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INVENTORY AND FEASIBILITY OF MANAGEMENT PROCEDURES FOR THE APPLE CREEK WETLAND REFUGE

River Science Center Technical Report 87-1

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BACKGROUND

The 1985 Farm Bill authorizes the Farm and Home Administration (FmHA) to grant 50 year conservation easements to local or state Government units or private non-profit organizations. The Greene County FmHA has on inventory a 336 acre tract bordering Apple Creek. The FmHA is interested in granting a 50 year conservation easement to the Soil and Water Conservation District or to the Illinois Department of Conservation.

The tract is located in Sections 6, 31, 32, T. 10 and 11 N.- R. 12W., Carrollton Township, Greene Co., IL. There is a 140 acre field within a levee system, a 62 acre tract of natural flooded woodland, a mature white pine plantation, and areas containing old pasture and native timber. In this report, the area will be referred to as the Apple Creek Wetland Refuge.

During the past 10 years the land was cropped (corn and soybeans) and leased as a waterfowl hunting club in the fall and winter.

The Green County Soil and Water Conservation Department submitted the Apple Creek Wetland Refuge project proposal to the Illinois Department of Conservation for FY87 Nongame Checkoff funds. The proposal was granted funds by DOC to determine possible alternative management strategies for the FmHA Apple Creek tract.

PROJECT OBJECTIVES

The two major objectives of this project were to inventory the Apple Creek Wetland Refuge and propose a long-range management plan. The inventory resulted in species lists and a base map of habitat types. The methods section details how the lists and map were produced. Management scenarios were produced for three alternatives: no action, managing for target species, or managing for diverse communities. Different management alternatives were considered for the units designated on the base map. FmHA was not interested in managing the site as a hunting area, so the management alternatives considered did not include hunting.

METHODS

Inventory

We used four different methods to inventory populations and wetland habitats in the Apple Creek Wetland Refuge.

Review Of Maps And Aerial Photographs

We used an enlarged, U.S.G.S., 7.5-minute topographic map (Figure 1) to identify area contours and landscape features. The map contained one error in the position of the levee along Apple Creek. We corrected this error by hand for the figures in this report. The map was used to produce a habitat overlay (Figure 2) for analysis of management alternatives. Old, but undated aerial photographs of the area (1"=660') were provided by the Soil Conservation Service.

County Species Lists

The Illinois Natural History Survey maintains computer files of animal and plant species collected or reported from all Illinois counties. We requested and received lists of wetland and endangered animals in Greene County. The lists were limited, apparently because relatively few scientific collections or studies have been made in the county. As a result we also requested and reviewed similar lists from surrounding counties of Calhoun, Macoupin, Jersey, Morgan, Scott and Pike. (Appendix I).

State Wetland Inventory Map Interpretations

The Illinois Department of Conservation, in cooperation with the U.S. Fish and Wildlife Service, is in the process of identifying all wetlands in the state. County Soil Conservation Service offices have been helping to ground truth wetland map interpretations produced during the program. We reviewed the map interpretations and wetland classifications (Cowardin et al. 1979) that covered the Apple Creek Wetland Refuge.

Site Visits

One or more of the authors visited the project area on six occasions between April and August, 1987. In July, Mr. Mark Hall, a botanist experienced in prairie ecology and restoration, asssisted in identifying the major plant species in the area.

During site visits we recorded all animal observations, animal signs, and major plant types. When possible we noted the relative abundance of species, but we made no quantitative measurements of population density.

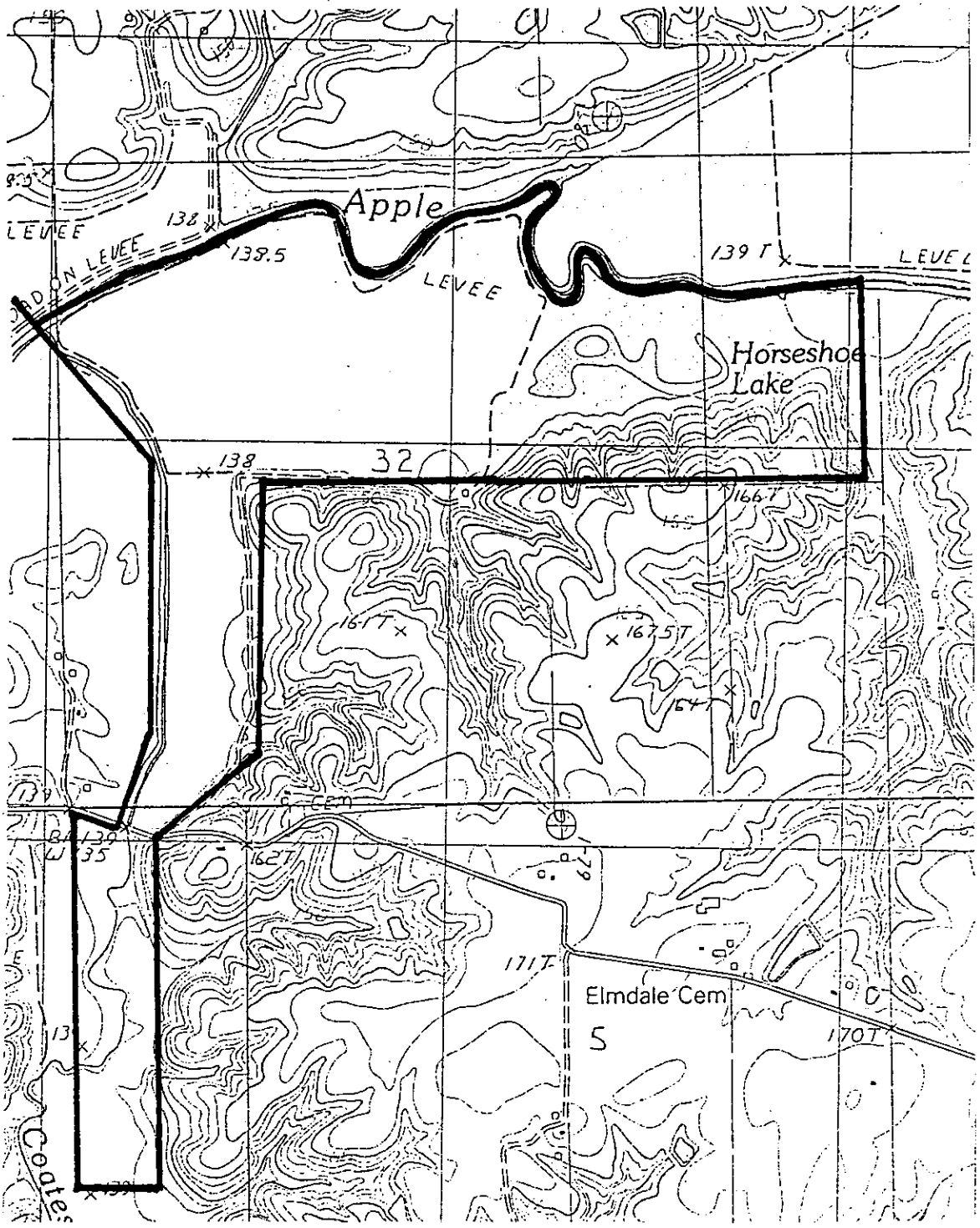

Figure 1. Base map of the Apple Creek Wetland Refuge.

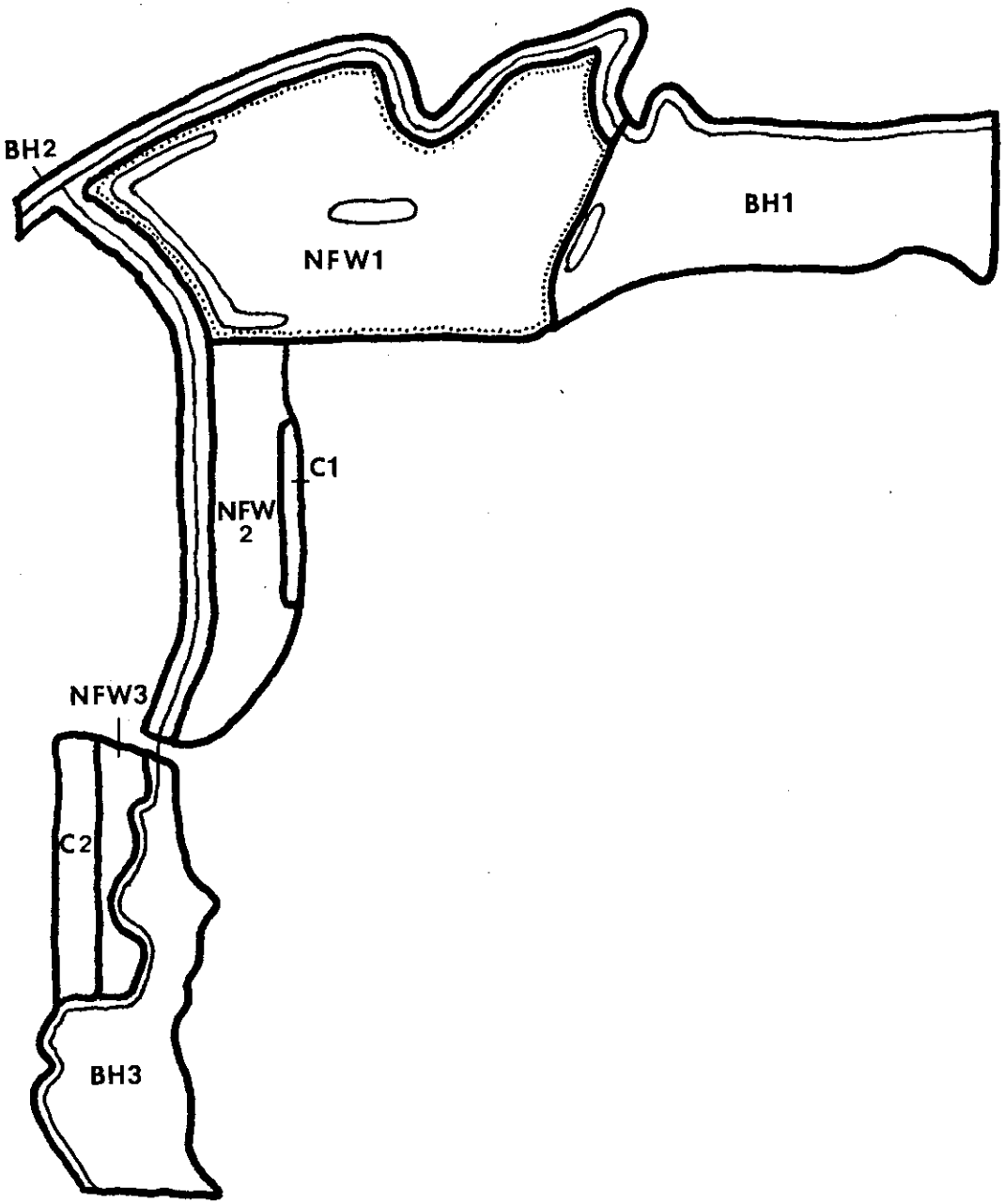

Figure 2. Wildlife habitat areas within the Apple Creek Wetland Refuge. Area codes include NFW (non-forested wetland), BH (bottomland hardwoods), and C (cropland)(Urich et al, 1984; Urich et al, 1986). Upland habitats were not included in WHAG analyses. NFW1 was surrounded by an earthen levee. Small bodies of summer standing water are indicated in NFW1 and BH1.

Identification and Evaluation of Management Alternatives

General Approach

Wetlands have numerous socio-economic functions (i.e. flood reduction, water quality improvement, recreation, education and research) and associated values. But our analysis focused on the role of the project area as wildlife and fish habitat. As a result, the three wetland management alternatives that we identified and evaluated represented divergent perspectives about why and how the area could be managed to provide habitat. The alternatives were: 1) no action; 2) target species management: and 3) community management. The alternatives permitted a discussion of a wide range of wetland management procedures.

Although our emphasis was on use of the area as habitat, it would have been unrealistic to disregard other important wetland functions. As a result, whenever appropriate we called attention to advantages or disadvantages of specific habitat management procedures in terms of their impact on other wetland functions.

Use Of Missouri's Wildlife Habitat Appraisal Guide

A quantitative method was required to evaluate and compare different management alternatives. We chose WHAG (Wildlife Habitat Appraisal Guide), Missouri's system of appraising habitat values (Urich et al. 1984; Urich et al. 1986) because 1) it is based on state-of-the-art methodology, 2) its use is becoming widespread, 3) it is readily adaptable to conditions available in the project area, and 4) it permitted the identification of specific management procedures that would provide maximum benefits to five target wetland species.

Under the definitions of WHAG, the Apple Creek Wetland Refuge included patches of four different habitat types: Non-forested wetland, bottomland forest, cropland, and woodland (an upland habitat category). Since future management procedures in the area were to be aimed at wetland, as opposed to upland, habitat types, our WHAG analyses were limited to non-forested wetland, bottomland hardwood, and cropland areas (Figure 2). A habitat value ranging from 0.1 (low) to 1.0 (high) for a selected species was calculated for each habitat area. Values were based on a combination of environmental features of the habitat area and habitat requirements of the species under consideration. (Sample data sheets are in Appendix II). Habitat area acreages were estimated from maps and are approximate only.

Selection of Target Wetland Species

WHAG permits the evaluation of a wetland habitat area for ten species. Because of time constraints we selected a limited number of these. Mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), muskrat (*Ondatra Zibethica*), least bittern (a heron, *Ixobrychus exilis*), and lesser yellowlegs (a shorebird *Tringa Flavipes*), were selected as target species because they occur in the project area, are variably sensitive to different management procedures, and because they represent a variety of animal groups.

Fishes are not represented under WHAG. Our assessment of the impacts of the three alternatives to the area fish community was limited to non-quantitative evaluations.

APPLE CREEK WETLAND REFUGE INVENTORY

The following species lists were compiled during five site visits during spring and summer 1987.

Animal Species List

Crustaceans

Crayfish (Genus not identified)

Fish

Black Bullheads (*Ictalurus melas*)
Common Carp (*Cyprinus carpio*)
Mosquitofish (*Gambusia affinis*)

Amphibians

American Toad (*Bufo americana*)
Northern Spring Peeper (*Hyla crucifer crucifer*)
Cricket frog (*Acris crepitans blanchardi*)
Green Frog (*Rana clamitans melanota*)
Bullfrog (*Rana catesbeiana*)

Reptiles

Black Rat Snake (*Elaphe obsoleta obsoleta*)
Turtles seen but not identified

Birds:

Great Egret (*Casmerodius albus*)
Great Blue Heron (*Ardea herodias*)
Green Heron (*Butorides striatus*)
Wood Duck (*Aix sponsa*)
Mallard (*Anas platyrhynchos*)
Hooded Merganser (*Lophodytes cucullatus*)
Turkey Vulture (*Cathartes aura*)
Redtail Hawks (pr.) (*Buteo jamaicensis*)
Killdeer (*Charadrius vociferus*)
Lesser Yellowlegs (*Tringa flavipes*)
Barred Owl (*Strix varia*)
2 different unidentified owls
Whip-poor-will (*Caprimulgus vociferus*)
Belted Kingfisher (*Ceryle alcyon*)
Pileated woodpecker (*Dryocopus pileatus*)
Red-headed Woodpecker (*Melanerpes erythrocephalus*)
Downy woodpecker (*Picoides pubescens*)
Eastern Kingbird (*Tyrannus tyrannus*)
Northern Rough-winged swallow (*Stlegidopteryx serripennis*)
American Crow (*Corvus brachyrhynchos*)
Tufted Titmouse (*Parus bicolor*)
Blue-Gray Gnatcatcher (*Polioptila caerulea*)

Gray Catbird (Dumetella carolinensis)
Warbling Vireo (Vireo gilvus)
Common Yellowthroat (Geothlypis trichas)
Yellow Warbler (Dendroica petechia)
Indigo Bunting (Passerina cyanea)
Dickcissel (Spiza americana)
Song Sparrow (Melsopiza melodia)
Red-winged Blackbird (Agelaius phoeniceus)
Brown-headed Cowbird (Molothrus ater)
Common Grackle (Quiscalus quiscula)
American Goldfinch (Carduelis tristis)
Eurasian Tree Sparrow (Passer montanus)

Mammals

Muskrat (Ondatra zibethica)
Raccoon (Procyon lotor)
Whitetail Deer (Odocoileus virginianus)
Coyote (Canis latrans)

Plant Species List and Comments

Leveed area - NFW-1

Foxtail (Setaria sp.)
Goosefoot (Chenopodium album)
Smartweed (Polygonum sp.)
Seedbox (Ludwigia sp.)
Frogfruit (Lipia sp.)
Swamp Milkweed (Asclepias incarnata)
Indian Hemp (Apocynum cannabinum)
Buttonbush (Cephalanthus occidentalis)
Cockelbur (Xanthium sp.)
Ragweed (Ambrosia trifida)
White Heath Aster (Aster pilosis)

Higher ground (around the edges of NFW-1)

Primrose (Oenothera sp.)
Velvet Leaf (Abutilon theophrasti)
Field Bindweed (Convolvulus arvensis)
Ivy-leaf Morning Glory (Ipomoea hederacea)
Pigweed (Amaranthus hybridus)
Bugleweed (Lycopus sp.)
Boneset (Eupatorium sp.)
Horse Weed (Erigeron canadensis)
Goldenrod (Solidago sp.)
Spanish Needles (Bidens bipinnata)

Around the lake in NFW-1

Cut Grass (Leersia sp.)
Cottonwood (Populus deltoides)
Loosestrife (Lythrum sp.)
Vervain (Verbena hasta)
Trumpet Creeper (Campsis radicans)
Buttonbush (Cephalanthus occidentalis)

Edge of Levee

Black Willow (Salix nigra)
Silver Maple (Acer saccharinum)
Dock (Rumex sp.)
Elderberry (Sambucus canadensis)
Indian Hemp (Apocynum cannabinum)
Ragweed (Ambrosia trifida)

Horseshoe Lake - BH-1

Black Willow (Salix nigra)
Cottonwood (Populus deltoides)
Dodder (Cuscuta sp.)
Aster sp.

Drier Ground (south side of NFW-1

Foxtail (Setaria sp.)
Nut sedge (Carex sp.)
Rough-leaved Dogwood (Cornus drummondi)
Dock (Rumex sp.)
St. John's-wort (Hypericum sp.)
Yellow Wood Sorrel (Oxalis stricta)
Primrose (Oenothera sp.)
Five Finger (Potentila sp.)
Queen Ann's Lace (Daucus carotus)
Vervain (Verbena sp.)
Germander (Teucrium sp.)
Sweet Clover (Melilotus officinalis)
Elderberry (Sambucus canadensis)
American Bellflower (Campanula sp.,)
Sneezeweed (Helenium sp.)
Boltonia (Boltonia sp.)
Fleabane (Erigeron sp.)
Horse Weed (Erigeron canadensis)
Prickly lettuce (Lactuca scariola)
Sow thistle (Sonchus oleraceus)
Ragweed (Ambrosia trifida)

Old Field area - NFW2 (small sampling - apparently fairly typical disturbed field-type growth with the exception of the drainage which runs down the middle)

Black Willow (Salix nigra)
Foxtail (Setaria sp.)
Dock (Rumex sp.)
Queen Ann's Lace (Daucus carotus)
Ragweed (Ambrosia trifida)
Horse Weed (Erigeron canadensis)
Sow Thistle (Sonchus oleraceus)
Fleabane (Erigeron sp.)

Mixed Hardwoods - BH4- south of county road (small sample)

Silver Maple (Acer saccharinum)
White oak (Quercus alba)
Cottonwood (Populus deltoides)
Walnut (Juglans nigra)
Ash (Fraxinus sp.)
Dogwood (Cornus florida)

While the major areas visited (NFW-1, BH-1, NFW-2, BH-3) show definite signs of disturbance, they all appear to have maintained potential for recreating their more natural state. Much of the area within NFW-1 had only old dead corn plants or smartweed (Polygonum sp.). There are several borrow pits along the levee on the west and northwest side of the property. These borrow pits held some water in the spring and were bordered by mudflats. There is one permanent small body of water in the middle of NFW-1. The water level appears to fluctuate during the spring and summer but there is apparently always some standing water. The south side of NFW-1 has plants which are more typical of drier fields however there are signs that the area has been submerged. NFW-1 has great potential as a wetland area. The land has many gentle rises resulting in islands of drier habitat.

A levee surrounding NFW-1 appears to be in good condition. There is one break in the levee on the south side apparently used by the previous land owner to drain NFW-2. There are two additional breaks on the east side along the creek flowing between Horseshoe Lake and NFW-1. There is also a 30" culvert in the northwest corner of the levee which drains towards Coates Creek.

BH-1, the Horseshoe Lake area, had been drained via drainage canals allowing dense undercover to emerge. The drainage canals connect the Horseshoe Lake area with the creek flowing between NFW-1 and BH-1.It appears that this area could recover to a floodplain forest if the drainage ditches were plugged.

NFW-2 has great potential as an area to recreate a native grass and forbs area. There is a shallow drainage area, lined with willow saplings, running through NFW-2.

EVALUATION OF WETLAND MANAGEMENT ALTERNATIVES

The "No Action" Alternative

Objective

The objective of this management alternative is to let ecological succession in the wetland habitats of the Apple Creek Refuge proceed entirely under the influence of future patterns of climate and floods. No active, purposeful management steps directed at increasing or expanding species or habitats would be taken.

Habitat Values

Present conditions were used to estimate short-term (0-5 year) values of 8 habitat areas (Figure 2) to five target species (Table 1). All area values for mallards were low (0.1). The low values resulted from the fact that there is very little predictable open water available during late summer and fall. Personal observations by farmers and hunters of reduced waterfowl use of the area during recent fall migrations substantiate this assessment. In contrast, spring use of the habitat areas, verified by our own observations is high (1000+ mallards observed on 26 March 1987). Spring use of the area by waterfowl, however, is not considered a critical habitat factor under WHAG.

Non-forest wetland area values for muskrats were low, ranging from 0.1 to 0.12 (Table 1). These low values resulted from the small percentages of permanent water that are available during the entire year. Our observations indicated that few muskrats utilize the area, and probably only sites around the standing bodies of water in NFW1 and BH1.

Bottomland hardwood area values for wood ducks were fair, ranging from 0.30-0.33 (Table 1). This evaluation of the area was verified by our own observations and those of Illinois Department of Conservation staff. A primary limiting factor for these areas to wood ducks was the low percentage of hardwoods in close (660 ft) proximity to permanent water. This factor limits the survival of nestlings as they leave their nest sites in search of aquatic habitat.

Non-forest wetland area values for lesser yellowlegs varied widely (Table 1). NFW1, the only leveed non-forest wetland area, had a good value, 0.52. But NFW2 and NFW3 each had a value of 0.1. The major factor limiting the value of the latter two areas was the rapid summer drying of these areas and consequent absence of mud flats.

Non-forest wetland area values for least bitterns also varied widely (Table 1). NFW1 had the highest value, 0.48, because of its large size, lack of invasion by woody plants, more gradual summer drying tendency, and higher degree of emergent vegetation coverage. NFW2 and NFW3 had lower values for least bitterns because of the combination of these factors.

The value of Apple Creek Wetland Refuge to fishes is presently minimal. Certain species of fish undoubtedly move into these areas during spring high waters and feed on available seeds and invertebrates. During high water years, some additional spawning habitat may be provided in flooded areas when water temperatures reach necessary thresholds. Our observations however, indicated that

Table 1. Present Apple Creek Wetland Refuge habitat area values to five target species.

Area (acres)		Target Species: Mallard	Muskrat	Wood Duck	Lesser Yellowlegs	Least Bittern
NFW1	(70)	0.10	0.12	-	0.52	0.48
NFW2	(29)	0.10	0.10	-	0.10	0.10
NFW3	(8)	0.10	0.10	-	0.10	0.10
BH1	(55)	0.10	-	0.31	-	-
BH2	(20)	0.10	-	0.33	-	-
BH3	(45)	0.10	-	0.30	-	-
C1	(6)	0.10	-	-	-	-
C2	(10)	0.10	-	-	-	-

few fish species, primarily black bullheads, (Ictalurus melas), common carp, (Cyprinus carpio), and mosquitofish, (Gambusia affinis), were able to survive in the shallow pools of NFW and BH1 throughout the year.

Discussion

The overall, long-term consequence of the no-action alternative would be a gradual succession of the Apple Creek Wetland Refuge into bottomland hardwoods interspersed with a few, small bodies of shallow, open water and aquatic vegetation. This succession will favor wood ducks while limiting the other four target species under consideration. The rate of succession is difficult to predict, but it will probably be relatively complete within 40 to 70 years.

Two environmental conditions may well prevent the establishment of many native plant species in the area over this period of time. First, high rates of soil erosion from upstream areas, may continue to produce abnormally high sedimentation rates in the wetland areas. Second, upstream levee construction and stream channelization practices, coupled with the increased use of drainage tiles in the watershed, have probably produced a more "flashy" flood regime along Apple Creek. Both of these conditions will favor certain wetland plant species that resist variable flooding "disturbances" better than other species that have more consistent or limited habitat requirements. As a result, the "No action" alternative will not necessarily result in a future plant community that is identical to the one that characterized the area, for instance, in 1850.

Of the three alternatives, "no-action" will logically require the least costs. However, some management costs will be involved. These include costs associated with project administration and monitoring of the area to document its changing wildlife value.

In addition, a decision will have to be made regarding whether to maintain the current condition of the levee and drainage system associated with NFW1. This area contains a drainage culvert equipped with a gravity gate, and a second culvert equipped with a screw gate. The gravity gate allows water to drain out of NFW1 only. The earthen levee has been washed out in three places. "No action" will result in the gradual deterioration of the levee due to future floods and the burrowing action of animals. "No action" will also result in the eventual filling and failure of the drainage pipes. While costs will be minimal, all control over water levels in NFW1 will eventually be lost.

The "no action" alternative will benefit most non-habitat functions of the Apple Creek Wetland Refuge area. The area will be available for flood storage, and will lessen flood heights on both Coates and Apple Creeks. Because stream sediment will fall out of suspension in the floodplain, less sediment load will transported downstream. Some benefits to education and research may be provided by this alternative if studies of long-term succession under uncontrolled conditions can be funded. Two major non-habitat disadvantages that will be created by this alternative will be a dramatic drop in the agricultural use of the area and a long-term reduction in the recreational (i.e. hunting) use of the area.

The "Target Species" Alternative

Objective

The objective of this alternative is to focus future management procedures on a selected animal species. Following are separate discussions pertaining to procedures that would benefit each of five wetland species.

Mallard

As noted earlier, values of Apple Creek Wetland Refuge for mallards are limited primarily by lack of open water habitats in late summer and fall. Management procedures for mallards therefore should concentrate on increasing the number and total surface acreage of open water habitats. This can be most efficiently and inexpensively accomplished in NFW1 because a levee and drainage system are already in place in the area. Open water habitats in NFW1 can be expanded either by excavating depressions or by repairing the levee to a given elevation and pumping water into NFW1 from Apple Creek. Excavation would involve a higher initial cost, but would produce-lying areas that would require less long-term pumping costs. We estimate that increasing open water habitat to 50 percent of that available in NFW1 would raise its value to mallards from 0.1 to 0.8.

Excavating and contouring land within NFW1 will result in substantial long-term impacts to many plant and animal species. An engineer should be consulted regarding how much ground to move to achieve certain landforms at given elevations and soil moisture content. In addition, contouring should probably be done gradually, a little each year when water levels are lowest, to monitor simultaneous changes in vegetation.

Waterfowl managers in both the Illinois and Missouri Departments of Conservation are experienced in managing water levels to benefit migrating waterfowl. They should be consulted to determine the optimum size and configuration of the expanded open water habitats in NFW1. If enough funds are available, excavation should maximize "edge" between open water and shore, and provide a combination of deep (i.e. greater than 6 ft.) and shallow water areas. This will promote the growth of several kinds of submergent and emergent aquatic plants and provide a diverse diet for ducks.

Water level control to promote the growth of moist-soil food plants for migrating waterfowl is a common management practice and would be well suited to NFW1. Waterfowl managers in Illinois typically attempt to expose mud flats for 70-90 days between 15 July and 15 October (Bellrose et al. 1979.).

Management procedures that could benefit mallards in other habitats of the Apple Creek Wetland Refuge include the provision of corn stubble and residue in cropland habitats after harvest, and the seeding of desirable moist soil plants like japanese millet (Echinochloa frumentacea) or rice cutgrass (Leersia Oryzoides). However, these efforts will not be successful unless additional open water areas are created.

It should be noted that any effective water level control in NFW1 will require some levee maintenance, even if the levee is repaired at a lower elevation. This will result in the loss of some flood transport capacity of the floodplain, and proportional rises in future flood heights.

Muskrats

Muskrats in the Apple Creek Wetland Refuge are limited by a lack of permanent open water areas and associated aquatic vegetation. As in the case for mallards, this limitation can be most easily be remedied in NFW1. Excavation or pumping are again the choices available for managing water levels to improve muskrat habitat. Water levels during the summer and fall should be kept as level as possible to

provide moist soil conditions appropriate for cattail (Typha spp.), bullrush (Scirpus spp.) or arrowhead (Sagittaria calycina). These plants will probably have to be initially seeded in the area. We estimate that increasing the amount of permanent open water in NFW1 to 50 percent of the total habitat available, and increasing the percent of cattail and bullrush coverage in the area to between 25 and 50 percent would increase the value of NFW1 to muskrats from 0.1 to 0.5.

Wood Duck

Wood ducks use bottomland forest habitats in the Apple Creek Wetland Refuge. They are primarily limited by long distances between nest sites and open water. The most appropriate location to remedy this problem is BH1, where an old, oxbow lake (Horseshoe Lake on Figure 1) has filled with sediment and is being invaded with willows, silver maples and cottonwoods. This lake should bge dredged, restoring open water areas within the bottomland hardwood forest canopy. Some clear water flow into the lake might be possible by diverting spring water from creeks immediately above and below. The long-term cost of this procedure may be high, since future floods of apple Creek may redeposit sediment in the lake and make additional dredging necessary. We estimate that dredging and filling Horseshoe Lake would increase the value of BH! to wood ducks from 0.31 to 0.9.

An additional procedure that may benefit wood ducks in the area would be the establishment of wood duck nest boxes. During our site visits, the number of older trees with suitable nesting cavities in all of the bottomland hardwood areas appeared to be limited.

Lesser Yellowlegs

Lesser yellowlegs prefer mud flat wetland habitats. The most appropriate location to provide suitable mud flats is NFW1. This can be done by contouring land in the area and by controlling water levels such that as much shallow water (i.e. between 1 and 4 inches) as possible is available between May and June. Emergent vegetation along the shoreline should be kept to a minimum. Land contours and the normal, unregulated water levels already present in a typical summer in NFW1 are relatively favorable to lesser yellowlegs, but we can estimate that by increasing the surface area of shallow water in NFW1 to 50 percent of the total area available, the value of NFW1 to lesser yellowlegs can be increased from 0.52 to 0.7.

Least Bittern

Least bitterns require shallow water feeding areas that are rich in invertebrates and small fishes, and emergent vegetation similar to cattails or bullrushes for cover. These conditions can best be enhanced in NFW1 and possibly NFW2. Appropriate water levels can be expanded by contouring land and pumping water from Apple Creek into NFW1. Unless some deep water refuges for small fish and aquatic invertebrates are provide in NFW1, it appears unlikely that enough food resources will be available to sustain many least bitterns in the area through a whole year. It is also unlikely that open water feeding areas would be easily maintained in NFW2, but some low lying land in NFW2 seems appropriate for seeding with cattails. We estimate that providing additional open water and emergent vegetation in NFW1 could increase the value of the area to least bitterns from 0.48 to 0.6.

The "Community" Alternative

Objective

the objective of this alternative is to manage the Apple Creek Wetland Refuge area as a community made up of selected plants and animals. Rather than focusing on one species or a group of closely allied species (ie. waterfowl), the broader perspective of this alternative stresses combinations of species that characterize wetland ecosystems. The goal of this alternative is to produce a diverse community that includes as many native species as possible.

Discussion

The "community" alternative encompasses many of the wetland management procedures already described under the "target species" alternative. However, the selection of which procedure to use at any given time or place is governed by a broader set of rules. To maximize native species diversity in the Apple Creek Wetland Refuge, we recommend that target species management procedures be selected to reflect four community level strategies: compartmentalization, rotation, shared resources, and introduction of native species.

Compartmentalization

Compartmentalization refers to matching management procedures to specific habitat types and their greatest values to species. In the Apple Creek Wetland Refuge the two major habitat types of concern are non-forested wetland, and bottomland hardwood. Three individual areas exist under each of these habitat types. This landscape pattern therefore could conceivably permit the use of 6 major management procedures at one time.

Some differences in environmental conditions exist between areas of the same habitat type, and these can be used to determine which management procedures best suited to each area. Examples already noted include dredging an old lake bed in BH1 but not BH2, and regulating water levels in NFW1 but not NFW2.

We recommend taking advantage of the management opportunities provided by these and similar differences. Doing so will not only enhance species diversity over the entire project area but will allow the evaluation of several management procedures at one time.

Some differences in environmental conditions exist between areas of the same habitat type, and these can be used to determine which management procedures are best suited to each area. Examples already noted include dredging an old lake bed in BH1 but not BH2, and regulating water levels in NFW1 but not NFW2.

We recommend taking advantage of the management opportunities provided by these and similar differences. Doing so will not only enhance species diversity over the entire project area but will allow the evaluation of several management procedures at one time.

NFW1, a special case, will probably require artificial compartmentalization to increase its value to several species at the same time. Table 1 indicates that NFW1 is important to many wetland species. Attempts to manage NFW1 as a whole unit for one species will inevitably reduce its value to some other species.

Compartmentalizing NFW1 however, could allow simultaneous management procedures directed at different species. The most logical time to consider compartmentalizing NFW1 would be as land within it is being contoured. Since the shallow bodies of open water present in NFW1 already have relatively high value to lesser yellowlegs and least bitterns, these could probably be left alone, while new and deeper areas are excavated for mallards and muskrats. Later, shorelines of muskrat areas could be seeded with cattails without endangering the mud flats of lesser yellowleg areas. Excavating pools to different depths will also make it easier to develop water level regulations that benefit multiple species.

Rotation

Rotation refers to using different modifications of a management procedure in alternate years. In the Apple Creek Wetland Refuge this strategy is best exemplified by potential water level regulation procedures in NFW1. In this case, adopting the same water level management procedure (i.e. dewatering to a given elevation between June and September) year after year would ultimately benefit a limited number of plants and animals. We recommend that slight modifications be incorporated into the procedure (i.e. dewatering to a slightly different elevation or over a slightly offset season) to encourage the germination and growth of a wider variety of plants. This strategy could actually reduce the costs of the procedure if the water level strategy in a given year could be matched to the precipitation and flooding pattern present. Rotation patterns could be set up in five year blocks, for instance, and the annual strategy selected to complete any of the available cells left in the block.

Shared resources:

In some cases, regardless of compartmentalization or rotation strategies, the requirements of one species in a habitat area are going to conflict with another. These conflicts make it particularly difficult to determine suitable management procedures. An example of this occurs when wildlife managers dewater an area to promote the growth of moist soil plants for waterfowl while reducing the value of the habitat for fish and increasing fish mortality.

In NFW1, water level regulation is the management procedure that will probably be used most often. However, there will be some management choices available that will favor multi-species sharing of the habitat area over single-species benefits. For instance, it might seem necessary to repair the levee around NFW1 to its original height for maximum control of water levels for waterfowl. But repairing the levee breaks to only mid-height will yield substantial water level control for waterfowl, and at the same time enhance the use of the area by feeding and spawning fish during moderate to high creek flows. This procedure will also maintain some of the flood retention capacity of NFW1. In addition, if the levee breaks are repaired by placing culverts at mid-height and covering them with earth to the original levee height, vehicle movement around NFW1 would be possible. This would greatly facilitate levee maintenance, and provide a convenient observation platform for research and educational tours of the area. We recommend that whenever necessary, management decisions be made based on multi-species benefits (or multi-species and non-habitat benefits) rather than single-species benefits.

Introduction of native species

The establishment of native species in the area might well take several decades or longer if left to chance. We recommend the seeding or stocking of native wetland or prairie species in appropriate areas, particularly NFW2 and NFW3. The Illinois Department of Conservation should be consulted regarding available seeds and the most successful planting procedures. Burning of drier areas will also help to maintain plant species diversity and native species composition.

SUMMARY OF MANAGEMENT RECOMMENDATIONS BY HABITAT AREA

NFW1

Goal: Improve value of habitat for many wetland species by increasing open water areas and aquatic vegetation.

Procedures: Excavate depressions inside leveed area to variable depths below the effective water table.

Repair breaks in levee and install pump to supply water from Apple Creek during summer and fall.

Seed area with desirable submergent and emergent plants.

NFW2, NFW3

Goal: Promote growth of native plant species.

Procedures: Seed, stock or transplant.

Periodic burning.

BH1

Goal: Improve value of habitat for wood ducks.

Procedures: Dredge Horseshoe Lake.

Distribute wood duck boxes as necessary.

BH2, BH3

Goal: Improve value of habitat for wood ducks.

Procedures: Distribute wood duck boxes as necessary.

C1, C2

Goal: Maintain fall food supply for migrating waterfowl.

Procedures: Provide corn stubble and residue after harvest. Seed area with other valuable plants.

REFERENCES

Bellrose, F.C., F.L. Paveglio, Jr. and D.W. Steffeck.
1979. Wateerfowl populations and the changing environment of the Illinois River Valley. Illinois Natural History Survey Bulletin 32 (1).

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS 79/31.

Urich, D.L., J.P. Graham, and E.A Gaskins.
1984. Habitat appraisal of private lands in Missouri. Wildlife Society Bulletin 12: 350-356.

Urich, D.L., J.P. Graham, and P.E. Kelly.
1986. Statewide planning using the wildlife and fish habitat relationships system. Wildlife Society Bulletin 14: 22-30.

Appendix I

Illinois Natural History Survey Species List For Greene and Surrounding Counties

SPECIES LIST FOR CALHOUN, MACOUPIN, JERSEY, MORGAN, SCOTT AND PIKE COUNTIES

*MOLLUSK (PELECY)		
*AMBLEMA PLICATA		THREE-RIDGE
*FUSCONAIA EBENA		EBONYSHELL
*FUSCONAIA FLAVA		WABASH PIGTOE
*QUADRULA NODULATA		WARTYBACK
*QUADRULA PUSTULOSA		PIMPLEBACK
*QUADRULA QUADRULA		MAPLELEAF
*TRITOGONIA VERRUCOSA		BUCKHORN
*MEGALONAIAS GIGANTEA		WASHBOARD
*ANODONTA IMBECILLIS		PAPER PONDSHELL
*ARCIDENS CONFRAGOSUS		ROCK POCKETBOOK
*LASMIGONA COMPLANATA		WHITE HEELSPLITTER
*LAMPSILIS TERES		YELLOW SANDSHELL
*LEPTODEA FRAGILIS		FRAGILE PAPERSHELL
*OBOVARIA OLIVARIA		HICKORYNUT
*POTAMILUS ALATUS		PINK HEELSPLITTER
*POTAMILUS LAEVISSIMA		PINK PAPER SHELL
*TOXOLASMA PARVUS		LILLIPUT
*TRUNCILLA DONACIFORMIS		FAWNSFOOT
*TRUNCILLA TRUNCATA		DEERTOE
*OBLIQUARIA REFLEXA		THREE-HORNED WARTYBACK
TOTAL MOLLUSK (PELECY)	20	
*CRUSTACEA		
*CAECIDOTEA BREVICAUDA		ISOPOD
*CAECIDOTEA FORBESI		ISOPOD
*CAECIDOTEA INTERMEDIUS		ISOPOD
*CAECIDOTEA KENDEIGHI		ISOPOD
*CAECIDOTEA PACKARDI		ISOPOD
*HYALELLA AZTECA		AMPHIPOD
*BACTRURUS BRACHYCAUDUS		AMPHIPOD
*BACTRURUS MUCRONATUS		AMPHIPOD
*CRANGONYX FORBESI		AMPHIPOD
*CRANGONYX GRACILIS		AMPHIPOD
*CRANGONYX MINOR		AMPHIPOD
*CRANGONYX RICHMONDENSIS		AMPHIPOD
*GAMMARUS MINUS		AMPHIPOD
*GAMMARUS PSEUDOLIMNAEUS		AMPHIPOD
*PALAEMONETES KADIAKENSIS		CRAYFISH
*PROCAMBARUS ACUTUS		CRAYFISH
*PROCAMBARUS GRACILIS		CRAYFISH
*ORCONECTES IMMUNIS		CRAYFISH
*ORCONECTES VIRILIS		CRAYFISH
*CAMBARUS DIOGENES		CRAYFISH
TOTAL CRUSTACEA	20	
*FISH		
*ICHTHYOMYZON CASTANEUS		CHESTNUT LAMPREY
*ICHTHYOMYZON UNICUSPIS		SILVER LAMPREY
*LEPISOSTEUS OSSEUS		LONGNOSE GAR
*LEPISOSTEUS PLATOSTOMUS		SHORTNOSE GAR
*AMIA CALVA		BOWFIN
*ANGUILLA ROSTRATA		AMERICAN EEL
*ALOSA CHRYSOCHLORIS		SKIPJACK HERRING
*DOROSOMA CEPEDIANUM		GIZZARD SHAD
*HIODON TERGISUS		MOONEYE
*ESOX AMERICANUS		GRASS PICKEREL
*CAMPOSTOMA ANOMALUM		CENTRAL STONEROLLER
*CARASSIUS AURATUS		GOLDFISH
*CYPRINUS CARPIO		COMMON CARP
*HYBOGNATHUS NUCHALIS		MISSISSIPPI SILVERY MINNO
*HYBOPSIS AESTIVALIS		SPECKLED CHUB

*HYBOPSIS STORERIANA	SILVER CHUB
*NOCOMIS BIGUTTATUS	HORNYHEAD CHUB
*NOTEMIGONUS CRYSOLEUCAS	GOLDEN SHINER
*NOTROPIS ATHERINOIDES	EMERALD SHINER
*NOTROPIS BLENNIUS	RIVER SHINER
*NOTROPIS BOOPS	BIGEYE SHINER
*NOTROPIS BUCHANANI	GHOST SHINER
*NOTROPIS DORSALIS	BIGMOUTH SHINER
*NOTROPIS EMILIAE	PUGNOSE MINNOW
*NOTROPIS HUDSONIUS	SPOTTAIL SHINER
*NOTROPIS LUTRENSIS	RED SHINER
*NOTROPIS SHUMARDI	SILVERBAND SHINER
*NOTROPIS STRAMINEUS	SAND SHINER
*NOTROPIS UMBRATILIS	REDFIN SHINER
*PHENACOBIUS MIRABILIS	SUCKERMOUTH MINNOW
*PHOXINUS ERYTHROGASTER	SOUTHERN REDBELLY DACE
*PIMEPHALES NOTATUS	BLUNTNOSE MINNOW
*PIMEPHALES PROMELAS	FATHEAD MINNOW
*PIMEPHALES VIGILAX	BULLHEAD MINNOW
*SEMOTILUS ATROMACULATUS	CREEK CHUB
*CARPIODES CARPIO	RIVER CARPSUCKER
*CARPIODES CYPRINUS	QUILLBACK
*CATOSTOMUS COMMERSONI	WHITE SUCKER
*HYPENTELIUM NIGRICANS	NORTHERN HOG SUCKER
*ICTIOBUS BUBALUS	SMALLMOUTH BUFFALO
*ICTIOBUS CYPRINELLUS	BIGMOUTH BUFFALO
*MOXOSTOMA ERYTHRURUM	GOLDEN REDHORSE
*MOXOSTOMA MACROLEPIDOTUM	SHORTHEAD REDHORSE
*ICTALURUS MELAS	BLACK BULLHEAD
*ICTALURUS NATALIS	YELLOW BULLHEAD
*ICTALURUS NEBULOSUS	BROWN BULLHEAD
*ICTALURUS PUNCTATUS	CHANNEL CATFISH
*NOTURUS EXILIS	SLENDER MADTOM
*NOTURUS FLAVUS	STONECAT
*NOTURUS GYRINUS	TADPOLE MADTOM
*PYLODICTIS OLIVARIS	FLATHEAD CATFISH
*APHREDODERUS SAYANUS	PIRATE PERCH
*PERCOPSIS OMISCOMAYCUS	TROUT-PERCH
*LOTA LOTA	BURBOT
*FUNDULUS NOTATUS	BLACKSTRIPE TOPMINNOW
*FUNDULUS NOTTI	STARHEAD TOPMINNOW
*GAMBUSIA AFFINIS	MOSQUITOFISH
*LABIDESTHES SICCULUS	BROOK SILVERSIDE
*MORONE CHRYSOPS	WHITE BASS
*MORONE MISSISSIPPIENSIS	YELLOW BASS
*LEPOMIS CYANELLUS	GREEN SUNFISH
*LEPOMIS GIBBOSUS	PUMPKINSEED
*LEPOMIS GULOSUS	WARMOUTH
*LEPOMIS HUMILIS	ORANGESPOTTED SUNFISH
*LEPOMIS MACROCHIRUS	BLUEGILL
*LEPOMIS MICROLOPHUS	REDEAR SUNFISH
*MICROPTERUS DOLOMIEUI	SMALLMOUTH BASS
*MICROPTERUS SALMOIDES	LARGEMOUTH BASS
*POMOXIS ANNULARIS	WHITE CRAPPIE
*POMOXIS NIGROMACULATUS	BLACK CRAPPIE
*AMMOCRYPTA CLARA	WESTERN SAND DARTER
*ETHEOSTOMA ASPRIGENE	MUD DARTER
*ETHEOSTOMA CHLOROSOMUM	BLUNTNOSE DARTER
*ETHEOSTOMA FLABELLARE	FANTAIL DARTER
*ETHEOSTOMA GRACILE	SLOUGH DARTER
*ETHEOSTOMA NIGRUM	JOHNNY DARTER
*ETHEOSTOMA SPECTABILE	ORANGETHROAT DARTER
*PERCA FLAVESCENS	YELLOW PERCH
*PERCINA CAPRODES	LOGPERCH
*PERCINA MACULATA	BLACKSIDE DARTER
*PERCINA PHOXOCEPHALA	SLENDERHEAD DARTER
*PERCINA SHUMARDI	RIVER DARTER

*PERCINA SHUMARDI		RIVER DARTER
*STIZOSTEDION CANADENSE		SAUGER
*STIZOSTEDION VITREUM		WALLEYE
*APLODINOTUS GRUNNIENS		FRESHWATER DRUM
*COTTUS CAROLINAE		BANDED SCULPIN
TOTAL FISH	86	
*AMPHIBIANS		
*NECTURUS MACULOSUS MACULOSUS		MUD PUPPY
*SIREN INTERMEDIA NETTINGI		WESTERN LESSER SIREN
*AMBYSTOMA TEXANUM		SMALLMOUTH SALAMANDER
*HEMIDACTYLIUM SCUTATUM		FOUR-TOED SALAMANDER
*BUFO WOODHOUSEI FOWLERI		FOWLER'S TOAD
*ACRIS CREPITANS BLANCHARDI		BLANCHARD'S CRICKET FROG
*HYLA CRUCIFER CRUCIFER		NORTHERN SPRING PEEPER
*PSEUDACRIS STRECKERI ILLINOENSIS		ILLINOIS CHORUS FROG
*PSEUDACRIS TRISERIATA TRISERIATA		WESTERN CHORUS FROG
*RANA BLAIRI		PLAINS LEOPARD FROG
*RANA CATESBEIANA		BULLFROG
*RANA PALUSTRIS		PICKEREL FROG
*RANA SPHENOCEPHALA		SOUTHERN LEOPARD FROG
*RANA AREOLATA CIRCULOSA		NORTHERN CRAWFISH FROG
*RANA CLAMITANS MELANOTA		GREEN FROG
TOTAL AMPHIBIANS	15	
*REPTILES		
*CHELYDRA SERPENTINA SERPENTINA		COMMON SNAPPING TURTLE
*MACROCLEMYS TEMMINCKII		ALLIGATOR SNAPPING TURTLE
*STERNOTHERUS ODORATUS		STINKPOT
*KINOSTERNON FLAVESCENS SPOONERI		ILLINOIS MUD TURTLE
*CHRYSEMYS PICTA BELLI		WESTERN PAINTED TURTLE
*EMYDOIDEA BLANDINGI		BLANDING'S TURTLE
*TERRAPENE CAROLINA CAROLINA		EASTERN BOX TURTLE
*PSEUDEMYS CONCINNA HIEROGLYPHICA		HIEROGLYPHIC TURTLE
*PSEUDEMYS SCRIPTA ELEGANS		RED-EARED SLIDER
*GRAPTEMYS GEOGRAPHICA		MAP TURTLE
*GRAPTEMYS OUACHITENSIS OUACHITENSIS		OUACHITA MAP TURTLE
*GRAPTEMYS PSEUDOGEOGRAPHICA PSEUDOGEOGRA		FALSE MAP TURTLE
*TRIONYX MUTICUS MUTICUS		MIDLAND SMOOTH SOFTSHELL
*TRIONYX SPINIFERUS SPINIFERUS		EASTERN SPINY SOFTSHELL
*CNEMIDOPHORUS SEXLINEATUS SEXLINEATUS		SIX-LINED RACERUNNER
*EUMECES FASCIATUS		FIVE-LINED SKINK
*EUMECES LATICEPS		BROADHEAD SKINK
*SCINCELLA LATERALIS		GROUND SKINK
*OPHISAURUS ATTENUATUS ATTENUATUS		WESTERN SLENDER GLASS LIZ
*CARPHOPHIS AMOENUS HELENAE		MIDWEST WORM SNAKE
*COLUBER CONSTRICTOR FLAVIVENTRIS		EASTERN YELLOWBELLY RACER
*ELAPHE GUTTATA EMORYI		GREAT PLAINS RAT SNAKE
*ELAPHE OBSOLETA OBSOLETA		BLACK RAT SNAKE
*ELAPHE VULPINA VULPINA		WESTERN FOX SNAKE
*HETERODON PLATYRHINOS		EASTERN HOGNOSE SNAKE
*HETERODON NASICUS GLOYDI		DUSTY HOGNOSE SNAKE
*LAMPROPELTIS CALLIGASTER CALLIGASTER		PRAIRIE KINGSNAKE
*LAMPROPELTIS GETULUS HOLBROOKI		SPECKLED KINGSNAKE
*LAMPROPELTIS TRIANGULUM SYSPILA		RED MILK SNAKE
*NERODIA RHOMBIFERA RHOMBIFERA		DIAMONDBACK WATER SNAKE
*NERODIA ERYTHROGASTER FLAVIGASTER		YELLOWBELLY WATER SNAKE
*OPHEODRYS AESTIVUS AESTIVUS		ROUGH GREEN SNAKE
*PITUOPHIS MELANOLEUCUS SAYI		BULLSNAKE
*REGINA GRAHAMI		GRAHAM'S CRAYFISH SNAKE
*STORERIA DEKAYI WRIGHTORUM		MIDLAND BROWN SNAKE
*STORERIA OCCIPITOMACULATA OCCIPITOMACULA		NORTHERN REDBELLY SNAKE
*THAMNOPHIS PROXIMUS PROXIMUS		WESTERN RIBBON SNAKE
*THAMNOPHIS RADIX RADIX		EASTERN PLAINS GARTER SNA
*THAMNOPHIS SIRTALIS SIRTALIS		EASTERN GARTER SNAKE
*TROPIDOCLONION LINEATUM ANNECTENS		CENTRAL LINED SNAKE

*VIRGINIA VALERIAE ELEGANS		WESTERN EARTH SNAKE
*SISTRURUS CATENATUS CATENATUS		EASTERN MASSASAUGA
TOTAL REPTILES	42	
*BIRDS		
*PODILYMBUS PODICEPS		PIED-BILLED GREBE
*BUBULCUS IBIS		CATTLE EGRET
*AIX SPONSA		WOOD DUCK
*CATHARTES AURA		TURKEY VULTURE
*MELEAGRIS GALLOPAVO		WILD TURKEY
*FULICA AMERICANA		AMERICAN COOT
*ACTITIS MACULARIA		SPOTTED SANDPIPER
*SCOLOPAX MINOR		AMERICAN WOODCOCK
*THRYOMANES BEWICKII		BEWICK'S WREN
*BOMBYCILLA CEDRORUM		CEDAR WAXWING
*VERMIVORA PINUS		BLUE-WINGED WARBLER
*HELMITHEROS VERMIVORUS		WORM-EATING WARBLER
*GUIRACA CAERULEA		BLUE GROSBEAK
*PASSER MONTANUS		EURASIAN TREE SPARROW
TOTAL BIRDS	14	
*MAMMALS		
*DIDELPHIS VIRGINIANA		OPOSSUM
*BLARINA BREVICAUDA		NORTHERN SHORT-TAILED SHR
*BLARINA CAROLINENSIS		SOUTHERN SHORT-TAILED SHR
*CRYPTOTIS PARVA		LEAST SHREW
*SCALOPUS AQUATICUS		EASTERN MOLE
*MYOTIS LUCIFUGUS		LITTLE BROWN BAT
*MYOTIS SODALIS		INDIANA BAT
*MYOTIS GRISESCENS		GRAY BAT
*PIPISTRELLUS SUBFLAVUS		EASTERN PIPISTRELLE
*EPTESICUS FUSCUS		BIG BROWN BAT
*LASIURUS BOREALIS		RED BAT
*LASIURUS CINEREUS		HOARY BAT
*NYCTICEIUS HUMERALIS		EVENING BAT
*SYLVILAGUS FLORIDANUS		EASTERN COTTONTAIL
*SPERMOPHILUS TRIDECEMLINEATUS		THIRTEEN-LINED GROUND SQU
*SPERMOPHILUS FRANKLINII		FRANKLIN'S GROUND SQUIRRE
*SCIURUS NIGER		FOX SQUIRREL
*GLAUCOMYS VOLANS		SOUTHERN FLYING SQUIRREL
*GEOMYS BURSARIUS		PLAINS POCKET GOPHER
*REITHRODONTOMYS MEGALOTIS		WESTERN HARVEST MOUSE
*PEROMYSCUS MANICULATUS		DEER MOUSE
*PEROMYSCUS LEUCOPUS		WHITE-FOOTED MOUSE
*PITYMYS OCHROGASTER		PRAIRIE MEADOW MOUSE
*ONDATRA ZIBETHICUS		MUSKRAT
*SYNAPTOMYS COOPERI		LEMMING MOUSE
*RATTUS NORVEGICUS		NORWAY RAT
*MUS MUSCULUS		HOUSE MOUSE
*CANIS LATRANS		COYOTE
*UROCYON CINEREOARGENTEUS		GRAY FOX
*MUSTELA FRENATA		LONG-TAILED WEASEL
*TAXIDEA TAXUS		BADGER
*LUTRA CANADENSIS		RIVER OTTER
TOTAL MAMMALS	32	

229 SPECIES

ENTER COMMAND >

WETLAND SPECIES

*CRUSTACEA		
*PROCAMBARUS GRACILIS		CRAYFISH
*CAMBARUS DIOGENES		CRAYFISH
TOTAL CRUSTACEA	2	
*AMPHIBIANS		
*HEMIDACTYLIUM SCUTATUM		FOUR-TOED SALAMANDER
*ACRIS CREPITANS BLANCHARDI		BLANCHARD'S CRICKET FROG
*HYLA CRUCIFER CRUCIFER		NORTHERN SPRING PEEPER
*PSEUDACRIS STRECKERI ILLINOENSIS		ILLINOIS CHORUS FROG
*PSEUDACRIS TRISERIATA TRISERIATA		WESTERN CHORUS FROG
*RANA BLAIRI		PLAINS LEOPARD FROG
*RANA CATESBEIANA		BULLFROG
*RANA SPHENOCEPHALA		SOUTHERN LEOPARD FROG
TOTAL AMPHIBIANS	8	
*REPTILES		
*CHELYDRA SERPENTINA SERPENTINA		COMMON SNAPPING TURTLE
*STERNOTHERUS ODORATUS		STINKPOT
*KINOSTERNON FLAVESCENS SPOONERI		ILLINOIS MUD TURTLE
*CHRYSEMYS PICTA BELLI		WESTERN PAINTED TURTLE
*EMYDOIDEA BLANDINGI		BLANDING'S TURTLE
*PSEUDEMYS SCRIPTA ELEGANS		RED-EARED SLIDER
*NERODIA RHOMBIFERA RHOMBIFERA		DIAMONDBACK WATER SNAKE
*NERODIA ERYTHROGASTER FLAVIGASTER		YELLOWBELLY WATER SNAKE
*OPHEODRYS AESTIVUS AESTIVUS		ROUGH GREEN SNAKE
*REGINA GRAHAMI		GRAHAM'S CRAYFISH SNAKE
*STORERIA DEKAYI WRIGHTORUM		MIDLAND BROWN SNAKE
*THAMNOPHIS PROXIMUS PROXIMUS		WESTERN RIBBON SNAKE
*THAMNOPHIS SIRTALIS SIRTALIS		EASTERN GARTER SNAKE
*SISTRURUS CATENATUS CATENATUS		EASTERN MASSASAUGA
TOTAL REPTILES	14	
*BIRDS		
*PODILYMBUS PODICEPS		PIED-BILLED GREBE
*BUBULCUS IBIS		CATTLE EGRET
*AIX SPONSA		WOOD DUCK
*FULICA AMERICANA		AMERICAN COOT
*ACTITIS MACULARIA		SPOTTED SANDPIPER
*SCOLOPAX MINOR		AMERICAN WOODCOCK
*VERMIVORA PINUS		BLUE-WINGED WARBLER
*GUIRACA CAERULEA		BLUE GROSBEAK
TOTAL BIRDS	8	
*MAMMALS		
*DIDELPHIS VIRGINIANA		OPOSSUM
*BLARINA BREVICAUDA		NORTHERN SHORT-TAILED SHR
*CRYPTOTIS PARVA		LEAST SHREW
*MYOTIS LUCIFUGUS		LITTLE BROWN BAT
*EPTESICUS FUSCUS		BIG BROWN BAT
*NYCTICEIUS HUMERALIS		EVENING BAT
*SYLVILAGUS FLORIDANUS		EASTERN COTTONTAIL
*SPERMOPHILUS FRANKLINII		FRANKLIN'S GROUND SQUIRRE
*GLAUCOMYS VOLANS		SOUTHERN FLYING SQUIRREL
*REITHRODONTOMYS MEGALOTIS		WESTERN HARVEST MOUSE
*PEROMYSCUS LEUCOPUS		WHITE-FOOTED MOUSE
*ONDATRA ZIBETHICUS		MUSKRAT
*SYNAPTOMYS COOPERI		LEMMING MOUSE
*MUS MUSCULUS		HOUSE MOUSE
*CANIS LATRANS		COYOTE
*UROCYON CINEREOARGENTEUS		GRAY FOX
*MUSTELA FRENATA		LONG-TAILED WEASEL
*LUTRA CANADENSIS		RIVER OTTER

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TOTAL MAMMALS          16

                       30 SPECIES

ENTER COMMAND >
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SPECIES		*****FEDERAL*****				***STATE****		
		END	THR	PROP	CAND	END	THR	PROP
*FISH								
NOTROPIS BOOPS BIGEYE SHINER		0	0	0	0	0	0	1
AMMOCRYPTA CLARA WESTERN SAND DARTER		0	0	0	0	0	0	1
TOTAL FISH	2							
*AMPHIBIANS								
PSEUDACRIS STRECKERI ILLINOENSIS ILLINOIS CHORUS FROG		0	0	0	0	0	1	0
TOTAL AMPHIBIANS	1							
*REPTILES								
KINOSTERNON FLAVESCENS SPOONERI ILLINOIS MUD TURTLE		0	0	0	0	1	0	0
PSEUDEMYS CONCINNA HIEROGLYPHICA HIEROGLYPHIC TURTLE		0	0	0	0	1	0	0
ELAPHE GUTTATA EMORYI GREAT PLAINS RAT SNAKE		0	0	0	0	0	1	0
HETERODON NASICUS GLOYDI DUSTY HOGNOSE SNAKE		0	0	0	0	0	1	0
TOTAL REPTILES	4							
*BIRDS								
THRYOMANES BEWICKII BEWICK'S WREN		0	0	0	0	0	1	0
TOTAL BIRDS	1							
*MAMMALS								
MYOTIS SODALIS INDIANA BAT		1	0	0	0	1	0	0
MYOTIS GRISESCENS GRAY BAT		1	0	0	0	1	0	0
LUTRA CANADENSIS RIVER OTTER		0	0	0	0	0	1	0
TOTAL MAMMALS	3							

11 SPECIES

ENTER COMMAND >

THREATENED OR ENDANGERED SPECIES OF GREENE COUNTY

SPECIES		*****FEDERAL***** END	THR	PROP	CAND	***STATE**** END	THR	PROP
*BIRDS								
CIRCUS CYANEUS NORTHERN HARRIER		0	0	0	0	1	0	0
BARTRAMIA LONGICAUDA UPLAND SANDPIPER		0	0	0	0	1	0	0
TOTAL BIRDS	2							

2 SPECIES

SPECIES OF GREENE COUNTY

*MOLLUSK (PELECY)		
*AMBLEMA PLICATA		THREE-RIDGE
*QUADRULA NODULATA		WARTYBACK
*QUADRULA PUSTULOSA		PIMPLESACK
*QUADRULA QUADRULA		MAPLELEAF
*MEGALONAIAS GIGANTEA		WASHBOARD
*ARCIDENS CONFRAGOSUS		ROCK POCKETBOOK
*LAMPSILIS TERES		YELLOW SANDSHELL
*LEPTODEA FRAGILIS		FRAGILE PAPERSHELL
*POTAMILUS ALATUS		PINK HEELSPLITTER
*POTAMILUS LAEVISSIMA		PINK PAPER SHELL
*OBLIQUARIA REFLEXA		THREE-HORNED WARTYBACK
TOTAL MOLLUSK (PELECY)	11	
*CRUSTACEA		
*CAECIDOTEA BREVICAUDA		ISOPOD
*CAECIDOTEA INTERMEDIUS		ISOPOD
*CRANGONYX MINOR		AMPHIPOD
*GAMMARUS MINUS		AMPHIPOD
*GAMMARUS PSEUDOLIMNAEUS		AMPHIPOD
TOTAL CRUSTACEA	5	
*FISH		
*DOROSOMA CEPEDIANUM		GIZZARD SHAD
*CAMPOSTOMA ANOMALUM		CENTRAL STONEROLLER
*CYPRINUS CARPIO		COMMON CARP
*HYBOGNATHUS NUCHALIS		MISSISSIPPI SILVERY MINNO
*NOCOMIS BIGUTTATUS		HORNYHEAD CHUB
*NOTEMIGONUS CRYSOLEUCAS		GOLDEN SHINER
*NOTROPIS ATHERINOIDES		EMERALD SHINER
*NOTROPIS DORSALIS		BIGMOUTH SHINER
*NOTROPIS LUTRENSIS		RED SHINER
*NOTROPIS STRAMINEUS		SAND SHINER
*PHENACOBIUS MIRABILIS		SUCKERMOUTH MINNOW
*PHOXINUS ERYTHROGASTER		SOUTHERN REDBELLY DACE
*PIMEPHALES NOTATUS		BLUNTNOSE MINNOW
*PIMEPHALES PROMELAS		FATHEAD MINNOW
*SEMOTILUS ATRONADULATUS		CREEK CHUB
*CARPIODES CYPRINUS		QUILLBACK
*CATOSTOMUS COMMERSONI		WHITE SUCKER
*MOXOSTOMA ERYTHRURUM		GOLDEN REDHORSE
*ICTALURUS MELAS		BLACK BULLHEAD
*ICTALURUS NATALIS		YELLOW BULLHEAD
*ICTALURUS PUNCTATUS		CHANNEL CATFISH
*NOTURUS FLAVUS		STONECAT

*NOTURUS NOCTURNUS		FRECKLED MADTOM
*PYLODICTIS OLIVARIS		FLATHEAD CATFISH
*FUNDULUS NOTATUS		BLACKSTRIPE TOPMINNOW
*GAMBUSIA AFFINIS		MOSQUITOFISH
*MORONE CHRYSOPS		WHITE BASS
*LEPOMIS CYANELLUS		GREEN SUNFISH
*LEPOMIS MACROCHIRUS		BLUEGILL
*MICROPTERUS DOLOMIEUI		SMALLMOUTH BASS
*MICROPTERUS SALMOIDES		LARGEMOUTH BASS
*POMOXIS ANNULARIS		WHITE CRAPPIE
*ETHEOSTOMA SPECTABILE		ORANGETHROAT DARTER
*PERCINA CAPRODES		LOGPERCH
*PERCINA PHOXOCEPHALA		SLENDERHEAD DARTER
*APLODINOTUS GRUNNIENS		FRESHWATER DRUM
*COTTUS CAROLINAE		BANDED SCULPIN
TOTAL FISH	37	
*AMPHIBIANS		
*SIREN INTERMEDIA NETTINGI		WESTERN LESSER SIREN
*BUFO WOODHOUSEI FOWLERI		FOWLER'S TOAD
*ACRIS CREPITANS BLANCHARDI		BLANCHARD'S CRICKET FROG
*HYLA CRUCIFER CRUCIFER		NORTHERN SPRING PEEPER
*RANA BLAIRI		PLAINS LEOPARD FROG
*RANA PALUSTRIS		PICKEREL FROG
*RANA SPHENOCEPHALA		SOUTHERN LEOPARD FROG
*RANA CLAMITANS MELANOTA		GREEN FROG
TOTAL AMPHIBIANS	8	
*REPTILES		
*TERRAPENE CAROLINA CAROLINA		EASTERN BOX TURTLE
*CNEMIDOPHORUS SEXLINEATUS SEXLINEATUS		SIX-LINED RACERUNNER
*OPHISAURUS ATTENUATUS ATTENUATUS		WESTERN SLENDER GLASS LIZ
*CARPHOPHIS AMOENUS HELENAE		MIDWEST WORM SNAKE
*ELAPHE OBSOLETA OBSOLETA		BLACK RAT SNAKE
*HETERODON PLATYRHINOS		EASTERN HOGNOSE SNAKE
*NERODIA RHOMBIFERA RHOMBIFERA		DIAMONDBACK WATER SNAKE
*THAMNOPHIS SIRTALIS SIRTALIS		EASTERN GARTER SNAKE
*VIRGINIA VALERIAE ELEGANS		WESTERN EARTH SNAKE
*SISTRURUS CATENATUS CATENATUS		EASTERN MASSASAUGA
TOTAL REPTILES	10	
*BIRDS		
*CIRCUS CYANEUS		NORTHERN HARRIER
*BARTRAMIA LONGICAUDA		UPLAND SANDPIPER
*DENDROICA DOMINICA		YELLOW-THROATED WARBLER
TOTAL BIRDS	3	
*MAMMALS		
*NYCTICEIUS HUMERALIS		EVENING BAT
*CANIS LATRANS		COYOTE
TOTAL MAMMALS	2	

76 SPECIES

WETLAND SPECIES OF GREENE COUNTY.

*AMPHIBIANS		
*ACRIS CREPITANS BLANCHARDI		BLANCHARD'S CRICKET FROG
*HYLA CRUCIFER CRUCIFER		NORTHERN SPRING PEEPER
*RANA BLAIRI		PLAINS LEOPARD FROG
*RANA SPHENOCEPHALA		SOUTHERN LEOPARD FROG
TOTAL AMPHIBIANS	4	
*REPTILES		

*NERODIA RHOMBIFERA RHOMBIFERA		DIAMONDBACK WATER SNAKE
*THAMNOPHIS SIRTALIS SIRTALIS		EASTERN GARTER SNAKE
*SISTRURUS CATENATUS CATENATUS		EASTERN MASSASAUGA
TOTAL REPTILES	3	
*BIRDS		
*CIRCUS CYANEUS		NORTHERN HARRIER
*DENDROICA DOMINICA		YELLOW-THROATED WARBLER
TOTAL BIRDS	2	
*MAMMALS		
*NYCTICEIUS HUMERALIS		EVENING BAT
*CANIS LATRANS		COYOTE
TOTAL MAMMALS	2	
	11 SPECIES	

BOTTOM

Wetland Species Characteristic Matrix

Wildlife Area: _____

Date: _____

Habitat Type: _____

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot
1.	**Percent Nonforest Wetlands in 2 Mile Wide Circle**	All										
	1. >75%				10	10	10	10				10
	2. 50 - 75%				8	8	8	8				8
	3. 25 - 50%				6	6	6	6				6
	4. 10 - 25%				4	4	4	4				4
	5. <10%				1	1	1	1				1
2.	**Percent Nonforest Wetlands and/or Open Water in 2 Mile Wide Circle**	All										
	1. >75%			10								
	2. 50 - 75%			8								
	3. 25 - 50%			6								
	4. 10 - 25%			4								
	5. <10%			LF								
3.	**Percent Bottomland Hardwoods and Nonforest Wetlands in 2 Mile Wide Circle**	All										
	1. >75%		10						10	10	10	
	2. 50 - 75%		8						8	8	8	
	3. 25 - 50%		6						6	6	6	
	4. 10 - 25%		4						4	4	4	
	5. <10%		LF						1	1	1	
4.	**Fall Winter Water Conditions**	N,B,C										
	1. Annually (Predictable, controlled)		10	10								
	2. Most years		7	7								
	3. 1 out of 3 years		4	4								
	4. Irregularly, unpredictable or dry fall		LF	LF								
5.	**Fall-Winter Flood Conditions (food plant availability)**	N,B	M	M								
	1. Food plants unaffected		10	10								
	2. Reduced 1 - 25% (Multiply index by .75)		8	8								
	3. Reduced 25 - 50% (Multiply index by .50)		6	6								
	4. Reduced 50 - 75% (Multiply index by .25)		4	4								
	5. Reduced >75% (Multiply index by .25)		1	1								
6.	**Water Depth 1" - 18" Fall - Winter**	N,B,C										
	1. >90%		6	6								
	2. 75 - 90%		8	8								
	3. 50-75%		10	10								
	4. 25 - 50%		4	4								
	5. <25%		1	1								
7.	**Water Depth 1" - 4" May-June**	N										
	1. >90%					10						LF
	2. 75 - 90%					8						2
	3. 50 - 75%					6						4
	4. 25 - 50%					4						7
	5. <25%					1*						10
8.	**Water Depth 1 - 18" By August**	N										
	1. >75%				1		10	1	10	5		10
	2. 50 - 75%				7		7	7	7	3		7
	3. 25 - 50%				10		4	10	4	2		4
	4. <25%				4		1	4	1	1		1
9.	**Permanent Water Entire Year**	N					M					
	1. >90%						10					
	2. 75 - 90% (Multiply index by .90)						8					
	3. 50 - 75% (Multiply index by .75)						6					
	4. 25 - 50% (Multiply index by .50)						4					
	5. <25% (Multiply index by .25)						1					
10.	**Percent Emergent Vegetation Within 2 yds. of water**	N										
	1. >75% of emer. veg. within 2 yd. of water				10							10
	2. 50-75% of emer. veg. within 2 yd. of water				7							7
	3. 25-50% of emer. veg. within 2 yd. of water				4							4
	4. <25% of emer. veg. within 2 yd. of water				1							1

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot
11.	**Woody Invasion**	N										
	1. <10%				10		5	6	1			
	2. 10 - 25%				8		4	8	6			
	3. 25 - 50%				6		3	10	8			
	4. 50 - 75%				4		2	4	10			
	5. >75%				1		1	1	4			
12.	**Emergent Vegetation Coverage**	N										
	1. >90%				6	LF			1			
	2. 75 - 90%				10	2			1			
	3. 50 - 75%				8	4			2			
	4. 25 - 50%				4	6			5			
	5. 10 - 25%				1*	8			4			
	6. <10%				1*	10			1			
13.	**Cattail and Bulrush Coverage**	N										
	1. >75%						10	LF				8
	2. 50 - 75%						8	2				10
	3. 25 - 50%						6	4				6
	4. 10 - 25%						4	7				4
	5. <10%						1	10				1*
14.	**Wetland Size**	N,B										
	1. >200 acres				10	10	10	10	10			10
	2. 100 - 200 acres				10	8	8	8	10			10
	3. 75 - 100 acres				8	6	6	6	10			8
	4. 50 - 75 acres				6	4	4	4	10			6
	5. 5 - 50 acres				4	1	2	2	10			4
	6. <5 acres				1*	1*	1	1	1*			1*
15.	**Wetland Edge**	N,B										
	1. >75% Bottomland H. - % adj. to water								10			
	2. 50-75% Nonforest w.-% woody or adj. to bottomland hardwoods								8			
	3. 25 - 50%								6			
	4. 10 - 25%								4			
	5. <10%								1			
16.	**Water Regime**	N										
	1. Gradual drying with >75% water remaining by Aug. 1				4	4	8	2	10			8
	2. Gradual drying with 50 - 75% water remaining by Aug. 1				6	6	6	6	6			6
	3. Gradual drying with 25 - 50% water remaining by Aug. 1				10	10	4	10	4			4
	4. Gradual drying with <25% water remaining by Aug. 1				8	8	2	8	2			2
	5. Stable water				2	1	10	1	10			10
	6. Rapid drying; or no water after June 1				LF	LF	LF	LF	LF			LF
17.	**Important Food Plant Coverage**	N,B	M	M								
	1. >75%		8	8								
	2. 50 - 75% (Multiply index by .75)		10	10								
	3. 25 - 50% (Multiply index by .50)		6	6								
	4. 10 - 25% (Multiply index by .25)		4	4								
	5. <10% (Multiply index by .25)		1	1								
18.	**Plant Diversity**	N,B										
	1. >7		5	5								
	2. 4 - 7		3	3								
	3. <4		1	1								
19.	**Persistent Emergent and Woody Vegetation Coverage**	N										
	1. 5 - 15%		5	5								
	2. 15 - 25%		4	4								
	3. 25 - 50%		2	2								
	4. <5% or >50%		1	1								
20.	**Loafing Sites**	N										
	1. 5 - 10% scattered		5	5					5			
	2. 10 - 20% scattered		4	4					4			
	3. Mainly along perimeter		2	2					2			
	4. <5% or >20%		1	1					1			

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot
21.	**Substrate - Surface Water Interspersion**	N										
	1. Substrate interspersed with shallow water					10						
	2. Shallow water occurring as one or few pools					1						
22.	**Percent Open Water**	N										
	1. <10%		5	5			10					6
	2. 10 - 25%		3	3			8					10
	3. 25 - 50%		1	1			6					8
	4. 50 - 90%		1	1			4					4
	5. >90%		1	1			1					1
23.	**Winter Water Depth (Oct. - March)**	N										
	1. 15 - 24"						10					
	2. 10 - 15" or 24 - 30"						7					
	3. 6 - 10" or 30 - 36"						4					
	4. <6" or >36"						1					
24.	**Sedge Canopy Coverage**	N										
	1. <90%							8				
	2. 75 - 90%							10				
	3. 50 - 75%							6				
	4. 25 - 50%							4				
	5. 1 - 25%							2				
	6. Zero							LF				
25.	**Wetland Substrate**	N										
	1. Muddy					5						
	2. Sandy					3						
	3. Gravel					1						
26.	**Percent Soil Waterlogged Substrate May-June**	N										
	1. >90% of substrate waterlogged					10						
	2. 75 - 90% of substrate waterlogged					8						
	3. 50 - 75% of substrate waterlogged					6						
	4. 25 - 50% of substrate waterlogged					4						
	5. <25% of substrate waterlogged					1						
27.	**Percent Exposed Wetland Substrate and 1-4" Shallow Water Covered by Vegetation May-June**	N										
	1. <10%					10						
	2. 10 - 25%					8						
	3. 25 - 50%					6						
	4. 50 - 75%					4						
	5. 75 - 90%					2						
	6. >90%					LF						
28.	**Aquatic Vegetation in Channel**	B										
	1. >10%									10	10	
	2. 5 - 10%									7	7	
	3. 1 - 5%									4	4	
	4. None									1	1	
29.	**Average Water Fluctuation in Channel**	B										
	1. Bank full <3 times per year										10	
	2. Bank full 3-5 times per year										7	
	3. Bank full 5-7 times per year										4	
	4. Bank full >7 times per year										1	
30.	**Cropfield Management**	C										
	1. No fall tillage		10	10								
	2. Winter Wheat		2	10								
	3. Chisel plowing		8	8								
	4. Chopped, baled, grazed		6	6								
	5. Fall disc		4	4								
	6. Fall moldboard		1	1								

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot
31.	**Cropping Practice**	C										
	1. >50 unharvested		10	10								
	2. 25-50% harvested		7	7								
	3. 10 - 25% unharvested		4	4								
	4. <10% unharvested		1	1								
32.	**Crop Rotation**	C										
	1. SG - RC - L			5								
	2. SG - RC; or idle some years			3								
	3. Continuous SG - RC			1								
33.	**Field Size (% w/in 660' Woodland or Treeline)**	C,G										
	1. <25%			10								
	2. 25 - 50%			6								
	3. 50 - 75%			3								
	4. >75%			1								
34.	**Grassland Composition**	G										
	1. Bluegrass, clover, alfalfa			10								
	2. Timothy, orchardgrass or mixed CSG			5								
	3. Fescue or WSG			1								
35.	**Average Height Herbaceous Vegetation (Fall)**	G										
	1. <6"			10								
	2. >6"			1								
36.	**Vegetative Cover (% ground covered by herbaceous and shrub cover 6"-18")**	B										
	1. >25%									10		
	2. 10-25%									5		
	3. <10%									1		
37.	**Woodland Tree Species**	B										
	1. >50% trees as elm, walnut, cottonwood, sycamore, willow, maple, ash		1							8	10	
	2. 25 - 50% trees as elm, walnut, cottonwood, sycamore, willow, maple, ash		4							10	8	
	3. <25% trees as elm, walnut, cottonwood, sycamore, willow, maple, ash; or <25% pin oak		6							1	6	
	4. 25 - 50% pin oak		8							4	4	
	5. >50% pin oak		10							6	1	
38.	**Permanent Water Within Woodland**	B										
	1. >50%		1						10			
	2. 25 - 50%		3						7			
	3. 10 - 25%		5						4			
	4. 5 - 10%		3						1			
	5. <5%		2						1*			
39.	**Concealment Cover**	B										
	1. >5%									5		
	2. 1 - 5%									3		
	3. Zero									1		
40.	**Forest Openings (<2 ac.)**	B										
	1. 15 - 30% scattered		1						10	10	5	
	2. 15 - 30% one or few		3						7	8	4	
	3. 5 - 15%		5						4	6	3	
	4. <5% or >30%		1						1	1	1	
41.	**Woodland Size Class**	B										
	1. Sawtimber - open canopy		10						4	10	4	
	2. Sawtimber - close canopy		8						1	8	1	
	3. Pole with scattered sawtimber		6						10	6	6	
	4. Reproduction with scattered sawtimber		4						8	4	8	
	5. Reproduction		1						8	LF	10	
	6. Pole		1						6	1	6	
42.	**Percent Canopy From Old Growth (>16" dbh)**	B										
	1. >25%									10	1	
	2. 10 - 25%									8	4	
	3. 5 - 10%									6	6	
	4. 1 - 5%									4	8	
	5. Zero									1	10	

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot
43.	**Number of Cavity Trees Per Acre**	B										
	1. >9									10		
	2. 3 - 9									7		
	3. 1 - 3									4		
	4. None									LP		
44.	**Stems per Square Yard of Shrub and Tree Reproduction >3 Feet Tall**											
	1. >4										10	
	2. 3-4										7	
	3. 2-3										4	
	4. <2										1	
45.	**Percent Woodland Within 660' of Permanent Water**	B								M	M	
	1. >75%								10	10	10	
	2. 50 - 75% (Multiply Index by .75)								6	6	6	
	3. 25 - 50% (Multiply Index by .50)								4	4	4	
	4. <25% (Multiply Index by .25)								1	1	1	
46.	**Distance to Nonforest Wetland, Oxbow or Slough**	B,C,G										
	1. <250' water predictable		10	10	10			10	10	10	10	
	2. 250'-1/8 mi. water predictable		10	10	8			8	10	10	10	
	3. 1/8-1 mi. water predictable		10	10	1			1	1	1	1	
	4. <250' water predictable 1 of 3 years		5	5	6			6	5	5	5	
	5. 250'-1/8 mi. water predictable 1 of 3 yrs.		5	5	4			4	5	5	5	
	6. 1/8-1 mi. flooding predictable 1 of 3 yrs.		5	5	1			1	1	1	1	
	7. >1 mi.; or <1 mi. water unpredictable		1	1	1			1	1	1	1	
47.	**Distance to Bottomland Hardwoods**	C,N										
	1. <1/4 mi. water predictable		10						5			
	2. 1/4-1/2 mi. water predictable		10						3			
	3. 1/2-1 mi. water predictable		8						1			
	4. <1/4 mi. water predictable 1 of 3 yrs.		6						5			
	5. 1/4-1/2 mi. water predictable 1 of 3 yrs.		6						3			
	6. 1/2-1 mi. water predictable 1 of 3 yrs.		4						1			
	7. >1 mi.; or <1 mi. water unpredictable		1						1			
48.	**Distance to Cropland**	N,B,G										
	1. <1/4 mi., unharvested or partially unharvested and water predictable		10	10								
	2. ¼-½ mi. unharvested or partially unharvested and water predictable		8	8								
	3. ½-1 mi. unharvested or partially unharvested and water predictable		6	6								
	4. <1/4 mi., unharvested or partially unharvested and water predictable 1 of 3 years; or adjacent, unflooded with residues undisturbed		5	5								
	5. ¼-½ mi. unharvested or partially unharvested and water predictable 1 of 3 years; or ¼-½ mi. unflooded with residues and undisturbed		4	4								
	6. ½-1 mi. unharvested or partially unharvested and water predictable 1 of 3 yrs; or ½-1 mi. unflooded with residues undisturbed; or winter wheat		2	2								
	7. >1 mi. to any cropfield; or <1 mi. unflooded cropfield with residues disced or plowed		1	1								
49.	**Distance to Grassland**	N,C										
	1. <½ mi. with winter height <6" and field size >40 acres			10								
	2. ½-1 mi. with winter height <6" and field size >40 acres			7								
	3. <1 mi. with winter height <6" and field size <40 acres			4								
	4. >1 mi. to any grassland with winter height <6"; or grassland with winter height>6"			1								

Wetland Species Characteristic Matrix

	CHARACTERISTIC	Habitat Type	Mallard	Canada Goose	Least Bittern	Lesser Yellowlegs	Muskrat	King Rail	Green-backed Heron	Wood Duck	Beaver	American Coot
50.	**Distance to Stream or River (permanent flow or pools)**	N,B										
	1. <1/4 mi.								10			
	2. 1/4 - 1/2 mi.								5			
	3. >1/2 mi.								1			
51.	**Distance to Major River, Lake or Reservoir >100 Acres**	N,C,G										
	1. <1 miles			10								
	2. 1 - 5 miles			7								
	3. 5 - 10 miles			4								
	4. >10 miles			1								
52.	**Distance to Major Canada Goose Winter Area**	N,C,G		M								
	1. <4 miles			10								
	2. 4 - 10 miles (Multiply Index by .75)			7								
	3. 10 - 25 miles (Multiply Index by .50)			4								
	4. >25 miles (Multiply Index by .25)			1								
	Total											
	Maximum Possible											
	HTSI											
	Multiplier											
	Revised HTSI											
	N		90 110		80	85	85	80	85			80
	B		105						90 100		90	
	C		70 105									
	P			80								

Abbreviations

LF - limiting factor, score Habitat Type Suitability Index (HTSI) as .1.
C = cropfield, G = grassland, N = nonforest wetland, B = bottomland hardwoods,
M = multiplier. Multiply HTSI by the appropriate value to calculate revised HTSI. Use lowest value if 2 multiplier values apply.

*Footnotes

Mallard - If Fall Winter Water Conditions in bottomland hardwood and nonforest wetland scores 1, HTSI = .1.
Canada goose - If Fall Winter Water Conditions in nonforest wetland scores 1, HTSI = .1.
Lesser yellowlegs - If Wetland Size and Water Depth 1" - 4" score 1, HTSI = .1.
Green-backed heron - If Wetland Size and Permanent Water Within Stand score 1, HTSI = .1.
Wood duck - If Woodland Size Class or Number of Tree Cavities score 1, HTSI = .1.
Least bittern - If Wetland Size and Emergent Vegetation Coverage score 1, HTSI = .1.
American Coot - If Cattail and Bulrush Coverage and Wetland Size score 1, HTSI = .1.

Multiplier

Mallard - Fall Winter Flood Conditions
Important Food Plant Coverage
Canada goose - Fall Winter Flood Conditions
Distance to Major Canada Goose Winter Area
Important Food Plant Coverage
Muskrat - Percent Permanent Water Entire Year
Wood duck - Percent Woodland Within 660' of Permanent Water
Beaver - Percent Woodland Within 660' of Permanent Water

4-87

(for references see Urich et al, 1984; Urich et al, 1986)

The
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618/374-2131

Biology Dept.
11 Dec 1987

Jim Garner
IDOC
524 South Second St.
Springfield, IL 62701-1787

Dear Jim,

Here is a cleaner copy of the Apple Creek Wetland Refuge Inventory. No wording is changed. I cleaned up the margins.

When this is reviewed, I hope you will send critical comments.

Thank you.

Sincerely,
Tanner

Dr. G. Tanner Girard