Chapter 4: Environmental Consequences

4.1 Introduction

This chapter describes the environmental consequences of implementing each of the alternatives. It provides the scientific and analytic basis for the comparisons of the alternatives. It describes the probable consequences, impacts, and effects of each alternative on the topics discussed in Chapter 3. The discussion of each alternative begins with a summary of the alternative and the management actions that would be initiated under each alternative. It is these management actions that would result in the impacts or effects that are the subject of this chapter. The sections of this chapter are organized as follows: Section 4.2 describes the effects and impacts common to all alternatives, Section 4.3 describes Alternative A by impact topic, Section 4.4 describes Alternative B, Section 4.5 describes Alternative C, Section 4.6 describes Alternative D, and Section 4.7 describes Alternative E.

Note that Alternative A (No Action) represents anticipated conditions if the current programs and trends at the Refuge of recent years were to continue for the next 15 years, the planning horizon for the Comprehensive Conservation Plan. Alternative A serves as a baseline for comparison with the consequences of the other alternatives and thus is often referenced when discussing Alternatives B through E.

Great Blue Heron, Crab Orchard NWR

4.1.1 Quantifying Effects of Alternatives on Wildlife Species

We used a modeling process developed by USGS scientists (Rohweder et al. 2002) to examine the relative effects of different alternatives on selected wildlife that use the Refuge. For each species of interest, habitat potential for each land cover type was given a rank of 0, 1, 2 or 3 (no, low, medium, and high potential, respectively). This resulted in a weighted average Potential Species Occurrence (PSO) score for each species or group of species for the year 2000 and for each alternative in 2015 and 2100. For example, if the entire Refuge were high potential habitat for a given species, it would receive a PSO score of 3.0. If half of the Refuge were medium potential habitat for a given species, and half were low, it would receive a PSO score of 1.5. Habitat potential ranks were based on the integrated life cycle needs of each species as determined by FWS biologists (Appendix N). Refuge

land cover types were identified and quantified by USGS scientists (Hop 2001). The year 2000 land cover type data were manipulated using Geographic Information System (GIS) to develop the 2015 and 2100 land cover alternatives.

In order to assess the broad impacts of the Comprehensive Conservation Plan, one mammal species and 29 birds were chosen to represent several important habitat types found on the Refuge (Table 33). We selected the species because they are Region 3 conservation priority species (USFWS 2002) that use the major habitat types on the Refuge. Potential Species Occurrence scores were calculated for Bald Eagle (threatened), Indiana bat (endangered), five groups of species (all 30 species, nine forest birds, four grassland birds, five shrubland birds, and seven species of waterfowl).

Potential Species Occurrence scores for 2000 ranged from 0.14 for grassland birds to 1.39 for forest birds and the projected effects of the different alternatives are quite variable (Table 34). Bald Eagle and waterfowl PSO scores remain nearly the same as 2000 scores under all alternatives. This is because most of the habitats used by Bald Eagles and waterfowl will remain available in quantities similar to those found in 2000. Potential Species Occurrence scores for forest birds and Indiana bat increase under all alternatives as a result of planned forest enhancement activities and the succession of young forests and fallow areas into more mature forest habitat. Grassland and shrubland bird PSO scores decrease under all alternatives as a result of succession of open grass and shrub habitats to forest habitat. The amount of Refuge habitat for grassland and shrubland birds is relatively limited, so losses of these habitats will have larger effects on PSO scores.

Potential Species Occurrence scores are rough estimates of the effects of different alternatives and focus more on habitat quantity than quality. Factors not considered in this modeling process will also affect the value of a given habitat to wildlife. For example, much of the Refuge's forests are relatively young and their value to wildlife will change as they continue to mature. Alternatives B, C, D and E would manage for large blocks of forest, which should result in better nesting habitat for area-sensitive forest birds because predation and nest parasitism would be reduced. All five alternatives also call for conversion of pine plantations to hardwoods that are more valuable to wildlife. Some alternatives also plan for improved wildlife management of pastures and hay fields: delayed mowing of hay to reduce the rate of nest destruction, conversion of fescue pastures to more desirable warm- and cool-season grasses, and removal of woody vegetation to make grassland more attractive to grass nesting birds. These proposed management activities would enhance these habitats for many wildlife species, but this is not reflected in the PSO scores.

4.1.2 Effects on Archaeological and Cultural Values

The activities that are most positive for cultural resources are those that reduce or eliminate activities on the Refuge. In general, recreation activities and invasive species control have little potential to affect cultural resources and are envisioned as having a neutral effect on cultural resources. However, non-motorized use of trails may have a negative impact on cultural resources by increasing visitor traffic to sensitive cultural areas. Cultural resources are sensitive to ground disturbing activities. Activities that may have a negative impact on cultural resources include timber harvesting, grazing, farming, and construction of new trails or facilities. Fire suppression activities can also damage archaeological sites if new roads and firelines are constructed while combating wildland fires.

The impacts of the alternatives on cultural resources were evaluated with the assumption that significant, but as yet unidentified, cultural resources may occur on the Refuge. Under any alternative, site specific actions such as construction of facilities will be subject to additional environmental review in accordance with the National Environmental Policy Act, which affords protection to significant cultural resources as prescribed by the National Historic Preservation Act and other applicable regulations and guidelines. Although avoidance is the preferred approach, mitigation of effect is an acceptable treatment and development activities may, therefore, result in a net loss of resources.

Livestock grazing can have a negative impact on cultural resources by encouraging erosion, trampling and displacement of artifacts. All alternatives would reduce the possible negative impacts of grazing on cultural resources by reducing the erosion around water. The possible trampling and displacement of artifacts, if it is occurring, would continue, but be limited to areas delineated as pastures. Farming, like grazing, can have a negative effect on cultural resources through excavation and displacement of artifacts. Farming would remain essentially

Table 33: Resource Conservation Priority Species Used to Assess the Broad Impacts of the Comprehensive Conservation Plan

Species	Refuge Breeder	Habitat	Regional Concerns	Refuge Abundance
Double-crested Cormorant	N	Lakes and adjacent forests	Nuisance	Common
Canada Goose (Resident)	Y	Wetlands, agricultural fields	Recreation/economic value	Common
Canada Goose (Migrant)	N	Wetlands, agricultural fields	Recreation/economic value	Abundant
Wood Duck	Y	Wetlands, bottomland forests	Recreation/economic value	Common
American Black Duck	N	Wetlands	Recreation/economic value	Uncommon
Mallard	Y	Wetlands, bottomland forest	Recreation/economic value	Common
Blue-winged Teal	N	Wetlands	Recreation/economic value	Common
Northern Pintail	N	Wetlands	Recreation/economic value, rare-declining	Uncommon
Canvasback	N	Lakes, wetlands	Recreation/economic value	Uncommon
Bald Eagle	Y	Lakes, forests	Bald Eagle Protection Act	Uncommon
Red-shouldered Hawk	Y	Forests	Rare/declining	Uncommon
American Woodcock	Y	Wet meadows, wet shrubs	Recreation/economic value, rare/declining	Uncommon
Chuck-will's-widow	Y	Forests	Rare/declining	Uncommon
Whip-poor-will	Y	Forests	Rare/declining	Uncommon
Red-headed Woodpecker	Y	Forests	Rare/declining	Uncommon
Northern Flicker	Y	Forests	Rare/declining	Uncommon
Acadian Flycatcher	Y	Forests	Rare/declining	Uncommon
Loggerhead Shrike (migrans)	Y	Grasslands, shrublands	Rare/declining	Occasional
Bell's Vireo	Y	Shrublands	Rare/declining	Occasional
Wood Thrush	Y	Forests	Rare/declining	Uncommon
Blue-winged Warbler	Y	Shrublands	Rare/declining	Occasional
Prairie Warbler	Y	Shrublands	Rare/declining	Uncommon
Cerulean Warbler	Y	Forests	Rare/declining	Rare
Worm-eating Warbler	Y	Forests	Rare/declining	Uncommon
Louisiana Waterthrush	Y	Forests	Rare/declining	Uncommon
Kentucky Warbler	Y	Forests	Rare/declining	Uncommon
Field Sparrow	Y	Shrublands, grasslands	Rare/declining	Uncommon
Grasshopper Sparrow	N	Grasslands	Rare/declining	Occasional
Dickcissel	Y	Grasslands	Rare/declining	Common
Eastern Meadowlark	Y	Grasslands	Rare/declining	Common
Indiana bat	N	Forests, caves	Endangered	Unknown

Table 34: Potential Species Occurrence Scores for Threatened and Endangered Species or Groups for the Year 2000 and For Each Alternative in 2015 and 2100[1]

	2000	2015					2100				
Species		Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Bald Eagle	0.56	0.56	0.56	0.57	0.56	0.56	0.56	0.56	0.57	0.56	0.56
Indiana bat	0.58	0.63	0.63	0.62	0.64	0.63	0.67	0.68	0.67	0.68	0.68
All Species Scored	0.74	0.76	0.76	0.76	0.77	0.76	0.81	0.81	0.80	0.81	0.81
Forest Birds[2]	1.39	1.50	1.51	1.49	1.52	1.51	1.65	1.66	1.63	1.67	1.66
Grassland Birds[3]	0.14	0.09	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Shrubland Birds[4]	0.23	0.17	0.17	0.17	0.17	0.17	0.15	0.16	0.16	0.16	0.16
Waterfowl[5]	0.60	0.59	0.59	0.59	0.58	0.59	0.59	0.59	0.60	0.59	0.59

1. *Alternative A is No Action; Alternative B is Reduced Habitat Fragmentation, Wildlife-dependent Recreation; Alternative C is Open Land Management, Consolidate and Improve Recreation; Alternative D is Forest Land Management, Consolidate and Improve Recreation; and Alternative E is Reduce Habitat Fragmentation, Consolidate and Improve Recreation (Preferred Alternative).*
2. *Acadian Flycatcher, Cerulean Warbler, Chuck-will's-widow, Kentucky Warbler, Louisiana Waterthrush, Red-shouldered Hawk, Whip-poor-will, Wood Thrush, and Worm-eating Warbler.*
3. *Dickcissel, Eastern Meadowlark, Field Sparrow, and Grasshopper Sparrow.*
4. *Bell's Vireo, Blue-winged Warbler, Field Sparrow, Loggerhead Shrike, and Prairie Warbler.*
5. *American Black Duck, Blue-winged Teal, Canada Goose, Canvasback, Mallard, Northern Pintail, Wood Duck.*

Source:

Hop, Kevin D. 2001. Crab Orchard NWR land cover and land use spatial database (2000) project report, December 2001. U.S. Geological Survey report, LaCrosse, Wis., 29 pp.

Rohweder, Jason J., Timoth J. Fox, Kevin P. Kenow, Carl E. Korschgen, and Henry CC. DeHaan. 2002. GIS tools for national wildlife refuge comprehensive conservation plans; users manual. U.S. Geological Survey report, LaCrosse, Wis., 74 pp.

the same under all alternatives. Farming would have a small possible negative impact on cultural resources under all alternatives. The industrial pro grams on the Refuge are not expected to change markedly under any alternative and the effect on cultural resources is expected to be neutral. Fire suppression and management activities are expected to be consistent across alternatives and the possible impact on cultural resources is expected to be neutral.

Forest management activities, such as and thinning and reforestation of old farm fields, can have a negative effect on cultural resources through site disturbance. The five alternatives include slight variations on the acres affected by these activities. The effect of forest management activities on cultural resources is seen as being essentially equivalent across all alternatives with the potential of having a slightly negative effect on cultural resources. In the long term, the forest habitat will have few ground disturbing activities applied to it and cultural resource sites will be protected. Overall, the effect on cultural resources by forest management activities is seen as neutral.

4.2 Effects Common to All Action Alternatives

4.2.1 Threatened and Endangered Species

In a broad interpretation, each alternative would accomplish the purposes of the Refuge. Federally listed threatened and endangered species would be protected under each alternative. We conducted a Section 7 review concurrent with the preparation of the Final EIS. The Section 7 review examines the proposed actions of the preferred alternative.

4.2.2 Cooperative Fishery Management

Under each alternative the Refuge would cooperate with the State of Illinois to maintain a recreational fishery in the Refuge's lakes and ponds.

4.2.3 Canada Geese

Under each alternative, the Refuge would provide sufficient habitat for wintering Canada geese (6.4 million goose-use-days) to support historic population levels and provide opportunities for wildlife observation and photography and Refuge hunting programs.

4.2.4 Communication and Community Support

Under each alternative the Refuge's relationship with the community would improve through improved communication and community participation. The volunteer opportunities and Refuge support groups would be expected to increase and result in increased support for the Refuge and its programs.

4.2.5 Wilderness

The area designated as Wilderness would increase under each alternative. The Wilderness would be managed similarly under each alternative. Because the areas that would be designated as Wilderness are already managed as Wilderness, there would be no change from the current condition.

4.2.6 Climate Change Impacts

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies under its direction that have land management responsibilities to consider potential climate change impacts as part of long range planning endeavors.

The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's "Carbon Sequestration Research and Development" (U.S. DOE, 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

Terrestrial biomes of all sorts – grasslands, forests, wetlands, tundra, perpetual ice and desert – are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. The Department of Energy report's conclusions noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Preserving natural habitat for wildlife is the heart of any long range plan for national wildlife refuges. The actions proposed in this Comprehensive Conservation Plan would preserve or restore land and water, and would thus enhance carbon sequestration. This in turn contributes positively to efforts to mitigate human-induced global climate changes.

4.2.7 Prescribed Fire

We have included detail here about the effects of prescribed fire to fully document the Refuge's recent Fire Management Plan in compliance with the National Environmental Policy Act.

4.2.7.1. Social Implications

A prescribed burn on the Refuge will benefit the public in creating recreational opportunities through increased wildlife populations for hunting and observation. If a wildland fire occurs on or near the Refuge, the areas that were prescribed burned and the fire-breaks intended for prescribed burning will help in controlling the fire.

Smoke from a Refuge fire could impair visibility on roads and become a hazard. All efforts will be taken to assure that smoke does not impact smoke sensitive areas such as roads and local residences. The impact of smoke can be reduced through management actions, which include: use of traffic control, signing, altering ignition techniques and sequence, halting ignition, suppressing the fire, and use of local law enforcement officers to assist with control traffic. Burning will be done only when the smoke will not be blown across the community or when the wind is sufficient to prevent heavy concentrations.

Combustion of fuels during prescribed fire operations may temporarily impact air quality, but the impacts are mitigated by small burn unit size, direction of wind, and distance from population centers. In the event of wind direction change, mitigative measures will be taken to assure public safety and comfort. Refuge staff will work with neighboring agencies and State air quality personnel to address

smoke issues that require additional mitigation. The Prescribed Fire Plan describes specific measures to deal with smoke management problems for each unit.

Any smoke from the Refuge may cause some public concern. This concern will be reduced through a concerted effort by Refuge personnel to inform the local citizens about the prescribed burning program, emphasizing the benefits to wildlife and the safety precautions that are taken. Interpretive programs, explaining the prescribed burning program, may also be conducted on and off the Refuge.

4.2.7.2. Cultural and Archaeological Resources

There may be archaeological sites within prescribed burn units. When these units are burned, it is doubtful that the fire will have any adverse impact on the sites. The fire will be only a temporary disturbance to the vegetation in the area and in no way destroy or reduce the archaeological value, since artifacts are buried beneath the surface. No known sites will be impacted by prescribed burning operations.

Constructing firebreaks usually involves some shallow ground disturbance that could damage or destroy these resources. If a firebreak is needed on undisturbed ground, the area will be surveyed prior to construction to protect any cultural or archaeological resources.

4.2.7.3. Flora

The prescribed burning program will have a visible impact on vegetation and the land. Immediately after a fire much of the land will be blackened. There will be few grasses or ground forbs remaining and most of the brush will be scorched. Trees may be scorched. Because of wet ground conditions or discontinuous fuel, there may be areas within the burn unit that are untouched by the fire.

In spring, grasses and forbs will begin to grow within a few days of the burn. The enriched soil will promote rapid growth such that after two or three weeks the ground will be covered. In some cases, young trees will re-sprout. Some of the less fire resistant trees will show signs of wilting and may succumb. After one season of regrowth, most signs of the prescribed burn will be difficult to detect without close examination.

Other signs of the burn will remain for longer periods. The firebreaks will be maintained for use in containing wildland fires and future prescribed burns. Vehicle tracks through the burn are visible on the freshly burned ash and may be longer lived if the vehicle created ruts in the ground. Travel across the burn area will be kept to a minimum. Vehicle travel is necessary in some instances, such as lighting the fire lines or quickly getting water to an escape point. A fire plow will be used only in the event that an escape occurs and cannot be controlled by any other method. The trench of the plow would be repaired by filling, which would eliminate it from view after several years.

4.2.7.4. Fauna

Many faunal communities have adapted in a fire environment to survive the pattern of fire frequency, severity, and uniformity in their associated habitat. The prescribed burning program will mainly affect animals through changes in their habitat structure and composition. Prescribed fire will be applied judiciously to maximize benefits and minimize detrimental effects to wildlife.

The extent to which an animal's habitat is altered corresponds with the severity of the fire. Our prescribed fires are generally of low intensity, which causes minor to moderate changes to the habitat structure. For small animals, short-term loss of cover is usually the most visible post-fire habitat structure change. New growth of grasses and forbs provides cover soon after a fire event, as well as unburned pockets of vegetation. Larger animals, with their more extensive home ranges, are opportunistic and not usually negatively affected by fire.

Fire events often cause short-term increases in forage availability, palatability, and productivity. Browsers typically find plenty of young, tender sprouts from woody vegetation following fire events. More intense fires in woodlands can create snags which are used by variety of wildlife species.

4.2.7.5. Listed Species

All prescribed fires will be at least 0.5 mile from known active Bald Eagle nests. Prescribed fires will also occur outside of the breeding season of Indiana bats. We conducted a Section 7 review concurrent with the preparation of the Final EIS. The Section 7 review examines the prescribed fire program.

4.2.7.6. Soils

The effect of fire on soil is dependent largely on the fire intensity and duration. On areas with high fuel loads, a slow backing fire is usually required for containment and desirable results. The intense heats generated by a slow backing fire will have a

greater effect on the soils than fast, cooler headfires. The cool, moist soils of wetter areas in the burn units or areas with little fuel will be minimally affected by the fire.

The degree of impact to the soil is a function of the thickness and composition of the organic mantle. In cases where only the top layer of the mantle is scorched or burned, there will be no effect on the soil. This usually occurs in the forested areas of the burn units.

On open grassland sites, the blackening of the relatively thin mantle will cause greater heat absorption and retention from the sun. This will encourage earlier germination during the spring growing season.

Nutrient release occurs as a result of the normal decomposition process. Fire will speed up the nutrient release process. The rate and amount of nutrients released will be dependent on the fire duration and intensity as well as the amount of humus, duff and other organic materials present in the mantle. The increase, immediately after a burn, of calcium, potash, phosphoric acid and other minerals will give the residual and emergent vegetation a short term boost.

There is no evidence to show that the direct heating of soil by a fire of low intensity above it has any significant adverse affect. Fire of this type has little total effect on the soil, and in most cases would be beneficial.

4.2.7.7. Escaped Fire

The possibility exists that prescribed fire may escape to the surrounding area. An escape can be caused by factors that may, or may not, be preventable. Inadequate firebreaks, too few personnel, unpredicted changes in weather conditions, peculiar fuel type, and insufficient knowledge of fire behavior are factors that can lead to a loss of control. An escaped fire can turn into a very serious situation. On the Refuge's wildlands, an escaped fire would cause less severe damage than on land where buildings, equipment, and land improvements could be damaged. Many of the prescribed burn areas are well within the Refuge and of minimal threat to private or other improved lands. We will exercise extreme care, careful planning, and adherence to the unit prescription when we conduct all prescribed burns. We will place an extra emphasis on control when burning areas that are near developed areas or the Refuge boundary.

Tundra Swans, Crab Orchard NWR. Glenn Smart

If a prescribed fire jumps a firebreak and burns into unplanned areas, there is a high probability of rapid control with minimal adverse impact. The network of firebreaks and roads will greatly assist in rapid containment. In most cases, all of the Refuge fire fighting equipment will be immediately available at the scene and nearby water sources identified. The Lake Egypt Fire Protection District will always be notified of a prescribed burn. Thus, maximum numbers of experienced personnel and equipment will be immediately available for wildland fire suppression activities.

4.3 Alternative A: Current Management/No Action

4.3.1 Impacts on Resources

4.3.1.1. Land cover

Under this alternative, the primary change in land cover of the Refuge over the next 15 years would be a decrease in fallow herbaceous fields (about 1,500 acres) and an increase in mixed hardwood upland forest (about 2,000 acres). Over the longer term, 100 years, the primary change would occur in the forests as pine plantations, shrubland, and red-cedar forests succeed to hardwood forest. Other changes in the shorter and longer terms are the succession of fallow and old fields to shrubland and forest cover types. The acres of land cover at the Refuge in 2000 and the acres projected for 2015 and 2100 under each alternative, along with the change from 2000, are shown in Table 35. The distribution of land cover for the years 2000, 2015, and 2100 are shown in Figure 21 on page 86, Figure 6 on page 36, and Figure 7 on page 37, respectively. .

Table 35: Areas of Land Cover at Crab Orchard NWR in 2000 and Acres Projected for 2015 and 2100 Under Each Alternative, With Change from 2000 Shown in Parentheses (Land Cover for Alternative E is the Same as Alternative B)

Land Cover	2000	2015				2100			
		Alt. A (No Action	Alts. B and E (Preferred)	Alt. C (Open Land)	Alt. D (Forest)	Alt. A (No Action)	Alts. B and E (Preferred)	Alt. C (Open Land)	Alt. D (Forest)
Agricultural Field	4,540	4,540 (0)	4,412 (-128)	4,751 (+211)	4,302 (-238)	4,540 (0)	4,412 (-128)	4,751 (+211)	4,301 (-238)
Aquatic Herbaceous Marsh	365	365 (0)	365 (0)	365 (0)	365 (0)	365 (0)	365 (0)	365 (0)	365 (0)
Bald-cypress Plantation, Swamp Forest	44	44 (0)	44 (0)	44 (0)	44 (0)	44 (0)	44 (0)	44 (0)	44 (0)
Buttonbush Swamp Shrubland	81	81 (0)	81 (0)	81 (0)	81 (0)	81 (0)	81 (0)	81 (0)	81 (0)
Cattail Marsh	25	25 (0)	25 (0)	25 (0)	25 (0)	25 (0)	25 (0)	25 (0)	25 (0)
Common Reed Marsh	7	7 (0)	7 (0)	7 (0)	7 (0)	7 (0)	7 (0)	7 (0)	7 (0)
Developed Land	1,138	1,138 (0)	1,138 (0)	1,138 (0)	1,138 (0)	1,138 (0)	1,138 (0)	1,138 (0)	1,138 (0)
Early Successional Oak Forest (reforested)	5	5 (0)	0 (-5)	0 (-5)	0 (-5)	0 (-5)	0 (-5)	0 (-5)	0 (-5)
Eastern Red-cedar, Mixed Hardwood Forest (old field)	1,006	1,006 (0)	1,006 (0)	1,006 (0)	1,006 (0)	0 (-1,006)	0 (-1,006)	0 (-1,006)	0 (-1,006)
Eastern Red-cedar Forest (old field)	71	71 (0)	71 (0)	71 (0)	71 (0)	0 (-71)	0 (-71)	0 (-71)	0 (-71)
Fallow Herbaceous Field	1,567	62 (-1,505)	172 (-1,395)	212 (-1,355)	174 (-1,393)	62 (-1,504)	172 (-1,394)	212 (-1,355)	174 (1,392)
Forest Regeneration Herbaceous Land	168	0 (-168)	0 (-168)	0 (-168)	0 (-168)	0 (-168)	0 (-168)	0 (-168)	0 (-168)
Mixed Hardwood Bottomland Forest	1,907	1,977 (+70)	2,042 (+135)	1,982 (+75)	2,042 (+135)	1,977 (+69)	2,042 (+135)	1,982 (+74)	2,042 (+135)
Mixed Hardwood Upland Forest	18,923	20,908 (+1,985)	21,148 (+2,225)	20,703 (+1,780)	21,297 (+2,374)	25,777 (+6,854)	25,869 (+6,946)	25,352 (+6,430)	26,030 (+7,107)
Open Water	9,082	9,082 (0)	9,082 (0)	9,082 (0)	9,082 (0)	9,082 (0)	9,082 (0)	9,082 (0)	9,082 (0)
Perennial Grass Crops	1,725	1,725 (0)	1,564 (-161)	1,659 (-66)	1,513 (-212)	1,725 (0)	1,564 (-160)	1,659 (-66)	1,513 (-212)
Pine Plantation / Mixed Hardwood Forest	1,633	1,633 (0)	1,633 (0)	1,633 (0)	1,633 (0)	0 (-1,633)	0 (-1,633)	0 (-1,633)	0 (-1,633)
Pine Plantation Forest	1,665	1,665 (0)	1,665 (0)	1,665 (0)	1,665 (0)	0 (-1,665)	0 (-1,665)	0 (-1,665)	0 (-1,665)
Restored native Grassland	240	240 (0)	261 (+21)	261 (+21)	260 (+20)	240 (0)	261 (+21)	261 (+21)	260 (+20)
Upland Mixed Shrubland (old field)	872	489 (-383)	347 (-525)	379 (-493)	358 (-514)	0 (-872)	0 (-872)	104 (-768)	0 (-872)
Wet Herbaceous Meadow	389	389 (0)	389 (0)	389 (0)	389 (0)	389 (0)	389 (0)	389 (0)	389 (0)
Willow Wet Shrubland	3	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)

Table 36: Predicted Difference in Land Cover by Alternative for 2000, 2015 and 2100

	2000	2015	2100	2015	2100	2015	2100	2015	2100
Land Cover		Alt. A No Action	Alt. A No Action	Alts. B and E (Preferred Alternative)	Alts. B and E (Preferred Alternative)	Alt. C Open Land	Alt. C Open Land	Alt. D Forest	Alt. D Forest
Area of Forest (acres)	25,254	27,309	27,798	27,609	27,995	27,103	27,378	27,758	28,116
Percent of Refuge Forested	56	60	61	61	62	60	60	61	62
Percent of Non-Open Water Refuge Forested	69	75	76	76	77	75	75	76	77
Total Core of Area of Upland (acres)	4,300	5,741	11,824	6,155	12,117	5,709	11,616	6,185	12,156
Percent of Refuge in Upland Hardwood Core Area	9	13	26	14	27	13	26	14	27
Percent of Non-Open Water Refuge in Upland Hardwood Core Area	12	16	33	17	33	16	32	17	33

4.3.1.2. Threatened and Endangered Species

Under Alternative A (No Action), the PSO score (habitat potential) for Bald Eagles would remain the same (Table 34 on page 132). The amount of open water (feeding) habitat would remain the same (Table 35). Forest (nesting) habitat would increase about 8 percent by the end of the 15-year planning period and 10 percent by the year 2100 (Table 36). These increases would result mostly from the maturation of existing forests and the succession of fallow fields and shrub lands into forest. The majority of new forest habitat would probably be far enough away from open water to limit its potential as nesting habitat for Bald Eagles. Nesting habitat would improve somewhat as existing forest continues to mature resulting in more trees that are large enough to support a nest.

Under Alternative A (No Action), the PSO score for Indiana bats would increase by 9 percent by the end of the 15-year planning period and 16 percent by the year 2100 (Table 34 on page 132). Forest habitat would increase about 8 percent by the end of the 15-year planning period and 10 percent by the year 2100 (Table 36). These increases would result mostly from the maturation of existing forests and the succession of fallow fields and shrub lands to forest.

4.3.1.3. Area-sensitive Forest Bird Species

Under Alternative A (No Action), the PSO score for area-sensitive forest birds would increase by 8 percent by the end of the 15-year planning period and 19 percent by the year 2100 (Table 34 on page 132). Forest habitat for area-sensitive forest birds, such as Acadian Flycatcher, Wood Thrush, and Worm-eating Warbler, would increase about 8 percent by the end of the 15-year planning period and 10 percent by the year 2100. Most of these increases would result from the maturation of existing forests and the succession of fallow fields and shrub lands into forest.

To evaluate the potential effects of changing forest cover on area-sensitive forest species, we measured the number of acres of upland hardwood forest (our most abundant, natural forest type) that were more than 100 meters from the edge of other land cover. This provides a measure of forest core area: the interior portion of the forest that is far enough away from the forest edge to have decreased rates of nest predation and nest parasitism. Under this alternative, the amount of upland hardwood forest core area would increase about 31 percent over the 15-year planning period and 189 percent by the year 2100. Most of the increase will come from the conversion of pine plantations and the succession of red-cedar habitat to upland hardwood forest. Some

of the increase in upland hardwood core area will be a result of fallow fields and shrublands succeeding to forest habitat.

4.3.1.4. Waterfowl and Other Water Bird Species

Under Alternative A (No Action), the PSO for waterfowl would decrease by 2 percent by the end of the 15-year planning period and then remain stable through the year 2100 (Table 34). Habitat for Wood Ducks would improve as forests mature and increase in coverage. Habitat for Canada Geese would decrease slightly, mostly due to succession of fallow fields to shrub land (Table 35 and Table 36) and small decreases in row crop and hay field acreages (Table 2 on page 43). The amount of potential food for wintering Canada Geese would decrease by 3 percent, but there would still be an amount adequate for providing 6.4 million goose-use-days (Table 3 on page 44). Current goose management activities would continue: seasonal closure of the east end of Crab Orchard Lake, management of existing moist soil management units, and annual fall mowing of the shorelines of selected ponds. The lakes, ponds, moist soil units, and other Refuge wetlands would continue to provide habitat for shorebirds and other water birds.

4.3.1.5. Grassland Birds

Under Alternative A (No Action), the PSO score for grassland birds, such as Dickcissel and Eastern Meadowlark, would decrease by 36 percent by the end of the 15-year planning period and 43 percent by the year 2100 (Table 34 on page 132). Most of these decreases would result from the succession of fallow fields to shrub land and forest (Table 35 on page 136). Nesting conditions for grassland birds would be improved by the prohibition of mowing in clover and hay fields until August 1 of each year.

4.3.1.6. Shrubland Birds

Under Alternative A (No Action), the PSO score for shrub land birds, such as Bell's Vireo and Field Sparrow, would decrease by 26 percent by the end of the 15-year planning period and 35 percent by the year 2100 (Table 34). Most of these decreases would result from the succession of shrub land to forest (Table 35).

4.3.1.7. Water Quality

Working with farmers on the Refuge to establish buffer strips and keep stock away from riparian areas and bodies of water would affect water quality in this alternative. We expect that sedimentation in Crab Orchard Lake would decrease a small amount over the next 15 years. The resulting changes in the water chemistry would be minor. The water quality in the other lakes and streams on the Refuge would remain unchanged. Investigation by CERCLA and remediation of contaminated sites should result in improved water quality in portions of Crab Orchard Lake.

4.3.1.8. Wilderness

Under Alternative A (No Action) the pine plantations (229 acres) and pine-hardwood stands (96 acres) in the Wilderness would be thinned to promote establishment and growth of native hardwoods. Thinning would be conducted in several phases over a 10- to 15-year period to mimic the natural process of succession where pines are gradually replaced by hardwoods. Individual pines would be killed by cutting, girdling or injecting herbicide. No trees would be removed from the site. Treatments would be conducted so that the results would appear natural as much as possible. However, trees along heavily used trails may need to be felled to avoid personal injury to visitors, in which case this zone may appear unnatural for several years. Eventual removal of all the non-native pines would restore the natural vegetative cover of the area and enhance wilderness characteristics.

In conjunction with thinning the pine and pine-hardwood stands, prescribed burning would be conducted during the dormant season (November through March) on a 3- to 5-year cycle to enhance habitat conditions and promote desirable hardwood regeneration. Control lines would be established by hand tools where necessary, using natural firebreaks as much as possible. Fire is a natural force in the ecosystem that should be reintroduced to provide many beneficial effects with minimal impacts.

Under Alternative A unauthorized sections of the River to River Trail would continue to pass through the Crab Orchard Wilderness. In addition, people would continue to ride horses and walk on other existing unauthorized trails and develop new ones. Trail erosion would continue and likely worsen because of increased foot and horse traffic and the lack of a hardened surface. Horses depositing dung along the trails may introduce invasive and exotic plants in the surrounding natural communities. An increased number of trail users, especially hikers, would express dissatisfaction with their trail experience.

The Wilderness would still be accessible to boaters from Devils Kitchen Lake using gas motors of 10 horsepower or less. The lake is not designated Wilderness, but the southern fingers of the lake extend far into the Wilderness.

4.3.2 Impacts on Public Uses

4.3.2.1. Wildlife-dependent Recreational Uses

Under Alternative A (No Action), wildlife-dependent recreational use levels would continue at the level experienced in 2000 with a slight increase over time due to population growth in the surrounding communities. Because the facilities would be gradually improved under this alternative, the quality of the recreational experience for visitors would gradually improve over the next 15 years. Goose hunting opportunities on and around the Refuge would remain unchanged.

4.3.2.2. Other Land- and Water-based Recreation

Camping

Four campgrounds would continue operation under this alternative. The facilities would be improved gradually over the next 15 years. The quality of the facilities and the camping experience would continue to be below the level available in nearby state park campgrounds.

Swimming

The opportunities and quality of experiences would remain unchanged from present conditions.

Picnicking

The opportunities and quality of experiences would gradually improve over the next 15 years as the current facilities are gradually improved.

Motorboating/sailing

Current management would continue under this alternative. Spatial and temporal zoning on Crab Orchard Lake would continue. Motors on Devils Kitchen and Little Grassy Lakes would continue to be limited to ten horsepower or less.

Water-skiing

The opportunities and quality of experiences would remain unchanged from present conditions. Conflicts would continue at the present level between users on Crab Orchard Lake.

Marinas

The capacity and condition of the marinas remain unchanged under this alternative.

Group Camps

Under this alternative camps and camp administration would remain unchanged from current conditions.

Private Clubs

Under this alternative clubs and their administration would remain unchanged from current conditions.

Horseback Riding

Under this alternative trails would continue to develop independent of plans and regulations. Trail erosion would continue and likely increase. The introduction of exotic plants would increase. An increased number of hikers would express dissatisfaction with their trail experience.

4.3.3 Volunteers and Support Groups

Under this alternative volunteer support and support from friends groups would increase gradually over the next 15 years.

4.3.4 Impacts on Industrial Use

Under this alternative the industrial operations on the Refuge would remain unchanged from current conditions.

4.3.5 Impacts on Agricultural Use

Under Alternative A (No Action), there would be few changes in agricultural operations on the Refuge when compared to current conditions. There would be little planned change in the number of acres farmed and grazed (Table 2 on page 43). Mowing of clover and hay fields would be prohibited until August 1 of each year.

4.3.6 Impact on Archaeological and Cultural Values

The impacts on archaeological and cultural values under Alternative A would remain unchanged from present conditions.

4.3.7 Boundary Modification

Under this alternative the existing boundaries of the Refuge would remain the same. We expect development to continue on inholdings and lands adjacent to the Refuge. There would be increased challenges to accomplishing the Refuge's wildlife conservation purpose.

4.4 Alternative B, Reduced Habitat Fragmentation: Wildlife-dependent Recreation Emphasis With Land Exchange

4.4.1 Impacts on Resources

4.4.1.1. Land Cover

Under this alternative, the primary change in land cover of the Refuge over the next 15 years would be a decrease in fallow herbaceous fields (about 1,400 acres) and shrubland (about 500 acres) and an increase in mixed hardwood upland forest (about 2,200 acres). Over the longer term, 100 years, the primary change would occur in the forests as pine plantations, shrubland, and red-cedar forests succeed to hardwood forest. Other changes in the shorter and longer terms are the succession of fallow and old fields to shrubland and forest cover types. There would also be a reduction in land used for row crops (about 100 acres) and hay fields (about 200 acres). The acres of land cover at Crab Orchard NWR in 2000 and the acres projected for 2015 and 2100 under each alternative, along with the change from 2000, are shown in Table 35 on page 136. The distribution of land cover types for the years 2000, 2015, and 2100 are shown in Figure 21 on page 86), Figure 9 on page 46, and Figure 10 on page 47, respectively. If the land exchange occurred, the forest land cover would be slightly more than is shown in the tables.

None of these changes would be large compared to the No Action Alternative. The predicted difference in land cover for Alternative A and Alternative B in 15 years is depicted in Figure 39.

4.4.1.2. Threatened and Endangered Species

Under Alternative B, the PSO score (habitat potential) for Bald Eagles would be the same as in Alternative A (Table 34 on page 132). The amount of open water (feeding) habitat would be the same as in Alternative A (Table 35 on page 136). The amount of forest (nesting) habitat would be 1 percent larger than in Alternative A (Table 36 on page 137).

Relative to Alternative A, the PSO score for Indiana bats would be the same over the 15-year planning period and be 1 percent larger by the year 2100 (Table 34).

Bunker, Crab Orchard NWR

4.4.1.3. Area-sensitive Forest Bird Species

Under Alternative B, the PSO score for area-sensitive forest birds would be 1 percent larger than under Alternative A (Table 34). Increases in forest habitat would be 1 percent larger than in Alternative A (Table 35). Relative to Alternative A, the amount of core area habitat would be 7 percent larger by the end of the 15-year planning period and 2 percent larger by the year 2100 (Table 36). Management of two portions of the Refuge would focus on reducing forest fragmentation by reforestation of 490 acres of open habitats and burning and thinning pine plantations to encourage succession to more desirable hardwood forest.

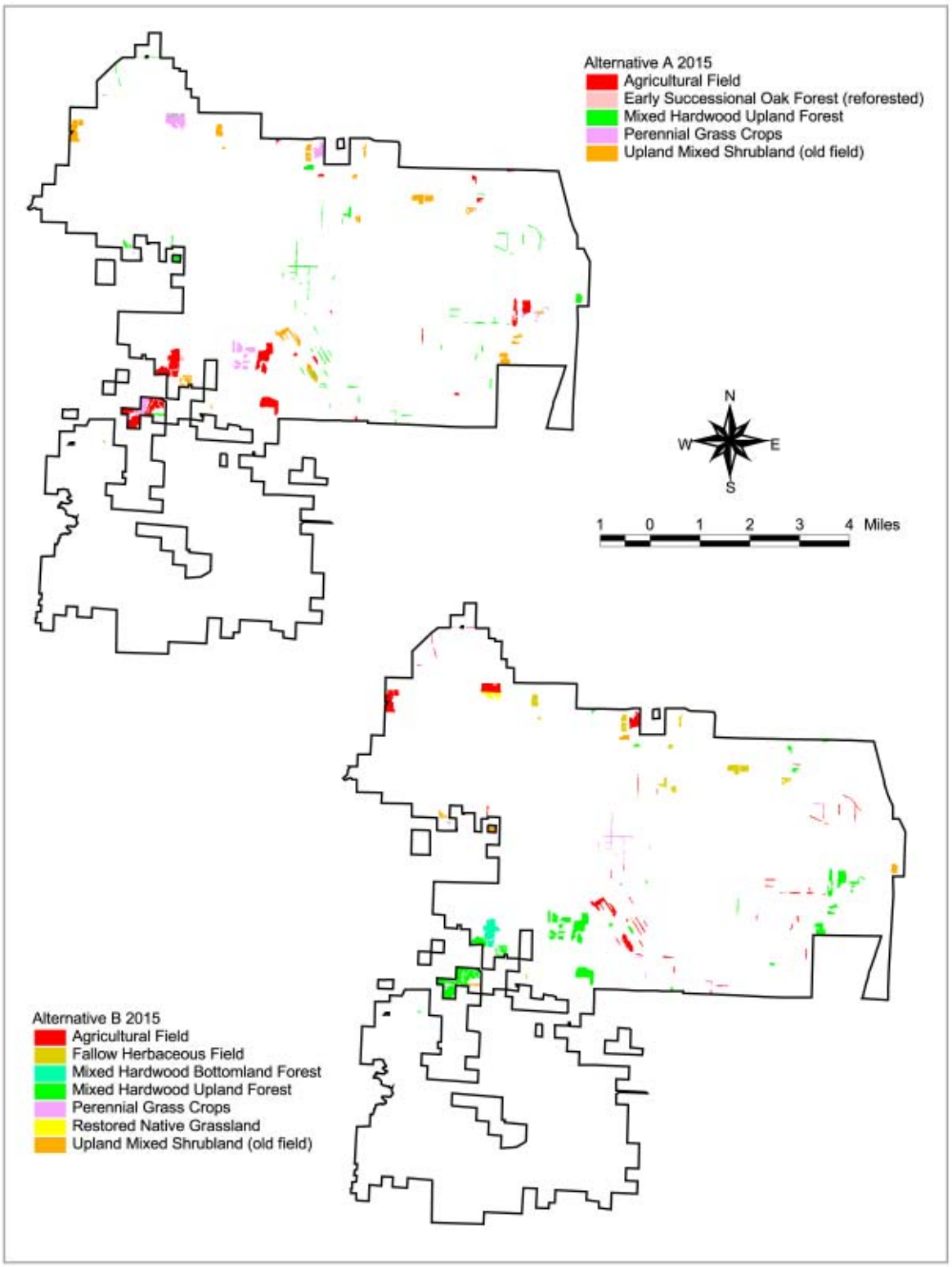
4.4.1.4. Waterfowl and Other Water Bird Species

Under Alternative B, the PSO score for waterfowl would be the same as in Alternative A (Table 34 on page 132). The amount of food producing habitat would be 1 percent less than under Alternative A (Table 2 on page 43). Relative to Alternative A, there would be 16 percent less potential food for wintering Canada Geese, but there would still be an amount adequate for providing 6.4 million goose-use-days (Table 3 on page 44). Most of the additional decrease in potential goose food results from conversion of pasture cover from fescue to native, warm-season grasses.

4.4.1.5. Grassland Birds

Under Alternative B, the PSO score for grassland birds would be 11 percent lower by the end of the 15-year planning period and be the same by the year 2100, when compared to Alternative A (Table 34 on page 132). As in Alternative A, nesting conditions for grassland birds would be improved by the prohibition of mowing in clover and hay fields until August 1 of each year. Under Alternative B, nesting conditions for grassland birds would be improved by changes in grazing operations, including the conversion of pasture cover from fescue to native, warm-season grasses. Under Alternative B,

Figure 39: Differences in Land Cover, Crab Orchard NWR (Alternative A (No Action) / Alternative B and Alternative E (Preferred Alternative), 2015



124 acres of linear forest habitat and 8 miles of hedge rows would be removed to enhance nesting habitat for grassland birds.

4.4.1.6. Shrubland Birds

Under Alternative B, the PSO score for shrub land birds would be the same by the end of the 15-year planning period and 7 percent lower by the year 2100, when compared to Alternative A (Table 34). Under Alternative B, some potential shrub land bird habitat (124 acres of linear forest habitat and 8 miles of hedge rows) would be removed to enhance nesting habitat for grassland birds.

4.4.1.7. Water Quality

In addition to working with farmers on the Refuge to establish buffer strips and keep stock away from riparian areas and bodies of water, under this alternative the Refuge staff would work with landowners in the watershed beyond the Refuge boundaries. We would expect less sedimentation in Crab Orchard Lake under this alternative than under Alternative A over the next 15 years. Investigation by CERCLA and remediation of contaminated sites should result in improved water quality in portions of Crab Orchard Lake, similar to Alternative A. The water quality in the other lakes and streams on the Refuge would also improve compared to Alternative A. The high quality water of Devils Kitchen Lake would be better protected under this alternative than under Alternative A.

4.4.1.8. Wilderness

Under Alternative B the pine plantations (229 acres) and pine-hardwood stands (96 acres) in the Wilderness would be thinned to promote establishment and growth of native hardwoods. Thinning would be conducted in several phases over a 10- to 15-year period to mimic the natural process of succession where pines are gradually replaced by hardwoods. Individual pines would be killed by cutting, girdling or injecting herbicide. No trees would be removed from the site. Treatments would be conducted so that the results would appear natural as much as possible. However, trees along heavily used trails may need to be felled to avoid personal injury to visitors, in which case this zone may appear unnatural for several years. Eventual removal of all the non-native pines would restore the natural vegetative cover of the area and enhance wilderness characteristics.

In conjunction with thinning the pine and pine-hardwood stands, prescribed burning would be conducted during the dormant season (November through March) on a 3- to 5-year cycle to enhance habitat conditions and promote desirable hardwood regeneration. Control lines would be established by hand tools where necessary, using natural firebreaks as much as possible. Fire is a natural force in the ecosystem that should be reintroduced to provide many beneficial effects with minimal impacts.

Under Alternative B the proposed River to River Trail route through the Crab Orchard Wilderness would become an officially designated trail for horseback riding and hiking. The trail would require substantial rehabilitation and regular maintenance to protect the fragile soils from increased foot and horse traffic. Horses depositing dung along the trail may introduce invasive and exotic plants in the surrounding natural communities. Since equestrians would be restricted to the River to River Trail, horseback riding on trails elsewhere in the Wilderness, and the associated impacts, would be eliminated.

Gas boat motors would be prohibited on the southern part of Devils Kitchen Lake. There would be a decline in visits, particularly for big game hunting, in the Wilderness bordering the shores of Devils Kitchen Lake because of the greater difficulty of access.

4.4.2 Impacts on Public Uses

4.4.2.1. Wildlife-dependent Recreational Uses

As a function of increased opportunities, accessibility, and improved facilities, under this alternative wildlife-dependent recreational use levels and quality of experiences would increase more than in Alternative A. Because the opportunities for teachers and students to use the Refuge would increase, a secondary effect would be a long-term increase in the community's conservation ethic. An increase in wildlife observation and photography would contribute to a minimal increase in wildlife disturbance. Goose hunting opportunities around the Refuge would remain the same as under Alternative A.

4.4.2.2. Other Land- and Water-based Recreation

Camping

One concession-operated campground on Little Grassy Lake would continue under this alternative. The facilities would be improved to industry standards within 5 years. The campground at Devils Kitchen would be discontinued and the area re-veg-

etated. The campground on Crab Orchard Lake, owned and managed by Southern Illinois University, would be improved. The quality of the facilities and the camping experience would be at the level available in nearby state park campgrounds. In comparison to the No Action Alternative, the campgrounds would be improved more rapidly under this alternative. The traditional users of the Devils Kitchen Campground would need to find alternative campgrounds, most likely at Giant City and Ferne Clyffe State Parks or the Little Grassy Campground. At Little Grassy Campground, we would limit the length of stay to 14 nights comparable with other Federal and State campgrounds in the area. For the first 2 years, approximately one-half of the campsites would remain available for long-term camping and the other half for stays up to 14 days maximum. The second 2-year period would permit up to one-third of campsites be available for 28-day stays and the remaining two-thirds would be limited to 14-day maximum stays. Finally, beginning in the fifth year, a 14-day maximum stay would apply to all campsites. We would require persons to remove all camping equipment from the campground for 48 hours at the end of any consecutive 14-day stay. Storage of equipment such as recreational vehicles and trailers would be prohibited. In addition, a reservation system would be developed for the campground. People who are accustomed to using a particular campsite for the entire season would be displaced. There would be greater opportunity and equity among visitors using the campground and the selection of prime sites.

Swimming

There would be increased swimming opportunities and higher quality of experiences in the Crab Orchard Lake area under this alternative. The concepts of Southern Illinois University include a water park, which would provide better opportunities compared to the No Action Alternative. There would be no developed beaches for the general public on other parts of the Refuge. Swimming would continue at the group camps and the campground on Little Grassy Lake. Under this alternative, some members of the local community would perceive a better fulfillment of their concept of the recreation purpose for the area, although the purpose would be achieved by Southern Illinois University rather than the Fish and Wildlife Service.

Picnicking

There would be increased picnicking opportunities and higher quality experiences in the Crab Orchard Lake area under this alternative. The opportunities for picnicking on other parts of the Refuge would improve to industry standards within five years as facilities were improved. Opportunities for picnicking on the Refuge would be provided to support wildlife-dependent recreation. The purpose would be achieved through actions by Southern Illinois University and the Fish and Wildlife Service.

Motorboating/sailing

Because gas motors would be prohibited south of the southernmost boat ramp on Devils Kitchen Lake, visitors to the lake would experience a quieter environment. Boaters who wanted to travel in the southern half of Devils Kitchen Lake would have to rely on electric trolling motors, paddling, or rowing for mobility. Boating use is not expected to change significantly on Devils Kitchen Lake.

Water-skiing

Because additional no-wake zones would be implemented under this alternative compared to Alternative A, anglers would have a better experience on Crab Orchard Lake. Conflict between anglers and personal watercraft users/waterskiers would be reduced. There would be fewer acres of water available for water-skiing under this alternative.

Marinas

Under this alternative the marinas on Crab Orchard Lake would be part of the land exchange with Southern Illinois University. The marinas at Little Grassy and Devils Kitchen Lakes would remain unchanged in quality and capacity. The marina facilities and related amenities on Crab Orchard Lake would increase under this alternative. The community interest in more developed facilities would be better met than under the No Action Alternative. There would be some increase in the local economy from increased tourist dollars. Students would receive training for careers in recreation management. There would be more intensive use on Crab Orchard Lake with a possible change in the nature of water-based recreation. Traditional users may feel more crowded under this alternative than under the No Action Alternative.

Group Camps

Campers will receive environmental education and the Refuge will be more actively involved in environmental education programming.

Private Clubs

Under this alternative the private clubs – The Haven and the Crab Orchard Boat & Yacht Club – would be part of the land transfer to Southern Illinois University. The expectation would be that the current use of The Haven would be accommodated at SIU facilities such as Touch of Nature or at the present site. The Boat & Yacht Club would continue its current operations under SIU ownership.

Horseback Riding

Horseback riding would be regulated under this alternative. Trail erosion and vegetative impacts would be reduced compared to Alternative A. The introduction of exotic species would be limited to a smaller area than in Alternative A. Hikers would have an improved trail experience compared to Alternative A.

4.4.3 Volunteer and Support Groups

Under this alternative volunteer support and support from friends groups would increase more over the next 15 years than in Alternative A.

4.4.4 Impacts on Industrial Use

Under this alternative, tenants would be expected to bring the leased facilities up to prescribed health and safety standards prior to moving into the facility. Therefore, initial costs to tenants would be greater than under Alternative A.

4.4.5 Impacts on Agricultural Use

Under Alternative B, agricultural operations on the Refuge would change little from current conditions. Relative to Alternative A, there would be 100 fewer acres of land farmed for row crops and 200 fewer acres mowed for hay. As in Alternative A, mowing of clover and hay fields would be prohibited until August 1 of each year.

4.4.6 Impacts on Archaeological and Cultural Values

Compared to Alternative A, Alternative B would have a neutral effect on cultural resources. The wildlife-dependent recreation component of the visitor services program would expand, but the majority of the expansion would not be related to ground disturbing activities. Horse traffic may increase erosion where trails pass through archaeological sites. The proposed plan will require horses to stay on a designated trail, which will protect any areas with sensitive resources. Under Alternative B, horseback use would be restricted to designated trails with possible unknown effect on cultural resources. Overall, the change in management of horseback use is viewed as having a slightly positive effect on cultural resources.

Indigo Bunting, Glenn Smart

Little or no impacts to cultural resources would occur as a result of the land exchange proposed in Alternative B. Although there is the potential for more ground disturbing activities as Southern Illinois University develops recreation facilities on the exchanged lands, Federal agencies must ensure that the significant values of federally owned historic properties will be preserved or enhanced. The Fish and Wildlife Service cannot dispose of historic properties unless the conservation of those resources are ensured by another agency or entity.

4.4.7 Boundary Modification

Under this alternative the authorized boundaries of the Refuge would expand. Over the long-term the Refuge would acquire additional property or property rights from willing sellers.

Acquired lands would contribute to the goals of the CCP by reducing habitat fragmentation, removing disruptions to public access, reducing disturbance to wildlife, and reducing potential interference with management activities. Acquiring inholdings creates the potential to restore habitats and further reduce fragmentation, particularly in the forested southwest portion of the Refuge. The Refuge contributes to a large block of forest in southern Illinois that includes contiguous lands managed by Southern Illinois University (Touch of Nature), State of Illinois (Giant City State Park), and U.S. Forest Service (Shawnee National Forest).

The reduced fragmentation would benefit area-sensitive forest birds, such as pileated woodpecker, yellow-billed cuckoo, and Kentucky warbler. The increased forested area also would provide more potential habitat for the endangered Indiana bat. If the inholdings were acquired, there would be increased opportunity for the public to pursue wildlife-dependent recreation on the Refuge. Because maintaining a boundary requires money and staff time, acquiring inholdings would lessen the demand on the Refuge budget and staff as boundaries internal to the Refuge are eliminated.

Because developed property is often accompanied by increased human activity and pets, which can disturb wildlife, acquisition of inholdings and potentially developed property up to the well defined boundary of a road would lead to potentially less disturbance of wildlife. Some Refuge management activities, prescribed burning and hunting, for example, benefit from well defined boundaries. By moving the Refuge boundary to a road and acquiring inholdings, management, particularly burning and hunting programs, would be made more efficient and safer.

Currently, if a landowner wishes to sell or exchange land that is outside the authorized boundary of the Refuge, the Service must complete an analysis for the individual parcel and complete environmental documents related to the transaction. This tract-by-tract analysis is inefficient and does not provide for an overall, cumulative analysis of the land transactions. Under this alternative the entire boundary modification is evaluated so that delays in land transactions, which may be detrimental to the seller, should be reduced.

Land acquired by the Refuge would be taken off the county tax rolls. However, payments in lieu of taxes (revenue sharing) would be made to the respective counties. These payments are expected to be nearly equivalent to taxes. Eventually a larger block of unfragmented forest would exist with increased benefit to area sensitive forest species compared to Alternative A.

The consequences of the land exchange portion of the boundary modification are discussed under the recreation, economic, and cumulative effects consequences sections of this chapter. As proposed, a land exchange would result in a loss to federal government (based on the appraisal value of the land). The loss might be as much as $20 million.

4.5 Alternative C: Open Land Management, Consolidate and Improve Recreation

4.5.1 Impacts on Resources

4.5.1.1. Land Cover

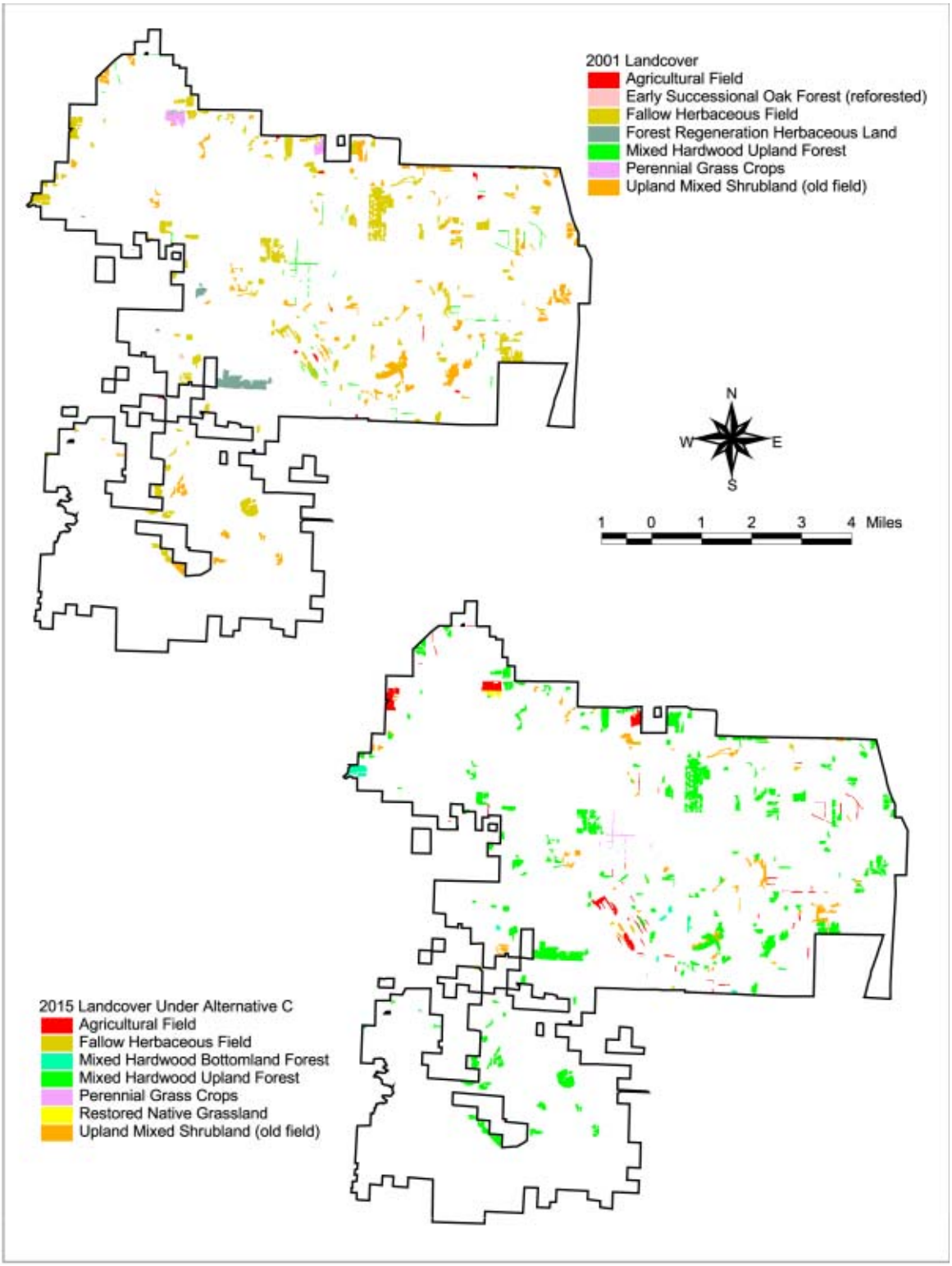
Under this alternative, the primary change in land cover of the Refuge over the next 15 years would be a decrease in fallow herbaceous fields (about 1,400 acres) and shrubland (about 500 acres) and an increase in mixed hardwood upland forest (about 1,800 acres). Over the longer term, 100 years, the primary change would occur in the forests as pine plantations, shrubland, and red-cedar forests succeed to hardwood forest. Other changes in the shorter and longer terms are the succession of fallow and old fields to shrubland and forest cover types. There would also be an increase in land used for row crops (about 200 acres) and a decrease in hay fields (about 100 acres). The acres of land cover at Crab Orchard NWR in 2000 and the acres projected for 2015 and 2100 under each alternative, along with the change from 2000, are shown in Table 35 on page 136. The distribution of land cover for the years 2000, 2015, and 2100 are shown in Figure 21 on page 86, Figure 14 on page 60, and Figure 15 on page 61, respectively.

The predicted difference in land cover for Alternative A and Alternative C in 15 years is depicted in Figure 40.

4.5.1.2. Threatened and Endangered Species

Under Alternative C, the PSO score (habitat potential) for Bald Eagles would be 1 percent greater than under Alternative A (Table 34 on page 132). The amount of open water (feeding) habi-

Figure 40: Predicted Difference in Land Cover, Alternative A (No Action) / Alternative C (Open Land Management), 2015



tat would be the same as in Alternative A (Table 35 on page 136). The amount of forest (nesting) habitat would be less than 1 percent smaller than in Alternative A (Table 36 on page 137).

Relative to Alternative A, the PSO score for Indiana bats would be 2 percent smaller by the end of the 15-year planning period and the same by the year 2100 (Table 34).

4.5.1.3. Area-sensitive Forest Bird Species

Under Alternative C, the PSO score for area-sensitive forest birds would be 1 percent smaller than under Alternative A (Table 34 on page 132). The amount of forest habitat would be less than 1 percent smaller than in Alternative A (Table 35). Relative to Alternative A, the amount of core area habitat would be 1 percent smaller by the end of the 15-year planning period and 2 percent smaller by the year 2100 (Table 36 on page 137).

4.5.1.4. Waterfowl and Other Water Bird Species

Under Alternative C, the PSO score for waterfowl would be the same by the end of the 15-year planning period and 2 percent smaller by the year 2100 than Alternative A (Table 34 on page 132). The amount of food-producing habitat would be 2 percent greater than under Alternative A (Table 2 on page 43). Relative to Alternative A, there would be 7 percent less potential food for wintering Canada Geese, but there would still be an amount adequate for providing 6.4 million goose-use-days (Table 3 on page 44). Most of the additional decrease in potential goose food results from conversion of pasture cover from fescue to native, warm-season grasses.

4.5.1.5. Grassland Birds

Under Alternative C, the PSO score for grassland birds would be the same as under Alternative A (Table 34). As in Alternative A, nesting conditions for grassland birds would be improved by the prohibition of mowing in clover and hay fields until August 1 of each year. Under Alternative C, nesting conditions for grassland birds would be improved by changes in grazing operations, including the conversion of pasture cover from fescue to native, warm-season grasses. Under Alternative C, 124 acres of linear forest habitat and 8 miles of hedge rows would be removed to enhance nesting habitat for grassland birds.

4.5.1.6. Shrubland Birds

Under Alternative C, the PSO score for shrub land birds would be the same by the end of the 15-year planning period and 7 percent larger by the year 2100, when compared to Alternative A (Table 34). Under Alternative C, some potential shrub land bird habitat (124 acres of linear forest habitat and 8 miles of hedge rows) would be removed to enhance nesting habitat for grassland birds.

4.5.1.7. Water Quality

Same as Alternative A (page 138).

4.5.1.8. Wilderness

Under Alternative C the pine plantations (229 acres) and pine-hardwood stands (96 acres) in the Wilderness would not be artificially thinned to promote more rapid establishment and growth of native hardwoods. Eventually, all the non-native pines should die naturally, thus restoring the native vegetative cover of the area and enhancing its wilderness character. However, it is estimated that this purely natural process could take 30 to 60 years – or perhaps longer if pines were to regenerate from seed. The continued presence of non-native pines would have long-term (but decreasing) negative impacts on ecosystem integrity and wilderness character.

The pine and pine-hardwood stands in the Wilderness would not be prescribed burned to enhance habitat conditions and promote desirable hardwood regeneration. Fire is a natural force in the ecosystem which can provide many beneficial effects with minimal impacts. Without the use of fire the forest would likely have a greater proportion of sugar maple and a smaller component of oaks. Since oaks generally provide higher quality wildlife habitat than sugar maple, exclusion of fire would reduce the overall quality of habitat.

Under Alternative C the proposed River to River Trail route through the Crab Orchard Wilderness would become an officially designated trail for horseback riding and hiking. The trail would require substantial rehabilitation and regular maintenance to protect the fragile soils from increased foot and horse traffic. Horses depositing dung along the trail may introduce invasive and exotic plants in the surrounding natural communities. Since equestrians would be restricted to the River to River Trail, horseback riding on trails elsewhere in the Wilderness, and the associated impacts, would be eliminated.

Gas boat motors would be prohibited on the southern part of Devils Kitchen Lake. There would be a decline in visits, particularly for big game hunt-

ing, in the Wilderness bordering the shores of Devils Kitchen Lake because of the greater difficulty of access.

4.5.2 Impacts on Public Uses

4.5.2.1. Wildlife-dependent Recreational Uses

As a function of somewhat increased opportunities, accessibility, and improved facilities, under this alternative wildlife-dependent use levels and quality of experiences would increase more than in Alternative A, but less than in Alternative B for hunting, fishing, observation and photography. As in Alternative B, the quality of the interpretive experience would increase. The improvements that would be made under this alternative would be implemented at a pace between that in Alternative A and B. Thus, the increases in use and quality of experiences would not be as rapid as under Alternative B. Because the opportunities for teachers and students to use the Refuge would increase, a secondary effect would be a long-term increase in the community's conservation ethic. An increase in wildlife observation and photography would contribute to a minimal increase in wildlife disturbance. Goose hunting opportunities around the Refuge would remain the same as under Alternative A.

4.5.2.2. Other Land- and Water-based Recreation

Camping

Three concession-operated campgrounds on the Refuge would continue under this alternative. In an effort to speed the improvement in the quality of facilities, the size of the campgrounds would be reduced. Limited resources would thus be directed at improving fewer facilities. The facilities would gradually be improved to standards comparable to others in the area over the next 10 years. The quality of the facilities and the camping experience would continue at a level below that available in nearby state park campgrounds for the next 10 years. In comparison to the No Action Alternative, there would be fewer camping opportunities, but they would be brought to standards comparable to others in the area in fewer years. The opportunity to occupy a campsite indefinitely would be discontinued as a 14-day stay limit was implemented. People who are accustomed to using a particular campsite for the entire season would be displaced. There would be greater opportunity and equity among visitors using the campground and the selection of prime sites.

Swimming

Same as Alternative A (page 139).

Picnicking

Same as Alternative A (page 139).

Motorboating/sailing

Same as Alternative A (page 139).

Water-skiing

There would be fewer acres of water available for water-skiing under this alternative than Alternative A. Because all bays on Crab Orchard Lake would be closed to water-skiing under this alternative and there would be additional no-wake zones, anglers would have a better experience on Crab Orchard Lake and conflict between anglers and personal watercraft users and waterskiers would be reduced, compared to Alternative A.

Marinas

The marinas at Little Grassy and Devils Kitchen Lakes would remain unchanged in quality and capacity compared to the No Action Alternative. Under this alternative the former Images Marina slips would be moved and consolidated at the Playport Marina. The present Images Marina site would become a multi-lane public boat ramp. The changes would result in a consolidated marina operation on Crab Orchard Lake. Boat access to Crab Orchard Lake would be increased, improved, and made safer compared to the No Action Alternative. The amount of use on Crab Orchard Lake would not change significantly compared to the No Action Alternative.

Group Camps

Same as Alternative B (page 143).

Private Clubs

Under this alternative, after 2 years the Crab Orchard Boat & Yacht Club would become a public, non-member facility operated as a concession. The Boat & Yacht Club tradition would end. The social atmosphere at the Club would become less personal.

Horseback Riding

Same as Alternative B (page 144).

4.5.3 Volunteer and Support Groups

Same as Alternative B (page 144).

4.5.4 Impacts on Industrial Use

Under this alternative existing tenants would continue at their option as long as they met the conditions of their lease. Leases would not be granted

to any new tenants. Because there would be fewer leases from loss by attrition, there would be less rental revenue for the Refuge. The demand for cold storage facilities would increase in the local area. The local industrial parks would experience less competition from the federal government under this alternative compared to the No Action Alternative. The total employment in the local area would not change. The industrial areas on the Refuge would be consolidated. Former industrial areas would be reclaimed, which would result in an increase in wildlife habitat compared to the No Action Alternative.

4.5.5 Impacts on Agricultural Use

Under Alternative C, agricultural operations on the Refuge would change little from current conditions. Relative to Alternative A, there would be 300 more acres of land farmed for row crops. As in Alternative A, mowing of clover and hay fields would be prohibited until August 1 of each year.

4.5.6 Impacts on Archaeological and Cultural Values

Compared to Alternative A, Alternative C would have a slightly positive effect on cultural resources. Grazing, farming, timber harvest, fire suppression, and revegetation of fields are all essentially the same or are only slightly modified. A positive program change includes the increased control of horseback riding. Because there would be less development of recreation facilities under Alternative C, there would be fewer ground disturbing activities and less potential effect on cultural resources.

4.5.7 Boundary Modification

Under this alternative the authorized boundary of the Refuge would expand as in Alternative B, but without the land exchange with SIU. The consequences would be similar to Alternative B.

4.6 Alternative D: Forest Land Management, Consolidate and Improve Recreation

4.6.1 Impacts on Resources

4.6.1.1. Land Cover

Under this alternative, the primary change in land cover of the Refuge over the next 15 years would be a decrease in fallow herbaceous fields (about 1,400 acres) and shrubland (about 500 acres) and an increase in mixed hardwood upland forest (about 2,400 acres). Over the longer term, 100 years, the primary change would occur in the forests as pine plantations, shrubland, and red-cedar forests succeed to hardwood forest. Other changes in the shorter and longer terms are the succession of fallow and old fields to shrubland and forest cover types. There would also be a decrease in land used for row crops (about 200 acres) and a decrease in hay fields (about 200 acres). The acres of land cover at Crab Orchard NWR in 2000 and the acres projected for 2015 and 2100 under each alternative, along with the change from 2000, are shown in Table 35 on page 136. The distribution of land cover types for the years 2000, 2015, and 2100 are shown in Figure 21 on page 86, Figure 16 on page 68 and Figure 17 on page 69, respectively.

The predicted difference in land cover for Alternative A and Alternative D in 15 years is depicted in Figure 41.

4.6.1.2. Threatened and Endangered Species

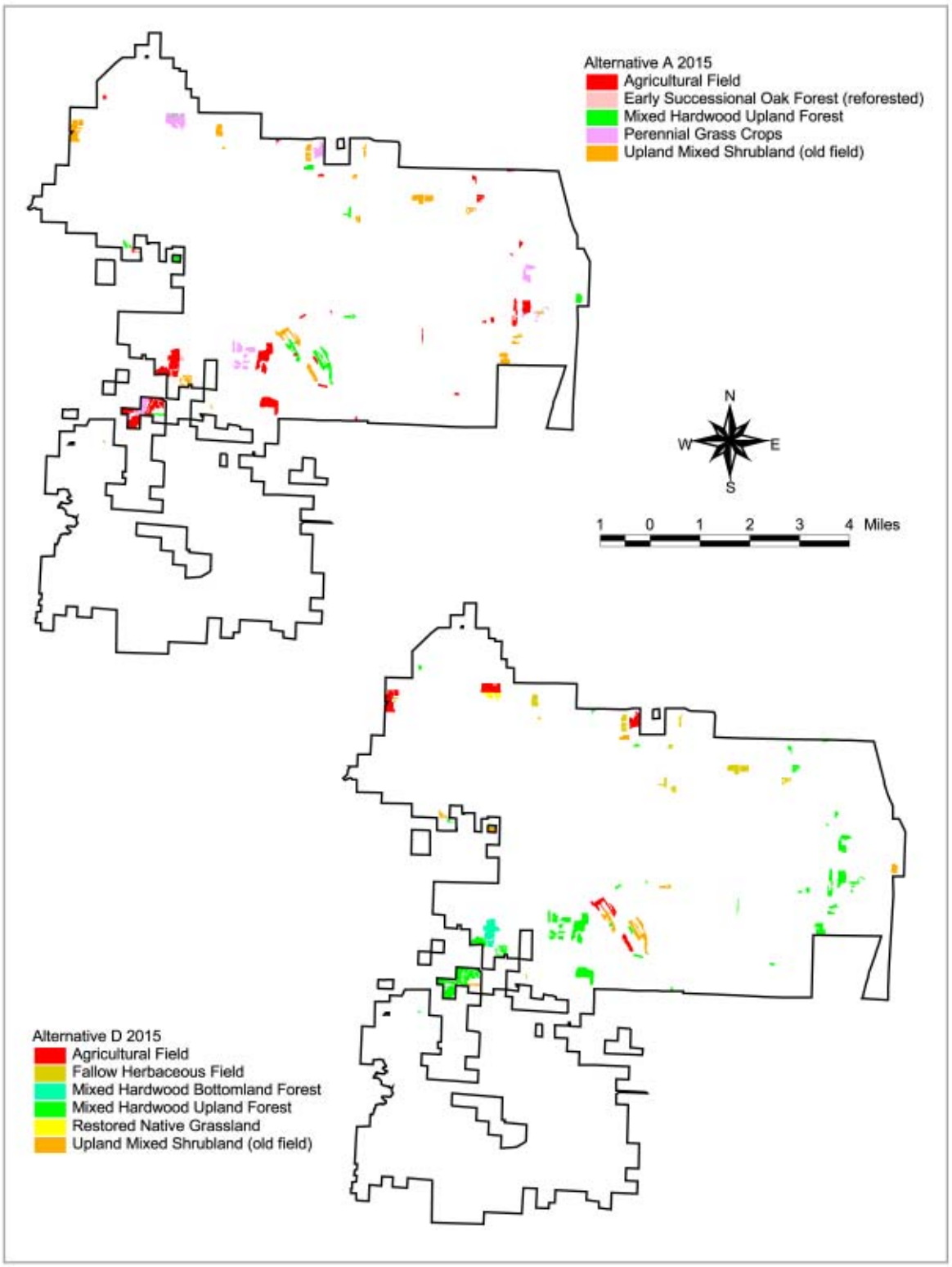
Under Alternative D, the PSO score (habitat potential) for Bald Eagles would be the same as under Alternative A (Table 34 on page 132). The amount of open water (feeding) habitat would be the same as in Alternative A (Table 35 on page 136). Relative to Alternative A, the amount of forest (nesting) habitat would be 2 percent greater by the end of the 15-year planning period and 1 percent greater by the year 2100 (Table 36 on page 137).

Relative to Alternative A, the PSO score for Indiana bats would be 2 percent greater by the end of the 15-year planning period and by the year 2100 (Table 34 on page 132).

4.6.1.3. Area-sensitive Forest Bird Species

Under Alternative D, the PSO score for area-sensitive forest birds would be 1 percent greater than under Alternative A (Table 34). Relative to Alterna-

Figure 41: Predicted Difference in Land Cover, Alternative A (No Action) / Alternative D (Forest Land Management), 2015



tive A, the amount of forest habitat would be 2 percent greater by the end of the 15-year planning period and 1 percent greater by the year 2100 (Table 36 on page 137). Relative to Alternative A, the amount of core area habitat would be 1 percent greater by the end of the 15-year planning period and 3 percent greater by the year 2100 (Table 36).

4.6.1.4. Waterfowl and Other Water Bird Species

Under Alternative D, the PSO score for waterfowl would be 2 percent smaller by the end of the 15-year planning period and the same by the year 2100 as in Alternative A (Table 34). The amount of food producing habitat would be 3 percent less than under Alternative A (Table 2 on page 43). Relative to Alternative A, there would be 7 percent less potential food for wintering Canada Geese, but there would still be an amount adequate for providing 6.4 million goose-use-days (Table 3 on page 44). Most of the additional decrease in potential goose food results from conversion of pasture cover from fescue to native, warm-season grasses.

4.6.1.5. Grassland Birds

Under Alternative D, the PSO score for grassland birds would be 11 percent less by the end of the 15-year planning period and the same by the year 2100 as under Alternative A (Table 34 on page 132). As in Alternative A, nesting conditions for grassland birds would be improved by the prohibition of mowing in clover and hay fields until August 1 of each year. Under Alternative D, 15 acres of linear forest habitat and 2 miles of hedge rows would be removed to enhance nesting habitat for grassland birds.

4.6.1.6. Shrubland Birds

Under Alternative D, the PSO score for shrub land birds would be the same during the 15-year planning period and 7 percent larger by the year 2100, when compared to Alternative A (Table 34). Under Alternative D, some potential shrub land bird habitat (15 acres of linear forest habitat and 2 miles of hedge rows) would be removed to enhance nesting habitat for grassland birds.

4.6.1.7. Water Quality

Same as Alternative A (page 138).

4.6.1.8. Wilderness

Under Alternative D the pine plantations (229 acres) and pine-hardwood stands (96 acres) in the Wilderness would be thinned to promote establishment and growth of native hardwoods. Thinning would be conducted in several phases over a 10- to 15-year period to mimic the natural process of succession where pines are gradually replaced by hardwoods. Individual pines would be killed by cutting, girdling or injecting herbicide. No trees would be removed from the site. Treatments would be conducted so that the results would appear natural as much as possible. However, trees along heavily used trails may need to be felled to avoid personal injury to visitors, in which case this zone may appear unnatural for several years. Eventual removal of all the non-native pines would restore the natural vegetative cover of the area and enhance wilderness characteristics.

In conjunction with thinning the pine and pine-hardwood stands, prescribed burning would be conducted during the dormant season (November through March) on a 3- to 5-year cycle to enhance habitat conditions and promote desirable hardwood regeneration. Control lines would be established by hand tools where necessary, using natural firebreaks as much as possible. Fire is a natural force in the ecosystem that should be reintroduced to provide many beneficial effects with minimal impacts.

Under Alternative D horseback riding would not be permitted anywhere on the Refuge. Therefore, the River to River Trail would not be officially routed through the Crab Orchard Wilderness. Existing trails in the Wilderness would continue to be used by hikers, but the trails likely would become overgrown with vegetation without horse traffic. Invasive and exotic plants would not be introduced in the surrounding natural communities by horses depositing dung.

The Wilderness would still be accessible to boaters from Devils Kitchen Lake using gas motors of 10 horsepower or less. The lake is not designated Wilderness, but the southern fingers of the lake extend far into the Wilderness.

4.6.2 Impacts on Public Uses

4.6.2.1. Wildlife-dependent Recreational Uses

Same as Alternative C for hunting, fishing, and wildlife observation and photography. Same as Alternative B for interpretation and environmental education.

4.6.2.2. Other Land- and Water-based Recreation

Camping

Same as Alternative C (page 148).

Swimming

Same as Alternative A (page 139).

Picnicking

Same as Alternative A (page 139).

Motorboating/sailing

Because gas motors would be prohibited on Devils Kitchen Lake, visitors to the lake would experience a quieter environment. Boaters who wanted to travel on Devils Kitchen Lake would have to rely on electric trolling motors, paddling, or rowing for mobility. There would be some shift in the anglers, in particular, using the lake as some current anglers would choose not to fish at the lake under the new restriction and new anglers would be drawn to the lake because of the quiet setting. Overall, boating on the lake would decrease.

Water-skiing

Same as Alternative C (page 148).

Marinas

Same as Alternative C (page 148).

Group Camps

Same as Alternative B (page 143).

Private Clubs

Same as Alternative C (page 148).

Horseback Riding

Under this alternative horseback riding would be excluded from the Refuge. Horseback riders on the River to River Trail would continue to travel a less scenic route bypassing the Refuge. There would be less trail erosion and fewer introductions of exotic plants than in Alternative A. Hikers on the trails in the Crab Orchard Wilderness would walk on a smoother tread and some hikers would report a better experience than under Alternative A.

4.6.3 Volunteer and Support Groups

Same as Alternative B (page 144).

4.6.4 Impacts on Industrial Use

Same as Alternative C (page 148).

4.6.5 Impacts on Agricultural Use

Under Alternative D, agricultural operations on the Refuge would change little from current conditions. Relative to Alternative A, there would be 200 fewer acres of land farmed for row crops and 200 fewer acres of land mowed for hay. Farming in fields smaller then 5 acres would be discontinued. As in Alternative A, mowing of clover and hay fields would be prohibited until August 1 of each year.

4.6.6 Archaeological and Cultural Values

Alternative D is similar to Alternative C, except for some slight modifications that make this alternative slightly more positive toward cultural resources. The prohibition of horseback use on the Refuge would lessen slightly the potential effect on cultural resources.

4.6.7 Boundary Modification

Same as Alternative C (page 149).

4.7 Alternative E, Reduced Habitat Fragmentation, Consolidate and Improve Recreation (Preferred Alternative)

4.7.1 Impacts on Resources

4.7.1.1. Land Cover

Under this alternative, the primary change in land cover of the Refuge over the next 15 years would be a decrease in fallow herbaceous fields (about 1,400 acres) and shrubland (about 500 acres) and an increase in mixed hardwood upland forest (about 2,200 acres). Over the longer term, 100 years, the primary change would occur in the forests as pine plantations, shrubland, and red-cedar forests succeed to hardwood forest. Other changes in the shorter and longer terms are the succession of fallow and old fields to shrubland and forest cover types. There would also be a reduction in land used for row crops (about 100 acres) and hay fields (about 200 acres). The acres of land cover at Crab Orchard NWR in 2000 and the acres projected for 2015 and 2100 under each alternative, along with the change from 2000, are shown in Table 35 on page 136. The distribution of land cover types for the years 2000, 2015, and 2100 are shown in Figure 21 on page 86, Figure 9 on page 46 and Figure 10 on page 47, respectively.

None of these changes would be large compared to the No Action Alternative. The predicted difference in land cover for Alternative A and Alternative E in 15 years is depicted in Figure 39 on page 141.

4.7.1.2. Threatened and Endangered Species

Under Alternative E, the PSO score (habitat potential) for Bald Eagles would be the same as in Alternative A (Table 34 on page 132). The amount of open water (feeding) habitat would be the same as in Alternative A (Table 35 on page 136). The amount of forest (nesting) habitat would be 1 percent larger than in Alternative A (Table 36 on page 137).

Relative to Alternative A, the PSO score for Indiana bats would be the same over the 15-year planning period and be 1 percent larger by the year 2100 (Table 34).

4.7.1.3. Area-sensitive Forest Bird Species

Under Alternative E, the PSO score for area-sensitive forest birds would be 1 percent larger than under Alternative A (Table 34). Increases in forest habitat would be 1 percent larger than in Alternative A (Table 35). Relative to Alternative A, the amount of core area habitat would be 7 percent larger by the end of the 15-year planning period and 2 percent larger by the year 2100 (Table 36). Management of two portions of the Refuge would focus on decreasing forest fragmentation by reforestation of 490 acres of open habitats and burning and thinning pine plantations to encourage succession to more desirable hardwood forest.

4.7.1.4. Waterfowl

Under Alternative E, the PSO score for waterfowl would be the same as in Alternative A (Table 34). The amount of food producing habitat would be 1 percent less than under Alternative A (Table 35). Relative to Alternative A, there would be 16 percent less potential food for wintering Canada Geese, but there would still be an amount adequate for providing 6.4 million goose-use-days (Table 3 on page 44). Most of the additional decrease in potential goose food results from conversion of pasture cover from fescue to native, warm-season grasses.

4.7.1.5. Grassland Birds

Under Alternative E, the PSO score for grassland birds would be 11 percent lower by the end of the 15-year planning period and be the same by the year 2100, when compared to Alternative A (Table 34 on page 132). As in Alternative A, nesting conditions for grassland birds would be improved by the prohibition of mowing in clover and hay fields until August 1 of each year. Under Alternative E, nesting conditions for grassland birds would be improved by changes in grazing operations, including the conversion of pasture cover from fescue to native, warm-season grasses. Under Alternative E, 124 acres of linear forest habitat and 8 miles of hedge rows would be removed to enhance nesting habitat for some grassland birds.

Wood Thrush, U.S. Fish & Wildlife Service

4.7.1.6. Shrubland Birds

Under Alternative E, the PSO score for shrub land birds would be the same by the end of the 15-year planning period and 7 percent lower by the year 2100, when compared to Alternative A (Table 34). Under Alternative E, some potential shrub land bird habitat (124 acres of linear forest habitat and 8 miles of hedge rows) would be removed to enhance nesting habitat for grassland birds. About 300 acres of early successional habitat would be maintained: prescribed fire or mechanical treatment to disturb about 200 acres every 3 to 5 years and about 100 acres of 30-foot-wide borders of native warm-season grasses would be established in row crop fields in the open portion of the Refuge.

4.7.1.7. Water Quality

In addition to working with farmers on the Refuge to establish buffer strips and keep stock away from riparian areas and bodies of water, under this alternative the Refuge staff would work with landowners in the watershed beyond the Refuge boundaries. We would expect less sedimentation in Crab Orchard Lake under this alternative than under Alternative A over the next 15 years. Investigation by CERCLA and remediation of contaminated sites

should result in improved water quality in portions of Crab Orchard Lake, similar to Alternative A. The water quality in the other lakes and streams on the Refuge would also improve compared to Alternative A. The high quality water of Devils Kitchen Lake would be better protected under this alternative than under Alternative A.

4.7.1.8. Wilderness

Under Alternative E (Preferred Alternative) the pine plantations (229 acres) and pine-hardwood stands (96 acres) in the Wilderness would be thinned to promote establishment and growth of native hardwoods. Thinning would be conducted in several phases over a 10- to 15-year period to mimic the natural process of succession where pines are gradually replaced by hardwoods. Individual pines would be killed by cutting, girdling or injecting herbicide. No trees would be removed from the site. Treatments would be conducted so that the results would appear natural as much as possible. However, trees along heavily used trails may need to be felled to avoid personal injury to visitors, in which case this zone may appear unnatural for several years. Eventual removal of all the non-native pines would restore the natural vegetative cover of the area and enhance wilderness characteristics.

In conjunction with thinning the pine and pine-hardwood stands, prescribed burning would be conducted during the dormant season (November through March) on a 3- to 5-year cycle to enhance habitat conditions and promote desirable hardwood regeneration. Control lines would be established by hand tools where necessary, using natural firebreaks as much as possible. Fire is a natural force in the ecosystem that should be reintroduced to provide many beneficial effects with minimal impacts.

Under Alternative E the proposed River to River Trail route through the Crab Orchard Wilderness would become an officially designated trail for horseback riding and hiking. The trail would require substantial rehabilitation and regular maintenance to protect the fragile soils from increased foot and horse traffic. Horses depositing dung along the trail may introduce invasive and exotic plants in the surrounding natural communities. Since equestrians would be restricted to the River to River Trail, horseback riding on trails elsewhere in the Wilderness, and the associated impacts, would be eliminated.

Because gas boat motors would be prohibited on the southern part of Devils Kitchen Lake, visitors to the lake would experience a quieter environment. There would be a decline in visits, particularly for big game hunting, in the Wilderness bordering the shores of Devils Kitchen Lake because of the greater difficulty of access.

4.7.2 Impacts on Public Uses

4.7.2.1. Wildlife-dependent Recreational Uses

As a function of somewhat increased opportunities, accessibility, and improved facilities, under this alternative wildlife-dependent recreational use levels and quality of experiences would increase more than in Alternative A, but less than in Alternative B for hunting, fishing, observation and photography. As in Alternative B, the quality of the interpretive experience would increase. The improvements that would be made under this alternative would be implemented at a pace between that in Alternative A and B. Thus, the increases in use and quality of experiences would not be as rapid as under Alternative B. Because the opportunities for teachers and students to use the Refuge would increase, a secondary effect would be a long-term increase in the community's conservation ethic. An increase in wildlife observation and photography would contribute to a minimal increase in wildlife disturbance. Goose hunting opportunities around the Refuge would remain the same as under Alternative A.

4.7.2.2. Other Land- and Water-based Recreation

Camping

Concession-operated campgrounds on the Refuge would increase from three to four under this alternative. In an effort to speed the improvement in the quality of facilities, the size of the campgrounds would be reduced. Limited resources would thus be directed at improving fewer facilities. The facilities would gradually be improved to standards comparable to others in the area over the next 10 years. The quality of the facilities and the camping experience would continue at a level below that available in nearby state park campgrounds for the next 10 years. In comparison to the No Action Alternative, there would be fewer camping opportunities, but they would be brought to standards comparable to others in the area in fewer years. The opportunity to occupy a campsite indefinitely would be discontinued as a 14-day stay limit was implemented. People who are accustomed to using a particular campsite for the entire season would be displaced. There would be greater opportunity and equity among visitors using the campground and the selection of prime sites.

Swimming

Swimming opportunities would remain unchanged from present conditions. Scuba diving would be prohibited on the Refuge.

Picnicking

The opportunities and quality of experiences would gradually improve over the next 15 years as the current facilities are gradually improved.

Motorboating/sailing

Because gas motors would be prohibited on the southeastern-most portion of Devils Kitchen Lake, visitors would experience a quieter environment. Boaters who wanted to travel in the southeastern-most portions of Devils Kitchen Lake would have to rely on electric trolling motors, paddling or rowing for mobility. Boating use is not expected to change significantly on Devils Kitchen Lake.

Water-skiing

There would be fewer acres of water available for water-skiing under this alternative than Alternative A. Because all bays on Crab Orchard Lake would be closed to water-skiing under this alternative and there would be additional no-wake zones, anglers would have a better experience on Crab Orchard Lake and conflict between anglers and personal watercraft users and waterskiers would be reduced, compared to Alternative A.

Marinas

The marinas at Little Grassy and Devils Kitchen Lakes would remain unchanged in quality and capacity compared to the No Action Alternative. Under this alternative the former Images Marina slips would be moved and consolidated at the Playport Marina. The present Images Marina site would become a four-lane boat ramp. The changes would result in a consolidated marina operation on Crab Orchard Lake. Boat access to Crab Orchard Lake would be increased, improved, and made safer compared to the No Action Alternative. The amount of use on Crab Orchard Lake would not change significantly compared to the No Action Alternative.

Group Camps

Campers will receive environmental education and the Refuge will be more actively involved in environmental education programming.

Private Clubs

Under this alternative, after 2 years the Crab Orchard Boat & Yacht Club would become a public, non-member facility operated as a concession. The Boat & Yacht Club tradition would end. The social atmosphere at the Club would become less personal.

Horseback Riding

Horseback riding would be regulated under this alternative. Trail erosion and vegetative impacts would be reduced compared to Alternative A. The introduction of exotic species would be limited to a smaller area than in Alternative A. Hikers would have an improved trail experience compared to Alternative A.

4.7.3 Volunteer and Support Groups

Under this alternative volunteer support and support from friends groups would increase more over the next 15 years than in Alternative A.

4.7.4 Impacts on Industrial Use

Under this alternative, tenants would be expected to bring the leased facilities up to prescribed health and safety standards prior to moving into the facility. Therefore, initial costs to tenants would be greater than under Alternative A.

4.7.5 Impacts on Agricultural Use

Under Alternative E, agricultural operations on the Refuge would change little from current conditions. Relative to Alternative A, there would be 100 fewer acres of land farmed for row crops and 200 fewer acres mowed for hay. As in Alternative A, mowing of clover and hay fields would be prohibited until August 1 of each year.

4.7.6 Impacts on Archaeological and Cultural Values

Compared to Alternative A, Alternative E would have a neutral effect on cultural resources. The wildlife-dependent recreation component of the visitor services program will expand, but the majority of the expansion will not be related to ground disturbing activities. Horse traffic may increase erosion where trails pass through archaeological sites. The proposed plan will require horses to stay on a designated trail, which will protect any areas with sensitive resources. Under Alternative A horseback use would continue with ill-defined restrictions and with possible unknown effect on cultural resources.

Overall, the change in management of horseback use is viewed as having a slightly positive effect on cultural resources.

4.7.7 Boundary Modification

Under this alternative the authorized boundaries of the Refuge would expand. Over the long-term the Refuge would acquire additional property or property rights from willing sellers.

If acquired, the lands would contribute to the goals of the CCP by reducing habitat fragmentation, removing disruptions to public access, reducing disturbance to wildlife, and reducing potential interference with management activities. Acquiring inholdings creates the potential to restore habitats and further reduce fragmentation, particularly in the forested southwest portion of the Refuge. The Refuge contributes to a large block of forest in southern Illinois that includes contiguous lands managed by Southern Illinois University (Touch of Nature), State of Illinois (Giant City State Park), and U.S. Forest Service (Shawnee National Forest).

The reduced fragmentation would benefit area-sensitive forest birds, such as pileated woodpecker, yellow-billed cuckoo, and Kentucky warbler. The increased forested area also would provide more potential habitat for the endangered Indiana bat. If the inholdings were acquired, there would be increased opportunity for the public to pursue wildlife-dependent recreation on the Refuge. Because maintaining a boundary requires money and staff time, acquiring inholdings would lessen the demand on the Refuge budget and staff as boundaries internal to the Refuge are eliminated.

Because developed property is often accompanied by increased human activity and pets, which can disturb wildlife, acquisition of inholdings and potentially developed property up to the well defined boundary of a road would lead to potentially less disturbance of wildlife. Some refuge management activities, prescribed burning and hunting, for example, benefit from well defined boundaries. By moving the refuge boundary to a road and acquiring inholdings, management, particularly burning and hunting programs, would be made more efficient and safer.

Currently, if a landowner wishes to sell or exchange land that is outside the authorized boundary of the Refuge, the Service must complete an analysis for the individual parcel and complete environmental documents related to the transaction. This tract-by-tract analysis is inefficient and does not provide for an overall, cumulative analysis of the land transactions. Under this alternative the entire boundary modification is evaluated so that delays in land transactions, which may be detrimental to the seller, should be reduced.

Land acquired by the Refuge would be taken off the county tax rolls. However, payments in lieu of taxes (revenue sharing) would be made to the respective counties. These payments are expected to be nearly equivalent to taxes. Eventually a larger block of unfragmented forest would exist with increased benefit to area sensitive forest species compared to Alternative A.

4.8 Summary of Economic Effects of Alternatives

4.8.1 Economic Effects of Recreation

4.8.1.1. Introduction

This section estimates the economic effects of implementing the action alternatives and potentially changing the scope and magnitude of public use on the Refuge.

Economic effect categories include changes in:

- # activity days;
- # net economic value (consumer surplus);
- # total expenditures;
- # economic output;
- # employment; and
- # employment income (these categories are defined and discussed in Chapter 2, Study Area Economic Profile).

The dollar values and employment figures in Table 37 and Table 38 are for the two-county study area as a whole. The first column summarizes current conditions; the next three columns show the net change from Alternative A (decreases are shown with a minus sign [-]). Note that the figures shown in the last three columns are net, one-time changes to the current situation; they are not accumulative in the sense that $10,000 indicates a $10,000 increase each year over the time span of the project. For example, say net economic value under Alternative A is $100,000 and under Alternative B is $10,000. This indicates that the implementation of Alternative B would increase net consumer surplus to $110,000 per year, not that Alternative B would result in an annual increase of $10,000 each year, so

Table 37: Comparison of Annual Economic Effects of Alternatives on Hunting in the Study Area

		Change from Alt. A	
Category	**Alt. A (No Action)**	**Alt. B**	**Alts. C, D and E**
Activity Days	43,679	0	0
Net economic value	$1,005,964	0	0
Total expenditures	$1,783,109	0	0
Economic Output	$2,267,456	0	0
Employment (number of jobs)	41.2	0	0
Labor Income	$939,162	0	0

Table 38: Comparison of Annual Economic Effects of Alternatives on Fishing in the Study Area

		Change from Alt. A	
Category	**Alt. A (No Action)**	**Alt. B**	**Alts. C, D and E**
Activity Days	210,478	10,572	0
Net economic value	$3,472,887	$174,438	0
Total Expenditures	$7,347,787	$369,069	0
Economic output	$9,260,444	$465,138	0
Employment (number of jobs)	180.5	9	0
Labor income	$3,972,468	$198,073	0

that year 1 would be $110,000, year 2 would be $120,000, etc.

4.8.1.2. Hunting

There would be essentially no change in hunting use on the Refuge from implementation of any of the four action alternatives. Alternatives B, C, D and E would implement controlled hunts to maintain the quality of the hunting experience on the Refuge, which may increase the number of hunters in the restricted use area during the hunting season. However, this is not expected to change the overall annual use of the Refuge for hunting.

Table 37 shows a comparison of the annual economic effects of the No Action alternative with the four action alternatives. The economic effects shown for Alternative A encompass big game, small game and migratory waterfowl hunting.

4.8.1.3. Fishing

Analysis of Alternative B is based on the assumption that four new facilities are added to increase access to Refuge fisheries. Alternative B would also enhance fisheries habitat to improve the fishing experience on the Refuge. Consequently, a 5 percent increase in Refuge fishing activity is anticipated with implementation of Alternative B. Alternatives C, D and E are expected to have similar impacts as Alternative A. (Table 38)

4.8.1.4. Wildlife Observation and Photography

Analysis of Alternative B assumes four major effects that would increase wildlife observation activities on the Refuge by about 10 percent annually:

- # the number of photo blinds will increase from two to four;
- # the number of observation platforms increases from one to three;
- # several additional wildlife observation sites are to be established on the Refuge; and
- # an annual wildlife photography contest will be initiated.

Alternatives C, D and E are similar to Alternative B with the exception that additional wildlife

Table 39: Comparison of Annual Economic Effects of Alternatives on Wildlife Observation

		Change from Alt. A	
Category	Alt. A (No Action)	Alt. B	Alts. C, D and E
Activity days	110,105	11,323	2,831
Net economic value	$1,613,258	$165,905	$41,480
Total expenditures	$4,923,785	$506,353	$126,560
Economic output	$6,088,532	$626,134	$156,547
Employment (number of jobs)	118	12	3
Labor income	$2,477,711	$251,971	$62,993

Table 40: Comparison of Annual Economic Effects of Alternatives on Boating

		Change from Alt. A	
Category	Alt. A (No Action)	Alt. B	Alts. C, D and E
Activity days	92,997	$4,856	0
Net economic value	$2,462,486	$128,583	0
Total expenditures	$2,757,469	$143,986	0
Economic output	$3,459,091	$180,622	0
Employment (number of jobs)	83.6	4.4	0
Labor income	$2,068,264	$108,856	0

observation sites are not part of Alternatives C, D and E. Consequently, it is anticipated that Alternatives C, D and E would result in a 2.5 percent annual increase in wildlife observation and photography on the Refuge (Table 39).

4.8.1.5. Boating

The major effects of implementing Alternatives B, C, D or E are the potential changes to available facilities and the number of available marina slips (Table 40).

4.8.1.6. Facilities and Marina Slips

Alternative B would transfer three marinas to SIU. It is assumed that SIU would manage these marinas in a manner consistent with current operations and facility capacity. Under Alternatives C, D and E, Images Marina and Playport Marina would be consolidated at the Playport site. The Boat & Yacht Club marina would be maintained as a concession-operated facility after 2 years.

Alternative B would generally improve the quality of the boating experience on the Refuge and improve boating access and associated parking. Consequently, it is anticipated that Alternative B would result in a 5 percent annual increase in boating activity on the Refuge. Implementation of Alternatives C, D and E would not result in any net change from Alternative A for the next 10 years.

4.8.1.7. Camping / Day Use

Alternative B would keep 130 sites at Little Grassy Campground, close Devils Kitchen Campground eliminating 45 sites, and transfer Crab Orchard Campground to SIU. Consequently there would be a net loss of 45 sites (assuming SIU continues to operate Crab Orchard Campground at current use levels). Little Grassy Campground would be brought up to public health and other use and design standards comparable to Illinois State Parks standards. The Devils Kitchen Campground is currently under-utilized; eliminating these sites would not materially affect the amount of camping taking place on the Refuge. It is expected that campground quality improvements and other infrastructure improvements would result in a higheroverall campground utilization rate compared with Alternative A. Alternatives C, D and E would not materially affect the amount of camping taking place on the Refuge (Table 41).

Table 41: Comparison of Annual Economic Effects of Alternatives on Camping and Picnicking

		Change from Alt. A	
Category	**Alt. A (No Action)**	**Alt. B**	**Alts. C, D and E**
Activity days	193,400	9,000	0
Net economic value ($28.36/day)	$5,484,824	$252,240	0
Total expenditures ($15/day)	$2,901,000	$135,000	0
Economic output	$3,655,260	$170,100	0
Employment (number of jobs)	71.3	3.3	0
Labor income	$1,569,180	$72,626	0

Table 42: Summary of Economic Effects of Alternatives on Public Use

		Change from Alt. A	
Category	**Alt. A (No Action)**	**Alt. B**	**Alts. C, D and E**
Activity days	650,659	35,751	2,831
Net economic value	$14,039,419	$721,166	$41,480
Total expenditures	$19,713,150	$1,154,408	$126,560
Economic output	$24,730,783	$1,441,994	$156,547
Employment (number of jobs)	494.6	28.7	3
Labor income	$11,026,785	$631,526	$62,993

4.8.1.8. Summary of Recreation Economic Effects

Implementation of any of the action alternatives would increase the economic effects of public use of the Refuge compared with Alternative A. Public use includes hunting, fishing, wildlife observation, boating, camping and picnicking. A major assumption behind the economic effects estimates is that enhancing the quality of the recreational experience on the Refuge (whether by enhancements to the physical and biological environment or by enhancements to facilities or by increasing convenient access to the Refuge) provides an incentive for longer, more frequent or new recreational visits to the Refuge. Compared to the No Action Alternative, Alternative B would increase Refuge recreational visitation by about 5 percent while Alternatives C, D and E would result in a 0.5 percent increase overall. (Table 42)

4.8.2 Economic Effects of Commercial Use

4.8.2.1. Introduction

This section discusses the economic impacts of the action alternatives on the Refuge's commercial uses. Commercial uses include agriculture, grazing, timber harvesting, and industry. As noted in the previous section that discussed public uses on the Refuge, the changes depicted in the summary tables represent net, one-time changes from the baseline.

4.8.2.2. Agriculture

An analysis of each alternative as it affects agriculture is described below. Each alternative's impact on acreage is assumed to be distributed to the same proportions of the 2001 baseline (41 percent corn, 33 percent clover, and 26 percent soybeans). Value per acre is the average crop value for the two-county study area. Impacts are summarized in Table 43. Under Alternative A, only changes to the management of hay fields would occur. Hay would not be mowed until after August 1, which would result in a

Table 43: Comparison of Annual Average Crop Values in Study Area

			Change from Alternative A					
	2001 Baseline (Alt. A)		Alts. B and E (Preferred Alternative)		Alternative C (Open Land)		Alternative D (Forest)	
	Acres	Value[1]	Acres	Value	Acres	Value	Acres	Value
Corn	1,877	$506,784	-53	-$14,288	87	$23,553	-99	$26,679
Clover[2]	1,484	$319,153	-42	-$8,998	69	$14,833	-78	-$16,801
Soybeans	1,179	$212,146	-33	-$5,981	55	$9,860	-62	-$11,168
Hay[3]	767	$82,453	-167	-$17,953	0	$0.0	-267	-$28,703
Total Impact	5,307	$1,120,536	-295	-$47,220	211	$48,246	-506	-$83,350

1. *Value is depicted in year 2000 dollars.*
2. *The price per ton for hay is used as a proxy for clover.*
3. *We assume that the two-county study aea has two hay cuttings per year. We further assume that the hay revenue is equally distributed between the two cuttings. Therefore, 50 percent of the value per acre in the two-county study area is attributable to the value per acre for one hay cutting at the Refuge.*

decrease from two hay cuttings to one hay cutting. We establish the one hay cutting as the baseline for the analysis.

Under Alternatives B and E, various additional conservation practices would be emphasized on certain fields. Because hay and clover would not be mowed until after August 1, we assumed only one cutting of hay. Buffers would be adjusted where erosion is a problem. Furthermore, the rate charged for hay would be updated to account for inflation. Some farmed lands would be removed, other acres would be reclaimed. The net change of land use for crops (corn, soybeans, and clover) would be an increase of 90 acres, thereby increasing corn, clover, and soybeans by 37, 29, and 23 acres respectively (Table 43). There would be no change to hay acreage. Assuming a proportional increase in harvest, total crop value would increase to about $1.07 million. Although crop acreage will increase, we do not expect an increase in the number of cooperators. However, economic output and labor income should increase accordingly with the increase in agricultural output.

Similar to the previous alternative, Alternative C would also emphasize adding new conservation practices. There would be no change in hay acreage, but this alternative would still result in a net increase of 212 acres to the farming program. An increase in production would result in a 4 percent increase in total value from the 2001 baseline. As in Alternative B, crop acreage will increase but we do not expect an increase in the number of cooperators. Again, economic output and labor income should increase in accordance with the increase in agricultural output.

Unlike the above alternatives, Alternative D would not emphasize new conservation practices. A limited amount of soybeans could be planted in 2 successive years. Also, the rate charged for hay would be updated to account for inflation. Alternative D would result in 239 fewer acres in the farming program for corn, clover and soybeans. There would also be a decrease in hay acreage by 267 acres. The net decrease in crop and hay acreage would result in a decline of total sales by about $83,000 annually. Hay would be impacted the most, as a 35 percent decrease in hay sales. We expect this decrease in sales to have only a minor impact on the region because $83,000 represents less than 1 percent of the region's agricultural value for these four crops.

4.8.2.3. Grazing

The Refuge currently allocates about 1,000 acres to support about 375 head of cattle and about 1,726 animal unit months (AUM). We assume that all cattle are yearlings, and are thus sold at the end of each grazing period. The period for cattle grazing on the fescue pastures normally runs from April 15 to September 30. Also, the grazing fee is $8.95 per AUM, and is paid through mowing credits of $2.53 per AUM and fertilizing. .

Alternatives B, C and E would emphasize conservation by implementing limited rotational grazing to provide vegetation structure that supports grassland birds. Although rotational grazing would also enhance the quality of the forage, 10 percent fewer head of cattle would be permitted on the pastures. There would be no impact on total pasture acres. The grazing period would increase by one month in the fall. Thus, cooperators would be less dependent

Table 44: Comparison of Economic Effects of Grazing at Crab Orchard NWR

		Change from Alternative A		
	Alt. A	Alt. B and Alt. E	Alt. C	Alt. D
Total Acres	1,000	0	0	1,000
Total Head	375	-37	-37	38
No. of Months	5.5	1	1	1
Total Value[1]	$172,500	-$17,020	-$17,020	$17,480

1. *Total value is equal to Total Head multiplied by the average price per head in the five-county area. Value is depicted in 2000 dollars.*

upon other grazing areas off the Refuge. Grazing fees and mowing credits would be updated to account for inflation. Cooperators may be slightly impacted because they would need to graze 37 head of cattle elsewhere. (This impact would be distributed evenly among the 10 cooperators.) If the cooperators choose not to graze elsewhere and to decrease the total head by 37, then total sales would decrease by about $17,000. The impacts are depicted in Table 44.

Optimizing cattle production in pastures would be the focus of Alternative D. Rather than increasing grasses with high wildlife value (as in Alternatives B, C and E), grasses with high forage production would be increased to benefit cattle. Forage would increase to support more cattle on the pastures, but there would be no change to the total acres of pasture. As in the other alternatives, the grazing period would increase by one month in the fall. Thus, cooperators would be less dependent upon other grazing areas off the Refuge. Grazing fees and mowing credits would be updated to account for inflation. Cooperators would benefit by being able to graze slightly more cattle and having better forage. The local economy would benefit by a slight increase of approximately $17,000 in economic output.

4.8.2.4. Timber Harvesting

Timber harvesting is one habitat management tool used on portions of the forest to support the Refuge's wildlife conservation purpose. In the past, the Refuge has sold pine and hardwood timber for a variety of products. The amount of revenue generated from timber sales has varied greatly from year to year. The average annual revenue for the years 1983 to 1998 was $17,600.

The Refuge would continue thinning treatments in pine stands under each alternative. Under Alternatives B and E, removal of the pine overstory would also occur in some cases. The amount of revenue from future timber sales is expected to be similar to that of the recent past. Refuge timber sales would continue to have a negligible effect on the local economy as a whole. Table 45 depicts the impacts of each alternative on timber harvests and pine and hardwood forest cover.

4.8.2.5. Industry

This section discusses the impacts of the alternatives on industry within the Refuge's boundaries. There would be minimal effect on munitions manufacturing operations, explosive storage areas, and other industrial facilities. Alternatives B, C, D and E would place more emphasis on building and grounds maintenance performed by the lessee. Because maintenance is already stated in the lease, we do not consider this change as an increase in costs to the tenant. As the buildings and infrastructure continue to age, the number of industrial leases will decrease in each of these alternatives. For example, structures would be eliminated as they become obsolete, and the tenant's lease would expire at such time. Alternatives C and D would not lease a structure to a new tenant if the current tenant does not renew the lease. We assume that Alternatives B and E would result in a 5 percent decrease annually in leased space, and Alternatives C and D would result in a 10 percent decrease annually. Besides these changes, the Refuge would continue to provide facilities for the existing tenants at fair market value rental rates. These changes are not expected to increase costs to industrial tenants on the Refuge. Furthermore, the local economy would not be negatively affected because companies would be expected to move to the industrial parks nearby. Impacts are shown in Table 46.

Table 45: Impacts of Each Alternative on Timber Harvesting and Pine and Hardwood Forest Cover

	Alternative A		Alternatives B and E		Alternative C		Alternative D	
	Forest Cover (acres)	Annual Harvest (tons)	Forest Cover (acres)	Annual Harvest (tons)	Forest Cover (acres)	Annual Harvest (tons	Forest Cover (acres)	Annual Harvest (tons)
Pine	2,497	1,803	-726	+524	-1,471	+1,062	-726	+524
Hardwood	832	123	726	107	1,471	217	726	107
Total Annual Impact	3,329	1,926	0	-417	0	-844	0	-417
Total Annual Value[1]		$6,641		-$1,657		-$3,355		-$1,657

1. *Total annual value is stated in year 2000 dollars. The price for pine and hardwood is averaged based upon past sales. The change in annual value is overestimated by about 18 percent.*

Table 46: Impacts of the Alternatives on Industry

		Change from Alternative A		
	Alt. A	**Alt. B and Alt. E**	**Alt. C**	**Alt. D**
Square Feet Leased	1.2 million	-0.06 million	-0.12 million	-0.06 million

4.9 Summary of Impacts of Alternatives

The previous sections described the consequences of management actions under the five alternatives. Table 47 on page 165 summarizes the effects for each alternative organized by the issues discussed in Chapter 1. The effects are summarized in short phrases to ease comparison among alternatives. The effects listed under Alternative B assume that a land exchange takes place and incorporate the combined effects of lands managed by the Service and former Refuge lands that would be managed by SIU. Thus, the effects for increased developed recreation reflect increases that would occur on SIU lands under Alternative B.

4.10 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments of resources are those that cannot be reversed. Irretrievable commitments can be reversed, given sufficient time and resources. There are no irreversible commitments of resources under any alternatives. Land use changes proposed under the alternatives would be irretrievable. Modifications would affect a maximum of 4,265 acres of net change in the preferred action alternative.

4.11 Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Bill Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

None of the alternatives disproportionately place an adverse environmental, economic, social, or health impacts on minority or low-income populations.

4.12 Cumulative Impacts

Cumulative effects are effects on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Potential cumulative effects for the alternatives are described below. The discussion considers the interaction of activities at the Refuge with other actions occurring over a larger spatial and temporal frame of reference.

4.12.1 Cumulative Effects Resulting from Habitat Management Actions

4.12.1.1. Forest

In 1820 an estimated 38 percent of Illinois was wooded. During the 1800s forest land was converted to agriculture. By the early 1900s about 8 percent of the original forest remained; today less than 1 percent remains. As Illinois farmers switched from animal to row crop production in the mid-1900s, abandoned pastures reverted to woods. The Illinois forests are estimated to have increased 41 percent since 1926. The current Illinois forest is about 31 percent as large as the state's original wooded acreage, about 12 percent of the area of the state.

Although the amount of woods has increased in Illinois, the average size of wooded parcels is decreasing. An analysis of 13 counties in south central Illinois found that the vast majority of woods were smaller than one acre in size. The average forest ownership in Illinois is about 20 acres. The fragmentation of forest is of concern because smaller tracts do not support the same species and ecological processes associated with large tracts.

Acres of forest would increase and forest fragmentation would decrease, to varying degrees, under all alternatives. The increase in forest acreage would be larger in Alternatives B, D, and E than in Alternative C. The decrease in fragmentation would increase the quantity and quality of habitat available for area-sensitive forest species on the Refuge. The three counties – Williamson, Jackson, Union – that contain the Refuge are among the top 10 forested counties in Illinois. Because the Refuge is adjacent to other protected lands managed by the U.S. Forest Service and the State of Illinois, which also contain blocks of forest, the Refuge will contribute to a cumulatively large area of forest. This larger forest area would result in greater benefits for area-sensitive forest species.

Forest habitat, Crab Orchard NWR. U.S. Fish & Wildlife Service

4.12.1.2. Grassland

In 1820, at least 60 percent of Illinois was some type of grassland. Much of Illinois' original prairie was converted to agriculture during the 1800s. In 1978, the Illinois Natural Areas Inventory (White, 1978) found that only 0.01 percent of original prairie survived in a high-quality condition. For a time the conversion of some of the prairie to hay fields and pastures enhanced habitat for certain birds such as dickcissel and prairie chicken. But conversion to row crops has led to the decline of this type of grassland, as well. Today about 18 percent of Illinois is covered in rural grassland-pastures, fallow fields, and greenways.

Although Williamson County is in the top 10 Illinois counties ranked by percentage of area in grassland with 32.7 percent, the counties with the largest rural grassland acreages are in the northern and west-central part of Illinois. The Conservation Reserve Program has set aside more than 600,000 acres of highly erodible agricultural land in Illinois since 1985 and planted much of it to grassland habitat. Still, populations of many species of grassland birds have continued to decline. Research has shown that many species of grassland birds require large blocks of habitat to nest successfully and they do poorly in areas where habitat is broken into small, isolated blocks.

Prairie restoration in Illinois consists of preserving the isolated tracts and restoration of other tracts. The Natural Resources Conservation Service (NRCS) includes grasslands and prairie as pri-

ority habitat types in Illinois. The Illinois Department of Natural Resources Strategic Plan, 2003-2008 includes a goal for protecting and restoring wildlife habitat, but does not give target acres for any particular habitat.

None of the alternatives evaluated for the comprehensive conservation plan would measurably contribute to or detract from the cumulative number of acres of grasslands in Illinois. The core area acres of Refuge grasslands – the area free of an edge effect – remains the same or increases only slightly under any alternative. We plan to maintain the restored native grassland that exists on the Refuge, but we do not plan to increase the grasslands significantly in an area that was historically forest.

Over the next 100 years, habitat for grassland birds will decrease about 43 percent under all alternatives (Table 34 on page 151). This will be a result of succession of fallow areas that contain some grassland to habitats dominated by shrubs or trees with little, if any, grassland. Areas currently managed as grasslands (prairies, permanent hay fields, and clover fields) will continue to be managed as open habitats that will provide habitat for grassland birds. Under all alternatives, mowing in permanent hay and clover fields will be delayed until August 1 in order to protect nesting grassland birds and their nests. Additional measures meant to enhance habitat for grassland birds will be taken in the action alternatives. In Alternatives B, C, and E, grassland bird habitat will be improved by converting fescue pastures to native warm season grasses. In Alternative D and especially in Alternatives B, C, and E, habitat for most grassland bird species will be improved by removing fencerows and other linear woody habitat.

4.12.2 Cumulative Effects Resulting from Recreation Changes

Under Alternative B, Southern Illinois University would begin to manage existing facilities and develop new recreation facilities adjacent to the northwest portion of the Refuge. The increased development that SIU has proposed would contribute to an increased 'critical mass' of recreation opportunities in Southern Illinois. The new development, in conjunction with other developed recreation opportunities in the area, would lead to improved quality of opportunities and a greater attraction to tourists. By increasing the grouping of high-quality, developed recreational opportunities, more people would see Southern Illinois as an attractive destination for a recreational trip. The increased attractiveness of concentrated recreational opportunities would have an economic effect greater than that of a lone enterprise. The development envisioned under Alternative B would contribute to the expanding development along the Highway 13 corridor between Marion and Carbondale. The increased development would likely change the social and economic culture as more people visit and move into the community.

Crab Orchard NWR. U.S. Fish & Wildlife Service

Under Alternatives B, C and E, the Refuge would formally designate a horseback riding trail through the Crab Orchard Wilderness as part of the River-to-River Trail. By officially designating the Refuge portion, the entire trail would likely be more attractive to trail users and be used more.

4.12.3 Cumulative Effects Resulting from Agricultural Management

Under all alternatives the size of the agricultural program on the Refuge is largely unchanged. Agricultural areas outside the Refuge will likely face the pressure of land conversion to industrial and residential uses. By maintaining agricultural acreage on the Refuge, when combined with the agriculture in nearby areas, agriculture will likely persist in the economic and social culture of the area longer than if the Refuge did not have an agricultural program.

Table 47: Summary of Effects of Alternatives Described in Chapter 4

	Alternative A: Current Management (No Action)	Alternative B: Reduced Habitat Fragmentation, Wildlife-dependent Recreation Emphasis With Land Exchange	Alternative C: Open Land Management, Consolidate and Improve Recreation	Alternative D: Forest Land Management, Consolidate and Improve Recreation	Alternative E: Reduced Habitat Fragmentation, Consolidate and Improve Recreation (Preferred Alternative)
Threatened and Endangered Species					
Bald Eagle	Minor increase in nesting habitat.	Minor increase in nesting habitat.	Minor increase in nesting habitat, alternative with highest habitat values.	Minor increase in nesting habitat.	Minor increase in nesting habitat.
Indiana bat	Minor increase in potential habitat.	Minor increase in potential habitat.	Minor increase in potential habitat, alternative with lowest habitat values.	Minor increase in potential habitat, alternative with highest habitat values.	Minor increase in potential habitat.
Resident Fish & Wildlife	Minimal impacts.	Minimal impacts.	Minimal Impacts	Minimal impacts	Minimal impacts
Canada Geese	Minor decrease in habitat, alternative with highest production of potential goose food.	Minor decrease in habitat, this and Alternative E have lowest production of potential goose food.	Minor decrease in habitat.	Minor decrease in habitat, higher production of potential goose food than Alternative C.	Minor decrease in habitat, this and Alternative B have lowest production of potential goose food.
Waterbirds	Minimal impacts.	Minor increase in habitat.	Minor increase in habitat.	Minimal impacts.	Minor increase in habitat.
Grassland Birds	Decrease in habitat (37%), improved nesting conditions.	Decrease in habitat (43%), much improved nesting conditions.	Decrease in habitat (36%), much improved nesting conditions.	Decrease in habitat (43%), improved nesting conditions.	Decrease in habitat (43%), much improved nesting conditions.
Area-sensitive Forest Birds	Increase in habitat (8%).	Increase in habitat (9%) improved nesting conditions.	Increase in habitat (7%).	Increase in habitat (9%), improved nesting conditions.	Increase in habitat (9%) improved nesting conditions.
Shrubland Birds	Decrease in habitat (26%).	Decrease in habitat (26%).	Decrease in habitat (26%).	Decrease in habitat (26%).	Decrease in habitat (26%).
Invasive Species	Most species increase.	Most species increase.	Most species increase.	Most species increase.	Most species increase.
Agricultural Uses	No acerage change, minor restriction in agricultural practices.	Minor acreage decrease, changes in some agricultural practices.	Minor acreage increase, changes in some agricultural practices, alternative with largest amount of agricultural land.	Minor acreage decrease, addition of practices beneficial to agriculture, alternative with least amount of agricultural land.	Minor acreage decrease, changes in some agricultural practices.

Table 47: Summary of Effects of Alternatives Described in Chapter 4 (Continued)

	Alternative A: Current Management (No Action)	Alternative B: Reduced Habitat Fragmentation, Wildlife-dependent Recreation Emphasis With Land Exchange	Alternative C: Open Land Management, Consolidate and Improve Recreation	Alternative D: Forest Land Management, Consolidate and Improve Recreation	Alternative E: Reduced Habitat Fragmentation, Consolidate and Improve Recreation (Preferred Alternative)
Wilderness	Minor increase in Wilderness designation.	Minor increase in Wilderness designation.	Minor increase in Wilderness designation.	Minor increase in Wilderness designation.	Minor increase in Wilderness designation.
Industrial Uses	Minimal impacts.	Minimal impacts.	Minor decreases in facilities.	Minor decreases in facilities.	Minimal impacts.
Hunting	Minimal impacts.	Increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.
Fishing	Minimal impacts.	Increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.
Wildlife Viewing & Photography	Minimal impacts.	Increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.
Interpretation and Environmental Education	Minimal impacts.	Increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.	Minor increase in opportunities and quality.
Swimming	No change.	Increased opportunities provided by SIU.	Minimal impacts.	Minimal impacts.	Minimal impacts.
Camping	Minimal impacts; 14-day stay limit.	Improved facilities provided by SIU; 14-day stay limit on Refuge.	Fewer campsites, improved facilities, 14-day stay limit.	Fewer campsites, improved facilities, 14-day stay limit.	Fewer campsites, improved facilities, 14-day stay limit.
Picnicking	Minor improvements.	Increased opportunities provided by SIU.	Minor improvements.	Minor improvements.	Minor improvements.
Motor boating /Sailing	Minimal impacts.	Minor restrictions in use (zoning); restricted use on Devils Kitchen Lake.	Minor restrictions in use (zoning).	Minor restrictions in use (zoning); prohibited use on Devils Kitchen	Minor restrictions in use (zoning); restricted use on Devils Kitchen Lake.
Water-skiing	Minimal impacts.	Reduction in area open to skiing.	Reduction in area open to skiing.	Reduction in area open to skiing.	Reduction in area open to skiing.
Marinas	Minimal impacts.	Improved facilities provided by SIU.	Minimal impacts.	Minimal impacts.	Minimal impacts.

Table 47: Summary of Effects of Alternatives Described in Chapter 4 (Continued)

	Alternative A: Current Management (No Action)	Alternative B: Reduced Habitat Fragmentation, Wildlife-dependent Recreation Emphasis With Land Exchange	Alternative C: Open Land Management, Consolidate and Improve Recreation	Alternative D: Forest Land Management, Consolidate and Improve Recreation	Alternative E: Reduced Habitat Fragmentation, Consolidate and Improve Recreation (Preferred Alternative)
Group Camps	Minimal impacts.	Increased costs to camps, limits on expansion, increased environmental education.	Increases costs to camps, limits on expansion, increased environmental education.	Increased costs to camps, limits on expansion, increased environmental education.	Increased costs to camps, limits on expansion, increased environmental education.
Private Clubs	Minimal impacts.	SIU management.	Tradition of Boat & Yacht Club would end. After 2 years the opportunities at site would be available to wider segment of public.	Tradition of Boat & Yacht Club would end. After 2 years the opportunities at site would be available to wider segment of public.	Tradition of Boat & Yacht Club would end. After 2 years the opportunities at site would be available to wider segment of public.
Horseback Riding	Minimal impacts.	More restricted opportunities.	More restricted opportunities.	No horseback riding.	More restricted opportunities.
Water Quality	Minimal impacts.	Minor improvements.	Minor improvements.	Minimal impacts.	Minor improvements.
Communication with Community	Improved.	Improved.	Improved.	Improved.	Improved.
Volunteer Program	Minimal impacts.	Improved.	Improved.	Improved.	Improved.
Cultural Resources	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.
Economics	Minimal impacts.	Most positive impact.	Minimal positive impacts.	Minimal positive impacts.	Minimal positive impacts.
Fire	Minimal impacts.	Minimal impacts.	Minimal impacts.	Minimal impacts.	Minimal impacts.
Environmental Justice	No disproportionate impacts on minority or low-income populations.	No disproportionate impacts on minority or low-income populations.	No disproportionate impacts on minority or low-income populations.	No disproportionate impacts on minority or low-income populations.	No disproportionate impacts on minority or low-income populations.
Climate Change	Minimal mitigation of human-induced global climate changes.	Minimal mitigation of human-induced global climate changes.	Minimal mitigation of human-induced global climate changes.	Minimal mitigation of human-induced global climate changes.	Minimal mitigation of human-induced global climate changes.
Air Quality	Minimal impacts.	Minimal impacts.	Minimal impacts.	Minimal impacts.	Minimal impacts.