STATE WILDLIFE GRANT (SWG)

State of Illinois

Grant Proposal

PROJECT TITLE: Effects of Off-channel Wetland Restoration on Breeding Bird Communities

PROJECT NUMBER: T-24 P-1

PURPOSE:

This research will measure the success of conservation efforts aimed at restoring an imperiled habitat that is an important component of bottomland forest ecosystems, and will determine how the restoration of off-channel wetlands benefits the bird community. Species on the Species in the Greatest Need of Conservation (SGNC) likely to benefit the most include Yellow-crowned Night-heron, Cerulean Warbler, and Brown Creeper. Other species benefiting from this conservation action and research (Prothonotary Warbler, Acadian Flycatcher, Louisiana Waterthrush, yellow-throated Warbler) are Birds of Conservation Concern within the Bird Conservation Regions (BCRs) where the research will occur, or in neighboring BCRs. These species are also on the Partners in Flight (PIF) U.S. Watch List as either Extremely or Moderately High Priority. This research represents the merging of research with conservation in action and will, by monitoring wildlife responses to restoration efforts, provide feedback to conservation plans and actions. The research will also evaluate effects of the off-channel restoration and provide a measure of its' success. This research contributes not only to the Illinois Comprehensive Wildlife Conservation Plan (now referred to as the Illinois Wildlife Action Plan), but also to the PIF bird conservation plans of birds within a bottomland forest ecosystem. By doing so, this research will determine the response of the bird community to off-channel wetland restoration, measure the success of the restoration effort of conservation partners, and provide results that are directly applicable to conservation plans and restoration efforts in other bottomland forest ecosystems. Specifically, I will compare wetland size, composition of the bird community (diversity and density), and nesting success before and after restoration efforts for 10 treatment (restored) and 10 control (not restored) wetlands.

NEED:

Populations of breeding birds continue to be threatened by the fragmentation and degradation of natural habitats (Wilcove et al. 1998, Askins 2000). In addition to the negative effects of forest fragmentation (e.g., increased brood parasitism by cowbirds and increased nest predation) (Robinson et al. 1995), populations of birds breeding in bottomland forests are threatened by the alteration and degradation of "natural" hydrologic processes (Hoover 2006). Channelization of streams and rivers has led to the formation of lateral gullies that connect the main channel of streams to adjacent (off-channel) wetlands, draining the wetlands (Shields et al. 1998). The unnatural draining of off-channel wetlands in bottomland forest ecosystems may expose birds breeding in these habitats to very high rates of next predation by raccoons and other nest predators (Hoover 2006), and may alter the plan community in ways that reduce bird diversity (Wakeley and Roberts 1996). In the Cache River watershed in Illinois, conservation partners (USFWS, IDNR, TNC) have implemented a conservation action to restore several off-channel wetlands. The composition of the bird community and their nesting success were documented in these wetlands prior to restoration. This proposed study will document how the bird

community responds to off-channel wetland restoration, thereby measuring the success of the conservation effort. This research proposal addresses objectives 3-5 of the eight Required Elements in the Illinois Comprehensive Wildlife Conservation Plan (now referred to as the Illinois Wildlife Action Plan) by describing the problem affecting this imperiled habitat and the bird community that uses it, and by monitoring the success of a conservation action to improve habitat quality that was recently implemented. Too often the effects (i.e. success) of conservation efforts are not measured in terms of the responses of the biota to specific conservation actions. This proposal aims to do just that.

OBJECTIVES:

The overall objective of this proposed research is to collect post-restoration data to document how the restoration of off-channel wetlands affects the diversity, abundance, and nesting success of birds within a bottomland forest ecosystem. By doing so, this research will

1. determine the response of the bird community to off-channel wetland restoration
2. measure the success of the restoration efforts of conservation partners, and
3. provide results that are directly applicable to conservation plans and restoration efforts in other bottomland forest ecosystems.

Specifically, I will compare pre-restoration data on

1. wetland size
2. composition of the bird community (diversity and density), and
3. nesting success

to post-restoration data for 10 treatment (restored) and 10 control (not restored) wetlands.

EXPECTED RESULTS AND BENEFITS:

Preliminary results of research on the breeding bird communities within these off-channel wetlands (pre-restoration) suggest that these wetlands are currently functioning poorly as breeding habitat for species such as the Prothonotary Warbler (*Protonotaria* citrea) which preferentially nest over water (Hoover 2006). The draining of the wetlands by the gullies has resulted in low densities of birds, and poor nesting success as a result of raccoons (*Procyon lotor*) foraging on the exposed mudflats and in the shallow water of the drained wetlands during the breeding season, and subsequently destroying bird nests (Hoover 2006). It is certain that filling these gullies will alter the hydrologic processes of the off-channel wetlands by holding water in the wetlands for longer periods of time and at greater depths than present conditions. This restoration effort should especially benefit the Prothonotary Warbler and other Neotropical migrants associated with these forested wetlands (e.g., Acadian Flycatcher, *Empidonax virescens*; Yellow-throated Warbler, *Dendroica dominica*; Louisiana Waterthrush, *Seiurus motacilla*; Cerulean Warbler, *Dendroica cerulea*).

We now have the unique opportunity to document how this restoration of hydrology (filling gullies that drain off-channel wetlands) affects the diversity, abundance, and nesting success of birds within the bottomland forest ecosystem. This proposed research will 1) determine the response of the bird community to off-channel wetland restoration, 2) measure the success of the restoration efforts of conservation partners (USFWS, Illinois DNR, and The Nature Conservancy), and 3) provide results

that are directly applicable to conservation plans and restoration efforts in other bottomland forest ecosystems. In addition, this proposed project continues the long-term research being conducted on the bird community residing within the Cypress Creek NWR and Cache River watershed, where an intensive bottomland forest restoration/management effort continues. This research will expand our knowledge and increase our ability to effectively and efficiently restore and manage bottomland forests, particularly the restoration of off-channel wetlands.

APPROACH:

This proposal requests funding to study the direct and immediate effects of off-channel wetland restoration on breeding bird communities during the breeding seasons of 2006-2007. During 2003-2005, prior to restoration (pre-treatment), preliminary data on wetland size and bird community parameters were collected (using standardized methods) from 20 off-channel wetlands in the Cache River watershed in Illinois. By the end of 2005, 10 of these wetlands will be affected by hydrologic restoration. Post-treatment data will be collected under the same protocol used to collect pre-treatment data for all 20 wetlands. The surface area of each wetland will be measured, the bird community will be surveyed to determine species diversity and individual species' densities, and nesting success will be monitored for Acadian Flycatchers, Prothonotary Warblers, and others using these wetlands. Comparisons will be made between pre-and post-restoration wetlands, and between treatment and control wetlands. Pre-treatment data will be compared to post-treatment data for the treatment (restored) wetlands. Parallel data collected from "control" (not restored) wetlands will be compared to treatment wetlands. Comparisons of wetland surface area, bird densities and diversity, and nesting success between control and treatment wetlands allow us to determine whether or not changes in the treatment wetlands are a direct result of restoring the off-channel wetlands. The budget reflects the costs of collecting the first two years of post-restoration data and includes the necessary field assistants, field vehicle use, field station use, and research supplies. The field assistants, along with PI Hoover, will implement the research during two breeding seasons (April-July, 2006-2007). At the end of each field season, data will be entered and analyzed and reports and publications will be submitted at the end of each segment with the two year project ending September 30, 2007.

Detailed Methodology

Study Area: This research will be conducted within the Cache River Watershed (CRW) located in Illinois, USA (Fig. 1). The Cache River has a total length of 176 km and meanders through the southern tip of Illinois to the Ohio River, draining 1,537 km^2 of land. Study sites are located within a 192 km^2 portion of the watershed and include isolated tracts of wet floodplain forests, forested sloughs and backwaters, and baldcypress (*Taxodium distichum*) and tupelo (*Nyssa aquatica*) swamps. These wet forested habitats are approximately 9% of the land cover in the watershed and are embedded in a landscape consisting of 32% agriculture, 31% grassland, and 26% upland forest. All individual study sites are located within 1 km of a river or stream (Fig. 2) and their hydrologic fluctuations are influenced to varying degrees by within-channel (river) water depth, runoff from adjacent lands following localized rain events, and the draining of wetlands by lateral gullies that connect some of the wetlands to the river channel.

Stream channelization in Cache River watershed in southern Illinois has led to channel incision in the Cache River. This channel incision has caused the formation of lateral gullies that are currently de-watering (draining) off-channel wetlands (forested wetlands adjacent to the main river channel). This channelization and formation of lateral gullies is not unique to the Cache River watershed in Illinois and threatens the integrity of bottomland forest systems throughout much of the U.S. (Shields

et al. 1998). Recent advances in the science of river and stream restoration have led to the development of Newberry Weirs, which can reduce or eliminate lateral gullying. Twenty-four Newberry Weirs were (or will be) placed in the main channel of the Cache River during 2002-early 2005. The plugging of lateral gullies will restore natural hydrologic processes to the off-channel wetlands that are currently being drained unnaturally. The restoration of these hydrologic processes is paramount to the successful restoration of the bottomland forest ecosystem (Sparks et al. 1998).

There are at least 20 gullies that presently drain off-channel wetlands along the Cache River and Dutchman Creek within the Cache River State Natural Area and Cypress Creek National Wildlife Refuge. These gullies range in size from 50 feet wide and 30 feet deep to 10 feet wide and 6 feet deep. Repair of these gullies will restore pre-disturbance hydrologic processes to approximately 420 acres of wetland and aquatic habitat within the floodplain of the Cache River, including over 250 acres of high quality Cypress-Tupelo swamps. The gullies will be plugged (filled) at the river channel, creating deep water habitat in the gullies themselves and holding water in the forested wetlands away from the river that are currently being drained by the gullies. This management practice will have a profound effect on the habitat, and will subsequently shape the composition of the breeding bird communities in these wetlands (Wakely and Roberts 1996).

Study Organisms: The Prothonotary Warbler (*Protonotaria citrea*) is a migratory bird that winters in the Neotropics and breeds in forested wetlands throughout much of the eastern half of the United States (Petit 1999). This species is territorial and socially monogamous, nests in secondary cavities, and associates closely with standing water in bottomland and swamp forests. Prothonotary Warblers prefer to nest over water (Petit and Petit 1996), readily use nest boxes when available (Hoover 2003), and can be studied in great detail during the breeding season (Hoover 2006). Nesting success in nest boxes is similar to that in natural cavities, and accurately represents the levels of reproductive success they achieve during the breeding season (Hoover 2003, 2006). Raccoons (*Procyon lotor*) are the primary nest predator for this species and rates of nest predation decrease with an increase in water depth below warbler nests (Hoover 2006). Nests over water that is deeper than 60 cm (2 ft) are particularly successful.

We will also focus our efforts on Acadian Flycatchers (*Empidonax virescens*). The Acadian Flycatcher is another Neotropical migratory bird that breeds in deciduous forests throughout the eastern United States (Whitehead and Taylor 2001). Acadian Flycatchers are vulnerable to a variety of nest predators (birds, snakes, and small mammals) (Wilson and Cooper 1998; Whitehead and Taylor 2001), are a common host of the brood parasitic Brown-headed Cowbird (*Molothrus ater*) (Robinson and Robinson 1999, 2001), and are sensitive to negative effects of habitat fragmentation and degradation (Robinson et al. 1995). Acadian Flycatchers are listed as a Regional (in the Bird Conservation Region where our study occurred) and Continental Stewardship Species by the bird conservation group Partners In Flight (http://www.rmbo.org/pif/scores/scores.html). Acadian Flycatcher nests are relatively easy to find and are typically located on the outer tips of tree branches in the subcanopy or canopy of the forest (Whitehead and Taylor 2001). In the Cache River watershed they typically establish territories throughout the bottomland forest system including forested wetlands, along the river channel, and also in the relatively dryer bottomland forests between off-channel forested wetlands. Acadian flycatchers are one of few species with breeding populations distributed fairly evenly throughout the bottomland forest. Most importantly, enough of their nests can be found and monitored at varying locations to adequately test for differences in nesting success between treatment and control forested wetlands.

Measuring Wetland Area: We will measure the perimeter and surface area of 10 treatment (gully plugs added) and 10 control (gully plugs not added) wetlands to determine changes in the surface area that are attributable to the restoration process (gully plugs). During the summers of 2003-2005, perimeters were recorded and areas estimated for each wetland by using a Garmin GPS unit. During the summers of 2006 and 2007 we will again measure the perimeter and area of each wetland and compare the areas of the post-restoration wetlands to what they were prior to the installation of gully plugs (before vs. after). We will also compare the changes in surface areas of treatment wetlands to changes in surface areas of control wetlands (treatment vs. control).

Bird Surveys: Birds in the treatment and control wetlands will be censused during the breeding season (May-June 2006 and 2007) using a standardized point-count method (Ralph et al. 1995). For these surveys we will use a modified version of the point-count method where observers stop for 6 minutes at points that are 150 m apart. Each day, point counts will begin half an hour after sunrise and continue until points to be censused that day are completed (always before 1030 h). At each stop, we record the species, vocalization (song, call, chip, etc.), compass direction, and distance of each bird heard or observed. For cowbirds, we separately record "rattle" calls, which are usually given by females (S. K. Robinson pers. comm.). We will fit as many census points within each forested wetland as possible given the necessary 150-m spacing between points, and the number of census points in treatment and control wetlands will be similar. We will visit each census point one time during each breeding season. Point counts will not be conducted on days when it is raining or when wind speeds exceed 10 mph. Data from these censuses will result in a list of the species present on each site (diversity) as well as a density estimate for each species. Pre-restoration bird diversity and breeding bird densities will be compared to post-restoration estimates, and diversity and density will also be compared between treatment (gully plugs added) and control (gully plugs not added) wetlands.

Monitoring Nesting Success: We will monitor nest boxes (for Prothonotary Warblers) already in place on treatment and on control wetlands, and continue to monitor nest boxes elsewhere in the Cache River watershed during 2006-2007. Nest boxes consist of 1.9-liter (half-gallon) milk and juice cartons (Petit 1989) placed approximately 1.7 m above ground on trees within forested wetlands. Nest boxes are placed on grids with 30-m spacing within each forested wetland and nesting success in nest boxes is similar to that in natural cavities (Hoover 2003). We will monitor nest boxes (and any natural cavity nests that we find) every 4 days from April through July and measure the water depth beneath each nest box on every visit. Upon each visit, we will document whether or not there is an active nest in the box, and for active nests we will record the exact contents (e.g., warbler and cowbird eggs or nestlings). We will visit nests more frequently (every 1-2 days) around the time when eggs are hatching or nestlings are fledging in order to get accurate measures of hatching success and reproductive output. We will take measurements (mass, tarsus and wing lengths) of and place an aluminum USFWS band on the right leg of every Prothonotary Warbler nestling one day prior to when they fledge from nests. For every nest predation event, we will identify the nest predator (based on the condition of the nest and its contents) and document the depth of the water beneath the nest at the time of predation. For each study site we will create a hydrologic profile (area of wetland and depth of water) for the breeding season, and record all nesting activity and the fate of each nest. Rates of nest predation will be estimated for water-depth categories within the range of 0-150 cm.

We will search for and monitor nests of Acadian Flycatchers throughout the forested wetlands within the study area for the duration of each breeding season (15 May to 05 August). We will go to great lengths to find most nests during the nest-building or egg-laying stage. We will use a mirror attached to an extendible pole to view the contents of nests up to 12 m above ground level. Once nests

are located, the contents will be examined every 3-4 days, and the numbers of flycatcher and cowbird eggs or nestlings will be recorded. Nests will be monitored until no longer active (failure caused by nest predation or some other factor, or the successful fledging of young). If a nest is empty when we monitor it near the time when nestlings are to fledge, we will search the area around it for recently fledged offspring. We will document the number of flycatcher fledglings produced for each nesting attempt. Each nest will be classified as parasitized/not parasitized and preyed upon/not preyed upon. Nest-searching efforts will be evenly distributed so that similar numbers of nests are found in the treatment and control areas. Both for Prothonotary Warblers and Acadian Flycatchers, rates of nest predation and nesting success will be compared between sites pre- and post-restoration, and also between treatment and control sites.

Monitoring Warbler Demographics: We will capture all adult Prothonotary Warblers on treatment and control off-channel wetlands (scattered throughout the Cypress Creek NWR and Cache River watershed) and band each unmarked individual with a unique color-band/USFWS aluminum band combination. Males will be captured using a mist net, decoy, and taped playback of a male song. Females will be captured while in the nest box. Prothonotary Warbler nestlings will be banded with a USFWS aluminum band when they are 9-10 days old (approx. 1-2 days before fledging). We will follow individual pairs of warblers throughout the breeding season and record, for each pair, nest-site location(s) and reproductive output (number of offspring produced per pair). Reproductive output will then be compared between pre-treatment and post-treatment wetlands and between treatment and control wetlands. By having color-marked adults and banded fledglings, we will also be able to document whether the between-year breeding site fidelity of adults is affected by the restoration of the forested off-channel wetlands (e.g., higher return rates to sites where nesting success is better; Hoover 2003) and whether warbler fledglings return to breed near where they were produced. This information is critical because it will allow us to better understand how local conservation efforts affect (benefit) the local population dynamics for one of the species we are trying to conserve.

Other Information

Bottomland forests are a prime example of an ecosystem in peril, because only 20 million ha remain out of an historical area of over 100 million ha and the loss of bottomland hardwoods is nearly five times greater than for any other major hardwood forest type (Abernethy and Turner 1987, Gosselink and Lee 1989). In bottomland forest ecosystems, hydrology is the ecosystem process responsible for modifying and perpetuating the habitat within the system (Pashley and Barrow 1993). The interplay of topography and hydrology creates and maintains this complexity of habitats and promotes high levels of biodiversity (Kozlowski 2002). Intact bottomland forest ecosystems are especially valuable because they support a high diversity and density of breeding Neotropical migratory birds (Wakeley and Roberts 1996, Sallabanks et al. 2000). The Prothonotary Warbler, Acadian Flycatcher, Cerulean Warbler and Louisiana Waterthrush are Birds of Conservation Concern either within the Bird Conservation Regions (BCRs) where the research will occur, or in adjacent BCRs which will be able to use the results of this research to better conserve these species. In addition, each of these species (plus the Yellow-throated Warbler) is listed on the Partners In Flight U.S. Watch List as either Extremely or Moderately High Priority.

Stream channelization, channel incision, the associated formation of lateral gullies, and the resulting draining of off-channel wetlands threaten the integrity of bottomland ecosystems and the quality of bottomland forests as breeding habitat for Neotropical migratory birds (Pashley and Barrow 1993, Sallabanks et al. 2000). Riffle weirs and gully plugs are a means to restore off-channel wetlands

and improve conditions for breeding birds. This conservation tool could be an invaluable component of bottomland forest ecosystem management and restoration plans. This proposed research provides the opportunity to document how off-channel wetland restoration affects the diversity, abundance, and nesting success of birds. The research is particularly valuable because it is founded on a sound experimental design with preliminary data and treatment and control sites.

This research represents the merging of research with conservation in action and continues the partnership between the Illinois Natural History Survey and the members of the Cache River Joint Venture. The research proposed here will expand our knowledge and increase our ability to effectively and efficiently restore and manage bottomland forests. This research will ultimately provide guidelines to promote restoration and management practices that will provide the greatest benefit to Neotropical migratory birds residing in bottomland forest ecosystems. Also, the conservation issues being addressed and the results of this research have broad application and will assist with other bottomland forest restoration efforts in the Midwest and throughout the United States.

Evaluation

Too often the effects (i.e. success) of conservation/restoration efforts are not measured in terms of responses of the biota to the specific conservation action. The research described in this proposal is designed to evaluate the success of a conservation action that should benefit breeding Neotropical migratory birds. That evaluation will involve comparisons of wetland size, bird diversity, bird densities, and nesting success between treatment (gully plugs added) and control (gully plugs not added) wetlands, and between pre-treatment and post-treatment wetlands. Therefore the success of this research and monitoring project will be measured in terms of our ability to collect the necessary census and nesting data that will allow us to determine the benefits of wetland restoration for these breeding birds. An additional indication of the success of the project will include the submission of timely reports to resource management agencies and manuscripts to peer-reviewed journals.

LOCATION: Cache River State Natural Area watershed in southernmost Illinois. Specifically in Union, Johnson, and Pulaski Counties, Illinois. See attached Figures 1 and 2 for general location of study (Fig. 1) and specific locations of Treatment and Control wetlands (Fig. 2)

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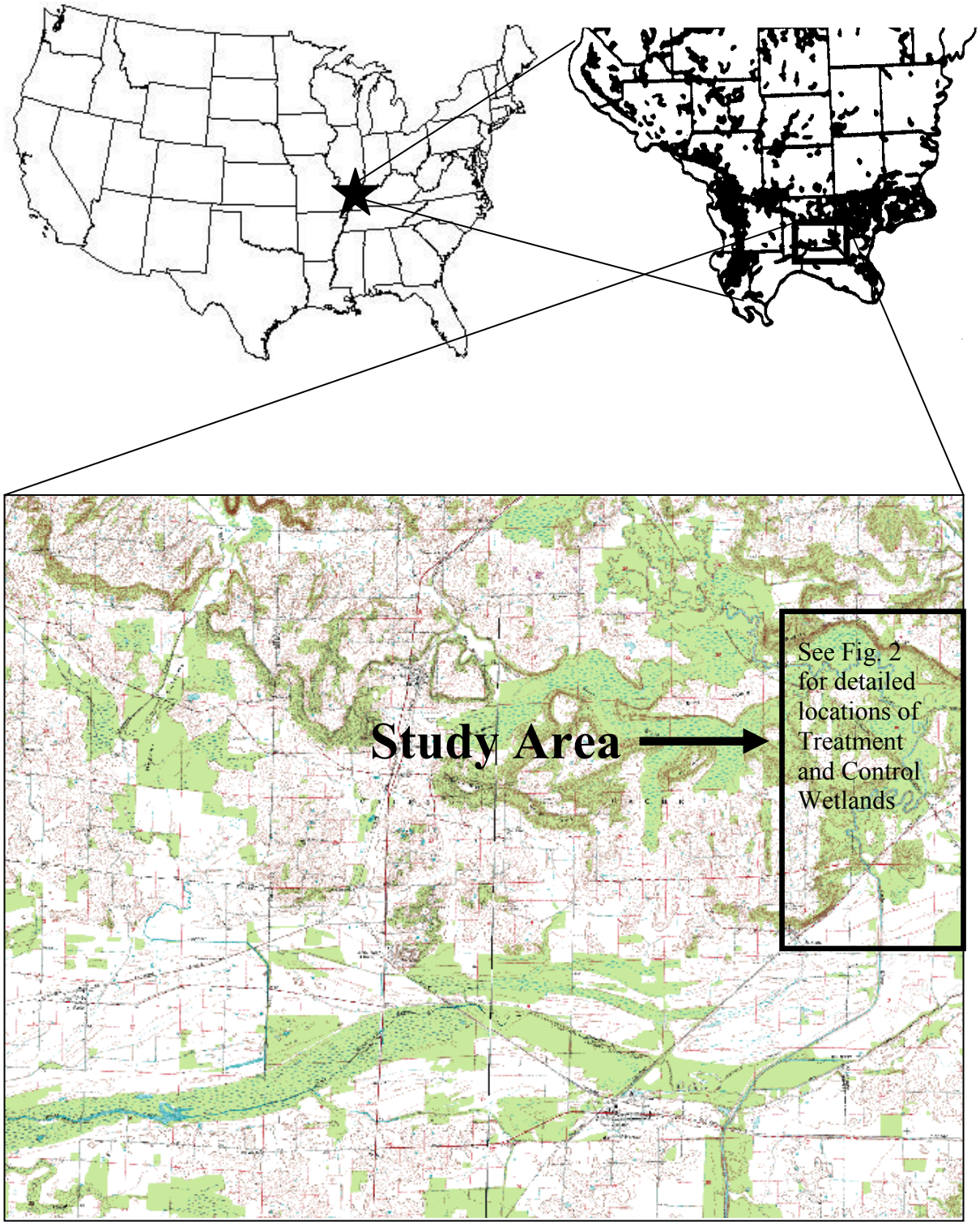
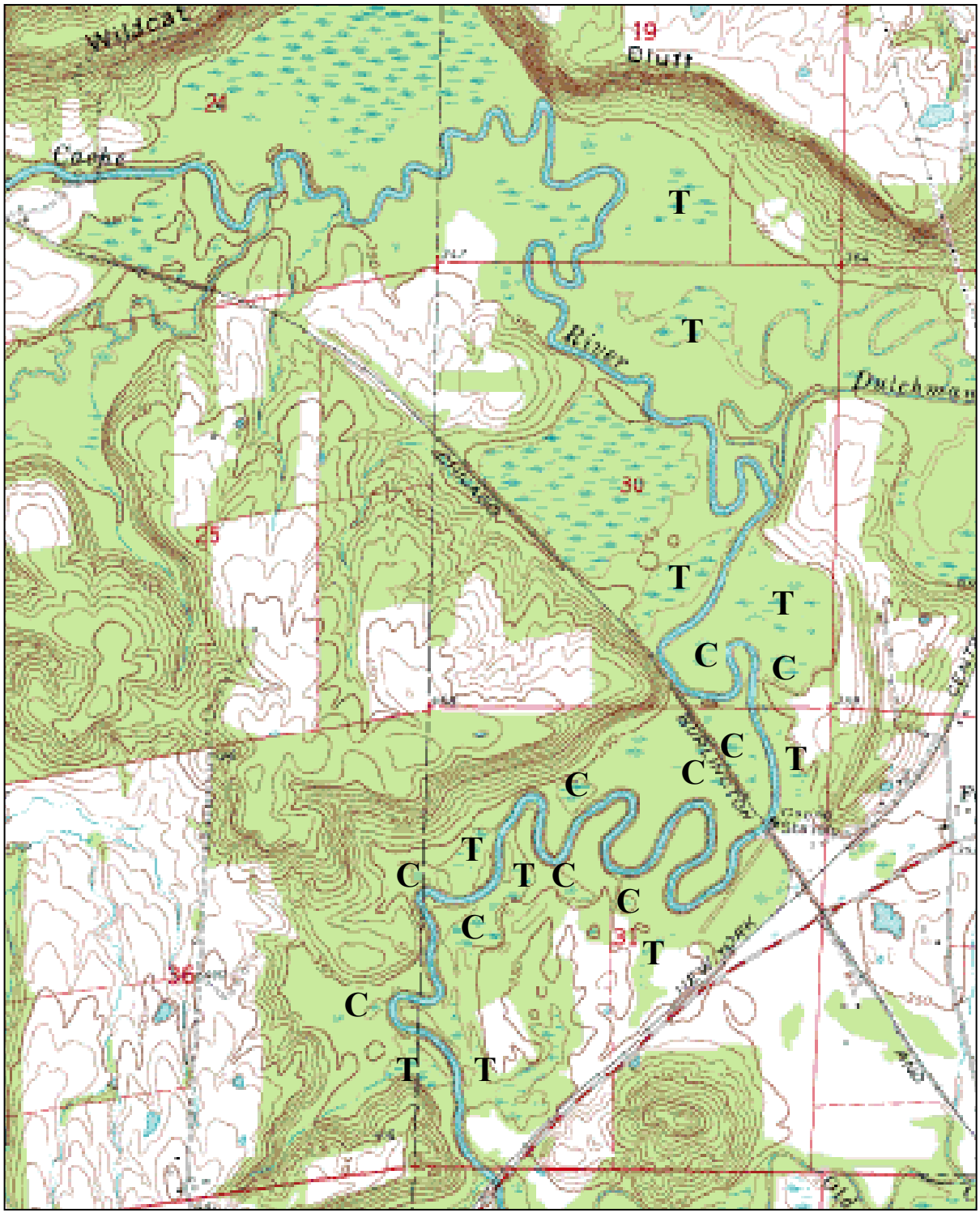

Study Area
See Fig. 2 for detailed locations of Treatment and Control Wetlands

Figure 1



T=Treatment Wetland
C=Control Wetland

0 0.5 1 km N

Figure 2