

Science Supporting Online Material

Synthesizing U.S. River Restoration Efforts

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Appendix: Additional supplemental information not directly cited in text.

List of all Data Sources: Tables A1 to A4

Fig. A1. Regional differences in the distribution of types of restoration efforts.

(a) Notes on NRRSS Methodology

We began by compiling data on restoration projects from 18 national coverage databases maintained by federal agencies (**b**), but found that the majority of projects are recorded only at the regional or local level. A large number of municipal, state and regional databases are being developed, but we found few extensive databases (**b**) of river restoration [average no. of project records per data source was 51 ± 26 (95% CI)] (this does not include personal contacts which on average yielded information on six projects). Our working group, with the extensive collaboration of data providers, restoration scientists, managers and practitioners within each of our nodes, has designed and implemented a database to begin addressing this need. The NRRSS metadata and database structure provides a common format to reduce duplication of effort in planned project tracking efforts and is freely available to all interested parties. The NRRSS Summary Database is a MySQL relational database developed on a LINUX platform (**g**). Only open source software was used for the database. The database schema, structure and metadata are available on line (at <http://nrrss.nbio.gov>) and the raw summary data will be freely available on

line by the end of 2005. The database includes all commonly encountered fields in existing regional restoration databases (such as location, costs, implementers, funders) as well as information on project goals, specific project activities, and project monitoring.

What was included: The following key was included in the metadata and used to determine whether a project would be included in the NRRSS database. (DNI, do not include)

Project record is part of a stream restoration specific database or data file	Go to 1
-OR-	
Project record is part of a database or data file not specific to stream restoration	Go to 4
1.	
a) Project is fundamentally concerned with community education and does NOT include field efforts to improve stream condition	DNI
b) Project is fundamentally concerned with community education and does include field efforts to improve stream condition	Include / 2
2.	
a) Land acquisition is the only restoration focus of the project	DNI
b) Land acquisition is a focus of the project, but is specifically performed to improve stream condition	Include / 3
3.	
a) Project is a site or watershed study intended to guide restoration efforts	DNI
b) Project implemented, regardless of the paucity of information	Include
4.	
a) Project has no statement of intent or activities	DNI
b) Project contains either a statement of intent or activities	Include / 5
5.	
a) Project record does NOT explicitly state stream restoration as intent	DNI
b) Project record merely states "stream restoration," even if record contains no additional information	Include / 6
6.	
a) Upland (non-riparian), wetland, estuary, or land acquisition as the only focus/foci of restoration	DNI
b) Upland (non-riparian), wetland, estuary, or land acquisition as the focus/foci of restoration, but is specifically performed to improve stream condition	Include

The definitions of "project" and "stream restoration" were left up to the data source—no judgments were made of the validity of the term "stream restoration" and there was no standardized size or cost unit for projects.

Calibration

Metadata were developed for all database fields to ensure consistency, repeatability, and utility of the data. Calibration of data entry for the database was done initially by the entire working group. All members received the same ten example project files which they entered into the database following the metadata. After this round, the group met to discuss differences in the entries and to modify the metadata to eliminate confusion. All persons responsible for data entry completed three additional rounds of calibration with 10 different projects in each round in which the only field completed was the categorization of stated project goals, objectives, or purposes into the intent categories, the only subjective field in this database. There was some

concern during development about the difficulty and inconsistency of inferring intent from project documentation; for this reason, our intent field is only a categorization of the stated goals, objectives, or purposes in the documentation based on the definitions of the intents in the metadata.

Removal of Duplicates

Because the data were obtained from a large variety of sources on a federal, state, and local scale and included funders, designers, implementers, and regulators, duplication of some projects within the database was inevitable. To remove duplicate projects, we sorted the data by location information and looked for projects with the same name and those done on the same stream, in the same area, with the same completion year and the same intents. Because projects may have multiple phases or adjacent, follow-up projects, we only removed projects from the database where they were clearly duplicates.

Validation

Creating a complete database of all stream restoration projects in the country was not a realistic goal. Some data were only available by contacting individual consulting firms for their files, and in some cases government agencies were unwilling or unable to share their data. For these reasons, the goal of NRRSS was to achieve a database that was representative of the goals and geographic variability of stream restoration activities within the seven nodes rather than a comprehensive database.

Validation of the database was done separately for each node. Data were summarized by cost, percent monitored, and intent categories as well as geographically, generally on a county or watershed scale. These summaries, along with a list of data sources used, were submitted to "stream restoration experts" in each node. These were people knowledgeable about stream restoration for a particular portion of the node who had not been involved directly in the overall data gathering for that node. They were asked to assess the completeness of data sources accessed and the representativeness by location and intent category of the NRRSS database for their particular geographic area of expertise. Experts who saw a weakness in the completeness or representativeness of the data were asked to provide suggestions of further data sources or contacts which the working group members then followed up on to complete the database. In some cases, this added only a few projects in a particular location or intent category, while in other cases new, large databases were discovered as a result of the validation process.

(b) List of National Coverage Databases

Environmental Protection Agency (EPA) 5 Star Restoration Challenge grants; EPA Grant Reporting and Tracking System (GRTS) for 319 programs; EPA River Corridor and Wetland Restoration; National Oceanic and Atmospheric Administration (NOAA) Community Based Restoration and Disaster Assistance Restoration Programs; Department of Transportation (DOT) Federal Highway Transportation Enhancement Program; US Fish and Wildlife Service (FWS) FWS Habitat Information Tracking System; FWS National Fish Passage Program; FWS Division of Bird and Habitat Conservation; Army Corps of Engineers (ACOE) 1135; ACOE Aquatic Environmental Projects by the Institute for Water Resources; ACOE Water Resources Development Act projects; Reviews of Non-Corps Restoration Projects ($n = 2$); National Park Service (NPS) Project Management Information System; Natural Resources Conservation

Service (NRCS) Success Stories; Bureau of Land Management (BLM) Abandoned Mine Land Program, Cleanwater.gov (*federal interagency group*) Watershed Success Stories; Coastal America (*federal interagency group*) Regional Conservation Projects, Federal Interagency Stream Corridor Restoration Working Group

(c) Metadata for Classification of Project Goals/Intents

All metadata and fields available at

http://nrrss.nbio.gov/cgi-bin/user_area/sample_input_form.cgi

Select one to many from list of alternatives defined below. Intent should capture only what is stated as a goal/objective/purpose in source documentation.

Do not infer intent. We have had difficulty, particularly when categorizing longer documents in avoiding this subjectivity. When you are reading a long document (more than a one-paragraph project description), only use sections that explicitly describe objectives/goals/purposes/intents, do not read the full document and then attempt to summarize the purpose yourself.

Some projects will require multiple selections because of overlapping categories (e.g., some dam removals are for fish passage, some dam outlet retrofits are water-quality management). If the project intent is impossible to classify in one of our 13 categories, select other and type in the intent as written in the documentation. If there are sufficient cases falling into a new category, we will add that category to the official database. [categorical]

Bank Stabilization: Practices designed to reduce/eliminate erosion or slumping of bank material into the river channel. This category DOES NOT include stormwater management, see next intent category.

Stormwater Management: Special case of *Flow Modification* that includes the construction and management of structures (ponds, wetlands, and flow regulators) in urban areas to modify the release of storm runoff into waterways from watersheds with elevated imperviousness into waterways. These practices/structures generally aim to reduce peak flow magnitudes and extend flow duration. For the purposes of NRRSS *Stormwater Management* refers to water quantity not quality. Urban sediment, litter and temperature control should be categorized as *Water Quality Management*.

Flow Modification: Practices that alter the timing and delivery of water quantity (DOES NOT include *Stormwater Management*). Typically, but not necessarily, associated with releases from impoundments and constructed flow regulators.

Channel Reconfiguration: Alteration of channel plan form or longitudinal profile and/or day-lighting (converting culverts and pipes to open channels). Includes stream meander restoration and in-channel structures that alter the thalweg of the stream. Note that many instream structures also claim to improve habitat. For NRRSS the intent declared in the source document must be used.

Fish Passage: Removal of barriers to upstream/downstream migration of fishes. Includes the physical removal of barriers and also construction of alternative pathways. Includes migration barriers placed at strategic locations along streams to prevent undesirable species from accessing upstream areas.

Riparian Management: Revegetation of riparian zone and/or removal of exotic species (e.g. weeds, cattle). Excludes localized planting only to stabilize bank areas (see *Bank Stabilization*).

In-Stream Species Management: Practices that directly alter aquatic native species distribution and abundance through the addition (stocking) or translocation of animal and plant species and/or removal of exotics. Excludes physical manipulations of habitat/breeding territory (see *In-stream Habitat Improvement*)

Dam Removal/Retrofit: Removal of dams and weirs or modifications/retrofits to existing dams to reduce negative ecological impacts. Excludes dam modifications that are simply for improving *Fish Passage*.

Floodplain Reconnection: Practices that increase the flood frequency of floodplain areas and/or promote flux of organisms and material between riverine and floodplain areas.

In-Stream Habitat Improvement: Altering structural complexity to increase habitat availability and diversity for target organisms and provision of breeding habitat and refugia from disturbance and predation. (In some cases habitat improvement may be an action with the intent of *In-Stream Species Management*, in other cases *Habitat Improvement* may be the intent, and might be accomplished through *Channel Reconfiguration*, be very careful to separate action from intent when deciding whether to select this category.

Aesthetics/Recreation/Education: Activities that increase community value: use, appearance, access, safety, knowledge.

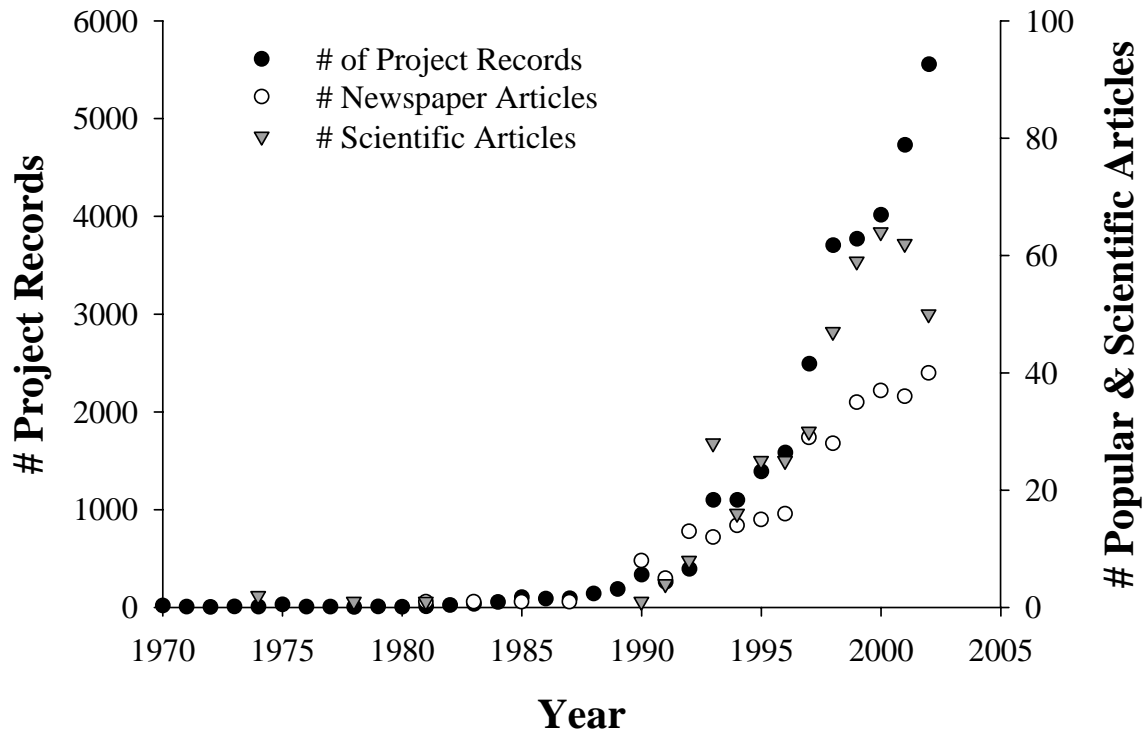
Water-Quality Management: Practices that protect existing water quality or change the chemical composition and/or suspended particulate load. Remediation of acid mine drainage falls into this category as does CSO separation. Excludes urban runoff quantity management (see *Stormwater Management*).

Land Acquisition: Practices that obtain lease/title/easements for stream-side land for the explicit purpose of preservation or removal of impacting agents and/or to facilitate future restoration projects. Note: Simple purchase and preservation to prevent potential future land conversion is insufficient for inclusion in the NRRSS database. NRRSS projects should demonstrate intended or actual cessation of detrimental activities in acquired land or active restoration components.

Other: Specify the project intent that differs from the choices provided. If there is no intent stated you should not select or enter any information in this section. If the intent is the generic "stream restoration" then this section should be left blank [text]

(d) Fig. S1. The number of river restoration projects recorded in NRRSS and citations related to stream restoration.

Fig. S1. The number of river restoration projects recorded in NRRSS is shown alongside the number of newspaper and scientific journal citations related to stream restoration. Newspaper and journal citations were derived from a search for the terms "stream restoration" or "river restoration" in Lexis Nexis Environmental News and ISI Web of Science databases.



(e) Cost Estimates

To estimate costs for the 37,099 project records in our database that occurred between 1990 and 2003 (date of completion, implementation, or permitting fell within this time period), we multiplied the number of records without cost data ($n = 13,039$) by the average project cost for records that included cost information ($n = 19,683$; mean project cost \$383,547), giving us an estimated \$5.0 billion in unrecorded costs. Federal database records accounted for 26.8 ± 10.7 % of the total number of records for each of the 23 states within our study regions. Therefore, we estimate that in-depth data collection in the remaining 27 states would generate between 2605 and 6073 additional projects. Multiplying these numbers by the average project costs for all records (\$383,547) within our database generates additional costs of \$1.0 to \$2.3 billion.

(f) Note on Large Restoration Project Cost

The data sources we accessed did not capture costs for the restoration of the Kissimmee River nor the full costs of Glen Canyon, San Francisco Bay, Columbia, and Missouri river restoration efforts, which would add hundreds of millions to billions of dollars to our cost estimate. Restoration of these large systems involves land acquisition for mitigation, actions aimed at restoring single species under the Endangered Species Act, and experimental management actions. For example, the U.S. Congress has authorized expenditures of over \$800 million for land acquisition along the Missouri River (15, 21). About 70% of these costs are for programs aimed at understanding whether experimental management actions yield results suitable for implementation as permanent restoration policy. This experimental program also causes a several million-dollar reduction in hydroelectric power revenues each year. It is likely that restoration efforts on large rivers alone will total in the hundreds of millions to billions of dollars in the foreseeable future.

(g) Full Description of NRRSS Database Software

LAMP for the National River Restoration Science Synthesis (NRRSS) :

LAMP is an acronym for (Linux, Apache, MySQL, Perl/PHP/Python). LAMP is comprised of open source software and as such is non-proprietary. This software is not only highly reliable but is less prone to security problems than some of the proprietary software available.

Linux is the operating system utilized by NRRSS. The two types of Linux that were utilized by NRRSS were first Mandrake Linux and then Suse Linux. Linux is freely distributed and its functionality, adaptability and robustness have made it an excellent alternative to proprietary Microsoft operating systems.

Apache which is also open source software is the web server being used by NRRSS. Apache is currently the number one HTTP server on the Internet. The Apache web server is more widely used than all other web servers combined, accounting for 67% of the web sites on the Internet as of October 2004. Software utilized by NRRSS on this Apache web server was HTML

(HyperText Markup Language), Javascript and CGI (Common Gateway Interface). CGI is the standard for interfacing external applications with information servers, such as HTTP or web servers. One of the external applications employed was Perl (Practical Extraction and Report Language).

MySQL was the relational database used by NRRSS and it is the world's most popular open source database with more than 5 million active installations. MySQL is a database that provides the following advantages:

- Reliability and performance
- Ease of use and deployment
- Freedom of platform lock-in
- Cross-platform support
- Millions of trained and certified developers.

Perl is the last software component of LAMP used for NRRSS. Perl uses two software packages for the database: Perl DBI (Database Interface) and Perl DBD (Database Drivers) for MySQL.

LAMP is a solid and reliable web platform that provides the environment for both the development and deployment of high performance web applications. As a result of LAMP, the NRRSS database can readily be provided to any organization free of charge simply by that organization adopting the use of these open source software tools that are readily available.

(h) Table S1. Regional differences in stream restoration efforts.

Table S1. Regional differences in stream restoration efforts. Number of projects and total cost are shown by state per 1000 km of streams and rivers. Monitoring numbers are percent of projects with some type of monitoring indicated in the project record; however, not all data sources contained monitoring information.

	No. of Projects/ 1000 km	Total Cost/ 1000 km	% Monitoring Indicated
California			
California	11.82	5,953,950.90	22.9
Central US			
Illinois	1.70	747,358.45	15.1
Iowa	0.68	667,966.12	35.9
Minnesota	1.39	1,213,483.03	23.4
Missouri	0.60	2,483,211.41	20.0
Wisconsin	4.69	973,512.71	24.8
Chesapeake Bay			
Maryland	168.12	5,670,841.57	6.3
Pennsylvania	11.16	708,065.45	9.3
Virginia	17.63	657,038.17	2.1
Pacific Northwest			
Idaho	11.32	263,501.75	13.6
Montana	9.12	253,308.73	0.5
Oregon	65.31	2,479,021.90	0.7
Washington	55.17	10,758,253.78	19.6
Southeast			
Georgia	1.11	245,587.47	15.2
Kentucky	2.49	425,690.15	11.2
North Carolina	8.25	7,058,155.31	36.2
South Carolina	0.83	176,758.21	47.5
Southwest			
Arizona	0.96	944,821.01	25.3
Colorado	0.68	1,046,349.40	46.2
New Mexico	1.01	727,113.96	29.4
Utah	0.75	1,053,503.50	17.3
Upper Midwest			
Ohio	3.78	640,720.02	18.1
Michigan	10.22	502,136.69	1.9
Wisconsin	4.69	973,512.71	24.8

Appendix: Additional Supplemental Information not directly cited in text.

List of all Data Sources

More information on the project available at <http://www.nrrss.umd.edu>

Table A1. List of types of data sources, the number of each type of source, and the average number of records obtained from each source for the NRRSS database.

Type	Number of Sources	Average Number of Records from Source
Database	73	450
Report	86	11
Webpage	79	4
peer reviewed publication	7	1
Book	9	4
conference proceedings	8	5
personal communication	252	6

Table A2. List of databases used as sources for the NRRSS database, including entity responsible for database, database title, number of records from database used in NRRSS database, and URL for internet location for those databases available online (URLs accurate as of January 10, 2005).

Entity	Title	Number of Records	Webpage
Anacostia Watershed Society	Anacostia Watershed Society Event Listing 2001-2003	60	
Arizona Department of Water Resources	Arizona Water Protection Fund: Funded Projects	42	http://www.awpf.state.az.us/funded.htm
CALFED	CALFED ERP	180	
California Department of Fish and Game, NOAA Fisheries, Pacific States Marine Fisheries Commission	California Habitat Restoration Project Database	1906	http://www.calfish.org
Chesapeake Bay Foundation	NON-AG projs 2001-02	16	
Chesapeake Bay Foundation	SSP proj log	8	
Chesapeake Bay Foundation	FSP proj log	30	
Chesapeake Bay Foundation	DU pship proj log	10	
Chesapeake Bay Foundation	00-02 Project Tracking Log	261	
Chesapeake Bay Foundation	CREP proj log	90	
Clean Water Action Plan	Clean Water Success Stories	15	http://water.usgs.gov/owq/cleanwater/success/index.html
Coastal America	Coastal America Regional Conservation Projects	46	http://www.coastalamerica.gov/text/projects/projects.html
Columbia Basin Fish and Wildlife Authority		151	
Ducks Unlimited	PNW Dataset and National Dataset	529	
Environmental Services Inc	Environmental Services Inc. Experience with Stream Assessments, Permitting, Design, Construction, and Monitoring	13	
Florida Department of Environmental Protection	Florida Ecological Restoration Inventory	4	http://www.dep.state.fl.us/water/wetlands/feri
Hydropower Reform Coalition	FERC completed dam removals	10	
Idaho Department of Environmental Quality	Nonpoint Source Management (\$319 Grants)	129	http://www.deq.state.id.us/water/data_reports/surface_water/nps/reports.cfm#annual
Idaho Department of Fish and Game		242	

Information Center for the Environment, Department of Environmental Science and Policy, University of California, Davis	Natural Resource Projects Inventory	1333	http://endeavor.des.ucdavis.edu/nrpi/
Kentucky Department of Water	Kentucky 401 mitigation projects	113	
Keystone Stream Team	Natural Stream Channel Design Initiatives in Pennsylvania	44	
Maryland Department of Natural Resources	Fish Passage Database	72	
Maryland Department of Natural Resources- Forestry	Riparian Forest Buffer Site Locations	1544	
Maryland Department of Natural Resources Watershed Restoration Division	Stream Restoration Tracking Database	456	
Model Watershed Programs		1231	
Montana Watersheds	Montana Watershed Projects Directory	311	http://water.montana.edu/watersheds/projects/default.asp
Montgomery County Department of Environmental Protection, Watershed Management Division	Montgomery County DEP restoration database	21	
National Fish and Wildlife Foundation	National Fish and Wildlife Foundation Grants	551	http://www.nfwf.org/programs/grant_ak.htm
National Park Service	Project Management Information System	93	
National Transportation Enhancements Clearinghouse of the Federal Highway Administration	Transportation Enhancements Project Database	168	
NOAA Fisheries	Community Based Restoration Program, Damage Assessment and Restoration Program	428	http://seahorse.nmfs.noaa.gov/rcdb/class/projects_main.html , http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/darp/projects.html
North Carolina Clean Water Management Trust Fund	North Carolina Clean Water Management Trust Fund Database	248	
Ohio Environmental Protection Agency	Ohio Environmental Protection Agency 404 Permit File	16	
Ohio Environmental Protection Agency	Ohio Environmental Protection Agency 319 Grant Files	31	
Oregon Water Trust		492	
Oregon Watershed Enhancement Board (OWEB)	Oregon Watershed Restoration Inventory	5292	
Pennsylvania Grow Greener	Grantee Progress Reports	4	

Regional Ecosystem Office	Interagency Restoration Database (IRDA)	5625	http://www.reo.gov/restoration/index.htm
State Highways Administration	Stream Database	18	
State of Maryland, Department of the Environment ,Water Management Administration, Bureau of Mines	State of Maryland, Department of the Environment ,Water Management Administration, Bureau of Mines Completed Abandoned Mine Reclamation Projects	28	
StreamNet		34	http://www.streamnet.org/
The Nature Conservancy	Flow Restoration Database	103	http://www.freshwaters.org/tools/#flow
U.S. Bureau of Land Management - Colorado Abandoned Mine Land Program	Abandoned Mine Land Program	3	http://www.co.blm.gov/mines/mine.htm
U.S. Fish and Wildlife Service	National Fish Passage Program	22	http://fisheries.fws.gov/FWSMA/fishpassage
United States Army Corps of Engineers	List of 1135 Projects	15	http://www.usace.army.mil/inet/functions/cw/cecwp/cecwp_temp/1135.htm
United States Army Corps of Engineers	National Review of Non-Corps Environmental Restoration Projects	13	
United States Army Corps of Engineers	Water Resource Development Acts of 1986, 1990, 1992, 1996, 1999, 2000, 2002	216	
United States Army Corps of Engineers Institute for Water Research	USACE Aquatic Environmental Projects	67	
United States Army Corps of Engineers-Savannah District	Approved Mitigation Banks in Georgia	9	
United States Department of Agriculture: Natural Resources Conservation Services	Collection of Buffer Success Stories	10	http://www.nrcs.usda.gov/feature/buffers/bufconts.html
United States Environmental Protection Agency	Nonpoint Source System Grant Reporting and Tracking System (GRTS)	80	
United States Environmental Protection Agency Five Star Restoration Program	Community-Based Restoration Projects Funded Prior to FY99	2	http://www.epa.gov/owow/wetlands/restore/5star/complete.html
United States Environmental Protection Agency Office of Research and Development	EPA River Corridor and Wetland Restoration Project Directory	89	http://yosemite.epa.gov/water/restorat.nsf/rpd-2a.htm?OpenPage

United States Environmental Protection Agency Office of Water	EPA Five Star Restoration program Projects for FY99	40	http://www.epa.gov/owow/wetlands/restore/5star/99grants.html
United States Environmental Protection Agency Office of Water	Projects Funded by Five Star Restoration Program in FY00	25	http://www.epa.gov/owow/wetlands/restore/5star/00grants.html
United States Environmental Protection Agency Office of Water	Projects Funded by Five Star Restoration Program in FY01	40	http://www.epa.gov/owow/wetlands/restore/5star/01grants.html
United States Environmental Protection Agency Office of Water	Five Star Restoration Challenge Grant Program	37	http://epa.gov/owow/wetlands/restore/5star/fy02grants.html
United States Fish and Wildlife Service	Division of Bird Habitat Conservation	17	
United States Fish and Wildlife Service, Partners for Fish and Wildlife	HABiTS database	672	
University of Michigan	Michigan Stream Habitat Improvements Database	707	
Upper Ocmulgee River RC&D Council	Georgia Stream Buffer Initiative tracking database	29	
US Bureau of Land Management	Rangeland Improvement Project System	4781	
Virginia Department of Conservation and Recreation- Department of Soil and Water Conservation	Virginia Conservation Reserve Enhancement Program Practices	1251	http://192.206.31.52/cfprog/dswc/crepprm.cfm
Virginia Department of Forestry Fairfax Office	Virginia Department of Forestry Fairfax Office Project Files	15	http://www.cdphe.state.co.us/wq/nps/fy03NPS_Annual_Report.pdf
Virginia Department of Transportation	Virginia DOT Projects	6	
Washington State Salmon Recovery Funding Board (SRFB)	Project Information System (PRISM)	857	http://www.iac.wa.gov/oia/prism.htm , http://www.iac.wa.gov/srfb/default.asp
Washington Department of Ecology	Centennial Clean Water Fund/Washington State Water Pollution Control Revolving Fund/Clean Water Act Section 319 Nonpoint Source Fund	433	http://www.ecy.wa.gov/programs/wq/funding/links.html
Washington Department of Fish and Wildlife	Watershed Restoration Inventory Project (WRIP)	609	http://wdfw.wa.gov/hab/wrip/reprtfin.htm
Washington Department of Fish and Wildlife	SSHEAR Databases of Fishways, Dams, and Culverts (SSHEAR: Salmonid Screening, Habitat Enhancement and Restoration Section)	750	

Washington Department of Transportation	Culvert Removal Grants Program	51
Washington Water Trust		20

Table A3. List of reports used as sources for the NRRSS database, including entity responsible for report, report title, number of NRRSS records derived from report, and URL for internet location for those reports available online (URLs accurate as of January 10, 2005).

Entity	Title	Number of Records	Webpage
Andrew Pickens Ranger District, Sumter National Forest, Oconee County, SC	Decision Notice and Finding of No Significant Impact: Brook Trout Restoration	5	
Arlington Department of Environmental Services	Arlington Department of Environmental Services Stream Restoration Projects	1	http://www.arlingtonva.us/Departments/EnvironmentalServices/epo/EnvironmentalServicesEpoLocalStreams.aspx#restore
Biohabitats, Inc	Brown Branch Stream Restoration	1	
Center for Environmental Studies at Arizona State University	Rio Salado Wildlife Habitat Restoration: Vegetation Monitoring Report Fall 1996	1	
Chesapeake Bay Program Office	Chesapeake Bay Small Watershed Grants Program 2002 Awards	40	http://www.chesapeakebay.net/pubs/2002_grant_summaries.pdf
City of Fairfax Dept of Public Works	City of Fairfax stream restoration projects	13	
Conasauga River Alliance	Conasauga River Alliance Watershed Project Community Based Partnership 2002 Annual Report	3	http://www.conasaugariver.net
Dekalb County Departments of Recreation, Parks and Cultural Affairs, and Roads & Drainage	Vegetative Streambank Stabilization and Reclamation Program--1st Quarterly Report	1	
Environmental Systems Analysis, Inc	ESA project files	28	
FishAmerica Foundation	FishAmerica Foundation Funded Projects August 1983 to March 2003	170	
Freshwater Initiative of The Nature Conservancy	Site Profile of Apalachicola River and Bay	1	http://63.236.108.147/

Freshwater Initiative of The Nature Conservancy	Site Profile of the Saco River Floodplain Project	1	http://www.freshwaters.org/info/specific/index.shtml
Idaho Department of Environmental Quality	2003 Restoration Site Inspections	8	
Kentucky Department of Environmental Protection	Ameliorative designs to improve the efficiency of constructed wetlands treating high metal load acid mine drainage in the Rock Creek watershed	1	
Kentucky Division of Water, Water Quality Branch, Nonpoint Source Section	Big South Fork/Bear Creek Nonpoint Source Interstate Demonstration Project Final Report	1	http://kywater.net/pubs
Kentucky Division of Water, Water Quality Branch, Nonpoint Source Section	Post-BMP Biological Survey of Pleasant Grove Spring, Logan County, Kentucky--Nonpoint Source Section Technical Bulletin No. 2	1	http://kywater.net/pubs
Kentucky Division of Water, Water Quality Branch, Nonpoint Source Section	Improving Equine Waste Management through a Best Management Practice (BMP) Demonstration Project--Nonpoint Source Section Technical Bulletin No. 4	1	http://kywater.net/pubs
Kentucky Division of Water--Water Quality Branch--Nonpoint Source Section	Fleming Creek Watershed Nonpoint Source Demonstration Project--Final Report	1	http://kywater.net/pubs
Kentucky Division of Water--Water Quality Branch--Nonpoint Source Section	Upper Salt River/Taylorville Reservoir Nonpoint Source Demonstration Project	1	http://kywater.net/pubs
Kentucky Division of Water--Water Quality Section--Nonpoint Source Section	Mammoth Cave Demonstration Project--Pre-BMP Report	1	http://kywater.net/pubs
Kentucky Natural Resources and Environmental Protection Cabinet--Division of Water	Water Quality Aspects of the Loch Mary Reclamation Project, Hopkins County, Kentucky	1	
Maine State Planning Office	Downeast Salmon Rivers Water Use Management Plan	2	

Maryland Bureau of Mines	Gorman Doser	1	
Maryland Bureau of Mines	Kitzmiller Doser	1	
Maryland Bureau of Mines	Laurel rn doser poster board.doc	1	
Middle Rio Grande Bosque Initiative	Middle Rio Grande Bosque Initiative Funded Projects FY 2000-2002	45	http://mrgbi.fws.gov
Middle Rio Grande Collaborative Program Workgroup	Financial Report for \$4,758,000 Appropriation, Fiscal Year 2001	5	
Middle Rio Grande Collaborative Program Workgroup	Financial Report for \$11,200,000 Appropriation, Fiscal Year 2002, Bureau of Reclamation, Middle Rio Grande Endangered Species Act Collaborative Program Activities	9	
Middle Rio Grande Collaborative Program Workgroup	FY 2003 Detailed Spending Plan for Middle Rio Grande Endangered Species Act Collaborative Program Activities	8	
New Mexico Institute of Mining and Technology	Water, Watersheds, and Land Use in New Mexico: Impacts of Population Growth on Natural Resources, Santa Fe Region	1	
North Carolina Department of Transportation	Natural System Units Monitoring Reports	48	http://www.ncdot.org/planning/pe/naturalunit/Monitoring/
North Carolina Division of Water Quality	Long Creek Watershed Nonpoint Source Water Quality Monitoring Project--Final Report	1	http://www.bae.ncsu.edu/bae/programs/extension/wqg/section319/319_LongCreek/index.htm
North Carolina Division of Water Quality	Nash County Cover Crop Establishment Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Nahunta Swamp Watershed Conservation Tillage Cotton Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Constructed Wetlands Demonstration for NPS Pollution Control	2	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	South Fork Mitchell River Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Crabtree Creek Urban Planning Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm

North Carolina Division of Water Quality	Ore Knob Reclamation	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Goose Creek Urban Stream Rehabilitation Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Upper French Broad Riparian Restoration and Protection Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Smith and Austin Creek Stream Restoration and Riparian Buffer Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Little Ivy River Watershed BMP Implementation	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	North Toe River Christmas Tree BMP Demonstration	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Devils Cradle Creek Watershed Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Sandy Creek Watershed Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Upper Shallotte River Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Little Coharie Watershed Protection Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Division of Water Quality	Ecological Functions of Restored Stream Systems Benthic Macroinvertebrates--2003 Summary Addendum	2	
North Carolina Division of Water Quality	Ecological Function of Restored Stream Systems: Benthic Macroinvertebrates: Final Report for EPA Wetland Program Development Grant, Grant no. CD984487-98	50	http://h2o.enr.state.nc.us/ncwetlands/bugstuff.pdf
North Carolina Division of Water Quality	Newfound Creek Watershed NPS Control Project	1	http://h2o.enr.state.nc.us/nps/Section_319_Projects.htm
North Carolina Ecosystem Enhancement Program	NC Wetlands Restoration Program 2002 Annual Report Table 1.2	56	http://www.nceep.net/abouteep/wetlands.html
North Carolina Ecosystem Enhancement Program	NC Wetlands Restoration Program 2002 Annual Report Table 1.3	19	http://www.nceep.net/abouteep/wetlands.html

North Carolina Ecosystem Enhancement Program	2003 Annual Report of the North Carolina Wetlands Restoration Program	5	http://www.nceep.net/abouteep/wetlands.html
Northern Arizona University, Department of Geology	Monitoring the Effects of the 1997 Glen Canyon Dam Test Flow on Colorado River Ecosystem Sand Bars	1	
Northern Arizona University, Department of Geology	Monitoring the Effects of the Spring 2000 Habitat Maintenance Flow on Colorado River Ecosystem Sand Bars	1	
Ohio Department of Natural Resources	Ohio Stream Management Guide, Biotechnical Projects in Ohio, Guide No. 10	47	http://www.dnr.state.oh.us/water/pubs/fs_st/stfs10.htm
Pennsylvania State University	Rootwads: Demonstration Projects and Design/Construction Criteria Development	3	
Regulated Rivers: Research and Management	Turbidity control and fisheries enhancement in a bottomland hardwood backwater system in Louisiana (U.S.A.)	1	
Rocky Mountain Institute	Daylighting: New Life for Buried Streams	6	http://www.rmi.org/sitepages/pid172.php
Schuylkill Conservation District	Schuylkill Conservation District Project Summary	2	
South Carolina Department of Health and Environmental Control - Bureau of Water	2003 Annual Report of South Carolinas Nonpoint Source Pollution Management Program	3	
South Carolina Department of Health and Environmental Control - Bureau of Water	Watershed Water Quality Assessment: Saluda River Basin: Technical Report No. 005-98	1	
South Carolina Department of Health and Environmental Control - Bureau of Water	Watershed Water Quality Assessment: PeeDee River Basin	2	
South Carolina Department of Health and Environmental Control - Bureau of Water	Watershed Water Quality Assessment: Savannah and Salkehatchie River Basins: Technical Report No. 003-97	4	

South Carolina Department of Health and Environmental Control - Bureau of Water	Watershed Water Quality Assessment Summary: The Santee River Watershed	3	
South Carolina Department of Health and Environmental Control - Bureau of Water	Watershed Water Quality Assessment - Broad River Basin: Technical Report No. 001-01	1	
Surface Water Quality Bureau of the New Mexico Environment Department	Surface Water Quality Bureau Watershed Protection Section Clean Water Act 319(h) Projects: 1998-2004	23	
Trout Unlimited	Dam Removal Success Stories	61	http://www.tu.org/pdf/newsstand/library/drss.pdf
United States Army Corps of Engineers, Albuquerque District	Arkansas River Fisheries Habitat Restoration, Pueblo, Colorado	1	http://www.spa.usace.army.mil/ppm/projectspdf/Arkansas-206.pdf
United States Army Corps of Engineers, Institute for Water Resources	A Collection of Ecosystem Restoration Projects (Corps of Engineers 1135)	1	http://www.iwr.usace.army.mil/iwr/products/reports/reports.htm
United States Army Corps of Engineers/Upper Midwest Environmental Sciences Center	Habitat Rehabilitation Enhancement Project Fact Sheets	42	http://www.mvr.usace.army.mil/EMP/hrep.htm
United States Bureau of Reclamation- Lower Colorado Regional Office	Habitat Restoration on the Lower Colorado River- Demonstration Projects: 1995-2002	4	
United States Department of Agriculture, Natural Resources Conservation Service, South Carolina	Restoring and Protecting Trout Waters in the Upstate	1	http://www.upstateforever.org/newsletters/Fall'02Newsletter/RestoreandProtectFall_02.htm
United States Environmental Protection Agency Region 4	USEPA Region 4 - Natural Channel Restoration on the Soque River, Georgia	1	
United States Geological Survey	Researchers Study Effects of Trout Removal and Fluctuating Flows on Native Fishes in the Grand Canyon	1	http://www.gcmrc.gov/files/pdf/nps_flyer_rev_1-24-03.pdf
University of Georgia, Institute of Ecology	Demonstration Sites of Best Management Practices: A Manual for the Upper Etowah River Alliance	2	
University of Georgia, Institute of Ecology	Restoring Water Quality to a Stream in Putnam County, Georgia	1	

University of New Mexico Water Resources Program	Taking Out the Jacks: Issues of Jetty Jack Removal in Bosque and River Restoration Planning	2	http://www.unm.edu/~wrp/wrp-6.pdf
Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program	Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program: Program Highlights 2002-2003	2	http://coloradoriverrecovery.fws.gov/publicpages/Highlights02-03.pdf
Upper Oconee Watershed Network	Land Disturbing Activity Plan: Oconee Rivers Riparian Enhancement/Streambank Stabilization Demonstration Project: Ben Burton Park Site	1	http://www.pincongrp.com/uown/index.asp
Upper Oconee Watershed Network	Land Disturbing Activity Plan: Oconee Rivers Riparian Enhancement/Streambank Stabilization Demonstration Project: Johnsons Meadow Site	1	http://www.pincongrp.com/uown/index.asp
Upper Oconee Watershed Network	Project Work Plan: Oconee Rivers Riparian Enhancement/Streambank Stabilization and Demonstration Project	2	http://www.pincongrp.com/uown/index.asp
Water Quality Control Division of the Colorado Department of Public Health and Environment	Colorado Nonpoint Source Program FY 2003 Annual Report	16	
Wisconsin Department of Natural Resources	Expenditures of Inland Waters Trout Stamp Revenues Fiscal Year 1998 - 2001, Administrative Report no. 46	52	http://www.dnr.state.wi.us/org/water/fhp/fish/trout/stamprep.pdf
Wisconsin Department of Natural Resources	Expenditures of Inland Waters Trout Stamp Revenues, Fiscal Years 2000-2003, Administrative Report no. 52	94	http://www.dnr.state.wi.us/org/water/fhp/fish/trout/stamprep.pdf

Table A4. List of webpages used as sources for the NRRSS database, including entity responsible for webpage, page title, number of NRRSS records derived from webpage, and URL (URLs accurate as of January 10, 2005).

Entity	Title	Number of Records	Webpage
Altamaha Riverkeeper	Altamaha Riverkeeper	2	http://www.altamahariverkeeper.org
Aquascape Environmental	Aquascape Environmental	2	http://www.aquascape.net
BLUE: Land, Water, Infrastructure	BLWI	1	http://www.blwi.com/
Broad River Watershed Association	BRWA	1	
Brodhead Watershed Association	Paradise Streambank Restoration Project	1	http://www.brodheadwatershed.org/
City and County of Denver	Denvergov.org	1	http://www.denvergov.org/South_Platte_River/template23256.asp
City of Gainesville	City of Gainesville	1	http://www.gainesville.org/recreation.asp?contentscreen_id = projects
City of Phoenix	Rio Salado Habitat Restoration Project	1	http://phoenix.gov/RIOSALADO/index.html
Colorado Division of Wildlife	Stream Habitat Investigations and Assistance	2	http://wildlife.state.co.us/aquatic/stream/index.asp
Colorado Division of Wildlife	Dolores River Habitat Improvement	1	http://wildlife.state.co.us/habitat/dolores_project/
Colorado Water Conservation Board	Rio Blanco Habitat Restoration	1	http://cwcb.state.co.us/isf/programs/project.htm
Columbia County Stormwater Utility	Stormwater--Holiday Park	1	http://www.co.columbia.ga.us/engineering_environmental/StormWater/projects/holiday_park.html
Coosa River Basin Initiative	Coosa River Basin Initiative	1	http://www.coosa.org
Cuidad Soil and Water Conservation District	Tijera Creek Project	1	http://www.ciudadswcd.org/TijerasCreekProject.htm
Cuidad Soil and Water Conservation District	Juan Tabo Demonstration Site	1	http://www.ciudadswcd.org/juantabo.htm
Cuyahoga River Remedial Action Plan	Stearns Farm Park	1	http://www.cuyahogariverrap.org/stearns_farm_park.htm
Dave Perrin and the Chattooga Outfitters Association	Conserving the Chattooga	1	http://gorp.away.com/gorp/resource/us_river/sc/chat_con.htm#stekoa
Dewberry	Dewberry	1	http://www.dewberry.com
Downeast Salmon Federation	The East Machias Dam Removal Before, During, and After	1	
Earth Works Institute	The Galisteo Watershed Restoration Projects	1	http://www.earthworksinstitute.org/index.html
EcoLogic Engineering/Construction	Ecologic	7	http://www.ecologic-nc.com/
EcoScience Corporation	EcoScience Stream Restoration, Design, and Engineering	6	http://www.ecosciencenc.com/services/DataSheets/Stream_Restoration_Design_Engineering_Intro.htm
Ecotone, Inc. Selected Projects	Ecotone, Inc. Selected Projects	5	http://www.ecotoneinc.com

Federal Interagency Stream Corridor Restoration Working Group	Federal Interagency Stream Corridor Restoration Working Group	1	http://www.nrcs.usda.gov/technical/stream_restoration/
Friends of Daniels Run Park	Friends of Daniels Run Park Newsletter	1	http://osf1.gmu.edu/~rcjones/fdrpnl8.pdf
Fuller, Mossbarger, Scott & May, Engineers, Inc	FMSM Engineering	5	http://www.fmsmengineers.com/engineeringServices/streamRestoration/
Georgia Environmental Organization	Georgia Environmental Organization	1	http://www.gaenv.org
Georgia Soil and Water Conservation Commission - Region 4	Region 4 Homepage	3	http://gaswcc.org/region4
Habitat Assessment and Restoration Program, Inc	Environmental Assessments, Habitat Restoration, Stream Restoration	7	http://www.habitatassessment.com/stream_restoration.htm
Hiwassee River Watershed Coalition	Hiwassee River Watershed Coalition	4	http://www.hrwc.net
Huff Run Watershed Restoration Partnership	Huff Run Projects	7	http://www.huffrun.org/projects.html
Hydra Aquatic, Inc.	MINE AND TAILINGS SITE WETLAND / RIPARIAN RECLAMATION	2	http://www.hydraaquatic.com/mine.html
Jackson Purchase RC&D	Jackson Purchase RC&D	2	http://www.jpof.org
John Horning	Forest Guardians	2	http://www.fguardians.org/
Katawba Valley Land Trust	KVLT Current Projects	1	http://www.kvlt.org/projects/tree_planting.html
Kentucky Dept of Natural Resources--Division of Abandoned Mine Lands	Projects	7	http://www.surfacemining.ky.gov/aml/projects
KY Division of Water Nonpoint Source Program	CWA in Kentucky--NPS Successes	4	http://www.water.ky.gov/homepage_repository/cwa30_nps_successes.htm
Las Vegas Wash Coordinating Committee	Las Vegas Wash Coordinating Committee	1	http://www.lvwash.org/being_done/being_done.html
Louisville - Jefferson County Metropolitan Sewer District	Stream Restoration and Soil Bioengineering	2	http://www.msdlouky.org/insidemsd/soilbio1.html
Louisville-Jefferson County Metropolitan Sewer District	Louisville-Jefferson County MSD Capital Projects	17	http://www.msdlouky.org/programs/cap-manual/openprojects/alphabet.htm
Mecklenburg County Storm Water Services	Stormwater Services Projects	6	http://www.charmeck.org/Departments/LUESA/Water+and+Land+Resources/Programs/Storm+Water/Storm+Water+Projects.htm
Miami Conservancy	Welcome to Miami Conservancy District		http://www.miamiconservancy.org/

Michigan Department of Natural Resources	Sturgeon Dam	1	http://www.michigan.gov/dnr/0,1607,7-153-10364_27415-80309--,00.html
North Buckhead Civic Association	Blue Heron Nature Preserve	1	http://www.nbca.org/BlueHeron/
North Carolina State University Stream Hydrology Institute	McLendons Creek Watershed	1	http://www.bae.ncsu.edu/programs/extension/wqg/ncwsheds/mlcw/
North Carolina Stream Restoration Institute	SRI Homepage	11	http://www.ncsu.edu/sri
North Carolina Ecosystem Enhancement Program	NCWRP Projects	7	http://h2o.enr.state.nc.us/wrp/project/projects.htm
North Carolina Wildlife Resources Commission	North Carolina Wildlife Resources Commission	1	http://216.27.49.98/index.htm
Northern Kentucky University Center for Applied Ecology	NKU Center for Applied Ecology	1	http://access.nku.edu/appliedecology/
Northern Virginia Soil & Water Conservation District	Stream Restoration and Stabilization	1	http://www.fairfaxcounty.gov/nvswcd/streamrestore.htm
Ohio EPA	Maumee RAP Publications	3	http://www.epa.state.oh.us/dsw/rap/maupub.html
Ohio Natural Channel Design Project	Ohio Natural Channel Design Project	1	http://www.ag.ohio-state.edu/~ncd/geo/2geoprint.html
Oxbow River and Stream Restoration	Oxbow River and Stream Restoration	5	http://www.oxbowriver.com
Pima County Flood Control District	Sonoran Desert Conservation Plan-Riparian Projects	4	http://www.dot.co.pima.az.us/flood/riparian/sdcp_rip.pdf
Raccoon Creek Watershed Project	Raccoon Creek Watershed Project	4	http://www.raccooncreek.org/project/index.html
River Alliance of Wisconsin	River Alliance of Wisconsin	17	http://www.wisconsinrivers.org/
River Network	River Network	1	http://www.rivernetwork.org/library/index.cfm?doc_id=269
Robert J Goldstein and Associates	RJGA	1	http://www.rigacarolina.com
Socorro Soil and Water Conservation District	Lower Rio Grande Salt Cedar Control Project	1	http://www.socorroswcd.com
South Florida Water Management District	Kissimmee River Restoration	1	http://www.sfwmd.gov/org/erd/krr/index.html
South Florida Water Management District	Restoring an endangered ecosystem - the journey to restore Americas Everglades	4	http://www.evergladesplan.org/index.cfm
Southern Alleghenies Conservancy	Southern Alleghenies Conservancy Projects	1	
STREAMS	STREAMS	11	http://www.ag.ohio-state.edu/%7estreams/
Sustainable Universities Initiative	SUI Activities at Lander University 2001-2002	1	http://www.sc.edu/sustainableu
The Nature Conservancy	Freshwater Initiative	2	http://63.236.108.147/

The Nature Conservancy	United States	10	http://nature.org/wherewework/northamerica/states/
Trout Unlimited	Kennebec Valley Chapter, Kennebec River, Maine	1	http://www.tu.org/small_dams/removal/3b-removal_kennebec.html
U.S. Army Corps of Engineers	Everglades Restoration Critical Projects	3	http://www.saj.usace.army.mil/projects/index.html
United States Department of Agriculture--Natural Resources Conservation Service--Kentucky	Henderson County Success Stories	3	http://www.ky.nrcs.usda.gov/about/success_stories/henderson_success.html
United States Environmental Protection Agency	American Heritage Rivers	1	http://www.epa.gov/rivers/
University of Washington	Upper Arkansas River Alluvium Remediation- Biosolids Demonstration	1	http://faculty.washington.edu/clh/leadville.html#anchor311724
Upper Etowah River Alliance	Upper Etowah River Alliance	2	http://www.etowahriver.org
USGS Reconfigured Channel Monitoring and Assessment Program	Lake Fork of the Gunnison River at Gateview, Colorado	1	http://webserver.cr.usgs.gov/projects/rcmap/LakeFork/html/lakefork.html
Utah Reclamation Mitigation and Conservation Commission	Provo River Restoration Project	1	http://www.mitigationcommission.gov/prrp/prrp.html
Virginia Dept of Environmental Quality	Virginia Coastal Program Funding and Projects	4	http://www.deq.state.va.us/coastal/funding.html#projects
Virginia Dept of Game and Inland Fisheries	Dam Removal	2	http://www.dgif.state.va.us/fishing/embrey_dam.html
Washington State Department of Ecology	Washington State Department of Ecology: Water Quality Home, List of Projects Funded Under the Aquatic Weeds Program 1994-2000.	5	http://www.ecy.wa.gov/programs/wq/plants/grants/projects.html
West Creek Preservation Committee	Ohio 319 Grant Program	1	http://www.westcreek.org/319.html
Wisconsin Department of Natural Resources Dam Safety Program	Wisconsin Department of Natural Resources Dam Safety Program	52	http://www.dnr.state.wi.us/org/water/wm/dsfm/dams/removal.html

