of burned and unburned control marshes and to investigate the influence of vegetation structure on bird community composition. Overall, we found that Seaside Sparrows (Emberizidae: Ammodramus maritimus [Wilson]) and Red-winged Blackbirds and Boat-tailed Grackles (Icteridae: Agelaius phoeniceus [L.] and Quiscalus major Vieillot, respectively) comprised > 85% of observed birds. In burned marshes during the first breeding season following experimental burns (1997), icterid abundance increased while Seaside Sparrow abundance decreased relative to pre-burn (1996) conditions. This pattern was reversed during the second breeding season post-burn. No obvious patterns of change in avian abundance were detected in unburned control marshes over the 3-year period. Qualitative changes in breeding bird community composition were related to effects of winter burning on percent cover of dead vegetation and Spartina patens (Aiton) Muhl.

1650. **Consequences of habitat loss and fragmentation for wetland amphibian assemblages.**
Lehtinen, R. M.; Galatowitsch, S. M.; and Tester, J. R.
Wetlands 19(1): 1-12. (1999)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ habitat changes/ conservation/ habitats/ amphibians/ land use/ marshes/ geographical information systems/ species extinction/ ecosystem disturbance/ nature conservation/ Amphibia/ Minnesota/ amphibians/ habitat fragmentation
Abstract: Landscape-level variables operating at multiple spatial scales likely influence wetland amphibian assemblages but have not been investigated in detail. We examined the significance of habitat loss and fragmentation, as well as selected within-wetland conditions, affecting amphibian assemblages in twenty-one glacial marshes. Wetlands were located within urban and agricultural regions of central and southwestern Minnesota, USA and were distributed across two ecoregions: tallgrass prairie and northern hardwood forest. We surveyed amphibian assemblages and used a geographic information system to quantify land-use variables at three scales: 500, 1000, and 2500 m. Ten species of amphibians were detected, the most abundant being Rana pipiens, Ambystoma tigrinum, and Bufo americanus. Amphibian species richness was lower with greater wetland isolation and road density at all spatial scales in both ecoregions. Amphibian species richness also had a negative relationship with the proportion of urban land-use at all spatial scales in the hardwood forest ecoregion, and species richness was greater in wetlands with fish and Ambystoma tigrinum. These biotic relationships are less consistent and more difficult to interpret than are land-use relationships. The data presented here suggest that decreases in landscape connectivity via fragmentation and habitat loss can affect amphibian assemblages, and reversing those landscape changes should be an important part of a regional conservation strategy.

1651. **Consequences of prairie wetland drainage for crustacean biodiversity and metapopulations.**
Jenkins, D. G.; Grissom, S.; and Miller, K.
Conservation Biology 17(1): 158-167. (Feb. 2003)
NAL Call #: QH75.A1C5 ; ISSN: 0888-8892
Descriptors: wetlands/ prairies/ drainage/ biological diversity/ metapopulations/ historical ecology/ temporary ponds/ community composition/ freshwater crustaceans/ species diversity/ historical account/ long-term records/ genetics/ population genetics/ species extinction/ man-induced effects/ land use/ agriculture/ Crustacea/ Illinois/ conservation/ mechanical and natural changes
Abstract: Much of Illinois was once wet prairie, dotted with ancient (ca. 10,000-year-old) ephemeral wetlands. Most wetland habitat (85%) was converted to agriculture over a span of about 100 years (ca. 1850-1950). The consequences of this severe habitat fragmentation on wetland communities and metapopulations are unknown. We studied crustacean communities (weekly stovepipe samples throughout hydroperiods) for 3 years in a set of extant ephemeral wetlands in Illinois. We generated species-sites curves by rarefaction and extrapolated those curves to conservatively estimate that 83-85 crustacean species may have inhabited approximately 4 million ephemeral wetlands that once existed in Illinois; 8-9 crustacean species were driven to extinction in Illinois during drainage; and 75-76 crustacean species are extant in the few remaining ephemeral wetlands of Illinois. We also conducted cellular automata simulations to examine the potential effects of habitat fragmentation on the genetic structure of extant crustacean metapopulation. Simulations indicated that conversion of the former wet prairie to agriculture may have reduced crustacean metapopulations to isolated populations that are more vulnerable to future habitat loss. Despite severe habitat fragmentation, curvilinear species-sites relationships suggest that the greatest extinction rates have yet to occur for ephemeral wetland crustaceans. However, selection for limited dispersal during habitat fragmentation may contribute to extinction debt for extant species. Conservation programs can preserve much of the historical biodiversity of ephemeral wetlands, but future wetland biodiversity will depend heavily on the success of those efforts. The consequences of historical wetland loss and the importance of wetland conservation efforts to agriculture in the United States should be instructive for other regions.

1652. **Conservation compliance and wetlands conservation provisions of the omnibus farm acts of 1985, 1990 and 1996.**
Brady, S. J.
In: A comprehensive review of Farm Bill contributions to wildlife conservation, 1985-2000/ Heard, L. P; Hohman, W. L.; Halloum, D. J.; and Wildlife Habitat Management Institute (U.S.); Series: Technical Report USDA/NRCS/WHMI. Madison, MS: U.S. Department of Agriculture, 2000; pp. 5-17.
NAL Call #: aS604.6 C66 2000
Descriptors: conservation compliance/ Conservation Reserve Program/ Wetlands Reserve Program/ Farm Bill/ laws and regulations/ wildlife habitats

1653. **Conservation implications of flooding rice fields on winter waterbird communities.**
Elphick, C. S. and Oring, L. W.
Agriculture, Ecosystems and Environment 94(1): 17-29. (Jan. 2003)
NAL Call #: S601.A34
Descriptors: California/ shorebird/ waterfowl/ wading birds/ agricultural wetland/ rice farming/ conservation value/ habitat management
Abstract: The effects of flooding harvested rice fields on waterbird communities were studied during winter. Variation in the number of waterbird species, overall densities of all waterbirds, wading birds, waterfowl, and shorebirds, and a measure of conservation value that weighted species according to their relative abundance and population trends were examined. Each variable was tested for differences among: (a) flooded and unflooded fields; (b) flooded fields that received different rice straw manipulations; and (c) fields with different water depths. Flooded fields were used by waterbirds more than unflooded fields according to most criteria, although wading bird densities did not differ between flooded and unflooded fields. In terms of conservation value, flooded fields contributed considerably more to waterbird conservation than unflooded fields. The number of waterbird species, total waterbird density, and the density of wading birds differed significantly among straw management treatments, though in different ways. Water depth significantly affected all measures, but in all cases most of the variation went unexplained. Bird densities were explained best by asymptotic relationships, with shorebird densities greatest in shallow water and waterfowl and wading bird densities greatest in deeper conditions. Waterbird richness and conservation value both were greatest at depths of 10-15cm. Intentionally flooding fields during winter significantly affected numerous aspects of the waterbird community. The method of flooding also influenced the waterbird community, although these effects often were small.
This citation is from AGRICOLA.

1654. **Conservation of aquatic insects: Worldwide crisis or localized threats.**
Polhemus, D. A.
American Zoologist 33(6): 588-598. (1993)
NAL Call #: 410 Am3; ISSN: 0003-1569 [AMZOAF].
Notes: Literature review.Paper presented at the Symposium, "The Crisis in Invertebrate Conservation," Annual Meeting of the American Society of Zoologists and the Canadian Society of Zoologists, December 27-30, 1992, Vancouver, British Columbia. Includes references.
Descriptors: aquatic insects/ nature conservation/ endangered species/ species diversity/ legislation/ biodiversity/ Ambrysus amargosus
This citation is from AGRICOLA.

1655. **Constructed ponds as mitigated habitat for wood frogs (Rana sylvatica) and spotted salamanders (Ambystoma maculatum).**
Good, C. D.; Pauley, T. K.; and Keyser, P.
Southeastern Biology 53(2): 225. (2006); ISSN: 1533-8436
Descriptors: amphibia/ wood frog/ spotted salamander/ ponds/ conservation actions/ habitat suitabilities/ breeding/ freshwater environments/ amphibia/ Aeschnidae/ Rana sylvatica/ Ambystoma maculatum
Abstract: Amphibian monitoring is important for successful conservation practices in timbered forests. Three ponds were constructed in 3 forested areas on MeadWestvaco's Wildlife and Ecosystem Research Forest in Randolph County, WV. To determine habitat suitability for breeding and larval amphibians, studies were conducted in 6 ponds during 2004, and all 9 in 2005. Drift fence methods with paired funnel traps (16 per pond) were used for amphibian captures. Species of focus included Rana sylvatica and Ambystoma maculatum because they are known to be philopatric thus providing data on the continued use of these ponds as breeding sites. During both years, trapped amphibians were measured and given 1 pond specific mark with viable implant elastomer. In 2005, juveniles were given individual tags. Breeding R. sylvatica (n = 15) were captured in early spring 2005. No breeding R. sylvatica were captured in 2004. In 2005, juvenile captures (n = 146) increased from 2004 (n = 30). No A. maculatum were captured. Phenological differences between ponds, possibly due to elevation or hydrology, will be presented. Adult R. sylvatica increased pond use, while larval success in ponds remains to be seen. Tadpoles did not successfully metamorphose from 2 ponds in 2005. Clear-cut treatments surrounding the ponds will be applied in 2006 and results will be compared to these baseline data.

1656. **Constructed wetlands for wastewater treatment and wildlife habitat: 17 case studies.**
United States Environmental Protection Agency.
Washington, DC: U.S. Environmental Protection Agency; EPA832-R93-005, 1993. 174 p.
Notes: EP 1.2:W 53/7 (SuDocs).
NAL Call #: TD756.5.C65--1993
Descriptors: Constructed wetlands---United States---Case studies/ Sewage---Purification---Biological treatment---United States---Case studies/ Habitat---Ecology---Modification---United States---Case studies
This citation is from AGRICOLA.

1657. **Constructing freshwater wetlands to replace impacted natural wetlands: A subtropical perspective.**
Streever, W. J.; Kiefer, J. H.; and Crisman, T. L.
In: Tropical Limnology/ Timotius, K. H. and Goeltenboth, F.; Vol. 3, 1995; pp. 127-135.
Notes: Special issue: Tropical rivers, wetlands and special topics; Conference: International Conference on Tropical Limnology in Commemoration of the 65th Anniversary of The Ruttner-Thienemann Limnological Sunda Expedition, Salatiga (Indonesia), 4-8 Jul 1994; ISBN: 979-8792-01-3.
Descriptors: wetlands/ nature conservation/ fishery management/ agricultural runoff/ water quality control/ Florida/ mining/ phosphates/ conservation, wildlife management and recreation
Abstract: Numerous tropical nations are interested in wetland conservation, but as economies and populations continue to grow wetland losses will continue to accrue. In the U.S.A. legislation encourages the construction of wetlands as mitigation for unavoidable wetland loss. Construction of over 4000 ha of freshwater wetlands in Florida's phosphate mining district (latitude 28 N, longitude 82 W) provides a subtropical perspective on the potential of wetland construction in the tropics. Extensive field data from industry reports and from government-supported

research indicate that vegetation, fish, meiofauna, and benthic invertebrate communities of some constructed wetlands are similar to those of nearby natural wetlands. In this paper, six "principles of wetland construction" are presented to summarize and synthesize experience gained through the construction of wetlands in central Florida: 1. The potential benefits offered by construction of wetlands should only be considered when loss of natural wetlands is unavoidable. 2. Clear and realistic goals should be formulated for each wetland construction project. 3. Establishment of the appropriate hydrology should be a primary concern in wetland construction. 4. Establishment and maintenance of vegetation involve both active and passive strategies. 5. Because wetland construction technology is still in a developmental stage, all projects should be carefully monitored. 6. If monitoring reveals major faults with a constructed system, remedial measures should be taken Future wetland construction projects in the tropics may benefit from wetland constructior experience in Florida's subtropics.

1658. **Created and restored marshes in the Lower Fraser River, British Columbia: Summary of their functioning as fish habitat.**
Levings, C. D. and Nishimura, D. J.
Water Quality Research Journal of Canada 32(3): 599-618. (1997); ISSN: 1201-3080
Descriptors: Canada, British Columbia, Fraser River/ marshes/ aquatic habitat/ estuaries/ invertebrates/ smolt/ salmon/ aquatic plants/ artificial wetlands/ rehabilitation/ comparison studies/ environmental restoration/ Oncorhynchus
Abstract: Ecological comparisons of transplanted, natural (reference) and disrupted (unvegetated) marsh sites on the Fraser River estuary, British Columbia, were conducted between 1991 and 1994. The study examined vegetative biomass and cover, invertebrate abundance, fish abundance, fish residency, fish food, and submergence time for the three habitats. Standing crop biomass at three transplant sites was within the range of values for reference sites, but was much lower at an unstable site where sediment slumping had occurred. The percent cover of Lyngbyei's sedge (Carex lyngbyei) in eight transplant sites was <50% of that observed in adjacent reference sites when data were averaged over the study area; rushes (Juncus spp.) were more abundant in transplant sites. In all study reaches, abundance of invertebrates at transplant and reference sites was significantly higher than at disrupted sites. In several instances, invertebrate abundance at transplant sites was greater than at reference sites. No significant difference (p>0.05) was observed among marsh sites when chum salmon (Oncorhynchus keta) and chinook salmon (O. tschawytscha) fry abundance were compared. However, chinook and sockeye smolt catches were significantly different (p<0.05) among marsh sites and were usually higher at disrupted sites. In nine sites in the North Arm and Deas Slough area chum fry residency was examined. At one transplant site (DE1) marked chum fry were caught up to 48 h after release. No fry were caught 1 h after release at a transplant site (DI1) and a disrupted site (DE4). At the remaining sites, fry were caught up to 1 and 3 h after release. At all sites, over 80% of the total number of food organisms examined in chum fry stomachs were harpacticoid copepods. Mean submergence time for reference marshes ranged from 33.2 to 50.7%, but for transplanted sites the value ranged from 26.4 to 60.1%. Our study shows that numerous factors need to be examined in determining if restored marshes will function as natural habitats. The development of a standardized set of reference criteria would assist in evaluating whether or not transplanted marshes are functioning as designed.

1659. **Creation and restoration of riparian habitat in southwestern arid and semi-arid regions.**
Johnson, R. R.; Mills, G. S.; and Carothers, S. W.
In: Wetland Creation and Restoration: The Status of the Science. Covelo, Calif.: Island Press, 1990; pp. 351-366.
Notes: ISBN: 1559630450.
NAL Call #: QH541.5.M3W462
Descriptors: artificial wetlands/ habitat restoration/ riparian land/ water resources management/ wetland restoration/ arid lands/ planting management/ research priorities/ riparian vegetation/ riparian waters/ soil-water-plant relationships/ vegetation establishment/ water resources development
Abstract: Though the literature on characteristics, values, and functions of riparian habitats in the arid and semiarid southwestern region of the United States is fairly extensive, few papers that pertain to its creation or restoration are available. Because these projects are so recent, evaluations of successes and failures are based on short-term results; long-term survival and growth rates are as yet unknown. In most cases, creation and restoration projects have involved the planting of vegetation and not the creation of conditions suitable for the natural regeneration of riparian habitats. Important considerations for riparian creation or restoration projects in the Southwest include: depth to water table; soil salinity and texture; amount and frequency of irrigation; effects of rising and dropping water tables on planted trees; protection from vandalism, off-road vehicles, and livestock; monitoring of growth rates as well as survival; and project design flexible enough to allow for major modifications. Because the creation and restoration of riparian habitats in the Southwest is new and mostly experimental, more information is needed for virtually every aspect of revegetation. Two major questions that need to be answered are whether planted trees survive for more than a few years and reach expected sizes, and what ranges of planting parameters are most cost-effective. Specific information needs include the identification of: the most suitable watering regimes; suitable soil conditions for various tree species; long- term survival and growth rates; and effects of variable water levels on planted trees.

1660. **Decline of duck nest success revisited: Relationships with predators and wetlands in dynamic prairie environments.**
Drever, M. C.; Wins-Purdy, A.; Nudds, T. D.; and Clark, R. G.
Auk 121(2): 497-508. (2004)
NAL Call #: 413.8 AU4 ; ISSN: 00048038
Descriptors: Anas acuta/ Anas clypeata/ Anas discors/ Anas platyrhynchos/ Anas strepera
Abstract: Covariation among factors that may affect nest success of dabbling ducks in the Prairie Pothole Region of North America (e.g. productivity of upland and wetland

habitat related to climate variation, and duck and predator densities) often confounds efforts to interpret the effect of any individual factor. A comparison of nest success of dabbling ducks at sites with and without predator management provided an opportunity to separate the effect of predation pressure from other factors because predator management has occurred over a range of climatic conditions. We updated an existing study on temporal trends of nest success for prairie ducks in the Prairie Pothole Region of North America by compiling recent estimates of nest success for five species of dabbling ducks (Mallard [Anas platyhrynchos], Northern Pintail [A. acuta], Northern Shoveler [A. clypeata], Blue-winged Teal [A. discors], and Gadwall [A. strepera]). In addition, we compared trends of nest success at unmanaged sites and sites where nest predators were excluded or removed. We used pond density calculated from annual surveys for breeding waterfowl as an index of upland and wetland productivity and a correlate of predator and duck density. At unmanaged sites, the best approximating local regression model suggested that, rather than having undergone a monotonic decline, average nest success has fluctuated through time, although those changes do not appear to be associated with changes in pond density. At sites where predators were excluded, nest success did not vary with time but varied positively with pond density in the previous year, although that effect was tempered by high pond density in the year of observation. At sites where predators were removed but could emigrate back into study plots, nest success varied widely over time and we found no evidence of an effect of pond density. We show that nest success of dabbling ducks is higher under predator management than at sites without predator management, and that this relationship varies with climatic conditions, possibly related to complex interactions within and among duck species, their predators, and their prey.

1661. **Design and management of edge-of-field water control structures for ecological benefits.**
Shields, F. D.; Smiley, P. C.; and Cooper, C. M.
Journal of Soil and Water Conservation 57(3): 151-157. (2002)
NAL Call #: 56.8 J822 ; ISSN: 00224561
Descriptors: amphibians/ birds/ ecological impairment/ erosion control/ fish/ gully/ mammals/ reptiles/ riparian zone/ species diversity/ ecological impact/ erosion control/ gully erosion/ riparian zone/ soil water/ United States
Abstract: Stream channel incision often triggers formation of tributary gullies. These gullies erode and extend into fields, generating sediments that pollute downstream waters and degrade aquatic habitats. Standard practice for gully treatment involves damming using an earthen embankment with drainage provided by an L-shaped metal pipe. To date, thousands of these structures, also known as drop pipes, have been constructed in riparian zones adjacent to agricultural areas, but environmental criteria have played no role in design. Sixteen drop pipe sites (defined as the region of temporary or permanent impoundment created by the structure) in northwestern Mississippi were sampled for fish, amphibians, reptiles, birds, and mammals; and physical habitat characteristics were assessed by sampling vegetation and surveying site topography. Speciose sites (those yielding 65 to 82 vertebrate species) were relatively large [≥0.09 ha (.22 ac)], with a significant pool area. Depauperate sites (only 11 to 20 species captured) were smaller, with no pool area and little woody vegetation. Considerable environmental benefits could be realized by slightly modified design and management of drop pipe structures. Results of this study suggest habitat benefits are minimal for sites smaller than 0.1 ha (0.2 ac), for sites lacking woody vegetation, and for sites that do not have at least 20% of their area below the inlet weir elevation.

1662. **Designing wetlands for amphibians: The importance of predatory fish and shallow littoral zones in structuring of amphibian communities.**
Porej, D. and Hetherington, T. E.
Wetlands Ecology and Management 13(4): 445-455. (2005)
NAL Call #: QH541.5.M3 W472; ISSN: 09234861.
Notes: doi: 10.1007/s11273-004-0522-y.
Descriptors: Ambystoma/ American bullfrog/ amphibian community/ colonization/ green frog/ habitat restoration/ leopard frog/ Ohio/ predation/ small-mouthed salamander/ wetland mitigation/ community structure/ habitat restoration/ littoral environment/ species diversity/ wetlands/ United States/ Ambystoma maculatum/ Ambystoma opacum/ Ambystoma texanum/ Amphibia/ Amphiuma means/ Anura/ Felidae/ Notophthalmus viridescens/ Panthera pardus/ Rana catesbeiana/ Rana clamitans/ Rana sylvatica/ Salamandridae
Abstract: Under section 401 and section 404 of the Clean Water Act, permission to degrade existing natural wetlands in the USA may be conditional on restoring or creating 'replacement' wetlands. Success of wetland mitigation efforts in adequately replacing lost wildlife habitats depends on our good understanding of key ecological attributes that affect the structure of wetland faunal communities. We examined the effects of the presence of predatory fish, shallow vegetated littoral zone, emergent vegetation cover, wetland age and size on amphibian diversity in 42 replacement wetlands located in the Ohio's North Central Tillplain ecoregion. We recorded 13 species of pond-breeding amphibians, and the average local species richness ([α-richness) was 4.2 ± 1.7 species per site (range 1-7). There is strong evidence for the positive association between amphibian species richness and presence of a shallow littoral zone, and the negative association with presence of predatory fish. There was no evidence for the association between species richness and age, size, amount of forest cover within 200 m, nor the amount of emergent vegetation cover at the study sites. It is estimated that local species richness in wetlands with shallows was 1.76 species higher on average than in wetlands without shallows (95% CI from 0.75 to 2.76). The presence of predatory fish was associated with an average reduction in species richness by an estimated 1.21 species (95% CI from 0.29 to 2.11). Replacement wetlands were placed in areas with little or no existing forest cover, and amphibian species associated with forested wetlands were either rare (eastern newt, spotted salamander) or not present at all (marbled salamander, wood frog). In addition, we surveyed all replacement wetlands constructed under section 401 in Ohio since 1990, and found that predatory fish were present in 52.4% of the sites and that shallows were absent

from 42.7% of the sites. Our results indicate that current wetland replacement practices could have a negative effect on the amphibian diversity within our region. © Springer 2005.

1663. **Designing wetlands for wildlife.**
Abney, C. D.
In: Proceedings of the 2001 Wetlands Engineering and River Restoration Conference. Hayes D. F. and Hayes D. F. (eds.)
Reno, NV; pp. 447-452; 2001. ISBN: 0784405816
Descriptors: biodiversity/ ecosystems/ hydrology/ nutrition/ recharging (underground waters)/ sedimentation/ vegetation/ water treatment/ natural system processes/ wildlife/ wetlands
Abstract: The designing of wetlands for specific wildlife species was discussed. The study focused on freshwater wetland requirements for migratory waterbirds in order to provide specific examples of habitat design. Questions regarding food production, shelter, reproduction, and predation must be addressed, as well as the hydrological dynamics that are present in natural systems that normally support the targeted wildlife and how these play a role in species survival. Once life cycle needs are assessed, wetlands can be strategically designed and managed to simulate natural conditions and thereby optimize habitat value.

1664. **Developing an invertebrate index of biological integrity for wetlands.**
Helgen, Judy
In: Methods for evaluating wetland condition; Washington, D.C: U.S. Environmental Protection Agency, Office of Water, 2002.
Notes: Original title: Developing an invertebrate index of biological integrity for wetlands (#9); Title from web page. "March 2002." "EPA-822-R-02-019." Description based on content viewed April 10, 2003. "Prepared jointly by U.S. Environmental Protection Agency, Health and Ecological Criteria Division (Office of Science and Technology) and Wetlands Division (Office of Wetlands, Oceans, and Watersheds)".
NAL Call #: QH541.5.M3H46 2002
http://www.epa.gov/waterscience/criteria/wetlands/9Invertebrate.pdf
Descriptors: Wetlands---United States/ Aquatic invertebrates---Environmental aspects---United States
This citation is from AGRICOLA.

1665. **Development of community metrics to evaluate recovery of Minnesota wetlands.**
Galatowitsch, S. M.; Whited, D. C.; and Tester, J. R.
Journal of Aquatic Ecosystem Stress and Recovery 6(3): 217-234. (1998)
NAL Call #: QH541.5.W3 J68; ISSN: 1386-1980.
Notes: Special Issue: Recovery in Aquatic Ecosystems.
Descriptors: wetlands/ environmental monitoring/ indicator species/ methodology/ land use/ restoration/ ecosystems/ long-term changes/ community composition/ land management/ bioindicators/ surface water/ birds/ populations/ Minnesota/ land restoration/ pollution monitoring and detection/ protective measures and control/ watershed protection/ environmental action
Abstract: Monitoring wetland recovery requires assessment tools that efficiently and reliably discern ecosystem changes in response to changes in land use. The biological indicator approach pioneered for rivers and streams that uses changes in species assemblages to interpret degradation levels may be a promising monitoring approach for wetlands. We explored how well metrics based on species assemblages related to land use patterns for eight kinds of wetlands in Minnesota. We evaluated land use on site and within 500 m, 1000 m, 2500 m and 5000 m of riverine, littoral, and depressional wetlands (n = 116) in three ecoregions. Proportion of agriculture, urban, grassland, forest, and water were correlated with metrics developed from plant, bird, fish, invertebrate, and amphibian community data collected from field surveys. We found 79 metrics that relate to land use, including five that may be useful for many wetlands: proportion of wetland birds, wetland bird richness, proportion of insectivorous birds, importance of Carex, importance of invasive perennials. Since very few metrics were significant for even one-half of the wetland types surveyed, our data suggest that monitoring recovery in wetlands with community indicators will likely require different metrics, depending on type and ecoregion. In addition, wetlands within extensively degraded ecoregions may be most problematic for indicator development because biotic degradation is historic and severe.

1666. **Diet of mallards wintering in greentree reservoirs in southeastern Arkansas.**
Dabbert, C. B. and Martin, T. E.
Journal of Field Ornithology 71(3): 423-428. (2000)
NAL Call #: 413.8 B534; ISSN: 02738570.
http://www.bioone.org/archive/0273-8570/71/3/pdf/i0273-8570-71-3-423.pdf
Descriptors: wetlands/ waterfowl/ ducks/ mallards/ greentree reservoirs/ flooding/ wildlife habitat
Abstract: Loss of wetlands to agriculture and development negatively impacts waterfowl. Greentree reservoirs are forested tracts that are purposefully flooded to increase hunting opportunities for sportsman and to provide shelter for waterfowl such as Mallards (Anas platyrhynchos). These human-made wetlands can also make natural foods such as acorns and invertebrates available to Mallards. Food habits analysis conducted in 1959 indicated acorns composed 24% of the volume of diets of Mallards collected from a variety of habitats including agricultural fields, naturally flooded bottomland forests, and greentree reservoirs in Arkansas. However, changes that may have occurred in food use by Mallards in bottomland hardwood habitats in Arkansas since last examined are unclear. We examined foods used by Mallards in greentree reservoirs from November 1990 to February 1991 in southeastern Arkansas. Seventeen species of plants and 21 families/orders of animals occurred in the diet of Mallards. Mallards consumed 65% plant matter, primarily seeds of narrowleaf foresteria (Foresteria angustifolia), Nuttall oak (Quercus nuttallii), Pennsylvania smartweed (Polygonum pensylvanicum), and rice (Oryza sativa). Invertebrate taxa, constituting 6% or more of the sample by both volume and mass, included the orders Coleoptera, Diptera, and

Isopoda. Diets of Mallards present in greentree reservoirs in our study indicate Mallards still use natural foods, though agricultural seeds were in close proximity to natural foods.

1667. **Dipteran standing stock biomass and effects of aquatic bird predation at a constructed wetland.**
Ashley, M. C.; Robinson, J. A.; Oring, L. W.; and Vinyard, G. A.
Wetlands 20(1): 84-90. (2000)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: American avocet/ aquatic birds/ Chironomid/ Diptera/ predation/ Wilson's phalarope/ constructed wetland/ population density/ predator-prey interaction/ zoobenthos/ United States/ Anas cyanoptera/ Phalaropus tricolor/ Recurvirostra americana
Abstract: We studied the relationship between benthic invertebrates and aquatic birds at a newly constructed wetland using an avian exclosure experiment combined with counts of aquatic bird use. We measured the standing stock biomass of benthic dipterans both inside and outside exclosures. Chironomidae was the most abundant dipteran family present. Maximum chironomid standing stock biomass per pond ranged from 3.62 to 27.82 g/m^2 and was comparable to that found in a number of natural systems. We monitored the abundance of ten aquatic birds species. Abundances of three aquatic bird species [American avocet (Recurvirostra americana), Wilson's phalarope (Phalaropus tricolor), and cinnamon teal (Anas cyanoptera)] were significantly correlated with chironomid and total dipteran densities. Our experiment, however, found no significant effect of predation on invertebrate densities.

1668. **Distribution of adult Odonata among localized wetlands in east-central Mississippi.**
Bried, Jason T. and Ervin, Gary N.
Southeastern Naturalist 4(4): 731-744. (2005)
NAL Call #: IPSP11706 ; ISSN: 1528-7092
Descriptors: species composition/ species richness/ habitat preference/ man made wetland site/ natural bottomland forest/ beta diversity index/ proportion coefficient
Abstract: We measured species richness and composition of adult Odonata and inferred habitat preferences among man-made wetland sites and surrounding tracts of natural bottomland forest. Cumulative species richness and composition were described by proportion coefficients and beta diversity indices. The three man-made sites provided open space resources, and more species were observed in each than in the floodplain forest. Twenty-nine of 42 species documented over a four-month period were observed in only one or two of the four wetlands studied. Large differences in species assemblages between the immediately adjacent ditch and marsh sites were the best evidence for high habitat affinity because distance and structural barriers to movement were absent. Such compositional asymmetry may reflect differential vegetative and reproductive suitability of the habitats. Results suggest that the open-canopy wetlands supported higher diversity of adult Odonata, and that distinct odonate assemblages were found among different habitat types in this floodplain wetland complex.

1669. **Does facilitation of faunal recruitment benefit ecosystem restoration? An experimental study of invertebrate assemblages in wetland mesocosms.**
Brady, V. J.; Cardinale, B. J.; Gathman, J. P.; and Burton, T. M.
Restoration Ecology 10(4): 617-626. (Dec. 2002)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: wetlands/ community structure/ aquatic ecosystems/ conservation/ zoobenthos/ macrofauna/ environment management/ nature conservation/ restoration/ transplantation/ stocking (organisms)/ biotic factors/ recruitment/ community composition/ colonization/ aquatic insects/ freshwater molluscs/ mesocosms/ comparative studies/ Chironomidae/ Gastropoda/ Invertebrata/ midges/ poor colonizers/ vegetation/ sediment plugs/ gastropods/ slugs/ snails/ aquatic entomology/ insects/ conservation, wildlife management and recreation
Abstract: We used wetland mesocosms (1) to experimentally assess whether inoculating a restored wetland site with vegetation/sediment plugs from a natural wetland would alter the development of invertebrate communities relative to unaided controls and (2) to determine if stocking of a poor invertebrate colonizer could further modify community development beyond that due to simple inoculation. After filling mesocosms with soil from a drained and cultivated former wetland and restoring comparable hydrology, mesocosms were randomly assigned to one of three treatments: control (a reference for unaided community development), inoculated (received three vegetation/sediment cores from a natural wetland), and stocked + inoculated (received three cores and were stocked with a poorly dispersing invertebrate group-gastropods). All mesocosms were placed 100 m from a natural wetland and allowed to colonize for 82 days. Facilitation of invertebrate colonization led to communities in inoculated and stocked + inoculated treatments that contrasted strongly with those in the unaided control treatment. Control mesocosms had the highest taxa richness but the lowest diversity due to high densities and dominance of Tanytarsini (Diptera: Chironomidae). Community structure in inoculated and stocked + inoculated mesocosms was more similar to that of a nearby natural wetland, with abundance more evenly distributed among taxa, leading to diversity that was higher than in the control treatment. Inoculated and stocked + inoculated communities were dominated by non-aerial invertebrates, whereas control mesocosms were dominated by aerial invertebrates. These results suggest that facilitation of invertebrate recruitment does indeed alter invertebrate community development and that facilitation may lead to a more natural community structure in less time under conditions simulating wetland restoration.

1670. **Duck nest success in the Prairie Pothole Region.**
Klett, A. T.; Shaffer, T. L.; and Johnson, D. H.
Journal of Wildlife Management 52(3): 431-440. (1988)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: breeding success/ breeding/ colonies/ nests/ population dynamics/ nature conservation/ aquatic birds/ Anas/ Minnesota/ North Dakota/ South Dakota/ aquatic birds
Abstract: The authors estimated nest success of mallard (Anas platyrhynchos), gadwall (A. strepera), blue-winged teal (A. discors), northern shoveler (A. clypeata), and

northern pintail (A. acuta) for 5 regions in North Dakota, South Dakota, and Minnesota, for 1-3 periods between 1986 and 1984, and for 8 habitat classes. Nest success rates ranged from < 5 to 36% among regions, periods, and species. Rates were lowest in western Minnesota (MNW) and eastern North Dakota (NDE), intermediate in central North Dakota (NDC) and eastern South Dakota (SDE), and highest in central South Dakota (SDC). In regions with comparable data, no consistent trend in nest success was apparent from early to late periods. Gadwalls and blue-winged teal nested more successfully than mallards and pintails; the relative success of shovelers varied regionally.

1671. **Duwamish River Coastal America restoration and reference sites: Results from 1997 monitoring studies.**
Cordell, J. R.; Tear, L. M.; Jensen, K.; and Higgins, H. A.
Seattle, WA: Fisheries Research Institute; FRI-UW-9903, 1999.
Notes: Other numbers: Technical report. School of Aquatic and Fishery Science, Fisheries Research Institute, Washington University [Rep. Fish. Res. Inst. Wash. Univ.]. No. 9903.
Descriptors: wetlands/ habitat improvement/ water resources/ riprap/ restoration/ brackishwater environment/ man-induced effects/ tidal currents/ riparian vegetation/ fishery sciences/ environmental protection/ coastal zone/ fishery management/ coastal inlets/ anthropogenic factors/ Oncorhynchus/ Carex lyngbyei/ Scirpus maritima/ Washington/ Seattle/ Duwamish Waterway/ habitat community
Abstract: In this report, we present the results of 1997 biological monitoring at three wetland restoration sites in the Duwamish River estuary, Seattle, Washington. Restoration at these sites was originally facilitated by the federal Coastal America program and was carried out by a partnership of the City of Seattle, U.S. Fish & Wildlife Service, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. Two of these sites are in the middle portion of the Duwamish Waterway, in a region dominated by tidal influence and mixed fresh- and marine water. The first of these sites consists of the General Service Administration (GSA) site located adjacent to the Federal Center South, which is a long, narrow intertidal strip running parallel to the east bank of the Duwamish Waterway adjacent/to the Seattle District Corps of Engineers. Restoration at this site included removal of rock riprap and a large overwater wharf structure to allow natural colonization by existing wetland plants, construction of a sediment "bench" at 0.0-m elevation to promote use by juvenile salmon (Oncorhynchus spp.), and planting of upland riparian vegetation. The second site is at Terminal 105 (T-105); this site originally consisted of a vacated street end and a large pipe that drained a small degraded wetland area. Restoration included removal of debris and replacement of the pipe with an estuarine channel that restored tidal flow to the area. The third Coastal America restoration site is at the upper Turning Basin at the head of the Duwamish Waterway. This site/comprises an upland riparian buffer planted with native vegetation and a small regraded upper intertidal basin planted with fringing native sedge, Carex lyngbyei, and rush, Scirpus maritima.

1672. **Ecological characteristics of a natural wetland receiving secondary effluent.**
Martin, J. R.; Clarke, R. A.; and Knight, R. L.
Water Science and Technology (2001); ISSN: 0273-1223
Descriptors: animals/ fishes/ invertebrates/ plants/ population dynamics/ trees/ ecosystem/ environmental monitoring/ waste disposal, fluid [methods]
Abstract: The Boot wetland treatment system is a 115-acre, hydrologically altered cypress-gum wetland in Polk County, Florida. The Poinciana Wastewater Treatment Plant No. 3 has discharged secondary effluent to the bermed Boot wetland since August 1984. Before that time this natural wetland had been affected adversely by forestry, drainage, and surrounding development which contributed to dying trees and a groundcover of invasive upland plants. In accordance with the Florida Department of Environmental Protection's Wetlands Application Rule (Chapter 62-611, F.A.C.), a routine biological and water quality monitoring program has been in effect since October 1990. Components of the biological monitoring program include surveys of canopy and subcanopy, herbaceous and shrub groundcover species, benthic macroinvertebrates, fish, and nuisance mosquitoes. Effluent addition to the Boot wetland has resulted in continuous wetland inundation with atypical water depth of 2.5 to 3.0 feet for the past 15 years. Dominance and density of trees has steadily increased, upland invader species were eliminated, and stable plant, fish, and invertebrate communities were established. The long term biological data from this treatment wetland is compared to data from other natural treatment wetlands and a control wetland.

1673. **Ecology and conservation biology of the Colorado River Delta, Mexico.**
Glenn, E. P.; Zamora-Arroyo, F.; Nagler, P. L.; Briggs, M.; Shaw, W.; and Flessa, K.
Journal of Arid Environments 49(1): 5-15. (2001)
NAL Call #: QH541.5.D4J6; ISSN: 01401963.
Notes: doi: 10.1006/jare.2001.0832.
Descriptors: biosphere reserve/ Colorado River/ Delta/ desert river/ El Nino/ estuary/ riparian/ wetland/ conservation/ delta/ endangered species/ migratory species/ revegetation/ water flow/ Mexico/ Anas/ Anatidae/ Anser/ Aves/ Empidonax traillii/ Rallus/ Rallus longirostris yumanensis/ Riparia/ Salix/ Typha/ Yuma
Abstract: The Colorado River Delta in Mexico has been partially revegetated following 20 years of water flows from the United States. Lake Powell, the last major impoundment built on the river, filled in 1981. Since then, flood flows in the main channel of the river have occurred in El Nino cycles, and have returned native trees and other vegetation to the riparian corridor. This vegetation provides a migration route for endangered southwestern willow flycatchers (Empidonax traillii) and other migratory birds moving from Mexico to the United States for summer nesting. Agricultural drain water from the Wellton-Mohawk Irrigation District conveyed to the delta since 1977 has created Cienega de Santa Clara, a 4200-ha Typha domengensis marsh containing the largest remaining population of the endangered Yuma clapper rail (Rallus longirostris yumanensis), plus numerous species of migratory and resident waterfowl. Populations in the marine

part of the delta have been severely affected by the lack of river flow, but some species have responded positively to renewed flows. Currently, there are 170,000 ha of natural areas in the lower delta in Mexico, containing riparian, wetland and intertidal habitats. Much of this land as well as the adjacent marine zone is protected in the Biosphere Reserve of the Upper Gulf of California and Colorado River Delta. Natural resource managers, scientists and non-governmental environmental groups in Mexico and the United States are exploring conservation measures that can provide water and protection for these areas for the future. © 2001 Academic Press.

1674. **Ecology and management of migrant shorebirds in the Playa Lakes Region of Texas.**
Davis, Craig A. and Smith, Loren M.
Wildlife Monographs(140): 1-45. (1998)
NAL Call #: 410 W64; ISSN: 0084-0173
Descriptors: body size/ diet/ feeding ecology/ habitat selection/ migration/ sex differences/ stopover site
Abstract: During spring and fall migration, shorebirds rely on stopover areas to replenish energy reserves and fulfill nutrient requirements. Most studies of stopover areas have focused on wetlands in the Northern Great Plains; little attention has been given to wetlands in the Southern Great Plains, especially the Playa Lakes Region (PLR). Our objectives were to determine migrant-shorebird species compositions, abundances, migration chronologies, use of habitats, and feeding ecologies in the PLR during spring and fall migration. More than 130 playa wetlands were surveyed for shorebirds in a 34,000-km^2 area of western Texas. We selected American avocet (Recurvirostra americana), long-billed dowitcher (Limnodromus scolopaceus), least sandpiper (Calidris minutilla), and western sandpiper (C. mauri) as a subset of all shorebirds present to examine feeding ecologies; these 4 species were common species during both migration periods and represent a wide range of body sizes and guilds. We also evaluated the influence of sex on the feeding ecologies of the 4 species. Thirty shorebird species used playa wetlands during spring and fall, 1993-94. The most abundant species during spring were American avocet, long-billed dowitcher, and Wilson's phalarope (Phalaropus tricolor), whereas the most abundant species during fall were American avocet, long-billed dowitcher, long-billed curlew (Numenius americanus), stilt sandpiper (Calidris himantopus), and lesser yellowlegs (Tringa flavipes). Migration chronologies of each species were distinct in spring with peak abundances occurring over 2-4 weeks and were protracted in fall with peak abundances occurring over 5-8 weeks. In general, most shorebird species selected playas that contained sparse vegetation (<25% vegetation cover), adequate amounts of mudflat (10-15%) and shallow (<4 cm depth) water (10-20%) habitats, and higher invertebrate populations. Invertebrates were the most important component in the diets of American avocets, long-billed dowitchers, least sandpipers, and western sandpipers, and diets varied little between males and females. In the spring, all 4 species consumed mostly chironomids, whereas in the fall, all 4 consumed a wider variety of invertebrates. important invertebrate foods during the fall included chironomids, hydrophilids, leeches, planorbids, corixids, conchostracans, and hydracarinas. The 4 species also consumed more plant material (predominantly seeds) in the fall than in the spring. Differences in spring and fall diets of the 4 shorebird species were attributed to seasonal differences in invertebrate abundances and diversities; invertebrate abundances and diversities were higher in the fall than in the spring. Shorebird diets were compared with availabilities of foods within and across individual playas. For most foods, overall selection patterns (i.e., selection across playas) were different from selection patterns within individual playas. In general, all 4 species exhibited a wide range of selection patterns for invertebrates as availability of invertebrates changed, suggesting that the 4 species used an opportunistic foraging strategy. Shorebird foraging appeared to decrease invertebrate populations in spring, but not in fall. Management of playas in the PLR should focus on creating and maintaining sparse vegetation cover, and adequate mudflat (at least 10-15%) and shallow water (at least 10-20%) habitats. Because invertebrates are important foods of migrant shorebirds, management also should focus on enhancing invertebrate populations in playas. Gradual drawdowns of playas with deep water and flooding of dry playas should be used to provide available habitat for shorebirds throughout migration. Mowing and shallow disking can be used to create preferred habitat conditions and provide a detrital food base to enhance invertebrate populations. Managers that can manage only a few playas should consider managing playas during periods of maximum shorebird diversity in the PLR. During spring, maximum shorebird diversity occurred in late April and early May, whereas during fall, maximum shorebird diversity occurred in late August.

1675. **Ecology of insect communities in nontidal wetlands.**
Batzer, D. P. and Wissinger, S. A.
Annual Review of Entomology 41: 75-100. (1996)
NAL Call #: 421 An72; ISSN: 0066-4170 [ARENAA].
Notes: Literature review.
Descriptors: wetlands/ insects/ community ecology/ habitats/ interactions/ colonization/ nature conservation/ insect communities/ freshwater ecology
This citation is from AGRICOLA.

1676. **Effect of forest management practices on southern forested wetland productivity.**
Conner, W. H.
Wetlands 14(1): 27-40. (1994)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: bobwhite quail/ wetlands/ forest industry/ biological production/ hydrology/ flooding/ resource management/ water levels/ environmental effects/ logging/ forest management/ water level/ drainage/
United States, Southeast
Abstract: In the interest of increasing productivity of forested wetlands for timber production and/or wildlife value, management schemes that deal mainly with water-level control have been developed. The three forest types in the southeastern U.S. most commonly affected are cypress/tupelo forests, bottomland hardwood forests, and wet pine sites (including pocosins). In forested wetlands, hydrology is the most important factor influencing productivity. In bottomland and cypress/tupelo forests, water-level control can have mixed results. Alterations in natural hydrologic patterns leading to increased flooding or drainage can cause decreased growth rates or even death

of the forest. Bottomland hardwoods respond favorably in the short term to water-level management, but the long-term response is currently under study. In wet pine sites, timber volume can be increased significantly by water-level management, but the impact upon other ecological functions is less understood. It is difficult to adequately describe productivity relations in wetland forests because of the great diversity in habitat types and the lack of data on how structure and function might be affected by forestry operations. There is a definite need for more long-term, regional studies involving multidisciplinary efforts.

1677. **Effect of watershed land use and lake age on zooplankton species richness.**
Dodson, Stanley I.; Everhart, William R.; Jandl, Andrew K.; and Krauskopf, Sara J.
Hydrobiologia 579: 393-399. (2007)
NAL Call #: 410 H992; ISSN: 0018-8158
Descriptors: ecology/ community structure/ habitat/ freshwater habitat/ lentic water/ land zones/ comprehensive zoology: watershed land use/ shallow lake species diversity effect/ species diversity/ effect of watershed land use/ lake/ Wisconsin/ shallow lake species diversity
Abstract: Results of a field survey of southern Wisconsin shallow lakes suggested that watershed (catchment basin) land use has a significant and adverse effect on zooplankton species richness. Zooplankton communities in lakes with no riparian buffer zone, in agriculture-dominated watersheds, contained about half as many species as lakes in least-impact watersheds. In that study, the age of the lake was not taken into account. It is possible that agricultural lakes, often artificial, were so recently-constructed that they had not yet accumulated the equilibrium number of species characteristic of older lakes. In other words, it is possible that the interpretation of the results of the previous study is fatally flawed, if the results were an artifact of lake age, rather than an effect of land use. The major aim of this current study was to determine the ages of agricultural lakes and of lakes in least-impact watersheds, to test for an effect of lake age on zooplankton species richness, using the same sites from the previous study. We used an anova approach to test the null hypothesis that two factors, watershed land use and lake age, had no systematic effect on zooplankton species richness. We determined the age of 35 shallow lakes, using aerial photos, satellite images, and interviews of resource managers and land owners. We identified five artificial agricultural sites and five artificial sites in least-impact prairie watersheds. The artificial sites in this study ranged from 3 to 37 years in age, while natural lakes dated from the melting of the last glacier, about 9500 years ago. Our results suggest, that because artificial lake made up only about a third of the sites, and for the range of lake age and watershed land use, lake age did not have a significant effect on zooplankton species richness, while land use had a highly significant adverse effect. These results pose a larger question for future research. Namely, how quickly do newly-constructed lakes attain the equilibrium number of species seen in the previous study, and what is the quantitative relationship between lake age and zooplankton richness?

1678. **The effects of a fall prescribed burn on Hemileuca eglanterina Boisduval (Saturniidae).**
Severns, Paul M.
Journal of the Lepidopterists' Society 57(2): 137-143. (2003); ISSN: 0024-0966
Descriptors: conservation measures/ reproduction/ reproductive behavior/ ecology/ terrestrial habitat/ abiotic factors/ physical factors/ land zones/ Hemileuca eglanterina: habitat management/ autumn prescribed burning/ impacts on population dynamics/ conservation implications/ wet prairie grassland/ breeding site/ oviposition sites/ egg laying/ population dynamics/ egg mass and larval abundances/ effects of autumn prescribed burning/ prairie/ grassland/ wet prairie/ fire/ autumn prescribed burn/ Oregon/ Willamette Valley/ Insecta, Lepidoptera, Glossata, Heteroneura, Bombycoidea, Saturniidae/ arthropods/ insects/ invertebrates/ lepidopterans
Abstract: Autumn prescribed burning is often used to manage a rare wet prairie plant community endemic to the Willamette Valley in western Oregon, USA. A local race of day flying Saturniid moth, Hemileuca eglanterina, was used to investigate the effects of a prescribed burn on adult, larval, and egg mass abundance contrasted with an adjacent unburned area. Adult male moths were not more frequently encountered in the burned habitat but female H. eglanterina laid more than twice as many egg masses in the burned compared to the unburned habitat in the burn year. Furthermore, females laid significantly more egg masses on the burn edge in the burn year ($p<0.001$), suggesting that H. eglanterina chose to oviposit on burned host plants over unburned host plants. Egg masses laid before the prescribed burn did not survive the fall fire, demonstrating that the management practice is catastrophic for the immature population. Although fire can substantially reduce immature Lepidoptera populations, some species living in ecosystems that had a frequent historic fire return interval may benefit from the ecological release caused by a prescribed burn. Fires consuming entire habitat parcels of fragmented ecosystems may lead to population bottlenecks and an increased frequency of inbreeding. Conservative prescribed burning practices with unburned refugia may be the most effective way to manage for the conservation of rare grassland plant communities and their insect fauna.

1679. **The effects of adjacent land use on wetland species richness and community composition.**
Houlahan, J. E.; Keddy, P. A.; Makkay, K.; and Findlay, C. S.
Wetlands 26(1): 79-96. (2006)
NAL Call #: QH75.A1W47; ISSN: 02775212.
Notes: doi: 10.1672/0277-5212(2006)26 [79:TEOALU]2.0.CO;2.
Descriptors: dispersal/ eutrophication/ exotics/ fertilizer/ forest cover/ functional groups/ land use/ plant diversity/ scale/ species-area/ streams/ wetlands
Abstract: Wetlands provide important ecosystem functions and values, such as wildlife habitat, water filtration and flood protection. Wetland plant communities play a fundamental role in maintaining these functions but are thought to be increasingly threatened by human modifications of the landscape, such as deforestation and road construction. Here, we examine the quantitative

relationships between two dependent variables (plant species richness, community composition) and a set of independent variables describing land use (e.g., forest cover, road density, and building density). As independent variables, we further include wetland characteristics that may be related to landuse practices (e.g., area and nutrient status). Wetland size is the most important predictor of both total plant species richness and the species richness within most functional groups. In addition, landscape properties, such as forest cover, presence of streams and nutrient status of water and sediment are significant predictors of plant species richness. Adjacent land use 250-300 m from the wetland affects plant diversity. Differences in the land-use-diversity relationship among different plant functional groups suggest that adjacent land use affects wetland plant communities in two important ways. First, it alters the abundance and distribution of propagules in adjoining habitats. Second, it alters the number of dispersal routes. Our results suggest that current management practices are inadequate and that regulation of adjacent land use is a critical component of wetland conservation. © 2006, The Society of Wetland Scientists.

1680. **The effects of bird use on nutrient removal in a constructed wastewater-treatment wetland.**
Andersen, D. C.; Sartoris, J. J.; Thullen, J. S. ; and Reusch, P. G.
Wetlands 23(2): 423-435. (2003)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: blackbirds/ California/ constructed wetland/ nitrogen/ nutrient removal/ phosphorus/ Schoenoplectus californicus/ Schoenoplectus acutus/ wastewater treatment/ waterfowl/ constructed wetland/ nitrogen/ phosphorus/ avifauna/ constructed wetland/ feces/ habitat use/ nitrogen/ nutrient enrichment/ phosphorus/ water treatment/ United States/ Agelaius phoeniceus
Abstract: A 9.9-ha constructed wetland designed to reduce nitrogen in municipal wastewater following conventional secondary treatment began operating in southern California's San Jacinto Valley in September 1994. The wetland incorporated zones of bulrush (Schoenoplectus acutus and S. californicus) for effluent treatment, plus areas of 1.8-m deep open water and other features to benefit wintering waterfowl. A one-year long program to monitor bird use and evaluate their contribution to loadings of nitrogen and phosphorus was initiated seven months later and a second, four-month long period of monitoring was initiated after a 20-month hiatus. Daily bird use peaked at nearly 12,000 individuals during the second period. Estimates of maximum daily nitrogen and phosphorus input by birds were 139 g N ha^{-1} day^{-1} and 56 g P ha^{-1} day^{-1}. Following a reconfiguration of the wetland that increased the area of open water, a third year-long period of monitoring was initiated in September 2000. Estimated maximum daily loading attributable to birds during this period reached 312 g N ha^{-1} day^{-1} and 124 g P ha^{-1} day^{-1}. These levels represent only 2.6% and 7.0%, respectively, of the mean daily loads of N and P in inflow water from the wastewater-treatment plant. Wintering waterfowl contributed the most to nutrient loading, but the numerically dominant species was the colonial Red-winged Blackbird (Agelaius phoeniceus). The wetland's nutrient-removal efficiency was negatively correlated to bird loading. However, the greatest bird loading occurred during November to March, when winter conditions would reduce microbial nutrient-removal processes and plant uptake in the wetland. Multiple regression analysis indicated that variation in nutrient removal efficiency over a one-year period was best explained by wetland water temperature (R^2 = 0.21) and that little additional insight was gained by adding bird loading and inflow nutrient load data (R^2 = 0.22). This case study supports the concept that a constructed wetland can be designed both to reduce nutrients in municipal wastewater and to provide habitat for wetland birds.

1681. **Effects of cattle grazing on diversity in ephemeral wetlands.**
Marty, Jaymee T.
Conservation Biology 19(5): 1626-1632. (2005)
NAL Call #: QH75.A1C5 ; ISSN: 0888-8892
Descriptors: species diversity/ grazing/ feeding behavior/ introduced species/ ranching/ endemic species/ wetlands/ life cycle/ nature conservation/ biodiversity/ rare species/ environmental impact/ aquatic plants/ species richness/ conservation/ Central Valley/ California
Abstract: Cattle are usually thought of as a threat to biodiversity. In regions threatened by exotic species invasion and lacking native wild grazers, however, cattle may produce the type of disturbance that helps maintain diverse communities. Across 72 vernal pools, I examined the effect of different grazing treatments (ungrazed, continuously grazed, wet-season grazed and dry-season grazed) on vernal-pool plant and aquatic faunal diversity in the Central Valley of California. After 3 years of treatment, ungrazed pools had 88% higher cover of exotic annual grasses and 47% lower relative cover of native species than pools grazed at historical levels (continuously grazed). Species richness of native plants declined by 25% and aquatic invertebrate richness was 28% lower in the ungrazed compared with the continuously grazed treatments. Release from grazing reduced pool inundation period by 50 to 80%, making it difficult for some vernal-pool endemic species to complete their life cycle. My results show that one should not assume livestock and ranching operations are necessarily damaging to native communities. In my central California study site, grazing helped maintain native plant and aquatic diversity in vernal pools.

1682. **Effects of climate change and land use on duck abundance in Canadian prairie-parklands.**
Bethke, Raymond W. and Nudds, Thomas D.
Ecological Applications 5(3): 588-600. (1995)
NAL Call #: QH540.E23 ; ISSN: 1051-0761
Descriptors: climatology: environmental sciences/ mathematical biology: computational biology/ models and simulations: computational biology/ systematics and taxonomy/ wildlife management: conservation/ agriculture/ drought/ habitat/ mathematical model/ precipitation/ survey
Abstract: Recent declines in the number of breeding ducks in the Canadian prairie-parklands have been hypothesized to be due to loss of habitat to agriculture However, prairie-parkland also has experienced wetland loss to drought as well as to agriculture. If habitat restoration is to be implemented and monitored successfully, it is important to separate the effects of anthropogenic changes to the

landscape on duck populations from those caused by changes in climate. We used data from annual air-ground surveys and from precipitation records to develop relationships between indices of abundance of each of 10 species of ducks and indices of wetland conditions during 1955-1974. We used these relationships to predict annual abundance of each species during 1975-1989. We compared predicted and observed abundances over the period 1975-1989 to distinguish declines in duck abundance greater than those accounted for by drought alone and to determine the magnitude and location of real "deficits" in duck abundance. Average annual deficits within Canadian prairie-parkland over the period 1975-1989 were estimated at 1.2 times 10-6 birds for both Mallard (Anas platyrhynchos) and Northern Pintail (A. acuta), 480 000 for Blue-winged Teal (A. discors), 190 000 for American Wigeon (A. americana), 175 000 for Northern Shoveler (A. clypeata), 50 000 for Gadwall (A. strepera), 10 000 for Green-winged Teal (A. crecca), 40 000 for Canvasback (Aythya valisineria), 25 000 for Lesser Scaup (A. affinis), and 5000 for Redhead (A. americana). Overall, the effect of agricultural expansion in the cast on prime waterfowl habitat since 1951 appears to have been negligible. There, as much as 90% had been already lost prior to 1951. In the west, however, where prime waterfowl habitat was still relatively abundant in 1951, agricultural development has encroached substantially. The relationship between the lost area of the best breeding habitats and the size of population deficits for Mallards and Northern Pintails in the entire Canadian prairie-parkland region was significant for both species ($P < 0.0027$ and $P < 0.0001$, respectively). Consequently, habitat restoration programs located where the highest quality waterfowl habitat and the lowest quality agricultural lands overlap most should have the greatest potential to affect recovery of breeding duck populations in the Canadian prairie-parklands.

1683. **Effects of foraging waterfowl in winter flooded rice fields on weed stress and residue decomposition.**
Van Groenigen, J. W.; Burns, E. G.; Eadie, J. M. ; Horwath, W. R.; and Van Kessel, C.
Agriculture, Ecosystems and Environment 95(1): 289-296. (2003)
NAL Call #: S601.A34; ISSN: 01678809.
Notes: doi: 10.1016/S0167-8809(02)00097-X.
Descriptors: conservation/ rice sustainability/ waterfowl foraging/ waterfowl habitat/ weed management/ biological control/ foraging behavior/ plant residue/ rice/ waterfowl/ weed control/ United States
Abstract: This study quantifies the agronomic benefits of foraging waterfowl in winter flooded rice fields in the Sacramento Valley of California (US). Fifteen winter flooded rice fields along a 105 km long transect, each with five pairs of waterfowl exclosures and control plots were used to measure residue decomposition in spring, and weed biomass and grain yield at harvest. Experimental exclusion of waterfowl resulted in a significant increase in remaining residue from 1014 to 1233 kg ha^{-1} across the transect. At seven sites with high waterfowl activity, remaining residue increased from 836 to 1549 kg ha^{-1} when waterfowl were excluded from the plot. Grassy weed biomass increased from 44 to 91 kg ha^{-1} over the whole transect in absence of waterfowl. At seven sites with high waterfowl activity the grassy weed biomass more than doubled in the absence of waterfowl from 89 to 204 kg ha^{-1}. No significant yield effect could be detected. Winter flooding rice fields resulted in mutual benefits for waterfowl and agriculture that could be of particular significance in organic farming systems.

1684. **Effects of forest harvesting on bufflehead and common loon foraging behavior.**
Pierre, Johanna P.; Boss, Shelly M.; and Paszkowski, Cynthia A.
Ornithological Science 4(2): 161-168. (2005);
ISSN: 1347-0558
Descriptors: commercial activities/ nutrition/ diet/ prey/ feeding behavior/ locomotion/ swimming/ ecology/ community structure/ population dynamics/ predators/ freshwater habitat/ lentic water/ abiotic factors/ land zones/ North America/ Canada/ Bucephala albeola/ Gavia immer: forestry/ piscean prey/ food availability/ foraging/ foraging behavior related to forest harvesting/ boreal lakes/ aquatic diving/ lake/ physical factors/ Alberta/ north/ Pisces/ birds/ chordates/ fish/ vertebrates
Abstract: We compared foraging behavior of Bufflehead (Bucephala albeola Linnaeus) and Common Loon (Gavia immer Brunnich) on eight lakes in harvested and unharvested boreal mixedwood forest in northern Alberta, Canada. For one summer before (1996) and two Summers after (1997, 1998) forest harvesting around three of the eight lakes, we recorded the duration of Bufflehead and Common Loon dives. After logging, forested buffer strips 100m-wide separated cut-blocks from lakes ('harvested lakes'). 'Unharvested lakes' were surrounded by ≥450m of undisturbed forest throughout the study. There were no detectable differences in dive duration between harvested and unharvested lakes for Bufflehead or Common Loon. Correlations between environmental variables (water clarity, fish biomass, depth) and the duration of Common Loon dives were not significant. However, the duration of Bufflehead dives differed between lakes, unrelated to forest harvesting. The duration of Bufflehead dives was negatively correlated with water clarity but was not significantly cot-related with fish biomass. While our study shows that the foraging behavior of Buffleheads was affected by lake conditions, the utility of aquatic birds as indicators of the effects of forestry on western boreal lakes remains unproven.

1685. **Effects of glyphosate herbicide on cattails, invertebrates, and waterfowl in South Dakota wetlands.**
Solberg, K. L. and Higgins, K. F.
Wildlife Society Bulletin 21(3): 299-307. (1993)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: wetlands/ glyphosate/ Typha/ waterfowl/ population density/ nontarget organisms/ aquatic invertebrates/ adverse effects/ South Dakota
This citation is from AGRICOLA.

1686. **Effects of habitat manipulation on reproductive success of individual largemouth bass in an Ozark reservoir.**
Hunt, J. and Annett, C. A.
North American Journal of Fisheries Management 22(4): 1201-1208. (2002)
NAL Call #: SH219.N66 ; ISSN: 02755947.

Notes: doi: 10.1577/1548-8675(2002)022 <1201:EOHMOR>2.0.CO;2.
Descriptors: coarse woody debris/ fish/ habitat management/ reproductive success/ spawning ground/ United States/ Micropterus/ Micropterus salmoides/ Perciformes
Abstract: Centrarchids prefer nesting near patches of physical structure, and both simple and complex supplemental structure enhance the reproduction of black basses Micropterus spp. in systems where naturally occurring structure is lacking. Supplemental structure may not be helpful in systems that contain plentiful physical structure, and nests located near supplemental structure may not be as successful as nests located near naturally occurring structure. We monitored nests of largemouth bass M. salmoides in areas with and without supplemental logs in a small Arkansas reservoir containing abundant natural structure to assess how spawning individuals responded to habitat manipulation on two spatial scales, microhabitat and mesohabitat. We compared the use of natural versus supplemental logs, mating success, hatching success, nesting success, nest density, and nearest-neighbor distances in manipulated and unmanipulated mesohabitats. Nesting males used supplemental logs more often than we expected based on their use of naturally occurring logs (67% versus 25.4%, respectively). Mating, hatching, and nesting success were equally high for broods located near supplemental logs and naturally occurring structure. Manipulated and unmanipulated mesohabitat produced equal nest densities and nearest-neighbor distances. We conclude that supplemental logs were a useful management tool in Lake Wedington and provided high-quality microhabitat for spawning. We recommend that managers consider installing log structures where natural structure is sparse or floaters are abundant. Supplemental logs should be installed in a configuration mimicking the natural spacing of nests to accommodate the parental behavior of black basses.

1687. **Effects of management practices on wetland birds.**
Johnson, D. H. and Dechant Shaffer, J. A.: Northern Prairie Wildlife Research Center, U.S. Geological Survey. (2001).
Notes: See also http://www.npwrc.usgs.gov/resource/literatr/grasbird/index.htm (Effects of management practices on grassland birds).
http://www.npwrc.usgs.gov/resource/literatr/wetbird/index.htm
Descriptors: ecological requirements/ dispersion/ wetland habitat/ brood-egg/ habitat management/ management/ North America
Abstract: These reports are a series of literature syntheses on North American wetland birds. The need for these reports was identified by the Prairie Pothole Joint Venture (PPJV), a part of the North American Waterfowl Management Plan. The PPJV recently adopted a new goal, to stabilize or increase populations of declining grassland- and wetland-associated wildlife species in the Prairie Pothole Region. To further that objective, it is essential to understand the habitat needs of birds other than waterfowl, and how management practices affect their habitats. The focus of these reports is on management of breeding habitat, particularly in the northern Great Plains. Resource contains 15 species accounts.

1688. **Effects of pesticides on soil and water microflora and mesofauna in wetland ricefields: A summary of current knowledge and extrapolation to temperate environments.**
Roger, P. A.; Simpson, I.; Oficial, R.; Ardales, S.; and Jimenez, R.
Australian Journal of Experimental Agriculture 34(7): 1057-1068. (1994)
NAL Call #: 23 Au792; ISSN: 0816-1089.
Notes: Literature review.
Descriptors: wetlands/ pesticides/ rice/ temperate zone/ invertebrates/ fertilizers/ agricultural practices/ microorganisms/ data collections/ rice fields/ pollution effects/ agricultural pollution/ Invertebrata/ biodiversity
Abstract: This review summarises information on the behaviour of pesticides and their impacts on microorganisms and non-target invertebrates that was collected in, or is applicable to, temperate wetland ricefields. An extensive bibliographic survey shows that current knowledge is fragmentary and partly outdated. Pesticides applied on soil at recommended levels rarely had a detrimental effect on microbial populations or their activities. They had more effect on invertebrate populations, inducing the blooming of individual species of floodwater zooplankton and reducing populations of aquatic oligochaetes in soil. Available information raises concerns regarding the long-term effects of pesticides on (i) microorganisms, primary producers, and invertebrates of importance to soil fertility, (ii) predators of rice pests and vectors, and (iii) microbial metabolism of pesticides.

1689. **Effects of prescribed fall burning on a wetland plant community, with implications for management of plants and herbivores.**
McWilliams, S. R.; Sloat, T.; Toft, C. A.; and Hatch, D.
Western North American Naturalist 67(2): 299-317. (2007)
NAL Call #: QH1.G7; ISSN: 15270904
Descriptors: adaptive management/ CANOCO/ correspondence analysis/ fire/ geese/ prescribed burning/ wetland plant community
Abstract: An important contemporary challenge for adaptive resource management is assessing both the direct and indirect effects of management activities by designing appropriate monitoring programs and sound analysis methods. Here we evaluate the effects of prescribed fall burning on a wetland plant community that is managed primarily for spring-migrating geese. During late fall in 2 consecutive years, we burned vegetation in 4 replicate blocks (2.3 ha each) that traversed a natural moisture and associated vegetation gradient. We used ordination, gradient analysis, and contingency table analysis to evaluate how annual changes in relative abundance of plants were affected by burning as well as other important ecological factors. Burning increased species diversity of plants, especially in the 2 wetter vegetation zones, but had no effect on species richness or on the proportion of native plant species. Wetland plant species responded to prescribed burning independently, and their response often differed by vegetation zone and with annual variation in

flooding. Burning enhanced the abundance of native foxtail barley (Hordeum jubatum) and reduced the abundance of introduced swamp timothy (Crypsis shoenoides). Saltgrass (Distichlis spicata), a native plant species, was usually less abundant following burning, although the level of response was different for each of the 3 vegetation zones. Two other introduced plant species, quackgrass (Elytrigia repens) and reed canarygrass (Phalaris arundinaceae), were less abundant after fall burning, especially when spring flooding was more extensive. Wild geese using the experimental blocks for feeding clearly preferred burned sites, suggesting that fall burning can enhance wetland use by geese during spring. Given that simple manipulations such as burning and flooding of a wetland system may often produce complex results, we suggest that on-going management schemes be regularly evaluated with field experiments such as those conducted in this study.

1690. **Effects of riparian timber management on amphibians in Maine.**
Perkins, Dustin W. and Hunter, Malcolm L.
Journal of Wildlife Management 70(3): 657-670. (2006)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: Caudata/ Salientia/ Ambystoma maculatum/ American toad/ Bufo americanus/ eastern red-backed salamander/ Plethodon cinereus/ Rana sylvatica/ spotted salamander/ wood frog/ wildlife-human relationships/ commercial enterprises/ communities/ disturbances/ habitat use/ forestry practices/ habitat alterations/ wetlands/ ecosystems/ headwater stream/ land zones/ Maine/ riparian habitat/ riparian timber harvesting/ riparian timber management/ rivers/ temperate forest/ wildlife management/ amphibians/ buffers/ first-order stream/ forest management/ headwater streams/ partial harvests/ riparian zones/ stream salamanders/ vegetation/ waters/ forest/ silviculture
Abstract: Riparian areas are one of the most complex, diverse, and dynamic environments in forested ecosystems. In areas managed for timber riparian areas are often protected with unharvested forested buffers, but it is unclear whether these buffers are adequate to maintain the floral and faunal diversity of riparian areas. Amphibians are sensitive to forest management, have high diversity in riparian areas, and are among the most abundant vertebrates in temperate forests; therefore, they are excellent candidates to use in a study of the effects of riparian timber management. We conducted a field experiment with 15 headwater streams in western Maine, USA, randomly assigned to 5 silvicultural treatments. We examined Amphibian abundance for 1 year prior to and 2 years following treatment We also undertook a retrospective study on 12 headwater streams representing 3 treatments where harvests had occurred 4-10 years earlier. We used pitfall traps with drift fences and cover-controlled, active-searches to sample terrestrial and stream Amphibians. Wood frogs (Rana sylvatica), eastern red-backed salamanders (Plethodon cinereus), and spotted salamanders (Ambystoma maculatum) were sensitive to timber harvesting along headwater streams. American toads (Bufo americanus) were either unaffected or increased in abundance postharvest. Buffers ranging in width from 11 to 35 m appeared to partially mitigate the effects of timber harvest because abundances were generally higher within the buffer than in the adjacent clearcut for wood frogs, American toads, and to a lesser extent red-backed salamanders. Partial harvests adjacent to headwater streams had the least effect on the riparian Amphibian community and should be considered for harvests along headwater streams when managing at the stream scale. Our results show that managers can conduct riparian timber harvesting in a manner that allows a diverse suite of Amphibian species to persist in the first years after harvest. It is plausible that these same practices may also mitigate the effects of timber harvesting on other forest species. Long-term effects of riparian timber harvesting on Amphibians and other forest species population persistence and viability is a logical next step.

1691. **Effects of sediment load on emergence of aquatic invertebrates and plants from wetland soil egg and seed banks.**
Gleason, R. A.; Euliss, N. H.; Hubbard, D. E.; and Duffy, W. G.
Wetlands 23(1): 26-34. (2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: agricultural impacts/ egg banks/ hydrophytes/ prairie potholes/ resting eggs/ sedimentation/ seed banks/ siltation/ tillage/ wetland condition/ wetland degradation
Abstract: Intensive agricultural activities near prairie wetlands may result in excessive sediment loads, which may bury seed and invertebrate egg banks that are important for maintenance and cycling of biotic communities during wet/dry cycles. We evaluated effects of sediment burial on emergence of plants and invertebrates from seed and invertebrate egg banks. Sediment-load experiments indicated that burial depths of 0.5 cm caused a 91.7% reduction in total seedling emergence and a 99.7% reduction in total invertebrate emergence. Results of our burial experiments corroborated prior research on seedling emergence. However, our study demonstrated that invertebrate emergence is also highly susceptible to the effects of burial. Our research suggests that sediment entering wetlands from agricultural erosion may also hamper successional changes throughout interannual climate cycles. Land-management strategies need to be implemented that will prevent erosion of cropland top soil from entering wetlands.

1692. **Effects of structural marsh management and salinity on sediments, hydrology, invertebrates, and waterbirds in marsh ponds during winter on the Gulf Coast Chenier Plain.**
Bolduc, Francois. Louisiana State University and Agricultural and Mechanical College, 2003.
Notes: Advisor: Afton, Alan D.
Descriptors: wetlands/ marshes/ structural marsh management/ waterbirds/ salinity/ wintering habitat/ Louisiana
Abstract: Compositions of wintering waterbird communities are dependent upon food accessibility (via water depth), biomasses and sizes of their invertebrate prey, which in turn are influenced by the hydrology and sediments of wetland habitats. The hydrology and sediments of marsh ponds on the Gulf Coast Chenier Plain probably are affected by structural marsh management (levees, water control structures and impoundments; SMM) and salinity; therefore, SMM and salinity ultimately may affect wintering

waterbird communities. Accordingly, I measured sediment and hydrologic variables, biomasses and sizes of common aquatic invertebrates, and densities of common wintering waterbird species in ponds of impounded freshwater (IF), impounded oligohaline (IO), impounded mesohaline (IM), and unimpounded mesohaline (UM) marshes during winters 1997-1998 to 1999-2000 on Rockefeller State Wildlife Refuge, near Grand Chenier, Louisiana. SMM affected sediment and hydrologic variables, which negatively affected biomasses of Nematoda and secondarily increased those of Ostracoda. However, few waterbird species possess the capacity to capture these small prey; consequently, I predicted that avian species that consume invertebrates would not be among those differentiating waterbird communities between ponds of IM and UM marshes. Comparisons of waterbird densities provided inconsistent results with this prediction because some shorebird and waterfowl species that feed heavily on invertebrates were those that primarily differentiated waterbird communities between ponds of IM and UM marshes. My comparison of IF, IO, and IM marsh ponds indicated that, except for salinity, they differed little in sediment and hydrologic variables. Accordingly, these marshes only differed in biomass of Oligochaeta; consequently, I predicted that avian species that consume invertebrates would not be among those differentiating waterbird communities among ponds of IF, IO, and IM marshes. Accordingly, their waterbird communities primarily differed in densities of waterbird species that feed on vegetation. In conclusion, some waterbird species exclusively used ponds of UM marshes rather than ponds of IM marshes, and most species had highest densities in IF marshes when water depth favored those that maximized their densities. Consequently, my results suggest that marsh managers should focus on the preservation of UM and IF marshes for the conservation of wintering waterbird populations on the Gulf Coast Chenier Plain.

1693. **Effects of structural marsh management and winter burning on plant and bird communities during summer in the Gulf Coast Chenier Plain.**
Gabrey, S. W.; Afton, A. D.; and Wilson, B. C.
Wildlife Society Bulletin 29(1): 218-231. (2001)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: wetlands/ watershed management/ prescribed burning/ coasts/ Louisiana/ Texas
This citation is from AGRICOLA.

1694. **Effects of the herbicide imazapyr on benthic macroinvertebrates in a logged pond cypress dome.**
Fowlkes, Mark D.; Michael, Jerry L.; Crisman, Thomas L.; and Prenger, Joseph P.
Environmental Toxicology and Chemistry 22(4): 900-907. (2003)
NAL Call #: QH545.A1E58; ISSN: 0730-7268.
http://www.srs.fs.usda.gov/pubs/5485
Descriptors: imazapyr/ herbicide/ macroinvertebrates/ chironomid deformity/ wetland
Abstract: Increased herbicide use in silviculture over the last several decades has led to concern over potential water contamination, which may affect biotic health. In the southeastern United States, pine Ratwoods are important for timber production and are often interspersed with cypress wetlands. Cypress domes are isolated, shallow basins that collect surficial waters from adjacent forested areas and therefore might be expected to contain pesticide from storm runoff. This study utilizes in situ microcosm experiments to assess the effects of a concentration gradient of the herbicide imazapyr (0.184, 1.84, and 18.4 mg/L, equivalent to 1, 10, and 100 times the expected environmental concentration from a normal application rate) on the nracroinvertebrate community of a logged pond cypress dome using changes in macroinvertebrate composition, chironomid biomass, and chironomid head-capsule deformities. The control core was not significantly different from the surrounding cypress dome for any parameter, suggesting that enclosure effects were likely of minimal importance in the final experimental results. The lack of statistical difference ($p < 0.05$) in macroinvertcbrate community composition, chironomid deformity rate, and chironomid biomass between treatments suggests that imazapyr did not affect the macroinvertebrate community at Ihe concentralions tested. Chironomid deformity rate ranged from 0.97% for imazapyr control to 4.96% for the 100X treatment, with chironomid biomass being 1.79 and 1.87 mg/L, respectively.
This citation is from Treesearch.

1695. **Effects of vegetation manipulation on breeding waterfowl in prairie wetlands: A literature review.**
Kantrud, H. A. Fish and Wildlife Service, U.S. Department of the Interior, 1986. Fish and Wildlife Technical Report.
Notes: Also available in USDA General Technical Report RM-194, Can Livestock Be Used as a Tool to Enhance Wildlife Habitat?, Reno, Nevada, 13 February 1990, edited by Severson, Kieth E., pp. 93-123.
Call no. aSD11.A42 no. 194.
http://www.npwrc.usgs.gov/resource/wetlands/vegmanip/index.htm#contents
Descriptors: waterfowl/ wetlands/ prairie/ ducks/ marshes
Abstract: Both dabbling and diving ducks and their broods prefer wetlands with openings in the marsh canopy. Decreased use is commonly associated with decreased habitat heterogeneity caused by tall, robust hydrophytes and other species adapted to form monotypes in the absence of disturbance. Reductions in height and density of tall, emergent hydrophytes by fire and grazing (unless very intensive) generally benefit breeding waterfowl. Such benefits are an increase in pair density, probably related to increased interspersion of cover and open water which decreases visibility among conspecific pairs, and improvements in their invertebrate food resources that result from increased habitat heterogeneity. Research needs are great because of the drastic changes that have accrued to prairie wetlands through fire suppression, cultivation, and other factors. -from Author

1696. **Effects of wastewater on wetland animal communities.**
Brennan, K. M.
In: Ecological Considerations in Wetlands Treatment of Municipal Wastewaters/ Godfrey, Paul J.
New York: Van Nostrand Reinhold, 1985; pp. 199-223.
Notes: Literature review; ISBN: 0442230095.
NAL Call #: QH545.S49E3

Descriptors: wetlands treatment/ wastewater treatment/ water pollution effects/ ecosystems/ wildlife/ environmental effects/ economic aspects/ artificial wetlands
Abstract: An inventory of known discharges of wastewater to wetlands in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin was performed. The results show that the use of natural wetlands for the discharge of treated wastewater is relatively common. However, the intentional inclusion of wetlands as part of the treatment process is rare. Both types of situations may become more attractive due to economic factors. Although the short-term benefits of the use of natural wetlands for the disposal or treatment of wastewater (cost-effectiveness, treatment efficiency, and convenience) appear promising, the long-term ability of these areas to treat wastewater is questionable. The construction of artificial wetlands for the treatment of wastewater would avoid any detrimental effects that might result from the use of natural wetlands and also could provide supplementary habitats for wetland wildlife and possibly reservoirs for rare species. Few animal-related studies have been performed at the small number of artificial wetland sites presently in existence; thus, the information base is too small and too short-term for any conclusions to be drawn.

1697. **Effects of wetland creation on breeding season bird use in boreal eastern Ontario.**
Locky, D. A.; Davies, J. C.; and Warner, B. G.
Canadian Field Naturalist 119(1): 64-75. (2005)
NAL Call #: 410.9 Ot8 ; ISSN: 00083550
Descriptors: boreal/ breeding birds/ constructed wetland/ marsh/ Ontario/ rare birds/ upland birds/ wetland birds
Abstract: Wetland construction has been an effective means of mitigating wetland habitat losses due to agricultural and other activities. However, the type, variety, and age of the habitats created are often critical components in the success of the wetland when the aim is to enhance the bird community. Hilliardton Marsh was constructed as a series of cells between 1993 and 1997 in boreal eastern Ontario to provide waterfowl habitat. We determined habitat change and monitored breeding-season bird use before construction and one year after the last cell was constructed. Wetland construction resulted in dramatic changes to the vegetation and bird communities. The area was transformed into a variety of wetland habitats, but primarily marsh, one of the rarest wetland types in boreal Ontario. Survey stations with moderate habitat change exhibited the greatest change in bird species richness. Total species richness increased 55% from 56 to 87 species, with obligate wetland birds increasing from 3 to 26 species. Rare birds increased from 11 to 27 species, with most as obligate or facultative wetland birds, but also Peregrine Falcon (Falco peregrinus). Bird abundance, as measured by the number of stations where a species was observed, increased significantly for obligate wetland birds. There were no significant losses of species from any bird group, as adjacent upland habitat was preserved. This short-term study has shown that construction of new wetland habitat in boreal eastern Ontario, especially marsh, can significantly increase the numbers of breeding-season birds, including rare species. However, long-term monitoring is required to ensure sustained success of wetland construction projects for birds.

1698. **Effects of winter marsh burning on abundance and nesting activity of Louisiana seaside sparrows in the Gulf Coast Chenier Plain.**
Gabrey, S. W. and Afton, A. D.
Wilson Bulletin 112(3): 365-372. (2000)
NAL Call #: 413.8 W692; ISSN: 00435643
Descriptors: abundance/ ecological impact/ habitat management/ marsh/ nesting/ passerines/ prescribed burning/ United States/ Ammodramus maritimus/ Gulf Coast Chenier Plain
Abstract: Louisiana Seaside Sparrows (Ammodramus maritimus fisheri) breed and winter exclusively in brackish and saline marshes along the northern Gulf of Mexico. Many Gulf Coast marshes, particularly in the Chenier Plain of southwestern Louisiana and southeastern Texas, are burned intentionally in fall or winter as part of waterfowl management programs. Fire reportedly has negatively affected two Seaside Sparrow subspecies (A. m. nigrescens and A. m. mirabilis) in Florida, but there is no published information regarding effects of fire on A. m. fisheri. We compared abundance of territorial male Louisiana Seaside Sparrows, number of nesting activity indicators, and vegetation structure in paired burned and unburned plots in Chenier Plain marshes in southwestern Louisiana during the 1996 breeding season (April-July) before experimental winter burns (January 1997) and again during two breeding seasons post-burn (1997-1998). We found that abundance of male sparrows decreased in burned plots during the first breeding season post-burn, but was higher than that of unburned plots during the second breeding season post-burn. Indicators of nesting activity showed a similar but non-significant pattern in response to burning. Sparrow abundance and nesting activity seemingly are linked to dead vegetation cover, which was lower in burned plots during the first breeding season post-burn, but did not differ from that in unburned plots during the second breeding season post-burn. We recommend that marsh management plans in the Gulf Coast Chenier Plain integrate waterfowl and Seaside Sparrow management by maintaining a mosaic of burned and unburned marshes and allowing vegetation to recover for at least two growing seasons before reburning a marsh.

1699. **Endangered species management requires a new look at the benefit of fire: The Cape Sable seaside sparrow in the Everglades ecosystem.**
La Puma, David A.; Lockwood, Julie L.; and Davis, Michelle J.
Biological Conservation 136(3): 398-407. (2007)
NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: conservation measures/ reproduction/ ecology/ population dynamics/ terrestrial habitat/ abiotic factors/ physical factors/ land zones/ Ammodramus maritimus mirabilis/ habitat management/ reproductive productivity/ nesting success/ population density/ grassland/ prairie habitat/ fire/ Florida/ Everglades National Park/ Aves/ Passeriformes/ Emberizidae/ birds/ chordates/ vertebrates
Abstract: Although disturbance processes play important roles in maintaining habitat heterogeneity, the potential effects of such processes on rare or endangered species is virtually unknown and difficult to test. We use an unplanned fire, which burned half of a long-term study plot, as a natural experiment to test the effects of fire on the federally

endangered Cape Sable seaside sparrow in Everglades National Park. By implementing a before-after-control impact study design we determine the mechanistic link between fire and demography of this endangered sparrow. Our results show that while the sparrow tolerates fire, neither sparrow density nor nesting success are enhanced by fire, which runs contrary to the current paradigm in which sparrows are expected to benefit and therefore require fire for persistence. Our results caution against the assumption that occupancy of disturbance-prone habitat automatically suggests dependence on disturbance. Land managers must prevent large and frequent fires from burning occupied sparrow habitat to best manage for the species. Moreover, it is imperative that more studies focus on the effects of disturbance processes on rare and endangered species in order to prevent further loss of biodiversity. © 2006 Elsevier Ltd. All rights reserved.

1700. **Enhanced prairie wetland effects on surface water quality in Crowfoot Creek, Alberta.**
Ontkean, G. R.; Chanasyk, D. S.; Riemersma, S.; Bennett, D. R.; and Brunen, J. M.
Water Quality Research Journal of Canada 38(2): 335-359. (2003); ISSN: 1201-3080
Descriptors: wetlands/ water quality/ surface water/ habitat/ aquatic birds/ watersheds/ nutrient concentrations/ fecal coliforms/ surface water/ water quality (natural waters)/ catchment areas/ nutrients/ bacteria (faecal)/ birds (waterfowl)/ monitoring/ fate of pollutants/ prairies/ data collections/ spatial distribution/ temporal distribution/ suspended solids/ bacteria/ Canada, Alberta, Crowfoot Creek
Abstract: A three-year study was conducted to examine the effects of a prairie wetland enhanced for waterfowl habitat on surface water quality in the Crowfoot Creek watershed in southern Alberta, Canada. Monitoring was carried out at the Hilton wetland from mid-March to the end of October in 1997 to 1999 at two inflow sites and one outflow site. Data were collected on flow, total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS), and fecal coliform (FC) bacteria. Nutrient concentrations were highest in the spring, and decreased during the remainder of the monitoring period each year. Nutrient concentrations did not change significantly within the wetland due to the form of nutrient, reduced retention times for nutrient uptake, and the addition of nutrients to the water through sediment release and decomposition of organic matter. The wetland acted as both a source and a sink for nutrients, depending on flow volumes. TSS concentrations decreased significantly from inflow to outflow, indicating sedimentation occurred in the wetland. FC bacteria levels were lowest in the spring and increased during the post-spring runoff (PSRO) period. FC bacteria counts decreased significantly within the wetland throughout the entire year. The Hilton wetland was effective in reducing the amounts of TSS and FC bacteria exported from the wetland; however, there was no significant change in nutrient status.

1701. **Estimated extent of geographically isolated wetlands in selected areas of the United States.**
Tiner, R. W.
Wetlands 23(3): 636-652. (2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: coastal plains/ geographical distribution/ geographical information systems/ grasslands/ habitats/ hydrological data/ meadows/ nature conservation/ prairies/ regulations/ watersheds/ wetlands
Abstract: In preparing a major report on geographically isolated wetlands, the US Fish and Wildlife Service (FWS) initiated a study of the extent of these wetlands across the country. The FWS used geographical information system (GIS) technology to analyse existing digital data (e.g., National Wetlands Inventory data and US Geological Survey hydrologic data) to predict the extent of isolated wetlands in 72 study areas. Study sites included areas where specific types of isolated wetlands (e.g., prairie pothole marshes, playas, Nebraska's rainwater basin marshes and meadows, terminal basins, sinkhole wetlands, Carolina bays, and West Coast vernal pools) were known to occur, as well as areas from other physiographic regions. In total, these sites represented a broad cross-section of America's landscape. Although intended to show examples of the extent of isolated wetlands across the country, the study was not designed to generate statistically significant estimates of isolated wetlands for the nation. As expected, the extent of isolated wetlands was quite variable. The study found that isolated wetlands constituted a significant proportion of the wetland resource in arid and semiarid to subhumid regions and in karst topography. Eight study areas had more than half of their wetland area designated as isolated, while 24 other areas had 20-50% of their wetland area in this category. For most sites, isolated wetlands represented a greater percent of the total number of wetlands than the percent of wetland area. This was largely attributed to difference in wetland size, with most non-isolated wetlands being larger than the isolated wetlands. Forty-three sites had more than 50% of their total number of wetlands designated as isolated. The estimates of isolated wetlands presented in this study cannot be readily translated to wetlands that have lost Clean Water Act "protection" based on a recent U.S. Supreme Court ruling for several reasons, including the lack of written guidance on interpreting the Court's decision for identifying jurisdictional wetlands. The results of this GIS analysis present one perspective on the extent of geographically isolated wetlands in the country and represent a starting point for more detailed assessments.

1702. **Estuarine wetland restoration: A dike breach project in the Snohomish River Estuary, Marysville, WA.**
Soden, John M.
Ecological Society of America Annual Meeting, Proceedings 87: 271. (2002)
NAL Call #: QH540.E365.
Notes: Meeting abstract; 87th Annual Meeting of the Ecological Society of America and the 14th Annual International Conference of the Society for Ecological Restoration, Tucson, Arizona, USA; August 04-09, 2002.
Descriptors: estuarine ecology: ecology, environmental sciences/ wildlife management: conservation/ estuarine wetland restoration/ management method/ dike breach

project/ fish use trends/ intertidal zone elevations/ natural vegetation/ reclaimed wet pasture/ salinity/ site drainage/ tidal flow restoration/ water quality/ water temperature/ wildlife

1703. **Eutrophication and restoration of Lake Apopka, USA.**
Gu, Binhe
Hupo Kexue 17(1): 1-8(2005); ISSN: 1003-5427
Descriptors: freshwater ecology: ecology, environmental sciences/ pollution assessment control and management/ sediment/ water quality/ eutrophication/ drainage basin/ habitat restoration/ agricultural development/ paleolimnology/ food web structure
Abstract: This paper provides a literature review on eutrophication and restoration of Lake Apopka, a large, shallow and subtropical take in Florida, USA. Prior to 1947, Lake Apopka was a clear-water, submerged macrophyte-dominated system with a famous recreation fishery. Hydrologic alteration of the drainage basin and large-scale agricultural development of floodplain has resulted in catastrophic changes in Lake Apopka ecosystem. These changes include excessive phosphorus loading to the lake, massive die-off of the submerged macrophytes and virtual disappearance of the large-mouth bass population. Nowadays, Lake Apopka is a hypereutrophic system dominated by picophytoplankton and rough fish gizzard shad. Approximately 90% of the lake bottom is covered by a layer of 50 cm thick, unconsolidated, flocculent organic materials largely originated from water column production. Measures of Lake Apopka restoration include (I) reduction of external phosphorus loading, (2) removal of phosphorus and other suspended solids from the lake by filtration through the marsh flow-way and by mass removal of gizzard shad, (3) improvement of food-web structure by removing gizzard shad, (4) restoration of habitat through shoreline plantation and (5) increases in water level fluctuation. Major research covers a variety of topics including analysis of past water quality conditions, estimates of external and internal phosphorus loading. setting water quality goal, sediment characterization, resuspension, nutrient inventory and fluxes, paleolimnological evidences for eutrophication, primary productivity, phytoplankton community structure, and limiting nutrients. Recent debates on eutrophication mechanisms and restoration strategies are also presented.

1704. **Evaluating acute toxicity of methyl parathion application in constructed wetland mesocosms.**
Milam, C. D.; Bouldin, J. L.; Farris, J. L.; Schulz, R.; Moore, M. T.; Bennett, E. R.; Cooper, C. M.; and Smith, S.
Environmental Toxicology 19(5): 471-479. (Oct. 2004)
NAL Call #: RA1221.T69; ISSN: 1520-4081
Descriptors: Ceriodaphnia (Cladocera)/ Hyalella azteca (Amphipoda)/ Chironomus tentans (Chironomidae)/ Pimephales promelas (Cyprinidae)/ pollutants/ survival/ semiaquatic habitat/ fertilizer and pesticide pollution/ toxic effects/ fertilizers and pesticides/ methyl parathion/ Mississippi/ Oxford, Miss./ toxic effects of methyl parathion/ constructed wetland mesocosms
Abstract: Wetland ecosystems have reduced ambient levels of various organic and metallic compounds, although their effectiveness on agricultural pesticides is not well documented. Five stations within each of two 10 X 50 m constructed wetlands (two vegetated, two nonvegetated) were selected to measure the fate and effects of methyl parathion (MeP). Following a simulated storm event (0.64 cm of rainfall), aqueous, sediment, and plant samples were collected and analyzed spatially (5, 10, 20, and 40 m from the inlet) and temporally (after 3-10 days) for MeP concentrations and for the impact of those concentrations on the aquatic fauna. Aqueous toxicity to fish decreased spatially and temporally in the vegetated mesocosm. Pimephales promelas survival was significantly reduced, to 68%, at the 10-m station of the nonvegetated wetlands (3 h postapplication), with pesticide concentrations averaging 9.6 µ g MeP/L. Ceriodaphnia in both the vegetated and nonvegetated wetlands was sensitive (i.e., a significant acute response to MeP occurred) to pesticide concentrations through 10 days postapplication. Mean MeP concentrations in water ranged from 0.5 to 15.4 µ g/L and from 0.1 to 27.0 µ g/L in the vegetated and nonvegetated wetlands, respectively. Hyalella azteca aqueous tests resulted in significant mortality in the 5-m vegetated segment 10 days after exposure to MeP (2.2 µ g/L. Solid-phase (10-day) sediment toxicity tests showed no significant reduction in Chironomus tentans survival or growth, except for the sediments sampled 3 h postapplication in the nonvegetated wetland (65% survival). Thereafter, midge survival averaged >87% in sediments sampled from both wetlands. These data suggest that wetlands play a significant role in mitigating the effect of MeP exposure in sensitive aquatic biota. © 2004 Wiley Periodicals, Inc.

1705. **Evaluating perturbations and developing restoration strategies for inland wetlands in the Great Lakes Basin.**
Detenbeck, N. E.; Galatowitsch, S. M.; Atkinson, J.; and Ball, H.
Wetlands 19(4): 789-820. (1999)
NAL Call #: QH75.A1W47; ISSN: 0277-5212.
Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995.
Descriptors: wetlands/ land reclamation/ land management/ hydrology/ water quality/ vegetation/ exotic species/ sedimentation/ disturbance/ environmental restoration/ nature conservation/ ecosystem disturbance/ eutrophication/ land use/ land restoration/ land/ water quality (natural waters)/ land restoration/ North America, Great Lakes
Abstract: Wetland coverage and type distributions vary systematically by ecoregion across the Great Lakes Basin. Land use and subsequent changes in wetland type distributions also vary among ecoregions. Incidence of wetland disturbance varies significantly within ecoregions but tends to increase from north to south with intensity of land use. Although the nature of disturbance activities varies by predominant land-use type, mechanisms of impact and potential response endpoints appear to be similar across agricultural and urban areas. Based on the proportion of associated disturbance activities and proportion response endpoints affected, the highest ranking mechanisms of impact are sedimentation/turbidity, retention time, eutrophication, and changes in hydrologic timing. Disturbance activities here are defined as events that cause wetland structure or function to vary outside of a normal

range, while stressors represent the individual internal or external agents (causes) that act singly or in combination to impair one or more wetland functions. Responses most likely associated with disturbance activities based on shared mechanisms of impact are 1) shifts in plant species composition, 2) reduction in wildlife production, 3) decreased local or regional biodiversity, 4) reduction in fish and/or other secondary production, 5) increased flood peaks/frequency, 6) increased aboveground production, 7) decreased water quality downstream, and 8) loss of aquatic plant species with high light compensation points. General strategies and goals for wetland restoration can be derived at the ecoregion scale using information on current and historic wetland extent and type distributions and the distribution of special-concern species dependent on specific wetland types or mosaics of habitat types. Restoration of flood-control and water-quality improvement functions will require estimates of wetland coverage relative to total land area or specific land uses (e.g., deforestation, urbanization) at the watershed scale. The high incidence of disturbance activities in the more developed southern ecoregions of both Canada and the U.S. is reflected in the loss of species across all wetland types. The species data here suggest that an effective regional strategy must include restoration of a diversity of wetland types, including the rarer wetland types (wet meadows, fens), as well as forested swamps, which were extensive historically. The prevalence of anthropogenic stresses and openwater habitats likely contributes to the concentration of exotic species in inland wetlands of the southern Great Lakes ecoregions. Vegetation removal and site disturbance are the best- documented causes for plant invasions, and encroachment activities are common in marshes and ponds of the southern ecoregions.

1706. **Evaluating salt marsh restoration in Delaware Bay: Analysis of fish response at former salt hay farms.**
Able, Kenneth W.; Nemerson, David M.; and Grothues, Thomas M.
Estuaries 27(1): 58-69. (2004)
NAL Call #: GC96.E79; ISSN: 0160-8347
Descriptors: conservation measures/ life cycle and development/ development/ Growth/ ecology/ population dynamics/ habitat/ brackish habitat/ marine zones/ Atlantic Ocean/ Micropogonias undulatus: growth rate/ salt marsh restoration effects/ North Atlantic/ Pisces, Actinopterygii, Perciformes, Sciaenidae/ chordates/ fish/ vertebrates
Abstract: In a continuing effort to monitor the fish response to marsh restoration (resumed tidal flow, creation of creeks), we compared qualitative and quantitative data on species richness, abundance, assemblage structure and growth between pre-restoration and post-restoration conditions at two former salt hay farms relative to a reference marsh in the mesohaline portion of Delaware Bay. The most extensive comparison, during April-November 1998, sampled fish populations in large marsh creeks with otter trawls and in small marsh creeks with weirs. Species richness and abundance increased dramatically after restoration. Subsequent comparisons indicated that fish size, assemblage structure, and growth of one of the dominant species, Micropogonias undulatus, was similar between reference and restored marshes 1 and 2 yr post-restoration. Total fish abundance and abundance of the dominant species was greater, often by an order of magnitude, in one of the older restored sites (2 yr post-restoration), while the other restored site (1 yr post-restoration) had values similar to the reference marsh. The success of the restoration at the time of this study suggests that return of the tidal flow and increased marsh area and edge in intertidal and subtidal creeks relative to the former salt hay farms contributed to the quick response of resident and transient young-of-the-year fishes.

1707. **Evaluating salt marsh restoration in Delaware Bay: The response of blue crabs, Callinectes sapidus, at former salt hay farms.**
Jivoff, Paul R. and Able, Kenneth W.
Estuaries 26(3): 709-719. (2003)
NAL Call #: GC96.E79; ISSN: 0160-8347
Descriptors: conservation measures/ ecology/ population dynamics/ habitat/ brackish habitat/ marine zones/ Atlantic Ocean/ North Atlantic/ Callinectes sapidus: habitat management/ salt marsh restoration/ population density/ population structure/ environmental indicators/ population level response based evaluation of salt marsh restoration/ salt marsh/ northwest Atlantic/ New Jersey/ Delaware Bay/ Crustacea, Malacostraca, Eumalacostraca, Eucarida, Decapoda, Reptantia, Brachyura/ arthropods/ crustaceans/ invertebrates
Abstract: Marshes are important habitats for various life history stages of many fish and invertebrates. Much effort has been directed at restoring marshes, yet it is not clear how fish and invertebrates have responded to marsh restoration. The blue crab, Callinectes sapidus, uses marsh habitats during much of its benthic life. We investigated the response of blue crabs to marsh restoration by comparing crab abundance (catch per unit effort), mean size and size frequency distribution, sex ratio, and molt stages of crabs in recently restored marshes that were former salt hay farms to that of adjacent reference marshes with similar physical characteristics in the mesohaline portion of Delaware Bay. Field sampling occurred monthly (April-November) in 1997 and 1998 using replicate daytime otter trawls in large marsh creeks and weirs in smaller intertidal marsh creeks. Blue crabs were either equal or more abundant, the incidence of molting was in most months similar, and population sex ratios were indistinguishable in restored and reference marshes, suggesting that the restored areas attract crabs and support their growth. Site location had a greater effect on the sex ratio of crabs such that marshes closer to the mouth of the bay contained a higher percentage of adult female crabs. In each annual growing season (April July), the monthly increase in crab size and, in some months (June July), the incidence of molting at the restored sites was greater than the reference sites, suggesting that the restored sites may provide areas for enhanced growth of crabs. These results suggest that blue crabs have responded positively to restoration of former salt hay farms in the mesohaline portion of Delaware Bay.

1708. **Evaluation of farmed playa wetlands as avian habitat using survey data and two rapid assessment techniques.**
Rivers, J. W. and Cable, T. T.
Transactions of the Kansas Academy of Science 106(3): 155-165. (2003)
NAL Call #: 500 K13T; ISSN: 0022-8443

Descriptors: wetlands/ playas/ agriculture/ aquatic birds/ biological surveys/ sampling/ habitat/ Kansas
Abstract: Playa wetlands contribute to the biological diversity of the southern Great Plains, yet many are modified by current farming practices. We surveyed 12 farmed playa wetlands from 1998-99 to (1) document seasonal avian use of these habitats and (2) assess the performance of two rapid assessment techniques, the Habitat Assessment Technique and the Wetland Evaluation Technique. Thirty-six bird species were observed on farmed playa wetlands, 42% of which are dependent on wetland habitats. In contrast, only 5 species were observed on upland reference sites in 1999, and none were dependent on wetlands. Collectively, both rapid assessment techniques rated farmed playa wetlands as poor habitats because of the physical characteristics of study sites. Based on field observations and published work, we conclude that farmed playa wetlands provide habitat for many avian species and the rapid assessment techniques examined are unsuitable for assessing playa wetlands as avian habitat in Kansas.

1709. **Evaluation of nekton use and habitat characteristics of restored Louisiana marsh.**
Bush Thom, Christina S.; La Peyre, Megan K.; and Nyman, J. Andrew
Ecological Engineering 23(2): 63-75. (2004)
NAL Call #: TD1.E26; ISSN: 0925-8574
Descriptors: conservation measures/ ecology/ habitat/ brackish habitat/ land zones/ marine zones/ Atlantic Ocean/ North Atlantic/ Crustacea/ Pisces: habitat management/ marsh terracing/ coconut matting restoration techniques/ nekton community structure/ habitat quality/ managed vs unmanaged marsh/ community structure/ nekton assemblage composition/ environmental indicators/ salt marsh/ Sabine National Wildlife Refuge/ Gulf of Mexico/ arthropods/ chordates/ crustaceans/ fish/ invertebrates/ vertebrates

1710. **Evaluation of partners for fish and wildlife wetland restoration efforts in the Saginaw Bay watershed (Michigan).**
Thompson, Katherine Ford. Michigan State University, 2004.
Notes: Advisor: Millenbah, Kelly F.; Degree: MS
Descriptors: wetland restoration/ fish/ wildlife/ ecological analysis/ Saginaw Bay/ Michigan
Abstract: Since 1987, the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program has provided technical assistance to private landowners to voluntarily restore wetlands on their property. However, monitoring and evaluation of these projects has been limited. to determine the success of past Partner's wetland restoration projects in the Saginaw Bay watershed of Michigan, both broad and intensive-level evaluations were conducted that compared restored and natural reference wetlands. Furthermore, through landowner surveys, the relationship of landowner perception and experience to the broad and intensive ecological evaluations was explored. Ecological evaluation revealed water depth and percent open water were greater ($P < 0.05$) on restored than reference sites. Conversely, percent total vegetation cover was less ($P < 0.05$) on restored than reference sites. Restored and reference sites supported similar mean avian species richness and avian diversity, however, restored sites supported higher ($P < 0.05$) densities of wetland dependent birds. Although water depth and land cover characteristics on restored sites did not approximate conditions on reference sites, avian response to these areas suggests that restored sites are able to support avian use similar or better than natural wetlands. Overall, landowner surveys had lower ($P = 0.02$) estimates of percent total cover than broad evaluations. However, percent open water was not different among the three evaluation techniques. Landowner surveys, broad and intensive evaluation techniques can all be used to effectively monitor and evaluate restored wetlands on private lands.

1711. **An evaluation of vegetation and wildlife communities in mitigation and natural wetlands of West Virginia.**
Balcombe, Collins K.
Morgantown, W. Va.: West Virginia University, 2003.
Notes: Thesis submitted to the Davis College of Agriculture, Forestry, and Consumer Sciences at West Virginia University in partial fulfillment of the requirements for the degree of Master of Science in Wildlife and Fisheries Resource Management
http://www.forestry.caf.wvu.edu/jAnderson/Balcombe_c_thesis.pdf
Descriptors: wetland mitigation/ wetland restoration/ wetland management/ mitigation wetland/ constructed wetland/ reference wetland

1712. **An evaluation of vernal pool creation projects in New England: Project documentation from 1991-2000.**
Lichko, L. E. and Calhoun, A. J. K.
Environmental Management 32(1): 141-151. (2003)
NAL Call #: HC79.E5E5 ; ISSN: 0364-152X
Descriptors: environment-ecology/ vernal pool/ wetland creation/ compensatory mitigation/ wetland monitoring/ reference wetlands/ New England/ metapopulation dynamics/ amphibian conservation/ temporary wetlands/ self design/ mitigation/ landscape/ declines/ biodiversity/ populations/ hydroperiod
Abstract: Vernal pools are vulnerable to loss through development and agricultural and forestry practices owing to their isolation from open water bodies and their small size. Some vernal pool-dependent species are already listed in New England as Endangered, Threatened, or Species of Special Concern. Vernal pool creation is becoming more common in compensatory mitigation as open water ponds, in general, may be easier to create than wooded wetlands. However, research on vernal pool creation is limited, A recent National Research Council study (2001) cites vernal pools as "challenging to recreate." We reviewed documentation on 15 vernal pool creation projects in New England that were required by federal regulatory action. Our purpose was to determine whether vernal pool creation for compensatory mitigation in New England replaced key vernal pool functions by assessing project goals and documentation (including mitigation plans, pool design criteria, monitoring protocols, and performance standards). Our results indicate that creation attempts often fail to replicate lost pool functions. Pool design specifications are often based on conjecture rather than on reference wetlands or created pools that function

successfully. Project monitoring lacks consistency and reliability, and record keeping by regulatory agencies is inadequate. Strengthening of protection of isolated wetlands in general, and standardization across all aspects of vernal pool creation, is needed to ensure success and to promote conservation of the long-term landscape functions of vernal pools.

1713. **Extent and distribution of waterfowl habitat managed on private lands in the Mississippi Alluvial Valley.**
Uihlein, W. B.
Mississippi State, MS: Mississippi State University, 2000.
Notes: Thesis (Ph.D.)
Descriptors: Mississippi Delta/ rice/ private lands/ winter/ agriculture/ habitat management/ surveys

1714. **Factors affecting condition of northern pintails wintering in the Southern High Plains.**
Smith, Loren M. and Sheeley, Douglas G.
Journal of Wildlife Management 57(1): 62-71. (1993)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: body weight/ carcass composition/ climate/ diet/ energetic cost/ fat/ gizzard mass/ lipid/ nutrient reserve/ paired male/ population ecology/ protein/ reproduction/ sex difference/ survival/ wetland management
Abstract: Because nutrient reserves affect survival and subsequent reproduction, it is necessary to examine factors affecting nutrient reserves to understand the population ecology of northern pintails (Anas acuta). Thus, we examined variation in carcass composition and organ mass of northern pintails wintering on the Southern High Plains (SHP) of Texas (USA) with respect to time (month, year; which varied in wetland availability), age, sex, and pair status. Carcass mass for males, and fat-gizzard mass, and percent fat were higher (P < 0.05) in 1985-86 (wet year) than 1985 (normal year) for males and females. This was attributed to precipitation that was 70% above normal in 1985-86, and resulted in increased availability of wetlands. Adult and immature birds did not differ (P > 0.10) with the exception of ash mass. Males were heavier (P < 0.001), had heavier (P < 0.001) organs (gizzard and liver), and had more (P < 0.001) protein and ash than females. Females had a higher (P < 0.001) percentage of fat than males. Fat and protein decreased from November to December in both years. In the normal year, fat did not vary (P > 0.05) from January to March. A decline (P < 0.05) in fat in February of the wet year may have been an endogenous response to reduce energetic costs. Changes in gizzard mass over time probably reflected dietary changes during winter. Paired males had greater (P < 0.01) lipid levels than unpaired birds in the wet year but not in the normal year. We could not make this comparison for females because ther were so few unpaired females. Management in the SHP should focus on improving playa wetlands in winter because pintail body condition can be improved by increased wetland availability, and improved condition has been associated with increased survival and reproduction.

1715. **Fall water requirements for seasonal diked wetlands at Lower Klamath National Wildlife Refuge.**
Mayer, T. D. and Thomasson, R.
Wetlands 24(1): 92-103. (Mar. 2004)
NAL Call #: QH75.A1W47
Descriptors: seasonal wetlands/ autumn/ hydrology/ water management/ flooded conditions/ saturated conditions/ surface water level/ groundwater/ volume/ water quantity/ soil water/ wetland soils/ water balance/ measurement/ models/ refuge habitats/ California/ water resources and management/ natural resources, environment, general ecology, and wildlife conservation/ soil chemistry and physics
This citation is from AGRICOLA.

1716. **The Farm Bill and duck production in the Prairie Pothole Region: Increasing the benefits.**
Reynolds, R. E.; Shaffer, T. L.; Loesch, C. R.; and Cox, R. R.
Wildlife Society Bulletin 34(4): 963-974. (2006)
NAL Call #: SK357.A1W5; ISSN: 00917648.
Notes: doi: 10.2193/0091-7648(2006)34[963:TFBADP]2.0.CO;2.
Descriptors: Conservation Reserve Program/ duck/ Farm Bill/ Prairie Pothole Region/ Swampbuster/ United States Department of Agriculture
Abstract: The Food Security Act of 1985 contained provisions that affected wildlife conservation nationwide. Two provisions that most benefited waterfowl populations in the Prairie Pothole Region (PPR) were the Conservation Reserve Program (CRP) and "Swampbuster" (wetland conservation). Permanent cover established under the CRP provides attractive nesting habitat for upland-nesting ducks that is more secure than other major habitats. Swampbuster has prevented drainage of wetlands vital to breeding duck pairs. In 2007 many CRP contracts will expire. Deliberations will begin in late 2006 regarding the next Farm Bill. The United States Department of Agriculture needs sound biological information and scientific analyses to help establish wildlife priorities in the Farm Bill. We used data from breeding duck population and wetland habitat surveys to develop models for 5 species of upland-nesting ducks and applied these models to >2.6 million wetlands in a digital database for the PPR in North and South Dakota, USA. We used geographic information systems techniques to identify locations in the PPR where CRP cover would be accessible to the greatest number of nesting hens. We then summarized distribution of current CRP contracts relative to distribution of upland-breeding ducks. We also used our models to predict change in the breeding duck population (landscape carrying capacity) that might occur if certain wetlands were exempt from the Swampbuster provision. Our analyses showed that 75% of CRP contracts as of July 2005 were in areas accessible to high or medium numbers of breeding ducks and 25% were in areas of low populations. We suggest a method to prioritize CRP extensions and reenrollment of current contracts or target new contracts to maintain or increase duck production. Additionally, our models suggested that if the Swampbuster provision were removed from future Farm Bills and protected wetland were drained, this area of the PPR could experience a 37% decline in the waterfowl populations we studied.

1717. **Fate of wetlands associated with the central Nebraska irrigation canal system.**
Ekstein, J. D. and Hygnstrom, S. E.
Great Plains Research 6(1): 41-60. (1996)
NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165
Descriptors: wetlands/ irrigation districts/ canals/ aerial photography/ environmental effects/ water table rise/ flooding/ wildlife management/ nature conservation/ environmental impact/ Nebraska/ nature conservation/ environmental impact/ irrigation districts/ water table rise/ wildlife management
Abstract: Changes in wetlands in the vicinity of the Phelps and E65 canals operated by Central Nebraska Public Power and Irrigation District in Southcentral Nebraska were examined using aerial photographs taken on seven occasions from 1938 to 1981. According to previous research, nearly 90% of the original wetlands within the surrounding Rainwater Basin were destroyed or altered by draining and filling between 1900 and 1980. Within a zone extending 10 kilometers on each side of the Phelps and E65 canals, however, we observed an increase in the number and total area of wetlands, which we hypothesize to have been caused by an elevated groundwater table. Of additional importance for wildlife management, there was a notable decrease in wetlands temporarily flooded for 2 months or less, and a notable increase in wetlands seasonally flooded for 3 to 5 months each year. These changes were most conspicuous after 1969.

1718. **Fish and wildlife benefits associated with wetland establishment practices.**
Rewa, Charles A.
In: Fish and Wildlife Response to Farm Bill Conservation Practices; Bethesda, MD: The Wildlife Society, 2007. 12 pp.
ftp://ftp-fc.sc.egov.usda.gov/NHQ/nri/ceap/fwfb6.pdf
Descriptors: aquatic habitat/ conservation practices/ wetland conservation/ wetland management/ terrestrial habitat/ wildlife species/ wildlife management
Abstract: This paper summarizes the findings of studies conducted to document fish and wildlife response to these practices. The majority of published studies describe bird response to wetland restoration, with most reporting bird communities in restored wetlands to be similar to those of natural reference wetlands. Studies also indicate that invertebrates and amphibians generally respond quickly to and colonize newly established wetland habitats. Key factors reported as correlated with wildlife species richness include wetland size, availability of nearby wetlands habitats, diversity of water depths and vegetation, wetland age, and maintenance and management activity. Key knowledge gaps in our understanding of fish and wildlife response to wetland establishment practices are identified, including the need for studies on biota other than birds and long-term monitoring of wetland condition and wildlife response over time.

1719. **Fish assemblage composition in constructed and natural tidal marshes of San Diego Bay: Relative influence of channel morphology and restoration history.**
Williams, G. D. and Zedler, J. B.
Estuaries 22(3A): 702-716. (Sept. 1999)
NAL Call #: GC96.E79; ISSN: 0160-8347
Descriptors: wetlands/ tides/ environmental restoration/ habitat utilization/ California/ San Diego Bay/ tidal marshes/ morphology/ rehabilitation/ channel morphology/ species composition/ aquatic habitat/ population density/ killifish/ multivariate analysis/ monitoring/ biological sampling/ physical properties/ environment management/ river engineering/ ecosystem disturbance/ environmental impact/ community composition/ fluvial morphology/ environmental factors/ Pisces/ Fundulus parvipinnis/ California killifish/ reclamation/ water quality control/ mechanical and natural changes/ multi-disciplinary studies/ environmental effects/ erosion and sedimentation
Abstract: This study evaluated the use by fish of restored tidal wetlands and identified links between fish species composition and habitat characteristics. We compared the attributes of natural and constructed channel habitats in Sweetwater Marsh National Wildlife Refuge, San Diego Bay, California, by using fish monitoring data to explore the relationships between channel environmental characteristics and fish species composition. Fishes were sampled annually for 8 yr (1989-1996) at eight sampling sites, four in constructed marshes and four in natural marshes, using beach seines and blocking nets. We also measured channel habitat characteristics, including channel hydrology (stream order), width and maximum depth, bank slope, water quality (DO, temperature, salinity), and sediment composition. Fish colonization was rapid in constructed channels, and there was no obvious relationship between channel age and species richness or density. Total richness and total density did not differ significantly between constructed and natural channels, although California killifish (Fundulus parvipinnis) were found in significantly higher densities in constructed channels. Multivariate analyses showed fish assemblage composition was related to channel habitat characteristics, suggesting a channel's physical properties were more important in determining fish use than its restoration status. This relationship highlights the importance of designing restoration projects with natural hydrologic features and choosing proper assessment criteria in order to avoid misleading interpretations of constructed channel success. We recommend that future projects be designed to mimic natural marsh hydrogeomorphology and diversity more closely, the assessment process utilize better estimates of fish habitat function (e.g., individual and community-based species trends, residence time, feeding, growth) and reference site choice, and experimental research be further incorporated into the restoration process.

1720. **Fish recruitment to a constructed wetland.**
Langston, M. A. and Kent, D. M.
Journal of Freshwater Ecology 12(1): 123-129. (1997)
NAL Call #: QH541.5.F7J68; ISSN: 0270-5060
Descriptors: Florida/ artificial wetlands/ fish populations/ seasonal variations/ fish establishment/ biological sampling/ Pisces/ fish recruitment/ environmental restoration/ artificial wetlands
Abstract: A 31.6 ha isolated, constructed wetland in east central Florida was sampled for fish over a two year period using a fyke net and minnow traps. A rich and abundant fish community rapidly developed. Cumulatively, 848 fish of 14 species were collected. Variation in abundance was observed, and reflects seasonal conditions. Gambusia affinis, Fundulus chrysotus, and Lepomis gulosis were the most abundant species. This fish community was similar to

natural fish communities of the region. Fish may have been introduced to the study wetland by irrigation, transport on terrestrial or volant fauna, or a combination of the two modes.

1721. **The fishery value of salt marsh restoration projects.**
Rozas, Lawrence P.; Caldwell, Philip; and Minello, Thomas J.
Journal of Coastal Research (Special Issue 40): 37-50. (Winter 2005); ISSN: 0749-0208
Descriptors: conservation measures/ ecology/ habitat/ brackish habitat/ marine zones/ Atlantic Ocean/ North Atlantic/ Callinectes sapidus/ Farfantepenaeus aztecus/ Litopenaeus setiferus: habitat management/ salt marsh restoration projects/ evaluation of value for enhancing fishery species populations/ biomass/ population dynamics/ salt marsh/ Gulf of Mexico/ Texas/ Galveston Bay/ Crustacea, Malacostraca, Eumalacostraca, Eucarida, Decapoda, Natantia/ arthropods/ Crustaceans/ invertebrates
Abstract: We assessed the benefits of different wetland restoration techniques for fishery resources by comparing habitat complexity, fishery support, and construction costs among five salt marsh restoration projects in Galveston Bay, Texas. The restoration projects included marsh terracing at Galveston Island State Park (GISPT) and Pierce Marsh Preserve (PMPT), mound construction at Jumbile Cove (JC), and marsh island construction north of Galveston Island along Interstate Highway 45 at I-45 East Marsh (145EM) and I-45 West Marsh (145WM). The projects were located in shallow estuarine waters and used bottom sediments or upland soils to construct intertidal areas that were planted with smooth cordgrass Spartina alterniflora. We used a Geographic Information System (GIS) and high-resolution aerial photography to classify areas into land (marsh vegetation) and water and applied fishery density models to assess fishery support. These models were developed to describe fine-scale distribution patterns for brown shrimp Farfantepenaeus aztecus, white shrimp Litopenaeus setiferus, and blue crab Callinectes, sapidus across shallow estuarine habitat types (emergent marsh and shallow open water) of the Galveston Bay estuary. Restoration sites ranged in size from 6.9 ha (145EM) to 68.2 ha (GISPT). Construction costs ranged from $362,250 (GISPT) to $74,200 (145EM). Costs standardized to 1 ha for comparison among projects were $40,608 (145WM), $11,875 (JC), 685 (145EM), $8,771 (PMPT), and $5,310 (GISPT). The 145WM project contained the greatest percentage of marsh vegetation (68%), whereas the two terracing projects had the smallest percentage (PMPT = 18%, GISPT = 19%). More of the constructed marsh in the terracing projects, however, was vegetated marsh edge (located within 1 m of the marsh shoreline) than in other projects (PMPT = 29%, GISPT 25%, 145EM - 20%, JC = 11%, 145WM - 9%), and this habitat type supports the greatest densities of fishery species. Based on our modeling analysis, overall fishery support was greatest for the two I-45 projects, followed by the PMPT terracing project. Estimates of standing crop (number of animals) standardized to 1 ha ranged between 22,246-30,863 for brown shrimp, 21,773-33,139 for white shrimp, and 17,240-24,927 for blue crab. The two terracing projects and 145EM had higher fishery-benefit: cost ratios (ratio of standardized net fishery value to standardized project cost) than the other projects. Although marsh terraces composed of small cells supported the highest nekton populations, terraces constructed of medium cells were more cost-effective than terraces composed of either small or large cells. Based on our modeling results, all five restored sites supported relatively high populations of fishery species compared to prerestoration conditions. However, restoration sites did not support populations equivalent to a reference marsh system. Restoration projects should maximize the area of marsh vegetation and create a high degree of water-marsh interspersion to provide the most benefit for fishery species.

1722. **Floral and faunal colonization of restored wetlands in west-central Minnesota and northeastern South Dakota.**
Sewell, R. S. and Higgins, K. F.
In: Proceedings of the Fourteenth Annual Conference on Wetlands Restoration and Creation/ Webb, F. J.
Plant City, Fl.: Hillsborough Community Coll, 1991; pp. 108-133.
Notes: Conference: 18. Annu. Conf. on Wetlands Restoration and Creation, Plant City, FL (USA), 16-17 May 1991.
Descriptors: wetlands/ biological surveys/ community composition/ land reclamation/ aquatic animals/ freshwater fish/ aquatic plants/ aquatic birds/ Minnesota/ South Dakota
Abstract: The objective of this study was to determine trends in species abundance and richness of waterfowl, aquatic macroinvertebrates, fishes and hydrophytes in restored wetlands of differing ages since restoration. One hundred fifty-six restored seasonal and semi-permanent basins of 12 different ages were surveyed in 3 counties of northeast South Dakota and 6 counties of west-central Minnesota, USA. A large diversity of flora and fauna colonized wetlands as early as one year after restoration. Twelve species of waterfowl were observed in all age classes of the restored basins. Thirty-one taxa of macroinvertebrates occurred in restored basins, 12 of which were in age class 1 basins. Four fish species inhibited restored basins of all ages. An average of over 16 taxa of aquatic hydrophytes had coverage values of greater than or equal to 5% of the total wetland area in restored basins. This study demonstrated that wetland managers can expect extensive floral and faunal colonization of prairie wetlands even in the first year after restoration.

1723. **Functional assessment of five wetlands constructed to mitigate wetland loss in Ohio, USA.**
Wilson, R. F. and Mitsch, W. J.
Wetlands 16(4): 436-451. (1996)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ habitat improvement/ man-induced effects/ nature conservation/ evaluation/ hydrology/ marshes/ environmental restoration/ Ohio/ evaluation/ depression wetlands/ environmental restoration/ habitat improvement/ man-induced effects/ nature conservation
Abstract: Five replacement wetlands in Ohio, USA, were investigated to determine their ecological and legal success. Hydrology, soils, vegetation, wildlife, and water quality of each wetland determined their functional success. The progress of the wetlands was also compared to their

legal requirements. Four of the five wetlands (80%) were in compliance with legal requirements and the same four wetlands demonstrated medium to high ecosystem success. For the four wetlands, a replacement ratio of 1.4:1 was achieved for area, and depressional wetlands were generally replaced with depressional wetlands.

1724. **Functional equivalency between rice fields and seminatural wetland habitats.**
Elphick, Chris S.
Conservation Biology 14(1): 181-191. (2000)
NAL Call #: QH75.A1C5 ; ISSN: 0888-8892
Descriptors: multivariate analysis: analytical method/ anthropogenic habitat/ behavior/ feeding efficiency/ food abundance/ foraging performance/ functional equivalency/ predation threat/ rice fields/ seminatural wetland habitat/ time allocation
Abstract: Evaluating the potential for anthropogenic habitats to act as surrogates for the natural habitats they replace is a key issue in conservation biology. In California, flooded rice fields are used by numerous aquatic birds during winter. If this habitat functions similarly to more natural wetlands, increased flooding may help replace the extensive wetlands that occurred in the region prior to agricultural development. I tested whether food abundance, perceived predation threat, foraging performance, and the way in which birds allocate their time to different behaviors differed between flooded rice fields and seminatural wetlands for several species of aquatic bird. When appropriate, I also compared flooded and unflooded fields. Invertebrate densities did not differ among habitats. Seminatural wetlands had less rice grain but more seeds from other plants than the two rice habitats. The frequency with which predators passed over a feeding area was lower in flooded fields than in unflooded fields or seminatural wetlands. Most differences in feeding performance and time allocation among habitats were small and statistically insignificant. For some species, feeding efficiency was greater in seminatural wetlands than in flooded fields. Increasing attack rates and the amount of time spent feeding when in flooded fields, however, may allow birds to compensate for reduced efficiency. Multivariate analyses showed that group size, predation threat, time of day, date, and water depth often were associated with behaviors, but that these variables rarely accounted for habitat differences. Flooded fields apparently provide equivalent foraging habitat to seminatural wetlands and, because of reduced predation threat, may be a safer habitat for waterbirds. Thus, if managed appropriately, one of the world's dominant forms of agriculture can provide valuable waterbird habitat.

1725. **Functional variability of habitats within the Sacramento-San Joaquin Delta: Restoration implications.**
Lucas, Lisa V.; Cloern, James E.; Thompson, Janet K.; and Monsen, Nancy E.
Ecological Applications 12(5): 1528-1547. (2002)
NAL Call #: QH540.E23; ISSN: 1051-0761
Descriptors: conservation measures/ ecology/ habitat/ freshwater habitat/ lotic water/ land zones/ comprehensive zoology: habitat management/ habitat restoration/ restoration outcomes prediction/ delta habitat comparison implications/ ecological energetics/ habitat restoration outcomes prediction/ river/ California/ Sacramento-San Joaquin Delta
Abstract: We have now entered an era of large-scale attempts to restore ecological functions and biological communities in impaired ecosystems. Our knowledge base of complex ecosystems and interrelated functions is limited, so the outcomes of specific restoration actions are highly uncertain. One approach for exploring that uncertainty and anticipating the range of possible restoration outcomes is comparative study of existing habitats similar to future habitats slated for construction. Here we compare two examples of one habitat type targeted for restoration in the Sacramento-San Joaquin River Delta. We compare one critical ecological function provided by these shallow tidal habitats -- production and distribution of phytoplankton biomass as the food supply to pelagic consumers. We measured spatial and short-term temporal variability of phytoplankton biomass and growth rate and quantified the hydrodynamic and biological processes governing that variability. Results show that the production and distribution of phytoplankton biomass can be highly variable within and between nearby habitats of the same type, due to variations in phytoplankton sources, sinks, and transport. Therefore, superficially similar, geographically proximate habitats can function very differently, and that functional variability introduces large uncertainties into the restoration process. Comparative study of existing habitats is one way ecosystem science can elucidate and potentially minimize restoration uncertainties, by identifying processes shaping habitat functionality, including those that can be controlled in the restoration design.

1726. **Grass buffers for playas in agricultural landscapes: An annotated bibliography.**
Melcher, C. P. and Skagen, S. K. U.S. Geological Survey; U.S. Geological Survey Open File Report no. 2005-1220, 2005. 56 pp.
http://www.fort.usgs.gov/products/publications/21485/21485.pdf
Descriptors: conservation/ ecology/ filters/ grasses/ grasslands/ playas/ sediment contamination/ wetlands/ Colorado/ Kansas/ Southern High Plains/ Texas
Abstract: This bibliography and associated literature synthesis (Melcher and Skagen, 2005) was developed for the Playa Lakes Joint Venture (PLJV). The PLJV sought compilation and annotation of the literature on grass buffers for protecting playas from runoff containing sediments, nutrients, pesticides, and other contaminants. In addition, PLJV sought information regarding the extent to which buffers may attenuate the precipitation runoff needed to fill playas, and avian use of buffers. We emphasize grass buffers, but we also provide information on other buffer types. There are a number of relatively synonymous terms that describe grass buffers for wetlands. They include: buffer strip, vegetated filter strip (VFS), grass buffer, grass filter, grass hedge, and grassed waterway (GW), among others (see McKague and others, 1996). Although some of these terms represent slightly different designs, placements, and/or purposes, they all perform similar functions. In this document, we use buffer and VFS more or less interchangeably; other types are specified by name (e.g., grass hedges). Our bibliography is by no means exhaustive, as the body of literature potentially relevant to

playas and wetland buffers is vast. Thus, we attempted to include and annotate at least 13 papers by numerous researchers heavily involved in buffer research and modeling. We also included single papers by other researchers to increase the spectrum of regional focus, watershed/wetland conditions, research approaches, researcher expertise, and the time over which buffer theories/practices have evolved. We found virtually no literature specific to buffers for playas (confirmed by D.A. Haukos, oral. commun., 2005); thus, we conducted interviews with playa scientists to glean information on possible buffer design and management specifically for playas. We did, however, find a significant body of literature on the results of controlled experiments designed to test buffer effectiveness, an important first step towards validating buffer effectiveness in real-world situations. Of the literature on playa ecology, flora, and wildlife, we found that most focuses on playa basins and wetlands rather than the surrounding uplands and grasslands; furthermore, most of the empirical work on playa ecology has taken place in the Southern High Plains (SHP; i.e., Texas and Oklahoma panhandles, southeastern Colorado, and southwestern Kansas) because many wetlands in other portions of the PLJV region (Fig. 1) were only recently recognized as playas. Finally, we found few papers on avian use of buffers; therefore, we focused on those that report on avian use of Conservation Reserve Program (CRP) fields or lands enrolled in similar programs.

1727. **Grazing management strategies for Lahontan cutthroat trout stream habitats.**
Coffin, P. D.
In: Proceedings of a symposium on sustaining rangeland ecosystems.Eastern Oregon State College, La Grande, Oregon. Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953.
Corvallis, Ore.: Oregon State University Extension Service; pp. 150-152; 1996.
NAL Call #: 100 Or3M no.953
Descriptors: grassland management/ grazing systems/ damage/ grasslands/ riparian grasslands/ grazing/ management/ plant height/ grazing intensity/ nature conservation/ soil conservation
Abstract: Recommended grazing management practices for the maintenance of the Lahontan cutthroat trout in Nevada, California and Oregon included maximum allowable use of 20% of the annual growth of woody species and 30% of the annual growth of other key riparian species; >6 inches grazing height left at the end of the season; limiting streambank damage to 10%; introducing grazing rest periods preferably annually; limiting livestock access to the stream; and monitoring of hot season grazing use.

1728. **Guiding principles for constructed treatment wetlands: Providing for water quality and wildlife habitat.**
Interagency Workgroup on Constructed Wetlands (U.S.)
Washington, DC: U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds. (2001).
Notes: Rev. 06/26/2001, Original document published in 2000; Title from web page. Developed by Interagency Workgroup on Constructed Wetlands. "October 2000" Description based on content viewed April 11, 2002. "EPA-843-B-00-003"
NAL Call #: TD756.5.G85 2000.
http://www.epa.gov/owow/wetlands/pdf/constructed.pdf
Descriptors: Constructed wetlands---United States/ Water quality---United States/ Water quality management---United States/ Wetland ecology---United States
Abstract: This User's Guide provides: guiding principles for planning, siting, design, construction, operation, maintenance, and monitoring of constructed treatment wetlands; information on current [Environmental Protection] Agency policies, permits, regulations, and resources; and answers to common questions.
This citation is from AGRICOLA.

1729. **Habitat and landscape associations of breeding birds in native and restored grasslands.**
Fletcher, R. J. and Koford, R. R.
Journal of Wildlife Management 66(4): 1011-1022. (2002)
NAL Call #: 410 J827; ISSN: 0022541X
Descriptors: bird density/ edge effects/ grassland birds/ habitat relationships/ Iowa/ landscape fragmentation/ Prairie Pothole Region/ restoration/ tallgrass prairie/ avifauna/ grassland/ habitat restoration/ species diversity/ United States/ Ammodramus savannature/ Passerculus sandwichensis
Abstract: In the midwestern United States, less than 1% of the original tallgrass prairie ecosystem remains. State and federal agencies have responded to this habitat loss with programs and land acquisition that have increased the amount of grassland on the landscape by restoring grassland from other land-use practices. We assessed the effects of habitat restoration and the relative contribution of local habitat and landscape factors on breeding grassland birds in northern Iowa. During the 1999 and 2000 breeding seasons, we surveyed grassland birds in 10 tallgrass prairies and 10 restored grasslands that contained a wide diversity of habitat and landscape conditions. Densities of common bird species were similar between habitat types, except for grasshopper sparrows (Ammodramus savannarum) and savannah sparrows (Passerculus sandwichensis), which were 4 and 9 times more dense in restored grasslands, respectively. Species richness of breeding birds was similar between habitat types. Habitat structure was different in prairies and restored grasslands; restored grasslands had 7% less total vegetation cover and 3% more bare ground. A nested, multiscale analysis indicated that habitat structure explained some variation in species richness and bird density of all common species, yet addition of landscape structure improved models for species richness and for density of 4 of 8 species considered, explaining an additional 10-29% of the variation. Edge-density metrics were the most common variables entering into landscape models; most species had lower densities in landscapes with high edge density. Our results indicate that restored grassland habitats contain bird communities generally similar to those in native prairie habitats in northern Iowa, suggesting that restored grasslands may provide similar habitat suitability for most grassland birds. In addition, both local habitat and landscape factors can be important for managing breeding grassland birds.

1730. **Habitat contribution and waterbird use of Wetland Reserve Program sites in the Cache River watershed, Illinois.**
Hicks, Brianne M.
Carbondale, Illinois: Southern Illinois University, 2003.
Descriptors: wetlands/ birds/ wildlife habitat/ Illinois/ Wetlands Reserve Program

1731. **Habitat selection and habitat use by the bog turtle (Clemmys muhlenbergii) in Maryland.**
Morrow, J. L.; Howard, J. H.; Smith, S. A.; and Poppel, D. K.
Journal of Herpetology 35(4): 545-552. (2001)
NAL Call #: QL640.J6; ISSN: 00221511
Descriptors: Clemmys muhlenbergii/ Lonicera japonica/ Maryland/ turtles/ habitat selection
Abstract: Habitat selection of 50 bog turtles (Clemmys muhlenbergii) was studied at two sites in Harford County, Maryland, from April 1996 to August 1997. These sites differ in size, amount of grazing, and stage of vegetative succession. In addition, one of the sites was studied intensively 20 years ago. Turtle movements were monitored using radiotelemetry: Individuals were located twice a week during the active season and once a month during hibernation to assess habitat selection and seasonal changes in habitat use: Vegetative, soil, and water characteristics were recorded in 0.25-m^2 quadrat placed at turtle locations and stratified random locations throughout the study areas. Turtles selected sedges and rushes and other low-lying herbaceous plants. They avoided some woody plants (alders, grapes, and berries) and an exotic plant (Japanese honeysuckle, Lonicera japonica) that may gradually eliminate typical wetland vegetation and produce a closed canopy. Management practices, such as moderate animal grazing and winter burns, will help retard plant succession and provide more open habitat.

1732. **Habitat use and movement of the mummichog (Fundulus heteroclitus) in a restored salt marsh.**
Teo, S. L. and Able, K. W.
Estuaries 26(3): 720-730. (2003)
NAL Call #: GC96.E79; ISSN: 0160-8347
Descriptors: animal behavior/ habitat selection/ habitats/ movement/ nature conservation/ population density/ salt marshes/ Fundulus heteroclitus
Abstract: The mummichog, Fundulus heteroclitus, is one of the most abundant macrofaunal components of salt marsh ecosystems along the east coast of the USA. During April-November 1998, we determined the habitat use and movement patterns of young-of-the-year (YOY) and adult mummichogs in a restored marsh, formerly a salt hay farm, and an adjacent creek in order to expand our understanding of the ecology of the species and evaluate the success of the restoration. Four major fish habitat types (large first-order natural creek, second-order created creek, linear drainage ditch, and marsh surface) were identified within the study site. Patterns of relative abundance and mark and recapture using coded wire tags were used to determine the habitat use, tidal movements, home range, and site fidelity of the species within these habitat types. A total of 14 784 fishes, ranging from 20-100 mm SL, were captured with wire mesh traps and tagged, and 1521 (10.3%) fishes were recaptured. A variety of gears were used to attempt to recapture fish across all habitat types, including wire mesh traps, push nets, and otter trawls. Based on abundance and recaptures of tagged fish, the YOY and adults primarily used the shallow subtidal and intertidal areas of the created creek, the intertidal drainage ditches, and the marsh surface of the restored marsh but not the larger, first-order natural creek. At low tide, large numbers were found in the subtidal areas of the created creek; these then moved onto the marsh surface on the flooding tide. Elevation, and thus hydroperiod, appeared to influence the microscale use of the marsh surface. We estimated the home range of adults and large YOY (20-100 mm SL) to be 15 ha at high tide, which was much larger than previously quantified. There was strong site fidelity to the created creek at low tide. The habitat use and movement patterns of the mummichog appeared similar to that reported for natural marshes. Coupled with the results of other studies on the feeding, growth, and production of this species in this restored marsh, the species appeared to have responded well to the restoration.

1733. **Habitat use by mallards during spring migration through central Iowa USA.**
Lagrange, T. G. and Dinsmore, J. J.
Journal of Wildlife Management 53(4): 1076-1081. (1989)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: Anas platyrhynchos/ high energy seed/ food/ nighttime cover/ sheetwater wetland
Abstract: We studied the use of 455 seasonally flooded farmed basins (sheetwater wetlands) and 16 small emergent wetlands by migratory mallards (Anas platyrhynchos) in central Iowa during spring 1983-84. During daytime, sheetwater wetlands provided 19,530 mallard use days compared with 103 on the few remaining emergent wetlands. Mallards used larger (> 2 ha) versus smaller sheetwater wetlands, moist-soil or corn-vegetated wetlands more than emergent wetlands or soybean-vegetated wetlands, untilled wetlands more than conservation-tiller or plowed sheetwater wetlands, and sheetwater wetlands located farther from disturbance. Mallards used sheetwater wetlands during all daylight hours, but flew ≤ 13 km to roost on larger emergent wetlands. A diversity of habitats appears necesary for spring migratory mallards: sheetwater wetlands provide food and high-energy seeds and emergent wetlands provide nighttime cover.

1734. **Habitat use by nonbreeding wood ducks in the Coastal Plain and Rice Prairie Region of Texas.**
Anderson, James T. and Tacha, Thomas C.
Southwestern Naturalist 47(3): 486-489. (2002)
NAL Call #: 409.6 So8 ; ISSN: 0038-4909
Descriptors: aquatic habitat/ forested wetlands/ habitat types/ habitat use

1735. **Hepatic retinoids of bullfrogs in relation to agricultural pesticides.**
Boily, M. H.; Berube, V. E.; Spear, P. A.; DeBlois, C.; and Dassylva, N.
Environmental Toxicology and Chemistry 24(5): 1099-1106. (2005)
NAL Call #: QH545.A1E58; ISSN: 07307268

Descriptors: amphibians/ pesticides/ Rana catesbeiana/ Retinol/ Retinyl ester/ agriculture/ ecosystems/ pesticides/ agricultural activity/ amphibians/ bullfrogs/ biodiversity/ agricultural chemical/ pesticide/ retinoid/ agricultural practices/ frog/ pesticide/ physiological response/ pollution effect/ agriculture/ biocides/ Canada/ North America/ Quebec [Canada]/ Amphibia
Abstract: Agricultural pesticides often have been cited as a factor affecting indigenous amphibian populations, but possible effects of pesticides and other factors associated with agricultural practices are understood poorly. Adult bullfrogs (Rana catesbeiana) were collected within the Yamaska River basin (Quebec, Canada) in subwatersheds representing low, medium, and high agricultural activities and 53 pesticides were analyzed in surface water. More pesticides were detected in subwatersheds associated with high agricultural activities like Rivière Noire and Rivière à la Barbue and pesticide concentrations were higher compared to the other study sites. Female and male body weights differed between sites. In the case of males, body weight was significantly less at Rivière à la Barbue. Liver retinol stores were decreased significantly in male bullfrogs from Rivière Noire, although total retinyl esters concentrations varied between sites having the highest concentration at Yamaska-Nord where the agricultural activity was considered low. The ratio of hepatic retinyl palmitate to retinol tended to be higher for male bullfrogs from Rivière Noire and Rivière à la Barbue. These results suggest that factors associated with intensive agricultural practices may affect the body weight and retinoid stores in male bullfrogs living in these agroecosystems. © 2005 SETAC.

1736. **Historic and comparative perspectives on rehabilitation of marshes as habitat for fish in the Lower Great Lakes Basin.**
Whillans, T. H.
Canadian Journal of Fisheries and Aquatic Science 53(Supplement 1): 58-66. (1996)
NAL Call #: 442.9 C16J; ISSN: 0706-652X
Descriptors: marshes/ environmental restoration/ ecosystem analysis/ historical account/ sedimentation/ ecosystems/ fish/ aquatic habitat/ Canada, Ontario
Abstract: Retrospective and comparative assessments of fish habitat have been used to guide rehabilitation in Cootes Paradise, a marsh at Hamilton, Ont., on Lake Ontario. The marsh was severely altered by human and natural stresses, including high water levels, influx of fine eroded sediments, and channelization. Recovery has been limited by a different but overlapping set of stresses, including the continued influx of fine eroded sediments, resuspension of sediments, exotic fish, and increased fetch. Assessment has involved the use of "accumulator-," "residue-," and "replica"-type retrospective evidence and the comparison of Cootes Paradise with other reference marshes. The emergent narrative science (a synthesis of science in historical and environmental context that serves as a partially testable hypothesis), verified and adjusted by small scale experiments, has identified the need to re-introduce vegetation, reduce fetch, exclude common carp (Cyprinus carpio), anchor the marsh sediments, and reduce the influx of land use derived fine sediments. Narrative science uses the "ecological memory" of the marsh for historical information on ecological degradation and in the form of the remnant natural resilience upon which ecological rehabilitation could build. The narrative science provides the basis for adaptive management and the monitoring that it requires.

1737. **Historical wetlands in Oregon's Willamette Valley: Implications for restoration of winter waterbird habitat.**
Taft, O. W. and Haig, S. M.
Wetlands 23(1): 51-64. (2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ environmental restoration/ overwintering/ historical ecology/ valleys/ habitats/ waterfowl/ agriculture/ river basins/ habitat improvement/ ecosystem management/ restoration/ anthropogenic factors/ biological surveys/ river valleys/ aquatic birds/ Aves/ Cygnus buccinator/ Chen caerulescens/ Grus canadensis/ Numenius americanus/ Oregon, Willamette Valley/ birds/ trumpeter swan/ snow goose/ sandhill crane/ long-billed curlew/ Anser caerulescens/ Olor buccinator
Abstract: Before agricultural expansion in the 19th century, river valleys of North America supported expanses of wetland habitat. In restoring these landscapes, it is important to understand their historical condition and biological function. Synthesizing historical primary accounts (from explorers, travelers, settlers, and farmers) with contemporary knowledge of these wetland systems, we developed a profile of the wetlands and their use by nonbreeding waterbirds (e.g., waterfowl, wading birds, and shorebirds) within the Willamette Valley, Oregon, ca. 1840. We found evidence for three types of wetlands used by non-breeding waterbirds in fall, winter, and spring: emergent wetlands, riverine wetlands, and wetland prairie. The most extensive wetland type was wetland prairie, which functioned as fall/winter habitat for waterbirds, but only while native Kalapuyans managed the region with fire. Since the mid-1800s, four species, in particular, have decreased their use of the Willamette Valley: trumpeter swan (Cygnus buccinator), snow goose (Chen caerulescens), sandhill crane (Grus canadensis), and long-billed curlew (Numenius americanus). Information suggests that ca. 1840, waterbirds and their habitats were more abundant in the Willamette Valley than today. Restoration of the Willamette Valley landscape is warranted, and today's agricultural wetlands-former wetland prairie-hold highest restoration potential.

1738. **Home ranges, movements, and habitat selection of Oregon spotted frogs (Rana pretiosa).**
Watson, James W.; McAllister, Kelly R.; and Pierce, D. John
Journal of Herpetology 37(2): 292-300. (June 2003)
NAL Call #: QL640.J6; ISSN: 0022-1511
Descriptors: Rana pretiosa (Ranidae)/ home range/ home range use/ distribution within habitat/ movement patterns/ habitat selection/ home-range use relationships/ habitat utilization/ range use/ habitat preference/ semiaquatic habitat/ wetland upland pasture mosaic/ grassland/ Washington/ Thurston County/ Dempsey Creek/ habitat selection/ home range use and movement patterns/ upland pasture wetland mosaic

Abstract: From 1997-1999 we studied one of four known populations of Oregon Spotted Frogs (Rana pretiosa) in Washington State to investigate patterns of range use, movements, and habitat selection. Sixty telemetered frogs occupied a range that was a mosaic of wetlands (15.6 ha) and upland pasture (13.2 ha) grazed by dairy cows. Mean (± SE) home-range size for four frogs was 2.2 ± 1.0 ha. Patterns of spatial use, determined from 654 telemetry locations, were closely related to season and changing surface water conditions. During the breeding season (February to May), frogs occupied >=-50% of the area they used the entire year, and oviposited in shallow pools (depth = 16.9 ± 0.6 cm) on the margins of an ephemeral creek. In the dry season (June to August), frogs moved down stream to deeper, permanent pools (depth = 23.6 ± 1.0 cm), significantly reduced their movements, and occupied the smallest ranges of any season. During the wet season (September to January), frogs moved back up stream and reoccupied the breeding range. During the coldest weather, frogs buried themselves at the base of dense vegetation in shallow water under ice (depth = 17.4 ± 0.8 cm). Frogs avoided dry uplands. Frogs selected sedge (Carex obnupta, and Carex utriculata)/rush (Juncos effuses) habitat during breeding and hardhack (Spiraea douglasii) cover during the dry season that shaded and maintained remnant pools. Frogs preferred microhabitats with 50-75% water surface exposure based on comparisons between telemetry locations and nearby locations that were randomly selected. Aquatic requirements necessary to complete the life cycle of Oregon Spotted Frogs in this population include (1) stable, shallow water areas for egg and tadpole survival in the breeding season, (2) deep, moderately vegetated pools for adult and juvenile survival in the dry season, and (3) shallow water levels over emergent vegetation for protecting all age classes during cold weather in the wet season.

1739. **Hydrologic aspects of marsh ponds during winter on the Gulf Coast Chenier Plain, USA: Effects of structural marsh management.**
Bolduc, F. and Afton, A. D.
Marine Ecology Progress Series 266: 35-42. (2004); ISSN: 01718630
Descriptors: coastal wetlands/ Gulf of Mexico/ Ponds/ wintering waterbirds/ avifauna/ coastal wetland/ dissolved oxygen/ ecological impact/ habitat management/ hydrology/ impoundment/ salinity/ water depth/ water temperature/ zoobenthos/ Gulf Coastal Plain/ Louisiana
Abstract: The hydrology of marsh ponds influences aquatic invertebrate and waterbird communities. Hydrologic variables in marsh ponds of the Gulf Coast Chenier Plain are potentially affected by structural marsh management (SMM: levees, water control structures and impoundments) that has been implemented since the 1950s. Assuming that SMM restricts tidal flows and drainage of rainwater, we predicted that SMM would increase water depth, and concomitantly decrease salinity and transparency in impounded marsh ponds. We also predicted that SMM would increase seasonal variability in water depth in impounded marsh ponds because of the potential incapacity of water control structures to cope with large flooding events. In addition, we predicted that SMM would decrease spatial variability in water depth. Finally, we predicted that ponds of impounded freshwater (IF), oligohaline (IO), and mesohaline (IM) marshes would be similar in water depth, temperature, dissolved oxygen (O2), and transparency. Using a priori multivariate analysis of variance (MANOVA) contrast, we tested these predictions by comparing hydrologic variables within ponds of impounded and unimpounded marshes during winters 1997-1998 to 1999-2000 on Rockefeller State Wildlife Refuge, near Grand Chenier, Louisiana. Specifically, we compared hydrologic variables (1) between IM and unimpounded mesohaline marsh ponds (UM); and (2) among IF, IO, and IM marshes ponds. As predicted, water depth was higher and salinity and O2 were lower in IM than in UM marsh ponds. However, temperature and transparency did not differ between IM and UM marsh ponds. Water depth varied more among months in IM marsh ponds than within those of UM marshes, and variances among and within ponds were lower in IM than UM marshes. Finally, all hydrologic variables, except salinity, were similar among IF, IO, and IM marsh ponds. Hydrologic changes within marsh ponds due to SMM should (1) promote benthic invertebrate taxa that tolerate low levels of O2 and salinity; (2) deter waterbird species that cannot cope with increased water levels; and (3) reduce waterbird species diversity by decreasing spatial variability in water depth among and within marsh ponds.

1740. **The impact of agriculture on temporary wetland amphibians in Florida.**
Babbitt, Kimberly J.; Baber, Matthew J.; and Tanner, George W.
In: Amphibians and reptiles: Status and conservation in Florida/ Meshaka, W. E. and Babbitt, K. J.
Malabar, FL: Krieger Publishing Co., 2005; pp. 48-55.
Notes: 1575242516 (ISBN).
Descriptors: agriculture/ biogeography: population studies/ wildlife management: conservation/ species richness/ habitat/ urbanization/ anthropogenic disturbance/ temporary wetland/ agricultural disturbance/ upland landscape

1741. **Impact of hydropattern disturbance on crayfish population dynamics in the seasonal wetlands of Everglades National Park, USA.**
Acosta, C. A. and Perry, S. A.
Aquatic Conservation: Marine and Freshwater Ecosystems 11(1): 45-57. (2001); ISSN: 10527613.
Notes: doi: 10.1002/aqc.426.
Descriptors: crayfish/ Everglades/ hydroperiod/ wetland restoration/ environmental stress/ hydroperiod/ population dynamics/ wetlands/ United States/ Procambarus alleni
Abstract: 1. The natural hydropattern in the seasonally-flooded marl prairie wetlands of Everglades National Park has been severely disrupted by human water control activities, seriously impacting higher trophic organisms, e.g. wading birds, that depend on these wetlands. Less is known about the impacts on key aquatic fauna, such as crayfish Procambarus alleni, or how these populations might respond to proposed habitat restoration strategies. 2. Under severe environmental stress, populations of burrowing crayfish are predicted to have skewed size structure, low reproductive success, low survival, and widespread dispersal. As predicted for populations in stressed habitats, crayfish density was low, small dispersing adults were dominant, juvenile abundance was

low, and survival was low in habitats where the hydroperiod (duration of flooding) was short and groundwater level was lowest. 3. Crayfish dispersed during flooding, but during the drydown, they burrowed rather than sought deeper water. This dispersal strategy may be adaptive for surviving in seasonal wetlands, but this had severe consequences on survival in disturbed habitats with shortened hydroperiods. Survival in burrows during the dry season was high in the longer-hydroperiod habitats but was zero in the short-hydroperiod habitat where the groundwater level fell more than 1 m. 4. Long-hydroperiod marl prairie may function as sources, whereas short-hydroperiod habitats act as population sinks. Our study suggests that the threshold conditions for preventing mass mortality of crayfish in these wetlands are hydroperiods > 7 months and groundwater levels < 0.5 m below the surface during the dry season. 5. Historical (pre-drainage) hydroperiods appear to be restricted to the longest hydroperiod areas of the marl prairie. This indicates that much of the marl prairie wetlands now function as population sinks for crayfish and other invertebrates. The historical hydropatterns need to be re-established throughout the marl prairie wetlands to achieve the restoration goal of increasing productivity in the aquatic faunal community. © 2001 John Wiley & Sons, Ltd.

1742. **The impact of waterfowl foraging on the decomposition of rice straw: Mutual benefits for rice growers and waterfowl.**
Bird, J. A.; Pettygrove, G. S.; and Eadie, J. M.
Journal of Applied Ecology 37(5): 728-741. (2000)
NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: agriculture/ ducks/ nitrogen/ straw disposal/ wetland management/ winter habitat
Abstract: 1. Recent legislation in California, USA, has restricted traditional open-field burning of rice straw residues, leading farmers to adopt alternative methods of straw disposal such as post-harvest flooding of rice fields. These changes may benefit wildlife because winter-flooded fallow rice fields provide foraging habitat to migratory waterfowl. In turn, the foraging activity of waterfowl may help to increase rice straw decomposition, providing a reciprocal benefit to farmers. We examined the effects of waterfowl foraging activity on straw decomposition and nitrogen mineralization following rice harvest in a fallow flooded soil. 2. Experimental plots (25 m^2) were established on a silty clay soil and were subjected to two post-harvest treatments: wet-rolled or untilled. Mallard ducks Arias platyrhynchos were placed in one-half of the experimental plots, following a splitplot design, for a 3-week period, at a density equivalent to 33 birds ha-1 over a season of 180 days to approximate regional abundance data. 3. Waterfowl foraging activity increased residual surface straw decomposition by 78% in untilled plots and 18% in wet-rolled plots compared with the respective unforaged plots. Average straw diameter in foraged plots was reduced to one-third that of unforaged plots. 4. Waterfowl foraging and field tillage reduced nitrogen (N) concentrations in the surface straw residue remaining at the end of the winter fallow period. Below-ground organic residue was not affected by waterfowl foraging, indicating that ducks did not incorporate the straw. There were no apparent additions of carbon (C) or N to the soil as a result of waterfowl activity. 5. We conclude that waterfowl foraging can substantially increase straw decomposition in flooded, fallow, rice fields. Accordingly, rice producers should consider agronomic practices that attract waterfowl, such as winter flooding, to maximize the decomposition of rice straw residue. At the upper end of regionally observed waterfowl densities (at or near 33 birds ha-1 season-1) waterfowl foraging activity may alleviate the need for autumn tillage. Shallow flooded rice fields will also provide important winter habitat to migratory waterfowl, aiding wetland management and conservation efforts in the Central Valley of California. 6. These results provide an example of how a mutually beneficial solution can be achieved that provides needed waterbird habitat while concomitantly alleviating an agricultural problem.

1743. **Impacts of center pivot irrigation systems on birds in prairie wetlands.**
Peterson, T. L. and Cooper, J. A.
Journal of Wildlife Management 51(1): 238-247. (1987)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wetlands/ center pivot irrigation/ birds/ nesting/ Minnesota
This citation is from AGRICOLA.

1744. **Impacts of changing irrigation practices on waterfowl habitat use in the southern San Joaquin Valley, California.**
Barnum, D. A. and Euliss, N. H.
California Fish and Game 77(1): 10-21. (1991)
NAL Call #: 410 C12; ISSN: 0008-1078
Descriptors: agricultural runoff/ California/ diurnal variation/ ducks/ irrigation/ Kern National Wildlife Refuge/ population dynamics/ seasonal variation/ ecological effects/ environmental impact/ irrigation effects/ irrigation practices/ San Joaquin Valley/ waterfowl/ habitat use/ hydrology/ water management/ mallards/ northern pintails/ cinnamon teal/ green-winged teal/ northern shovelers/ ruddy ducks
Abstract: Diurnal aerial census data were used to examine habitat use patterns of ducks wintering in the southern San Joaquin Valley, California from 1980-87. Densities (birds/ha) for the northern pintail (Anas acuta), mallard (A. platyrhynchos), green-winged teal (A. crecca), cinnamon teal (A. cyanoptera), shoveler (A. clypeata), ruddy duck (Oxyura jamaicensis), and total ducks, in each of five habitats, were determined--nocturnal habitat use by ducks may be very different than diurnal use and would therefore yield different densities. Low densities were observed for most species on evaporation ponds, hunting clubs and miscellaneous wetlands. Most hunting clubs were small, isolated parcels of wetland with food production limited by cost and availability of irrigation water. The low densities observed on these wetlands suggests that they were not heavily used by wintering ducks. However, hunting clubs provided habitat important for attracting ducks away from contaminated evaporation ponds in September and again in late winter (January-February). Evaporation ponds were not heavily used by ducks, but the large area provided by evaporation ponds may affect use of these habitats in the future. Density for all species, except the ruddy duck, was highest on preirrigated croplands or Kern National Wildlife Refuge (Kern NWR). Ducks such as mallard and teal that use densely vegetated wetlands were probably attracted to the diversity of vegetative cover on Kern NWR. Other species, such as pintail, make use of Kern NWR's managed areas for diurnal feeding and resting. Preirrigated

croplands had the highest density of pintail. The value of these shallow-flooded wetlands with their available waste grains may be similar to that of rice fields in the Sacramento Valley. Moreover, preirrigated fields provided large expanses of open water for diurnal resting locations important to pintail for predator detection.

1745. **Impacts of forest harvest on small ponds and amphibians.**
Wind, Elke
Northwestern Naturalist 87(2): 193. (2006)
NAL Call #: QL671.M8; ISSN: 1051-1733.
Notes: Conference: 2006 Annual Meetings of the Society for Northwestern Vertebrate Biology and the Washington Chapter of the Wildlife Society, held jointly at Evergreen State College, Washington, March 27-April 1, 2006.
Descriptors: forests/ amphibians/ Canada/ British Columbia/ riparian buffers/ variable retention harvesting/ ponds
Abstract: Studies have shown that forest harvesting can reduce the abundance of amphibians in terrestrial environments, but few studies have investigated impacts on lentic aquatic habitats. Most amphibian species in the Pacific Northwest live in forests and breed in standing water, often laying their eggs in small, seasonal ponds that offer protection from predation. However, in British Columbia small ponds are not afforded protection under the Forest and Range Practices Act and the effects of forest harvesting on these habitats and he importance of riparian buffers are unknown. In 2002, I began a study with Weyerhaeuser's British Columbia Coastal Group to investigate whether amphibians and small ponds were useful indicators to evaluate the effectiveness of variable retention (VR) harvesting methods at maintaining biodiversity. Weyerhaeuser's VR harvesting methods often result in the retention of tree patches around small ponds, so I initiated a pre- and post-harvest buffer experiment at three forested sites slated for harvest in 2004 to 2005. Results to date suggest that immediately after harvesting, small ponds on southeastern Vancouver Island have longer hydroperiods compared to pre-harvest conditions and that amphibians continue to breed in these habitats, with some species appearing to be attracted to the reduced canopy cover conditions. However, the survival rate of larvae in cutover areas may be reduced based on the detection rate of larvae and metamorphs in harvested versus unharvested areas. As a result, creative retention solutions may be necessary to maintain adequate cover and microclimate conditions for amphibians within harvested landscapes.

1746. **Impacts of marsh management on coastal-marsh bird habitats.**
Mitchell, L. R.; Gabrey, S.; Marra, P. P.; and Erwin, R. M.
Studies in Avian Biology 32: 155-175. (2006)
NAL Call #: QL671.S8.
Notes: 01979922 (ISSN); 0943610702 (ISBN).
Descriptors: disturbance/ impoundment/ marsh endemic/ marsh management/ mosquito control/ open-marsh water management/ prescribed fire/ structural marsh management
Abstract: The effects of habitat-management practices in coastal marshes have been poorly evaluated. We summarize the extant literature concerning whether these manipulations achieve their goals and the effects of these manipulations on target (i.e., waterfowl and waterfowl food plants) and non-target organisms (particularly coastal-marsh endemics). Although we focus on the effects of marsh management on birds, we also summarize the scant literature concerning the impacts of marsh manipulations on wildlife such as small mammals and invertebrates. We address three common forms of anthropogenic marsh disturbance: prescribed fire, structural marsh management, and open-marsh water management. We also address marsh perturbations by native and introduced vertebrates.

1747. **Impacts of water development on aquatic macroinvertebrates, amphibians, and plants in wetlands of a semi-arid landscape.**
Euliss, Ned H. and Mushet, David M.
Aquatic Ecosystem Health and Management 7(1): 73-84. (2004); ISSN: 1463-4988
Descriptors: ecology/ habitat/ land zones/ Amphibia/ Macroinvertebrata: disturbance by man/ wetlands excavation/ impact on communities/ semi arid landscape/ community structure/ impact of water development/ semiaquatic habitat/ wetlands/ water development impact on communities/ North Dakota/ Little Missouri National Grassland/ water development impact on wetland communities/ amphibians/ chordates/ invertebrates/ vertebrates
Abstract: We compared the macroinvertebrate and amphibian communities of 12 excavated and 12 natural wetlands in western North Dakota, USA, to assess the effects of artificially lengthened hydroperiods on the biotic communities of wetlands in this semi-arid region. Excavated wetlands were much deeper and captured greater volumes of water than natural wetlands. Most excavated wetlands maintained water throughout the study period (May to October 1999), whereas most of the natural wetlands were dry by June. Excavated wetlands were largely unvegetated or contained submergent and deep-marsh plant species. The natural wetlands had two well-defined vegetative zones populated by plant species typical of wet meadows and shallow marshes. Excavated wetlands had a richer aquatic macroinvertebrate community that included several predatory taxa not found in natural wetlands. Taxa adapted to the short hydroperiods of seasonal wetlands were largely absent from excavated wetlands. The amphibian community of natural and excavated wetlands included the boreal chorus frog (Pseudacris maculata), northern leopard frog (Rana pipiens), plains spadefoot (Scaphiopus bombifrons), Woodhouse's toad (Bufo woodhousii woodhousii), and tiger salamander (Ambystoma tigrinum). The plains spadefoot occurred only in natural wetlands while tiger salamanders occurred in all 12 excavated wetlands and only one natural wetland. Boreal chorus frogs and northern leopard frogs were present in both wetland types; however, they successfully reproduced only in wetlands lacking tiger salamanders. Artificially extending the hydroperiod of wetlands by excavation has greatly influenced the composition of native biotic communities adapted to the naturally short hydroperiods of wetlands in this semi-arid region. The compositional change of the biotic communities can be related to hydrological changes and biotic interactions, especially predation related to excavation.

1748. **Implications of climate change on marsh bird conservation in Lower Great Lakes coastal wetlands.**
Ingram, J. W.; Meyer, S. W.; and Holmes, K.
Annual Conference on Great Lakes Research 49 (2006)
Descriptors: aquatic plants/ birds/ climate change scenarios/ climate models/ coastal geomorphology/ community composition/ conservation/ ecological distribution/ geomorphology/ water levels/ marshes/ prediction/ species diversity/ water levels/ wetlands/ wetlands vegetation/ Aves/ North America, Great Lakes/ Ontario L./ Erie L./ Pennsylvania, Erie
Abstract: Water level cycles are critical drivers governing coastal wetland distribution, ecological diversity and functioning within the Laurentian Great Lakes. Projections from 2050 climate change scenarios suggest a decline in Great Lakes water levels which may affect the diversity and distribution of current wetland plant and wildlife communities. Wetland vegetation and bird community predictive models were used to estimate impacts on community structure due to reductions in mean annual water levels for Lakes Ontario and Erie. Shoreline alteration and coastal geomorphology will strongly affect the ability of current wetland communities to respond and persist under declining water level scenarios. Existing wetland conservation projects and future Great Lakes coastal wetland conservation programs need to consider climate change scenarios to ensure that actions taken in the next 10 years remain good conservation decisions into the future.

1749. **The importance of beaver to wetland habitats and waterfowl in Wyoming.**
McKinstry, M. C.; Caffrey, P.; and Anderson, S. H.
Journal of the American Water Resources Association 37(6): 1571-1577. (2001)
NAL Call #: GB651.W315; ISSN: 1093474X
Descriptors: beavers/ Castor canadensis/ waterfowl/ wetlands/ Wyoming/ biodiversity/ drainage/ land use/ managers/ plants (botany)/ ponding/ wetland habitats/ wetlands/ keystone species/ restoration ecology/ riparian zones/ rodents
Abstract: Beaver (Castor canadensis) are habitat-modifying keystone species, and their activities broadly influence many other plants and animals. Beaver are especially important to waterfowl in the western U.S. where riparian and wetland habitats comprise less than 2 percent of the landscape yet provide habitat for greater than 80 percent of wildlife species. Wyoming is currently ranked sixth of the 50 states in the size of its breeding waterfowl population, and beaver ponds may play a significant role in providing habitat for these birds. The objectives of this research were to: (1) identify streams in Wyoming where beaver are currently present, extirpated, or used to manage riparian habitat; (2) identify areas where beaver could be relocated to create wetlands and improve riparian habitat; (3) compare wetland surface areas between areas that have beaver with those that did not; and (4) compare waterfowl numbers in areas with and without beaver. Using a survey of 125 land managers in Wyoming, we found that beaver have been removed from 23 percent (6,497 km) of the streams for which managers had direct knowledge (28,297 km). The same managers estimated that there are over 3,500 km of streams where beaver could improve habitat conditions. The riparian width in streams with beaver ponds averaged 33.9 m (95 percent CI = 25.1-42.7 m) in contrast to 10.5 m (CI = 8.6-12.4 m) in streams without beaver. During waterfowl surveys we counted 7.5 ducks/km (CI = 0.9-14.4 ducks/km) of stream in areas with beaver ponds and only 0.1 ducks/km (no CIs calculated) of stream in similar areas without beaver present. Beginning in 1994, we restored beaver to 14 streams throughout Wyoming in an effort to create wetlands and improve riparian habitat. Waterfowl have been quick to respond to these important habitats. We feel that beaver restoration and management can be used to improve habitat in drainages where conflicts with other land uses are minimal.

1750. **Importance of grasslands in waterfowl conservation in the Prairie Pothole Region.**
Thoroughgood, P.; Edwards, C.; Guyn, K.; and Devries, J.
Canadian Journal of Plant Science 87(3): 529. (2007)
NAL Call #: 450 C16; ISSN: 0008-4220.
Notes: Conference: Annual Conference of the Canadian Society of Agronomy/Canadian Society for Horticultural Science/Canadian Society of Animal Science, Halifax, CANADA; August 01 -04, 2006.
Descriptors: nutrition/ wildlife management: conservation/ animal care/ wildlife habitat/ economic reality/ bird breeding/ perennial forage/ prairie grassland/ beef producers/ large scale forage conservation
Abstract: Prairie grasslands are a vital component of Canada's natural capital and provide numerous ecological goods and services; including wildlife habitat. Beef producers are the primary stewards of these grasslands and have an important role in wildlife conservation. Research conducted by Ducks Unlimited Canada has shown that perennial forage, including hay, tame pasture and native rangeland, provides attractive and productive habitat for upland nesting waterfowl. The Prairie Pothole Region (PPR) supports about 52% of the continental duck population, thus changes in perennial forage acreage in the PPR significantly impacts breeding waterfowl populations in North America. In this presentation, DUC provides an explanation of the importance of perennial forage crops to breeding waterfowl. It demonstrates that Government and market forces that change the economic reality of beef production can have a direct impact on waterfowl and other wildlife. We will examine programs such as Agriculture and Agri-Food Canada's Permanent Cover Program and, more recently, Greencover Canada, to demonstrate the benefits that large-scale forage conversion has on PPR waterfowl productivity.

1751. **The importance of local and regional factors in predicting effective conservation: Planning strategies for wetland bird communities in agricultural and urban landscapes.**
Whited, Diane; Galatowitsch, Susan; Tester, John R.; Schik, Karen; Lehtinen, Rick; and Husveth, Jason
Landscape and Urban Planning 49(1-2): 49-65. (2000)
NAL Call #: QH75.A1L32; ISSN: 0169-2046
Descriptors: wildlife management: conservation/ agricultural landscapes/ conservation effectiveness: local factors, regional factors/ urban landscapes/ wetland communities

Abstract: Wetland assessment techniques have generally focused on rapid evaluations of local and site impacts; however, wetland biodiversity is often influenced both by adjacent and regional land use. Forty wetlands were studied in the Red River Valley (RRV), Southwest Prairie (SWP), and the Northern Hardwood Forest (NHF) ecoregions of Minnesota, USA, to assess the strength of association between local and landscape condition and avian community composition. We examined the relationship between bird assemblages and local and landscape factors (connectedness, isolation, road density, and site impacts). Landscape variables were calculated for three spatial scales at 500 m (79 ha), 1000 m (314 ha), and 2500 m (1963 ha). Connectedness and road density are important measures for predicting bird assemblages in both agricultural ecoregions (SWP and RRV). Connectedness and its relationship with wetland bird assemblages were most pronounced at the larger scale (2500 m), where the largest remnant patches can be discerned. In contrast, road effects on bird assemblages were most pronounced at the smallest scale (500 m). Wetland isolation corresponded to bird community patterns as well, but only in one ecoregion (SWP). In the urbanizing ecoregion (NHF), species richness was considerably lower than elsewhere but community patterns did not correspond to landscape variables. The focus of wetland conservation planning needs to shift from the site scale to the landscape scale to ensure that connection with the regional wetland pattern is accounted for, therefore, affording the best opportunity to successfully maintain wetland avian diversity.

1752. **The importance of playa wetlands to biodiversity of the Southern High Plains.**
Haukos, David A. and Smith, Loren M.
Landscape and Urban Planning 28(1): 83-98. (Feb. 1994)
NAL Call #: QH75.A1L32; ISSN: 0169-2046
Descriptors: comprehensive zoology/ farming and agriculture/ threats to playa wetland habitats/ habitat management/ conservation/ New Mexico/ Texas/ species diversity/ playa wetlands/ semiaquatic habitat/ prairie biodiversity/ grasslands/ prairie/ chemical pollution/ Southern High Plains

1753. **The importance of winter floods to mallards in the Mississippi Alluvial Valley.**
Heitmeyer, M. E.
Journal of Wildlife Management 70(1): 101-110. (2006)
NAL Call #: 410 J827; ISSN: 0022541X
Descriptors: Anas platyrhynchos/ body composition/ bottomland hardwood wetlands/ carrying capacity/ floods/ food habits/ mallard/ Mississippi Alluvial Valley/ prebasic molt/ time budgets
Abstract: Winter flooding of bottomland hardwood (BLH) floodplains in the Mississippi Alluvial Valley (MAV) causes dynamic availability of resources to wintering mallards (Anas platyrhynchos). The effect of changing resource availability on mallard body condition and timing of life-cycle events are important considerations for waterfowl habitat conservation planning in the MAV. During a study of mallards wintering in the Mingo Basin of southeastern Missouri, USA, I collected data on population size, habitat use, behavior, food habits, body composition, and chronology of the prebasic molt during 2 major flood events in 1982. I also analyzed winter (Dec-Feb) hydrological data for 14 rivers in the MAV from 1939-1940 to 1998-1999 to provide a perspective on variation of winter flooding in this ecosystem. Winter floods in the Mingo Basin precipitated ecological events that benefited mallards. During floods, mallards redistributed to shallowly flooded (<50cm) live forest dominated by red oaks (Quercus spp.), increased daily foraging time by up to 8×, consumed 170-222 g dry weight of food/day, increased consumption of animal matter by up to 14×, gained fresh body and lipid mass, and initiated the prebasic molt. Winter flooding of major rivers in the MAV during 1939-1940 to 1998-1999 was highly variable among locations and years. An average of 6.7 ± 2.1 (±SE) and 5.1 ± 1.9 of 17 river gage stations were flooded >5 and >10 days/winter, respectively. Mallards increased daily food consumption by 33-39% over daily existence energy (DEE) levels during floods. These data suggest that previous estimates of foraging carrying capacity in MAV habitats (and other wintering and migration areas where significant fat deposition occurs) using only DEE-based daily food consumption estimates may be overestimated. Consequently, habitat and acre goals set by North American Waterfowl Management Plan Joint Ventures for these areas may be greatly underestimated. The evolutionary adaptations of mallards seem influenced by timing, duration, and extent of winter flooding in the MAV. Efforts to protect the integrity of MAV rivers, associated floodplain habitats, and their winter flow and flooding regimes are critical for sustaining local, regional, and continental mallard populations.

1754. **Improving the cost-effectiveness of ecosystem management: An application to waterfowl production.**
Rashford, B. S. and Adams, R. M.
American Journal of Agricultural Economics 89(3): 755-768. (2007); ISSN: 00029092.
Notes: doi: 10.1111/j.1467-8276.2007.00984.x.
Descriptors: cost minimization/ simulation/ waterfowl/ wildlife management
Abstract: Species conservation is an important global policy issue. The design of cost-effective species conservation programs requires resource managers to choose from a suite of conservation activities and sites. This article determines cost-effective conservation strategies for waterfowl using a bioeconomic modeling framework, which is developed using a biological simulation model for waterfowl and regression analysis. The model accounts for (a) a broad range of land-use and direct wildlife conservation activities, (b) the effect of landscape heterogeneity, and (c) interactions between conservation activities. Results indicate that accounting for the three factors listed above can improve the cost-effectiveness of waterfowl conservation on agricultural land. © 2007 American Agricultural Economics Association.

1755. **Indicators of wetland condition for the Prairie Pothole Region of the United States.**
Guntenspergen, G. R.; Peterson, S. A.; Leibowitz, S. G.; and Cowardin, L. M.
Environmental Monitoring and Assessment 78(3): 229-252. (2002)
NAL Call #: TD194.E5; ISSN: 0167-6369
Descriptors: birds/ ecosystems/ prairies/ wetlands/

grasslands/ farmland/ upland habitat/ wildlife-habitat relationships/ habitat management/ habitat surveys/ monitoring/ remote sensing/
United States, north central region
Abstract: The authors describe a study designed to evaluate the performance of wetland condition indicators of the Prairie Pothole Region (PPR) of the north central United States. Basin and landscape scale indicators were tested in 1992 and 1993 to determine their ability to discriminate between the influences of grassland dominated and cropland dominated landscapes in the PPR. Paired plots were selected from each of the major regions of the PPR. Among the landscape scale indicators tested, those most capable of distinguishing between the two landscapes were: 1) frequency of drained wetland basins, 2) total length of drainage ditch per plot, 3) amount of exposed soil in the upland subject to erosion, 4) indices of change in area of wetland covered by water, and 5) number of breeding duck pairs. Basin scale indicators including soil phosphorus concentrations and invertebrate taxa richness showed some promise; however, plant species richness was the only statistically significant basin scale indicator distinguishing grassland dominated from cropland dominated landscapes. Although this study found a number of promising candidate indicators, one of the authors' conclusions is that basin scale indicators present a number of implementation problems, including: skill level requirements, site access denials, and recession of site access by landowners. Alternatively, they suggest that the use of landscape indicators based on remote sensing can be an effective means of assessing wetland integrity.

1756. **Indirect effects of feral horses on estuarine communities.**
Levin, P. S.; Ellis, J.; Petrik, R.; and Hay, M. E.
Conservation Biology 16(5): 1364-1371. (2002)
NAL Call #: QH75.A1C5; ISSN: 08888892.
Notes: doi: 10.1046/j.1523-1739.2002.01167.x.
Descriptors: biodiversity/ estuarine ecosystem/ feral organism/ saltmarsh/ ungulate/ Animalia/ Aves/ Decapoda (Crustacea)/ Equidae/ Equus caballus/ Pisces/ Spartina/ Ungulata
Abstract: Livestock have grazed on salt marshes for centuries and have dramatic effects on marsh vegetation. Most studies examining the effects of livestock on salt marshes have focused on the effects on plants rather than on salt marsh fauna or ecological processes. However, grazers such as feral horses may have strong indirect effects on communities by altering the habitat, making it more or less suitable for species that potentially occur there. We evaluated the indirect effects of grazing by feral horses on estuarine animals that use salt marshes and adjacent subtidal communities. Surveys revealed that horse-grazed marshes had less vegetation, a higher diversity of foraging birds, higher densities of crabs, and a lower density and species richness of fishes than marshes not grazed by horses. In addition, fish density was reduced in subtidal habitats adjacent to grazed marshes. Experiments manipulating marsh vegetation indicated that the potential for predation on fishes in ungrazed marshes was higher than in grazed marshes. Results of additional experiments in which fishes were enclosed with or without artificial Spartina suggested that the removal of shelter provided by marsh vegetation results in behavioral shifts by fishes that make them more susceptible to predation. Although large herbivores are naturally absent from extant salt marsh ecosystems, such large herbivores were common members of Pleistocene communities. Using modern horses as surrogates for extinct ungulates, we hypothesize that large herbivores could have had strong indirect effects on Pleistocene estuarine habitats. We argue that both the modern introduction of ungulates to salt marshes, and the prehistoric elimination of large herbivores affected estuarine biodiversity.

1757. **Infaunal assemblages on constructed intertidal mudflats at Jonesport, Maine (USA).**
Ray, G. L.
Marine Pollution Bulletin 40(12): 1186-1200. (2000);
ISSN: 0025326X.
Notes: doi: 10.1016/S0025-326X(00)00083-7.
Descriptors: benthos/ community structure/ dredged material/ habitat construction/ Maine/ mudflat/ biomass/ constructed wetland/ species diversity/ species richness/ benthic environment/ biodiversity/ biomass/ dredging/ ecology/ environmental protection/ sediment/ United States/ Ovis aries
Abstract: Dredged materials have been used to construct two mudflats near Jonesport, Maine (USA). A flat at Sheep Island was constructed in 1989 and along with an adjacent reference area (REF) has been monitored for infaunal assemblage development and sediment texture since 1990. The second site, Beals Island, an example of a much older constructed flat (CF), has been monitored since 1991. Infaunal taxa richness, total numerical abundance, species composition, and diversity values were similar between the Sheep Island natural and constructed sites within two years of construction. At Beals Island, taxa richness and other diversity measures were similar between sites, however, abundance and total biomass values were lower at the constructed site. Although total biomass was also lower at the Sheep Island CF than its REF, biomass values at both constructed sites (Sheep Island and Beals Island) were within the range of values previously reported for natural flats.

1758. **Influence of agriculture on aquatic invertebrate communities of temporary wetlands in the Prairie Pothole Region of North Dakota, USA.**
Euliss, N. H. and Mushet, D. M.
Wetlands 19(3): 578-583. (1999)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ land use/ agriculture/ prairies/ cultivated lands/ agricultural practices/ invertebrates/ environmental impact/ aquatic communities/ temporary ponds/ cladocera/ Invertebrata/ North Dakota/ Prairie Pothole Region/ water fleas
Abstract: We evaluated the influence of intensive agriculture on invertebrate communities of temporary wetlands as indicated by aquatic invertebrate resting eggs, shells, and cases remaining after wetlands dried. To facilitate the comparison, we sampled 19 wetlands within cropland areas and 19 wetlands within grassland areas. We found resting eggs, shells, and cases of significantly more taxa and greater numbers of cladoceran resting eggs (ephippia), planorbid and physid snail shells, and ostracod shells in wetlands within grasslands than in croplands. We

also successfully incubated greater numbers of cladocerans and ostracods from soil samples collected from grassland sites. We were unable to detect differences in the viability of cladoceran ephippia between grassland and cropland wetlands, but our sample size was small due to an absence of ephippia in most cropland wetlands sampled; 74% of the cropland wetlands were devoid of cladoceran ephippia whereas ephippia were well represented in nearly all of our grassland sites. Our results corroborate findings of other investigators that prairie pothole wetlands have been negatively impacted by human activities. Our study demonstrates that aquatic invertebrates of temporary wetlands have been negatively impacted by intensive agriculture and suggests that future studies need to assess the influence of agricultural practices on wetland-dependant wildlife.

1759. **Influence of cattle grazing and pasture land use on macroinvertebrate communities in freshwater wetlands.**
Steinman, A. D.; Conklin, J.; Bohlen, P. J.; and Uzarski, D. G.
Wetlands 23(4): 877-889. (2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: community structure/ species richness/ nutrient concentrations/ water column/ wetlands/ freshwater environments/ grazing/ stocking rates/ land use/ pasture/ pastures/ invertebrates/ nutrients/ cattle/ livestock/ environmental effects/ ostracods/ macroinvertebrates/ midges/ bioindicators/ eutrophication/ aquatic insects/ freshwater crustaceans/ zoobenthos/ population structure/ community composition/ species diversity/ biotic factors/ dominant species/ aquatic plants/ stocking density/ stocks/ agriculture/ indicator species/ pollution indicators/ Invertebrata/ Culicidae/ Juncus effusus/ Polygonum/ Panicum hemitomon/ Florida/ cattle/ cattle stocking/ mosquitoes
Abstract: Responses of wetland abiotic variables and aquatic invertebrate community structure to cattle stocking density, pasture type, and dominant vegetation were evaluated in subtropical pastures. Cattle were stocked at four treatment levels on improved (fertilized) and semi-native (unfertilized) pastures in south-central Florida, USA. Improved pasture wetlands were dominated either by Panicum hemitomon (maidencane) or by a mixture of Polygonum spp. (smartweed) and Juncus effusus; semi-native pasture wetlands were dominated mainly by maidencane. Cattle stocking density had few significant effects on water-column nutrient concentration or invertebrate community structure. However, water-column nutrient concentrations were significantly greater in the wetlands on improved pastures compared to semi-native pastures. Invertebrate richness and diversity were greater in wetlands on semi-native pastures than on improved pastures, despite lower nutrient concentrations in the former. Overall, the cattle stocking treatment had little impact on invertebrate community structure in these systems relative to prior pasture land use. However, vegetation type influenced invertebrate communities and explained some of the differences between pasture types. Semi-native (lower nutrient) wetland pastures dominated by maidencane had significantly greater invertebrate richness and diversity than improved (higher nutrient) wetland pastures dominated by mixed vegetation but showed no difference when compared to improved wetland pastures dominated by maidencane. Chironomids were the dominant invertebrate in wetlands of both pasture types. Correspondence analysis revealed that ostracods and Culicidae larvae might be useful as bioindicators of subtropical wetlands that are experiencing cultural eutrophication.

1760. **Influence of flood waters on survival, reproduction, and habitat use of white-tailed deer in the Florida Everglades.**
MacDonald-Beyers, K. and Labisky, R. F.
Wetlands 25: 659-666. (Sept. 2005)
NAL Call #: QH75.A1W47
Descriptors: Odocoileus virginianus/ wildlife/ wildlife habitats/ floods/ hydrology/ wetlands/ ecosystem management/ anthropogenic activities/ water flow/ ecological restoration/ surface water level/ depth/ population ecology/ population dynamics/ Florida/ Everglades/ aquatic biology and ecology animals/ animal ecology and behavior/ water resources and management/ natural resources, environment, general ecology, and wildlife conservation/ meteorology and climatology
This citation is from AGRICOLA.

1761. **Influence of grazing systems on waterfowl production.**
Hertel, D. and Barker, W. T.
Proceedings of the North Dakota Academy of Science 41(79): 6. (1987)
NAL Call #: 500 N813; ISSN: 0096-9214
Descriptors: cattle/ waterfowl/ grazing/ range management/ wildlife management/ North Dakota
This citation is from AGRICOLA.

1762. **Influence of land use on postmetamorphic body size of playa lake amphibians.**
Gray, M. J. and Smith, L. M.
Journal of Wildlife Management 69(2): 515-524. (2005)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wetlands/ body size/ grasslands/ reproduction/ conspecifics/ rainfall/ drift/ land use/ amphibiotic species/ hydrology/ playas/ habitat improvement/ growth rate/ Spea multiplicata/ Bufo cognatus/ Ambystoma tigrinum mavortium/ Southern High Plains/ Great Plains toad/ barred tiger salamander
Abstract: Agricultural land use may indirectly affect the body size of amphibians by altering the hydroperiods of nearby wetlands and influencing amphibian densities-both factors which can limit the larval and postmetamorphic growth rates of amphibians. We measured postmetamorphic body size for 4 species (Spea multiplicata, S. bombifrons, Bufo cognatus, Ambystoma tigrinum mavortium) and 3 age classes (metamorph, subadult, adult) of amphibians captured at playa wetlands surrounded by one of 2 general land-use types (cultivation, grassland) in the Southern High Plains. Sixteen playas (4 per land-use type in 1999 and 2000) were partially enclosed with drift fence and pitfall traps, and mass and snout-vent length (SVL) were measured from a subsample of captured individuals. Mass and SVL were 10-148% greater for amphibians captured at grassland wetlands than at cropland wetlands for most species and age classes. Mass and SVL also were 3-124% greater in 1999 than in

2000 for most species and age classes. We attribute differences in body size between land-use types to differences in the hydroperiods of the associated wetlands, and potentially to variation in the density of terrestrial conspecifics and aquatic predators. We attribute differences in body size between years to differences in rainfall. Body size is positively related to the probability of survival, reproduction, and evolutionary fitness in amphibians. Thus, if cultivation of landscapes surrounding wetlands negatively influences postmetamorphic body size of amphibians, restoration of native grasslands surrounding playa wetlands may help prevent local amphibian declines.

1763. **Influence of wetland age on bird use of restored wetlands in Iowa.**
Vanrees-Siewert, K. L. and Dinsmore, J. J.
Wetlands 16(4): 577-582. (1996)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ habitat improvement/ reclamation/ aquatic birds/ breeding sites/ evaluation/ species diversity/ environmental restoration/ habitat utilization/ environmental quality/ birds/ habitats/ waterfowl/ Iowa/ evaluation/ breeding sites/ Aves
Abstract: A goal of wetland restoration is to provide habitat for breeding populations of waterfowl and other bird species. To meet this goal, it is important to determine how birds respond to restored wetlands and which factors influence their use of restored wetlands. We examined the relationship between bird species richness and years since restoration at restored prairie wetlands in Iowa. We detected 42 bird species in restored wetlands, 15 of which were breeding species. The mean number of breeding bird species was significantly greater in older restored wetlands (4.3 species in 1-year-old wetlands, 7.2 species in 4-year-old wetlands, P = 0.005). The mean number of all bird species, waterfowl species, and breeding waterfowl species did not change with wetland age. Total and breeding bird species richness increased with percent cover of emergent vegetation. Waterfowl species richness and breeding waterfowl species richness were influenced more by wetland area than vegetation characteristics, whereas total species richness and breeding bird species richness were influenced more by vegetation characteristics. If the goal of restoration is simply to provide a breeding site for waterfowl, our data suggest that this can be done in a few years. However, we favor longterm restorations. Such restorations are more likely to have a more diverse bird community that more closely resembles those found in natural wetlands.

1764. **Influences of riparian logging on plants and invertebrates in small, depressional wetlands of Georgia, USA.**
Batzer, D. P. Jackson, C. R. ; and Mosner, M.
Hydrobiologia 441(1-3): 123-132. (2000)
NAL Call #: 410 H992; ISSN: 0018-8158
Descriptors: wetlands/ logging/ plants/ Georgia/ pine trees/ invertebrates/ ecological effects/ water temperature/ biomass/ vegetation/ hydrogen ion concentration/ ecosystem disturbance/ man-induced effects/ forest industry/ aquatic plants/ long-term changes/ environmental conditions/ biota/ ecosystem management/ riparian environments/ population-environment relations/ human impact/ forestry/ aquatic organisms/ environmental impact/ environmental changes/ ecology/ daphnia/ Oligochaeta/ Invertebrata/ pinus/ plantae/ pine/ oligochaetes/ angleworms/ earthworms/ pines
Abstract: We studied 12 small, seasonally flooded, depressional wetlands on the Atlantic Coastal Plain of Georgia, U.S.A. Each wetland was embedded in stands of managed plantation pine. The pine trees surrounding each wetland had been harvested and replanted beginning in 1997 (2 sites), 1995 (2 sites), 1993 (1 site), 1988 (2 sites), 1984 (2 sites) or 1975 (3 sites). Regressions of various environmental variables with harvest histories indicated that those wetlands surrounded by smaller trees had greater light levels, water temperatures, pH, herbaceous plant cover and biomass, terrestrial invertebrate diversities and numbers, and water flea numbers, and lower water electrical conductivities and aquatic oligochaete numbers than those wetlands surrounded by more mature trees. Detected variations in hydroperiod, water depth, dissolved oxygen levels, sediment inputs, macrophyte diversity, periphyton biomass and densities of most aquatic invertebrates were not clearly correlated with past histories of peripheral tree harvest. This study suggests that harvesting trees around small wetlands initiates physical and ecological changes within the embedded habitats and that changes can persist for up to 15 years.

1765. **Initial response of fishes to marsh restoration at a former salt hay farm bordering Delaware Bay.**
Able, K. W.; Nemerson, D. M.; Light, P. R.; and Bush, R. O.
In: Concepts and controversies in tidal marsh ecology/ Weinstein, Michael P. and Kreeger, Daniel A.
Dordrecht: Kluwer Academic Publishers, 2000; pp. 749-773.
Descriptors: conservation measures/ biometrics/ ecology/ population dynamics/ habitat/ brackish habitat/ marine zones/ Atlantic Ocean/ North Atlantic/ Pisces: habitat management/ habitat restoration/ size/ community structure/ population size/ salt marsh restoration effects/ salt marsh/ restoration/ initial responses/ North West Atlantic/ New Jersey/ Delaware Bay/ Initial responses to salt marsh restoration/ Pisces/ chordates/ fish/ vertebrates
Abstract: The success of salt marsh restoration, especially as it relates to the structural and functional role of fish populations, is poorly defined. In order to evaluate the effectiveness of the restoration of a former salt hay farm toward a functional marsh, we monitored the fish response to the restoration (resumed tidal flow, creation of creeks) from September 1996 to November 1997 and compared that to the prerestoration condition. During the post-restoration period we compared fish species richness, abundance, composition and size during the spring, summer and fall between the restored site and an adjacent reference marsh with similar physical characteristics (temperature, salinity, dissolved oxygen, depth, distance from the bay). Fish populations, primarily young-of-the-year, were characterized at both sites by monthly sampling with replicate (4 tows per site, 2 sites in each of two creeks) daytime otter trawls (4.9 m, 6 mm cod end mesh, n=375 two-minute tows) in large marsh creeks and with weirs (2.0 m×1.5 m×1.5 m, with 5.0 m×1.5 m wings, 6.0 mm mesh, n=48) in smaller intertidal marsh creeks (2 sites in the restored marsh, 4 sites in reference marshes). Based on these observations, fish abundance was greater in the

restored creeks while species richness, species composition, and average size of fishes were similar to the reference site. An analysis of fish assemblages at the same sites indicated that the reference and restored marshes were similar for large and small marsh creeks. Where differences occurred it was often the result of greater abundances of selected species at the restored marsh. Also, during this period the standing stock at the restored marsh may have exceeded that for the reference marsh. Thus, it appears that the fish responded quickly to the restoration.

1766. **Integrated management of waterbird habitats at impounded wetlands in Delaware Bay, U.S.A.**
Parsons, K. C.
Waterbirds 25(SPECIAL PUBL.2): 25-41. (2002)
NAL Call #: QL671; ISSN: 07386028
Descriptors: Delaware Bay/ drawdown/ impoundments/ waterbirds/ wetland management/ drawdown/ habitat management/ impoundment/ integrated approach/ waterfowl/ wetland/ United States
Abstract: Most streams in the upper Delaware Bay U.S.A. drainage have been impounded either historically or at present to accommodate a variety of wetland management objectives. Long-term impoundment has resulted in loss of wetland function and biodiversity. Nevertheless, extensive wetlands in Salem County, New Jersey and New Castle County, Delaware provide habitat for many important waterbirds, including breeding wading birds, migratory shorebirds, and waterfowl. Public and private agencies in both states have initiated wetland restoration programs to improve habitat values for multiple waterbird groups. I conducted wetland studies in nine streams to examine patterns of waterbird use to 1) identify water level management practices that promote waterbird utilization, and 2) develop guidelines for resource managers to meet integrated wetland management objectives. A total of 62 species (32,100 individuals) of wading birds, waterfowl, shorebirds, seabirds, marshbirds, and raptors was recorded April-July, 1993-1996 and 2000 during weekly observations. Most waterbird groups were more abundant at impounded sites than at tidal sites in streams. In addition, the use of streams within the region varied for all waterbird groups indicating that some streams were highly utilized while at others, relatively few waterbirds were present. Water level management regime was an important factor in determining waterbird use. Wading birds were most abundant at wetlands undergoing a mid-season drawdown at which time many locally-breeding species were meeting adult and nestling food requirements. Waterfowl were more abundant at wetlands with relatively high water levels in early spring compared to levels later in the season, which coincided with duck migration. Migratory shorebirds were most abundant on wetlands with relatively low water levels during May. Results 1) confirm the need for variably-managed wetland mosaics which provide habitat at a variety of water levels and 2) identify the importance of timing of drawdown in meeting the foraging needs of multiple waterbird groups.

1767. **Integrated management of waterbirds: Beyond the conventional.**
Erwin, R. M.
Waterbirds 25(Special Publ.2): 5-12. (2002)
NAL Call #: QL671; ISSN: 07386028
Descriptors: impoundments/ landscape scale/ refuges/ shorebirds/ wading birds/ waterfowl/ wetland and waterbird management/ conservation management/ habitat management/ integrated approach/ waterfowl/ wetland
Abstract: Integrated waterbird management over the past few decades has implicitly referred to methods for managing wetlands that usually attempt to enhance habitat for taxonomic groups such as shorebirds and wading birds, in addition to waterfowl, the traditional focus group. Here I describe five elements of integration in management: taxonomic, spatial, temporal, population and habitat, and multiple-use management objectives. Spatial integration simply expands the scale of management concern. Rather than emphasizing management on a very limited number of impoundments or wetlands in small refuges or wildlife management areas, the vision is beginning to shift to connectivity within larger landscapes on the order of many square kilometers as telemetry data on daily and seasonal movements for many species become available. Temporal integration refers to the potential for either simultaneous management for waterbirds and commercial "crops" (e.g., crayfish and rice) or for temporally-staggered management such as row crop production in spring-summer growing seasons and waterbird management on fallow fields in the non-growing (winter) season. Integrating population dynamics with habitats has become a major research focus over the past decade. Identifying which wetlands are "sources" or "sinks" for specific populations provides managers with critical information about effective management. Further, the applications of spatially explicit population models place heavy demands on researchers to identify use patterns for breeding and dispersing individuals by age, sex, and reproductive class. Population viability analysis models require much the same information. Finally, multiple-use management integration refers to trying to optimize the uses of wetlands, when only one (perhaps secondary) use may include waterbird management. Depending upon the ownership and primary land use of a particular parcel of land containing wetlands and/or water bodies, managing for waterbirds may be an "easy sell" (e.g., public natural resource lands) or a very contentious one, where wetlands are created for industrial, aquaculture or urban uses. In the latter case, careful planning and implementation require broad stakeholder participation and education.

1768. **Integrating shorebird habitat needs with water management efforts at the Laguna Atascosa National Wildlife Refuge, Texas.**
Fernandez, Marie Kathryn
Kingsville, TX: Texas A&M University - Kingsville, 2000.
Notes: Degree: MS; Advisor: Smith, Steven A.
Descriptors: wetlands/ shorebirds/ winter/ habitat management/ migration/ water level/ seasons/ lowland/ habitat use/ Laguna Atascosa National Wildlife Refuge/ Texas

Abstract: The lower Laguna Madre area and adjacent wetlands, including those found at the Laguna Atascosa National Wildlife Refuge in coastal southern Texas, provide important wintering and spring stopover habitat for migratory shorebirds. During winter-spring of 1996 and 1997, shorebird migration chronology and habitat use were studied on a 2,024 ha impoundment system at the Laguna Atascosa National Wildlife Refuge. The purpose of this study was to provide recommendations for shorebird management during winter and spring in conjunction with current management practices for waterfowl. Twenty-six species of shorebirds were documented in the first winter-spring field season and eighteen species in the second field season. The most abundant shorebird group was the semipalmated/western sandpiper Calidris pusilla/ C. mauri. Wintering shorebirds and early migrants were present at the initiation of the study period each year. Peak migration of shorebirds (based on numbers) appears to fall between mid-March and the end of April. Great variability occurs from year to year due to fluctuating water conditions. Shorebirds foraged primarily on wet mud or in shallow water and did not use vegetated areas to a great extent. Shorebird presence was directly related to water level. High water levels resulted in inaccessibility of prey to many foraging shorebirds or water depths too deep to be utilized by shorebirds. Dry mudflats were not used by most shorebirds, with the exception of long-billed curlew Numenius americanus, willet Catoptrophorus semipalmatus and plovers Pluvialis sp. and Charadrius spp.).

1769. **Interactive effects of animal disturbance and elevation on vegetation of a tidal freshwater marsh.**
Baldwin, A. H. and Pendleton, F. N.
Estuaries 26(4 A): 905-915. (2003)
NAL Call #: GC96.E79; ISSN: 01608347
Descriptors: community composition/ disturbance/ elevation/ saltmarsh/ vegetation structure/ United States/ Bidens laevis/ Zizania aquatica
Abstract: We studied interactions between animal disturbance (geese, carp, and muskrat) and elevation in a field experiment in tidal freshwater marshes of the Patuxent River, Maryland, United States. Vegetation changes were recorded in fenced and unfenced plots in high and low marsh community types for 2 yr using measurements of areal cover and within-plot frequency (which were averaged to create a dominance index), Leaf Area Index (LAI), and aboveground biomass. We related light environment to differences in vegetation using below-canopy measurements of Photosynthetically Active Radiation (PAR). In the low marsh, total cover of all species, cover of annual species, biomass, and LAI were significantly higher in plots fenced to exclude animals (exclosures) than in unfenced plots (fenced/unfenced total cover = 76/40%, annual cover = 45/10%, biomass = 936/352 g m-2, LAI = 3.3/1.4). PAR was significantly lower in fenced than unfenced plots (fenced/unfenced = 115/442 µ mol s-l m -2). Despite the strong effect of fencing on biomass, species richness per plot (i.e., the number of species per plot, or species density) was not affected significantly by fencing in the low marsh. Most of the observed differences in cover, biomass, LAI, and PAR were due to variation in the abundance of the herbaceous annual species Bidens laevis (dominance index fenced/unfenced = 45/10%) and Zizania aquatica (30/12%). In the high marsh community, fencing had only minor effects on plant community composition and did not significantly affect species richness, cover, biomass, PAR, or LAI. Our results show that animals can dramatically affect low marsh vegetation, primarily via physical disturbance or herbivory of shallowly rooted seedlings of annual species.

1770. **Interspecific differences in habitat use of shorebirds and waterfowl foraging in managed wetlands of California's San Joaquin Valley.**
Isola, C. R.; Colwell, M. A.; Taft, O. W.; and Safran, R. J.
Waterbirds 23(2): 196-203. (2000)
NAL Call #: QL671; ISSN: 1524-4695
Descriptors: bottom topography/ foraging/ habitat use/ interspecific differences/ managed wetlands/ water depth
Abstract: A common wetland management objective is to provide habitat for a diverse assemblage of species, which requires data on interspecific differences in habitat use. Consequently, we studied habitat use by ten water-bird taxa (four dabbling ducks and six shorebirds) foraging in managed, seasonal wetlands in the northern San Joaquin Valley, California during late winter and early spring of 1994 and 1995. A MANOVA analysis detected strong interspecific differences in habitat use, with water depth explaining 86% of differences among taxa in a discriminant function analysis. ANOVA identified four groups based on similarities in use of water depth: 1) small shore-birds (<5 cm): 2) large shorebirds (5-11 cm); 3) teal (10-15 cm); and large dabbling ducks (>20 cm). Among these groups, variation in water depth at foraging locations increased with size, suggesting that water depth constrained foraging by shorebirds and teal more than larger waterfowl. In California's Central Valley, where large numbers of shorebirds and waterfowl winter, our findings suggest that managers can provide habitat for shorebirds and water-fowl by reducing the average depth to which habitats are flooded, especially during winter when deep-water habitat is abundant. Within a wetland complex or an individual wetland, this prescription will yield greatest diversity of water depth, and, hence, bird use in wetlands characterized by variable bottom topography.

1771. **Invertebrate assemblages and trace element bioaccumulation associated with constructed wetlands.**
Nelson, S. M.; Roline, R. A.; Thullen, J. S.; Sartoris, J. J.; and Boutwell, J. E.
Wetlands 20(2): 406-415. (June 2000)
NAL Call #: QH75.A1W47
Descriptors: dissolved oxygen/ bioaccumulation/ community structure/ trace elements/ artificial wetlands/ invertebrates/ wetlands/ wastewater treatment/ heavy metals/ aluminum/ arsenic/ selenium/ aluminium/ plant populations/ vegetation cover/ aquatic plants/ community composition/ animals (invertebrates)/ Invertebrata/ Potamogeton/ Scirpus
Abstract: Invertebrate assemblages were studied in eight monoculture wetland mesocosms constructed for wastewater treatment. Low concentrationsof dissolved oxygen (D.O.) were measured in bulrush mesocosms while higher concentrations of D.O. were measured in open watermesocosms containing submerged pondweeds. Invertebrate taxarichness was positively related to D.O.

concentrations that were,in turn, related to vegetation communities. Reference wetland sites contained a variety of plant species along with extensive open water areas. Invertebrate taxa richness was greater at reference sites than in any wastewater mesocosm. Invertebrate samples from the wastewater mesocosms and reference sites were analyzed for five trace elements. While the concentrations of aluminum, arsenic, mercury, and silver were below values harmful to wildlife, the concentrations of selenium reached levels of moderate concern on one occasion. Data from this study suggest that selenium bioaccumulation by invertebrates may be related tothe type of vegetation community or detrital habitat type.Wetlands designed for invertebrate production for waterfowl should take into account the potential for low D.O. concentrations and trace element bioaccumulation associated with vegetation community types.

1772. **Invertebrate egg banks of restored, natural, and drained wetlands in the Prairie Pothole Region of the United States.**
Gleason, R. A.; Euliss, N. H.; Hubbard, D. E.; and Duffy, W. G.
Wetlands 24(3): 562-572. (2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ prairies/ abundance/ drainage/ eggs/ succession/ recruitment/ man-induced effects/ anthropogenic factors/ embryonic development/ habitat improvement/ aquatic insects/ seasonal variations/ restoration/ water levels/ dispersion/ statistical analysis/ community composition/ population dynamics/ species diversity/ invertebrates/ banks/ history/ cultivation/ maintenance/ seeds/ indicators/ drawdown/ Invertebrata/ United States/ Canada/ Saskatchewan/ Prairie Pothole Region
Abstract: Analogous to 'seed banks,' 'egg banks' are important for seasonal succession and maintenance of invertebrate species diversity throughout wet and dry cycles in the prairie pothole region. Further, recruitment of invertebrates from relic egg banks in the sediments and dispersal of eggs into wetlands is believed to be important for reestablishment of invertebrates in recently restored wetlands. Alhough tens-of-thousands of wetlands have been restored in the prairie pothole region of the United States, studies have not been conducted to evaluate the recovery of invertebrate egg banks in restored wetlands. We used taxon richness and abundance as indicators of potential egg bank recovery and compared these parameters in restored wetlands to those of non-drained and drained wetlands with a history of cultivation and also to reference wetlands with no history of cultivation. We found few significant differences among wetland categories within three physiographic regions (Glaciated Plains, Missouri Coteau, and Prairie Coteau). Most statistical comparisons indicated that restored wetlands had invertebrate egg banks similar to reference, non-drained, and drained wetlands. The one exception was drained seasonal wetlands in the Glaciated Plains, which had significantly lower taxon richness and invertebrate abundance than the other wetland categories. Trends did suggest that invertebrate egg bank taxon richness and abundance are increasing in restored seasonal wetlands relative to their drained analogues, whereas a similar trend was not observed for restored semi-permanent wetlands. Although recovery was not related to years since restoration, comparisons of restored wetlands with reference wetlands suggest that recovery potential may be inversely related to the extent of wetland drainage and intensive agriculture that varies spatially in the prairie pothole region. Our research suggests that periodic drawdowns of semi-permanent restored wetlands may be needed to promote production and development of invertebrate egg banks. Inoculation of restored wetlands may also be needed in areas where extensive wetland drainage has resulted in fewer wetland habitats to provide sources of passively dispersed eggs to newly restored wetlands.

1773. **Invertebrate response to moist-soil management of playa wetlands.**
Anderson, J. T. and Smith, L. M.
Ecological Applications 10(2): 550-558. (2000)
NAL Call #: QH540.E23 ; ISSN: 10510761
Descriptors: invertebrates/ migratory birds/ moist-soil management/ Playas/ wetlands/ biomass/ density/ invertebrate/ species diversity/ wetland management/ United States
Abstract: Moist-soil management is a wetland management technique commonly used to increase seed production for migratory birds. However, the responses of invertebrates to moist-soil management have seldom been investigated even though their availability may be as important as seeds to foraging waterbirds. We studied the effects of moist-soil management and initial fall flooding date (September vs. November) on invertebrate density, biomass, and diversity in 12 playa wetlands on the Southern High Plains, USA, during the winters of 1994-1995 and 1995-1996. Invertebrates were sampled using a combination of benthic core, epiphytic, and water-column samplers. Total invertebrate density and biomass were higher in playas that were moist-soil managed and that had longer hydroperiods (four rather than two months) than in playas that were not managed or that had shorter hydroperiods. Most invertebrate taxa (75%) were more abundant in moist-soil managed wetlands than in unmanaged wetlands. Invertebrate familial richness and diversity were greater in moist-soil managed playas than in unmanaged playas, but initial flooding date had little effect on invertebrate diversity. Planorbidae snails were the most abundant invertebrate taxon. A combination of moist-soil management and early fall (September) water application is an effective tool to increase invertebrate density, biomass, and diversity in playas for migratory birds.

1774. **Invertebrates associated with woody debris in a southeastern U.S. forested floodplain wetland.**
Braccia, Amy and Batzer, Darold P.
Wetlands 21(1): 18-31. (Mar. 2001)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: Invertebrata/ biomass/ community structure/ habitat utilization/ woody debris/ forested wetlands/ semiaquatic habitat/ forest and woodland/ South Carolina/ Coosawhatchie River Floodplain/ surveys
Abstract: Woody debris is an ecologically important resource in upland forests and stream ecosystems. Although much is known about invertebrate-woody debris interactions in forests and streams, little information exists

for forested wetlands. In this study, invertebrates associated with woody debris in a Southeastern U. S. forested floodplain are described and factors that shape community structure are examined. Woody debris samples were collected during two wet (March 1998 and 1999) and one dry period (August 1998) from a bottomland hardwood wetland along the Coosawhatchie River, South Carolina, USA. During wet period collections, both submersed and floating woody debris were collected. Invertebrate richness, density, and arthropod standing-stock biomass were compared among sampling periods (wet and dry), between floating and submersed wood, and among woody debris decay classes. Most invertebrate richness and arthropod biomass was associated with wood collected during wet periods. However, the non-aquatic rather than aquatic arthropods were the most significant component of the overall community structure. Floating woody debris was a "hot spot" for invertebrate richness and arthropod biomass. Increased invertebrate richness was also associated with well-decayed wood. Invertebrates were classified based on temporal use of woody debris and included perennial residents, seasonal colonizers, and seasonal refugees. Overall findings suggest that woody debris is an important resource for invertebrates, and wood-associated invertebrates (especially non-aquatics) need to be considered when studying the diversity and function of forested wetlands.

1775. **Invited paper: Principles for management of aquatic-breeding amphibians.**
Semlitsch, Raymond D.
Journal of Wildlife Management 64(3): 615-631. (2000)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wildlife management: conservation/ population studies/ connectivity/ dispersal/ ecological disturbance/ ecosystem management/ habitat fragmentation/ habitat loss/ hydrologic cycle/ population dynamics/ recolonization/ wetlands
Abstract: Coordinated efforts by ecologists and natural resource managers are necessary to balance the conservation of biological diversity with the potential for sustained economic development. Because some amphibians have suffered world-wide declines during the last 20 years, it is important to consider biologically based management strategies that will preserve local and regional populations. This paper provides a brief overview of potential threats to local and regional populations, the state of knowledge on population and landscape processes, and the critical elements needed for an effective management plan for amphibians. Local population dynamics and ecological connectivity of amphibian metapopulations must be considered in effective management plans. There are 3 critical factors to consider in a management plan (1) the number or density of individuals dispersing from individual wetlands, (2) the diversity of wetlands with regard to hydroperiod, and (3) the probability of dispersal among adjacent wetlands or the rescue and recolonization of local populations. Wetlands losses reduce the total number of sites where pond-breeding amphibians can reproduce and recruit juveniles into the breeding population. Loss of small, temporary wetlands (<4.0 ha) may be especially harmful to amphibians because of their abundance and high species diversity. Alteration of wetlands, particularly hydrologic cycles, can severely impair completion of larval metamorphosis through either early pond drying (if hydroperiod is shortened) or through increased predation (if hydroperiod is lengthened or connections made with fish-infested lakes, rivers, or canals). Wetland loss also increases the distance between neighboring wetlands that is critical to metapopulation source-sink processes. Reduction in wetland density reduces the probability that populations will be rescued from extinction by nearby source populations. Local populations cannot be considered independent of source-sink processes that connect wetlands at the landscape or regional level. Further, the fragmentation of natural habitats from timber harvesting, agriculture, roads, drainage canals, or urban development impedes or prevents dispersal and decreases the probability of wetland recolonization. If our goal is to maintain or enhance present levels of amphibian diversity, then resource managers must incorporate critical elements into plans that protect population and landscape processes thereby maintaining viable populations and communities of amphibians.

1776. **Iowa's wetlands present and future with a focus on prairie potholes.**
Bishop, R. A.; Joens, J.; and Zohrer, J.
Journal of the Iowa Academy of Science 105(3): 89-93. (1998)
NAL Call #: Q11.J68; ISSN: 0896-8381
Descriptors: pothole habitat/ prairie marsh/ riparian floodplain/ uplands/ wetland restoration/ wildlife habitat
Abstract: The vast prairie marsh-pothole complex that historically covered approximately 7.6 millions acres in Iowa was reduced to less than 30,000 acres by 1980 when it was estimated that only 5,000 acres of prairie marsh and pothole habitat remained in private ownership. A bleak outlook for the future of wetlands was presented by Bishop (1981)." This outlook changed with the development of the North American Waterfowl Management Plan and the passage of two important pieces of legislation: the North American Wetlands Conservation Act and the Food Security Act of 1985. Protection of existing wetlands was afforded through the Swampbuster provision of the Food Security Act. The North American Wetlands Conservation Act and the Wetland Reserve Program offered through the Food Security Act provided needed funding for the protection and restoration of wetlands in Iowa. Since 1988, the Iowa Department of Natural Resources, the U.S. Fish and Wildlife Service, and various county conservation boards together with Pheasants Forever, Ducks Unlimited, and the Iowa Natural Heritage Foundation have purchased over 10,000 ha (25,000 ac) of wetlands and uplands in the Prairie Pothole Region of Iowa and restored over 24,240 ha (6,600 ac) of public and private wetlands. The United States Department of Agriculture, Natural Resources Conservation Service has enrolled approximately 24,240 ha (60,600 ac) of riparian floodplains and potholes into the Wetland Reserve Program and Emergency Wetland Reserve Program, affording them protection through permanent easements. Public support of wetland legislation will ensure that funding continues to be available to protect and restore Iowa's prairie wetlands.

1777. **Isotopic evidence for changes in residue decomposition and N-cycling in winter flooded rice fields by foraging waterfowl.**
Diepen, L. T. A. van; Groenigen, J. W. van; and Kessel, C. van
Agriculture, Ecosystems and Environment 102(1): 41-47. (2004)
NAL Call #: S601.A34; ISSN: 0167-8809
Descriptors: wetlands/ animal behavior/ crop residues/ cycling/ decomposition/ flooding/ foraging/ isotope fractionation/ nitrogen/ rice/ rice straw/ straw/ waterfowl/ wild birds
Abstract: Winter flooded rice fields can serve as substitute habitat for migratory waterfowl. Not much is known about the effects of the foraging waterfowl on nutrient cycling in rice production systems. This study quantifies the effect of foraging waterfowl on decomposition of rice residue and N-cycling in a winter flooded rice field in the Sacramento Valley, California. Along two transects in a field, pairs of control plots and exclosure plots, which excluded waterfowl, were set up. The original straw residue within the inner 2 m^2 of the 3 m x 3 m plots was replaced by ^{15}N labelled straw residue. The labelled residue was subsequently followed into the light fraction and mineral fraction of the soil through the winter flooding period. Foraging waterfowl increased the loss of ^{15}N from the residue from 83 to 89%, but did not affect the mass decomposition and loss of total N of the residue. No significant effect of the waterfowl was seen in the recovery of the residue N in the total soil N pool and in the light fraction, although there was a low recovery of residue N within these pools in the control treatments. The recovery of residue N in the NH_4 ± N pool after winter flooding was significantly lower in the presence of waterfowl. The increased loss of residue N and lower recovery of residue N in the presence of waterfowl may indicate that the rate of N-cycling was increased. A better understanding of the N-cycle in winter flooded rice fields in the presence of waterfowl is needed to assess the potential benefits of winter flooding for the rice farmers.
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1778. **Juvenile sciaenid fishes respond favorably to Delaware Bay marsh restoration.**
Nemerson, David M. and Able, Kenneth W.
Ecological Engineering 25(3): 260-274. (2005)
NAL Call #: TD1.E26; ISSN: 0925-8574.
Notes: In 2 volumes.
Descriptors: conservation measures/ biometrics/ whole animal physiology/ nutrition/ diet/ ecology/ population dynamics/ brackish habitat/ marine zones/ Atlantic Ocean/ Cynoscion regalis/ Leiostomus xanthurus/ Micropogonias undulatus: habitat management/ salt marsh restoration/ size/ length/ weight/ physiological condition/ condition factor/ prey/ feeding rate/ stomach fullness/ population density/ salt marsh/ abundance/ prey type/ stomach fullness and condition/ natural vs restored sites/ man-made habitat/ restored salt marsh/ North Atlantic/ New Jersey/ Delaware Bay/ Pisces, Actinopterygii, Perciformes, Sciaenidae/ chordates/ fish/ vertebrates
Abstract: Former salt hay farms in Delaware Bay have been the site of extensive restorations aimed at restoring tidal flow to the sites, encouraging Spartina alterniflora (smooth cordgrass) recolonization and creating high-quality juvenile fish habitat. We assessed the 234 ha Dennis Township restoration site as habitat for juvenile Cynoscion regalis (weakfish), Leiostomus xanthurus (spot) and Micropogonias undulatus (Atlantic croaker) by comparing abundance, prey types consumed, stomach fullness and condition factor at the restored site and at a nearby reference marsh, Moores Beach. The three sciaenid species were equally or more abundant at the restored marsh. Measures of feeding were generally equal or higher at the restored site and stomach fullness was equal to or significantly higher at the restored marsh compared with the reference marsh. Fish condition, as measured by predicted weight-at-length, was generally at least equal between the sites and was occasionally higher at the restored site. At both sites, a seasonal pattern typical of mid-Atlantic estuaries of recruitment, ontogenetic change in food habits and emigration of transient fishes was apparent. Three years following restoration, the Dennis Township site provided equivalent to enhanced conditions for feeding and growth for large numbers of juvenile sciaenid fish, compared to a nearby reference site. © 2005 Elsevier B.V. All rights reserved.
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1779. **Land use, water chemistry, aquatic vegetation and zooplankton community structure of shallow lakes.**
Dodson, Stanley I.; Lillie, Richard A.; and Will Wolf, Susan
Ecological Applications 15(4): 1191-1198. (2005)
NAL Call #: QH540.E23; ISSN: 1051-0761
Descriptors: ecology/ habitat/ freshwater habitat/ lentic water/ abiotic factors/ land zones/ comprehensive zoology: disturbance by man/ land use effect on shallow lake community structure/ community structure/ influencing factors/ lake/ shallow lakes/ chemical factors/ water chemistry/ effect on community structure/ Wisconsin/ shallow lake community structure
Abstract: Landscape-lake interactions, including anthropogenic effects in modern human-dominated landscapes, are essential elements of our understanding of aquatic community ecology. This study links land use (six categories) to the aquatic environment (30 water chemistry, lake morphology, and vegetation variables) and to zooplankton community richness (32 common taxa) and composition in 73 small and shallow lakes of southeastern Wisconsin, USA. The sites differed most according to two environmental variables (principal components analysis (PCA) ordination): the presence/absence of riparian vegetation and the water source (whether ground or atmospheric). Shallow lakes in different land use categories (reference, urban, and agricultural) differed significantly in terms of the two major environmental variables, especially presence of riparian and aquatic vegetation. Reference sites were characterized by the most vegetation and the highest zooplankton richness. Agricultural sites with wide riparian vegetative buffer strips (>30 m) had significantly more zooplankton taxa than agricultural lakes with narrow buffer strips. A non-metric multidimensional scaling (NMS) ordination of zooplankton community composition suggested a single community among land use categories, with some variation related to vegetation and the water source. The first NMS axis was correlated with PCAI axis (vegetation) and with zooplankton taxon richness, and the second axis was correlated with PCA2 (water source). The third axis was not strongly correlated with any of the measured environmental factors, suggesting that an unmeasured factor related to disturbance was also important in determining taxon composition. Our analysis

supports the hypothesis that zooplankton community structure (taxon richness and composition) is indirectly associated with land use, via the effect of land use on vegetation and the hydrological continuum.

1780. **Landowner satisfaction with the Wetlands Reserve Program in Wisconsin.**
Forshay, K. J.; Morzaria-Luna, H. N.; Hale, B.; and Predick, K.
Environmental Management 36(2): 248-257. (2005)
NAL Call #: HC79.E5E5 ; ISSN: 0364152X.
Notes: doi: 10.1007/s00267-004-0093-y.
Descriptors: conservation easement/ federal program/ invasive species/ monitoring/ restoration/ wetland/ biodiversity/ costs/ data reduction/ environmental impact/ plants (botany)/ restoration/ ecological monitoring/ landowners/ restoration sites/ Wetlands Reserve Program (WRP)/ ecology/ landowner/ monitoring/ restoration ecology/ ecosystem restoration/ program development/ wetland/ conservation of natural resources/ consumer participation/ fresh water/ personal satisfaction/ Wisconsin/ Cervidae
Abstract: We evaluated ecological monitoring data and landowner perceptions to the federally funded Wetlands Reserve Program (WRP) in a three-county region in Wisconsin. We surveyed landowner satisfaction, involvement, participation, and use of the WRP restoration sites. We found that landowners are satisfied with the overall program (mean, 3.6 ± 0.2 [SE], on a scale of 1-5, with 5 being completely satisfied). WRP restorations significantly increased the area of wetland within the sites surveyed, the increase was primarily of fresh meadow (736.32 ha after restoration). Satisfaction is related to landowner participation during restoration and to the economic incentives provided by the WRP, Landowner satisfaction and the number of plant communities after restoration are unrelated to each other or to restoration and easement costs per hectare. Survey participants recommended some changes to the WRP, including a reduction in the tax rate of land enrolled in the WRP, approval for permanent deer stands, and increased communication with WRP officials during the restoration. Monitoring information collected for WRP restoration sites does not allow assessment of whether WRP sites are functionally equivalent to natural sites. We suggest that the WRP require a more rigorous monitoring program, including guidelines for invasive species control. Managers should also encourage collaborations with external researchers and consider restorations within an experimental framework. © 2005 Springer Science+Business Media, Inc.

1781. **A landscape approach to conserving wetland bird habitat in the Prairie Pothole Region of eastern South Dakota.**
Naugle, David E.; Johnson, Rex R.; Estey, Michael E.; and Higgins, Kenneth F.
Wetlands 21(1): 1-17. (2001)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: conservation measures/ terrestrial habitat/ land and freshwater zones/ Aves/ habitat management/ semiaquatic habitat/ grasslands/ prairie wetlands/ South Dakota/ Prairie Pothole Region/ landscape survey/ birds/ chordates/ vertebrates
Abstract: Resource managers confronted with preserving ecosystems for prairie wetland birds in fragmented landscapes require landscape studies that direct conservation efforts over broad geographic regions. We investigated the role of local and landscape factors affecting habitat suitability by integrating remotely sensed wetland and land-cover data with wetland bird habitat models. We linked habitat models with locations of easement and fee-title wetlands to evaluate spatial location and extent of protected, suitable habitat. We also simulated impacts of the loss of small wetlands on suitability of larger wetlands for mobile species that use multiple wetlands. Lastly, we evaluated the efficacy of waterfowl habitat programs in preserving suitable habitat for nongame wetland bird species to recommend strategies for maximizing regional landscape connectivity. Regional databases constructed for this study indicate that easement and fee-title tracts encompass 13.9% (1.2 million ha) of land area and protect 19.8% of the wetlands in eastern South Dakota, USA. Proportion of protected wetlands is highest for semi-permanent (32.3%), intermediate for seasonal (25.6%), and lowest for temporary wetlands (15.8%). A stratified, two-stage cluster sample was used to randomly select 834 semi-permanent and seasonal wetlands that were surveyed for birds in 1995 and 1996. Logistic analyses indicate that habitat suitability for some species (e.g., Virginia rail, pied-billed grebe) is related to local vegetation conditions within wetlands, while suitability for others (e.g., northern pintail, black tern) is related to landscape structure at larger scales. As a result, unfragmented prairie wetland landscapes (i.e., areas with wetland complexes embedded within upland grasslands) provide habitat for more species than isolated wetlands in tillage fields. Models developed from survey wetlands were used to classify habitat suitability for all semi-permanent and seasonal wetlands in eastern South Dakota. Small wetlands are critical components of the surrounding landscape that influence habitat suitability of larger wetlands. Models used to reclassify suitability of larger remaining wetlands after small wetlands (<0.5 ha) were removed indicate that species most vulnerable to loss of small wetlands are vagile species that exploit resources over broad spatial scales. Number of wetlands suitable for northern pintails, a mobile species that uses multiple wetlands within a season, decreased 20.7% when wetlands <0.5 ha were removed. Historic paradigms dictating waterfowl habitat protection efforts also have conserved habitat for nongame bird species. Modern paradigms that acknowledge the importance of small shallow wetlands to breeding waterfowl have shifted the focus of protection towards preserving habitat for species that occupy more abundant seasonal wetlands. Cessation of protection efforts would result in further fragmentation of regional wetland landscapes. We recommend that wetlands be acquired not only to consolidate suitable habitat within protected core areas but also to ensure that core areas coalesce to preserve connectivity among regional wetland landscapes.

1782. **Landscape-based spatially explicit species index models for Everglades restoration.**
Curnutt, J. L.; Comiskey, J.; Nott, M. P.; and Gross, L. J.
Ecological Applications 10(6): 1849-1860. (2000)
NAL Call #: QH540.E23; ISSN: 1051-0761
Descriptors: wetlands/ models/ landscape/ environmental restoration/ Florida/ ecosystem management/ nature conservation/ habitat improvement/ hydrology/ water management/ Everglades/ modeling, mathematics, computer applications/ protective measures and control/ reclamation
Abstract: As part of the effort to restore the similar to 10,000-km^2 Everglades drainage in southern Florida, USA, we developed spatially explicit species index (SESI) models of a number of species and species groups. In this paper we describe the methodology and results of three such models: those for the Cape Sable Seaside Sparrow and the Snail Kite, and the species group model of long-legged wading birds. SESI models are designed to produce relative comparisons of one management alternative to a base scenario or to another alternative. The model outputs do not provide an exact quantitative prediction of future biotic group responses, but rather, when applying the same input data and different hydrologic plans, the models provide the best available means to compare the relative response of the biotic groups. We compared four alternative hydrologic management scenarios to a base scenario (i.e., predicted conditions assuming that current water management practices continue). We ranked the results of the comparisons for each set of models. No one scenario was beneficial to all species; however, they provide a uniform assessment, based on the best available observational information, of relative species responses to alternative water-management plans. As such, these models were used extensively in the restoration planning.

1783. **Landscape characteristics influence pond occupancy by frogs after accounting for detectability.**
Mazerolle, M. J.; Desrochers, A.; and Rochefort, L.
Ecological Applications 15(3): 824-834. (2005)
NAL Call #: QH540.E23 ; ISSN: 10510761
Descriptors: amphibians/ detection/ field surveys/ habitat disturbance/ landscape/ logistic regression/ New Brunswick, Canada/ patch/ peatland/ Rana clamitans/ site-occupancy model/ agricultural land/ frog/ habitat structure/ patchiness/ population distribution/ species occurrence/ North America/ Amphibia/ Anura
Abstract: Many investigators have hypothesized that landscape attributes such as the amount and proximity of habitat are important for amphibian spatial patterns. This has produced a number of studies focusing on the effects of landscape characteristics on amphibian patterns of occurrence in patches or ponds, most of which conclude that the landscape is important. We identified two concerns associated with these studies: one deals with their applicability to other landscape types, as most have been conducted in agricultural landscapes; the other highlights the need to account for the probability of detection. We tested the hypothesis that landscape characteristics influence spatial patterns of amphibian occurrence at ponds after accounting for the probability of detection in little-studied peatland landscapes undergoing peat mining. We also illustrated the costs of not accounting for the probability of detection by comparing our results to conventional logistic regression analyses. Results indicate that frog occurrence increased with the percent cover of ponds within 100, 250, and 1000 m, as well as the amount of forest cover within 1000 m. However, forest cover at 250 m had a negative influence on frog presence at ponds. Not accounting for the probability of detection resulted in underestimating the influence of most variables on frog occurrence, whereas a few were overestimated. Regardless, we show that conventional logistic regression can lead to different conclusions than analyses accounting for detectability. Our study is consistent with the hypothesis that landscape characteristics are important in determining the spatial patterns of frog occurrence at ponds. We strongly recommend estimating the probability of detection in field surveys, as this will increase the quality and conservation potential of models derived from such data.

1784. **Landscape context mediates influence of local food abundance on wetland use by wintering shorebirds in an agricultural valley.**
Taft, O. W. and Haig, S. M.
Biological Conservation 128(3): 298-307. (2006)
NAL Call #: S900.B5; ISSN: 00063207.
Notes: doi: 10.1016/j.biocon.2005.09.036.
Descriptors: benthic invertebrates/ dunlin/ Calidris alpina/ killdeer/ Charadrius vociferus/ wetland conservation/ wetland landscape planning/ food availability/ habitat conservation/ habitat use/ landscape ecology/ wader/ wetlands/ Oregon/ Willamette Valley/ Aves/ Invertebrata
Abstract: While it is widely understood that local abundance of benthic invertebrates can greatly influence the distribution and abundance of wetland birds, no studies have examined if wetland landscape context can mediate this relationship. We studied the influence of wetland food abundance and landscape context on use of agricultural wetlands by wintering dunlin (Calidris alpina) and killdeer (Charadrius vociferus) in the Willamette Valley of Oregon, USA, over two winters (1999-2000, 2000-2001) of differing rainfall and subsequent habitat distribution. We monitored bird use (frequency of occurrence and abundance) at a sample of wetlands differing in local food abundance (density and biomass) and landscape context [adjacent shorebird habitat (defined as ha of wet habitat with less than 50% vegetative cover and within a 2-km radius) and nearest neighbor distance]. We evaluated predictive models for bird use using linear regression and the Cp criterion to select the most parsimonious model. During the dry winter (2000-2001), dunlin exhibited greater use of sites with higher invertebrate density and biomass but also with more adjacent shorebird habitat and closest to a wetland neighbor. However, neither landscape context nor food abundance were important predictors of dunlin use during the wet winter (1999-2000). Use of sites by killdeer was unrelated to either local food abundance or landscape context measures during both winters. Our findings contribute to a growing recognition of the importance of landscape structure to wetland birds and highlight a number of implications for the spatial planning and enhancement of wetlands using a landscape approach.

1785. **Landscape ecological planning process for wetland, waterfowl, and farmland conservation.**
Musacchio, L. R. and Coulson, R. N.
Landscape and Urban Planning 56(3-4): 125-147. (Oct. 2001)
NAL Call #: QH75.A1L32; ISSN: 0169-2046
Descriptors: wetlands/ landscape/ habitat/ geographic information systems/ agricultural land/ rice fields/ land use/ grants/ policies/ regional planning/ rice field aquaculture/ nature conservation/ overwintering/ plant culture/ conservation/ waterfowl/ ecological effects/ farms/ geographical information systems/ rice/ anatidae/ Chen caerulescens caerulescens/ Oryza sativa/ Texas/ ducks/ lesser snow goose/ Anser caerulescens caerulescens/ rice/ planning/ development/ law, policy, economics and social sciences/ plant culture/ conservation, wildlife management and recreation/ ecological impact of water development
Abstract: A landscape ecological planning process (LEP process) is described that addresses the issues of rice production and wetland habitat conservation on privately owned rice farms in Texas. The LEP process was used to evaluate proposed land-use management plans based on alternative policies for the next US Farm Bill, which would be in effect from 2003 to 2009. A system simulation model, geographic information systems (GIS) model based on expert knowledge, as well as expert opinion, were used to evaluate uncertainty about the effects of these plans and policies on different types of farms and the quality of winter habitat of lesser snow geese. The models simulated shifts in land-use, rice and cattle production, farm profitability, and use of habitat by geese. Simulation results suggested that the level of federal subsidies for all policies influenced the continuation of rice production from 2003 to 2009. In addition, the size of the farm influenced whether rice production continued until 2009. The smaller farms were more sensitive to decreases in federal subsidies than larger farms because smaller farms received less income from goose hunting leases. Winter habitat for lesser snow geese was reduced in terms of patch size and nearest neighbor distance when rice production was discontinued by 2009 for all policies. Agricultural policy experts, who were familiar with the study sites, selected the modified version of the conservation policy as the example that would most benefit farmers and geese. The experts emphasized that their policy would offer far mers more flexibility to manage their farms, to diversify their incomes, and to be good land stewards.

1786. **Local and landscape-level influences on wetland bird communities of the Prairie Pothole Region of Iowa, USA.**
Fairbairn, S. E. and Dinsmore, J. J.
Wetlands 21(1): 41-47. (2001)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ landscape/ community composition/ prairies/ birds/ habitats/ wildlife management/ aquatic birds/ population structure/ habitat selection/ population density/ ecosystem management/ Aves/ Iowa/ Iowa/ birds
Abstract: Bird species richness and individual species densities were measured in wetland complexes in 1998. These values were then related to habitat variables within the complexes and to area of wetland habitat in the surrounding landscape. The percentage of wetland area within a complex that was covered with emergent vegetation and the total area of wetland habitat in the 3 km surrounding each complex were significant predictors of species richness. A perimeter-to-area ratio was the most frequently selected variable for inclusion in species-density models, being selected for 8 of 15 models. Five species' densities were related to the percentage of the wetland area that was covered by emergent vegetation, and 4 densities were related to the area covered by weak-stemmed wet-meadow vegetation. Densities of 5 species, as well as the overall species richness, were associated with a measure of the amount of wetland habitat within a 3-km buffer surrounding the wetland complexes. This indicates that the presence and abundance of some wetland bird species may be influenced by the amount of wetland habitat nearby. Thus, programs that encourage restoration of tracts of land that contain multiple wetland basins should be emphasized to maximize benefits to the wetland bird community.

1787. **Long-term impacts of forest road crossings of wetlands in Pennsylvania.**
Miller, R. L.; DeWalle, D. R.; Brooks, R. P.; and Finley, J. C.
Northern Journal of Applied Forestry 14(3): 109-116. (1997)
NAL Call #: SD143.N6; ISSN: 0742-6348
Descriptors: wetlands/ forests/ roads/ surveys/ habitats/ waterways/ vegetation/ land ownership/ landforms/ rivers/ width/ Pennsylvania
Abstract: A survey was conducted of 70 forest road crossings of wetlands in Pennsylvania to describe the characteristics of these crossings and to evaluate the long-term impacts of the crossings on habitat quality, channel stability, vegetation, wetland width and channel sediment embeddedness above and below the crossings. Sampling was stratified into five physiographic provinces and three land ownership types. Difficulty was encountered in identifying sites for the survey especially in the glaciated northwest region and on private and industry lands. The majority of samples obtained were from unglaciated provinces and public lands. Wetlands identified were primarily linear riparian wetlands associated with first- and second-order channels. Crossings encountered were largely gravel-covered culverts used to provide access to adjacent management areas. Only 35 of 814 comparisons of mean environmental conditions above and below the wetland crossings were found to be significant. Significant differences that did occur suggested that stream bed fine sediment levels were higher, basal area lower, and herbaceous cover higher in the immediate vicinity of some crossings simply due to the presence of the road and fill banks.
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1788. **Long term monitoring of grass shrimp Palaemonetes spp. population metrics at sites with agricultural runoff influences.**
Leight, A. K.; Scott, G. I.; Fulton, M. H.; and Daugomah, J. W.
Integrative and Comparative Biology 45(1): 143-150. (2005); ISSN: 15407063
Descriptors: Decapoda (Crustacea)/ Palaemonetes/ grass shrimp/ integrated pest management/ shrimp/ aquatic invertebrates

Abstract: Rising concern over pesticide usage near estuarine systems and evidence of physical and physiological impacts on estuarine organisms have strengthened the need to better identify the ecological effects of nonpoint source runoff. Grass shrimp, Palaemonetes spp., are ecologically important and abundant marsh inhabitants that may be impacted by anthropogenic contamination. Populations of grass shrimp were sampled monthly, over a period of ten years, at four sites in South Carolina with varying upland land use characteristics. Spatial and temporal trends in grass shrimp densities were noted over time and between sites. Agricultural and golf course land usage corresponded with decreased grass shrimp population levels, overall shrimp size, and percentage of gravid females. Conservation methods, such as the use of best management practices (BMPs) and integrated pesticide management (IPM) at agricultural fields, corresponded with increased grass shrimp population density.

1789. **Long-term response of northern pintails to changes in wetlands and agriculture in the Canadian Prairie Pothole Region.**
Podruzny, Kevin M.; DeVries, James H.; Armstrong, Llwellyn M.; and Rotella, Jay J.
Journal of Wildlife Management 66(4): 993-1010. (2002)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: commercial activities/ ecology/ population dynamics/ land and freshwater zones/ North America/ Anas acuta (Anatidae): farming and agriculture/ population size/ semiaquatic habitat/ Canada/ Canadian Prairie Pothole Region/ long term response to changes in wetlands and agriculture/ Anatidae/ Anseriformes/ Aves/ birds/ chordates/ vertebrates
Abstract: From 1955 through the late 1970s, northern pintail (Anas acuta) populations closely tracked the abundance of spring ponds. Declines in numbers of both northern pintails (hereafter, pintails) and ponds were evident during years of drought. However, since the early 1980s, the strength of the relationship between pintails and ponds has weakened greatly. Agricultural expansion on primary breeding grounds has been implicated as the cause of sustained pintail declines, but previous studies investigated pintail response only at large geographic scales (e.g., prairie-wide, stratum level). Potentially important effects of localized or multiscale changes in wetlands and agriculture on pintails are not well understood. Using data from the Canadian Prairie Pothole Region for 1961 to 1996, we investigated spatial and temporal covariation of pintail numbers with environmental factors (pond numbers and wetness indices) and agriculture at various scales. Models best supported by the data indicated that pintails responded positively to winter precipitation but with important regional variation and positively to pond numbers in some locations (southwestern Saskatchewan and southern Alberta). Results also indicated that pintail settling was better explained (increases in R^2 values of 0.05-0.06) using information about specific agricultural practices than about overall increases in farmed area. At a prairie-wide scale, we detected a negative association between settling and increased cropland area. At regional scales, settling was positively associated to various degrees with area in fallow (i.e., summerfallow - land tilled but not planted to crop in a given year). Both associations were strengthened with higher winter precipitation. Because cropland stubble is used readily as a nesting habitat by pintails and spring tillage of fields not used for summerfallow destroys nests, a shift from summerfallow to continuous cropping in the Prairie Pothole Region of Canada may have reduced the reproductive capacity of pintails in important breeding areas. In regions with characteristics that historically have attracted pintails to settle, we encourage land managers to promote agricultural practices that minimize use of spring tillage, convert cropland to perennial forages and pasture, and protect and restore wetland and upland habitat.

1790. **Macroinvertebrate abundance, water chemistry, and wetland characteristics affect use of wetlands by avian species in Maine.**
Longcore, J. R.; McAuley, D. G.; Pendelton, G. W.; Bennatti, C. R.; Mingo, T. M.; and Stromborg, K. L.
Hydrobiologia 567(1): 143-167. (2006)
NAL Call #: 410 H992; ISSN: 00188158.
Notes: doi: 10.1007/s10750-006-0055-x.
Descriptors: acidity/ avian species/ beavers/ Castor canadensis/ macroinvertebrates/ water chemistry/ waterfowl broods/ wetland characteristics/ wetland use
Abstract: Our objective was to determine use by avian species (e.g., piscivores, marsh birds, waterfowl, selected passerines) of 29 wetlands in areas with low (<200 μ eq l^{-1}) acid-neutralizing capacity (ANC) in southeastern Maine. We documented bird, pair, and brood use during 1982-1984 and in 1982 we sampled 10 wetlands with a sweep net to collect invertebrates. We related mean numbers of invertebrates per wetland to water chemistry, basin characteristics, and avian use of different wetland types. Shallow, beaver (Castor canadensis)-created wetlands with the highest phosphorus levels and abundant and varied macrophyte assemblages supported greater densities of macroinvertebrates and numbers of duck broods (88.3% of all broods) in contrast to deep, glacial type wetlands with sparse vegetation and lower invertebrate densities that supported fewer broods (11.7%). Low pH may have affected some acid-intolerant invertebrate taxa (i.e., Ephemeroptera), but high mean numbers of Insecta per wetland were recorded from wetlands with a pH of 5.51. Other Classes and Orders of invertebrates were more abundant on wetlands with pH > 5.51. All years combined use of wetlands by broods was greater on wetlands with pH ≤ 5.51 (77.4%) in contract to wetlands with pH > 5.51 that supported 21.8% of the broods. High mean brood density was associated with mean number of Insecta per wetland. For lentic wetlands created by beaver, those habitats contained vegetative structure and nutrients necessary to provide cover to support invertebrate populations that are prey of omnivore and insectivore species. The fishless status of a few wetlands may have affected use by some waterfowl species and obligate piscivores. © Springer 2006.

1791. **Macroinvertebrate assemblage response to highway crossings in forested wetlands: Implications for biological assessment.**
King, R. S.; Nunnery, K. T.; and Richardson, C. J.
Wetlands Ecology and Management 8(4): 243-256. (2000)
NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861
Descriptors: wildlife management: conservation/ terrestrial

ecology: ecology, environmental sciences/ biological assessment/ assessment method/ ordination tests/ statistical method/ perturbation tests/ statistical method/ Clean Water Act/ biological integrity/ biological monitoring/ bottomland forested wetlands: habitat/ chemical integrity/ community structure/ grazing/ habitat complexity/ habitat patchiness/ herbaceous detrital resources/ highway crossings/ metrics/ physical integrity/ swamps: habitat/ taxon richness: areal, numerical
Abstract: Despite the mandate of the Clean Water Act to protect the physical, chemical, and biological integrity of the USA's wetlands, the use of biota to assess wetland condition has not been well explored. During June, 1996, we evaluated the response of macroinvertebrate assemblages to fill-culvert highway crossings in two bottomland forested wetlands in North Carolina. Our objective was to apply biological assessment methods and metrics that have been effectively used in streams to explore their applicability in forested wetlands. We found significant changes in several metrics as a function of distance from the highway crossings. Areal and numerical taxon richness increased within at least 40 m of highway when compared to control locations. Percent dominant taxon values were lowest within 10 m of the highway. Percent herbivores also increased significantly within at least 40 m of the highway, reflecting the lower % crown closure and associated shift in primary production from trees to herbaceous macrophytes and algae. The North Carolina Biotic Index, a metric of tolerance, did not reflect assemblage changes near the highway. Ordination and permutation tests revealed that assemblage composition was significantly different from controls at 10 and 40 m distances from the highway crossings. In particular, algal grazers such as the mayflies Caenis sp. and Callibaetis sp. responded positively and the damselflies Ischnura spp. and the fingernail clams Sphaerium spp. responded negatively to the crossings. Favorable algal and herbaceous detrital resources, greater patchiness and habitat complexity, and overall high tolerance to natural stressors probably contributed to the increase in taxon richness near the highway. However, significant deviation from control locations indicated the highway was a source of perturbation. Our findings illustrate the potential utility of macroinvertebrate assemblages for wetland assessment, but suggest the importance of defining the reference condition as well as the need for development of metrics for specific classes of wetlands.

1792. **Macroinvertebrate response to cattail management at Cheyenne Bottoms, Kansas, USA.**
Kostecke, R. M.; Smith, L. M.; and Hands, H. M.
Wetlands 25(3): 758-763. (2005)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: recruitment/ biomass/ wetlands/ head/ hydrology/ food/ basins/ typha/ chironomidae
Abstract: Cheyenne Bottoms, Kansas, USA has been designated by the Ramsar convention as a Wetland of International Importance. However, since that 1988 designation, cattail (Typha spp.) has become the dominant plant within the basin, and migratory bird use has decreased. We examined the effects of different cattail-management treatments (burned, disked, and grazed by 5 and 20 head of cattle) on macroinvertebrates used as food resources by migratory birds. We found few differences in diversity, biomass, or density of macroinvertebrates among treatments. When differences existed, diversity, biomass, and density were greater within the control or more heavily vegetated treatments (e.g., burned) than within less vegetated treatments (e.g., disked). Macroinvertebrate densities, particularly Chironomidae, ranged from 154 to 681/m^2; however, they were up to seven times lower than historic densities and well below the 5000/m^2 that has been suggested for supporting large numbers (0.5 million) of migratory waterbirds. Thus, Cheyenne Bottoms' capacity to support migratory waterbirds may currently be reduced due to low macroinvertebrate densities in areas where cattail has invaded, as well as in areas where cattail has been managed. Research and management should be targeted at restoring the hydrology and dependent biotic communities that support migratory birds.

1793. **Macroinvertebrate response to marsh management strategies in Utah.**
Huener, J. D. and Kadlec, J. A.
Wetlands 12(2): 72-78. (1992)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wildlife management/ marshes/ water levels/ macrofauna/ ecosystem management/ population density/ Invertebrata/ Utah
Abstract: The authors examined the response of aquatic macroinvertebrates to three marsh management strategies. The three management practices compared were conventional full pool management, full pool management with carp (Cyprinus carpio) control, and contour furrowing (also with carp control). Significant differences in standing crops (both numbers and biomass) of invertebrates were observed among the three management strategies. The contour furrowed area had the highest standing crops of water column invertebrates, followed by the carp-controlled full pool area, while the conventionally managed area had the lowest standing crops. In the benthos, the two full pool areas (with and without carp) had higher standing crops than the contour furrowed area. Significant differences were noted in seasonal abundance, with all management practices having lowest densities of invertebrates in April and May. Implications for management include indications of the negative impacts of carp and winter drawdowns on invertebrates in managed marshes.

1794. **Macroinvertebrate responses to wetland restoration in northern New York.**
Brown, S. C.; Smith, K.; and Batzer, D.
Environmental Entomology 26(5): 1016-1024. (Oct. 1997)
NAL Call #: QL461.E532; ISSN: 0046-225X
Descriptors: wetlands/ environmental restoration/ New York/ macrofauna/ man-induced effects/ environmental impact/ environment management/ habitat improvement/ colonization/ community composition/ aquatic insects/ Insecta/ soil transplantation/ aquatic entomology/ reclamation/ mechanical and natural changes/ habitat community studies
Abstract: Wetlands are being restored throughout the United States in an effort to replace habitat functions lost following drainage. We studied the macroinvertebrate communities that developed in wetlands restored by the U.S. Fish and Wildlife Service and compared them to those occurring at natural wetlands in the same area. During the

3 yr of the study, most taxa found at the natural sites could also be found in similar numbers at the restored sites. Insects with aerial dispersal capability rapidly colonized the restored habitats, but some less mobile forms (noninsects and some hemipterans) either colonized more slowly or not at all. We analyzed the effects of experimental techniques for site preparation that were applied before restoration of hydrology to determine if they influenced macroinvertebrate recolonization. Transplantation of remnant wetland soil, which resulted in faster and more prolific plant growth, significantly increased overall macroinvertebrate numbers, and significantly increased the abundance of 10 specific taxonomic groups. The use of this technique, along with possible inoculation of some less mobile taxa, could improve efforts to reestablish natural macroinvertebrate communities to newly restored wetland habitats.

1795. **Management of rice fields for wetlands, water, and rice production.**
Andrews, Elizabeth S. and Williams, Philip B.
In: National Conference on Hydraulic Engineering. San Francisco, Calif.
New York: American Society of Civil Engineers; pp. 1161-1166; 1993.
NAL Call #: TC5.H824 1993; ISBN: 0872629201
Descriptors: wetlands/ waterfowl/ aquatic habitat/ rice production/ California/ Sacramento Valley
Abstract: The feasibility of managing a portion of the Sacramento Valley's rice fields as wetlands for waterfowl use, storage, and aid in rice straw decomposition was evaluated. Approximately 95% of the area's original wetlands have been lost, and populations of resident and migratory waterfowl have declined as a result of this and other pressures on the ecosystem. The analysis showed that there was significant potential to manage rice acreages in the Sacramento Valley for winter wetlands for the benefit of farmers, waterfowl, and downstream water uses, though constraints to such operation are numerous.

1796. **Managing agricultural wetlands for waterbirds in the coastal regions of Louisiana, USA.**
Huner, J. V.; Jeske, C. W.; and Norling, W.
Waterbirds 25(Special Publication 2): 66-78. (2003)
NAL Call #: QL671; ISSN: 1524-4695
Descriptors: agricultural wetlands/ artificial freshwater habitat/ coastal wetlands/ crawfish management/ crawfish ponds/ freshwater habitat/ gulf coastal plain/ land conservation programs/ migration/ riparian habitat
Abstract: Rice and/or crawfish are cultivated in over 225,000 ha of shallow earthen impoundments within 160 km of the Gulf of Mexico along the coast of Louisiana. The region includes both the Gulf Coastal Plain and Prairie and the Lower Mississippi River Valley. Annual loss of 4,475 ha of coastal wetlands in Louisiana due to subsidence, erosion, and rising sea level has significantly reduced desirable freshwater habitat in the region. The suite of resident, migrant, breeding, and wintering waterbirds depending on this region includes grebes, pelicans, cormorants, anhingas, wading birds, waterfowl, coots, rails, gallinules, shorebirds, gulls, terns, and kingfishers. These taxa utilize the artificial freshwater wetland habitat provided by the agricultural wetlands. Numerous other birds utilize riparian areas associated with these artificial wetlands. Crawfish ponds are especially valuable cool season habitat for predaceous waterbirds because they provide shallow water systems rich in invertebrate and small vertebrate prey during the period from mid-autumn through mid-spring when most rice fields are drained. Because most crawfish ponds are not drained until late spring or early summer, predictable, food-rich, shallow water waterbird habitat is available throughout the region when rice fields are being cultivated for rice production. Incorporation of crawfish management into government-sponsored land conservation programs should encourage land owners to sustain standing water habitat outside of program mandated fill/drain requirements. Farmers could adjust the times when their impoundments are filled or drained to maximize benefits to many species, especially migrating shorebirds.

1797. **Marsh impoundments for the management of wildlife and plants in Louisiana.**
Chabreck, R. H. and Junkin, G. M.
In: Marsh management in coastal Louisiana: Effects and issues.Baton Rouge, LA. Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 112-119; 1989.
NAL Call #: QH540.U562 no. 89(22)
Descriptors: marshes/ wetlands/ wildlife/ Louisiana/ wildlife habitats
Abstract: Marsh impoundments are widely used in coastal regions for improving wildlife habitats, aquaculture, water storage for agricultural irrigation and industrial uses, flooding of marshes for mosquito control, and maintenance of favorable water depths for navigation. Impoundments used to improve wildlife habitat can be categorized into 4 types by water depth and salinity regimes: permanently flooded with freshwater, manipulated freshwater, permanently flooded with brackish water, and manipulated brackish water. In certain areas, e.g. SE Louisiana, impoundment use is limited because of the fluid nature of the subsoil. -from Authors

1798. **Marsh terracing as a wetland restoration tool for creating fishery habitat.**
Rozas, L. P. and Minello, T. J.
Wetlands 21(3): 327-341. (Sept. 2001)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ intertidal environment/ habitat improvement/ marshes/ restoration/ fishery resources/ nekton/ marine crustaceans/ biomass/ population density/ terraces/ environmental restoration/ fisheries/ geological terraces/ crustaceans/ fetch/ biological sampling/ habitats/ mullet/ menhaden/ trout/ intertidal areas/ Litopenaeus setiferus/ Palaemonetes pugio/ Callinectes sapidus/ Farfantepenaeus aztecus/ Brevoortia patronus/ Mugil cephalus/ Cynoscion nebulosus/ Louisiana/ northern white shrimp/ white shrimp/ daggerblade grass shrimp/ blue crab/ gulf menhaden/ striped mullet/ spotted seatrout/ restoration/ protective measures and control/ conservation and environmental protection/ reclamation
Abstract: Terracing is a relatively new wetland-restoration technique used to convert shallow subtidal bottom to marsh. This method uses existing bottom sediments to form terraces or ridges at marsh elevation. A terrace field is constructed by arranging these ridges in some pattern that maximizes intertidal edge and minimizes fetch between

ridges; the intertidal area is planted with marsh vegetation. We examined the habitat value of terracing for fishery species at Sabine National Wildlife Refuge, Louisiana (USA) in spring and fall 1999 by quantifying and comparing nekton densities in a 9-yr-old terrace field and nearby reference area using a 1-m^2 drop sampler. Decapod crustaceans were more abundant than fishes, composing 62% and 95% of all organisms we collected in spring and fall, respectively. White shrimp Litopenaeus setiferus, dagger-blade grass shrimp Palaemonetes pugio, blue crab Callinectes sapidus, and brown shrimp Farfantepenaeus aztecus accounted for 94% of all crustaceans, whereas 60% of all fishes were gulf menhaden Brevoortia patronus. Mean densities of white shrimp (fall), daggerblade grass shrimp, blue crab, and brown shrimp (spring) were significantly greater in terrace marsh than on non-vegetated bottom in the reference pond. Densities of most nekton on non-vegetated bottom were similar in the terrace field and the reference pond, but gulf menhaden and white shrimp had higher densities at terrace pond sites and brown shrimp (spring) were more abundant at reference pond sites. The pattern for biomass was similar to that for density in that the mean biomass of most species was significantly greater at terrace marsh sites than reference pond sites and similar at terrace and reference pond sites. Terrace marsh, however, was not functionally equivalent to natural marsh, as mean densities of daggerblade grass shrimp (fall), brown shrimp (spring), and blue crab and mean biomass of white shrimp (fall), striped mullet Mugil cephalus (spring), and spotted seatrout Cynoscion nebulosus (fall) were greater at reference marsh sites than terrace marsh sites. Using these density and biomass patterns and the percentage of marsh and pond area in the terrace field, we concluded that terrace fields support higher standing crops of most fishery species compared with shallow marsh ponds of similar size. Future restoration projects could include design changes to increase the proportion of marsh in a terrace field and enhance the habitat value of marsh terraces for fishery species.

1799. **Microhabitat association of Blanding's turtles in natural and constructed wetlands in southeastern New York.**
Hartwig, T. S. and Kiviat, E.
Journal of Wildlife Management 71(2): 576-582. (Apr. 2007)
NAL Call #: 410 J827
Descriptors: wildlife management/ wild animals/ turtles/ constructed wetlands/ wildlife habitats/ Emydidae/ wetlands/ habitat conservation/ radio frequency identification/ vegetation cover/ Cephalanthus occidentalis/ water temperature/ spring/ summer/ foraging/ submerged aquatic plants/ endangered species/ habitat destruction/ population size/ New York/ Emydoidea blandingii
Abstract: We studied Blanding's turtle (Emydoidea blandingii) microhabitat in natural wetlands and wetlands constructed for the turtles in Dutchess County, New York, USA. Investigation of these topics can provide information on ways to increase the extent of Blanding's turtle habitat, improve its quality, and assure that conservation or restoration managers do not overlook key habitat characteristics. Microhabitat was determined by radiotracking individuals to their exact locations and recording habitat variables. Blanding's turtles were associated with shallow water depths ($\bar{x}$ = 30 cm), muck substrates, and areas of abundant vegetation (total cover $\bar{x}$ = 87%). Buttonbush (Cephalanthus occidentalis) had the greatest mean total cover (29%). In the constructed wetlands, Blanding's turtles were associated with significantly less cover and warmer water than in the natural wetlands. Blanding's turtles appeared to be using the constructed wetlands to bask and forage in the spring and early summer but moved to deeper wetlands in late summer when the constructed wetlands dried up or became too warm. For Blanding's turtles, new habitat should contain abundant emergent vegetation (including buttonbush in Dutchess County and other areas where the turtles are known to use buttonbush swamps), basking areas, muck, floating plant material, and submerged aquatic vegetation. Blanding's turtle's use of constructed wetlands highlights the value of a complex of connected wetland habitats in providing for the varied needs of the turtle.
This citation is from AGRICOLA.

1800. **Migrant shorebird predation on benthic invertebrates along the Illinois River, Illinois.**
Hamer, G. L.; Heske, E. J.; Brawn, J. D.; and Brown, P. W.
Wilson Journal of Ornithology 118(2): 152-163. (2006)
NAL Call #: QL671.W55 ; ISSN: 15594491.
http://www.bioone.org/archive/1559-4491/118/2/pdf/i1559-4491-118-2-152.pdf
Descriptors: shorebirds/ wetlands/ invertebrates/ predation/ wildlife habitat/ Illinois
Abstract: We evaluated the effect of shorebird predation on invertebrates at a wetland complex along the Illinois River, west-central Illinois, during spring migration. Using a new exclosure experiment design adapted to the shifting nature of foraging microhabitat of interior wetlands, we found that shorebird predation did not significantly deplete total invertebrate density or total biomass in open (no exclosure) versus exclosure treatments. Chironomids and oligochaetes were the most common invertebrates occurring in substrate samples. The density of oligochaetes was lower in open treatments, though the degree of difference varied both spatially and temporally. Shorebird density was positively correlated with the amount of invertebrate biomass removed from the substrate during the late-May sampling period. Our results suggest that shorebirds use an opportunistic foraging strategy and consume the most abundant invertebrate prey. The dynamic hydrology at our study site likely played a role in preventing invertebrate depletion by continually exposing new foraging areas and prey.

1801. **Migratory bird responses to grazing.**
Wetlands Reserve Program Grasslands Workgroup Natural Resources Conservation Service, U.S. Department of Agriculture, 2005.
ftp://ftpfc.sc.egov.usda.gov/NHQ/ecs/Wild/WRPgrassland.pdf
Descriptors: grazing/ birds/ environmental impact/ wetlands/ Wetlands Reserve Program/ grasslands

1802. **Mine-drainage treatment wetland as habitat for herptofaunal wildlife.**
Lacki, M. J.; Hummer, J. W.; and Webster, H. J.
Environmental Management 16(4): 513-520. (1992)
NAL Call #: HC79.E5E5 ; ISSN: 0364-152X
Descriptors: constructed wetlands/ wildlife habitat/ herptofauna/ amphibians/ reptiles
Abstract: Land reclamation techniques that incorporate habitat features for herptofaunal wildlife have received little attention. We assessed the suitability of a wetland, constructed for the treatment of mine-water drainage, for supporting herptofaunal wildlife from 1988 through 1990 using diurnal and nocturnal surveys. Natural wetlands within the surrounding watershed were also monitored for comparison. The treatment wetland supported the greatest abundance and species richness of herptofauna among the sites surveyed. Abundance was a function of the frog density, particularly green frogs (Rana clamitans) and pickerel frogs (R. palustris), while species richness was due to the number of snake species found. The rich mix of snake species present at the treatment wetland was believed due to a combination of an abundant frog prey base and an amply supply of den sites in rock debris left behind from earlier surface-mining activities. Nocturnal surveys of breeding male frogs demonstrated highest breeding activity at the treatment wetland, particularly for spring peepers (Hyla crucifer). Whole-body assays of green frog and bullfrog (R. catesbeiana) tissues showed no differences among sites in uptake of iron, aluminum, and zinc; manganese levels in samples from the treatment wetland were significantly lower than those from natural wetlands. These results suggest that wetlands established for water quality improvement can provide habitat for reptiles and amphibians, with the species composition dependent on the construction design, the proximity to source populations, and the degree of acidity and heavy-metal concentrations in drainage waters.

1803. **Modeling habitat change in salt marshes after tidal restoration.**
Boumans, R. M.; Burdick, D. M.; and Dionne, M.
Restoration Ecology 10(3): 543-555. (Sept. 2002)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: hydrology/ salt marshes/ human impact/ tides/ topography/ coastal zone management/ restoration/ man-induced effects/ plant populations/ vegetation cover/ tidal effects/ tidal currents/ United States, New England/ reclamation/ conservation, wildlife management and recreation/ ecosystems and energetics
Abstract: Salt marshes continue to degrade in the United States due to indirect human impacts arising from tidal restrictions. Roads or berms with inadequate provision for tidal flow hinder ecosystem functions and interfere with self-maintenance of habitat, because interactions among vegetation, soil, and hydrology within tidally restricted marshes prevent them from responding to sea level rise. Prediction of the tidal range that is expected after restoration relative to the current geomorphology is crucial for successful restoration of salt marsh habitat. Both insufficient (due to restriction) and excessive (due to subsidence and sea level rise) tidal flooding can lead to loss of salt marshes. We developed and applied the Marsh Response to Hydrological Modifications model as a predictive tool to forecast the success of management scenarios for restoring full tides to previously restricted areas. We present an overview of a computer simulation tool that evaluates potential culvert installations with output of expected tidal ranges, water discharges, and flood potentials. For three New England tidal marshes we show species distributions of plants for tidally restricted and nonrestricted areas. Elevation ranges of species are used for short-term (<5 years) predictions of changes to salt marsh habitat after tidal restoration. In addition, elevation changes of the marsh substrate measured at these sites are extrapolated to predict long-term (>5 years) changes in marsh geomorphology under restored tidal regimes. The resultant tidal regime should be designed to provide habitat requirements for salt marsh plants. At sites with substantial elevation losses a balance must be struck that stimulates elevation increases by improving sediment fluxes into marshes while establishing flooding regimes appropriate to sustain the desired plants.

1804. **Modelling self-design of the aquatic community in a newly created freshwater wetland.**
Metzker, K. D. and Mitsch, W. J.
Ecological Modelling 100(1-3): 61-86. (1997)
NAL Call #: QH541.15.M3E25; ISSN: 0304-3800
Descriptors: wetlands/ marshes/ freshwater fish/ community composition/ ecological succession/ climax community/ fish/ evolution/ fish populations/ community development/ Ohio/ Pisces/ models/ community structure
Abstract: A dynamic simulation model was constructed to predict the natural development of a fish community in a recently constructed, freshwater marsh in the midwestern USA, and to determine which forces are significant in shaping the self-design trajectory of the fish community. The model allowed immigration of five species of fishes from a nearby river into the constructed wetland system and allowed them to interact with each other as well as with the other biotic components of the wetland. Imported fishes included Micropterus salmoides, Lepomis macrochirus, Lepomis cyanellus, Cyprinus carpio and Ameirus natalis. These species were chosen because each is common in the nearby river and because each possesses physiological characteristics allowing survival in typical marsh conditions. Each species population was divided into three distinct ontogenetic stages and were graduated into the next ontogenetic stage as the normal consequence of growth. Modelled interactions included intra and interspecific competition; predation; feeding; reproduction; fish effects on system abiotic components (e.g., bioturbation) and mortality. The fish community underwent several major changes in structure during the first 4 years of its simulated existence, before establishing a stable structure. Under environmental conditions prevailing in the system, the fish community always evolved toward a stable state with a high-biomass population dominated by Cyprinus carpio and a smaller population of Ameirus natalis. If the effects of suboptimal environmental conditions were removed, then the system always evolved toward a low-biomass state consisting entirely of Micropterus salmoides. The role of chance was also tested and resulted in significant short term modifications to the community structure; however, these changes decreased in magnitude and were insufficient to prevent attainment of either of the two alternate steady states. These results indicate that the fish community in wetlands has a strong self-design trajectory,

tending toward almost complete dominance by Cyprinus carpio unless typical wetland environmental conditions were significantly ameliorated.

1805. **Monitoring the hydrology of Canadian prairie wetlands to detect the effects of climate change and land use changes.**
Conly, F. M. and van der Kamp, G.
Environmental Monitoring and Assessment 67(1-2): 195-215. (2001)
NAL Call #: TD194.E5; ISSN: 01676369.
Notes: doi: 10.1023/A:1006486607040.
Descriptors: climate change/ land use/ monitoring/ prairie pothole wetlands/ prairie wetland/ wetland hydrology/ agriculture/ climate change/ ecology/ hydrology/ wetlands/ sloughs/ environmental engineering/ climate change/ environmental monitoring/ hydrological response/ land use change/ wetland/ environmental monitoring/ climate/ conservation of natural resources/ ecosystem/ water movements/ Canada/ Anas/ Anas sp./ Anatidae
Abstract: There are millions of small isolated wetlands in the semi-arid Canadian prairies. These 'sloughs' are refuges for wildlife in an area that is otherwise intensively used for agriculture. They are particularly important as waterfowl habitat, with more than half of all North American ducks nesting in prairie sloughs. The water levels and ecology of the wetlands are sensitive to atmospheric change and to changes of agricultural practices in the surrounding fields. Monitoring of the hydrological conditions of the wetlands across the region is vital for detecting long-term trends and for studying the processes that control the water balance of the wetlands. Such monitoring therefore requires extensive regional-scale data complemented by intensive measurements at a few locations. At present, wetlands are being enumerated across the region once each year and year-round monitoring is being carried out at a few locations. The regional-scale data can be statistically related to regional climate data, but such analyses cast little light on the hydrological processes and have limited predictive value when climate and land use are changing. The intensive monitoring network has provided important insights but it now needs to be expanded and revised to meet new questions concerning the effects of climate change and land use.

1806. **Muskrat abundance, distribution, and herbivory within cattail-dominated coastal wetlands: Effects of water level manipulation.**
Toner, J. A.; Farrell, J. M.; and Leopold, D. J.
In: Global threats to large lakes: Managing in an environment of instability and unpredictability. Chicago, IL International Lake Environment Committee (eds.); pp. 48; 2003.
Notes: 46th Conference on Great Lakes Research and 10th World Lake Conference.
Descriptors: aquatic plants/ cattails/ marshes/ muskrats/ quantitative distribution/ shallow water/ vegetation/ water control/ water level fluctuations/ water management/ water levels/ wetlands/ Ondatra zibethicus/ Typha/ Canada, Quebec, St. Lawrence R.
Abstract: Water level management of aquatic ecosystems has cumulative, long-term impacts on wetland communities. Stabilization of St. Lawrence River (SLR) water levels is proposed to have created dense cattail (Typha spp.) stands where diverse shallow water marsh communities historically existed. Cattail expansion and dominance may also be related to important herbivore populations, such as the muskrat (Ondatra zibethicus). We hypothesize that current SLR water level regulations limit muskrat abundance, distribution, and subsequent herbivory effects within cattail-dominated marshes. To test this hypothesis, we evaluated muskrat populations in wetlands where water levels are raised by water control structures (managed) and wetlands where the International Joint Commission (IJC) regulates water levels. Muskrat house locations were recorded with a GPS during winter censuses in 2001 and 2002. Cattail consumption estimates were developed with data from vegetation surveys and house counts. Results indicate that muskrat abundance, distribution, and herbivory effects are limited by IJC water level regulations. Managed wetlands have greater muskrat house densities than IJC regulated wetlands (p=0.0201). Current regulations may contribute to the dominance of cattail and reduction of fish and waterfowl habitat in SLR wetlands.

1807. **Natural flatwoods marshes and created freshwater marshes of Florida: Factors influencing aquatic invertebrate distribution and comparisons between natural and created marsh communities.**
Evans, David L.; Streever, William J.; and Crisman, Thomas L.
In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 81-104.
Notes: ISBN: 0471292583.
NAL Call #: QL365.4.A1I58
Descriptors: Invertebrata/ community structure/ natural flatwoods marshes/ population density/ natural flatwoods marshes community/ influencing factors/ comparison with created freshwater marshes/ marsh/ Florida/ natural flatwoods marshes community structure/ influencing factors and comparison with created freshwater marshes

1808. **Nest sites of ducks in grazed mixed-grass prairie in North Dakota.**
Duebbert, H. F.; Lokemoen, J. T.; and Sharp, D. E.
Prairie Naturalist 18(2): 99-108. (1986)
NAL Call #: QH540.P7; ISSN: 0091-0376
Descriptors: Symphoricarpos occidentalis/ Anas platyrhynchos/ Anas strepera/ Rosa woodsii/ Anas discors/ Anas clypeata/ Stipa viridula/ Agropyron smithii/ habitat use/ nesting success/ seasonal wetland/ grazing pressure management
Abstract: Habitat use and nesting success of seven species of dabbling ducks were evaluated in five vegetative associations within grazed mixed-grass prairie in central North Dakota. During 1976-80, 548 nests were found on 412 ha of grazed prairie for an annual average density of 27 nests/100 ha. Numbers of nests found ranged from 1/100 ha in 1977 (a drought year) to 58/100 ha in 1979 (a very wet year), reflecting the variability that may be expected in a dynamic prairie wetland environment. Nesting success ranged from an average of 23% in the western snowberry (Symphoricarpos occidentalis) association to 34% in the mixed-grass association. Forty-two percent of

the mallard (Anas platyrhynchos) nests and 35% of the gadwall (A. strepera) nests were in patches of western snowberry and/or Wood's rose (Rosa woodsii) that made up 2% of the available cover. Numbers of nests of blue-winged teal (A. discors) and northern shoveler (A. clypeata) were highest in cool-season grasses, especially green needlegrass (Stipa viridula) and western wheatgrass (Agropyron smithii). Height/density (HD) of residual cover decreased exponentially with increased grazing pressure. Use of grazed prairie by blue-winged teal was maximized when the HD of residual cover was 0.5 dm or higher, as could be maintained under light grazing. Results of this study indicated that properly grazed mixed-grass prairie can provide adequate nesting habitat for dabbling ducks. We recommend that preservation and sound ecological management be focused on large tracts of mixed-grass prairie with complexes of seasonal and semipermanent wetlands.

1809. **Nesting and foraging behavior of red-winged blackbirds in stormwater wetlands.**
Sparling, D. W.; Eisemann, J.; and Kuenzel, W.
Urban Ecosystems 10(1): 1-15. (2007)
NAL Call #: QH541.5.C6 U73; ISSN: 10838155.
Notes: doi: 10.1007/s11252-006-0009-0.
Descriptors: birds/ blackbirds/ suburban/ urban/ wildlife
Abstract: Stormwater wetlands are a common part of urban and suburban landscapes. These constructed wetlands provide first-order treatment of effluent from roads, parking lots, lawns and other surfaces. They also provide habitat for wetland-associated birds. Thus, there is a concern that birds may be attracted to potentially toxic habitats. This study assesses nesting success and forging behavior of Red-winged Blackbirds (Agelaius phoeniceus) in retention stormwater wetlands based on drainage type. Drainage categories included residential, commercial, and highway sites. Commercial sites had the lowest nesting success and the lowest diversity of invertebrate foods. Mean nest success values for all three types of wetlands, especially for highway drainages, were comparable to published values from natural wetlands. Over two years of study highway ponds collectively served as source populations whereas residential and commercial sites were population sinks in one year and sources in the other. Red-wings using highway sites had the highest foraging efficiency as determined by the frequency and duration of forays. Residential sites had the greatest human disturbance and generally had intermediate-quality habitat and nesting success. We conclude that while stormwater wetlands collect run off and accompanying pollutants, they can still be valuable habitats for nesting birds in urban and suburban areas. We recommend a few management strategies that can increase avian use of these habitats. © Springer Science+Business Media, LLC 2007.

1810. **Nongame bird use of restored wetlands in Manitowoc County, Wisconsin.**
Guggisberg, A. C. Wisconsin Department of Natural Resources, 1996. 60 p.
Descriptors: land ownership/ questionnaire/ statistics/ surveys/ vegetation
Abstract: Nongame wildlife use and vegetation were monitored on 143 restored wetlands in Manitowoc County. Included is a supplement, entitled "Wisconsin's Coastal Lake Michigan Wetland Restoration Research Program: Getting Started & Data Sheets and Instructions."

1811. **Odonates as biological indicators of grazing effects on Canadian prairie wetlands.**
Foote, Alee and Hornung, Christine L. Rice
Ecological Entomology 30(3): 273-283. (2005)
NAL Call #: QL461.E4; ISSN: 0307-6946
Descriptors: wetlands/ grazing/ vegetation/ prairies/ abundance/ indicator species/ reproductive effort/ water quality/ biodiversity/ agriculture/ aquatic insects/ emergent vegetation/ lentic environment/ ecosystem disturbance/ Scirpus acutus/ Zygoptera/ Odonata/ Canada, Alberta/ damselflies/ dragonflies
Abstract: 1. Aquatic macro-invertebrates have frequently been used as biological indicators in lotic environments but much less commonly so in lentic habitats. Dragonflies and damselflies (Order Odonata) satisfy most selection criteria for lentic bioindicators of grazing impacts. 2. Intensive cattle grazing affects most of the Canadian prairie pothole region but the effects of grazing on wetlands are poorly understood. 3. Here the vegetation structure and invertebrate community composition of 27 prairie potholes in Alberta, Canada were studied and compared. Wetlands were evenly divided into three treatments of different grazing regimes. 4. Removal of emergent vegetation by cattle grazing decreased odonate abundance and reproductive effort. Shorter Scirpus acutus stems resulted in significantly fewer damselflies (Suborder Zygoptera) and lower reproductive efforts. 5. Overall odonate diversity was affected by the height of key plant species, highlighting the importance of the vegetation structure of both emergent vegetation for breeding and adjacent upland vegetation for nocturnal roosts. Wetland vegetation structure was more important than vegetation composition to the life history of odonates. 6. Wetland water quality parameters of nitrogen, phosphorus, total dissolved solids (TDS), and chlorophyll-a concentration did not change due to the presence of grazing cattle at wetlands so water quality influences were rejected as mechanisms of change. 7. Larval odonate diversity and abundance was positively correlated with overall aquatic macro-invertebrate diversity and abundance, hence it was concluded that the larval odonate community can be an accurate bioindicator of intactness and diversity of overall aquatic macro-invertebrate communities in Canadian prairie wetlands.

1812. **Organochlorine pesticides and polychlorinated biphenyls in sediment and fish from wetlands in the north central United States.**
Martin, D. B. and Hartman, W. A.
Journal of the Association of Official Analytical Chemists 68(4): 12-17. (1985)
NAL Call #: 381 As7; ISSN: 0004-5756
Descriptors: biomagnification/ polychlorinated biphenyls/ organochlorines/ animals/ chromatography, gas/ fishes [metabolism]/ insecticides/ soil pollutants/ water pollutants, chemical/ United States, north central region
Abstract: Sediment samples collected in 1980-1982 from riverine and pothole wetlands at 17 locations in the north central United States were analyzed for organochlorine pesticides, certain of their metabolites, and polychlorinated

biphenyls (PCBs). Concentrations were above minimum detection levels (5 ng/g of organochlorines and 20 ng/g of PCBs) in less than 4% of the samples taken. Fish samples taken at 9 of these 17 locations, and analyzed for the same compounds, showed a higher frequency of detectable contaminants. The most common compound found in fish was DDE, which was found in 51% of the samples at levels up to 512 ng/g. alpha-BHC was present at concentrations of 5 to 27 ng/g in 36% of the fish samples, and DDD was found at levels of 5 to 60 ng/g in 14%. Four other compounds, DDT, dieldrin, PCB, and trans-nonachlor, were detected in fish at relatively low concentrations in less than 10% of the samples. This survey, thus, indicated little contamination by organochlorine pesticides or PCBs in the wetland habitats of this region.

1813. **Organochlorine residues in ducks on playa lakes of the Texas panhandle and eastern New Mexico USA.**
Flickinger E. L. and Krynitsky A. J.
Journal of Wildlife Diseases 23(1): 165-168. (1987)
NAL Call #: 41.9 W64B; ISSN: 0090-3558
Descriptors: DDT/ heptachlor/ insecticide/ nontarget organism

1814. **An overview of major wetland functions and values.**
Sather, J. H.; Smith, R. D.; and Western Energy and Land Use Team (Sept. 1984).
Notes: Microfiche item number: 611-R-1; Other number: SFA 29 (4).
Descriptors: wetlands/ management/ research/ ecology/ freshwater environment/ food chains/ nutrients/ trophic interactions/ habitats/ fishery/ aquatic birds/ sociological aspects/ economics/ hydrology/ water quality/ ecology and conservation/ aquaculture, aquariology and water use

1815. **Parasitism and ecology of wetlands: A review.**
Thomas, F.; Cezilly, F.; De Meeues, T.; Crivelli, A.; and Renaud, F.
Estuaries 20(3): 646-654. (1997)
NAL Call #: GC96.E79; ISSN: 0160-8347.
Notes: Literature review.
Descriptors: wetlands/ ecosystems/ ecology/ coastal waters/ parasites/ predation/ conservation/ estuaries/ nature conservation/ species interactions: parasites and diseases/ ecology/ community studies
Abstract: Recent advances in ecology have suggested that parasites, through the spectrum of their effects, could act as key species in ecosystems. Wetlands are productive ecosystems within which parasitism is diversified. There already exists evidence for direct and indirect effects of parasites on their host species. The influence of parasites on the population ecology of hosts includes survival, castration, sexual selection, predation, and spatial distribution. Parasites can also affect the evolution of host biological diversity (i.e., genetic structure and interspecific competition) and trophic interactions between prey and predators. The key role parasites might play in the ecology of coastal waters and wetlands should be considered in conservation programs applied to such ecosystems.

1816. **Passing of northern pike and common carp through experimental barriers designed for use in wetland restoration.**
French, J. R. P.; Wilcox, D. A.; and Nichols, S. J.
Wetlands 19(4): 883-888. (Dec. 1999)
NAL Call #: QH75.A1W47; ISSN: 0277-5212.
Notes: Conference: Temperate Wetlands Restoration Workshop, Barrie, ON (Canada), 27 Nov-1 Dec 1995.
Descriptors: wetlands/ fish passages/ coasts/ land reclamation/ fish management/ carp/ fish populations/ environmental restoration/ fishways/ restoration/ ecosystem management/ population control/ body size/ freshwater fish/ Cyprinus carpio/ Esox lucius/ Ohio/ Erie L./ Metzger Marsh/ common carp/ northern pike/ European carp/ fisheries engineering/ reclamation/ conservation/ wildlife management
Abstract: Restoration plans for Metzger Marsh, a coastal wetland on the south shore of western Lake Erie, incorporated a fish-control system designed to restrict access to the wetland by large common carp (Cyprinus carpio). Ingress fish passageways in the structure contain slots into which experimental grates of varying size and shape can be placed to selectively allow entry and transfer of other large fish species while minimizing the number of common carp to be handled. We tested different sizes and shapes of grates in experimental tanks in the laboratory to determine the best design for testing in the field. We also tested northern pike (Esox lucius) because lack of access to wetland spawning habitat has greatly reduced their populations in western Lake Erie. Based on our results, vertical bar grates were chosen for installation because common carp were able to pass through circular grates smaller than body height by compressing their soft abdomens; they passed through rectangular grates on the diagonal. Vertical bar grates with 5-cm spacing that were installed across much of the control structure should limit access of common carp larger than 34 cm total length (TL) and northern pike larger than 70 cm. Vertical bar grates selected for initial field trials in the fish passageway had spacings of 5.8 and 6.6 cm, which increased access by common carp to 40 and 47 cm TL and by northern pike to 76 and 81 cm, respectively. The percentage of potential common carp biomass (fish seeking entry) that must be handled in lift baskets in the passageway increased from 0.9 to 4.8 to 15.4 with each increase in spacing between bars. Further increases in spacing would greatly increase the number of common carp that would have to be handled. The results of field testing should be useful in designing selective fish-control systems for other wetland restoration sites adjacent to large water bodies.

1817. **Past and future impacts of wetland regulations on playa ecology in the southern Great Plains.**
Haukos, D. A. and Smith, L. M.
Wetlands 23(3): 577-589. (2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ legislation/ environmental regulations/ conservation/ education/ government regulations/ government policy/ playas/ regulations/ solid wastes/ feedlot runoff/ excavation/ aquifers/ watersheds/ groundwater recharge/ municipal wastewater/ urban planning/ degradation/ surface drainage/ nature conservation/ Southern Great Plains/ Texas/ New Mexico/ playas

Abstract: Playa wetlands provide functions critical to the existence of life on the High Plains portion of the Great Plains, including surface drainage, aquifer recharge, and wildlife habitat. These small, circular, isolated depressional wetlands with closed watersheds have a dynamic, unpredictable hydroperiod, which is essential to the maintenance of biodiversity. Most numerous in the Southern High Plains of northwestern Texas and eastern New Mexico, playas have been impacted by sedimentation, pit excavation, road construction, industrial and municipal wastewater, feedlot runoff, urban development, overgrazing, and deliberate filling. Despite being declared, as a wetland class, jurisdictional 'waters of the United States' since 1977, regulations and laws for conservation of wetland functions have seldom been applied to playas. The January 2001 Supreme Court decision, Solid Waste Agency of Northern Cook County (SWANCC) v. United States Army of Corps of Engineers, likely eliminated federal regulation of impacts covered by the Clean Water Act in all but a few playas. Although still subject to the Federal 'Swampbuster' provision enacted by the 1985 Food Security Act, extended natural dry periods allows for frequent cultivation and other activities in playas without incurring violation, contributing to the continued degradation of playa functions. None of the states with significant numbers of playas have regulations for the conservation of playa functions. Suggestions for the successful future conservation of playas and their associated functions include (1) increased promotion and implementation of existing federal and state conservation programs specifically for playas; (2) proposed state regulations for playa conservation; (3) recognition of agricultural impacts on wetland determinations; (4) creation of Wetland Management Districts to preserve intact, functioning playas; and (5) increased public education on the value of playas.

1818. **Patterns and dynamics of shorebird use of California's Central Valley.**
David Shuford, W.; Page, G. W.; and Kjelmyr, J. E.
Condor 100(2): 227-244. (1998)
NAL Call #: QL671.C6; ISSN: 0021-8901
Descriptors: wetlands/ conservation/ distribution/ habitat use/ Pacific Flyway/ ricelands/ seasonal abundance
Abstract: Surveys of California's Central Valley between 1992-1995 document it as one of the most important regions in western North America to migratory and wintering shorebirds. Populations averaged 134,000 individuals in August, 211,000 in November, 303,000 in January, and 335,000 in April. Of 33 species, the 10 or 11 that averaged over 1,000 individuals each season accounted for 99% of total numbers. Managed wetlands, agricultural fields (especially rice), and agricultural evaporation ponds held the most shorebirds. Species varied their seasonal, geographic, and habitat use of the Central Valley, primarily in response to changes in water availability from rainfall or management practices and latitudinal variation in habitat availability mediated, in part, by climate. In the record rainfall year of 1994-1995, shorebird numbers increased 74% between November and January, primarily from coast-to-interior movements of the Dunlin (Calidris alpina) and Long-billed Dowitcher (Limnodromus scolopaceus) and local habitat shifts of Killdeer (Charadrius vociferus). Although the Valley's shorebirds face threats from poor or toxic water quality, changing agricultural practices, and habitat loss to urbanization, they should benefit from current efforts to increase flooding of rice fields and to secure a stable high quality water supply for wetlands. Development of a sound conservation strategy is crucial for the preservation of shorebird populations in the Central Valley, as this agriculturally-dominated landscape is among the most altered in North America and remains vulnerable to strong economic and population growth pressures that may impact shorebird habitats in the future.

1819. **Physical, chemical, and biological data for detailed study of irrigation drainage in the middle Green River Basin, Utah, 1988-89, with selected data for 1982-87.**
Peltz, L. A. and Waddell, B.
Denver, Colo.: U.S. Geological Survey; Open-File Report 91-530, 1991. 213 p.
Descriptors: wetlands/ water quality/ water pollution sources/ nonpoint pollution sources/ Utah/ selenium/ irrigation/ drainage water/ sediments/ plants/ waterfowl/ fish/ invertebrates/ water measurement/ data collections/ irrigation
Abstract: Physical, chemical, and biological data were collected in the middle Green River basin, eastern Utah, between 1988 and 1989, as part of a detailed study of the effects of irrigation drainage on wetlands areas. Data-collection efforts were concentrated in the Stewart Lake Waterfowl Management Area near Jensen, and Ouray National Wildlife Refuge near Ouray. Data also were collected from Ashley Creek near Vernal, Pelican Lake near Ouray, and in Pariette Wetlands near Myton. A limited quantity of data collected during earlier studies (1982-87), funded by the U.S. Fish and Wildlife Service, also is included. This report contains data needed to assess the effects of selenium and other potentially toxic contaminants on streams and wetlands. Data consist of concentrations of trace elements and common elements in samples of water, sediments, plants, waterfowl, birds, fish, and invertebrates. Other data presented in the report are groundwater levels, surface water discharges, radiochemical constituents in water, analyses of organochlorine compounds in biota, and morphometric measurements of biota. (USGS)

1820. **Phytoplankton primary production and photosynthetic parameters in reservoirs along a gradient of watershed land use.**
Knoll, Lesley B.; Vanni, Michael J.; and Renwick, William H.
Limnology and Oceanography 48(2): 608-617. (2003); ISSN: 0024-3590
Descriptors: freshwater ecology/ chlorophyll/ nonvolatile suspended solids/ multiple regression/ agriculture/ cropland area/ dam outflows/ irradiance/ land use gradients/ light attenuation/ light limitation/ light saturation/ photosynthetic parameters/ primary production/ reservoirs/ stream inflows/ water depth/ watersheds
Abstract: We investigated how watershed land use (a gradient of agricultural vs. forested land) relates to phytoplankton primary production (PPr) and photosynthetic parameters in 12 reservoirs in Ohio and examined spatial variation in these parameters. Shallow sites near stream inflows had higher light attenuation, total phosphorus (TP), chlorophyll, nonvolatile suspended solids (NVSS), light-

saturated photosynthesis (PmB), and volumetric PPr than deeper sites near dam outflows, but areal PPr and the initial slope of the photosynthesis-irradiance curve (alphaB) were not significantly different between sites. Mean mixed layer irradiance and the severity of light limitation did not differ between sites because shallower depths compensated for higher light attenuation at inflow sites. Watershed land use (percent agriculture) was only weakly (but significantly) related to mean annual PPr, TP, and chlorophyll, but there was a well-defined upper limit to the effect of land use on all three of these parameters. Multiple regression showed that inclusion of additional watershed factors (the ratio of watershed land area to reservoir volume and the ratio of cropland area to number of livestock) greatly increased the variance explained compared to land use alone. TP and chlorophyll were highly correlated with each other and with PPr. Comparison of our TP-chlorophyll, TP-PPr, and chlorophyll-PPr regressions with those of other studies suggests that reservoirs have lower PPr per unit TP than natural lakes, probably because of lower light intensity and higher concentrations of nonalgal P in reservoirs.

1821. **Plant and animal community responses to restored Iowa wetlands.**
LaGrange, Theodore G. and Dinsmore, James J.
Prairie Naturalist 21(1): 39-48. (1989)
NAL Call #: QH540.P7; ISSN: 0091-0376
Descriptors: wetlands/ communities/ ecosystems/ habitat management/ habitat surveys/ management/ plants/ wildlife/ Iowa

1822. **Plant community composition and biomass in Gulf Coast Chenier Plain marshes: Responses to winter burning and structural marsh management.**
Gabrey, S. W. and Afton, A. D.
Environmental Management 27(2): 281-293. (2001)
NAL Call #: HC79.E5E5; ISSN: 0364152X.
Notes: doi: 10.1007/s002670010149.
Descriptors: burning/ coastal marshes/ Gulf Coast Chenier Plain/ Louisiana/ marsh process/ plant biomass/ plant community/ productivity/ structural marsh management/ biomass/ coastal zones/ plants (botany)/ productivity/ wetlands/ nutrient cycles/ environmental impact/ biomass/ community composition/ habitat management/ marsh/ plant community/ prescribed burning/ primary production/ environmental management/ conservation of natural resources/ fires/ United States/ Anatidae
Abstract: Many marshes in the Gulf Coast Chenier Plain, USA, are managed through a combination of fall or winter burning and structural marsh management (i.e., levees and water control structures; hereafter SMM). The goals of winter burning and SMM include improvement of waterfowl and furbearer habitat, maintenance of historic isohaline lines, and creation and maintenance of emergent wetlands. Although management practices are intended to influence the plant community, effects of these practices on primary productivity have not been investigated. Marsh processes, such as vertical accretion and nutrient cycles, which depend on primary productivity may be affected directly or indirectly by winter burning or SMM. We compared Chenier Plain plant community characteristics (species composition and above- and belowground biomass) in experimentally burned and unburned control plots within impounded and unimpounded marshes at 7 months (1996), 19 months (1997), and 31 months (1998) after burning. Burning and SMM did not affect number of plant species or species composition in our experiment. For all three years combined, burned plots had higher live above-ground biomass than did unburned plots. Total above-ground and dead above-ground biomasses were reduced in burned plots for two and three years, respectively, compared to those in unburned control plots. During all three years, belowground biomass was lower in impounded than in unimpounded marshes but did not differ between burn treatments. Our results clearly indicate that current marsh management practices influence marsh primary productivity and may impact other marsh processes, such as vertical accretion, that are dependent on organic matter accumulation and decay.

1823. **Plant composition and erosion potential of a grazed wetland in the Salmon River subbasin, Idaho.**
Hopfensperger, K. N.; Wu, J. Q.; and Gill, R. A.
Western North American Naturalist 66(3): 354-364. (2006)
NAL Call #: QH1.G7; ISSN: 1527-0904
Descriptors: botanical composition/ erosion/ forbs/ geographical information systems/ grassland management/ grasslands/ grazing/ introduced species/ livestock/ meadows/ riparian grasslands/ shrubs/ spatial variation/ species diversity/ species richness/ stand structure/ Universal Soil Loss Equation/ water erosion/ watersheds/ wetlands/ grasses/ Poaceae
Abstract: Wetlands are dynamic habitats with many unique, important functions including filtering sediments and providing diverse habitats for fish and wildlife. Wetlands in the western United States are particularly important because they offer habitat for a number of protected runs of endangered fish species. Historically, livestock grazing has altered wetland and riparian area form and function by facilitating exotic species invasions, altering spatial heterogeneity of vegetation, and increasing erosion. In this study, we examined the vegetation structure and erosion potential in a wetland meadow exposed to unregulated grazing along Deer Creek in the Salmon River subbasin, Idaho, USA. We characterized the vegetation composition and structure within the study area and attempted to assess potential erosion conditions using the Revised Universal Soil Loss Equation (RUSLE) with geographical information system, an empirical approach developed by the U.S. Department of Agriculture-Agricultural Research Service. Historically, the riparian vegetation in the study region was dominated by graminoids and forbs. The current wetland meadow is dominated by forbs blended with few sedges and grasses that are all listed as wetland indicators by the USFWS. The Salmon River subbasin also includes subalpine meadow, broadleaf riparian vegetation and shrub-dominated riparian vegetation. We found no significant spatial variability in species richness and noted a moderate number of exotic species in the total plant composition. Plant cover was higher near slightly entrenched banks, indicating that uncontrolled livestock were primarily occupying gently sloped streambanks and the interior of the meadow. Based on current vegetation composition and RUSLE results, uncontrolled grazing may be negatively impacting the study

area. If uncontrolled grazing were excluded or carefully managed in the wetland meadows of the upper portion of the Deer Creek watershed, a reduction in excess sediments to Deer Creek may occur.

1824. **Plant succession and greentree reservoir management: Implications for management and restoration of bottomland hardwood wetlands.**
King, Sammy L. and Allen, James A.
Wetlands 16(4): 503-511. (1996)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: plants/ Plantae/ plants/ bottomland hardwood wetlands/ conservation/ greentree reservoir management/ plant succession/ vegetation establishment/ wetlands management/ wetlands restoration
Abstract: Bottomland hardwood forests are distributed along rivers and streams throughout the central and eastern United States, with the greatest concentration in the Southeast. Past and projected losses of bottomland hardwoods and degradation of remaining stands suggest that habitat management and/or restoration strategies that target multiple species and multiple uses will be necessary to maintain, enhance, and restore flora and fauna within bottomland hardwood wetlands. A greentree reservoir is a current management strategy that entails manipulating water regimes to provide habitat for wintering waterfowl. We conducted a literature review and synthesis to determine the potential impacts of greentree reservoir management on plant succession within bottomland hardwood wetlands. Greentree reservoirs can impact vegetation establishment through several processes. Despite shortcomings of greentree reservoirs, designs similar to them could be very beneficial in restoring bottomland hardwood plant and animal communities from degraded forests provided water-level control and maintenance are substantially improved. Emulation of natural hydrologic regimes, including natural variability, could produce diverse bottomland hardwood plant communities and provide habitat for a variety of wildlife species.

1825. **Playas of the Southern High Plains: The macroinvertebrate fauna.**
Hall, Dianne L.; Sites, Robert W.; Fish, Ernest B.; Mollhagen, Tony R.; Moorhead, Daryl L.; and Willig, Michael R.
In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 635-665.
Notes: ISBN: 0471292583.
NAL Call #: QL365.4.A1I58
Descriptors: Macroinvertebrata/ habitat management/ playa lakes overview/ food webs/ community structure/ playa lakes/ emigration/ immigration/ playa lakes fauna overview/ habitat colonization/ playa lakes colonization patterns/ temporary water/ Southern Great Plains/ playa lakes community ecology and conservation

1826. **Postbreeding movements of American avocets and implications for wetland connectivity in the western Great Basin.**
Plissner, J. H.; Haig, S. M.; and Oring, L. W.
Auk 117(2): 290-298. (2000)
NAL Call #: 413.8 AU4 ; ISSN: 00048038
Descriptors: connectivity/ dispersal/ patchiness/ shorebird/ wetland management/ United States/ Recurvirostra americana
Abstract: Wetlands in the western Great Basin of the United States are patchily distributed and undergo extensive seasonal and annual variation in water levels. The American Avocet (Recurvirostra americana) is one of many shorebird species that use these wetlands as breeding and migratory stopover sites and must adjust to variable conditions. We used radio telemetry to determine postbreeding, premigratory movement patterns of avocets throughout the region. In 1996 and 1997, 185 breeding adults were captured and fitted with radio transmitters at five breeding areas in Oregon, California, and Nevada. Regular aerial and ground surveys were conducted at the five main study areas from June through September, or until all avocets had left a site. Other wetlands in the western Great Basin also were surveyed by aircraft for the presence of radio-marked birds. Fifty-six percent of radio-marked avocets were still detected in the region at least eight weeks after capture. Each of these individuals was detected at an average of 2.1 lakes (range 0 to 6), with 74% found at more than one lake system. Forty radio-marked individuals moved at least 200 km between wetlands prior to migration, most of which dispersed northward. Male and female patterns did not differ significantly. Overall, movements may be associated with a prebasic molt, exploitation of a superabundant food source in northern lakes, and reconnaissance for future breeding efforts or staging sites. These results also demonstrate wide-ranging patterns of dispersal in this species and suggest a need for the consideration of large-scale habitat connectivity issues in establishing conservation strategies for shorebirds in the western Great Basin.

1827. **Potential impact of selected agricultural chemical contaminants on a northern prairie wetland: A microcosm evaluation.**
Johnson, B. T.
Environmental Toxicology and Chemistry 5(5): 473-485. (1986)
NAL Call #: QH545.A1E58; ISSN: 0730-7268
Descriptors: wetlands/ water pollution effects/ wildlife habitats/ limnology/ agricultural chemicals/ prairies/ pesticides/ microcosms/ toxicity/ sediments/ plants/ invertebrates/ algae/ macrophytes/ growth/ productivity
Abstract: An aquatic, multicomponent microcosm simulating a northern prairie wetland was used to asses the potential effects of six extensively used agricultural pesticides. 16 3-liter aquatic microcosms were treated with three concentrations of each of the pesticides carbofuran, fonofos, phorate, atrazine, treflan and triallate. The microcosm units were incubated for 30 d in an environmental chamber, with a 16-h light:8-h dark cycle, maintained at 20 C. The laboratory protocol was designed as an initial, rapid, economical screening test to determine

the effect, but not the fate, of chemical contaminants in terms of toxicity, impaired productivity and community biochemical functions. Static acute toxicity tests with Daphnia magna and Chironomus riparius suggested that carbofuran, fonofos, phorate and triallate were very toxic to aquatic invertebrates. For D. magna the 48-h EC50 values were 48, 15, 19 and 57 microgram(µg)/L, respectively. Invertebrates viability tests indicated rapid changes in the toxicological persistence of these pesticides after microcosm interaction. Populations of D. magna were established in the 10 µg/L test concentration of carbofuran, phorate, triallate and fonofos at 1, 1, 14 and 28 d, respectively. Preexposure of the wetland sediments to either triallate or fonofos did not appear to change the relative toxicological persistence of each compound in the water column. Changes in pH, alkalinity, conductivity, dissolved oxygen, total nitrogen and total phosphorus were also observed with different pesticide treatments. Atrazine significantly reduced gross primary productivity and inhibited algal and macrophytic growth. The respiratory electron transfer system, phosphatase activity, oxygen consumption and mineralization of dissolved organic carbon were not significantly impacted by any of these pesticides in hydrosoils. However, the impact of atrazine, fonofos and triallate on invertebrates and plants in the microcosm - both key elements in wetland productivity - would suggest that caution be used in application of these pesticides in or near wetland habitats.

1828. **Potential impacts of agricultural chemicals on waterfowl and other wildlife inhabiting prairie wetlands: An evaluation of research needs and approaches.**
Grue, C. E.; DeWeese, L. R.; Mineau, P.; Swanson, G. A.; Foster, J. R.; Arnold, P. M.; Huckins, J. N.; Sheehan, P. J.; Marshall, W. K.; and Ludden, A. P.
Transactions of the North American Wildlife and Natural Resource Conference 51: 357-383. (1986)
NAL Call #: 412.9 N814; ISSN: 0078-1355
Descriptors: pesticide residues/ fertilizers/ pollution/ research/ toxicity/ waterfowl/ wildlife/ United States, Midwest/ Canada
This citation is from AGRICOLA.

1829. **Predicted distribution and characteristics of wetlands used by mallard pairs in five Great Lakes states.**
Yerkes, T.; Paige, R.; MacLeod, R.; Armstrong, L.; Soulliere, G.; and Gatti, R.
American Midland Naturalist 157(2): 356-364. (2007)
NAL Call #: 410 M58; ISSN: 0003-0031
Descriptors: animal behavior/ distribution/ habitat selection/ habitats/ models/ wetlands/ wildlife conservation/ Anas platyrhynchos/ birds
Abstract: Understanding the relationship between wetland types and waterfowl distribution in the Great Lakes States of Wisconsin, Michigan, Illinois, Indiana and Ohio is complicated because basin specific waterfowl survey data do not exist. We used data from breeding waterfowl surveys in Michigan and Wisconsin during 1993 to 2002 and digital wetland data within buffered transect routes to develop a predictive model of mallard distribution within the 5 Great Lake States. The most parsimonious model based on AICc was used to map predictive distributions of breeding mallards. Based on the positive influence of palustrine emergent, palustrine unknown and palustrine unconsolidated shore and the negative influence of palustrine forested wetlands, the highest densities of breeding mallards were predicted in southeastern Wisconsin and southeastern Michigan. Additionally, we flew helicopter surveys in spring of 2003 to characterize wetland basins used by mallard pairs. Individual pairs were observed most often on small palustrine emergent and palustrine forested wetlands. The resulting models and maps can be used by a variety of agencies to plan conservation and management actions for mallards breeding in the Great Lakes States.

1830. **Principles for management of aquatic-breeding amphibians.**
Semlitsch, R. D.
Journal of Wildlife Management 64(3): 615-631. (2000)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wildlife management/ conservation/ population dynamics/ wetlands/ ecosystem management/ breeding sites/ hydrology/ nature conservation/ land use/ Amphibia/ amphibians/ species diversity/ conservation/ habitat community studies/ conservation, wildlife management and recreation
Abstract: Coordinated efforts by ecologists and natural resource managers are necessary to balance the conservation of biological diversity with the potential for sustained economic development. Because some amphibians have suffered world-wide declines during the last 20 years, it is important to consider biologically based management strategies that will preserve local and regional populations. This paper provides a brief overview of potential threats to local and regional populations, the state of knowledge on population and landscape processes, and the critical elements needed for an effective management plan for amphibians. Local population dynamics and ecological connectivity of amphibian metapopulations must be considered in effective management plans. There are 3 critical factors to consider in a management plan (1) the number or density of individuals dispersing from individual wetlands, (2) the diversity of wetlands with regard to hydroperiod, and (3) the probability of dispersal among adjacent wetlands or the rescue and recolonization of local populations. Wetland losses reduce the total number of sites where pond-breeding amphibians can reproduce and recruit juveniles into the breeding population. Loss of small, temporary wetlands (<4.0 ha) may be especially harmful to amphibians because of their abundance and high species diversity. Alteration of wetlands, particularly hydrologic cycles, can severely impair completion of larval metamorphosis through either early pond drying (if hydroperiod is shortened) or through increased predation (if hydroperiod is lengthened or connections made with fish-infested lakes, rivers, or canals). Wetland loss also increases the distance between neighboring wetlands that is critical to metapopulation source-sink processes. Reduction in wetland density reduces the probablity that populations will be rescued from extinction by nearby source populations. Local populations cannot be considered independent of source-sink processes that connect wetlands at the landscape or regional level. Further the fragmentation of natural habitats from timber harvesting, agriculture, roads, drainage canals, or urban development impedes or prevents dispersal and decreases

the probability of wetland recolonization. If our goal is to maintain or enhance present levels of amphibian diversity, then resource managers must incorporate critical elements into plans that protect population and landscape processes thereby maintaining viable populations and communities of amphibians.

1831. **Progress in wetland restoration ecology.**
Zedler, Joy B.
Trends in Ecology and Evolution 15(10): 402-407. (2000)
NAL Call #: QH540.T742 ; ISSN: 0169-5347
Descriptors: biodiversity/ disturbance regimes/ habitat types/ invasive species/ landscape setting/ seed banks/ soil properties/ spatial scales/ temporal/ topography/ water preservation/ wetland restoration ecology

1832. **Protection of habitat for rare wetland fauna during timber harvesting in Massachusetts (USA).**
Kittredge, D. B.
Natural Areas Journal 16(4): 310-317. (1996)
NAL Call #: QH76.N37; ISSN: 0885-8608
Descriptors: wetlands/ conservation/ rare species/ environmental protection/ trees/ harvesting/ nature conservation/ aquatic organisms/ ecosystem disturbance/ environmental impact/ forestry/ environmental effects/ forest industry/ Massachusetts/ harvesting/ forest industry/ trees/ forestry/ rare species/ nature conservation/ aquatic organisms/ ecosystem disturbance/ environmental impact/ environmental effects
Abstract: The practice of harvesting timber is commonly thought of as conflicting with the protection of rare species habitat. In Massachusetts, over 5 years and more than 3,300 harvesting operations, rare wetland faunal habitat was involved 5.3% of the time (175 occurrences). The Massachusetts Natural Heritage and Endangered Species Program reviewed all proposed harvesting that involved habitat for rare wetland species and determined that operations would cause "no impact" in 58.9% of the cases, "possible impact" in 40% of the cases, and "definite impact" in 1.1% of the cases. Rare fauna whose habitat was most frequently involved were wood turtle (Clemmys insculpta), spotted turtle (Clemmys guttata), and spring salamander (Gyrinophilus porphyriticus). The Natural Heritage and Endangered Species Program recommended mitigating measures such as timing of the harvest, buffers around water bodies, improved stream crossing techniques, and other practices. In most circumstances, these were incorporated into the forest cutting plan and were made a requirement of the operation. When they were not required, the regulating agency had determined that the recommendations did not apply to the specific circumstances on the ground. In general, habitat of rare wetland faunal species is not impacted by timber harvesting in Massachusetts, and likewise, harvesting is not seriously impacted by habitat protection. Regulation of harvesting, an atlas of rare species habitats, and good communication result in protection of habitat that is compatible with harvesting.

1833. **Rapid response of macroinvertebrates to drainage management of shallow connected lakes.**
Van De Meutter, Frank; Stoks, Robby; and De Meester, Luc
Journal of Applied Ecology 43(1): 51-60. (2006)
NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: methods and techniques/ conservation/ terrestrial ecology: ecology, environmental sciences/ biodiversity/ lake restoration/ applied and field techniques/ drainage management/ applied and field techniques/ lake drainage/ applied and field techniques/ lake recolonization/ applied and field techniques/ species richness/ species diversity/ abiotic conditions/ shallow connected lake
Abstract: 1. Shallow lakes throughout the world are subject to drainage, either for fish harvesting or lake restoration. Lake drainage of fish lakes is known to improve macrophyte and zooplankton diversity, but the effect on the macroinvertebrate community is poorly known.2. In the present study, we investigated temporal trends in the macroinvertebrate community following drainage of six shallow connected lakes. Diversity increased for all macroinvertebrates (family level). Recolonization of the lakes occurred within the first year after the drainage and was supplemented with a set of species that were previously rare or did not occur in the lakes. Changes in the abiotic conditions of the lakes were small and transient, except for the decline in fish. The rapid recolonization by the species occurring before drainage is attributed to the high connectivity of our system. The appearance of supplementary species may relate to lowered fish predation, suggesting that fish were a dominant factor in shaping the communities.4. Synthesis and applications. Lake drainage has a positive effect on the diversity and richness of macroinvertebrates in shallow connected lakes. This positive effect may be due to a decline in fish predation following lake drainage in combination with a high rate of recolonization among others via connections to non-drained lakes. Lake drainage, therefore, is probably the most cost-effective lake restoration tool in shallow connected lakes. Other restoration tools may be preferable in isolated lakes where recolonization is constrained.

1834. **Reforestation of frequently flooded agricultural fields: A compendium of results from research conducted at the Lake George Wetland and Wildlife Restoration Project, Mississippi.**
Williams, H. M.; Craft, M. H.; and Young, G. L.
Vicksburg, MS.: Army Engineer Waterways Experiment Station; WES/TR/WRP-RE-18, 1997.
Notes: NTIS accession number: ADA3311321.
Descriptors: wetlands/ flood plains/ agriculture/ land use/ reclamation/ ecosystem management/ environment management/ plant populations/ vegetation cover/ habitat/ Mississippi, George L./ bottomland hardwood reforestation/ habitat community studies/ conservation, wildlife management and recreation
Abstract: The objective of the Lake George Bottomland Hardwood Wildlife and Wetland Restoration Project is to restore functioning bottomland hardwood wetland habitat by reforesting 3,600 ha of agricultural fields located in the Mississippi Delta. The Lake George Project provided an opportunity to conduct applied research on several bottomland hardwood reforestation topics. University and

Federal agency scientists conducted studies on matching tree species to the site, selecting plant stock type, selecting when to plant, and monitoring early habitat development following planting.

1835. **A regional assessment of salt marsh restoration and monitoring in the Gulf of Maine.**
Konisky, R. A.; Burdick, D. M.; Dionne, M.; and Neckles, H. A.
Restoration Ecology 14(4): 516-525. (2006)
NAL Call #: QH541.15.R45R515; ISSN: 10612971.
Notes: doi: 10.1111/j.1526-100X.2006.00163.x.
Descriptors: estuary/ monitoring protocol/ regional assessment/ salt marsh/ tidal restoration
Abstract: We compiled salt marsh monitoring datasets from 36 complete or imminent restoration projects in the Gulf of Maine to assess regional monitoring and restoration practices. Data were organized by functional indicators and restoration project types (culvert replacement, excavation works, or ditch plugging) then pooled to generate mean values for indicators before restoration, after restoration, and at reference sites. Monitoring data were checked against the regional standards of a voluntary protocol for the Gulf of Maine. Data inventories showed that vegetation and salinity indicators were most frequently collected (89 and 78% of sites, respectively), whereas nekton, bird, and hydrologic measures were collected at only about half of the sites. Reference conditions were monitored at 72% of sites. Indicators were analyzed to see if project sites were degraded relative to reference areas and to detect ecological responses to restoration activities. Results showed that compared to reference areas, prerestoration sites had smaller tidal ranges, reduced salinity levels, greater cover of brackish plants species, and lower cover of halophyte plants. Following restoration, physical factors rebounded rapidly with increased flood and salinity levels after about one year, especially for culvert projects. Biological responses were less definitive and occurred over longer time frames. Plant communities trended toward recovered halophytes and reduced brackish species at 3+ years following restoration. Nekton and avian indicators were indistinguishable among reference, impacted, and restored areas. The protocol was successful in demonstrating restoration response for the region, but results were limited by regional inconsistencies in field practices and relatively few multiyear datasets. To improve future assessment capabilities, we encourage greater adherence to the standard protocol throughout the Gulf of Maine salt marsh restoration community. © 2006 Society for Ecological Restoration International.

1836. **Regional patterns of wading bird productivity in northeastern U.S. estuaries.**
Parsons, K. C.; Schmidt, S. R.; and Matz, A. C.
Waterbirds 24(3): 323-330. (2001)
NAL Call #: QL671; ISSN: 07386028
Descriptors: estuaries/ northeastern United States/ predation/ productivity/ wading birds/ estuarine ecosystem/ mortality/ predation/ reproductive success/ wader/ United States/ Bubulcus ibis/ Egretta thula/ Nycticorax nycticorax/ Plegadis falcinellus
Abstract: We investigated wading bird productivity in four estuaries from Delaware Bay to Boston Harbor in northeastern U.S.A. over the period 1986-1998. To document and characterize reproductive performance of numerically dominant species for use in wildlife and habitat management planning, we recorded 1) number of eggs laid, 2) percent of eggs hatched, 3) percent of hatchlings surviving 10-15 days post-hatch, 4) number of nestlings produced, and 5) factors of offspring mortality in nests of Black-crowned Night Heron (Nycticorax nycticorax), Snowy Egret (Egretta thula), Cattle Egret (Bubulcus ibis), and Glossy Ibis (Plegadis falcinellus). We randomly selected 30-50 nests of each species (as available) for study at colonies in Delaware Bay (1993-1998), New York Harbor (1986-1994), Cape Cod (1990-94), and Boston Harbor (1993-94). In addition, we recorded abundance of nesting wading birds and avian predators in most years of study. Colony size ranged from 120-8,300 nests. Clutch size of all species was greater at northern-most sites. Loss of eggs varied between estuaries for all species except Glossy Ibis. Hatching success ranged from 75-88% and differed between estuaries for Black-crowned Night Heron and Glossy Ibis. Hatchling survival ranged from 16-87% and was lowest in Delaware Bay for all species. Nestling production was lowest in Delaware Bay for all species. In general, predation was high in Delaware Bay and egg inviability was high in Boston Harbor. Predation of nestlings was greatest in Delaware Bay for Cattle Egret, but there were no differences between estuaries for other species. Proportions of avian predators to nesting herons did not explain high predation rates in Delaware Bay. Received 18 April 2001, accepted 21 June 2001.

1837. **Regional wetlands planning: A case study of coastal wetlands planning in the San Francisco Bay area and southern California.**
Denisoff, C. and Movassaghi, M.
In: Taking a Look at California's Ocean Resources: An Agenda for the Future. San Deigo, California. Magoon, O. R.; Converse, H.; Baird, B.; and Miller-Henson, M. (eds.); Vol. 2. Reston, Va.: American Society of Civil Engineers; pp. 1028-1037; 1998.
Notes: Case studies; Conference: California and the World Ocean '97.
Descriptors: wetlands/ marine resources/ resource management/ coastal zone management/ environment management/ regional planning/ salt marshes/ San Francisco Bay/ land reclamation/ land management/ agriculture/ estimating/ coasts/ coastal zone/ San Francisco County/ conservation, wildlife management and recreation/ coastal zone management/ conservation and environmental protection/ techniques of planning/ environmental action/ legal/ governmental
Abstract: Historically, wetland habitats were often seen only as a breeding ground for disease-carrying mosquitoes. From approximately the mid-18th century through the middle of the 20th century, the vast majority of wetlands in the United States were drained and converted into agricultural land through policies of the federal and state governments for what were the considered more "productive" uses. For example, the Federal Swamp Land Acts - National Swamp and Overflowed Land Act- of the 1800's gave 65 million acres of wetlands to 15 states, including California, for reclamation. In 1866, the California Legislature Commissioned the Board of Swamp and

Overflowed Land to manage these properties. In turn, by 1870, the majority of wetlands had been transferred to private ownership. Between 1850 and 1920, about 70 percent of California's wetlands were destroyed, largely by levee and drainage projects. These projects where in some cases subsidized to aid private developers in reclaiming swamplands for agricultural purposes, helping to make California the leading agricultural state in the Nation by 1887 (CA Department of Water Resources 1993). Estimates of wetlands that historically existed in California range from 3 to 5 million acres. The current estimate of wetland acreage in California is approximately 454,000 acres; this represents an 85 to 90 percent reduction, the greatest percentage loss in the nation.

1838. **Relationship of breeding bird density and diversity to habitat variables in forested wetlands.**
Swift, B. L.; Larson, J. S.; and DeGraaf, R. M.
Wilson Bulletin 96(1): 48-59. (1984)
NAL Call #: 413.8 W692; ISSN: 0043-5643
Descriptors: Aves/ community structure/ breeding/ forest-wetland-habitat relationships/ semiaquatic habitat/ forested wetlands/ breeding community/ Massachusetts/ Connecticut Valley/ population density/ wildlife habitat/ species diversity

1839. **Relationships between wintering waterbirds and invertebrates, sediments and hydrology of coastal marsh ponds.**
Bolduc, F. and Afton, A. D.
Waterbirds 27(3): 333-341. (2004)
NAL Call #: QL671; ISSN: 15244695
Descriptors: coastal wetlands/ Gulf of Mexico/ hydrology/ invertebrates/ sediments/ shorebirds/ wading birds/ waterfowl/ habitat management/ hydrology/ invertebrate/ population density/ sediment/ wader/ Louisiana/ North America/ Rockefeller State Wildlife Refuge/ United States/ Anas/ Anas clypeata/ Anas crecca/ Anatidae/ Anser/ Aves/ Invertebrata
Abstract: We studied relationships among sediment variables (carbon content, C:N, hardness, oxygen penetration, silt-clay fraction), hydrologic variables (dissolved oxygen, salinity, temperature, transparency, water depth), sizes and biomass of common invertebrate classes, and densities of 15 common waterbird species in ponds of impounded freshwater, oligohaline, mesohaline, and unimpounded mesohaline marshes during winters 1997-98 to 1999-2000 on Rockefeller State Wildlife Refuge, Louisiana, USA. Canonical correspondence analysis and forward selection was used to analyze the above variables. Water depth and oxygen penetration were the variables that best segregated habitat characteristics that resulted in maximum densities of common waterbird species. Most common waterbird species were associated with specific marsh types, except Green-winged Teal (Anas crecca) and Northern Shoveler (Anas clypeata). We concluded that hydrologic manipulation of marsh ponds is the best way to manage habitats for these birds, if the hydrology can be controlled adequately.

1840. **Remarkable amphibian biomass and abundance in an isolated wetland: Implications for wetland conservation.**
Gibbons, J. Whitfield; Winne, Christopher T.; Scott, David E.; Willson, John D.; Glaudas, Xavier; Andrews, Kimberly M.; Todd, Brian D.; Fedewa, Luke A.; Wilkinson, Lucas; Tsaliagos, Ria N.; Harper, Steven J.; Greene, Judith L.; Tuberville, Tracey D.; Metts, Brian S.; Dorcas, Michael E.; Nestor, John P.; Young, Cameron A.; Akre, Tom; Reed, Robert N.; Buhlmann, Kurt A.; Norman, Jason; Croshaw, Dean A.; Hagen, Cris; and Rothermel, Betsie B.
Conservation Biology 20(5): 1457-1465. (2006)
NAL Call #: QH75.A1C5 ; ISSN: 0888-8892
Descriptors: Rana sphenocephala/ southern leopard frog/ amphibian decline/ biodiversity/ drought/ land use/ wetland recovery/ biomass/ ecosystem/ amphibia [physiology]/ conservation of natural resources [methods]/ animals/ fresh water/ population density/ population dynamics/ South Carolina
Abstract: Despite the continuing loss of wetland habitats and associated declines in amphibian populations, attempts to translate wetland losses into measurable losses to ecosystems have been lacking. We estimated the potential productivity from the amphibian community that would be compromised by the loss of a single isolated wetland that has been protected from most industrial, agricultural, and urban impacts for the past 54 years. We used a continuous drift fence at Ellenton Bay, a 10-ha freshwater wetland on the Savannah River Site, near Aiken, South Carolina (U.S.A.), to sample all amphibians for 1 year following a prolonged drought. Despite intensive agricultural use of the land surrounding Ellenton Bay prior to 1951, we documented 24 species and remarkably high numbers and biomass of juvenile amphibians (>360,000 individuals; >1,400 kg) produced during one breeding season. Anurans (17 species) were more abundant than salamanders (7 species), comprising 96.4% of individual captures. Most (95.9%) of the amphibian biomass came from 232095 individuals of a single species of anuran (southern leopard frog[Rana sphenocephala]). Our results revealed the resilience of an amphibian community to natural stressors and historical habitat alteration and the potential magnitude of biomass and energy transfer from isolated wetlands to surrounding terrestrial habitat. We attributed the postdrought success of amphibians to a combination of adult longevity (often >5 years), a reduction in predator abundance, and an abundance of larval food resources. Likewise, the increase of forest cover around Ellenton Bay from <20% in 1951 to >60% in 2001 probably contributed to the long-term persistence of amphibians at this site. Our findings provide an optimistic counterpoint to the issue of the global decline of biological diversity by demonstrating that conservation efforts can mitigate historical habitat degradation.

1841. **Research and policy issues regarding coastal wetland impoundments: Lessons learned in South Carolina.**
Devoe, M. R. and Baughman, D. S.
In: Marsh management in coastal Louisiana: Effects and issues.Baton Rouge, LA. Duffy, W. G. and Clark, D. (eds.): Fish and Wildlife Service, U.S. Department of the Interior; pp. 98-106; 1989.

NAL Call #: QH540.U562 no.89(22)
Descriptors: waterfowl/ habitats/ marshes/ Louisiana/ wetlands/ impoundment/ rice production
Abstract: More than 140 000 acres along South Carolina's coastal rivers and tidal creeks were impounded for rice production during the early 1800's; 70 000 of the State's 504 000 acres of contiguous wetlands remain impounded today. Because of heightened awareness of the inherent productivity of these systems for waterfowl habitat and aquaculture, a number of property owners have submitted permit applications to State and Federal regulatory agencies to re-impound formerly impounded areas. These applications have generated a number of questions, regarding the ecology, management, and public policy of coastal impoundments, and wetlands in general. Opinions concerning the effects impoundments have on wetland processes have differed between wildlife and marine biologists. This dichotomy is especially evident within several of the 13 agencies which play a role in the decision-making process. Additionally, inconsistent decision-making has contributed to the dilemma, politics and economics play an extremely important role in the process. These and other issues have underscored the need for credible and focused research data and information on one hand and a fair, consistent, and unbiased regulatory framework on the other. -from Authors

1842. **Residual organochlorine pesticides in soils and fish from wetland restoration areas in central Florida, USA.**
Marburger, J. E.; Johnson, W. E.; Gross, T. S.; Douglas, D. R.; and Di, J.
Wetlands 22(4): 705-711. (Dec. 2002)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ soil contamination/ organochlorine compounds/ pesticides/ aquatic organisms/ Chlordane/ DDT/ Dieldrin/ tissues/ soil/ contamination/ pesticides (organochlorine)/ Florida/ rehabilitation/ water pollution/ fate of pollutants/ sediment contamination/ spatial distribution/ bioaccumulation/ fish populations/ animal tissues/ data collections/ sediment pollution/ DDE/ geographical distribution/ restoration/ pollution dispersion/ Pisces/ Ameiurus nebulosus/ Micropterus salmoides/ Pomoxis nigromaculatus/ fish/ black crappie/ largemouth bass/ brown bullhead/ freshwater pollution/ environmental impact/ sources and fate of pollution/ effects on organisms/ water pollution: monitoring, control and remediation
Abstract: Four wetland restoration sites in the Emeralda Marsh Conservation Area located in central Florida, USA were flooded between 1992 and 1994. Florida Fish and Wildlife Conservation Commission stocked largemouth bass in the flooded areas from 1992 to 1996. In 1996, organochlorine pesticides (OCPs) were measured in flooded soils and in black crappie, brown bullhead catfish, and largemouth bass from the four sites. Areas 5 and 7 had the highest concentrations of total residual OCPs in the flooded soils, including dieldrin (385 ± 241 µg/kg), sum of DDT, DDD, and DDE (7,173 ± 1,710 µg/kg), and toxaphene (39,444 ± 11,284 µg/kg). Sum of chlordane residuals was highest in area 5 (1,766 ± 1,037 µg/kg). ANOVA indicated significant differences in location and fish muscle tissue concentrations for chlordane residuals, DDT residuals, and dieldrin. Fish from areas 5 and 7 had the greatest concentrations of chlordane residuals, DDT residuals, and dieldrin, which corresponded to the higher soil concentrations in these two areas. OCPs in muscle tissue were below the U.S. Food and Drug Administration action limits for human consumption. For three-year-old bass collected from Area 5, mean concentrations of chlordane residuals, DDT residuals, and dieldrin were 15-17 times higher in ovary tissue and 76-80 times higher in fat tissue compared with muscle tissue. Mean toxaphene levels in bass ovary and fat tissues were 9 and 39 times higher, respectively, than in muscle tissues. Tissue OCP concentrations were consistent with site OCPs, regardless of fish species.

1843. **Response of a terrestrial mollusc community to an autumn prescribed burn in a rare wetland prairie of western Oregon, USA.**
Severns, Paul M.
Journal of Molluscan Studies 71(Part 2): 181-187. (2005)
NAL Call #: QL401; ISSN: 0260-1230
Descriptors: prescribed burning: applied and field techniques/ grasslands/ wetland prairie
Abstract: Conservation and management of grasslands may involve the use of prescribed fire to reinstate a historical disturbance regime recently suppressed by humans. I used traps to describe the terrestrial mollusc community in a rare wetland prairie ecosystem of western Oregon, USA over a 3-year period in an adjacent burned and unburned wetland prairie parcel beginning 1 year following an autumn prescribed fire. Species richness was lower throughout the burned area for the duration of the study period and mollusc abundance was lower in the first postburn year, but steadily increased over time, surpassing the adjacent burned area by the third postburn year. According to Multi-response Permutation Procedure, the mollusc community in the adjacent burned area differed significantly from the unburned prairie each year since the burn, suggesting that fire history may structure the wetland prairie mollusc community. Indicator species analysis identified that Deroceras reticulatum and Monadenia fidelis were indicator species for unburned wetland prairie, while Catinella rhederi and Vertigo modesta were indicator species for burned habitat at the study site. Since fire appears to decrease wetland prairie mollusc diversity and abundance, prescribed burns should be conducted in accordance with refuges, to provide a source population for colonizing molluscs and for other animals with unknown responses to fire.

1844. **Response of amphibians to restoration of a southern Appalachian wetland: A long-term analysis of community dynamics.**
Petranka, J. W.; Kennedy, C. A.; and Murray, S. S.
Wetlands 23(4): 1030-1042. (Dec. 2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ environmental restoration/ community structure/ species diversity/ amphibians/ monitoring/ frogs/ dynamics/ salamanders/ ecosystems/ restoration/ colonization/ community composition/ environmental impact/ breeding seasons/ Ambystoma maculatum/ Rana sylvatica/ Notophthalmus viridescens/ Anura/ North Carolina/ spotted salamander/ wood frog/ reclamation/ effects of pollution/ conservation, wildlife

management and recreation/ water pollution: monitoring, control and remediation
Abstract: Although amphibians are increasingly being used to assess ecosystem function of compensatory wetlands, there are almost no long-term studies of responses to ecological restoration. Consequently, much uncertainty exists about the appropriate timeframes and best criteria for evaluating responses to wetland restoration. We studied aspects of pond colonization and long-term community dynamics in ponds created at a mitigation site in western North Carolina. We examined whether landscape variables influenced the initial colonization of 22 constructed ponds and conducted a long-term study of changes in species richness and community composition in ten constructed and ten reference ponds over seven breeding seasons. During the first year of pond filling, species richness and the number of egg masses of the wood frog (Rana sylvatica) and spotted salamander (Ambystoma maculatum) were positively correlated with pond size, depth, and hydroperiod but independent of distance to the nearest forest, paved road, or source pond. The ten constructed ponds in the long-term study first filled in 1996 and were larger, deeper, warmer, more oxygen-rich, and of longer seasonal hydroperiod than reference ponds. Seven species bred in the constructed ponds during the first year of filling, and species richness reached equilibrium within two years of initial pond filling. Most species colonized constructed ponds rapidly, but frequency of use by eastern newts (Notophthalmus viridescens) increased slowly over five years. Constructed ponds supported significantly more species than reference ponds, and the annual turnover rate of breeding populations was approximately 25% for both pond types. Our data suggest that post-restoration monitoring for 2-3 years may be sufficient to characterize species and communities that will utilize ponds for the first decade or so after pond creation.

1845. **Response of amphibians to restoration of a southern Appalachian wetland: Perturbations confound post-restoration assessment.**
Petranka, J. W.; Murray, S. S.; and Kennedy, C. A.
Wetlands 23(2): 278-290. (June 2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ environmental restoration/ monitoring/ demography/ pathogens/ amphibians/ population dynamics/ eggs/ ponds/ land management/ restoration/ amphibiotic species/ larvae/ environmental monitoring/ droughts/ environmental impact/ reproduction/ mortality causes/ recruitment/ hatching/ breeding seasons/ animal physiology/ life cycle/ sexual selection/ metamorphosis/ governments/ Rana sylvatica/ Ambystoma maculatum/ Ranavirus/ Anura/ North Carolina/ wood frog/ spotted salamander/ reclamation/ water quality control/ habitat community studies/ conservation, wildlife management and recreation/ water pollution: monitoring, control and remediation
Abstract: Although regulatory agencies in the USA typically require 3-5 yr of post-restoration monitoring of biotic responses to wetland mitigation, many researchers have argued that longer time frames are needed to assess population responses adequately. We conducted an 8-yr study to examine the demographic responses of the wood frog (Rana sylvatica) and spotted salamander (Ambystoma maculatum) to wetland creation at a mitigation bank in western North Carolina. Our primary goals were to compare juvenile output in ten reference and ten constructed ponds and to assess the overall change in breeding population size in response to site restoration. We used annual censuses of egg masses to assess changes in breeding population size and used estimates of larval population size at hatching and the initiation of metamorphosis to assess embryonic and larval survival. Adults of both species bred in most constructed ponds within a few months after filling in 1996. Estimated juvenile production from 1996 to 2002 did not differ significantly between pond types for either species. The percentage of both constructed and reference ponds that produced juveniles decreased markedly from 1996 to 1998 and remained low through 2002. The decrease in juvenile output was mostly associated with reduced larval survival rather than increased embryonic mortality across years. Drought and outbreaks of a pathogen (Ranavirus) were the primary causes of low juvenile production from 1998 to 2002. The overall breeding population of R. sylvatica increased markedly in 1999-2000 following a large recruitment of juveniles from constructed ponds in 1996-1997. With the onset of drought and ranaviral infections, the population declined to levels in 2002 that were at or below 1995 pre-restoration numbers. Despite site perturbations, the breeding population of A. maculatum remained relatively stable from 1995 to 2002, a phenomenon that may reflect selection for delayed reproduction and iteroparity in this species. Although we have monitored R. sylvatica and A. maculatum for seven breeding seasons after the creation of seasonal wetlands, we are still uncertain that site restoration will achieve the goal of increasing breeding populations above pre-restoration levels. Because amphibians have significant population lags and are sensitive to site perturbations, monitoring that exceeds five years may be required to assess demographic responses to site restoration adequately.

1846. **Response of breeding birds to shearing and burning in wetland brush ecosystems.**
Hanowski, J. M.; Christian, D. P.; and Nelson, M. C.
Wetlands 19(3): 584-593. (1999)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ wild birds/ population density/ prescribed burning/ cutting/ Minnesota
This citation is from AGRICOLA.

1847. **Response of invertebrates to glyphosate-induced habitat alterations in wetlands.**
Linz, G. M.; Bleier, W. J.; Overland, J. D.; and Homan, H. J.
Wetlands 19(1): 220-227. (1999)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ habitat availability/ herbicides/ abundance/ plant populations/ plant control/ freshwater crustaceans/ aquatic plants/ aquatic insects/ community composition/ cattails/ habitats/ invertebrates/ weed control/ Typha/ Chaoboridae/ Chironomidae/ Corixidae/ Ostracoda/ Oligochaeta/ Cladocera/ Hydracarina/ North Dakota/ glyphosate/ copepods/ ostracods/ angleworms/ earthworms/ oligochaetes/ water fleas/ water boatman/ midges/ phantom midges/ Invertebrata/ Copepoda
Abstract: Wetlands in the Prairie Pothole Region of eastern North Dakota, USA are often overgrown with cattails (Typha spp), providing habitat for crop-depredating

blackbirds and impeding use by waterfowl. One and two years post-treatment (1992 and 1993), we assessed the response of invertebrates to a catastrophic reduction in cattail coverage caused by glyphosate, a herbicide applied to about 14,000 ha of North Dakota's wetlands since 1991. Numbers of Crustacea, Hydracarina, Oligochaeta, Copepoda, Ostracoda, and Cladocera were similar between treated and reference wetlands (P > 0.10), while abundance of Gastropoda was greater in the treated wetlands (P = 0.10). Insect abundance was greater in treated wetlands (P < 0.01), with activity traps yielding highest numbers in July. Corixidae and Chironomidae were more abundant in treated wetlands (P < 0.10), whereas Chaoboridae was consistently more plentiful in the reference wetlands (P = 0.05). Our results suggest that populations of some aquatic invertebrates may be enhanced by a reduction in cattail coverage with glyphosate-based herbicide.

1848. **Response of macroinvertebrates and small fish to nutrient enrichment in the northern Everglades.**
Rader, Russell B. and Richardson, Curtis J.
Wetlands 14(2): 134-146. (June 1994)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: Invertebrata/ pisces/ farming and agriculture/ agricultural runoff effects on wetland community/ trophic structure/ community structure/ population density/ effects of nutrient enrichment/ semiaquatic habitat/ wetland/ chemical factors/ nutrient enrichment effects on wetland community/ Florida/ Everglades, North/ nutrient enrichments effects on community

1849. **Response of waterbirds to number of wetlands in the Prairie Pothole Region of North Dakota, USA.**
Niemuth, N. D. and Solberg, J. W.
Waterbirds 26(2): 233-238. (2003)
NAL Call #: QL671; ISSN: 07386028
Descriptors: American bittern/ American coot/ black tern/ Breeding Bird Survey/ North Dakota/ pied-billed grebe/ population dynamics/ Prairie Pothole Region/ Sora/ temporal variation/ wetland/ birds/ habitat availability/ spatial variation/ species occurrence/ wildlife management/ United States/ Anas acuta/ Botaurus lentiginosus/ Chlidonias niger/ Fulica americana/ Podilymbus podiceps
Abstract: We examined the relationship between number of wetlands and occurrence of five waterbird and one waterfowl species in the Prairie Pothole Region of North Dakota, USA, from 1980-2000. Data from 13 Breeding Bird Survey routes provided an index to regional density and distribution of Pied-billed Grebe (Podilymbus podiceps), Black Tern (Chlidonias niger), American Bittern (Botaurus lentiginosus), Northern Pintail (Anas acuta), Sora (Porzana carolina), and American Coot (Fulica americano), while 69 segments from annual Waterfowl Breeding Ground Population and Habitat Surveys provided air index to regional wetland availability. Numbers of wetlands and birds varied among years, and density and distribution of all six species showed a strong positive correlation with number of wetlands. Correlations were weaker when the number of wetlands was lagged one year, suggesting that waterbird distributions shift in response to water availability rather than respond locally. Spatial and temporal variation of waterbird habitat and numbers should be considered in monitoring and management of waterbirds in the Prairie Pothole Region.

1850. **Responses of amphibians to restoration of a southern Appalachian wetland: Perturbations confound post-restoration assessment.**
Petranka, J. W.; Murray, S. S.; and Kennedy, C. A.
Wetlands 23(2): 278-290. (2003)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: amphibians/ created ponds/ drought/ mitigation banks/ North Carolina/ Ranavirus/ disturbance/ drought stress/ population size/ reproduction/ restoration ecology/ wetlands/ United States/ Ambystoma maculatum/ Rana sylvatica
Abstract: Although regulatory agencies in the USA typically require 3-5 yr of post-restoration monitoring of biotic responses to wetland mitigation, many researchers have argued that longer time frames are needed to assess population responses adequately. We conducted an 8-yr study to examine the demographic responses of the wood frog (Rana sylvatica) and spotted salamander (Ambystoma maculatum) to wetland creation at a mitigation bank in western North Carolina. Our primary goals were to compare juvenile output in ten reference and ten constructed ponds and to assess the overall change in breeding population size in response to site restoration. We used annual censuses of egg masses to assess changes in breeding population size and used estimates of larval population size at hatching and the initiation of metamorphosis to assess embryonic and larval survival. Adults of both species bred in most constructed ponds within a few months after filling in 1996. Estimated juvenile production from 1996 to 2002 did not differ significantly between pond types for either species. The percentage of both constructed and reference ponds that produced juveniles decreased markedly from 1996 to 1998 and remained low through 2002. The decrease in juvenile output was mostly associated with reduced larval survival rather than increased embryonic mortality across years. Drought and outbreaks of a pathogen (Ranavirus) were the primary causes of low juvenile production from 1998 to 2002. The overall breeding population of R. sylvatica increased markedly in 1999-2000 following a large recruitment of juveniles from constructed ponds in 1996-1997. With the onset of drought and ranaviral infections, the population declined to levels in 2002 that were at or below 1995 pre-restoration numbers. Despite site perturbations, the breeding population of A. maculatum remained relatively stable from 1995 to 2002, a phenomenon that may reflect selection for delayed reproduction and iteroparity in this species. Although we have monitored R. sylvatica and A. maculatum for seven breeding seasons after the creation of seasonal wetlands, we are still uncertain that site restoration will achieve the goal of increasing breeding populations above pre-restoration levels. Because amphibians have significant population lags and are sensitive to site perturbations, monitoring that exceeds five years may be required to assess demographic responses to site restoration adequately.

1851. **Restoration of a south Florida forested wetland.**
Weller, J. D.
Ecological Engineering 4(2): 143-151. (1995)
NAL Call #: TD1.E26; ISSN: 0925-8574.
Notes: Special issue: Restoration and Creation of Wetlands.
Descriptors: wetlands/ environmental restoration/ forests/ land use/ drainage/ ecosystem disturbance/ ecosystem management/ nature conservation/ swamps/ hydrology/ surface water/ groundwater recharge/ groundwater/ habitat improvement/ vegetation cover/ water control/ Florida/ water control
Abstract: A rewatering project conducted at Fern Forest Nature Center in Pompano Beach, Florida, USA, has rejuvenated and restored an area of south Florida forested wetland to its pre-drainage condition in three years. Through the removal of undesirable vegetation such as Brazilian pepper (Schinus terebinthifolius) and the re-introduction of water, the following have been accomplished: increase in surfacewater duration time; elevation of groundwater by 70 to 84 cm; rejuvenation of a depressed forested wetland, a deciduous hardwood swamp, and an emergent wetland; and enhancement of a wading bird habitat, a cypress dome, and 3.2 km of shallow stream bed (1.5 m deep or less). These accomplishments have assured the survival of the park's 34 rare and endangered fern species and encouraged the natural return of 16 wetland bird species, 8 fish species, 6 species of turtles, 6 species of snakes, 5 snails, 2 frog species, and even the American alligator (Alligator mississippiensis).
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1852. **The restoration of Union Grove Lake, Iowa.**
Bachmann, R. W. and Hoyman, T. A.
Lake and Reservoir Management 9(2): 53-54. (1994)
Descriptors: agricultural runoff/ cropland/ dissolved oxygen/ dredging/ eutrophication/ habitat improvement/ lake reclamation/ lake restoration/ land use/ sedimentation rates/ sediments/ silt load/ water pollution sources/ watersheds
Abstract: Union Grove Lake is a 105 acre impoundment with about 90% of its watershed in cropland. A US EPA funded Clean Lakes diagnostic/feasibility study in 1983 found that siltation was a major problem that threatened to diminish the recreational usage of the lake. Other problems included winter fish kills due to loss of dissolved oxygen under winter ice cover, poor water transparency, high summer algal levels, and occasional problems with aquatic macrophytes. A lake restoration project was carried out in the period from 1984 through 1992. The lake was dredged to remove 275,000 cubic yards of sediment, shorelines were protected with rip rap, a sediment-retention dike was constructed on the arm with the main tributary, and an artificial aeration system was installed in the deepest part of the lake to maintain winter dissolved oxygen levels. A cooperative program was carried out in the watershed to intensify soil conservation activities. This included increased use of conservation tillage, construction of terraces, grassed waterways, and water and sediment retention basins. The Soil Conservation Service reported that by 1993 nearly 100% of the watershed was in SCS approved soil conservation practices. A post restoration study found that the dredging had increased the lake volume by 14% and thus increased the life of the lake, but it is too early to evaluate the effectiveness of the soil conservation work in slowing down the rate of sedimentation in the lake. It was recommended that the lake be remapped in 10 years to measure the post restoration sedimentation rates. The sedimentation dike was found to provide a barrier to mixing between the upper arm and the main portion of the lake and may help to keep particulate matter from moving from the tributary out into the main part of the lake. The aeration of the lake in the winter has eliminated the winter oxygen loss and there are no more fish kills. This has enhanced the fisheries management program. There was no evidence that the restoration project has changed water quality in the lake as measured by water transparency, concentrations of plant nutrients, and concentrations of algal chlorophylls.
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1853. **Restored wetlands as management tools for wetland-dependent birds.**
Dick, Thomas M.
Pennsylvania Birds 7(1): 4-6. (1993); ISSN: 0898-8501
Descriptors: wetlands/ birds/ communities/ ecosystems/ habitat management/ management/ restoration/ wildlife
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1854. **Restoring fish populations in a heavily managed ecosystem: The San Francisco Bay-Delta and its watershed.**
Luoma, S.; Brown, R.; Taylor, K.; and Bernstein, B.
In: American Fisheries Society Annual Meeting of the Worldwide Decline of Wild Fish Populations, Quebec, PQ, Canada; August 10-14, 2003; Vol. 133.; pp. 244; 2003.
Descriptors: freshwater ecology: ecology, environmental sciences/ population studies/ wildlife management: conservation/ CALFED Bay Delta Program/ agriculture/ dams/ ecosystem processes/ escapement/ fish population restoration/ heavily managed ecosystem/ natural variability/ population level processes/ urbanization/ water diversions/ watershed
© Thomson Reuters Scientific

1855. **Restoring wetland habitats with cows and other livestock: A prescribed grazing program to conserve bog turtle habitat in New Jersey.**
Tesauro, J.
Conservation Biology in Practice 2(2): 26-30. (2001); ISSN: 1526-4629.
http://www.conbio.org/CIP/article22wet.cfm
Descriptors: Bos taurus/ reptiles/ cattle/ wetland/ habitat management/ agriculture/ New Jersey
© NISC

1856. **Restoring wetlands in the Orange Creek Basin: An innovative state/federal partnership approach.**
Moore, Rosalind A.
Ecological Society of America Annual Meeting, Proceedings 87: 394. (2002)
NAL Call #: QH540.E365.
Notes: Poster session; Conference: 87th Annual Meeting of the Ecological Society of America and the 14th Annual International Conference of the Society for Ecological Restoration, Tucson, Arizona, USA; August 04-09, 2002.
Descriptors: freshwater ecology: ecology, environmental sciences/ wildlife management: conservation/ St. Johns River Water Management District/ U.S. Department of

Agriculture/ NRCS/ USDA/ Natural Resources Conservation Service/ grazing/ hunting/ hydrology/ innovative state/ federal partnership/ land use/ nutrient load/ public recreation/ vegetation reestablishment/ wetland restoration/ wetlands condition/ wildlife habitat enhancement/ Florida
Abstract: Florida's St. Johns River Water Management District (SJRWMD) and the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) are conducting a four-year project to restore wetlands in the Orange Creek Basin, a tributary of the St. Johns River in north central Florida. The 3,400 acre parcel containing 1,500 acres of wetlands was purchased by the SJRWMD, and a 30-year easement purchased under NRCS' Wetlands Reserve Program. Funding for restoration work is shared between the SJRWMD and NRCS. Prior to restoration, the property was drained and used for muck farming, timber production and pasture. Major goals of the project are to restore the hydrologic connection of the wetlands to the Orange Creek floodplain, reduce nutrient loading into the creek, and enhance waterfowl and wading bird populations. In the year following hydrologic restoration, good wetland conditions developed despite the continuation of a multi-year drought. Wetland vegetation has reestablished and several shallow islands have been created to enhance wading bird habitat. Upland restoration continues through prescribed fire and range management. The site is open to the public for passive recreation and for occasional hunting during winter. Ongoing challenges include control of tropical soda apple (Solanum viarum), an invasive exotic, and management of adjacent uplands for cattle grazing. Monitoring and adaptive management techniques are enlisted to meet project goals. The project is a good example of an innovative agency partnership and multi-objective planning.

1857. **A review of basin morphology and pool hydrology of isolated ponded wetlands: Implications for seasonal forest pools of the northeastern United States.**
Brooks, Robert T.
Wetlands Ecology and Management 13: 335-348. (2005)
NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861.
http://www.treesearch.fs.fed.us/pubs/21526
Descriptors: amphibians/ aquatic invertebrates/ hydrology/ hydroperiod/ seasonal forest pools/ woodland vernal pools
Abstract: Seasonal forest pools (SFPs) are geographically- and hydrologically- isolated ponded wetlands, in that they are topographically isolated from other surface waters. SFPs occur commonly throughout the temperate forests of the eastern United States and adjacent Canada. SFPs are ephemeral in occurrence, typically drying annually. The regular drying of SFPs excludes fish from these habitats, and as a result, they are the preferred breeding habitat of some amphibians, notably ambystomid ('mole') salamanders and wood frogs (Rana sylvatica Le Conte). The pools also support a rich and diverse invertebrate fauna. The duration of the wet phase, or hydroperiod of SFPs, has been repeatedly shown to be the dominant influence on the composition and fitness of the faunal community of the pools. Despite the importance of SFP hydrology, it is a poorly studied subject. This paper reviews the limited state-of-knowledge of seasonal forest pool hydrology and associated basin morphology. The review discusses findings from studies of other isolated ponded wetlands that could be applicable to our understanding of the hydrology of SFPs.
This citation is from Treesearch.

1858. **A review of early literature on forested wetlands in the United States.**
Lugo, A. E. (1984).
Notes: Literature review.
Descriptors: wetlands/ forests/ ecology/ forested/ habitat community studies/ freshwater habitats/ United States
Abstract: A review of the literature dealing with freshwater-forested wetlands reveals three phases prior to 1970: early descriptions, formal descriptive accounts, and ecological descriptions. Each of these phases is reviewed with the objective of presenting the points of view of early students of forested wetlands and focusing on the generalizations that emerged from those studies. Specific topics of discussion are species composition and diversity, vegetation structure and physiognomy, response to flooding, succession, site factors and wetland classification, wildlife, and uses and values.

1859. **Review of the effects of non-point nutrient loading on coastal ecosystems.**
Gabric, A. J. and Bell, P. R. F.
Australian Journal of Marine and Freshwater Research 44(2): 261-283. (1993); ISSN: 0067-1940.
Notes: Literature review.
Descriptors: pollution effects/ nutrients (mineral)/ coastal waters/ eutrophication/ ecosystem management/ runoff/ erosion/ land use/ coastal zone management/ man-induced effects/ human factors/ coastal water/ nutrients/ nonpoint pollution/ non point pollution/ ecosystems and energetics/ effects on organisms/ pollution environment/ coastal zone management/ pollution effects/ marine pollution
Abstract: In many coastal regions (e.g. parts of the North Sea, northern Adriatic Sea, Baltic Sea, Great Barrier Reef lagoon, wider Caribbean, coastal areas of the USA) there is large-scale, and in some cases chronic, eutrophication. In some regions, the link between eutrophication and the destruction of an ecosystem is obvious, with excessive algal growth and water-column anoxia. In other cases, particularly in more fragile ecosystems such as coral-reef and seagrass areas, the links are not so obvious, yet the impacts of eutrophication in such regions can be devastating. Eutrophication can have more insidious effects such as contributing directly to the mortality of fish, marine mammals and sea birds and indirectly to disease or death in humans owing to the accumulation of biotoxins in seafoods. Increased development and changes in land-use patterns in the coastal zone have increased the loading of diffuse or non-point nutrients. In areas subject to runoff and soil erosion, most of the nutrient load is transported in particulate form. In such cases, the loads of nutrients discharged from cropping lands are typically an order of magnitude greater than those discharged from pristine forested areas. Nutrient export from pasture lands, whether these are fertilized or not, is also significantly greater than that from pristine areas, and in many cases the total loads from such areas are far higher than those from intensively farmed areas. A reduction in nutrient discharges to coastal waters will require careful land-use planning. The importance of the particulate fraction in the nutrient load

necessitates effective control of soil erosion. The hydrological and nutrient linkage between terrestrial and marine ecosystems must be emphasized. Collective management of hinterland and coastal-zone resources could initiate remediation of a serious and growing problem. © ProQuest

1860. **Rice fields as temporary wetlands: A review.**
Lawler, S. P.
Israel Journal of Zoology 47(4): 513-528. (2001);
ISSN: 0021-2210
Descriptors: wetlands/ agricultural land/ Oryza sativa/ rice/ wetlands/ aquatic entomology
Abstract: Rice fields are temporary wetlands that harbor many of the same species that breed in natural temporary ponds. Therefore the rice agroecosystem has the potential to help sustain the regional biodiversity of many invertebrates and vertebrates. Like natural areas of wetlands, rice cultivation provides a habitat mosaic of temporary and more permanent waters. Because of their low floral diversity and because their species composition will rarely overlap completely with that of natural ponds, rice fields are not substitutes for natural temporary ponds. However, they are important in sustaining populations of several species, including wading birds and frogs. Farming methods vary widely, and different practices can alter the suitability of rice fields as habitats. Farmers use water management, pesticides, and sometimes fish to control crop pests and mosquitoes, and other taxa may be affected as well. Farmers may irrigate rice intermittently to control pests, and intermittent habitat holds fewer species than areas that are flooded for longer periods. Broad-spectrum pesticides may harm invertebrates and other wildlife, and may even cause pest resurgences if they have greater effects on predator populations than on the pests. Fish often decrease the abundance of invertebrate predators, but fish farming in rice fields often discourages the use of harmful pesticides. Because farming practices can affect the conservation value of rice fields, ecologists are encouraged to work with farmers and study the role of rice fields in the population dynamics of temporary pond species, and how changing farming methods alter this role. © ProQuest

1861. **The role of submersed aquatic vegetation as habitat for fish in Minnesota lakes, including the implications of non-native plant invasions and their management.**
Valley, Ray D.; Cross, Timothy K.; and Radomski, Paul
Minnesota Department of Natural Resources Section of Fisheries Special Publication 160: 1-25. (2004);
ISSN: 0193-1245.
http://wfs.sdstate.edu/wfsdept/Pond%20Web%20Page/Subm%20veg%20MN%20DRN%20Valley%20report.pdf
Descriptors: conservation measures/ ecology/ habitat/ freshwater habitat/ lentic water/ land zones/ Pisces: habitat management/ aquatic plant management/ implications of role as habitat in lakes/ habitat utilization/ role of submersed aquatic vegetation in lakes/ exotic plant invasions and management implications/ Lake/ role of submersed aquatic vegetation as habitat/ exotic plant invasion and management implications/ Minnesota/ habitat role of submerged aquatic vegetation in lakes/ plant invasions and management implications/ Pisces/ chordates/ fish/ vertebrates
Abstract: This review updates the Division of Fish and Wildlife's understanding of the role of submersed aquatic vegetation (SAV) in providing fish habitat in Minnesota lakes. Below, are several generalizations and recommended approaches for aquatic plant management. 1. Many fish, such as sunfish, largemouth bass, northern pike, and muskellunge, depend on SAV for food and shelter. Nongame fish such as darters, minnows, and killifishes depend primarily on nearshore emergent and submersed vegetation 2. The presence of SAV tends to promote higher water clarity. 3. Black bullhead and common carp often dominate turbid lakes with little to no SAV. Carp are an invasive non-native species that contributes to the loss of native SAV by dislodging rooted plants and resuspending sediments. 4. Generally, conditions for game fish deteriorate when the percentage of a basin that is covered with SAV falls below 10% or exceeds 60%. This range does not consider basin morphometry (i.e., shallow versus deep) which ultimately controls how much vegetation naturally grows within a lake. 5. Studies show native plants provide higher quality habitat for desirable fish than invasive non-native plants such as curly-leaf pondweed or Eurasian watermilfoil. However, these non-native plants provide better habitat than little or no SAV. 6. Minnesota lakes infested with curly-leaf pondweed or Eurasian watermilfoil have not seen large declines in game fish populations. 7. Lake productivity and initial plant conditions appear to greatly affect selective wholelake herbicide's (such as fluridone) effect on fish habitat. Whole-lake studies in infested, moderately-productive (mesotrophic) Michigan lakes with abundant native plants, showed neutral to positive effects of fluridone on fish habitat. 2 8. Fluridone applications in infested productive (eutrophic) Minnesota lakes with low cover of native SAV can have dramatic negative effects on SAV habitats, water clarity, and fish communities. 9. Aquatic plant management policies should reflect a precautionary approach where it is understood that any alteration to SAV will invariably have some effect on a lake's fish community. Therefore, policies should ostensibly be conservative with the intent to minimize habitat degradation. 10. Limiting the cumulative amount of SAV removal may be the most prudent approach towards precautionary management. However, thresholds should be dependent on lake type. The current 15% rule (maximum treatment area within the 15 foot depth zone) for chemicals and 50% rule for mechanical harvesting may be reasonable for some lakes (e.g., small eutrophic lakes); stricter thresholds may be needed for others (e.g., soft water lakes, large or deep lakes). 11. Overall, whole-lake aquatic plant treatment is risky. Significant biological risks associated with large-scale manipulations include excessive removal of fish habitat and thus decline of fish populations, loss of sensitive plant species, declines in water clarity and potential long-term cumulative effects of multiple treatments, since eradication of non-native plant species is highly unlikely. 12. Vegetated, nearshore habitat is critical for fish recruitment. Any removal should be viewed as habitat loss, and efforts should be made to minimize this loss. It follows that 100 feet of removal is worse than 50 feet of removal even if the removal is of a non-native species. 13. Mechanical harvesting may be the best alternative for managing nuisance surface growth of vegetation. Although this requires perpetual maintenance, harvested boat lanes through surface-growing vegetation represents a positive

benefit for recreational access and fish habitat (harvested strips of SAV increases edge and may benefit game species).

1862. **The role of the Wetland Reserve Program in conservation efforts in the Mississippi River Alluvial Valley.**
King, S. L.; Twedt, D. J.; and Wilson, R. R.
Wildlife Society Bulletin 34(4): 914-920. (2006)
NAL Call #: SK357.A1W5; ISSN: 00917648.
Notes: doi: 10.2193/0091-7648 (2006)34 [914:TROTWR] 2.0.CO;2.
Descriptors: Black bear/ conservation/ migratory birds/ Mississippi Alluvial Valley/ restoration/ Ursus americanus luteolus/ Wetlands Reserve Program/ Wetlands
Abstract: The Mississippi River Alluvial Valley includes the floodplain of the Mississippi River from Cairo, Illinois, USA, to the Gulf of Mexico. Originally this region supported about 10 million ha of bottomland hardwood forests, but only about 2.8 million ha remain today. Furthermore, most of the remaining bottomland forest is highly fragmented with altered hydrologic processes. During the 1990s landscape-scale conservation planning efforts were initiated for migratory birds and the threatened Louisiana black bear (Ursus americanus luteolus). These plans call for large-scale reforestation and restoration efforts in the region, particularly on private lands. In 1990 the Food, Agriculture, Conservation and Trade Act authorized the Wetlands Reserve Program (WRP). The WRP is a voluntary program administered by the United States Department of Agriculture that provides eligible landowners with financial incentives to restore wetlands and retire marginal farmlands from agricultural production. As of 30 September 2005, over 275,700 ha have been enrolled in the program in the Mississippi River Alluvial Valley, with the greatest concentration in Louisiana, Arkansas, and Mississippi, USA. Hydrologic restoration is common on most sites, with open-water wetlands, such as moist-soil units and sloughs, constituting up to 30% of a given tract. Over 33,200 ha of open-water wetlands have been created, potentially providing over 115,000,000 duck-use days. Twenty-three of 87 forest-bird conservation areas have met or exceed core habitat goals for migratory songbirds and another 24 have met minimum area requirements. The WRP played an integral role in the fulfillment of these goals. Although some landscape goals have been attained, the young age of the program and forest stands, and the lack of monitoring, has limited evaluations of the program's impact on wildlife populations.

1863. **The role of wildlife science in wetland ecosystem restoration: Lessons from the Everglades.**
Gawlik, D. E.
Ecological Engineering 26(1): 70-83. (2006)
NAL Call #: TD1.E26; ISSN: 09258574.
Notes: doi: 10.1016/j.ecoleng.2005.09.008.
Descriptors: conceptual model/ ecosystem restoration/ Everglades/ indicator/ monitoring/ performance measure/ wading birds/ wildlife/ biodiversity/ ecology/ ecosystems/ environmental protection/ monitoring/ wetlands/ biodiversity/ ecology/ ecosystems/ environmental protection/ monitoring/ restoration/ wetlands/ bioindicator/ monitoring/ restoration ecology/ wetland/ Aves
Abstract: There has been little discussion of how and when to integrate wildlife science into ecological restoration projects. The recent emergence of wetland ecosystem restoration offers an opportunity to use wildlife science to increase the probability of a project being successful. This paper traces the evolution of wetland ecosystem restoration in North America and proposes three roles for wildlife science in wetland ecosystem restoration: (1) contribute to conceptual ecosystem models, (2) develop quantitative performance measures and restoration targets that track the progress of restoration, and (3) achieve social feasibility by sustaining long-term public support for a project. The extensive knowledge base for many species of wildlife makes them especially useful for contributing to conceptual ecosystem models. Wildlife species are often the subject of long-term monitoring and research because they have commercial value, are conspicuous, or have aesthetic appeal. Wildlife parameters can be good performance measures for large-scale restoration projects because some species integrate information over large spatial scales and are long-lived. Parameters associated with threatened or endangered wildlife species should get special consideration as performance measures because the information will meet multiple needs rather than just those of the conceptual ecosystem model. Finally, wetland ecosystem restoration projects need to sustain funding over decades to ensure the restored system is self-sustaining. Wildlife are a valued resource that can help achieve the social feasibility of a project by providing a way to communicate complex science in terms that society understands and values.

1864. **Salt toxicosis in ruddy ducks that winter on an agricultural evaporation basin in California.**
Gordus, A. G.; Shivaprasad, H. L.; and Swift, P. K.
Journal of Wildlife Diseases 38(1): 124-131. (2002)
NAL Call #: 41.9 W64B; ISSN: 0090-3558
Descriptors: brain sodium/ evaporation ponds/ hypersaline water/ Oxyura jamaicensis/ ruddy duck/ salt encrustation/ salt toxicosis
Abstract: Agricultural evaporation basins are used as a means to dispose of highly saline underground-tile-drainage water in the San Joaquin Valley (California, USA). The hypersaline water conditions encourage high aquatic invertebrate production, primarily brine shrimp (Artemia franciscana), which attract birds to those sites. Cool winter temperatures (<4 C) and hypersaline water conditions (>70,000 µ mhos/cm) resulted in feather salt encrustation and salt toxicosis in ruddy ducks (Oxyura jamaicensis). During December 1998 and January 1999, approximately 200 dead and sick ruddy ducks were collected from an evaporation basin and five healthy control ruddy ducks were collected from a freshwater wetland. Brains contained ≥1,890 ppm sodium (wet tissue mass) in seven dead birds and contained ≤1.150 ppm sodium in the control birds. Liver arsenic, lead, and mercury concentrations were <1 ppm in all birds examined. Manganese, molybdenum, and copper liver concentrations did not differ significantly (P > 0.05) between the two groups of ducks. The dead ducks had significantly higher liver selenium, cadmium, iron, and zinc than the controls, but the concentrations were not sufficient to cause toxicity. Significant gross and microscopic lesions in most of the dead birds included conjunctivitis, lens opacity and cataract formation, vascular

congestion in various organs most notably in the meninges of the brain, and myocardial and skeletal muscle degeneration.

1865. **Scale-dependent habitat use in three species of prairie wetland birds.**
Naugle, D. E.; Higgins, K. F.; Nusser, S. M.; and Johnson, W. C.
Landscape Ecology 14(3): 267-276. (1999)
NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973
Descriptors: wetlands/ habitat utilization/ nesting behavior/ foraging behavior/ aquatic birds/ Podilymbus podiceps/ Xanthocephalus xanthocephalus/ Chlidonias niger/ South Dakota/ yellow-headed blackbird/ black tern/ prairie wetlands
Abstract: We evaluated the influence of scale on habitat use for three wetland-obligate bird species with divergent life history characteristics and possible scale-dependent criteria for nesting and foraging in South Dakota, USA. A stratified, two-stage cluster sample was used to randomly select survey wetlands within strata defined by region, wetland density, and wetland surface area. We used 18-m (0.1 ha) fixed radius circular-plots to survey birds in 412 semipermanent wetlands during the summers of 1995 and 1996. Variation in habitat use by pied-billed grebes (Podilymbus podiceps) and yellow-headed blackbirds (Xanthocephalus xanthocephalus), two sedentary species that rarely exploit resources outside the vicinity of nest wetlands, was explained solely by within-patch variation. Yellow-headed blackbirds were a cosmopolitan species that commonly nested in small wetlands, whereas pied-billed grebes were an area-sensitive species that used larger wetlands regardless of landscape pattern. Area requirements for black terns (Chlidonias niger), a vagile species that typically forages up to 4 km away from the nest wetland, fluctuated in response to landscape structure. Black tern area requirements were small (6.5 ha) in heterogeneous landscapes compared to those in homogeneous landscapes (15.4 - 32.6 ha). Low wetland density landscapes composed of small wetlands, where few nesting wetlands occurred and potential food sources were spread over large distances, were not widely used by black terns. Landscape-level measurements related to black tern occurrence extended past relationships between wetlands into the surrounding matrix. Black terns were more likely to occur in landscapes where grasslands had not been tilled for agricultural production. Our findings represent empirical evidence that characteristics of entire landscapes, rather than individual patches, must be quantified to assess habitat suitability for wide-ranging species that use resources over large areas.

1866. **Seasonal and semipermanent wetlands of California: Invertebrate community ecology and responses to management methods.**
de Szalay, Ferenc A.; Euliss, Ned H.; and Batzer, Darold P.
In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 829-855.
Notes: ISBN: 0471292583.
NAL Call #: QL365.4.A1I58
Descriptors: Invertebrata/ habitat management/ seasonal and semipermanent wetlands management effect on fauna/ ecology/ semiaquatic habitat/ seasonal and semipermanent wetlands/ community ecology and management/ California

1867. **Seasonal dynamics of aquatic fauna and habitat parameters in a perched upper Missouri River Wetland.**
Fisher, S. J. and Willis, D. W.
Wetlands 20(3): 470-478. (2000)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: Missouri River/ native fishes/ perched wetland/ zooplankton production/ community dynamics/ ichthyofauna/ seasonality/ wetland/ zooplankton/ United States/ Ameiurus melas/ Bosmina
Abstract: The Missouri River floodplain historically contained numerous wetlands; however, alterations to the corridor have resulted in the loss of flood-pulse processes. The annual contributions of small wetlands (<15 ha) perched on the Missouri River floodplain have not been viewed as important; however, consequences of draining or filling perched wetlands in the upper Missouri River basin remain unclear. The objective of this study was to survey aquatic fauna and basic habitat characteristics in a small perched wetland before, during, and after a connection period within a naturally functioning section of the Missouri River. Fishes, macroinvertebrates, zooplankton, and habitat parameters were sampled during May, July, and September 1997. No significant differences ($P > 0.05$; $F < 4.2$; $df = 2,9$) in densities or catch-per-unit-effort among sample periods were detected for macroinvertebrates. Copepoda nauplii, calanoid Copepoda, and Bosmina spp. densities showed significant changes ($P < 0.03$; $F > 6.1$; $df = 2,9$) and collectively surpassed 3,200 organisms/L. These densities exceeded other regional means by as much as 900%. Twenty-four fish species were documented in the wetland; however, the black bullhead, Ameiurus melas Rafinesque, dominated the fish community. Wetland depth and surface area increased during the connection period and inundated terrestrial grasses and woody debris. Decay of submerged organic matter, combined with the lack of rooted macrophytes, loss of algal productivity to flushing, and higher turbidity, may have all contributed to reduced summer dissolved oxygen levels. Avian feeding activity suggested that fishes were using the upper water column when nearly anoxic lower water column conditions existed. Although the wetland habitat may be harsh, presence of juvenile fishes and dense zooplankton populations establishes the potential importance of these water bodies to the Missouri River ecosystem.

1868. **Seasonal dynamics of bird assemblages in a Texas estuarine wetland.**
Weller, Milton W.
Journal of Field Ornithology 65(3): 388-401. (1994)
NAL Call #: 413.8 B534; ISSN: 0273-8570
Descriptors: management strategy/ species richness/ Texas/ birds/ bird diversity/ estuarine ecosystems/ wetlands/ bird populations
Abstract: Bird species richness and seasonality were sampled in diverse habitats of an estuarine wetland complex of San Bernard National Wildlife Refuge on the mid-Texas coast. Observations made between 1985 and 1991 included all months, and form a composite annual

view; 121 species were recorded, with 54 taxa identified in 1 mo. Only 23 species occurred regularly over a series of months, and their patterns of wetland use varied markedly by species and season. The wetland complex served different functions for different species, but most used the area for migration stops and wintering. Eleven species were considered breeders in the brackish marsh, but another 33 species probably nested in nearby freshwater wetlands, coastal islands or in shrubs or small trees, and fed or rested in the marsh. Such coastal areas are used by birds year-round and, in addition to protection, need management strategies to ensure habitat diversity and normal water regimes which will maintain natural bird diversity and serve all species for different life stages.

1869. **Sedimentation of Prairie Pothole wetlands: The need for integrated research by agricultural and wildlife interests.**
Gleason, R. A. and Euliss, N. H.
In: Water for Agriculture and Wildlife and the Environment: Win-Win Opportunities -- Proceedings from the USCID Wetlands Seminar.Bismarck, North Dakota.) Schaack, J.; Anderson, S. S.; U.S. Committee on Irrigation and Drainage; and U.S. Bureau of Reclamation (eds.) Denver, Colo.: U.S. Committee on Irrigation and Drainage; pp. 107-114; 1997.
NAL Call #: GB624.U83 1996
Descriptors: Conservation Reserve Program/ regional conservation programs/ Prairie Pothole Region
Abstract: Examined the influences of sedimentation on wildlife values in wetlands within the Prairie Pothole Region.

1870. **Selenium in agricultural drainage: Essential nutrient or toxic threat?**
Moore, S. B.
Journal of Irrigation and Drainage Engineering 115(1): 21-28. (1989)
NAL Call #: 290.9 Am3ps (IR); ISSN: 0733-9437
Descriptors: agricultural drainage/ wildlife habitat/ selenium/ Kesterson Reservoir/ California
Abstract: The essential nutrient selenium is believed responsible for numerous deformities, reproductive failures, and deaths of migratory birds at Kesterson Reservoir in California's San Joaquin Valley. Wildlife problems at the reservoir appeared only a few years after the area began receiving selenium-laden subsurface drainage water from less than 42,000 acre (17,000 ha) or irrigated agricultural land on the west side of the valley. Although substantially reduced in acreage from their historic extent, the valleys's wetland habitats continue to satisfy the wintering and migratory needs of substantial populations of Pacific Flyway migratory birds. Remnant anadromous fish populations struggle to survive the inadequate flows and low water quality of the valley's riverine habitats. It is estimated that in order to sustain intensively managed, irrigated agriculture and associated high levels of crop production, more than 1,000,000 acre (405,000 ha) of land on the west side of the valley must eventually be drained. Unless extraordinary measures are taken, the potential is great for contaminated agricultural drainage to further harm fish and wildlife resources of the San Joaquin Valley.

1871. **Selenium in wetlands and waterfowl foods at Kesterson Reservoir California, USA 1984.**
Schuler C. A.; Anthony R. G.; and Ohlendorf H. M.
Archives of Environmental Contamination and Toxicology 19(6): 845-853. (1990)
NAL Call #: TD172.A7; ISSN: 0090-4341
Descriptors: plants/ aquatic insects/ agrichemicals/ water pollution/ environmental surveillance/ bioaccumulation/ health hazard/ toxicity
Abstract: Kesterson Reservoir (Kesterson) received subsurface agricultural drainwater containing high levels of salts and selenium from farmland in the San Joaquin Valley of California. The accumulation of selenium in wetlands and waterfowl foods at Kesterson was investigated during May, August, and December of 1984. High concentrations of selenium were found in water, sediments, terrestrial and aquatic vegetation, and aquatic insects. Mean selenium concentrations in aquatic plants and insects ranged from 1.5 to 170 . µ.g/g dry weight and were about 11 to 290 times those found at a nearby reference site. Concentrations in some waterfowl food plants and insects at Kesterson were up to 64 times those reported to be a health hazard to birds. Selenium concentrations were more seasonally variable in aquatic plants than in aquatic insects. Few differences in selenium accumulation were found among ponds. Deposition of selenium in plant parts was not uniform; rhizomes contained higher concentrations than seeds and leaves were intermediate. Most biota bioaccumulated maximum selenium concentrations that were 1,000 to nearly 5,00 times the concentration in the water.

1872. **Shorebird breeding biology in wetlands of the Playa Lakes, Texas, USA.**
Conway, W. C.; Smith, L. M.; and Ray, J. D.
Waterbirds 28(2): 129-138. (2005)
NAL Call #: QL671; ISSN: 15244695
Descriptors: American avocet/ black-necked stilt/ breeding biology/ killdeer/ playas/ saline lakes/ snowy plover/ clutch size/ conservation planning/ habitat management/ hatching/ predation/ reproductive biology/ reproductive success/ waders/ wetlands/ playa lakes/ Texas/ Anatidae/ Charadrius alexandrinus/ Charadrius vociferous/ Charadrius vociferus/ Himantopus mexicanus/ Recurvirostra americana
Abstract: Wetlands in the Playa Lakes Region of Texas are important habitats for North American wintering waterfowl and migrant shorebirds. However, shorebird breeding biology has been overlooked in characterizing the region's ecological importance. In 1998 and 1999, American Avocet (Recurvirostra americana), Black-necked Stilt (Himantopus mexicanus), Killdeer (Charadrius vociferous), and Snowy Plover (C. alexandrinus) breeding ecology were studied in playas, saline lakes, and riparian wetlands in the Playa Lakes Region of Texas. Chronology of nest initiation, clutch sizes, and hatching success for 298 Snowy Plover, 111 American Avocet, 43 Killdeer, and 26 Black-necked Stilt clutches were measured. All four species nested in saline lakes, American Avocet and Killdeer also nested in playas, and Snowy Plover nested on riparian wetlands. American Avocet had higher hatching success in 1999 (52%) than 1998 (8%), because of more suitable hydrological conditions and lower predation. Hatching success was

higher in 1998 than 1999 for Killdeer (1998, 63%; 1999, 21%) and Snowy Plover (1998, 47%; 1999, 33%) due to failures caused by flooding and hail in 1999. In other regions, clutch predation limits shorebird productivity, but hatching success in the Playa Lakes Region appears to be limited by unpredictable precipitation patterns and wetland hydroperiod. As such, breeding shorebird conservation and management should focus upon maintaining wetland hydrological integrity.

1873. **Shorebird habitat use and nest-site selection in the Playa Lakes Region.**
Conway, Warren C.; Smith, Loren M.; and Ray, James D.
Journal of Wildlife Management 69(1): 174-184. (2005)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: freshwater ecology: ecology, environmental sciences/ conservation/ biogeography: population studies/ anthropogenic stress/ nest site selection/ hydroperiod/ riparian wetland/ saline lake/ playas/ created wetland/ brood rearing habitat
Abstract: Wetlands in the Playa Lakes Region (PLR) provide important habitats for wintering waterfowl, cranes, and both migrant and breeding shorebirds. Playa Lakes Region wetlands experience naturally fluctuating hydroperiods but are exposed to anthropogenic stresses, which are exacerbated during summer and may influence PLR wetland occupancy and selection by breeding shorebirds. We examined wetland-scale habitat use and nest-site selection of the 4 dominant shorebirds (American avocets [Recurvirostra americana], black-necked stilts [Himantopus mexicanus], killdeer [Charadrius vociferus], snowy plovers [C. alexandrinus]) nesting in playas, saline lakes, and in both created and riparian wetlands in the PLR of Texas, USA. All 4 species nested in saline lakes. Only avocets and killdeer nested in playas, and snowy plovers nested in riparian wetlands. No nests were found in created wetlands. Wetland habitat changed ($P < 0.001$) during the breeding season, while water habitats generally decreased. Used (i.e., shorebirds found nesting) Wetlands had more ($P < 0.05$) mudflats than non-used (i.e., shorebirds not found nesting) wetlands, which had more ($P < 0.05$) dry habitats. Used and non-used wetlands had similar ($P > 0.05$) amounts of water habitats. Nests were located close to vegetation on bare dry ground and dry ground with vegetation. Because water is ephemeral in PLR wetlands, shorebirds must select - in a somewhat predictive manner upon arrival - wetlands with suitable nest-site and brood-rearing habitat. Although surface water is necessary for nesting, its presence is not adequate for delineating suitable PLR wetland habitat for breeding shorebirds. Our findings that created wetlands cannot compensate for regional wetland losses in habitat or function highlights the need for conservation of natural PLR wetlands.

1874. **Shorebird use of managed wetlands in the Mississippi Alluvial Valley.**
Twedt, D. J.; Nelms, C. O.; Rettig, V. E.; and Aycock, S. R.
American Midland Naturalist 140(1): 140-152. (1998)
NAL Call #: 410 M58; ISSN: 0003-0031
Descriptors: wetlands/ habitat utilization/ agricultural land/ wildlife management/ aquatic birds/ artificial substrata/ population density/ migratory species/ ecosystem management/ birds/ land management/ environmental protection/ habitats/ Aves/ Charadrius vociferus/ Gallinago gallinago/ Mississippi R./ United States/ birds/ killdeer/ common snipe
Abstract: We assessed shorebird use of artificial wetlands within the Mississippi Alluvial Valley during the winters of 1991-1992 and 1992-1993 and during the autumn of 1994. On agricultural fields managed to provide habitat for waterfowl from November to March, mean shorebird density was 58.6 birds/100 ha, but shorebird densities were greater on soybean fields than on rice or moist-soil fields. Killdeer (Charadrius vociferus) and common snipe (Gallinago gallinago) were common throughout winter, but shorebird abundance and species richness along survey routes increased from November through April. During the late summer and autumn, wetlands on public lands in the Mississippi Alluvial Valley are managed by the U.S. Fish and Wildlife Service specifically to provide foraging habitat for shorebirds. From August through October 1994, we observed 14,564 individual shorebirds of 22 species using these anthropogenic wetlands. Mean shorebird density on wetlands managed by flooding previously dry, disked fields was 695 birds/100 ha, whereas mean density on wetlands managed by drawing down water reservoirs was 1224 birds/100 ha. We recommend increased shallow-water flooding of agricultural fields, particularly soybean fields, during winter to provide habitat for wintering and early spring migrant shorebirds. More importantly, we recommend continued water management on public wetlands from July through October, preferably by drawing down water reservoirs, to provide foraging habitat for southward migrating shorebirds.

1875. **Short-term response of wetland birds to prescribed burning in Rainwater Basin wetlands.**
Brennan, E. K.; Smith, L. M.; Haukos, D. A.; and Lagrange, T. G.
Wetlands 25(3): 667-674. (2005)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ burning/ species richness/ abundance/ migration/ recruitment/ basins/ introduced species/ incineration/ birds/ species diversity/ forest fires/ litter/ Aves/ Nebraska/ birds
Abstract: Prescribed burning is often used in wetlands to remove plant litter, decrease woody or invasive species, and increase use by wetland birds. However, little is known about the within-season, short-term response of wetland birds to prescribed burning, especially during spring migration. We surveyed use of 19 burned and 19 unburned (reference) wetlands by migratory birds in the Rainwater Basin region of Nebraska, USA during three spring migrations, 2002-2004. We calculated the change in avian abundance and species richness, as well as generating the Soerenson's similarity index for burned and reference wetlands in the weeks immediately before and after burning. We compared Soerenson's index values and percent change in abundance and species richness between burned and reference wetlands using an analysis of covariance with week and wetland area as covariates to account for migration chronology and differences in the area of experimental units. Following removal of effects due to wetland area and week, burning had no effect on the percent change in avian abundance and species richness. Soerenson's index also did not differ between burned and reference wetlands. Prescribed burning did not improve use

of wetlands by migratory birds in the short term. Understanding the immediate and long-term effects of prescribed burning on migratory avian abundance, species richness, and community composition is imperative for management decisions.

1876. **Spatial modeling of wetland condition in the U.S. Prairie Pothole Region.**
Royle, J. A.; Koneff, M. D.; and Reynolds, R. E.
Biometrics 58(2): 270-279. (2002); ISSN: 0006-341X
Descriptors: grasslands/ habitats/ mapping/ prairies/ remote sensing/ spatial variation/ statistical analysis/ waterfowl/ wetlands/ wildlife conservation/ birds
Abstract: We propose a spatial modelling framework for wetland data produced from a remote-sensing-based waterfowl habitat survey conducted in the U.S. Prairie Pothole Region (PPR) of Montana and North Dakota. The data produced from this survey consist of the area containing water on many thousands of wetland basins (i.e., prairie potholes). We propose a two-state model containing wet and dry states. This model provides a concise description of wet probability, i.e., the probability that a basin contains water, and the amount of water contained in wet basins. The two model components are spatially linked through a common latent effect, which is assumed to be spatially correlated. Model fitting and prediction is carried out using Markov chain Monte Carlo methods. The model primarily facilitates mapping of habitat conditions, which is useful in varied monitoring and assessment capacities. More importantly, the predictive capability of the model provides a rigorous statistical framework for directing management and conservation activities by enabling characterization of habitat structure at any point on the landscape.

1877. **Spatial scale and abundance patterns of large fish communities in freshwater marshes of the Florida Everglades.**
Chick, J. H.; Ruetz, C. R.; and Trexler, J. C.
Wetlands 24(3): 652-664. (2004)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: abundance patterns/ Everglades/ hydroperiod/ large fish communities/ spatial scale
Abstract: Anthropogenic habitat alterations and water-management practices have imposed an artificial spatial scale onto the once contiguous freshwater marshes of the Florida Everglades. To gain insight into how these changes may affect biotic communities, we examined whether variation in the abundance and community structure of large fishes (SL > 8 cm) in Everglades marshes varied more at regional or intra-regional scales, and whether this variation was related to hydroperiod, water depth, floating mat volume, and vegetation density. From October 1997 to October 2002, we used an airboat electrofisher to sample large fishes at sites within three regions of the Everglades. Each of these regions is subject to unique water-management schedules. Dry-down events (water depth < 10 cm) occurred at several sites during spring in 1999, 2000, 2001, and 2002. The 2001 dry-down event was the most severe and widespread. Abundance of several fishes decreased significantly through time, and the number of days post-dry-down covaried significantly with abundance for several species. Processes operating at the regional scale appear to play important roles in regulating large fishes. The most pronounced patterns in abundance and community structure occurred at the regional scale, and the effect size for region was greater than the effect size for sites nested within region for abundance of all species combined, all predators combined, and each of the seven most abundant species. Non-metric multi-dimensional scaling revealed distinct groupings of sites corresponding to the three regions. We also found significant variation in community structure through time that correlated with the number of days post-dry-down. Our results suggest that hydroperiod and water management at the regional scale influence large fish communities of Everglades marshes.

1878. **Spatial use by wintering greater white-fronted geese relative to a decade of habitat change in California's Central Valley.**
Ackerman, J. T.; Takekawa, J. Y.; Orthmeyer, D. L.; Fleskes, J. P.; Yee, J. L.; and Kruse, K. L.
Journal of Wildlife Management 70(4): 965-976. (2006)
NAL Call #: 410 J827; ISSN: 0022541X.
Notes: doi: 10.2193/0022-541X(2006)70[965:SUBWGW]2.0.CO;2.
Descriptors: agriculture/ Anser albifrons/ California/ Central Valley Joint Venture/ flooded rice/ greater white-fronted geese/ habitat use/ landscape change/ radiotelemetry/ wetland management
Abstract: We investigated the effect of recent habitat changes in California's Central Valley on wintering Pacific greater white-fronted geese (Anser albifrons frontalis) by comparing roost-to-feed distances, distributions, population range sizes, and habitat use during 1987-1990 and 1998-2000. These habitat changes included wetland restoration and agricultural land enhancement due to the 1990 implementation of the Central Valley Joint Venture, increased land area used for rice (Oryza sativa) production, and the practice of flooding, rather than burning, rice straw residues for decomposition because of burning restrictions enacted in 1991. Using radiotelemetry, we tracked 192 female geese and recorded 4,516 locations. Geese traveled shorter distances between roosting and feeding sites during 1998-2000 (24.2 ± 2.2 km) than during 1987-1990 (32.5 ± 3.4 km); distance traveled tended to decline throughout winter during both decades and varied among watershed basins. Population range size was smaller during 1998-2000 (3,367 km^2) than during 1987-1990 (5,145 km^2), despite a 2.2-fold increase in the size of the Pacific Flyway population of white-fronted geese during the same time period. The population range size also tended to increase throughout winter during both decades. Feeding and roosting distributions of geese also differed between decades; geese shifted into basins that had the greatest increases in the amount of area in rice production (i.e., American Basin) and out of other basins (i.e., Delta Basin). The use of rice habitat for roosting (1987-1990: 40%, 1998-2000: 54%) and feeding (1987-1990: 57%, 1998-2000: 72%) increased between decades, whereas use of wetlands declined for roosting (1987-1990: 36%, 1998-2000: 31%) and feeding (1987-1990: 22%, 1998-2000: 12%). Within postharvested rice habitats, geese roosted and fed primarily in burned rice fields during 1987-1990 (roost: 43%, feed: 34%), whereas they used flooded rice fields during 1998-2000 (roost: 78%, feed: 64%). Our

results suggest that white-fronted geese have altered their spatial use of California's Central Valley during the past decade in response to changing agricultural practices and the implementation of the Central Valley Joint Venture.

1879. **Spring distribution of ring-necked pheasants (Phasianus colchicus) following cattail reduction with glyphosate herbicide.**
Homan, H. J.; Linz, G. M.; Carlson, R. C.; and Bleier, W. J.
Wildlife Research 30(2): 159-166. (2003); ISSN: 10353712.
Notes: doi: 10.1071/WR01003.
Descriptors: bird/ glyphosate/ habitat use/ weed control/ wetland/ United States/ Helianthus annuus/ Phasianus colchicus/ Typha
Abstract: To reduce blackbird (leteridae) damage to field crops in the north-central United States, dense stands of cattail (Typha spp.) are thinned with glyphosate herbicide. The stands become unusable as roosting and loafing sites, which helps to protect susceptible crops nearby, particularly sunflower (Helianthus annus). Landscape-level impacts of cattail management on non-target avian species have not been studied. We measured use of upland breeding territories by male ring-necked pheasants (Phasianus colchicus) following cattail reduction in wetlands used by pheasants for overwintering. In August 1992, glyphosate was applied to all wetlands with ≥70% cattail coverage in four 23-km^2 study blocks in south-eastern North Dakota. Four other blocks were used for controls. Habitat use was inferred from territorial crowing counts. No treatment effect or treatment*year interaction (all P ≥ 0.05) was evident during 2 years of post-treatment observations. Although the herbicide eradicated large contiguous stands of cattail that pheasants had used for winter cover, surface water levels rose in 1993, which created additional cattail growth in untreated wetlands within the blocks. The additional cattail may have lessened the effect of the herbicide treatments. During drier periods, when cattail growth slows, cattail reduction could affect use of upland breeding sites. We recommend more research to assess the effects of glyphosate during drier periods.

1880. **Status of lesser snow geese and Ross's geese wintering in the Interior Highlands of Mexico.**
Drewien, R. C.; Terrazas, A. L.; Taylor, J. P.; Barraza, J. M. O.; and Shea, R. E.
Wildlife Society Bulletin 31(2): 417-432. (2003)
NAL Call #: SK357.A1W5; ISSN: 00917648
Descriptors: Chen c. caerulescens/ Chen rossii/ Chihuahua/ distribution/ Durango/ interior highlands/ lesser snow geese/ Mexico/ Ross's geese/ status/ winter populations/ conservation status/ habitat use/ population estimation/ spatial distribution/ waterfowl
Abstract: During winters 1998 and 1999 we surveyed, by air or ground, 145 wetland areas in 8 states of the Mexican Interior Highlands for lesser snow geese (Chen caerulescens caerulescens) and Ross's geese (C. rossii; hereafter both species are jointly referred to as light geese). Only limited data were available on abundance, distribution, habitat use, and species composition of light geese flocks wintering in the Mexican Interior Highlands. We surveyed wetlands from the northern border of Chihuahua southward >1,400 km into the states of Jalisco and Michoacan. During ground surveys we visually sampled geese to assess species, color phase, and age composition (n=60,967). In 1998, drought in the northern Highlands left many natural wetlands dry or nearly dry; wetland water levels farther south were generally low. In 1999 water levels improved in the northern Highlands but drought prevailed in the southern Highlands. During 1998 and 1999 we recorded 229,288 and 310,204 light geese, respectively, at 58 wetlands in 5 states. Combining our counts with the midwinter inventories in the United States provided estimates of 465,653 and 447,729 light geese wintering in the western Central Flyway during 1998 and 1999, respectively, or 76-83% higher than the previous peak estimate in winter 1993. Most light geese (95%) were in the northern states of Chihuahua and Durango. Species ratios, weighted by flock size, showed 78.5% and 81.2% snow geese (1.3-1.5% blue phase) and 21.5% and 18.8% Ross's geese during winters 1998 and 1999, respectively. Population estimates by species included 180,100 and 252,000 snow geese and 49,200 and 58,200 Ross's geese for the 2 winters, respectively. Ross's geese were most abundant in Chihuahua, and their proportion in flocks declined southward. We observed higher proportions of Ross's geese and blue-phase snow geese than were reported in this region during the 1980s. Primary foraging sites for light geese were corn, oats, and sorghum fields. We observed little waterfowl hunting, and opportunities to increase harvest of light geese, if desired in the future, appear limited due to restrictive hunting regulations, especially for foreigners. Changing land uses and crop patterns could adversely affect the future quality and quantity of some winter habitats for light geese and other migratory birds in Mexico. Only combined counts in Mexico and the United States can reliably assess the population status of western Central Flyway light geese; 15 surveys during 1969-99 showed that an average of 60.6% of the population wintered in Mexico.

1881. **Strategies for biodiversity protection.**
Bean, Michael J.
In: Precious heritage: The status of biodiversity in the United States/ Stein, Bruce A.; Kutner, Lynn S.; and Adams, Jonathan S.
New York: Oxford, 2000; pp. 255-273.
Descriptors: Wetlands Reserve Program/ biodiversity protection/ conservation interests/ conservation land acquisition/ land trusts/ land use/ water use/ wildlife refuges/ animals/ plants/ animal (Animalia)/ plant (Plantae)

1882. **Straw and winter flooding benefit mosquitoes and other insects in a rice agroecosystem.**
Lawler, S. P. and Dritz, D. A.
Ecological Applications 15(6): 2052-2059. (2005)
NAL Call #: QH540.E23; ISSN: 10510761
Descriptors: aquatic insects/ bottom-up effects/ Culex tarsalis/ detritus/ macroinvertebrates/ paddy/ rice/ wetland/ agricultural ecosystem/ flooding/ food web/ mosquito/ paddy field/ algae/ Culex tarsalis/ Hexapoda/ Insecta
Abstract: Rice fields are widespread agroecosystems that provide wetland habitat for many species, including pests like mosquitoes and beneficial insects. They can be used as models to understand how basal resources affect food web dynamics in seasonal wetlands. Rice field management may also influence adjacent communities by

affecting mosquitoes, wildlife, and air quality. Rice straw incorporation and winter flooding have become common methods used to prepare seedbeds, largely replacing burning of straw. These methods could affect aquatic insects, including mosquitoes, because they increase nutrient availability during the growing season. We studied 16 fields where straw was either burned or incorporated into soil after the previous growing season; these treatments were crossed with either winter flooding or no winter flooding. Algae, mosquitoes, other herbivorous insects and predatory insects all responded positively to one or both treatments that increased nutrients (straw incorporation and winter flooding). While the overall increase in insect production could benefit wildlife, mosquito abatement personnel may need to monitor unburned fields more closely. The issue of mosquito production adds to the complexity of agricultural and environmental concerns bearing on rice field management. Straw incorporation and winter flooding reduce particulate pollutants caused by burning, reduce fertilizer needs, and increase densities of beneficial insects. However, these techniques may increase mosquitoes, methane production, and fungal diseases of rice. Further improvement of straw management practices could minimize these problems.

1883. **Succession of macroinvertebrates in playas of the Southern High Plains, USA.**
Moorhead, D. L.; Hall, D. L.; and Willig, M. R.
Journal of the North American Benthological Society 17(4): 430-442. (1998)
NAL Call #: QL141.F7; ISSN: 0887-3593
Descriptors: wetlands/ trophic structure/ community composition/ species diversity/ temporal variations/ predators/ filter feeders/ detritus feeders/ ecological succession/ colonization/ temporary ponds/ playas/ succession/ macrofauna/ species richness/ trophic levels/ trophic level/ macroinvertebrates/ sampling/ aquatic insects/ Ostracoda/ Branchiopoda/ Notonectidae/ Hydrophilidae/ Invertebrata/ ostracods/ branchiopods/ water scavenger beetles/ freshwater crustaceans/ backswimmers/ Texas
Abstract: Playas are seasonal wetlands that constitute the principal surface-water features of the semiarid, Southern High Plains, USA. They are shallow pools that usually persist for 2-4 mo following inundation by spring rains. The development of macroinvertebrate assemblages in 10 playas located in West Texas was examined during the summer of 1994. Playas were sampled 3 times at approximately monthly intervals, beginning shortly after initial inundation in early May. All playas were dry within 90 d. Species richness and diversity (Fisher's log-series alpha) increased significantly over time ($p < 0.05$). Thirteen of the 16 species representing at least 1% of collected individuals, showed significant differences in abundances over time ($p < 0.05$). Some taxa increased in abundance (especially insects), whereas others decreased (most crustaceans). Trophic structure of assemblages also changed over time, with a significant reduction in the abundances of detrivores ($p < 0.05$) and filter-feeders ($p < 0.05$) occurring concurrently with an increase in the abundance of predators ($p < 0.05$). The composition of macroinvertebrate assemblages became more similar among playas over time (Ochai's index, $p < 0.05$), and changes in composition within individual playas tended to decrease with time ($p < 0.05$). These results suggest a rapid development of macroinvertebrate assemblages in playas, begining with early dominance of crustacean detritivores and filter-feeders (e.g., phyllopods and ostracods), followed by later dominance of herbivorous and predaceous insects (e.g., hydrophilids and notonectids). Increases in species richness, diversity, and similarity in assemblage composition among playas over time are consistent with a pattern of progressive colonization by a finite set of species capable of exploiting these ephemeral habitats.

1884. **Summer distribution, abundance, and habitat use of black-necked stilts and American avocets in California's Central Valley.**
Shuford, W. David; Humphrey, Joan M.; Hansen, Robert B.; Page, Gary W.; Stenzel, Lynne E.; and Hickey, Catherine M.
Western Birds 38(1): 11-28. (2007)
NAL Call #: QL684.C2; ISSN: 0160-1121
Descriptors: Charadriiformes/ Recurvirostridae/ Himantopus mexicanus/ Recurvirostra americana/ California/ Central Valley/ distribution/ habitat use/ status/ wetlands/ ecosystems/ shallow water habitats/ summer distribution/ land zones/ population ecology
Abstract: Little is known about breeding shorebirds in California's Central Valley on which conservation actions could be based. In summer 2003, we surveyed shallow-water habitats throughout that region for Black-necked Stilts (Himantopus mexicanus) and American Avocets (Recurvirostra americana). Survey methods included ground counts, aerial surveys, and sampling of Sacramento Valley rice fields. We estimated about 30,000 Black-necked Stilts and 10,700 American Avocets in the Central Valley, exclusive of Suisun Marsh. The proportion of stilts and avocets, respectedly, within four subregions were Sacramento Valley 74% and 37%. delta 1% and 1%. San Joaquin basin 2% and 7%, and Tulare basin 23% and 56%. The ratio of stilts to avocets was 5.6:1 in the Sacramento Valley, 1.1:1 in the San Joaquin Val-ley. The Sacramento Valley held 64% of all stilts and avocets, the Tulare basin 32%. the San Joaquin basin 3%, and the delta 1%. Key habitats were rice fields (73%). managed wetlands (10%), and sewage ponds (6%) for stilts, and rice (35%). managed wetlands (32%), agricultural evaporation ponds (14%), sewage ponds (9%), and agricultural canals (6%) for avocets. Rice held 98% of all stilts and 93% of all avocets in the Sacramento Valley. The Tulare basin had five habitats that held >10% of its total for at least one of the species and was the only region where agricultural evaporation ponds, agricultural canals and ditches, and water-storage facilities supported large numbers of shorebirds. Overall, >80% of all stilts and avocets in the Central Valley were found in environments created for agriculture, water management, or industry. where they may be exposed to toxins. Their reliance on these artificial environments is risky, as future changes to serve human economies may reduce the value of such habitats to wildlife. Thus there is a need to restore and enhance high-quality wetlands in the Central Valley to counter historic losses and potential future loss of other shallow-water habitats of uncertain reliability and quality.

1885. **Targeting ecosystem features for conservation: Standing crops in the Florida Everglades.**
Turner, Andrew M.; Trexler, Joel C.; Jordan, C. Frank; Slack, Sarah J.; Geddes, Pamela; Chick, John H.; and Loftus, William F.
Conservation Biology 13(4): 898-911. (1999)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: ecology/ community structure/ habitat/ pollution/ land and freshwater zones/ Invertebrata/ Pisces: biomass/ species diversity/ low biodiversity/ semiaquatic habitat/ oligotrophic wetland biomass/ biodiversity/ conservation aspects/ oligotrophic wetlands/ Florida/ Everglades/ biomass and biodiversity/ conservation significance/ chordates/ fish/ invertebrates/ vertebrates

1886. **Temporal overlap of nesting duck and aquatic invertebrate abundances in the Grasslands Ecological Area, California, USA.**
de Szalay, F. A.; Carroll, L. C.; Beam, J. A.; and Resh, V. H.
Wetlands 23(4): 739-749. (2003)
NAL Call #: QH75.A1W47; ISSN: 02775212
Descriptors: Anas cyanoptera/ Anas platyrhynchos/ Anas strepera/ California/ Crustaceans/ insects/ invertebrates/ nesting waterfowl/ snails/ wetlands/ abundance/ food availability/ invertebrate/ predator-prey interaction/ temporal variation/ waterfowl/ wetland/ California/ North America/ San Joaquin Valley/ United States/ Amphipoda/ Anas cyanoptera/ Anas platyrhynchos/ Anas strepera/ Cladocera/ Coleoptera/ Corixidae/ Dytiscidae/ Gastropoda/ Heteroptera/ Hydrophiidae/ Ostracoda
Abstract: Aquatic invertebrates are essential components of duckling diets, but little is known about temporal changes of invertebrate populations in different types of brood habitats. In spring and summer 1996 and 1997, we conducted searches for duck nests in upland fields in the Grasslands Ecological Area in California's Central Valley to determine timing of nest initiation and hatching. We also sampled aquatic invertebrate populations in adjacent permanent wetlands, semi-permanent borrow areas within seasonal wetlands that were drawn down in spring, and reverse-cycle wetlands (i.e., wetlands flooded from spring to summer) to estimate invertebrate food resources available to ducklings. Abundances of many invertebrates important in duckling diets (Gastropoda, Cladocera, Ostracoda, Amphipoda, Corixidae, Dytiscidae, Hydrophilidae) were greater in borrow areas and reverse-cycle wetlands than in permanent wetlands. Peak macroinvertebrate densities in borrow areas occurred immediately after adjacent wetlands are drawn down in March-April. Peak densities in reverse-cycle wetlands and permanent wetlands occur in May. Although total numbers of microinvertebrates (<1 mm size) and macroinvertebrates (≥1 mm size) in all wetlands decreased after May, most mallard (Anas platyrhynchos) and cinnamon teal (A. cyanoptera) eggs hatched in May. Therefore, these ducklings hatch when abundant invertebrate food resources were most available in reverse-cycle wetlands. In contrast, most gadwall (A. strepera) eggs hatched in June after invertebrate numbers started to decrease. In areas where hydrology is controlled, managing for reverse-cycle wetlands may be a useful strategy to provide abundant invertebrate food resources during the waterfowl breeding season. © 2003, The Society of Wetland Scientists.

1887. **Temporarily flooded wetlands of Missouri: Invertebrate ecology and management.**
Magee, Patrick A.; Reid, Frederic A.; and Fredrickson, Leigh H.
In: Invertebrates in freshwater wetlands of North America: Ecology and management/ Batzer, Darold P.; Rader, Russell B.; and Wissinger, Scott A.
New York: John Wiley & Sons, 1999; pp. 691-710.
Notes: ISBN: 0471292583.
NAL Call #: QL365.4.A1I58
Descriptors: Invertebrata/ habitat management/ ecology/ temporarily flooded wetlands/ semiaquatic habitat/ flooding/ Missouri/ temporarily flooded wetlands ecology and management

1888. **Temporary forest pools: Can we see the water for the trees?**
Williams, D. D.
Wetlands Ecology and Management 13(3): 213-233. (2005)
NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861
Descriptors: aquatic communities/ forestry practices/ forests/ nature conservation/ ponds/ riparian vegetation/ survival/ water resources/ wetlands
Abstract: Temporary waters, in general, are fascinating habitats in which to study the properties of species adapted to living in highly variable environments. Species display a remarkable array of strategies for dealing with the periodic loss of their primary medium that sets them apart from the inhabitants of permanent water bodies. Survival of individuals typically depends on exceptional physiological tolerance or effective migrational abilities, and communities have their own, distinctive hallmarks. This paper will broadly overview the biology of temporary ponds, but will emphasize those in temperate forests. In particular, links will be sought between aquatic community properties, the nature of the riparian vegetation, and forestry practices. Quite apart from their inherent biological interest, temporary waters are now in the limelight both from a conservation perspective, as these habitats come more into conflict with human activities, and a health-control perspective, as breeding habitats for vectors of arboviruses. Traditionally, many temporary waters, be they pools, streams or wetlands, have been considered to be 'wasted' areas of land, potentially convertible to agriculture/silviculture once drained. In reality, they are natural features of the global landscape representing distinct and unique habitats for many species - some that are found nowhere else, others that reach their maximum abundance there. To be effective, conservation measures must preserve the full, hydroseral range of wetland types.

1889. **Testing the efficacy of harvest buffers on the invertebrate communities in seasonal forest wetlands.**
Hanson, Mark A.; Church, James O.; Miller, Anthony T.; Palik, Brian J.; and Butler, Malcolm G.
Minnesota Department of Natural Resources Summaries of Wildlife Research Findings 2004: 164-179. (2005)
Descriptors: commercial activities/ conservation measures/ ecology/ terrestrial habitat/ land zones/ Invertebrata: forestry/ timber harvesting/ community structure effects/ habitat management/ timber harvesting buffer zones/ community structure/ timber harvesting and buffer zones effects/ semiaquatic habitat/ seasonal forest wetlands/ forest and woodland/ Minnesota, North central/ invertebrates
Abstract: We assessed community-level responses of aquatic invertebrates in small, seasonal forest wetlands to evaluate potential influences of timber harvest and harvest buffers in adjacent uplands. Data gathered during the first 4 years following clear-cut timber harvest (2001-2004) indicated that tree removal produced discernable shifts in aquatic invertebrate communities in adjacent seasonal wetlands. Retention of harvest buffers appeared to partially mitigate against these influences, but benefits of buffers may be limited by windthrow or other factors. Additional site-level research is needed to clarify relationships between physical and ecological characteristics of seasonal wetlands and adjacent silviculture activities, and to better document efficacy and longevity of harvest buffers.
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1890. **Threats to imperiled freshwater fauna.**
Richter, B. D.; Braun, D. P.; Mendelson, M. A.; and Master, L. L.
Conservation Biology 11(5): 1081-1093. (Oct. 1997)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: population decline/ freshwater environments/ aquatic animals/ conservation/ environmental stress/ anthropogenic factors/ pollution effects/ eutrophication/ sediment load/ river engineering/ agricultural pollution/ introduced species/ freshwater fish/ aquatic insects/ freshwater molluscs/ freshwater crustaceans/ Amphibiotic species/ ecosystem disturbance/ nature conservation/ Inland water environment/ regulated rivers/ sedimentation/ exotic species/ hydrological regime/ mussels/ fish/ dams/ United States/ conservation/ ecological impact/ water development
Abstract: Threats to imperiled freshwater fauna in the U.S. were assessed through an experts survey addressing anthropogenic stressors and their sources. Specifically, causes of historic declines and current limits to recovery were identified for 135 imperiled freshwater species of fishes, crayfishes, dragonflies and damselflies, mussels, and amphibians. The survey was designed to identify threats with sufficient specificity to inform resource managers and regulators faced with translating information about predominant biological threats into specific, responsive actions. The findings point to altered sediment loads and nutrient inputs from agricultural nonpoint pollution; interference from exotic species; and altered hydrologic regimes associated with impoundment operations as the three leading threats nationwide, accompanied by many lesser but still significant threats. Variations in threats among regions and among taxa were also evident. Eastern species are most commonly affected by altered sediment loads from agricultural activities, whereas exotic species, habitat removal/damage, and altered hydrologic regimes predominate in the West. Altered sediment loading from agricultural activities and exotic species are dominant problems for both eastern mussels and fishes. However, eastern fishes also appear to be suffering from municipal nonpoint pollution (nutrients and sediments), whereas eastern mussels appear to be more severely affected by altered nutrient impacts from hydroelectric impoundments and agricultural runoff. Our findings suggest that control of nonpoint source pollution associated with agriculture activities should be a very high priority for agricultural producers and governmental support programs. Additionally, the large number of hydropower dams in the U.S. subject to federal re-licensing in coming years suggests a significant opportunity to restore natural hydrologic regimes in the affected rivers.
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1891. **Threats to waterbirds and wetlands: Implications for conservation, inventory and research.**
O'Connell, Mark
Wildfowl 51: 1-15. (2000)
NAL Call #: SK351.W575; ISSN: 0954-6324
Descriptors: waterbirds (Aves)/ animals/ birds/ chordates/ nonhuman vertebrates/ vertebrates/ biodiversity/ conservation/ demographic changes/ economic changes/ human activity/ social changes/ wetlands: habitat
Abstract: The world has undergone major social, economic and demographic changes in the last two centuries. Predictions suggest that during the next 100 years, even greater changes will occur and this will put increasing pressure on wetlands and their biodiversity. This paper examines the changes that have occurred, and the nature of threats facing waterbirds and wetlands as a result of human activities. The need for specific areas of research is identified, particularly in relation to detecting and measuring change and the need to provide solution-oriented research to underpin conservation action.
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1892. **A tidal habitat restoration success story: The Union Slough Restoration Project.**
Houghton, J. P. and Uhlig, L.
2003 Georgia Basin/Puget Sound Resarch Conference Proceedings (Feb. 2004).
Notes: Publisher: Puget Sound Action Team, Olympia, WA. http://www.psat.wa.gov/Publications/03_proceedings/PAPERS/ORAL/6a_hough.pdf
Descriptors: agriculture/ anadromous species/ benthos/ coast defences/ estuarine dynamics/ flooding/ habitat/ habitat improvement/ marshes/ restoration/ seining/ zoobenthos/ Cancer magister/ Oncorhynchus kisutch/ Oncorhynchus tshawytscha/ Salmonidae/ INE, Canada, British Columbia, Georgia Basin/ INE, Washington, Everett/ INE, Washington, Puget Sound/ INE, Washington, Snohomish Estuary, Union Slough
Abstract: In February 2001, dikes were breached to restore tidal circulation to a ± 20-acre, former agricultural parcel along Union Slough in the lower Snohomish Estuary, near Everett, Washington. Before dike breaching, an internal dike was constructed to protect Interstate 5 (I-5) and the site was graded to provide desired elevations for brackish marsh development. Finally, we excavated a deep dendritic channel that would allow maximum accessibility by juvenile salmonids and possibly Dungeness crab. Substantial

numbers of small invertebrates and fish were observed using and feeding in the site as early as the April following dike breaching. Summer and fall seining demonstrated use by six species of juvenile anadromous salmonids, with chinook and coho juveniles remaining in the site through November 2001. Benthic productivity appears to be high and a variety of shorebirds and waterfowl have been observed. Marsh vegetation has rapidly colonized elevations between about +7 and +11 feet mean lower low water, covering over 3 acres of the site by late summer 2002. Several pieces of large woody debris were recruited to shorelines within the site during winter 2001 - 2002 flooding, and most have remained. This and several other sites in the Snohomish Estuary clearly demonstrate that breaching dikes to restore tidal action is a relatively certain and often low-cost means of providing real and immediate increases in habitat function.

1893. **Toxicity assessment of water from lakes anad wetlands receiving irrigation drain water.**
Dickerson, K. K.; Hubert, W. A.; and Bergman, H. L.
Environmental Toxicology and Chemistry 15(7): 1097-1101. (1996)
NAL Call #: QH545.A1E58; ISSN: 0730-7268
Descriptors: wetlands/ drainage water/ irrigation water/ contaminants/ toxicity/ Ceriodaphnia dubia/ Pimephales promelas/ mortality/ water quality/ lakes/ water pollution/ Colorado/ Wyoming/ Montana
Abstract: A method for reconnaissance-level assessments of the potential toxicity of water in lakes and wetlands that receive irrigation drain water is needed. We evaluated a model that predicts toxicity to aquatic organisms due to major ionic composition as a primary means of assessing water quality. The model was used in conjunction with acute toxicity tests and trace element analyses. Mortality of Ceriodaphnia dubia and fathead minnows (Pimephales promelas) observed in acute toxicity tests was compared to mortality predicted by the model. The method was applied at 22 lakes and wetlands on federally administered lands in Colorado, Montana, Utah, and Wyoming Fourteen of 22 locations had water that was not toxic to test organisms. Six locations had undiluted water that was toxic to C. dubia due to major ionic composition, and two locations had undiluted water that showed toxic effects caused by factors other than elevated levels of major ions. The model for C. dubia seemed to be sufficiently accurate for future application using our approach to assess lakes and wetlands receiving irrigation drain water.
This citation is from AGRICOLA.

1894. **Tracking wetland restoration: Do mitigation sites follow desired trajectories?**
Zedler, J. B. and Callaway, J. C.
Restoration Ecology 7(1): 69-73. (Mar. 1999)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: wetlands/ environmental restoration/ environment management/ California/ San Diego Bay/ rehabilitation/ ecosystems/ damage/ monitoring/ wildlife habitats/ model studies/ alternative planning/ nature conservation/ environmental assessment/ trajectories/ Sweetwater Marsh National Wildlife Refuge/ reclamation/ water quality control/ conservation, wildlife management and recreation/ environmental engineering
Abstract: Hypothetical models in the scientific literature suggest that ecosystem restoration and creation sites follow a smooth path of development (called a trajectory), rapidly matching natural reference sites (the target). Multi-million-dollar mitigation agreements have been based on the expectation that damages to habitat will be compensated within 5-10 years, and monitoring periods have been set accordingly. Our San Diego Bay study site, the Sweetwater Marsh National Wildlife Refuge, has one of the longest and most detailed records of habitat development at a mitigation site: data on soil organic matter, soil nitrogen, plant growth, and plant canopies for up to 10 years from a 12-year-old site. High interannual variation and lack of directional changes indicate little chance that targets will be reached in the near future. Other papers perpetuate the trajectory model, despite data that corroborate our findings. After reviewing "trajectory models" and presenting our comprehensive data for the first time, we suggest alternative management and mitigation policies.

1895. **Trophic structure and avian communities across a salinity gradient in evaporation ponds of the San Francisco Bay Estuary.**
Takekawa, J. Y.; Miles, A. K.; Schoellhamer, D. H.; Athearn, N. D.; Saiki, M. K.; Duffy, W. D.; Kleinschmidt, S.; Shellenbarger, G. G.; and Jannusch, C. A.
Hydrobiologia 567(1): 307-327. (2006)
NAL Call #: 410 H992; ISSN: 00188158.
Notes: doi: 10.1007/s10750-006-0061-z.
Descriptors: salt evaporation ponds/ salt ponds/ San Francisco Bay/ waterbirds
Abstract: Commercial salt evaporation ponds comprise a large proportion of baylands adjacent to the San Francisco Bay, a highly urbanized estuary. In the past two centuries, more than 79% of the historic tidal wetlands in this estuary have been lost. Resource management agencies have acquired more than 10 000 ha of commercial salt ponds with plans to undertake one of the largest wetland restoration projects in North America. However, these plans have created debate about the ecological importance of salt ponds for migratory bird communities in western North America. Salt ponds are unique mesohaline (5-18 g l-1) to hyperhaline (> 40 g l-1) wetlands, but little is known of their ecological structure or value. Thus, we studied decommissioned salt ponds in the North Bay of the San Francisco Bay estuary from January 1999 through November 2001. We measured water quality parameters (salinity, DO, pH, temperature), nutrient concentrations, primary productivity, zooplankton, macroinvertebrates, fish, and birds across a range of salinities from 24 to 264 g l-1. Our studies documented how unique limnological characteristics of salt ponds were related to nutrient levels, primary productivity rates, invertebrate biomass and taxa richness, prey fish, and avian predator numbers. Salt ponds were shown to have unique trophic and physical attributes that supported large numbers of migratory birds. Therefore, managers should carefully weigh the benefits of increasing habitat for native tidal marsh species with the costs of losing these unique hypersaline systems. © Springer 2006.

1896. **Use of restored small wetlands by breeding waterfowl in Prince Edward Island, Canada.**
Stevens, C. E.; Gabor, T. S.; and Diamond, A. W.
Restoration Ecology 11(1): 3-12. (2003)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: wetlands/ environmental restoration/ breeding/ restoration/ environment management/ aquatic birds/ abundance/ plant populations/ environmental factors/ nature conservation/ Anas crecca carolinensis/ Anas rubripes/ Typha/ Canada, Prince Edward Island/ green-winged teal/ American black duck/ ring-necked ducks/ gadwell
Abstract: Since 1990 under the Eastern Habitat Joint Venture over 100 small wetlands have been restored in Prince Edward Island, Canada. Wetlands were restored by means of dredging accumulated sediment from erosion to emulate pre-disturbance conditions (i.e., open water and extended hydroperiod). In 1998 and 1999 we compared waterfowl pair and brood use on 22 restored and 24 reference wetlands. More pairs and broods of Ring-necked Ducks, Gadwall, Green-winged Teal, and American Black Ducks used restored versus reference wetlands. In restored wetlands waterfowl pair density and species richness were positively correlated with wetland/cattail area, percent cattail cover, and close proximity to freshwater rivers. In addition, a waterfowl reproductive index was positively correlated with percent cattail cover. Green-winged Teal pair occurrence in restored wetlands was positively correlated with greater amounts of open water and water depths. American Black Duck pairs occurred on most (86%) restored wetlands. Restored small wetlands likely served as stopover points for American Black Duck broods during overland or stream movements, whereas they likely served as a final brood-rearing destination for Green-winged Teal broods. We suggest that wetland restoration is a good management tool for increasing populations of Green-winged Teal and American Black Ducks in Prince Edward Island.

1897. **Use of temporary wetlands by anurans in a hydrologically modified landscape.**
Babbitt, Kimberly J. and Tanner, George W.
Wetlands 20(2): 313-322. (2000)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: freshwater ecology: ecology, environmental sciences/ breeding activity/ breeding sites/ cattle ranch/ dynamic habitats/ habitat use/ hydrologically modified landscape/ localized flooding/ meteorological conditions/ species abundance/ species composition/ temporary wetlands/ water table/ wetland hydrology/ wetland size
Abstract: We examined larval anuran assemblages at 12 temporary wetlands occurring on the MacArthur Agro-Ecology Research Center (MAERC) in southcentral Florida. MAERC is an active cattle ranch, and the wetlands on the site are heavily influenced by an extensive series of ditches that drain the landscape. Ditching has resulted in a change from a historically extensive marsh system to a series of isolated wetlands surrounded by upland habitats. Because a majority of anurans in Florida breed exclusively or facultatively in wetlands whose drying regime excludes fish, we were interested in determining the value of these modified wetlands as breeding sites. We examined the effect of wetland size and hydrology on anuran use, and compared breeding activity across three summers that varied greatly in rainfall pattern. We sampled tadpoles from May 93 to August 93 and from May 94 to September 95. A total of 3678 tadpoles from 11 species was collected. Rana utricularia was the most abundant species and the only species found in every wetland. Species richness was related positively to wetland size (r = 0.65, p = 0.023) but not hydroperiod (r = 0.03, p = 0.93). Tadpole abundance was not related to wetland size (r = 0.35, p = 0.29) nor hydroperiod (r = 0.40, p = 0.22). Annual variation in rainfall resulted in significant changes in species composition. A drought during 1993 resulted in no breeding. A high water table in the spring of 1995 resulted in localized flooding in early summer on part of the ranch. Wetlands in these areas were exposed to spillover of water from ditches containing fishes. Wetlands so impacted showed significant changes in species composition from the previous year (x2 = 1008, p < 0.0001), whereas wetlands that were not impacted did not differ in composition. The wetlands at MAERC provide dynamic habitats that offer varying breeding opportunities that are highly dependent on meteorological conditions.

1898. **Use of wetlands by spring-migrant shorebirds in agricultural landscapes of North Dakota's Drift Prairie.**
Niemuth, N. D.; Estey, M. E.; Reynolds, R. E.; Loesch, C. R.; and Meeks, W. A.
Wetlands 26(1): 30-39. (2006)
NAL Call #: QH75.A1W47; ISSN: 02775212.
Notes: doi: 10.1672/0277-5212(2006)26 [30:UOWBSS]2.0.CO;2.
Descriptors: Farm Bill/ landscape ecology/ migration chronology/ Prairie Pothole Region/ wetland complex
Abstract: Small, isolated wetlands in the Prairie Pothole Region of North America may be of critical importance to migrating shorebirds but are at high risk of drainage for agricultural production. We evaluated shorebird use of 1,181 temporary and seasonal wetlands within agricultural fields in the Drift Prairie physiographic region of North Dakota, USA over a 10-week period in spring of 2001. A total of 4,050 shorebirds of 25 species was observed on sampled wetlands. Shorebirds selected temporary wetlands that had water present during multiple visits, little emergent vegetation, large perimeters, and other wetlands in the surrounding landscape. Shorebirds were less likely to use wetlands showing evidence of drainage. Observed use of wetland basins suggests that small wetlands in the Prairie Pothole Region host millions of migrant shorebirds each spring. Continued existence of many of these wetlands may be threatened by a recent U.S. Supreme Court ruling that removed federal protection from certain isolated wetlands. Our results show the importance of current wetland protection provisions such as "Swampbuster" and other conservation practices of the United States Department of Agriculture Farm Program. © 2006, The Society of Wetland Scientists.

1899. **Using species-habitat models to target conservation: A case study with breeding mallards.**
Newbold, S. and Eadie, J. M.
Ecological Applications 14(5): 1384-1393. (2004)
NAL Call #: QH540.E23; ISSN: 10510761
Descriptors: Anas platyrhynchos/ count regression/ edge effects/ GIS/ habitat selection/ mallards/ optimization/ reserve site selection/ species-habitat models/ systematic

conservation/ wetlands/ conservation management/ conservation planning/ decision making/ ecological modeling/ habitat restoration/ habitat use/ waterfowl/ California/ Central Valley/ Anas/ Anas platyrhynchos/ Anatidae/ Anser
Abstract: To make effective conservation decisions, managers must understand the ecology of species targeted for conservation and be able to apply that knowledge in decision-making. Most conservation research to date has focused on the first of these requirements, but lately ecologists and others have begun to address more systematically the decision-making component of conservation. In this paper, we develop an explicit model of species-habitat relations and incorporate it into an optimization framework for prioritizing sites for management. We then present a case study that applies these concepts to choosing sites for wetlands restoration to benefit breeding Mallards (Anas platyrhynchos) in the Central Valley of California, USA. First, a model of habitat selection by Mallards was estimated using count regression techniques. Our results indicate that breeding Mallard abundances depend not only on the amount of each land use type present, but also on the interspersion of particular land use types in the vicinity of each survey location. We then used the estimated parameters in an optimization model to predict the differences in the expected total Mallard abundance under three generalized strategies for wetlands restoration. Our results suggest that using the spatial habitat preferences of Mallards to target restoration can lead to a greater-than-proportional increase in Mallard abundances: a simulated 50% increase in the total area of wetlands resulted in a nearly 80% increase in the total abundance of breeding Mallards. In contrast, simulated strategies for choosing restoration sites that did not account for the spatial habitat preferences of Mallards resulted in 13-33% increases in total abundance. Accounting for the spatial arrangement of preferred habitats when setting restoration priorities can enhance conservation effectiveness considerably.

1900. **The value of agricultural wetlands as invertebrate resources for wintering shorebirds.**
Taft, O. W. and Haig, S. M.
Agriculture, Ecosystems and Environment 110(3-4): 249-256. (2005)
NAL Call #: S601.A34; ISSN: 0167-8809
Descriptors: invertebrate abundance/ dunlin/ killdeer/ oligochaetes/ wetland landscape/ wintering waterbirds
Abstract: Agricultural landscapes have received little recognition for the food resources they provide to wintering waterbirds. In the Willamette Valley of Oregon, modest yet significant populations of wintering shorebirds (Charadriiformes) regularly use hundreds of dispersed wetlands on agricultural lands. Benthic invertebrates are a critical resource for the survival of overwintering shorebirds, yet the abundance of invertebrate resources in agricultural wetlands such as these has not been quantified. To evaluate the importance of agricultural wetlands to a population of wintering shorebirds, the density, biomass, and general community composition of invertebrates available to birds were quantified at a sample of Willamette Valley sites during a wet (1999-2000) and a dry winter (2000-2001). Invertebrate densities ranged among wetlands from 173 to 1925 (mean +/- S.E.: 936 +/- 106) individuals/m^2 in the wet winter, and from 214 to 3484 (1028 +/- 155) individuals/m^2 in the dry winter. Total invertebrate estimated biomass among wetlands ranged from 35 to 652 (mean +/- S.E.: 364 +/- 35) mg/m^2 in the wet winter, and from 85 to 1405 (437 +/- 62) mg/m^2 in the dry winter. These estimates for food abundance were comparable to that observed in some other important freshwater wintering regions in North America.
This citation is from AGRICOLA.

1901. **Variation in size and location of wading bird colonies in the Upper St. Johns River Basin, Florida, USA.**
Bryan, J. C.; Miller, S. J.; Yates, C. S.; and Minno, M.
Waterbirds 26(2): 239-251. (2003)
NAL Call #: QL671; ISSN: 07386028
Descriptors: borrow pits/ Upper St. Johns River/ wading bird colonies/ wetland restoration/ aerial survey/ habitat restoration/ nest site/ wader/ United States/ Bubulcus ibis/ Mycteria americana
Abstract: Wading bird nesting colonies were surveyed in the Upper St. Johns River Basin, east central Florida, USA in 1993-1995 and 1998-2000 using aerial survey methods. A total of 62 colony locations were found over six years, with a maximum of 35 sites active in each of two years. Borrow pits and managed impoundments were the most important nesting locations based on size and persistence. Most of these sites were in or adjacent to the Upper St. Johns River Basin Project, a wetland restoration protect. Higher numbers of nests were counted during nesting seasons preceded by above average rainfall than during seasons characterized by drought. Cattle Egrets (Bubulcus ibis) were the most common nesting species in all years, however, the proportion of the total nests that were Cattle Egrets decreased over the study period. Wood Storks (Mycteria americana), a federally endangered species, nested in increasing numbers within three borrow pits adjacent to the Upper St. Johns River Basin Project. This study reveals the importance of borrow pits, most of which are on private land where sites are unprotected, to wading bird nesting in east central Florida.

1902. **Vegetation, invertebrate, and wildlife community rankings and habitat analysis of mitigation wetlands in West Virginia.**
Balcombe, C. K.; Anderson, J. T.; Fortney, R. H.; and Kordek, W. S.
Wetlands Ecology and Management 13(5): 517-530. (2005)
NAL Call #: QH541.5.M3 W472; ISSN: 0923-4861
Descriptors: created wetland/ man-made wetland/ mitigation wetland/ reference wetland/ restored wetland/ wetland management/ wetland mitigation
Abstract: Numerous efforts have been made in West Virginia to construct and restore compensatory wetlands as mitigation for natural wetlands destroyed through highway development, timbering, mining, and other human activities. Because such little effort has been made to evaluate these wetlands, there is a need to evaluate the success of these systems. The objective of this study was to determine if mitigation wetlands in West Virginia were adequately supporting ecological communities relative to naturally occurring reference wetlands and to attribute specific characteristics in wetland habitat with trends in wildlife abundance across wetlands. Specifically, avian and anuran

communities, as well as habitat quality for eight wetland-dependent wildlife species were evaluated. To supplement this evaluation, vegetation and invertebrate communities also were assessed. Wetland ranks were assigned based on several parameters including richness, abundance, diversity, density, and biomass, depending on which taxa was being analyzed. Mitigation wetlands consistently scored better ranks than reference wetlands across all communities analyzed. Canonical correspondence analysis revealed no correlations between environmental variables and community data. However, trends relating wetland habitat characteristics to community structure were observed. These data stress the need to maintain specific habitat characteristics in mitigated wetlands that are compatible with wildlife colonization and proliferation. © Springer 2005.

1903. **Vegetation similarity and avifaunal food value of restored and natural marshes in northern New York.**
Brown, Stephen C.
Restoration Ecology 7(1): 56-68. (1999)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: natural restored marsh comparisons: avifaunal food value, vegetation/ restoration ecology
Abstract: Measuring the success of wetland restoration efforts requires an assessment of the wetland plant community as it changes following restoration. But analyses of restored wetlands often include plant community data from only one time period. We studied the development of plant communities at 13 restored marshes in northern New York for 4 years, including 1 year prior to restoration and 3 years afterwards. Restored wetlands ranged in size from 0.23 to 1.70 ha. Four reference wetlands of similar basin morphology, soil type, and size (0.29-0.48 ha) that occurred naturally in the same area were studied as comparisons. Dike construction to restore hydrology disturbed the existing vegetation in some parts of the restored sites, and vegetation was monitored in both disturbed and undisturbed areas. Undisturbed areas within the restored sites, which were dominated by upland field grasses before restoration, developed wetland plant communities with lower wetland index values but comparable numbers of wetland plant species than the reference wetlands, and they lagged behind the reference sites in terms of total wetland plant cover. There were significantly more plant species valuable as food sources for wetland birds, and a significantly higher percent cover of these species, at the undisturbed areas of the restored sites than at the reference wetlands. Areas of the restored sites that were disturbed by dike construction, however, often developed dense, monospecific cattail stands. In general, the plant communities at restored sites became increasingly similar to those at the reference wetlands over time, but higher numbers of herbaceous plants developed at the restored sites, including food plants for waterfowl, rails, and songbirds. Differences in shrub cover will probably lessen as natural recolonization increases shrub cover at the restored sites. Natural recolonization appears to be an effective technique for restoring wetlands on abandoned agricultural fields with established plant cover, but it is less successful in areas where soil has been exposed by construction activity.

1904. **Vertebrate use of habitats created by installation of field-scale erosion control structures.**
Cooper, C. M.; Smiley, P. C.; Wigginton, J. D.; Knight, S. S.; and Kallies, K. W.
Journal of Freshwater Ecology 12(2): 199-207. (June 1997)
NAL Call #: QH541.5.F7J68; ISSN: 0270-5060
Descriptors: Vertebrata/ farming and agriculture/ agricultural field runoff control by drop pipe installation/ community structure/ habitat utilization/ semiaquatic habitat/ wetland habitats created by drop pipe installation in field/ community structures and habitat use survey/ Mississippi/ Panola County/ agriculture field runoff control by drop pipe installation/ created wetland habitats use and community structures

1905. **Vertebrate use of nontidal wetlands on Galveston Island, Texas, USA.**
Mueller A. J.
Texas Journal of Science 37(2-3): 215-226. (1985)
NAL Call #: 470 T31; ISSN: 0040-4403
Descriptors: amphibians/ reptiles/ birds/ emergent aquatic vegetation/ rainfall/ evaporation/ salinity/ barrier islands
Abstract: The nontidal wetlands of Galveston Island, Texas, depend on local rainfall for freshwater, and many dry out during summer. Evaporation and inundation by storm tides cause salinities to rise; they decline when heavy rains flush out the saltwater. Aquatic emergents are the dominant vegetation. Nontidal marshes provide important habitat for many kinds of wildlife, especially birds. In a comparison of two wetlands, one natural and the other man-made, the natural area received equal or greater use by all aquatic bird groups except the black-crowned night heron (Nycticorax nycticorax) and American coot (Fulica americana). Nontidal wetlands are the only available habitat on Galveston Island for many amphibians and reptiles.

1906. **Volunteers monitor bird use of wetland restoration on public lands in central Florida.**
Marburger, J. E.
Ecological Restoration 20(3): 164-172. (2002);
ISSN: 1543-4079
Descriptors: Aves/ Florida/ seabirds/ waterfowl/ restoration/ wetlands/ surface water level/ hydrology/ habitat conservation/ ecological restoration
Abstract: In the Emeralda Marsh Connection Area (FL), the purpose of the volunteers' work was to evaluate certain related species to see if they responded to environmental changes brought on by the restoration, particularly alterations in water levels.

1907. **Waste rice for waterfowl in the Mississippi Alluvial Valley.**
Stafford, J. D.; Kaminski, R. M.; Reinecke, K. J.; and Manley, S. W.
Journal of Wildlife Management 70(1): 61-69. (2006)
NAL Call #: 410 J827; ISSN: 0022541X
Descriptors: carrying capacity/ conservation planning/ estimation/ food resources/ foraging/ Mississippi Alluvial Valley/ rice/ sampling/ waterfowl
Abstract: Flooded rice fields are important foraging habitats for waterfowl in the lower Mississippi Alluvial Valley (MAV). Waste rice previously was abundant in late autumn (140-492 kg/ha), but early planting and harvest dates in recent

years may have increased losses of waste rice during autumn before waterfowl arrive. Research in Mississippi rice fields revealed waste-rice abundance decreased 79-99% during autumns 1995-1996 (Manley et al. 2004). To determine if this trend existed throughout the MAV, we used multistage sampling (MSS) to estimate waste-rice abundance during September-December 2000-2002. Averaged over years, mean abundance of waste rice decreased 71% between harvest ($\bar{x}$ = 271.0 kg/ha, CV=13% n = 3 years) and late autumn ($\bar{x}$ = 78.4 kg/ha, CV= 15% n = 3). Among 15 models formulated to explain variation in rice abundance among fields and across years, the best model indicated abundance of waste rice in late autumn differed between harvester types (i.e., conventional > stripper header) and was positively related to initial waste-rice abundance after harvest. Because abundance of waste rice in late autumn was less than previous estimates in all 3 years, we concluded that waterfowl conservationists have overestimated carrying capacity of rice fields for wintering waterfowl by 52-83% and recommend 325 duck-use days/ha (DUDs) as a revised estimate. We suggest monitoring advances in rice harvest dates to determine when new surveys are warranted and recommend increased management of moist-soil wetlands to compensate for decreased rice abundance.

1908. **Water quality and macroinvertebrate assemblages in three types of seasonally inundated limesink wetlands in southwest Georgia.**
Battle, J. and Golladay, S. W.
Journal of Freshwater Ecology 16(2): 189-208. (2001)
NAL Call #: QH541.5.F7J68; ISSN: 0270-5060
Descriptors: wetlands/ macrofauna/ zoobenthos/ water quality/ community composition/ species diversity/ ecology/ invertebrates/ aquatic life/ Georgia
Abstract: In southwest Georgia there are three types of shallow, seasonally inundated limesink wetlands based on soil characteristics and vegetation-grass-sedge marshes, cypress savannas, and cypress-gum swamps. We sampled wetlands of the three types from February 1997 through June 1998 during early, mid, and late hydroperiod in 1997. The wetlands had similar water chemistry soon after inundation. Over rime, water in swamps generally had higher levels of dissolved organic carbon, NH_4 -N, NO_3 -N, and PO_4 -P, was more darkly stained, and had lower temperatures than in other wetland types. We collected 121 macroinvertebrate taxa, with 40 taxa occurring in >10% of the samples. Marshes had higher macroinvertebrate numbers and taxa richness than other wetland types. Early in the hydroperiod, macroinvertebrate assemblages were composed of taxa that overwintered in wetlands. Later, predators were abundant in the marshes, and detritivore numbers declined in swamps. Our findings suggest that water quality is influenced by interactions of vegetation, soils, and time since inundation. We believe that macroinvertebrate assemblages differed among the wetland types due mainly to vegetation. Macroinvertebrates in marshes probably have a wider variety of food sources (i.e., algae) and greater habitat structure available, whereas in swamps macroinvertebrates have more stressful conditions (i.e., low dissolved oxygen) caused by processing of large detrital inputs.

1909. **Waterbird communities and associated wetlands of the Colorado River Delta, Mexico.**
Hinojosa Huerta, Osvel; Destefano, Stephen; Carrillo Guerrero, Yamilett; Shaw, William W.; and Valdes Casillas, Carlos
Studies in Avian Biology (27): 52-60. (2004)
NAL Call #: QL671.S8; ISSN: 0197-9922
Descriptors: biodiversity/ biogeography: population studies/ marine ecology: ecology, environmental sciences/ agricultural drain/ flood control measures/ guild composition/ species abundance/ species richness/ waterbird communities/ wetland habitat/ wetland management program
Abstract: Despite extensive losses of wetlands caused by water diversions upstream, the Colorado River Delta in northwestern Mexico remains an important wetland system in the Sonoran Desert. The purpose of our study was to describe waterbird communities across a variety of wetland habitat types and zones that exist in the Delta. We measured species richness and abundance of waterbirds from September 1999 to August 2000. We observed a total of 11,918 individuals of 71 species at sites within seven wetland areas. The waterbird communities differed with respect to guild composition and species abundances among the wetland zones. Wetlands along the eastern portion of the Delta (Cienega and Indio), which are supported by agricultural drains and managed under conservation initiatives, exhibited the highest species richness in our summer and winter censuses, and highest abundance in summer. Shorebirds were the dominant guild in the summer period, while waterfowl were dominant during winter. Breeding marshbirds were also abundant, with the Yuma Clapper Rail (Rallus longirostris yumanensis) being most notable. Wetlands along the western Delta (Hardy and Cucapa) were also supported by agricultural drains, but were not managed specifically for wildlife. The Double-crested Cormorant (Phalacrocorax auritus) and American Coot (Fulica americana) were dominant during winter, while long-legged waders (Ardeidae) were dominant in summer. The composition of waterbird communities along the mainstem of the Colorado River was similar to that of wetlands along the western portion of the Delta. The shallow and ephemeral Laguna Salada, along the western boundary of the Delta, exhibited the highest waterbird abundance among our winter censuses when it was flooded in 2000. The results of our study suggest that even minimal levels of instream flows would lead to habitat improvements for waterbirds in the Delta floodplain. A bi-national wetland management program for the Delta should consider the impacts of flood control measures and diversions for agricultural and urban uses to the health of wetland habitats on both sides of the international border.

1910. **Waterbird communities in managed wetlands of varying water depth.**
Colwell, M. A. and Taft, O. W.
Waterbirds 23(1): 45-55. (2000)
NAL Call #: QL671; ISSN: 0738-6028
Descriptors: wetlands/ habitat selection/ community composition/ species diversity/ aquatic birds/ water depth/ environment management/ ecosystem management/ ecological distribution/ habitat utilization/ winter/ California/ Aves/ San Joaquin Valley/ birds/ behavior/ management/

Abstract: Published accounts of interspecific differences in habitat use by waterbirds predict that shallow wetlands should accommodate more species and greater numbers of waterbirds than deep wetlands. We evaluated this hypothesis by examining relationships between winter (January/February) waterbird use (presence/absence, density and number of species) and average depth, variation in depth and size of 25 wetlands in the northern San Joaquin Valley, California. Bird densities correlated consistently with depth. Likelihood of use increased in shallow wetlands for all nine wading birds (shorebirds and ibis); densities of three dabbling duck species and Black-necked Stilt (Himantopus mexicanus) also increased in shallow wetlands, whereas use and densities of two diving birds increased in deep wetlands. We observed no statistically significant relationship between depth and densities of two other waterbird species. The number of species of waterbird, dabbling duck, and wading bird increased in shallow wetlands, whereas the number of species of diving bird increased in deep wetlands. Wetland size and topographic variation inconsistently predicted waterbird densities, but both characteristics correlated positively with number of species. Our results provide general support for shallow flooding of wetlands to provide habitat for more species. We conclude that managers seeking to provide foraging habitat for a diverse community of wintering waterbirds should flood wetlands to average depths of 10-20 cm, where topography can provide a range of depths attractive to a large number of species. However, this prescription is region-specific and influenced by the great diversity and abundance of waterfowl and shorebirds wintering in California's Central Valley.

1911. **Waterbird communities in rice fields subjected to different post-harvest treatments.**
Day, John H. and Colwell, Mark A.
Colonial Waterbirds 21(2): 185-197. (1998);
ISSN: 0738-6028
Descriptors: community composition/ post harvest treatments/ rice fields/ habitat/ species richness/ wetland management
Abstract: In California's Sacramento Valley, the potential value of rice fields as habitat for waterbirds may vary with harvest method, postharvest treatment of rice straw (chopped, burned, plowed), and extent of flooding. Recent changes in rice harvesting methods (i.e., use of stripper-headers) and a legislative mandate to decrease burning of rice straw after harvest may alter habitat availability and use. Thus, we investigated species richness and community composition of nonbreeding waterbirds during October-March 1993-94 and 1994-95 in rice fields of the northern Sacramento Valley. Most (85-91% of land area) rice was conventionally harvested (i.e., cutter bar), and the remainder was stripped. Rice straw was left untreated in more than half of fields (52% in 1994 and 54% in 1995), especially in stripped fields (56-70%). In fields where farmers treated straw, the most common management methods were plowing (15-21%), burning (19-24%), and chopping (3-5%). Fields became increasingly wet from October through March as seasonal precipitation accumulated and farmers flooded fields to facilitate straw decomposition and provide habitat for ducks. Species richness of waterbirds was greater ($P < 0.002$) in conventionally-harvested fields than in stripped fields; within harvest methods, species richness was consistently greater ($P < 0.01$) in flooded than non-flooded fields. By contrast, species richness did not differ among straw treatments ($P > 0.23$). Species richness in stripped fields probably was low because foraging opportunities were limited by tall dense straw, decreased grain density, and infrequent flooding. We recommend that land managers wishing to provide habitat for a diverse waterbird community harvest rice using conventional methods and flood fields shallowly.

1912. **Waterbird foods in winter-managed ricefields in Mississippi.**
Manley, S. W.; Kaminski, R. M.; Reinecke, K. J.; and Gerard, P. D.
Journal of Wildlife Management 68(1): 74-83. (2004)
NAL Call #: 410 J827; ISSN: 0022541X
Descriptors: foraging carrying capacity/ Mississippi Alluvial Valley/ Oryza saliva/ private-lands management/ rice/ shorebirds/ waterfowl/ agricultural land/ carrying capacity/ feeding ground/ rice/ waterfowl/ wildlife management/ winter/ Mississippi
Abstract: Ricefields are important foraging habitats for waterfowl and other waterbirds in primary North American wintering regions. We conducted a large-scale experiment to test effects of post-harvest ricefield treatment, winter water management, and temporal factors on availabilities of rice, moist-soil plant seeds, aquatic invertebrates, and green forage in the Mississippi Alluvial Valley (MAV), Mississippi, USA, fall-winter 1995-1997. Our results revealed that a large decrease in rice grain occurred between harvest and early winter (79-99%), which, if generally true throughout the MAV, would have critical implications on foraging carrying capacity of ricefields for migrating and wintering waterbirds. During the remainder of winter, food resources generally were similar among treatment combinations. An exception was biomass of aquatic invertebrates, which demonstrated potential to increase by late winter in ricefields that remained flooded. We offer revised calculations of foraging carrying capacity for waterfowl in MAV ricefields and recommend continuing research and management designed to increase availability of residual rice and aquatic invertebrates in winter.

1913. **Waterbird responses to experimental drawdown: Implications for the multispecies management of wetland mosaics.**
Taft, O. W.; Colwell, M. A.; Isola, C. R.; and Safran, R. J.
Journal of Applied Ecology 39(6): 987-1001. (2002)
NAL Call #: 410 J828; ISSN: 00218901.
Notes: doi: 10.1046/j.1365-2664.2002.00763.x.
Descriptors: diving waterbirds/ habitat use/ moist-soil management/ non-breeding season/ shorebirds/ water depth/ waterfowl/ abundance/ avifauna/ human activity/ species richness/ wetland management/ United States/ Anas/ Anas sp./ Anatidae/ Anser
Abstract: 1. The loss and human modification of wetlands world-wide underscores the importance of efficient management. For wetlands that provide habitats for non-breeding waterbirds, such management often aims to support a rich and abundant waterbird community. 2. Among the world's many seasonal, moist-soil managed wetlands, annual winter flooding is followed by spring

drawdown to encourage germination of waterfowl food plants. Recommendations on how best to maintain flooded wetlands for multiple species are mostly theoretical, and drawdown management typically focuses on spring for migrating shorebirds. The benefits and drawbacks of shallow-water management in winter have not been examined, especially where sizeable populations of wintering shorebirds and waterfowl occur together. 3. We considered The Grasslands Ecological Area in California's Central Valley, USA, as a model wetland complex in which to assess optimal winter flood-depth for multi-species use. We also examined the relative benefits for each waterbird group (e.g. shorebirds and waterfowl) of drawdowns conducted in winter and spring. We experimentally dewatered wetlands of measured topography in the winter and spring of 1994-95, documenting changes in waterbird species richness and abundance associated with daily changes in habitat diversity and availability. 4. Results indicated limited regional availability of shallow-water habitat across the landscape in winter but not spring, as use by shorebirds and teal increased on drawndown wetlands in winter only. Use by deeper-water dabbling ducks and diving waterbirds declined during the later stages of drawdown in both seasons, but not until use by shorebirds and teal had peaked. The maximum diversity and abundance of waterbirds occurred at average depths of 10-20 cm on wetlands with topographic gradients of 30-40 cm. 5. This study has important implications for the winter management of seasonal wetland complexes, especially moist-soil systems where managers provide habitat for different waterbird groups (from shorebirds to diving waterbirds) simultaneously. In general, where topography is variable (e.g. a difference of 30-40 cm between the deepest and shallowest zones), wetlands flooded to average depths of 15-20 cm should accommodate the greatest richness and abundance of waterbirds.

1914. **Waterbird responses to hydrological management of Wetlands Reserve Program habitats in New York.**
Kaminski, M. R.; Baldassarre, G. A.; and Pearse, A. T.
Wildlife Society Bulletin 34(4): 921-926. (2006)
NAL Call #: SK357.A1W5; ISSN: 00917648.
Notes: doi: 10.2193/0091-7648(2006)34 [921:WRTHMO]2.0.CO;2.
Descriptors: moist-soil management/ New York/ restoration/ waterbird/ waterfowl/ wetland management/ Wetlands Reserve Program
Abstract: The Wetlands Reserve Program (WRP) has restored nearly 600,000 ha of wetlands in the United States since inception of the program in 1996. However, no research has evaluated postrestoration management of WRP wetlands in relation to waterfowl and waterbird use. Therefore, we conducted an experiment to compare waterfowl and waterbird abundance and diversity between hydrologically managed (i.e., spring-summer drawdown for vegetation regeneration) and nonmanaged WRP wetlands in central New York, USA, in 2004. We surveyed waterfowl and other waterbirds on 5 managed and 5 nonmanaged wetlands over 3 10-week periods (i.e., spring: 7 Mar-15 May; summer: 16 May-24 Jul; autumn: 25 Jul-30 Sep). We detected a total of 36 taxa of these birds across the 3 periods and both types of wetlands but observed 1.4-2.3 times more taxa on managed than on nonmanaged wetlands among periods. Additionally, we recorded 0.8-13.2 times greater relative abundances (n birds/ha of wetland) of waterfowl and other waterbirds on managed than on nonmanaged wetlands during spring through autumn. We recommend regular postrestoration hydrological management of WRP wetlands to regenerate moist-soil and other emergent plants and promote waterfowl and waterbird use of these restored habitats.

1915. **Waterbird use of bayland wetlands in the San Francisco Bay Estuary: Movements of long-billed dowitchers during the winter.**
Takekawa, J. Y.; Warnock, N.; Martinelli, G. M.; Miles, A. K.; and Tsao, D. C.
Waterbirds 25 (Special Publ.2): 93-105. (2002)
NAL Call #: QL671; ISSN: 07386028
Descriptors: Limnodromus scolopaceus/ long-billed dowitcher/ radio telemetry/ San Francisco Bay/ wintering ecology/ biotelemetry/ estuarine ecosystem/ habitat use/ movement/ overwintering/ restoration ecology/ waterfowl/ wetland/ United States/ Calidris alpina/ Calidris mauri/ Himantopus mexicanus/ Limnodromus scolopaceus
Abstract: The San Francisco Bay estuary is a migration and wintering area for more than 1.5 million waterbirds on the west coast of North America. Because the estuary is located in a metropolitan area, development and diking of baylands (the region between the edge of the bay and the historical high tide line) have greatly altered the wetland landscape. Recently, conservation interests have promoted restoration of diked baylands to tidal salt marshes for the benefit of endangered native species. However, effects of tidal marsh conversion on the existing community of waterbirds in the baylands are largely unknown, especially in muted tidal marshes with restricted inflows and in artificial salt evaporation ponds where high waterbird densities are found. The first radio-marking study of the Long-billed Dowitcher (Limnodromus scolopaceus) was conducted in November-December 2000 to examine their use of baylands. We captured 32 birds by rocket netting in a muted tidal marsh on the North Bay and radio-marked them with 1.2 g transmitters affixed with glue. Individuals were tracked for an average of 20.3 d (±8.5 SD) and obtained 217 high tide and 195 low tide locations. Movements between tides ($\bar{x}$ = 1.29 ± 1.48 SD km) and home range sizes ($\bar{x}$ = 17.7 ± 16.0 SD km^2) were highly variable. Long-billed Dowitchers preferred open habitats such as muted tidal marshes during the high tide, but the majority (78.5%) also remained in these wetlands during low tide rather than feeding at nearby mud flats. Their avoidance of mud flats contrasted sharply with Western Sandpipers (Calidris mauri) but was similar to Black-necked Stilts (Himantopus mexicanus). Seven Long-billed Dowitchers flew 110 km inland to Central Valley wetlands in mid-December, a regional movement documented earlier for Dunlin (Calidris alpina) wintering on the coast. However, unlike Dunlin, their movements were not in response to rainfall but may have been in response to a low pressure front or possibly predictable flooding of fields in the Central Valley. Although the estuary is a major wintering area supporting large numbers of waterbirds, some birds such as Long-billed Dowitchers move inland to freshwater wetlands in the Central Valley.

1916. **Waterfowl use of forested wetlands of the southern United States: An overview.**
Fredrickson, L. H. and Heitmeyer, M. E.
In: Waterfowl in winter/ Weller, M. W.
Minneapolis: University of Minnesota Press, 1988
pp. 307-323.
NAL Call #: QL696.A52W38
Descriptors: Anatidae/ wildlife management/ habitat exploitation/ semiaquatic habitat/ forest/ wetland/ United States, southern region/ wetland forests/ habitat exploitation and wildlife management

1917. **Waterfowl use of managed and unmanaged beaver ponds in south-central Ontario.**
Gabor, T. Shane; Murkin, Henry R.; and Ingram, Joel W.
Northeast Wildlife 57: 45-57. (2002)
Descriptors: conservation measures/ nutrition/ diet/ prey/ ecology/ population dynamics/ predators/ habitat/ freshwater habitat/ lentic water/ land zones/ North America/ Canada/ Aix sponsa/ Anas platyrhynchos/ Lophodytes cucullatus: habitat management/ prey/ Invertebrata/ piscean prey/ Cyprinidae/ food availability/ population density/ habitat utilization/ food resource availability relationship/ beaver ponds/ Ontario/ Pisces, Actinopterygii, Cypriniformes/ birds/ chordates/ fish/ invertebrates/ vertebrates
Abstract: We studied waterfowl habitat use and resource availability on beaver (Castor canadensis) ponds in south-central Ontario. We studied 6 types of natural beaver ponds (aquatic bed, emergent, forested, scrub-shrub, unvegetated, seasonally flooded) and 1 managed beaver pond (dewatered for >1 year to rejuvenate vegetation communities and then re-flooded). Waterfowl use was determined from helicopter surveys for breeding pairs and elevated platforms for broods. Invertebrate and minnow abundance and biomass were determined using sweep net samples. Mallard (Anas platyrhynchos) pair densities were higher (P = 0.001) on emergent (0.16 ± 0.02 SE) and scrub-shrub (0.20 ± 0.03) wetlands than on seasonally flooded (0.08 ± 0.02) ponds. Wood duck (Aix sponsa) pair densities were higher (P = 0.0001) on forested (0.20 ± 0.04), emergent (0.14 ± 0.03) and unvegetated (0.23 ± 0.06) wetlands than on seasonally flooded ponds (0.01 ± 0.01). Hooded merganser (Lophodytes cucullatus) pair densities were higher (P = 0.0001) on forested (0.10 ± 0.02) and unvegetated (0.07 ± 0.01) ponds than on scrub-shrub (0.01 ± 0.01) and seasonally flooded (0) wetlands. Differences in brood densities were not detected between wetland classes for mallard/black duck (P = 0.08), wood ducks (P = 0.17) and all species combined (P = 0.44). Hooded merganser brood densities were higher (P = 0.02) on forested (0.66 ± 0.22) and unvegetated (0.59 ± 0.23) wetlands than on emergent (0) wetlands. In June, total invertebrate biomass was higher (P = 0.008) in emergent (0.72 ± 0.32), forested (0.78 ± 0.30), scrub-shrub (0.75 ± 0.24), and managed wetlands (0.70 ± 0.17) than in unvegetated ponds (0.08 ± 0.05). In July, total invertebrate biomass was higher (P = 0.009) in emergent (1.23 ± 0.38) and managed (0.99 ± 0.22) wetlands than in unvegetated ponds (0.07 ± 0.03). Managed wetlands had similar productivity to natural vegetated wetlands and therefore intensive water level management to increase waterfowl productivity has limited potential. Waterfowl use in the region is primarily affected by wetland availability. Beaver abundance and distribution determine wetland availability and therefore, programs, partnerships, and policy initiatives that consider both forestry and beaver management will positively impact waterfowl in Canada's forested regions.

1918. **Weak correspondence between macroinvertebrate assemblages and land use in Prairie Pothole Region wetlands, USA.**
Tangen, B. A.; Butler, M. G.; and Ell, M. J.
Wetlands 23(1): 104-115. (2003)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ macrofauna/ land use/ agricultural land/ aquatic communities/ aquatic insects/ community composition/ species diversity/ biotic factors/ trophic relationships/ freshwater fish/ environmental impact/ ecosystem disturbance/ agriculture/ environment management/ invertebrates/ fish/ population dynamics/ aquatic habitat/ Invertebrata/ pisces/ North Dakota/ Prairie Pothole Region
Abstract: To evaluate the potential development of a macroinvertebrate Index of Biotic Integrity (IBI) for Prairie Pothole Region wetlands, we sampled the aquatic macroinvertebrate and fish communities in 24 semipermanent wetlands located throughout Central North Dakota. Wetland basins were selected to encompass a range of surrounding land-use, ranging from 100% grassland to 100% cropland. We used redundancy analysis (RDA) to identify the influences of fish, and temporal and spatial variation on the macroinvertebrate community. We also used RDA to look for relationships between wetland macroinvertebrate communities and land-use. Seventeen potential invertebrate metrics were tested by graphical analyses. We identified a strong influence on the macroinvertebrate community due to the presence of fish. A number of invertebrate taxa decreased in abundance as the summer progressed, and there was noticeable variation in the invertebrate community among individual wetlands of the region. However, we detected no strong relationships between the varying degrees of agricultural land-use in the wetland catchments and the invertebrate community. Consequently, we were unable to identify any effective IBI metrics indicative of land-use disturbance. Lack of correspondence between land-use and macroinvertebrates in this habitat is most likely due to a high degree of natural disturbance (e.g., presence of fish, temporal changes) and a low diversity community of resilient taxa in Prairie Pothole Region wetlands.

1919. **Wetland and aquatic habitats.**
Mathias, M. E. and Moyle, P.
Agriculture, Ecosystems and Environment 42(1-2): 165-176. (1992)
NAL Call #: S601.A34; ISSN: 0167-8809.
Notes: Special issue: Integrating conservation biol. & agric. production.
Descriptors: wetlands/ riparian environments/ dispersal/ agricultural practices/ biological diversity/ species diversity/ ecosystem management/ environmental impact/ agriculture/ dispersion/ man-induced effects/ man-induced effects/ dispersal/ agricultural practices/ biological diversity/ mechanical and natural changes
Abstract: Riparian wetland areas often represent critical corridors for animal and plant dispersion in wildland

watersheds and downstream river systems. It is essential that integrated management of riparian wetland areas be developed to reverse the loss of biological diversity. Agricultural and urban uses, and related water developments, have led to a marked decline of stream-side wetland habitats. Six major ways are discussed in which conventional agriculture alters wetlands and aquatic habitats: wetland drainage, water diversions, stream channelization, bank stabilization, grazing, and the release of agricultural pollutants. This article discusses these practices and suggests ways biological diversity can be protected, or even enhanced. In addition, aquaculture is discussed as a new force which affects the diversity of aquatic organisms. Aquaculture methods range in intensity of management from low to high. Management for biological diversity as well as for food production should be encouraged.

1920. **Wetland and riparian birds of West Virginia: Status, future research and guidelines for constructed wetlands.**
Edinger, Bruce
West Virginia Academy of Science. Proceedings 72(1): 4-5. (2000); ISSN: 0096-4263
Descriptors: agricultural practices/ biological indicators/ birds/ communities/ ecosystems/ habitat alterations/ habitat islands/ riparian habitat/ rivers/ trophic relationships/ urbanization/ wetland draining/ wetlands/ wildlife-habitat relationships/ West Virginia
Abstract: Birds, along with amphibians, are excellent vertebrate indicators of wetland functioning and values. Wetland birds, often specialist predators high on the food web, indicate an intact trophic pyramid. They are also sensitive to vegetation type and other landscape parameters. The absence or rarity of wetland birds can indicate problems with wetland quantity or quality. To determine the status of West Virginia's wetland birds, a review of existing records (Hall, 1983; Buckelew and Hall, 1994; lists assembled by bird clubs and state and federal agencies, etc.) and of conservation and management sources (journal articles, Partners in Flight Abstracts of The Nature Conservancy, Birds of North America, etc.) was conducted. Also, from 1996 through 1999, plot censuses of six natural and created wetland habitats in north-central West Virginia and similar studies in riparian communities along five rivers, allowed up to date (if local) data on wetland bird densities. This study provides an overview of the general status of wetland bird communities, important wetland habitat characteristics, long-term population changes, problematic wetland species, recommendations for future wetland bird research, and recommendations for constructed wetlands. West Virginia wetland communities are riverine, lacustrine (reservoirs and lakes), and palustrine (wet meadow, emergent, shrub-scrub, forested, and beaver pond) systems, and the bird community varied from one wetland type to another. For example, isolated and ephemeral beaver ponds, support a high diversity of secondary cavity nesters (high quantity of snags) and black ducks (possibly lessened competition with ma1lards who threaten hybridization and genetic swamping). Wetlands lacking a shrub layer, either naturally or because a constructed wetland was in an early stage of succession, lacked species such as Empidonax flycatchers. In sum, West Virginia's wetland bird species were sensitive to surrounding habitat, type of wetland vegetation, proportion and depth of open water, and availability of mud margin. Threats to wetland-dependent birds in West Virginia continue to be habitat fragmentation, loss, and degradation. Quantified, long-term studies of breeding and non-breeding bird usage of some of West Virginia's larger wetlands are needed to adequately assess population trends. Breeding Bird Survey studies poorly monitor wetland species. At the same time, given the high diversity of migratory wetland birds found in some West Virginia wetlands, additional research is needed into the value of these wetlands, despite their sma11 size, as stopover sites for migratory species. Ecotonal and seasonal use of wetlands by "non-wetland" bird species is a third area needing attention. In the same way red-shouldered hawks have territories that allow feeding in forested wetlands, but are also found in other habitats, several other species of birds may be found to have "habitat mosaic" needs that include wetlands. Finally, since constructed wetlands are a growing part of the wetland mix in West Virginia, mitigation wetlands can be improved as wetland bird habitat if they are sufficiently large, hydrologically joined to rivers, allowed to undergo wetland succession to develop shrub-scrub and organic soils, and surrounded by plant communities complementary to the needs of wetland bird species.

1921. **Wetland birds: Habitat resources and conservation implications.**
Weller, Milton W.
Cambridge, UK : Cambridge University Press; xv, 271 p., [26] p. of plates : ill., map. (1999).
Notes: Contents note: Introduction -- Wetlands: what, where, and why -- Major groups of birds that use wetlands -- Water and other resource influences -- Foods, feeding tactics, strategies, and guilds -- Bird mobility and wetland predictability -- Other behavioral and physical influences on wetland living -- Spatial and structural patterns -- Habitat dynamics: water, plant succession, and time -- Population consequences of wetland abundance and quality -- How birds influence wetlands -- Conservation implications -- Measures of bird habitat use and quality -- Current status and some conservation problems -- Conservation and management strategies -- Outlook.
NAL Call #: QL698.95.W45 1999; ISBN: 0521633265.
Descriptors: Water birds---Ecology/ Wetland animals---Ecology/ Birds, Protection of
This citation is from AGRICOLA.

1922. **Wetland conservation and Ducks Unlimited: Real world approaches to multispecies management.**
Tori, Gildo M.; McLeod, Scott; McKnight, Keith; Moorman, Thomas; and Reid, Frederic A.
Waterbirds 25 (Special Publication 2): 115-121. (2002)
NAL Call #: QL671; ISSN: 1524-4695
Descriptors: biodiversity/ freshwater ecology: ecology, environmental sciences/ terrestrial ecology: ecology, environmental sciences/ wildlife management: conservation/ multispecies management/ applied and field techniques/ Ducks Unlimited/ biodiversity/ coastal wetlands/ development: agricultural, industrial, urban/ habitat degradation/ habitat loss/ hydrological modification/ integrated habitat based landscape management/ land conversion/ palustrine wetlands/ riverine wetlands/ sustainable ecosystems/ wetland conservation/ wetland

management/ wetland restoration/ wetland associated uplands/ wildlife diversity
Abstract: Conversion and loss of coastal, riverine, and palustrine wetlands to agricultural, urban, and industrial developments have had significant impacts on waterbirds. Degradation of wetlands and associated upland habitats, and associated impacts on several duck and rail species are well documented. Wetland restoration and management are essential for wildlife diversity because of the magnitude of wetland destruction and hydrological modification that has occurred in most of the United States. Half of threatened and endangered species rely upon wetlands for some portion of their life cycle, underscoring the importance of wetlands to all wildlife. Ducks Unlimited, during its 65-year history of conservation programs, has restored, protected, and enhanced nearly 4.05 million hectares of wetlands and associated uplands in North America. Despite the accomplishments of Ducks Unlimited and its private, state, provincial and federal partners, the perception remains that our efforts benefit only waterfowl. However, wildlife inventories on Ducks Unlimited projects indicate benefits to more than 900 species. Herein, we promote an integrated, habitat-based landscape approach to wetland restoration and management, rather than individual species management, to achieve biodiversity and sustainable ecosystem objectives. We discuss the development of wetland restoration and management strategies for quality wetland complexes needed for waterbirds during their annual life cycles. Further, we underscore the importance of wetland management by our state, federal and private land partners to manage wetland complexes to provide high quality habitat for a wide array of wetland wildlife.

1923. **Wetland management for shorebirds and other species: Experiences on the Canadian prairies.**
Dickson, H. Loney and McKeating, Gerald
Transactions of the North American Wildlife and Natural Resource Conference 58: 370-377. (1993)
NAL Call #: 412.9 N814; ISSN: 0078-1355
Descriptors: Aves/ habitat management/ semiaquatic habitat/ wetlands management/ multispecies approach/ Canada/ Alberta/ Manitoba/ Saskatchewan/ multispecies approach to wetland management/

1924. **Wetland restoration in the Prairie Pothole Region of North America: A literature review.**
Knutsen, G. A. and Euliss, N. H. U.S. Geological Survey; USGS/BRD/BSR 2001-0006, 2001. 54 p.
Notes: Literature review; U.S. Geological Survey, Biological Resources Division, Biological Science Report 2001-0006.
Descriptors: amphibians/ birds/ fishes, freshwater/ floods/ habitat management for wildlife/ land reclamation/ land use/ mammals/ prairie/ rehabilitation/ reptiles/ seeds/ vegetation/ water catchments/ water, chemical properties/ water, physical properties invertebrates/ wetlands/ wetland restoration/ prairie potholes/ Prairie Pothole Region
Abstract: In this report, prairie pothole region (PPR) literature is categorized into five general sections: wildlife, vegetation, invertebrates, fish, and physical and chemical characteristics of restored wetlands. Each of the five sections includes a summary of research and is divided into two parts: an overview of research and findings, and regional case studies. It is noted that there is a scarcity of research in the western and northern portions of the PPR most studies having been conducted in Iowa, Minnesota, or South Dakota.

1925. **Wetland restoration thresholds: Can a degradation transition be reversed with increased effort?**
Lindig-Cisneros, R.; Desmond, J.; Boyer, K. E.; and Zedler, J. B.
Ecological Applications 13(1): 193-205. (2003)
NAL Call #: QH540.E23 ; ISSN: 10510761
Descriptors: alternative-state theory/ cordgrass/ fertilization effects/ irreversible transition/ management actions/ nitrogen addition/ restoration outcome, evaluating/ restoration threshold/ Spartina foliosa/ statistical design/ wetland restoration, coastal/ coastal wetland/ degradation/ restoration ecology/ wetland management/ Spartina foliosa
Abstract: Previous attempts to reverse the degradation of a coastal wetland and restore nesting habitat for an endangered bird showed that adding nitrogen could temporarily increase the height of Spartina foliosa, but not produce self-sustaining tall canopies. We asked if increased effort (up to five years of N fertilization) would shift canopy attributes across the hypothesized threshold. Thirty plots were treated with 0-5 yr of urea addition, and all were followed for 5 yr. Canopies were robust while urea was being added, but Spartina reverted to short stature soon after fertilization ended, supporting R. J. Hobbs and D. A. Norton's concept of an irreversible transition. However, specific outcomes depended on thechoice of response variable (six comparisons), the choice of reference data (initial conditions, same-year data, and pooled data), and the choice of statistical design (repeated measures vs. complete design), indicating the need to assess experiments thoroughly before making strong recommendations for management.

1926. **Wetland use by non-breeding ducks in coastal Texas, USA.**
Anderson, James T.; Muehl, George T.; Tacha, Thomas C.; and Lobpries, David S.
Wildfowl 51: 191-214. (2000)
NAL Call #: SK351.W575; ISSN: 0954-6324
Descriptors: aquatic vegetation/ habitat use/ management priorities/ population density/ wetland types
Abstract: Wetland use by nonbreeding ducks in coastal Texas in the areas between Galveston Bay and the Rio Grande were studied, September 1991 to March 1993, to determine the most important wetland types based on density. Twenty-five species of ducks were observed using wetlands on a stratified (based on dominant land use) random sample of 64.75 ha (one-quarter section) plots. Ranks of density for all ducks, as a group, were highest in lacustrine littoral emergent nonpersistent wetlands. Anatini density ranks were greatest in wetlands with scrub-shrub vegetation, but individual species' ranks varied. Dendrocygnini and Aythyini density ranks were highest in lacustrine littoral wetlands, particularly those with aquatic-bed vegetation. Ducks depend on a wide array of wetland types (including 48 of 82 available subclasses), and management should provide complexes of wetlands. Management should concentrate on protecting, enhancing,

and/or creating 15 of 1,201 wetland types occurring in the coastal plains of Texas that were prioritized for management actions. These wetlands were predominantly aquatic-bed, scrub-shrub, and unconsolidated substrate types.

1927. **Wetland use, settling patterns, and recruitment in mallards.**
Krapu, G. L.; Greenwood, R. J.; Dwyer, C. P.; Kraft, K. M.; and Cowardin, L. M.
Journal of Wildlife Management 61(3): 736-746. (1997)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: wetlands/ habitat selection/ aquatic birds/ ecosystem disturbance/ ponds/ population dynamics/ ducks/ populations/ wildlife management/ waterfowl/ habitats/ habitat utilization/ recruitment/ breeding sites/ Anas platyrhynchos/ mallard/ Minnesota/ North Dakota/ breeding pairs
Abstract: The correlation between number of May ponds in the Prairie Pothole Region (PPR) of North America and size of the continental mallard (Anas platyrhynchos) breeding population the following spring weakened from the 1950s to the 1980s, suggesting possible changes in suitability of prairie ponds for meeting reproductive needs. We studied wetland use and preferences of radioequipped female mallards by reproductive stage (1988-90) in eastern North Dakota and westcentral Minnesota and evaluated effect of land use on pair distribution in eastern North Dakota (1987-91). May pond density varied among years and study areas, with changes in number of temporary and seasonal ponds accounting for 93% of variation in total ponds. During all reproductive stages, semipermanent basins were used most by females, but temporary and seasonal ponds were preferred during prenesting and egg production. Accounting for number of relocations, number of ponds used varied by year, by reproductive stage and with pond density during egg production. Numbers of breeding mallard pairs in stratum 46 in eastern North Dakota increased as May ponds increased from 1963 to 1985, but 33,659 fewer breeding pairs on average were present in 1971-85 than in 1963-70. Number of breeding pairs declined relative to May ponds from the 1960s to the 1980s, probably because fewer pairs settle in temporary and seasonal ponds as the percent of landscape in cropland increases. Waterfowl managers in the PPR should target efforts to increase duck production on landscapes where non-cropped temporarily and seasonally flooded wetland habitats are plentiful, thereby increasing cost effectiveness of management actions taken to increase nest success rate.

1928. **Wetlands Reserve Program.**
Hussey, S. L.
Fisheries 19(8): 42-43. (1994)
NAL Call #: SH1.F54; ISSN: 0363-2415
Descriptors: wetlands/ fishery resources/ agriculture/ nature conservation/ legislation/ resources management/ environmental protection/ fisheries/ habitats/ wildlife conservation/ Wetlands Reserve Program/ stock assessment and management/ law/ policy/ economics/ social sciences/ conservation/ wildlife management/ recreation/ water law and institutions/ environmental action/ United States
Abstract: Historically, one of the greatest threats to wetlands has been drainage for agricultural purposes. One-fourth of U.S. Cropland, more than 100 million acres, was obtained by clearing and draining wetlands. This loss of wetland functions and terrestrial ecosystems. Three-fourths of the nation's fish production depends on wetlands. A wetlands protection program with tremendous potential is the Wetlands Reserve Program, authorized by the food, Agriculture, Conservation and Trade Act of 1990. While not commonly associated with fisheries, this program offers significant opportunities to improve fisheries habitats. The Wetlands Reserve Program was established for the voluntary restoration and protection of wetland by landowners through permanent or 30-year easements on up to 1 million acres of wetlands previously modified for agricultural production. The program is designed to take marginal cropland out of production, providing landowners with the opportunity to benefit by maintaining wetlands. Riparian areas are also eligible for enrollment in the program. The prospect of habitat for fish and wildlife is one national priority factor in determining eligibility for enrollment.

1929. **Wildlife habitat on grazed or ungrazed small pond shorelines in south Texas.**
Whyte, R. J. and Cain, B. W.
Journal of Range Management 34(1): 64-68. (1981)
NAL Call #: 60.18 J82; ISSN: 0022-409X.
http://jrm.library.arizona.edu/Volume34/Number1/azu_jrm_v34_n1_64_68_m.pdf
Descriptors: grazing/ littoral zone/ vegetation/ ponds/ community composition/ vegetation cover/ Aves/ Texas/ effects on/ environmental effects/ vegetation cover
Abstract: Three man-made ponds constructed in 1956 and fenced to exclude cattle from the shoreline were selected to study the effects of cattle on shoreline vegetation. These ponds were partially opened in 1977 to allow grazing on one-half of the shoreline. In most areas the foliar cover and vegetation height were reduced by cattle pressure. The stable Longtom Community and the Knotgrass-Smartweed Community were more affected by cattle pressure than the Transition Community which changed as the water level rose or dropped. The seasonal Aquatic Community was least affected by cattle pressure and thus maintained good stands of waterfowl food plants. Carefully planned grazing which allows key rest and grazing periods will control the impact of grazing on the shoreline vegetation.

1930. **Wildlife responses to wetland restoration and creation: An annotated bibliography.**
Rewa, C.
In: A comprehensive review of Farm Bill contributions to wildlife conservation, 1985-2000/ Heard, L. P; Hohman, W. L.; Halloum, D. J.; and Wildlife Habitat Management Institute (U.S.); Series: Technical Report USDA/NRCS/WHMI. Madison, MS: USDA, NRCS, Wildlife Habitat Management Institute, 2000; pp. 135-150.
NAL Call #: aS604.6 C66 2000
Descriptors: wetlands/ constructed wetlands/ water quality/ wildlife habitats

1931. **Wildlife use of mitigation and reference wetlands in West Virginia.**
Balcombe, C. K.; Anderson, J. T.; Fortney, R. H.; and Kordek, W. S.
Ecological Engineering 25(1): 85-99. (2005)
NAL Call #: TD1.E26; ISSN: 09258574.
Notes: doi: 10.1016/j.ecoleng.2005.03.003.
Descriptors: anurans/ birds/ frogs/ habitat use/ mitigation/ mitigation success/ mitigation wetland/ West Virginia/ wetland-dependent species/ biodiversity/ ecosystems/ Anuran densities/ mitigation/ reference wetlands/ wildlife/ abundance/ amphibians/ birds/ habitat use/ species diversity/ species richness/ wetland/ West Virginia/ Anatidae/ Anura/ Aves
Abstract: We evaluated avian and anuran communities in 11 mitigation and four reference wetlands throughout West Virginia, USA. Avian species richness (P = 0.711), diversity (P = 0.314), and abundance (P = 0.856) (expressed as mean ± S.E. per ha) were similar between mitigation (richness: 11.3 ± 0.40; diversity: 3.1 ± 0.53; abundance: 27.1 ± 2.2) and reference (richness: 11.2 ± 0.62; diversity: 2.8 ± 0.47; abundance: 28.5 ± 4.9) wetlands. Waterbird (P = 0.013) and waterfowl (P = 0.013) abundance were higher in mitigation (waterbird: 5.1 ± 1.5; waterfowl: 4.4 ± 1.4) than reference (waterbird: 0.44 ± 0.23; waterfowl: 0.24 ± 0.21) wetlands. Anuran (frogs and toads) species richness (P = 0.023), Wisconsin index (WI) calling values (P < 0.001), and abundance (P < 0.001) (expressed as mean ± S.E. per survey point) were higher in mitigation (richness: 2.01 ± 0.09; WI: 0.52 ± 0.03; abundance: 4.75 ± 0.66) than reference (richness: 1.47 ± 0.14; WI: 0.40 ± 0.17; abundance: 4.69 ± 1.18) wetlands. Evidence suggests that avian and anuran densities in mitigation wetlands are similar or in some cases higher than in natural (reference) wetlands.

1932. **Winter aggregations, Dehnel Effect, and habitat relations in the Suisun shrew Sorex ornatus sinuosus.**
Hays, Warren S. and Lidicker, William Z.
Acta Theriologica 45(4): 433-442. (2000)
NAL Call #: 410 AC88; ISSN: 0001-7051
Descriptors: conservation measures/ biometrics/ behavior/ social behavior/ ecology/ habitat utilization/ habitat/ brackish habitat/ land and freshwater zones/ Sorex ornatus sinuosus (Soricidae): habitat management/ weight/ body mass/ aggregating behavior/ social organization/ distribution within habitat/ habitat preference/ salt marsh/ tidal marsh habitat/ California/ Solano County/ Suisun Bay/ Rush Ranch/ winter aggregations/ Dehnel Effect/ habitat relations/ Soricidae/ Insectivora, Mammalia/ chordates/ mammals/ vertebrates
Abstract: A live-trapping study on Suisun shrews Sorex ornatus sinuosus Grinnell, 1913, an endangered subspecies, was performed during the non-breeding season along the edge of a tidal marsh in California. During the winter, these shrews lived in distinct social aggregations composed of a single adult male, several adult females, and subadults. These groups remained stable even when the adult male died. As the breeding season approached, these groups were invaded by numerous adult males resulting in a nearly complete change in group membership. At the end of the breeding season, adult body mass declined by 30 to 40% (Dehnel Effect). Shrews reached high densities along the marsh/grassland ecotone, but the precise locations of social groups seemed unrelated to the presence of particular plant species or to the amphipod food supply. Subadult males wintered mostly outside of social groups in the marsh below high tide level. Conservation efforts need to focus on preserving the tidal marsh ecotone without promoting contact with the upland subspecies.

1933. **Winter management of Californian rice fields for waterbirds.**
Elphick, C. S. and Oring, L. W.
Journal of Applied Ecology 35(1): 95-108. (1998)
NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: wetlands/ water management/ rice/ crop residues/ legislation/ burning/ waste management/ stubble/ wild birds/ nature conservation/ flooding/ submergence/ incorporation/ water/ depth/ land use/ decomposition
Abstract: Recent legislation designed to reduce air pollution has restricted Californian rice-farmers from burning rice stubble after harvest. Intentional flooding of fields during winter to speed straw decomposition is becoming increasingly common as growers seek alternatives to burning residual straw. The potential for flooded fields to act as a surrogate for destroyed wetland habitat may be an additional benefit in a region that hosts a large proportion of North America's wintering water birds. The degree to which water birds use flooded fields and whether the method of flooding affects their use was investigated. Intentionally flooded rice fields received significantly greater use by 24 of 31 species studied. Only great blue herons Ardea herodias and sandhill cranes Grus canadensis were significantly more common in unflooded fields. Geese densities did not differ between flooded and unflooded fields. There were no differences in the densities of most bird species in flooded fields that received different straw manipulations to improve decomposition rates. Exceptions included several small shore birds which occurred at highest densities in fields where straw was incorporated into the soil. For 14 species, it was tested whether preferred depths, suggested in the literature, received disproportionately higher use. Most of these species were more likely to be encountered within the suggested depth ranges. Depth, however, was a poor predictor of bird density. Depths of 15-20 cm resulted in frequent use by the greatest number of species. It is concluded that flooding rice fields increased suitable habitat for most, but not all, species studied. Different straw manipulation methods had little effect on most species. Water depth, however, was important in determining species occurrence. During the first half of the winter, water depths were greater than the median depths used by most species.

1934. **Wintering shorebird assemblages and behavior in restored tidal wetlands in southern California.**
Armitage, A. R.; Jensen, S. M.; Yoon, J. E.; and Ambrose, R. F.
Restoration Ecology 15(1): 139-148. (2007)
NAL Call #: QH541.15.R45R515; ISSN: 10612971.
Notes: doi: 10.1111/j.1526-100X.2006.00198.x.
Descriptors: behavior/ diversity/ habitat heterogeneity/ landscape matrix/ mudflats/ restoration/ shorebirds
Abstract: Habitat restoration can partially compensate for

the extensive loss of coastal wetlands, but creation of functional habitat and assessment of restoration success remain challenging tasks. To evaluate wintering shorebird use of restored coastal wetlands, we quantified shorebird assemblages and behavior of selected focal species at five restored sites and paired reference sites in Mugu Lagoon, southern California, United States. The Shannon-Wiener index of species diversity (for all birds in order Charadriiformes) was higher in the restored than in the reference portion of three of the five sites, higher in the reference portion of a fourth site, and similar between reference and restored areas of the fifth site. Species diversity was lower in sites closer to man-made structures. The four most abundant species groups across the five sites were selected for detailed analysis of site use and behavior: Willets (Catoptrophorus semipalmatus), Marbled Godwits (Limosa fedoa), Dowitchers (Limnodromus spp.), and Sandpipers (Calidris spp.) (Western, Least, and Dunlin). Each focal species group exhibited distinct site preferences, and densities in restored sites were often as high or higher than in reference sites. Willets and Dowitchers preferred habitats with more extensive tidal flats, a characteristic of restored sites. Godwits and Sandpipers preferred heterogeneous habitats with a mix of water and tidal flats. Most birds were engaged in feeding activities during the ebb tides surveyed, and there were no apparent differences in behavior between reference and restored sites. Though not all restored sites were used equally by all species, the creation of multiple restored sites with varied habitat characteristics attracted a diverse assemblage of shorebirds and may have contributed to the integrity of the regional wetland landscape. © 2007 Society for Ecological Restoration International.

1935. **Zooplankton, benthic macroinvertebrate, and fish responses to drought and hydrologic restoration of a pondcypress ecosystem in Tate's Hell Swamp, Florida.**
Roberts, C. R. University of Florida, 2000.
Notes: Thesis (M.S.). Includes bibliographical references (leaves 182-202).
Descriptors: Freshwater zooplankton---Ecology---Florida/ Aquatic invertebrates---Ecology---Florida/ Fishes---Ecology---Florida/ Wetland restoration---Florida
This citation is from AGRICOLA.

1936. **Zooplankton communities of restored depressional wetlands in Wisconsin, USA.**
Dodson, S. I. and Lillie, R. A.
Wetlands 21(2): 292-300. (2001)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: wetlands/ watersheds/ zooplankton/ waterfowl/ agriculture/ sexual reproduction/ taxonomy/ daphnia/ ecosystems/ eutrophication/ turbidity/ surface water/ environment management/ community structure/ environmental restoration/ species richness/ agricultural land/ plankton/ ecosystem disturbance/ nutrient enrichment/ restoration/ evaluation/ community composition/ species diversity/ Cladocera/ Copepoda/ Wisconsin/ restoration/ water fleas/ copepods
Abstract: Wisconsin has lost approximately 2 million hectares of wetland since statehood (1848). Through the combined efforts of state and federal agencies and private groups focused primarily on wetland restoration for waterfowl habitat management or compensatory mitigation, a fairly substantial gain in wetland area has been achieved. Much of the wetland restoration effort in Wisconsin has occurred on formerly agricultural lands. However, due to the nature of the past disturbance and possible residual effects not corrected by simply returning surface waters to these lands, there is some question regarding the resultant wetland quality or biological integrity. In an effort aimed at developing tools to measure wetland gains in terms of quality or ecological integrity, the Wisconsin Department of Natural Resources (WDNR) initiated a study of biological communities on restored wetlands in Wisconsin. In this paper, we report on the community of microcrustaceans and arthropods that can be collected with a plankton net in open water in wetlands. We examined zooplankton community structure in restored wetlands in terms of richness, taxonomic representation, and Daphnia sexual reproduction and related these metrics to attributes on wetlands representing least-disturbed conditions and agriculturally impacted wetlands. We sampled 56 palustrine wetlands distributed across Wisconsin. These wetland sites were categorized as agricultural, least-impacted, and restored (recently withdrawn from agricultural usage). The wetlands were reasonably homogeneous in many ways, so that taxon richness was not correlated with basin origin, presence of adjacent roads, presence or absence of fish, water chemistry, or the size of the open water. We identified a total of 40 taxa. Taxon richness was significantly lower in agricultural sites (average of 3.88 taxa per site) compared to that of least-impacted sites (7.29 taxa) and restored sites (7.21 taxa). Taxon richness of restored sites was significantly correlated with time since restoration. The data indicate that taxon richness changes from a value typical of agricultural sites to the average richness of least-impacted sites in about 6.4 years. The total taxon list for 8 agricultural sites (14 taxa) was significantly smaller than the average value for randomly chosen sets of 8 least-impacted sites (20.4 taxa). Agricultural and least-impacted sites tended to have the same common taxa. Many taxa of chydorid cladocerans and cyclopoid copepods that were rare in least-impacted sites did not occur in the agricultural sites, nor did fairy shrimp occur in agricultural sites. Daphnia populations only produced males in least-impacted and restored sites. Further research is needed to identify the mechanism(s) responsible for the reduced species richness and lack of sexual reproduction in agricultural wetland sites. Likely factors include eutrophication, turbidity, or chemical contamination. We conclude that restoration of wetland watersheds works. Withdrawal of the watershed from agricultural usage is followed by an increase in taxon richness, and the sites resembled least-impacted sites in about 6-7 years.