Current Research at Neal Smith National Wildlife Refuge as of June 3, 2005

Principle Investigator: Daryl Smith
Masters Student: Ryan Welsh
Institution: University of Northern Iowa, Cedar Falls, IA
Project Title: Use of side oats grama (*Bouteloua curtependula*) as a prairie planting matrix for weed suppression and establishment of native forb diversity.
Purpose: To determine the effects of seeding rates of side-oats grama on native forb and grass establishment and on weed densities in a new prairie planting, as well as investigating effects of mowing and non-mowing treatments on seeding treatments.
Refuge Implications: Study indicates possible new approaches in more efficient prairie establishment and weed suppression.

Principle Investigator/Institutions: Cynthia Cambardella[1], Pauline Drobney[2], Keith Schilling[3], Mark Tomer[1], Peter Jacobson[4]

1- Soil Scientists, USDA/ARS NSTL, 2150 Pammel Dr. Ames IA
2- USDI/FWS NSNWR, Prairie City IA
3- IDNR/GSB, Iowa City IA
4- Dept of Biology, Grinnell College, Grinnell IA

Project Title: Integrated monitoring of soils, hydrology, and flora across a landscape in the early phases of prairie reconstruction.
Purpose: Work is focused on linking landscape-scale C and hydrologic cycles to groundwater nitrate-N and DOC for a small (12 ha) hydrologic catchment area within a new prairie reconstruction site which was seeded in the fall of 2003. Neutron-probe access tubes were installed along 15 monitoring transects along hillslopes, plus 2 more across runoff drainageways. These transects to allow repeated measurements of soil moisture. Runoff collectors are used to document areas of runoff generation on the landscape. Suction cup lysimeters allow water samples to be collected from the unsaturated zone for analyses of nutrients, dissolved carbon, and other inorganic constituents. Soil moisture, runoff, and soil water chemistry are being monitored. Floristic studies along transects relates to soil and water characteristics.
Refuge Implications: Provides basic information about the process and function of prairie reconstruction. This study serves as a model for the entire refuge and can provide information critical to controlling erosion, strategic placement of seed of various species relative to water and soil condition. It indicates changes in qualities of water and soil with establishment of vegetation and predicts time needed for changes in water quality in stream and groundwater.

Principle Investigator: Keith Schilling, Pauline Drobney
Institutions: Iowa Geological Survey, Iowa City, IA, and NSM respectively
Project Title: Conversion of reed canary grass (*Phalaris arundinacea*) dominated area to diverse sedge meadow, considering the effects of channel incision on riparian zone hydrology.

Purpose: To investigate effectiveness of an approach to conversion of a reed canary grass dominated area to a diverse sedge meadow, considering floristic changes and changes in hydrology.
Refuge Implications: Study provides basic information about conversion of a highly invasive species that dominates riparian areas and upland drainages on the refuge and in prairie reconstructions/restorations throughout large portions of the Midwest. Also provides information about ecosystem function relative to hydrology that is important in stream restoration.

Principle Investigator: Heidi Asbjornsen
Institution: Iowa State University, Ames, IA
Project Title: Oak savanna research at Neal Smith National Wildlife Refuge: hydrologic response of degraded oak savannas to restoration treatments.
Purpose: To understand changes in plant species composition and ecological functioning in response to restoration treatments. Treatments include woody species thinning, and fire application vs. controls. Additionally, researchers are interested in understanding how interactions between trees and the understory herbaceous vegetation in restored and degraded savanna ecosystems regulate the cycling of water and nutrients throughout the system.
Refuge Implications: Study will inform savanna restoration process by indicating effectiveness of treatments, and will provide basic ecosystem function information that is important in relating restoration of biota to hydrology.

Principle Investigator: Bret Geisler
Project Title: Breeding bird point count on four cover types.
Purpose: To monitor breeding bird use of the refuge on four cover types and relative to management treatments.
Refuge Implications: Study indicates bird use of the refuge, including increases or declines in species of concern. Data can be used to develop an understanding of bird species using restoration/reconstruction phases, and therefore, provides information for adaptive management.

Principle Investigator: Heidi Asbjornsen
Institution: Iowa State University, Ames, IA
Collaboration: Researchers involved in this project and their respective institutions are as follows: *Iowa State University:* Rick Cruse, Matt Helmets, Matt Liebman, and Lisa Schulte. *The National Soil Tilth Lab*: Cindy Cambardella and Mark Tomer. *Iowa Geologic Survey/DNR*: Keith Schilling. U.S. Forest Service: Dave Lytle, Randy Kolka. New collaborators from *Iowa State University* who will likely participate in future research include: Cathy Kling, German Mora, Matt O'Neil, Jean Opsomer, and Silvia Secchi. Graduate students involved in the project include: Melissa Cheatham, Greg Shepherd, and Mario Perez-Bidegain. In addition, Maged Nosshi has been working as a

research associate on this project since August 2004, and will most likely continue until August of 2005.
Title: Agroecosystem restoration research at Neal Smith National Wildlife Refuge: integration of water, nutrient and carbon cycling under diverse annual-perennial plant communities in agricultural landscapes
Purpose: Objective 1) to quantify the influence of different proportions and landscape configurations of annual (e.g., corn and soybean) and perennial (e.g., prairie, savanna, agroforestry) plant communities on the storage, cycling, and output of nutrients, water, and carbon at the field and catchment scale. Objective 2) to catalyze change on the landscape by promoting greater understanding among diverse groups of people (i.e., the public, policy makers, farmers, environmentalists, etc.) that agroecosystem production and environmental stewardship are compatible when appropriate combinations and configurations of perennial and annual plants are established. A major component of addressing this objective will involve educational and outreach activities coordinated through the Land Management and Demonstration Refuge Program at NSM.
Refuge Implications: Potentially indicates methods for use of native vegetation in the agricultural landscape on-refuge and off-refuge that provide habitat for native species and cleaner water and soil retention in farming practices. Project also provides outreach to an audience that might otherwise be less informed about or interested in prairie.

Principle Investigator: Brian Wilsey
Institution: Iowa State University, Ames, IA
Project Title: Relationship of vegetation to Bison/elk grazing.
Purpose: To determine effects of bison/elk grazing on plant species diversity and biomass in prairie plantings.
Refuge Implications: Provides information on bison/elk carrying capacity in enclosure, and provides information about impacts and relationships of grazing on prairie reconstruction.

Principle Investigator: Keith Schilling
Institution: Iowa Geological Survey, IDNR, Iowa City, IA
Project Title: A ten year study of hydrology comparing Walnut Creek and Squaw creek watersheds.
Purpose: To monitor ground water, and surface water movement, volume, and relate to hydrologic inputs to determine water budgets for a watershed dominated by ecological restoration land use compared to agricultural use. To determine surface water chemistry 10 sites in both watersheds on a regular basis throughout the year, and analyze for temperature, pH, specific conductance, dissolved oxygen, redox and turbidity in the field using a Hydrolab H20 water analyzer. Anions, fecal coliform, pesticides and phosphorus analyses will also be provided.
Refuge Implications: Study provides direct information about the effects of ecological restoration on water quality, stream flow, water budget, erosion, nutrient and sediment loading, and implications of prairie reconstruction/restoration on hydrology.

Principal Investigators and Institutions: Thomas Isenhart and Richard Schultz, Department of Natural Resource Ecology and Management, Iowa State University, Ames; Keith Schilling, Iowa Geological Survey, Iowa City, Iowa
Title: Quantifying the role of riparian land use on stream bank erosion and nutrient pollution
Purpose: Objectives: 1) Measure the amounts of sediment and nutrient losses from stream bank erosion in riparian areas managed as ungrazed grasslands, grazed pastures, wooded riparian areas, reestablished native prairie buffers or cropland with and without buffers on the Neal Smith National Wildlife Refuge and on producer farms in the Squaw Creek watershed. 2) Quantify the reduction of sediment and nutrient loss from stream bank erosion in grazed riparian areas where fencing excludes livestock from the channel on producer farms with whom we worked during a previous study. 3) Monitor a sub-set of stream bank erosion sites in northeast, central and southeastern Iowa from the previous study that have been monitored for three years. The extended survey time will provide more temporal data that is so critical for watershed studies.

Refuge Implications: Sediment, phosphorus and nitrogen loading of Midwestern streams produces major pollution problems in these surface waters. While upland sediment and nutrient flow likely contribute to non-point source pollution of surface water sources, sediment and nutrient flows from riparian row cropped fields, congregating areas within riparian pastures, stream bank erosion, or direct deposition of feces and urine may be more important to stream water quality because of their proximity to the streams. **This provides important information about the effects of off-refuge farming practices to refuge efforts at ecological restoration. It also provides important information about erosion processes, so prevalent in former agricultural land.**

Principle Investigator: Keith Summerville
Institution: Drake University, Des Moines, IA
Project Title: Beyond site specific assembly rules: species traits as predictors of the frequency of occurrence of Lepidoptera in restored tallgrass prairies.
Purpose: The goals of this study are to sample the regional species pool of Lepidoptera and to determine whether combinations of species traits predispose species toward becoming members of the actual species pool within restored prairies.
Refuge Implications: Invertebrates are critical components of tallgrass prairie and savanna ecosystems. This study provides information about Lepidoptera on the refuge, and relates findings to flora and thus, to refuge management. It also relates refuge Lepidopteran diversity to that found on other sites.

Principle Investigator: Steve Spangler
Institution: Independent
Project Title: Arthropod diversity on prairie plantings
Purpose: To determine arthropod use of early prairie reconstruction on the refuge.

Refuge Implications: Study further defines use of prairie reconstruction by invertebrates including Homoptera, Hemiptera, Coleoptera taxa. Understanding changes in these invertebrates from initial planting year through time can provide information about availability of food for wildlife including grassland birds.

Principle Investigator: Scott Bryant and Inger Lamb
Institution: Independent
Project Title: Mycorrhizal symbiosis at Neal Smith National Wildlife Refuge
Purpose: This study involves a survey of mycorrhizal associations in remnant (virgin) and reconstructed prairies at Neal Smith National Wildlife Refuge. Techniques for root sample processing and spore isolation and identification will be developed to fit the facilities. The results will be establishment of baseline data and experimental protocols that will be used to direct and develop future research on this important soil component. Data produced will be made available to any interested party, with the intent of encouraging follow-up studies by graduate students, interns, and other researchers from a wide range of institutions
Refuge Implications: Mycorrhizae are one of the soil biological components frequently ignored or at best poorly evaluated and understood. Essentially no research has been done documenting the extent or importance of mycorrhizae in Iowa prairies. This research will provide basic information about potential benefits and essential nature of this common root-fungal symbiosis, and the probable importance in the prairie ecosystems being re-established in Iowa.

Principle Investigator: Diane Larson et al
Institution: Northern Prairie Wildlife Research Center, USGS
Project Title: Evaluation of methods for Canada thistle-free habitat restoration
Purpose: To determine potential suppressive effects on Canada thistle (Cirsium arvense) establishment among 3 seed mix treatments, two planting season treatments, and two seeding methods.
Refuge Implications: Provides information about exotic species suppression and selection of best management practices for prairie reconstruction.

Principle Investigator: Robert Woodward
Institution: Drake University, Des Moines, IA
Project Title: Monarch butterfly use of Neal Smith NWR for reproduction and migration
Purpose: To determine use of monarchs for reproduction and migration on selected sites and on driving tours.
Refuge Implications: Determines contribution of the refuge to conservation of butterfly species of international concern.

Principle Investigator: Walt Sadinski
Institution: Upper Midwest Environmental Sciences Center, USGS, La Crosse, WI
Project Title: The Distribution and relative abundance of amphibians and reptiles on the Neal Smith NWR and the implications for management actions related to restoration of tallgrass prairie, wetlands, and woodland habitats
Purpose: To establish NSM as a long-term monitoring site and a research site for studying causes of declines in Blanchard's cricket frogs and other species on selected sites.
Refuge Implications: NSM has an opportunity to restore native assemblages of such species on the refuge in a region where natural habitat is rare due to human activities. To do so, data that describe which species currently live in or near the refuge and in what numbers are needed. Data on habitat needs and use for reproduction, foraging, and overwintering, as well as connectivity to other suitable habitat outside of the refuge are also critical. We propose to begin to obtain such data during 2004 via extensive and intensive sampling, trapping, and GIS analyses.

Principle Investigator: Rebecca McCulley; Postdoctoral Fellowship
Institution: Duke University, Durham, N.C.
Project Title: Carbon storage consequences of land use change in the tallgrass prairie region of North America.
Purpose: To 1) determine current ecosystem C storage of native tallgrass prairie relicts across the pre-settlement range, 2) quantify the soil C consequences of restoring abandoned cultivated fields to tallgrass prairie or woodland, 3)evaluate the differences in the processes controlling soil C storage between tallgrass prairie and woodland, and 4) explore the long-term differences in soil C sequestration between restored grassland and woodland and the time-scales required for each vegetation type to reach maximum levels of C sequestration.
Refuge Implications: NSM is one sampling point of a large study. Refuge will understand relationship of refuge to national prairie C issues.

Principle Investigator: Mahdi Al-Kaisi
Institution: Iowa State University, Ames, IA
Project Title: Evaluation of water infiltration and related soil Physical, chemical, and biological properties across topo- and chrono-sequence of native and reconstructed prairies
Purpose: The main objectives of this research are to: 1) investigate infiltration rates of native prairie, mature reconstructed prairie, and row crop soils in south central Iowa, 2) evaluate the impact of soil carbon, bulk density, aggregate stability, and microbial populations on soil infiltration rates of different prairie grass systems and landscape positions.
Refuge Implications: The slope positioning and time of establishment of prairie grasses can significantly impact water infiltration due to their impacts on soil carbon distribution, soil microbial population, sediment movement, and a whole suite of other related properties. Evaluating these parameters along with infiltration rate will help refuge staff understand the impacts of landscape position, time, and management practices on these soil properties.