

2007 FIELD STATION ANNUAL REPORT



UNIVERSITY of WISCONSIN
UWMILWAUKEE

Field Station

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On the Cover: On 4 September 2007, the Aviation Support Unit of the US Army National Guard used two Blackhawk helicopters to airlift boardwalk sections and materials to the "east island" in the heart of the Cedarburg Bog. Boardwalk sections and supports had been pre-assembled by Field Station staff and volunteers from the Friends of Cedarburg Bog with materials purchased by the Friends group. The boardwalk sections are being used to rebuild the portion of the boardwalk east of the "east island" and in the string bog. Construction of this last portion of the boardwalk to be rebuilt was nearly completed in the fall of 2007.

Director: James A. Reinartz
 Manager/Staff Biologist: Gretchen A. Meyer
 Field Station Committee: Douglas Cherkauer, Peter Dunn, Timothy Ehlinger, Millicent Ficken, Glen Fredlund, Tim Grundl, Jeffrey Karron (Chairman), Craig Sandgren, Stefan Schnitzer, Thomas Schuck, Linda Whittingham, Erica Young

About Us

2007 Highlights

- Projects funded by the UWM Research Growth Initiative grant to study change in the plant and animal communities at the Field Station and in the Cedarburg Bog were very active in 2007.
- The *Friends of the Cedarburg Bog* sponsored several events and donated a large number of volunteer hours in 2007. The Friends also raised all of the funding needed to complete the rebuilding of the Field Station boardwalk in the Cedarburg Bog.
- Jim Reinartz received a State Wildlife Grant to study the "Conservation, management, and restoration of tamarack in southern tamarack swamps".
- Reconstruction of most of the string bog loop of the boardwalk was completed in fall 2007.
- 49 research projects conducted in 2007.
- Over 11,000 student hours of instruction and group use in 2007.

The UWM Field Station – An Outdoor Laboratory

The UWM Field Station is used as an outdoor laboratory by researchers from various disciplines, including plant and animal ecology, evolutionary biology, ethology, taxonomy, geology, hydrology, and climatology. Located in the Town of Saukville, Wisconsin, about 30 miles (45 minutes) north of Milwaukee, the main Station facility has about 2000 acres including a wide variety of habitats available for research and teaching. The University of Wisconsin-Milwaukee owns approximately 320 acres, most of which were donated by The Nature Conservancy in 1965. Research at the Station has produced 265 scientific publications and 134 theses since 1970.

Natural Areas at the Field Station

The Cedarburg Bog State Natural Area - One of the largest and the most biologically diverse of the wetlands in southern Wisconsin, is accessible to researchers and classes by the Field Station's boardwalk. Shallow and deep lakes, marshes, shrub carrs, sedge meadow, hardwood swamp, conifer swamp, and the southernmost string bog in North America are just some of the vegetation types of the Cedarburg Bog. Populations of at least 35 species of higher plants and 19 birds are at or near the southern edge of their range in the Bog. The Bog is part of the national system of Experimental Ecological Reserves established by the National Science Foundation and The Institute of Ecology. A "Guide to the Natural History of the Cedarburg Bog," which serves as a ready introduction and reference source for researchers and educators using the Bog, is available from the Field Station and on our website.

The Cedarburg Beech Woods State Natural Area – 80 acres of one of the finest mature beech-maple forests in southern Wisconsin. The beech-maple forest and the Cedarburg Bog are each State Natural Areas, and are classified as National Natural Landmarks by the Department of Interior.

The Sapa Spruce Bog State Natural Area – 12 acres of highly acidic black spruce/tamarack bog and 11 acres of swamp hardwoods. The southernmost black spruce bog in Wisconsin, the small, acidic, Sapa Spruce Bog provides an ecological contrast to the large, neutral-pH, Cedarburg Bog, with which it shares most of its flora.

Old Agricultural Fields – Over 100 acres in various stages of succession are available for experimental research. A history of the use and management of the fields over the past 38 years is maintained. Six separate areas in the old fields have been planted with prairie species native to Wisconsin.

A new experimental prairie area planted in the "North Hay Field" in the fall of 2005 was managed during the 2007 growing season and is becoming very well established.

Management – The primary management that Field Station natural areas receive is maintenance of trails and control of invasive exotic plants. Glossy buckthorn (*Rhamnus frangula*), common buckthorn (*Rhamnus cathartica*), Tartarian honeysuckle (*Lonicera tatarica*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), meadow parsnip (*Pastinaca sativa*), purple loosestrife (*Lythrum salicaria*), sweet clover (*Melilotus* spp.), motherwort (*Leonurus cardiaca*), and garlic mustard (*Alliaria petiolata*) are all present, and being controlled in the Field Station natural areas. The Friends of Cedarburg Bog held several volunteer workdays during 2007 contributing about 35 person days to help Field Station staff with our efforts to control invasives. Only glossy buckthorn in the Cedarburg Bog is currently so widespread and abundant that it seems to be beyond control with the hand and mechanical methods we are using elsewhere. Fruiting-sized glossy buckthorn has been removed, and continues to be excluded, from a 6-acre plot and a 45-acre plot at the center of the Bog. The Wisconsin Department of Natural Resources has also been removing glossy buckthorn from large areas of the northern portion of Cedarburg Bog. During the winter of 2006-07 contracted work crews removed buckthorn from over 100 acres. This work is being continued during the 2007-08 winter.

Research and Teaching Facilities

General Facilities

- Office/classroom building with meeting rooms, teaching lab, and computer lab.
- A new Research Lab constructed in 2004
- Service building – machine shop & woodshop
- The Farm House for researcher & student housing – Window replacement and construction of new bunk beds completed in 2007

- Natural areas marked with a permanent grid – Accurately GPS-located in 2005
- Boardwalk to the center of the Cedarburg Bog
- 14 aquatic mesocosms (200 gallon tanks)
- Several small boats, canoes, and trailers
- Global Positioning System equipment
- Extensive map and aerial photo collection

Hydrology, Meteorology & Phenology

- Extensive array of environmental sensors recorded by a digital data logger
- Phenological observation garden & native plant observations maintained
- Lysimeter pit in the old-growth forest
- Transect of piezometers from upland to Bog

Animal Ecology & Behavior

- Large outdoor experimental aviary
- Sound analysis lab & recording equipment
- Video equipment, cameras, night vision scope
- Live traps & animal holding facilities
- Extensive arrays of bird nest boxes
- Insect collection, small mammal & bird study skins

Experimental Garden

- 9 fenced research gardens
- Shade lattice, water & electricity
- A 30' x 60' screen house, constructed in 2005, for studies of pollination biology
- A screen house for studies of plant-insect interactions
- Greenhouse & garden building
- High capacity irrigation well
- Farm & cultivating machinery

Plant Ecology

- Herbarium & Plant lists
- Plant identification lab
- Vegetation sampling & surveying equipment
- Fenced deer exclusion plots in various plant communities and habitats

Outlying Natural Areas

Neda Mine Bat Hibernaculum State Natural Area – An abandoned iron mine, located on the Niagara Escarpment near Mayville and Horicon, Wisconsin, is the largest bat hibernaculum in the Midwest. Up to 200,000 bats of four species (Little brown bats, Big brown bats, Eastern pipistrelles, and Northern long-eared bats) use the hibernaculum. The hibernaculum has the infrastructure and instrumentation to be a productive facility for research on the behavioral ecology of bats at a major hibernaculum. An infrared beam system provides continuous counts of bat flights through the entrances to the mine. The mine is also of geological interest; its cliffs provide an excellent exposure of the Niagara Dolomite and the only accessible exposure of the Neda Iron formation.

Neda Beechwoods State Natural Area – Lies on the Niagara Escarpment, just north of Neda Mine and is a well developed stand of American beech (*Fagus grandifolia*) at the western boundary of its range.

Benedict Prairie – Near Kenosha, is a 6-acre tract of virgin prairie along a railroad right of way that has a remarkably diverse flora. A vascular plant species list for Benedict Prairie has been published in the Field Station Bulletin.

Downer Woods Natural Area – An 11.1-acre fenced woodlot, is an island of forested natural area in an intensely urbanized setting on the UWM campus. The Field Station assumed management of Downer Woods in 1998. Since that time we have been working very hard to control the garlic mustard, buckthorn, and honeysuckle with funding provided by the University.

Field Station Programs

- 49 active research projects conducted at the Field Station in 2007.
- Including: 6 M.S. thesis, 4 Ph.D. and 15 studies by researchers from outside of the University.
- 9 papers published during 2007. Several others are in press.

Database Development

The collection of a variety of long-term data is an important part of the Field Station's research program. The Station gathers long-term records, which include species lists, weather data, hydrologic studies, small mammal population studies, population fluctuation of certain avian species and ecological studies of various plant communities.

Examples of our databases include:

- Vascular plant flora of the Field Station area (including approximately 720 taxa) & excellent herbarium.
- A complete stem map and diameter measurements of all trees in 5.5 acres (2.25 hectares) of the beech-maple woods first censused in 1987.
- Repeated surveys of the entire beech-maple forest at the permanent grid locations.
- A complete, quantitative, survey of the vegetation of the Cedarburg Bog, first conducted in 1991 and repeated in 2006.
- The Charles Weise 30-year study of Dark-eyed Juncos, including mark-recapture estimates of population size, age and sex composition, and seasonal and daily physiological changes in the wintering population.
- The Charles Weise 27-year intensive study of the Black-capped Chickadee, with a color-marked population of approximately 300 birds. This study involved precise monitoring of population changes throughout each year, analyses of dispersal mechanisms of juvenile

birds, survival rates of juveniles and adults, dominance rank of flock members, and key-factor analyses of causes of fluctuation.

- The Charles Weise 26-year breeding bird survey of the Cedarburg Bog & upland woods from 1971 to 1996, repeated in 2006 and 2007.
- The Charles Weise 30-year bird-netting and banding program conducted in fall.
- The Field Station is a major site for long-term studies of avian vocalizations, including their organization and function.
- GIS system developed for the Field Station area.

Educational Programs

- Over 11,000 student hours of instruction and group use in 2007.
- Seven workshops on advanced topics in natural history were filled to capacity.
- Three undergraduate student interns.
- Three undergraduates doing independent research studies (699 projects).
- Programs for the general public on: Winter ecology, Spring frogs and woodcocks, Bird migration, Spring flora, Medicinal plants, Mud Lake ecology, Bird banding, and the Ecology of the Cedarburg Bog.
- The guidebook to the Bog is available to teachers using the boardwalk for instruction.
- Several field ecology exercises developed for the Field Station are available to instructors



The Friends of the Cedarburg Bog

The mission of the Friends of Cedarburg Bog is to help preserve and study the Cedarburg Bog and to make the public more aware of its uniqueness. Specifically, their objectives are:

- To support research, including long-term monitoring.
- To assist in land preservation, management and stewardship.
- To develop formal and informal opportunities for public education.
- To generate volunteer labor for natural area management, education, public events, monitoring and research, and facility development and maintenance.
- To raise funds to support the activities of the group as defined above.

The Friends of Cedarburg Bog raised over \$13,000 in 2007 for materials to reconstruct the Field Station boardwalk east of the 'east island' in the Bog. Much of this funding was donated by family and friends in the memory of Don Bezella, long-time lover of the Bog and Mud Lake, who died late in 2006. Don was a founding member of the Board of Directors of the Friends. The Friends also obtained grants from the James J. Schwabe Endowment Fund, the Norma & Stanley DeBoer Quiet Trails Fund, and a Besadny Conservation Grant.

In 2007 the Friends helped sponsor 14 educational events for the general public. Volunteers from the Friends contributed approximately 95 person-days of labor, including natural area management and boardwalk construction, publishing a newsletter, raising funds, and sponsoring and providing staff for events. If you are interested in the Field Station's programs and activities, or you wish to support the preservation of the Cedarburg Bog State Natural Area, please consider joining the Friends group. Contact the Field Station for information on how to become involved!

Abstracts of Research

Invasion and Displacement of Native Vegetation by *Rhamnus cathartica*: Toward a Mechanistic Understanding

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Rhamnus cathartica (common buckthorn) has aggressively invaded many Eastern Deciduous forests of the United States, including those in Wisconsin. Buckthorn commonly forms dense thickets and appears to exclude native woody vegetation by reducing light to levels below which natives can regenerate. Alternatively, buckthorn may exclude native vegetation by below-ground competition or allelopathy. The extent to which buckthorn excludes natives and the exact mechanisms by which it accomplishes this remain unknown. Using a combination of experimental approaches, we are testing the degree to which buckthorn excludes the regeneration of woody plants and by what mechanism. In one experiment, we are testing whether buckthorn does indeed exclude native vegetation and whether this effect varies among species. To accomplish this, we are following the growth of buckthorn recruits and native woody species in 12 paired plots; for each pair, we have removed existing buckthorn from one plot but allowed it to remain in the other. In a

second experiment, we will test whether buckthorn prevents native vegetation from establishing via above- or below-ground effects. To test for below-ground competition from this invasive, we will monitor the growth of buckthorn seedlings and woody plants in buckthorn thickets in which the buckthorn is tied back to reduce above-ground competition from it. We will compare seedling establishment and growth from this treatment to that of seedlings in paired plots in which we have removed buckthorn but simulated above-ground competition using shade frames. Preliminary results show that removing buckthorn significantly increased native seedling recruitment (Wilcoxon, $p = 0.011$). Removal also increased buckthorn recruitment, but the difference between treatments was only marginally significant ($p = 0.077$). These findings show that buckthorn is excluding native species and its own seedlings, but to a lesser extent. M.S. Thesis research, Stefan Schnitzer, Major Professor.

Nutrient limitation and morphological plasticity of the carnivorous pitcher plant *Sarracenia purpurea* in contrasting wetland environments

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The Northern Pitcher Plant, *Sarracenia purpurea* L. subspecies *purpurea* is a carnivorous wetland plant found over a large area of North America from the Great Lakes northeast to Maine and northwest to British Columbia. In southeastern Wisconsin two nearby populations of *S. purpurea* are found in contrasting wetland environments - an open neutral pH minerotrophic fen and a

shady acidic ombrotrophic black spruce bog. We assessed nutrient limitation in both populations and examined leaf nutrient content and morphological plasticity of the two populations of *S. purpurea* using a reciprocal transplant experiment between the two wetlands. Plant morphological traits were monitored over two growing seasons, along with dissolved nutrients (nitrate,

ammonium, phosphate) in surface water and leaf N and P content. Leaf N and P content declined with leaf age ($p < 0.001$) and varied with position in the leaf. Leaf N and P concentrations were higher in the bog than in the fen but in both wetlands, plants were limited by N but not P (N content $< 2\%$ DW-1, N:P < 14) although photosynthesis was not compromised by N limitation as quantum yields were high ($F_v/F_m > 0.79$). Despite use of carnivory, leaf N content correlated with dissolved N availability in the wetlands (leaf N vs NO_3^- , $r_2 = 0.344$, $P < 0.0001$) and N acquisition via carnivory did not overcome N limitation. Plants in the bog had longer leaves and wider keels than plants in the fen. Following transplantation, leaf morphological traits changed along

with N content in new leaves to become like plants in the new environment, reflecting wetland nutrient availability. Changes in leaf morphology were faster when plants were transplanted from fen to bog than from bog to fen, possibly reflecting a more stressful environment in the bog but leaf morphology changes were not significantly correlated with seasonal photon dose. Previous studies suggested that morphology of *S. purpurea* responds to experimental fertilization of pitchers with high inorganic N concentrations. This study is the first to demonstrate that leaf N and P content and morphology of *S. purpurea* also responds to natural wetland nutrient availability. M.S. Thesis Research, Dr. Erica Young, Major Professor.

Somatochlora hineana Survey and Habitat Assessment at the Cedarburg Bog

Lesley Brotkowski

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Adult *S. hineana* have been observed at Cedarburg Bog, located in Ozaukee County, WI, for several years. Breeding habitat was first verified at Cedarburg Bog in 2006 when *S. hineana* larvae were collected from crayfish burrows located on this site. Quantifying the abundance of *S. hineana* larvae in this wetland is critical to protecting this particular population, which is likely isolated from populations further to the north in Door and Kewaunee Counties. A quantitative larval survey was conducted in June 2007 by Lesley Brotkowski, M.S., Senior Conservation Biologist, and Laura Smith, Staff Ecologist, both of Cedarburg Science, LLC, and Dr. Daniel A. Soluk, Associate Professor, at the University of South Dakota. A transect survey utilizing aquatic dip net samples and crayfish burrow pumping was completed. Sample stations were set up along a wetland drainage in five meter intervals along a thirty-five meter transect. A total of three *S. hineana* dragonfly larvae were obtained from the five crayfish burrows sampled. This study was an important first step in quantifying and monitoring the long term

population trends of *S. hineana* within the identified habitat at Cedarburg Bog. Yearly quantitative sampling is recommended to monitor this important population.



Habitat Restoration and Quality Assessment in Ozaukee and Washington Counties, Wisconsin

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The Ozaukee Washington Land Trust (OWLT) initiated a Milwaukee River Basin project in the Lake Michigan watershed in 2004, to protect, restore, and enhance land in cooperation with local communities, through seeding, planting, and invasive species control. This grant allowed us to continue this mission, and to add quality assessment through monitoring of amphibians and reptiles (herps). We planted trees on approximately 45 acres, restored wetlands on approximately 10 acres, and controlled invasive species on over 300 acres. We tested herp monitoring methods

on 6 sites and collected baseline data. We hosted training workshops on herptile monitoring, invasive species control, and habitat restoration, began development of detection probability statistics and a "proportion of area occupied (PAO)" model for herptiles in the Milwaukee River Basin, established a weather station at the Mequon Nature Preserve, and began disseminating results through project reports, publications, and lectures and presentations at symposia and workshops. Funded by: National Fish and Wildlife Foundation, Great Lakes Watershed Restoration Grant.

Conservation, Genetics and Morphology of the Butler's - Plains Gartersnake Complex

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Butler's gartersnake, *Thamnophis butleri*, is found in a fairly contiguous range involving lower Michigan, northern Indiana and Ohio, and western Ontario. There is also a disjunct population found in at least five counties in southeastern Wisconsin. This population is in an area of rapid development and the species needs some protection in Wisconsin. The issue is complicated by our observations, to date, on molecular, morphological, and behavioral traits. Wisconsin *T. butleri* differ significantly from both Michigan *T. butleri*, and their closest relative the Plains Gartersnake (*Thamnophis radix*), found to the west and south of *T. butleri* in Wisconsin. In order to determine if Wisconsin *T. butleri* have closer affinities with the more eastern *T. butleri*, or, alternatively, with *T. radix*, we are performing taxonomic investigations utilizing standard morphological measures, and molecular DNA analyses (ND2 mitochondrial DNA sequencing and nuclear DNA fingerprinting), in order to compare

Midwest *T. radix* and Michigan area *T. butleri* with animals from both "pure" and "hybrid" populations of *T. butleri* in Wisconsin. The results of this research could potentially change the range limits or taxonomic designation of Wisconsin *T. butleri* populations. Results will also provide the needed guidance for directing appropriate conservation measures, and avoiding preservation of the "wrong" snakes in the "wrong" areas. We are examining out groups from Michigan, Indiana, Illinois, Nebraska, Iowa and Montana. In 2007 we concentrated on material collected from within the hypothesized hybrid zone, with over 200 snakes examined and harvested for tissues. Results will more clearly delineate the hybrid zone, taxonomic relationships, conservation issues, and identification of southeastern Wisconsin gartersnakes. Funded by Wisconsin DNR.

Wisconsin Herp Atlas

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The Wisconsin Herp Atlas tracks the distributions of amphibians and reptiles in Wisconsin. The Atlas was initiated in 1986 at the Milwaukee Public Museum, with the cooperative support of the Natural Heritage Inventory Program (WDNR) and The Nature Conservancy (Wisconsin Chapter). The Atlas is a computerized database of amphibian and reptile distribution, based on records obtained from museum collections, field surveys, literature, and field notes provided by volunteer observers throughout the state. Over 450 new county records have been confirmed by the project. The data collected helps to map species distributions, document rare species occurrences,



analyze distribution trends, examine habitat requirements, and plan conservation priorities. In 2006 the Atlas was abandoned by the financially troubled Milwaukee Public Museum, and in 2007 it was re-established through the UWM Field Station, where it now resides.

HerpNet

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HerpNet is a collaborative effort by natural history museums to establish a global network of herpetological collections data. Currently, 58 institutions are participating in the HerpNet community, with an open-ended invitation to institutions who would like to join. Fifty-three institutions are available on the specimen searching portal, with data

from over 5.5 million specimens available for searching. The mission of HerpNet is to bring the accumulated knowledge from more than four million specimens in worldwide museum collections into currency for science and society by creating a distributed database with access from various portals. HerpNet will connect large repositories of information with smaller collections that have regional specializations. Similar efforts (e.g. MaNIS, FishNetII, MaPSTeDI, ORNIS) are being accomplished for other taxa and regions and the herpetological community is poised to make its own contribution to the study of biodiversity. HerpNet will bring together researchers from diverse institutions and will initiate and strengthen collaborations among natural history collections, conservation biology, phylogenetics and biodiversity informatics. Funded by the National Science Foundation and a Global Biodiversity Information Facility DIGIT grant to the University of Kansas Center for Research Inc.



Wildlife Ecopassage Monitoring for State Highway 164 in Waukesha County

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Wildlife ecopassages are designed to afford safe passage for wildlife across roadways, thereby reducing road mortality. Ecopassages allow wildlife to pass underneath the highway lanes, and maintain habitat and population connectivity on the landscape. This can be especially important in maintaining genetic interchange across highways for more sedentary wildlife such as amphibians and reptiles. Little data are available for evaluating the conservation effectiveness of these structures. During recent expansion of State Highway 164 from two lanes to four lanes, five ecopassages were installed (enhanced box culverts or stream spans), designed to reduce wildlife

mortality on the roadway and maintain genetic interchange across the roadway. This project installed four wildlife cameras within ecopassages in 2007, to determine what species of wildlife are using the ecopassages, obtain counts of wildlife use, and examine if opportunistic predation is promoted, where predators such as raccoons may learn to hunt at ecopassages to capture prey concentrated at these crossing points. In 2008 additional funding is expected for more intensive wildlife monitoring of the ecopassage areas. Funded by C.D. Besadny Conservation Grant, Natural Resources Foundation of WI.

Genetic Variation and Environmental Stochasticity: Adaptations in the Bdelloid Rotifer *Habrotrocha rosa*

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This study is part of a large scale investigation of the genetic structure and dispersal abilities of *Habrotrocha rosa*, an asexual rotifer that is an important component of the detritus-based food web that forms in the water-filled, pitcher shaped leaves of the carnivorous northern pitcher plant *Sarracenia purpurea*. The results of this study will provide insights into the role of genetic variation in the survival of animal and plant metapopulations - populations that are subdivided among habitat patches and connected by dispersal. I am looking at both genetic and phenotypic variations among clones of this animal to try to answer two questions: 1) Is there variation among clones across multiple spatial and temporal scales; and 2) Does the variation tell us anything about selection for certain clones at different ages of the leaf itself or under the different environmental conditions associated with calendar date? Genotypic variation will be analyzed using allozyme profiles as well as sequence data for the *cox1* and *cob* genes,

while phenotypic variation will be measured as changes in population growth rate or the ability to survive environmental stresses. Rotifers will be collected using a sampling scheme that tracks changes at three spatial



scales: within pitchers, among pitchers on the same plant, and between plants. The spatial distribution of genotypes can tell

us something about the dispersal abilities of *H. rosa*. The scheme also allows me to track changes over time at two levels: leaf age and calendar date. In an earlier study, I showed that the bacterial species assemblage of a pitcher changes with leaf age and calendar date. Preliminary data suggest that rotifer clones have different population growth rates depending on the species of bacteria provided as food. Genetic variation among rotifer clones that is associated with leaf age might indicate clonal specialization for feeding on certain bacteria types. Bacterial assemblages will be monitored using EcoPlates (BioLog, Inc.) to track changes in their physiological profile over time; bacterial cell sizes and shapes will be determined using gram stains of concentrated pitcher fluid. A laboratory

reciprocal transplant experiment will be run to test the effects of bacteria from different leaf age categories on the population growth rate of *H. rosa* from selected leaf ages. Clonal variations associated with calendar date may indicate adaptations for growth and reproduction at specific temperatures or the ability to survive freezing, desiccation, or starvation, all of which have a seasonal (temperature) component. Clones from each calendar date will be randomly selected and exposed to these environmental challenges in the lab. This study was begun in 2007, but some clones died out. I am beginning the collection again in June 2008, and will reduce the number of plants in order to reduce the total number of clones and bacterial samples to a more manageable number.

Bog-Fen *Carex* of the Upper Midwest

Linda Curtis, College of Lake County, Illinois. Biology emerita, lcurtisbotanist@ameritech.net

Carex are a genus of the Cyperaceae, a plant family that superficially resembles the grass family Poaceae. Other genera of Cyperaceae include *Bulbostylus*, *Cyperus*, *Dulichium*, *Eleocharis*, *Eriophorum*, *Rhynchospora*, *Scirpus* and its newly sub-divided *Schoenoplectus* and *Bolboschoenus*, among others. Of the 49 species of *Carex* that are reported in the Cedarburg Bog area, 34 species grow in the bog and swampy areas, but also in the water-filled depressions in the woodlands. The other 15 *Carex* are woodland species. The focus of this ongoing research is to document *Carex* species by photograph and also to collect specimens to be scanned and micro-photographed. The Cedarburg Bog was one of several Wisconsin bogs chosen for study in preparation for the author's next book about *Carex* species of bogs, fens, coniferous swamps, and wet prairie. With WDNR plant collection permits, *Carex* culms, sheaths, and rhizomes were collected and scanned for individual computer images

as well as photographed with associates on site. Those specimens were later sent to the herbaria at UW-Milwaukee, UW-Madison and the Cedarburg Bog Field Station. One species that was reported at the Cedarburg Bog but not yet included on the species list is *C. gynocrates*. Only one male culm was found and possibly separate female culms, but they were too immature to be positively identified. Other northern bog species such as *C. sterilis* and *C. echinata* may be present, and once found, *C. rostrata* may instead be *C. utriculata*. The species *C. schweinitzii* reported at the Chiwaukee Prairie has never been collected for documentation, and was not located in 2007. The eight species of *Carex* in the Benedict Prairie, listed in Vegetation Analysis of the Benedict Prairie (UWM Thesis, Curtis 1974), were relocated, but additional species reported by Smith and Kuchenreuther in 1993 were not found (*C. aquatilis*, *C. bicknelli*, *C. tetanica*).

The Effects of Competitor Plant Abundance on Pollinator Visitation, Pollen Deposition, and Reproductive Success in *Mimulus ringens*

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We explored how the presence and abundance of a competitor for pollination influenced pollinator visitation patterns, conspecific and heterospecific pollen deposition, and seed set. We established replicate experimental arrays of the wetland perennial *Mimulus ringens* and manipulated the presence and abundance of *Lythrum salicaria*, a co-flowering invasive exotic. We quantified pollinator visitation to *Mimulus* flowers, pollen deposition on *Mimulus* stigmas and seed set when a) no *Lythrum* was present, b) an equal frequency of *Lythrum* and *Mimulus* were present, or c) *Lythrum* plants were 3X as frequent as *Mimulus* plants. The rate of pollinator visitation to *Mimulus* flowers was reduced in the presence of *Lythrum*, but did not decline further with increased relative abundance of the competitor. However, patterns of pollinator movement were strongly influenced by *Lythrum* abundance. When *Lythrum* was more abundant than *Mimulus* pollinator probes of *Mimulus* flowers were often immediately preceded or followed

by visits to *Lythrum*. The mean number of conspecific pollen grains deposited onto each *Mimulus stigma* was significantly influenced by the abundance of the competitor. In addition, the mean number of *Lythrum* grains on *Mimulus* stigmas nearly doubled with increasing *Lythrum* abundance. The reduction in conspecific pollen on *Mimulus* stigmas with increasing *Lythrum* abundance is likely to reflect the increased rate of pollinator transitions between *Mimulus* and *Lythrum*, leading to heterospecific pollen loss. The mean number of *Mimulus* seeds per fruit was highly variable among days, but tended to be lower in the presence of the competitor. These results suggest that changes in bumblebee foraging due to an increased abundance of competitor plants has a direct effect on conspecific and heterospecific pollen deposition and seed set in *Mimulus ringens*. PhD. Dissertation research, Jeffrey Karron, Major Professor.

Vegetation of the Riparian Zone and Islands of the Milwaukee River

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There is a great deal of current interest in preserving and restoring natural communities along the Milwaukee River corridor, and there are several groups and organizations focused on revitalizing or providing stewardship for various aspects of the river corridor. There have, however, been no descriptions of the native, or relatively undisturbed, plant communities of the Milwaukee River riparian zone to use as models for restoration, nor of the current status of the vegetation in the riparian zone. This project is funded by the Eastern States Field Office of the US Bureau of Land



Management to assess the current condition of 11 BLM-owned islands in the Milwaukee River. We will expand that project to a description of the riparian zone in general. During the 2008 and 2009 field seasons, we will sample and identify using ordination and classification techniques the plant communities of the riparian zone, and map the vegetation on the BLM-owned islands. The maps of the plant communities on the 11 BLM-owned islands will pay special attention to invasive species, which will be used as a basis for future monitoring, and to formulate recommendations for management of the vegetation of each island. We will correlate environmental factors in the riparian zone,

especially various forms of disturbance, to the current distribution of native and exotic plant species. We will examine the most pristine forested areas along the riparian zone to serve as reference sites. These will provide some picture of the processes in the original plant communities of the islands and riparian zone before major environmental disturbances occurred. The effects of stream flow, erosion, farming practices, and urban settings along the river will be considered when evaluating the vegetation types of the riparian zone. Funding provided by a Cooperative Agreement with the Bureau of Land Management. MS Thesis research, J. A. Reinartz, Major Advisor.

Gypsy Moth Treatments Proposed at the University of Wisconsin-Milwaukee Campus as Populations Increase in 2007

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Gypsy moth numbers are starting to rebound in scattered areas in southeast Wisconsin since the population crashed in 2004. Counties reporting nuisance level caterpillars in 2007 included Milwaukee, Racine, Kenosha, and Walworth Counties. The University of Wisconsin, Milwaukee also experienced increased numbers of gypsy moth this year and predictive egg mass surveys in the fall of 2007 indicated damaging levels of gypsy moth present on campus. Egg mass survey estimates averaged around 1040 egg masses per acre for the campus as a whole. This is double the minimum requirement of 500 egg masses per acre to qualify for suppression treatment. The University has applied through the county to the DNR to participate in the 2008 gypsy moth suppression program. Aerial treatments are proposed for approximately 45 acres on campus including Downer Woods. The suppression program utilizes the biological insecticide, Btk (*Bacillus thuringiensis* var. *kurstaki*), specific

to Lepidoptera caterpillars feeding during and shortly after treatment. Treatments are generally conducted in mid to late May in southern Wisconsin. The exact timing for treatment is based on leaf phenology and caterpillar development. For more information on gypsy moth and the DNR suppression program visit <http://gypsymoth.wi.gov>.



Multiple pollinator visits to *Mimulus ringens* (Phrymaceae) flowers increase mate number and seed set within fruits

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The timing and effectiveness of pollinator visitation to flowers is thought to be an important factor influencing plant mating patterns and reproductive success. Multiple pollinator probes to a flower may increase both the quantity and genetic diversity of progeny within a fruit. This is especially likely if the amount of pollen deposited by a single probe is insufficient for maximal seed set, or if the interval between successive probes is brief. When pollen carryover is limited, sequential pollen loads may also differ markedly in sire representation. We hypothesized that these conditions help explain high levels of multiple paternity in fruits of *Mimulus ringens*. We documented all bumble bee visits to individual flowers, and quantified resulting seed set. We then unambiguously assigned paternity to samples of 20 seeds from each of 51 fruits. Most (76%) flowers received multiple probes, and the interval between the first and second

probe was usually < 30 min. Flowers probed three or more times produced 44% more seeds than flowers probed only once. All fruits were multiply sired. Flowers receiving a single probe averaged (\pm SE) 3.12 ± 0.44 outcross sires per fruit, indicating that single probes deposit pollen from several donors. Multiple paternity was even greater after three or more probes (4.92 ± 0.37 outcross sires per fruit), suggesting that sequential visits bring pollen from additional donors not represented in the initial probe. This is the first direct demonstration that sequential deposition of pollen during distinct probes increases the number of sires per fruit. The important role of sequential deposition in our study is consistent with the short interval between probes, which may enhance the likelihood that fast growing pollen from later probes sometimes catches up to and outcompetes pollen tubes from the first pollen load.

Avian Response to Restored Wetland Plant Community Succession in Southeastern Wisconsin

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We described the change in avian use over time in small created and restored wetlands in southeastern Wisconsin. Quantitative avian surveys were conducted in 30 sites ranging in age from 11 to 15 years and compared to data collected in the same sites in 1994, 2 to 6 years after they were constructed. Avian species were categorized into ruderal, wetland, and old field habitat guilds. We tested for significant effects of wetland age, design, and landscape variables on avian use and plant community composition using multivariate analysis. The total number of bird species using the restorations in 2004 was very similar to the

1994 census, however, our follow-up survey revealed a dramatic shift in old field and wetland-dependent habitat guilds. Wetland-dependent species decreased by more than 50%, while the number of old field-dependent species more than doubled. Use of the wetlands by ruderal species was similar in both surveys. Mean number of individual birds/wetland/visit increased from 5.47 in 1994 to 20.95 in 2004. The increase in bird numbers was distributed evenly across the habitat guilds. For both survey dates, wetland size was positively correlated with overall richness and individuals per visit, the number of wetland-dependent species, and

wetland and old field-dependent individuals per visit. In 2004, percent open water was positively correlated with overall richness and individuals per visit, and the number of

wetland-dependent species. Funded by: U.S. Environmental Protection Agency and Wisconsin Coastal Management Program.

The Effects of Age and Landscape Placement on the Development of Restored and Created Wetland Plant Communities in Southeastern Wisconsin, USA

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Despite decades of interest in wetland restoration, few studies have been published describing effects of age or landscape placement on development of vegetation for a large sample of restorations. We described the natural development of vegetation in small created and restored wetlands that differed in their age and landscape placement. The wetlands were small, shallow wildlife areas, created and restored on private lands in southeastern Wisconsin through government-funded wetland restoration programs. Quantitative data on vegetation cover were recorded during the 2001-2004 field seasons in 100 sites ranging from 1 to 17 years post-construction. All sites were included in multivariate analysis. Plant community diversity and floristic quality increased steadily through time, although the change was most dramatic during the first five years. Floristic quality and diversity increased the farther a wetland was located from the nearest active agricultural field or road, and the closer the wetland was to a woodland or natural wetland. However, once wetlands were older than five years there were no

longer significant differences correlated with those particular landscape factors. On the other hand, wetlands with relatively more agricultural land in their drainage basin had significantly lower floristic quality and more open ground than wetlands with less active agricultural practices in their drainage basin. The percentage of open ground was strongly negatively correlated with all measures of plant community diversity and quality. Woody plant coverage in the restored wetlands and the coverage of sandbar willow (*Salix exigua*) were both significantly greater in wetlands with woodlots nearby. Funded by: U.S. Environmental Protection Agency, Wisconsin Coastal Management Program, WE Energies, UW-Milwaukee, Ozaukee County Planning, Resources, & Land Management Department, Ozaukee County Land Information Office, Wisconsin Herp Atlas, Whitetails Unlimited, GeoBotany Systems, Natural Resources Conservation Service, U.S. Fish & Wildlife Service, and Wisconsin Department of Natural Resources.

Long-term Effects of Initial Seeding on Wetland Plant Community Development

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Over the past two decades, thousands of wetlands have been voluntarily restored in formerly cropped land by interrupting drainage lines. Re-vegetation of the wetland restoration relied primarily on existing seed banks in the soil and seed colonization from proximal natural wetlands. A 1991 study

compared the vegetation in 11 naturally colonized wetlands with 5 wetlands to which 21 species of native wetland plants were introduced 1-3 years following restoration. In 2002, 9 of those sites that had not been altered or drained for agriculture were re-sampled at age 12. We used quantitative

surveys to describe the plant communities and analyzed the effects of the introduction of native wetland seed on the development of the plant communities. Of the 21 introduced native species, nineteen were recorded in the remaining 4 seeded sites during the current study, while 8 species occurred frequently in unseeded sites as well: water plantain (*Alisma subcordatum*), marsh milkweed (*Asclepias incarnate*), sedge (*Carex retrorsa*), red-osier dogwood (*Cornus sericea*), joe-pye weed (*Eupatorium maculatum*), fowl managrass (*Glyceria striata*), dark green bulrush (*Scirpus atrovirens*), and softstem bulrush (*Schoenoplectus tabernaemontani*). At one and two years old seeded wetlands had higher floristic diversity and quality than unseeded wetlands, and also had significantly greater cover of native wetland plants and less of non-native plants. At 12 to 13 years these same seeded wetlands continued to have higher floristic diversity and quality

2007 Butler's Gartersnake *Thamnophis butleri* Surveys at the Cedarburg Bog

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Butler's gartersnake (*Thamnophis butleri*) surveys were conducted within a previously unsurveyed Tier 3 habitat site within Cedarburg Bog in 2007. The purpose of this survey was to determine the presence or absence of this snake at this location to determine whether it could serve as a long-term conservation site for this species. If present at this location, the Cedarburg Bog complex would have a demonstrated capacity for managing for this species at a metapopulation scale, where two or more discrete habitat sites could be managed to restore their connectivity, helping to insure the long-term viability of this species at the Bog. Cover board objects (CBO) (32" X 48" 3/4" CDX plywood sheets) were used to detect snakes for this survey. Twelve CBO were placed in April, prior to green-up in upland short grass old field habitat. CBO were placed within 100 feet of adjacent wetland habitat where snakes would predictably overwinter based on prior

than unseeded wetlands, but no significant differences in the variables summarizing the structure of the plant communities including cover of reed canary grass (*Phalaris arundinacea*) and cattail (*Typha* spp.), cover of woody plants, non-native species, or native wetland plants. In short, while the seeded wetlands in this study retained a distinct native wetland plant flora and diversity, seeding did not influence the overall structure of the plant communities over time. Funded by: U.S. Environmental Protection Agency, Wisconsin Coastal Management Program, WE Energies, UW-Milwaukee, Ozaukee County Planning, Resources, & Land Management Department, Ozaukee County Land Information Office, Wisconsin Herp Atlas, Whitetails Unlimited, GeoBotany Systems, Natural Resources Conservation Service, U.S. Fish & Wildlife Service, and Wisconsin Department of Natural Resources.

research. The sites where CBO were placed were first raked to remove some of the old vegetative biomass, which improves snake detectability. CBO were checked no sooner than three hours before sunset on days where temperatures exceeded 60° F and where there were at least several hours of sunshine during the day (G. Casper pers. comm.). All snake species detected were recorded as were other fauna located under the boards. On the day that CBO were placed, two juvenile Butler's were located while raking biomass from the CBO locations. Following board placement, eight surveys were conducted between May 23 and June 25. A total of four Butler's were found during eight surveys and the board placement event. Catch per unit effort was .021/CBO for Butler's and .41 for common gartersnakes. The results of this survey are preliminary due to the fact that only eight surveys were conducted. Ideally, 15 surveys would have been conducted, but staffing

limitations prevented us from obtaining a full survey complement at this location. Dry weather may also have contributed to low Butler's gartersnake numbers at this location. Snakes prefer to bask under boards where both temperature and humidity levels are elevated by daytime sunshine and heat. However, when drought occurs, other refugia may be sought to find preferred humidity conditions. There is some indication from 2007 that Butler's may have spent more time than normal underground. More Butler's had soil residue on their dorsal scales than has been noted in other years of surveys for this species. Also, Butler's may have spent more time underground rather than under CBO because of altered foraging behavior, also triggered by dryer than normal conditions. Butler's feed almost exclusively on worms and dry conditions may have forced worms, and subsequently Butler's to spend more time underground. Results from 16 other Butler's surveys conducted in 2007

Possible symbiotic relationship between the carpenter ant *Camponotus noveboracensis* and the pitcher plant *Sarracenia purpurea*

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The northern pitcher plant *Sarracenia purpurea* is a carnivorous plant with a wide distribution in North America, occurring in bogs and other nutrient poor wetlands. In most its range, ants make up the majority of insect prey captured by the plant; however, they make up only a small proportion of the prey for plants at Cedarburg Bog in southeastern Wisconsin. During field observations we observed ants entering and again leaving pitcher plant leaf traps, clearly avoiding all of the plant's "escape-proofing" adaptations. We have tentatively identified these ants as *Camponotus noveboracensis*, a species typically found in open bogs and wet woods feeding on nectar, honeydew and scavenging dead invertebrates. In Borneo, a species of *Camponotus* co-exists with the tropical pitcher plant *Nepenthes bicalcarata*,

indicating that sites with higher and dryer soils produced lower snake numbers on a catch per unit effort basis. Full analyses of these results are still pending. The placement of CBO at the Cedarburg survey site were in higher and dryer soils, in part due to elevation changes adjacent to the wetlands, but also by a lack of sunny conditions closer to the wetlands caused by heavy brush and trees close to the wetland edge. However, the results of this survey are somewhat consistent with other surveys conducted in the northern portion of their range in Ozaukee and Washington counties where common gartersnakes often represent a higher percentage of the snake community than do Butler's. Common gartersnakes were detected at significantly higher rates than were Butler's at this location. We suggest that additional surveys be conducted at this location in subsequent years to better determine relative Butler's numbers.

feeding on large prey items caught by the plant. These ants are capable of swimming in the pitcher fluid, and can haul prey many times their size out of the pitcher to their nests in the leaf tendrils. The relationship is most likely a mutualism, since by removing excess large prey, the ants prevent rapid decomposition and fouling of the pitcher fluid thus killing the inquilines and sometimes the pitcher itself. Ants foraging in pitchers without suitable prey have been observed killing and eating mosquito larvae living in the pitcher fluid. Based on the behavior of this tropical species, we hypothesize that *C. noveboracensis* may be partnered with *S. purpurea* in a similar fashion. Additional field studies are planned to determine the nature of the ant-plant interaction.

Evaluation of Plant Defensive Chemicals in Plants Attacked by Specialist Aphids

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The Evolution of Increased Competitive Ability (EICA) hypothesis reasons that if specialist herbivore pressure on exotic plants is reduced in the introduced range, then invasive plants should evolve to decrease their investment in defenses and thus maximize their investment in growth and reproduction. We evaluated four plant defensive chemicals of the late goldenrod, *Solidago gigantea*, in plants derived from 10 native North American and 20 invasive European populations grown within their native host range. Two chemicals analyzed, naphthalene and kaur-16-ene, are known to have negative effects on insect growth. Nonacosane has been found in the epicuticular lipids of aphids and heptacosane has been found as a component within aphid communication systems; these chemicals may be absorbed from the plant material. Plants were voluntarily colonized by the specialist aphid, *Uroleucon nigrotuberculatus*, in a screenhouse

that provided protection from other herbivores. In the plants that we have analyzed to date, we found that native plants without aphids had a greater mean concentration of heptacosane (48.9%) and a greater concentration of nonacosane (38.3%) than native plants with aphids ($P < 0.001$). Invasive plants with aphids had a greater concentration of heptacosane (18.5%) and a much greater concentration of nonacosane (74.9%) than invasive plants without aphids ($P < 0.001$). There was no significant difference between native and invasive plant for naphthalene concentration ($F_{1,85} = 1.54$, $P = 0.23$) nor kaur-16-ene ($F_{1,85} = 0.0$, $P = 0.98$) and no significant interactions between plant source and aphid attack. These results suggest that there are differences in chemical composition between native and invasive plants; however, nonacosane and heptacosane may not be important secondary metabolites for aphids.

Crayfish and Dragonfly Members of the Marshland Community

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At the invitation of University of South Dakota Professor D. Soluk, I participated in a June 4th search made by Soluk's Hine's emerald dragonfly (HED) team for HED immatures and crayfishes that co-inhabit marshland southeast of the Field Station building. With the use of a modified bilge pump to bring measured volumes of water through collecting sieves, two juvenile crayfishes were collected and their identifications as *Cambarus diogenes* were verified onsite using the dissecting microscope in the Field Station lab. Young-of-year individuals of *C. diogenes* have been recorded in Wisconsin from May through October. This is one of six crayfish species that have been reported from Ozaukee County.



Use of Mark-Recapture Techniques to Estimate Milksnake (*Lampropeltis triangulum*) Populations in the Upper Midwest

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In Wisconsin, relatively little research has been conducted on native snake species in the sub-family Colubrinae, including milksnakes (*Lampropeltis triangulum*). Published data on population characteristics for this species are particularly rare, focusing mostly on estimates of density per area in populations from the western portions of its range. Information on Wisconsin populations does not exist, despite the importance of such baseline data for future conservation efforts. The University of Wisconsin-Milwaukee Field Station contains a rich herpetofauna that previous surveys have determined includes milksnakes. This research represents an ongoing attempt to study several population parameters of these snakes through the use of mark-recapture methods (Schnabel population estimation method). This work began in June 2006 in association with a field herpetology class. Annual sampling efforts are constrained to a two to three-day period in late May/early June of each year, when individuals have been found to be active and frequently encountered on-site. During each sampling period, four surveys of equal length are conducted in a 6.12 ha area for milksnakes over a two-day period (in the early evening and morning of both days). The number of surveys ($n=4$) is important for accommodating future Zero-truncated Poisson tests of equal catchability for animals caught during surveys. Both cover board and visual encounter surveys

are employed. Upon capture, snakes are marked with Passive Integrated Transponder (PIT) microchips, which are commonly employed by researchers to mark snakes for future identification. Sex ratios are also determined in surveyed individuals via probing. To-date, two sampling efforts have been completed (2006 and 2007). In 2006, a total of 14 adult individuals were captured, with five being recaptures. This resulted in an estimated adult population of 12.4 individuals, and a density of approximately 2 individuals per hectare. In 2007, a total of 12 adult individuals were captured, with 4 being recaptures. This yielded an estimated adult population of 9.3 individuals, and a density of approximately 1.5 individuals per hectare. Because survey efforts have varied during this time, and small sample sizes have been achieved, I believe it will be important to look at long-term trends more so than yearly results and I hope to continue this work for at least five years.



Long-term Monitoring of the Eastern Prairie White-fringed Orchid, [*Platanthera leucophaea* (Nutt.) Lindl.] at Cedarburg Bog

Joanne Kline, Wisconsin Department of Natural Resources

P. leucophaea is one of the largest and showiest of the native North American orchids. Loss of wet prairies and fens, where the orchid was once widespread, greatly reduced the orchid's range and led to its listing as a Federal Threatened and

a State Endangered Species. Populations rely on pollination by sphinx moths for long distance out-crossing, which is more effective where many orchids grow over a large area. Insuring the stability of these highly viable populations is a major objective

for recovery of the species and for removal of its threatened and endangered status. The Cedarburg Bog population is the largest in Wisconsin and the largest in a peatland plant community nationwide. Monitoring in two string bog habitats includes an annual census of flowering plants and tracking the demographics of individual plants for life span, flowering history, pollination success and impacts of herbivory. Numbers of flowering plants at most Wisconsin sites were low in 2007. The Cedarburg Bog population was the lowest since 2001, with an estimated 3.8 plants per hectare, down from a high of 24 plants per hectare in 2002. Based on tracking individual plants for 5 years most plants take at least 2 years to flower and then flower for 2 or 3 consecutive years before they disappear. One plant has flowered for at least 4 years. Plants that flower after being dormant through one growing season have been noted at other locations, but not observed at Cedarburg

Geology Insights into the Natural History of the Cedarburg Bog

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The Cedarburg Bog in Ozaukee County, Wisconsin is a complex forest swamp ecosystem developed upon a complex glacial geologic foundation. This initial investigation examines the stratigraphy of the swamp and portions of the underlying and surrounding glacial geology and hydrology with the intent of adding understanding to its development and natural history. The Ecological Geology Workshop of 2007 conducted new research into the geologic history of the Cedarburg Bog as part of the class work and fieldwork. A 40.9-foot core sample from the bog was collected using a coring tool that allowed 3-foot sampling intervals. The core was the first continuous sampling of the bog, and was examined for stratigraphic markers, clastic versus organic sediment content, water content, floral and faunal remains, and other color and textural information. The core was photographed, dissected, and remains wrapped in plastic and frozen for continued research. The class field trips also included examination of area glacial

Bog. Threats to the population continue to be the invasive shrub, glossy buckthorn (*Rhamnus frangula*), and lack of legal protection to the State Natural Area. Giant reed grass (*Phragmites australis*), a native but potentially invasive species, appears to be increasing. The extent and density of giant reed grass has been documented in the open string bog since 2006 to determine if control measures are needed. Neighboring land owners, who provide access, and Marsha Burzynski, who provides GPS data support make this project possible.



geology to understand the development of the Cedarburg Bog. The core indicates changing sedimentation styles (clastic to organic), and changing habitats (forest-proximal, to open water and all situations in between). Future work can attempt to collect pollen grains and chemical compositions of the organic sediment. Future work on the core will also include an integration of the present day plant studies to better identify plant type in the samples. Data were collected with the assistance of the 2007 Ecological Geology Workshop (Kathy Bates, Mickey Boerger, Tim Cushman, Norlene Emerson, Tianah Moungey, Stefanie Nadeau, Mike Steiner, Bruce Stromberg, Alice Thompson, Joyce Witebsky, and Peter Ziegler).



Atlas of North American Amphibians

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This is a book project with the University of California Press. The Atlas of North American Amphibians will present detailed distribution maps and brief species descriptions of each of the 293 currently recognized amphibian species in the United States and Canada. The intended audience will be professionals, including researchers, teachers,

land and wildlife managers, natural resource technicians and administrators, nature center staff, zoo staff, wildlife health staff, various federal and state agencies such as forest service, park service, environmental quality and agricultural departmental staff, and amateur naturalists. Funded by the Indiana University School of Medicine.

Genetic Studies of the Hine's Emerald Dragonfly Population at Cedarburg Bog

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Previous studies have examined the mitochondrial DNA of Hine's Emerald Dragonfly from populations along the Des Plaines River, Illinois, and from wetlands in Door County, Wisconsin. Only one genetic variant was recovered from several individuals sampled from Door Co and the Door County variant was not found in Illinois, despite the fact that this latter population contained a number of other variants. The population of Hine's Emerald at Cedarburg Bog is located between those in Door County and the Des Plaines River valley. Genetic analysis of the first specimen discovered from the Cedarburg Bog area

recovered the same haplotype as found in Door County, suggesting possible recent contact between these areas. The availability of 16 specimens recovered in 2001 and 5 in 2002 from Cedarburg provides an opportunity to expand these genetic studies on Hine's Emerald and perhaps resolve some long-standing problems, such as past dispersal patterns and normal levels of genetic diversity for populations. Currently, funding is being sought that will allow us to incorporate these additional samples from the Cedarburg population in future genetic studies of Hine's Emerald.

The Structural and Functional Characteristics of Ecosystems Dominated by Exotic Plants

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Recent work on exotic species in island ecosystems has revealed that many exotic woody plants are capable of totally dominating forests where they occur, resulting in significant changes to forest structure and nutrient cycling. Despite some observational accounts, however, few empirical examples of exotic dominance exist in northeastern forests. Common buckthorn (*Rhamnus cathartica* L.) is known to choke temperate forest understories but

its degree of dominance has been described only anecdotally. We found evidence for monotypic dominance by this exotic tree in several mesic and wet sites in Southern Wisconsin. Among eight "exotic" forest sites where *R. cathartica* was abundant, its mean relative density and basal area were 80 and 45%, respectively. Density differences were not the result of bifurcation by *R. cathartica*: its relative density remained at 78% when only genets (i.e., independently rooted

plants, excluding shoots) were considered. Compared to a group of eight "native" forest sites on similar soils, total stem density at exotic sites was more than three times higher (t test; $p < 0.01$), but total basal area did not differ significantly ($p > 0.33$). When considering dominance by size class, we found that *R. cathartica* genets were more abundant than native genets at 5 cm size classes up to and including 20 - 25 cm dbh, indicating that dominance may generally extend beyond understory size classes. Although *R. cathartica* is shorter in stature

Detection of Avian Blood Parasites in the Common Yellowthroat (*Geothlypis trichas*): a Comparison of Multiple Methods

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There are many unknown factors that contribute to bird population declines. Disease, specifically blood parasites may be one of the factors that negatively affects the reproductive success and survival in birds. The purpose of this study is to document the prevalence of blood parasites in the common yellowthroat (*Geothlypis trichas*) and to compare the ability of two methods, PCR-based and blood smear analysis, to detect intracellular blood parasites. Two additional methods were compared; microhematocrit concentration method and

than a majority of native and some exotic trees, mean relative density and basal area for *R. cathartica* among the eight exotic sites exceed that reported for four other woody invaders found in the northeast United States, suggesting a prominent role for this species in forest leaf area, biomass, and functional characteristics, including nutrient and carbon cycling. Funded by Applied Ecological Services and UWM. Ph.D. Dissertation research, Stefan A. Schnitzer, Major Professor.

blood smear analysis, for the detection of motile blood parasites. PCR was more sensitive in detecting *Haemoproteus* sp. and *Plasmodium* sp. than blood smear analysis. The microhematocrit analysis detected more microfilariae and *Trypanosoma* sp. parasitemias than blood smear analyses. *Trypanosoma paruli*, 69% (140/204) had the intracellular hematozoan blood parasites (*Plasmodium* sp. or *Haemoproteus* sp.), and 3% (5/191) had *Leucocytozoon parulis*. MS Thesis Research; Linda Whittingham, Major Professor.

Effects of Polyploidy on Resistance, Physiology, and Performance of Native and Invasive Genotypes of *Solidago gigantea*

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The role of polyploidy in facilitating plant invasions is not fully understood. In this study we examined the effects of polyploidy on native and invasive populations of *Solidago gigantea*. *S. gigantea* is native to North America and introduced to Europe. Three cytotypes are found in the native range (diploid, tetraploid, and hexaploid). All 3 cytotypes have been reported in Europe, although their abundance and

distribution have not been well-characterized. We determined the chromosome number of 80 US and 80 European genotypes drawn from 10 populations in the US and 20 populations in Europe. Chromosome numbers were determined using root tip staining and slide press squashes. Plants were grown in common gardens for several different experiments carried out over several years.



Plants were propagated from year-to-year using rhizome cuttings, so the same genotypes were used in successive experiments. We found all 3 cytotypes in our North American samples, but only diploids and tetraploids in the European populations. We tested for the combined effects of ploidy and continental source on resistance to insects and leaf pathogens, secondary chemistry, physiological and morphological characters (photosynthesis, conductance, leaf area and specific leaf area), and plant fitness (rhizome and infructescence biomass). Some plant traits were strongly affected by ploidy but not by continental origin, while other traits were influenced by origin but not ploidy. Other traits were jointly affected by both continental origin and ploidy. These results can help provide insights into evolutionary changes occurring in *S. gigantea* in its invasive range in Europe. Funded by NSF awards DEB-0315430 to G. Meyer and DEB-0315127 to R. Johnson.

Long-term Monitoring of Bat Activity and Temperature at the Neda Mine Bat Hibernaculum

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The Neda Mine, an abandoned iron mine located near Iron Ridge in Dodge Co., supports about 150,000 bats each winter, making it among the largest hibernacula in the midwest. The mine is used primarily by little brown bats (*Myotis lucifugus*), with Northern Bats (*M. septentrionalis*), Eastern Pipistrelles (*Pipistrellus subflavus*), and Big Brown Bats (*Eptesicus fuscus*) found in smaller numbers. We have been monitoring bat activity at the mine since 2001 using an infra-red photo beam-break detection system that records the number of bats entering and leaving the mine on a 5-minute interval 365 days per year. We have been collecting temperature data since 1996 using 18 battery-powered temperature dataloggers spread within the mine and 2 dataloggers outside. We are also monitoring airflow in the mine. We are currently using these

data to examine trends over time in winter temperatures in the mine, and the phenology of bat emergence in spring.



Attractive Males Provide Less Parental Care in Two Populations of the Common Yellowthroat

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Male ornaments may be signals of direct or indirect benefits to females that mate with those males. One important direct benefit to females is the level of male parental assistance they receive when provisioning young. Three main hypotheses attempt to explain the relationship between male ornament size and parental care. The good parent hypothesis predicts that males with larger ornaments will provide more care, while the differential allocation and trade-off hypotheses predict that they will provide less care. We examined the relationship between male ornamentation and parental care in two populations of common yellowthroats, *Geothlypis trichas*, in which the

sexually selected male ornament differs. More ornamented males provided less parental care in both populations, contrary to the good parent hypothesis. However, females did not feed their nestlings more frequently when mated with more ornamented males, which is an additional prediction of the differential allocation hypothesis. Our results are most consistent with the trade-off hypothesis, which suggests that more ornamented males provide less care because they spend relatively more of their effort in pursuing extrapair mates or defending their territories from other males. MS Thesis of Dan Mitchell; Major Advisor Peter Dunn.

Glossy buckthorn (*Rhamnus frangula*) Invasion at Cedarburg Bog: 1991 to 2006

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The vegetation of Cedarburg Bog, a relatively undisturbed 1000-hectare forested wetland in SE Wisconsin, includes species more common further north. This protected wetland provides refuge to a wide variety of plants and animals in a region that was largely converted to agricultural use in the nineteenth century and now faces suburban development. As part of ongoing research on long-term ecological change in Cedarburg Bog, we resampled herb, shrub and tree strata in 2006 using 165 sampling units established and initially surveyed in 1991. A single exotic species, glossy buckthorn (*Rhamnus frangula*), caused the most apparent change in the vegetation. In the 15 years between sample dates, the number of plots in which it occurred increased by more than 60%. By 2006, adults grew in nearly two thirds of sampling units, and seedlings grew in more than 75% of sampling units.

Despite dramatic increases in buckthorn abundance, the effects of this invasion on other plant species in the wetland have been slight. We expected buckthorn to displace other species by reducing light and nutrient availability, but changes in herb richness and cover showed no relationship with increases in buckthorn cover or seedling number. Similarly, compositional shifts in the herb stratum seemed unrelated to increases in buckthorn cover. Change in shrub species richness was also unrelated to increasing buckthorn cover, but the cover of other shrubs decreased as buckthorn cover increased. This long-term study has yielded unexpected results that improve our understanding of invasion biology and the wetland plant community response to invasion. Funded by Research Growth Initiative, UWM.

Cedarburg Bog and Beech Woods State Natural Areas Breeding Bird Surveys

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During June and early July of 2007, I did point count surveys for avian species in three habitat types of the Cedarburg Bog, Ozaukee County, Wisconsin, closely matching the methodology used and areas covered by C.M. Weise, during the time period from the early 1970s through the mid-1990s. This is the second year of a contemporary series of surveys; I also completed these surveys in 2006. Randomly-located points were chosen in three habitat areas as follows: bog conifer forest, "dead" bog forest, and string bog. In this contemporary series of surveys, I have continued to utilize a ten-minute unlimited-radius point count method, keeping data for the first five minutes separate from that noted during the first three minutes and first five minutes, to facilitate comparison with Weise's data, and if desired, comparisons with the federal Breeding Bird Survey and other monitoring programs. Ten-minute point counts are currently considered to be standard avian survey methodology, and an improvement over previously-used

methods. Longer-duration counts are utilized because some species are not detected during counts of shorter durations. A total of twelve point locations were chosen in the bog conifer forest, seventeen in the "dead" bog forest, and twelve in the string bog. This compares to a total of ten point locations in the bog conifer forest in 2006, fourteen in the "dead" bog forest, and nine in the string bog. Point counts were also done again this year in Cedarburg Beech Woods, as well as a canoe survey of Mud Lake. Funded by Research Growth Initiative, UWM.



Ecological and Phylogeographical Approach to a Biological Invasion: *Prunus serotina*, a Case Study

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Invasion of new habitats by non-indigenous species is a major threat for biodiversity, economy and health. The prediction and anticipation of biological invasions is central to avoid such impacts. However, biological invasions are very complex phenomena implying accurate knowledge on ecological requirements, micro-evolution or biotic interactions. In this study, we investigated *Prunus serotina*, a native tree in North America and invasive in the European forests. This study combines two approaches: first, ecological niche models were developed from 6984 occurrences distributed in both native and invasive ranges which

we related to eight climatic parameters. Second, the phylogeography of the species was investigated by analyzing chloroplast sequences from 57 populations distributed in both ranges to determine which lineages were introduced in Europe. Then we tried to combine both approaches to distinguish phylogenetic components in the adaptation of *P. serotina* to its new range.

Prediction accuracy of models calibrated in the native range is very high when projected to the native range (AUC = 0.93 +/- 0.02) but low on the invaded range (AUC = 0.59 +/- 0.06). Ecological niche models are efficient when they are calibrated on both

ranges: it increases prediction accuracy on the invaded range (AUC = 0.93 +/- 0.04) but lowers on the native range (AUC = 0.91 +/- 0.05). We further performed a Principal Component Analysis to investigate the ecological requirements of the species in the space of climatic parameters. We find a pronounced climatic niche shift occurring between the two ranges. Six phylogenetic lineages were found; three are common to both ranges, whereas two are present only in North America and one has been found only in Europe. This suggests multiple

introduction sources. When projecting the distribution of haplotypes in the PCA, we find that climatic niche shift occurs for every three shared haplotypes. This shows the limitation of predictive ecological models efficiency on biological invasion. Nuclear microsatellites analyses are in process. We expect to have a better comprehension of the phylogenetic process from these analyses. MS thesis research, Supervised By Guillaume Besnard, Olivier Broennimann and Antoine Guisan.

15 Years of Change in the Vegetation of the Cedarburg Bog

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In 1991 we conducted the first complete vegetation survey of the Cedarburg Bog State Natural Area. We located 10, east-west transects across the Bog at ¼ mile intervals from north to south. The northernmost transect was just south of Highway 33 and the southernmost transect was ¼ mile north of Cedar Sauk Road. Sample units were spaced at 100 m intervals along each transect for a total of 170 sample points. At each sample point the species and DBH of each tree were recorded in a 100 m² circular quadrat; number of saplings of each tree species was recorded in two, 4 m² quadrats; herbaceous species presence and cover were recorded in two, 1 m² quadrats; and shrub species cover was recorded along a 10 m line intercept. Transects were placed in reference to landmarks and permanently marked so that the sample units could be approximately relocated. In the summer of 2006, we hired Ron Londre, a recent UWM



Masters student to help Reinartz conduct fieldwork to resurvey the vegetation of the Bog. We followed identical methods to those of the original survey in 1991. The data are currently being analyzed and will provide a quantitative description of change in this complex wetland over a 15-year period. Funded by Research Growth Initiative, UWM.

Growth Patterns of Glossy Buckthorn (*Rhamnus frangula*) and Tamarack (*Larix laricina*) in Cedarburg Bog

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The invasive plant, glossy buckthorn (*Rhamnus frangula*), is a small tree that has invaded much of the Cedarburg Bog SNA,

where it has been naturalized since at least 1955. Even in parts of the wetland characterized by nutrient-poor, water-logged soils

and by low primary productivity, buckthorn has spread rapidly and has growth rates that exceed those of native woody species in the same community. The native coniferous tree tamarack (*Larix laricina*), dominates much of the forest canopy and grows with buckthorn in the Bog. To compare the growth patterns of an invader and a relatively conservative native species, we collected stem sections or cores from individuals growing in close proximity at sample points throughout the wetland. We measured diameter of each stem and counted annual rings, from which we estimated mean annual rates of radial growth. The sample plot mean annual growth increment of tamarack varied by almost 14-fold; ranging from plots with very small trees over 225 years old to plots with much larger trees in their 30s. While we

found a weak positive correlation between the tamarack and buckthorn growth rates in samples, buckthorn maintained a relatively more constant growth rate across a wide range of habitats than did tamarack, varying less than 3-fold in mean plot growth rate in the same plots in which tamarack showed that tremendous range of growth rates (coefficient of variation of tamarack growth rate = 69% versus buckthorn 33%). Stem diameter was a much better predictor of age in buckthorn than it was in tamarack. In both species, the oldest stems had relatively slow growth rates. We will also relate buckthorn and tamarack growth rates to vegetation composition and abiotic conditions. Undergraduate research project, James Reinartz and Erica Young, advisors.

Comparing the Distributions of Pre-settlement and Present Day Southern Tamarack Swamp in the Southeast Glacial Plains

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According to the original land surveyors' records from the mid 19th century, tamarack (*Larix laricina*) was one of the most common and dominant trees in the swamps of southern Wisconsin. Today, it is considered to be an indicator of some of the highest quality and least disturbed wetland communities remaining in southeastern Wisconsin, having a coefficient of conservatism of 8. Unfortunately, tamarack has been lost from many of the southern swamps that it formerly dominated. Many factors have contributed to this loss, including changes in land use, sensitivity of tamarack to hydrologic disturbances, outbreaks of insect pests and unusual and severe climatic events. In this study, we develop a map of the pre-settlement distribution of tamarack swamps in the Southeast Glacial Plains (SGP) Ecological Landscape of Wisconsin using the data from the original land survey records. Comparison of the original distribution of tamarack swamps with the present distribution of tamarack mapped by the Wisconsin Wetland Inventory (WDNR) and the hydric soil data from the Soil Survey Geographic Database (SSURGO) allow

us to estimate the extent of tamarack loss. Based on preliminary estimates, tamarack communities covered between 145,000 and 190,000 acres in the SGP Landscape prior to Euro-American settlement. Approximately 47,000 acres of tamarack swamp remains today. A GIS analysis comparing landscape factors of wetlands that have lost tamarack with those in which tamarack survives, points to some of the major risk factors to tamarack survival in southeastern Wisconsin. This analysis will help us prioritize conservation and restoration practices in the region.



Evaluating Five Site Preparation Treatments for Tamarack Seedling Establishment in the Cedarburg Bog

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Wetland research offers evaluations of numerous restoration techniques for some wetland types, but relatively few for restoring tamarack swamp. With a thorough knowledge of tamarack life history, we have prepared two 30 X 10 meter plots within the Cedarburg Bog to test different site preparation methods for tamarack restoration. Each site contains 20 replicates of 5 different treatments on individual hummocks, including burning, 1 herbicide, 2 herbicides, soil scarification and two control plots. We will plant approximately 250 seeds directly on the individual hummocks in a 0.5 X 0.5 meter plot and record the number of seedlings established and mortality over 2 years. In addition, we will plant 1-2 year old seedlings on hummocks to determine if seedlings afford better establishment after

2 years. Funding for this project comes from a Wisconsin Department of Natural Resources State Wildlife Grant.



Ash Yellows Survey in Wisconsin

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Ash yellows is caused by a phytoplasma, a wall-less bacteria-like microorganism. Symptoms of ash yellows include yellow/sub-normal size foliage, slow twig growth, thin crown, branch dieback and vertical cracks on the trunk near the ground, as well as witches' brooms. Witches' brooms are clusters of upright shoots often with dwarfed, yellowish single or compound leaves with fewer than normal number of leaflets. In the summer of 2007, leaf and wood samples were collected from an ash tree that was showing dieback in Downer Woods, as well as from trees in 4 other locations (Columbia, Kewaunee, La Crosse, and Rock Cos.). All of the sampled trees were exhibiting crown dieback and epicormic sprouting. The sampled tree in Downer Woods also exhibited yellow/subnormal size leaves and slow twig growth. Witches' brooms were also found on the main trunk of the sampled tree, approximately 3 feet

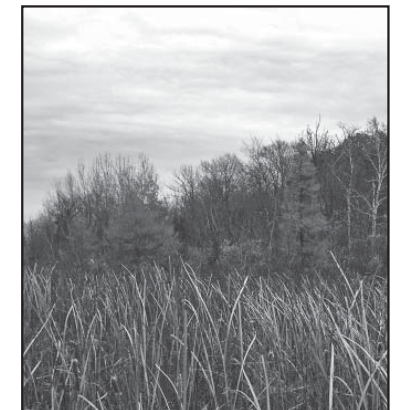
above the ground. Samples were tested for the presence of phytoplasma through the genetic analysis by Dr. Glen Stanosz, University of Wisconsin, Department of Plant Pathology. Results were positive for the sample collected in Downer Woods for the presence of phytoplasma as well as 3 out of 4 other sites where samples were collected. This is believed to be the first confirmed report of ash yellows in Milwaukee County. Based on the existence of witches' brooms and results of the genetic analysis, in 2007, La Crosse, Milwaukee, and Rock Counties were added as Counties confirmed with ash yellows. In Wisconsin, ash yellows is currently found in 20 counties (Brown, Calumet, Chippewa, Columbia, Dane, Dodge, Door, Grant, Jefferson, La Crosse, Manitowoc, Marathon, Milwaukee, Ozaukee, Rock, Sauk, Shawano, Sheboygan, Taylor, and Waukesha Cos.).

Land Cover Change Over 60 Years on Landscape Surrounding Cedarburg Bog

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Cedarburg Bog, a large forested wetland that includes diverse species existing near their southerly limits, provides a unique setting in which to study long-term ecological changes in response to land use and climate changes. Land cover changes can alter the amount and distribution of habitat available to organisms and in turn influence the movement of organisms and their ability to respond to a changing climate. We used GIS to quantify patterns of land cover change by comparing a 1941 land cover map to a recent land cover map in order to explore patterns of land cover change within recent history. To create a historical land cover map, we scanned 1941 aerial photos to create digital images that were then georeferenced and joined into a photo mosaic. A simple land cover classification scheme was manually applied to the historical and recent imagery. Our preliminary results suggest two main changes on this landscape over the last 60 years. Suburban developments now occur on patches of former agricultural land, and roads associated with development have increased fragmentation. It also appears that forest cover has increased due to reduced logging and abandonment of agricultural lands. Cedarburg Bog

remains a large, undisturbed wetland in an otherwise changing landscape. Changes in the surrounding landscape could increase the abundance of nonnative species and favor the movement of organisms, native and non-native, within forested cover types. Undergraduate research project, Erica Young, advisor.



Development of Intercomparison Strategies for Multiple Measures of the Onset of Spring

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Many methods are used to measure the onset and progress of vegetative growth during the spring season in temperate climates. These can be grouped into three major categories: 1) conventional phenological observations of numerous native and indicator plants (both cloned and normal types) recorded by human observers; 2) instrumental measurements of latent-sensible heat energy balance and carbon dioxide

flux (related to plant photosynthesis and transpiration); and 3) satellite measurements of vegetative development (derived from visible and near-infrared band reflectance values). All of the measurements are valid (i.e., record a real characteristic related to plant development) but the three categories are looking at different features, and typically have incompatible levels of spatial representation. This project is part of initial efforts to

standardize measurements at two phenology "super-sites" in eastern North America (where large numbers of plants species are monitored together with detailed recordings of atmospheric and remotely-sensed data), and explore strategies to evaluate the comparability of multiple spring vegetative growth measures. Extensive conventional phenological measurements are available at the University of Wisconsin-Milwaukee Field Station (UWMFS, 43.39°N, 88.02°W),

and Harvard Forest, Massachusetts (HF, 42.43°N, 72.19°W) sites. These include bud-burst measurements of the native species (taken since 1990 at HF, and at both sites using the same protocol since 2000), and the clone indicator lilac *Syringa chinensis* 'Red Rothomagensis' (since 1993 at UWMFS and both sites since 2000). This project is nearing completion, and a publication will be submitted in 2008.

Bridging Spatial Scales Using Phenological Measurements to Improve Understanding of Springtime Atmosphere-Biosphere Interactions

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As part of this project, 108 evenly distributed trees have been marked in Downer Woods (on the UW-Milwaukee campus) and are being phenologically observed both in autumn (starting in 2007) and in spring (starting in 2008). In addition, automatic air and soil temperature measurements are being collected at several locations to support analyses of these phenological

measurements. These measurements will also be compared to data being collected on at least one similar species (*Tilia americana*, Basswood) at both the UW-Milwaukee Field Station and at the primary study site of this project near Park Falls, WI. Presentations from this work will be made in 2008. Funded by National Science Foundation Grant #BCS-0649380.

Geographic Variation of Stable-strontium Isotopes ($\delta^{87}\text{Sr}$) in Avian Tissue: Applications for Tracking Migratory Passerine Birds

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Understanding the ecology of migratory birds requires information on long-distance movements between breeding and wintering grounds. Intrinsic markers, such as stable isotopes, provide a novel and cost-effective opportunity to track migration movements. These markers are powerful tools for asking fundamental questions about the ecology and evolution of migration because the origin of individuals can theoretically be estimated from a single capture. Isotopes are naturally occurring forms of elements that vary in atomic weight, and signatures are incorporated into animal tissues through local food webs. Because of this, the isotopic signature of a migrant's tissues reflects the



habitat used during the time of tissue growth. Stable-light isotopes have been used to track long-distance migratory movements but with relatively coarse resolution. In an attempt to increase resolution, our study investigated the effectiveness of stable-strontium isotope ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) to act as markers to track migration. To accomplish this, we sampled feathers from Tree Swallows (*Tachycineta bicolor*) at 18 sites across North America from 4 May – 1 September, 2007. We are in the process of completing the analysis of these samples at the Queen's Facility for Isotope Research, Queen's University, Kingston, Ontario. Analyses will be completed by February 2008 and project completion is expected by June 2008. This project is the first to

examine the large-scale variation of $^{87}\text{Sr}/^{86}\text{Sr}$ in animal tissue, and results will indicate whether, and at what scale, $^{87}\text{Sr}/^{86}\text{Sr}$ can be used to track the annual movements of avian migrants. If $^{87}\text{Sr}/^{86}\text{Sr}$ values in avian tissues vary predictably across North America, this isotope could be combined with other isotopic markers (e.g. Hydrogen) to further increase spatial resolution. Estimating the degree of connectivity using isotopic markers will provide critical information for understanding the causes and consequences of population decline in migratory birds and increase our ability to identify critical habitats for species-at-risk. Funding for this project is provided by the AOU, SCO, Ellis Bird Farm, and NSERC Discovery Grant.

An Urban Cooper's Hawk Nesting Study in the Metropolitan Milwaukee Area

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The objectives of this study are to gather baseline data on the reproductive success of Cooper's Hawks (*Accipiter cooperii*) in the urban metropolitan Milwaukee area, to describe urban nesting habitat, and to compare these data with other Cooper's Hawk studies in Wisconsin. Long-term objectives are to determine Cooper's Hawk nest site fidelity, breeding population mortality and recruitment, population growth trends, immigration and emigration patterns, and natal dispersal patterns for the same urban population. In 2007, 25 of 31 laying pairs produced 91 young to a bandable age (ca. 18 days; 2.94 young/laying pair; 3.64 young/successful pair, 80.6% nesting success). All nestlings (47 males, 44 females) were banded. One second nesting attempt (i.e., re-nest) failed. Blood was drawn on all nestlings for genetic analysis, blood slides were prepared from blood of 50 nestlings for blood parasite analysis, and throat swabs were collected from 49 nestlings for *Trichomoniasis* analysis. Forty-one adult (i.e., breeding) Cooper's

Hawks (20 males, 21 females) were trapped, banded, measured, colormarked, and processed for additional analyses at 25 different nest sites. Blood was drawn on all 41 adults for genetic analysis, and blood slides were prepared for blood parasite analysis and throat swabs were collected for *Trichomoniasis* analysis from 40 adults. Two of 49 throat swab samples from nestlings tested positive for *Trichomoniasis* at two different nest sites. One of these nest sites had apparently healthy fledged young (at least 4 of 5 nestlings were seen) when revisited; no young were seen at the second nest site when revisited. All adult Cooper's Hawk throat swab samples tested negative for *Trichomoniasis*. The nest in Downer Woods produced two young. Both adults and both nestlings tested negative for *Trichomoniasis*. This project was supported, in part, through the Wisconsin Society for Ornithology (WSO) Small Grants Program.

Establishing a Long-term Citizen-based Herptile Monitoring Program in Historic Riverside Park, Milwaukee

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We are establishing a long-term citizen-based monitoring program for snakes and turtles in Riverside Park, Milwaukee. The program includes annual snake mark/recapture surveys using plywood cover boards, and tracking individuals of the state Threatened Butler's gartersnake (*Thamnophis butleri*) to determine life history parameters and population trends. We will also conduct annual turtle visual basking surveys and mark/recapture surveys using traps, and radio track turtles to determine activity ranges within the study area. Recent sightings of basking map turtles in the Milwaukee River, an area outside their published range in Wisconsin, highlight the importance of a long-term turtle survey. Painted, snapping, and spiny softshell turtles have also been sighted in the study area. The Wisconsin Strategy for Wildlife Species of Greatest Conservation Need identifies several priorities for amphibians and reptiles which will be advanced by this research - a) implementing more routes and surveys for all amphibian and reptile monitoring programs in the state, b) developing new volunteer programs for monitoring snakes and turtles, c) the development and

use of standard or comparable protocols, d) conducting more training in field identification and survey methods, and e) increasing efforts to involve the public, K-12 schools, and colleges in collecting inventory and monitoring data. Funded by Citizen-based Monitoring Partnership Program, Prairie Biotic Research Program and Milwaukee County Zoo.



Testing the Enemy Release Hypothesis on Exotic Plant Species of a Prairie Old-field Community in Southeastern Wisconsin

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Invasive plant species are becoming increasingly costly, both economically and environmentally. The mechanisms that allow certain exotic species to become invasive are poorly understood. One leading theory to explain invasiveness is the Enemy Release Hypothesis. This hypothesis states that certain exotic plants gain a competitive advantage over natives because the

important predator and pathogen enemies that regulate their populations in the home range are absent in the introduced range. Several studies have provided equivocal evidence for enemy release. Typically these studies have measured damage levels on invasives and compared them to natives of various growth forms and habitat types. However, no study has measured damage

levels and the potential gained competitive advantages of invasives relative to the other species that constitute the invaded community. In our test of the Enemy Release Hypothesis we determined if enemy release exists for an invasive exotic plant species in comparison to the other, potentially competing native and exotic species in the same community. An enemy exclusion experiment was run to help determine the impact herbivore and pathogen damage have on the growth and reproduction of native and exotic plant species. This study addresses the following questions: (1) Does an invaded community contain a higher abundance of the problematic invasive exotic species than the natives and other exotics in that community? (2) Are invasive species receiving less damage than the natives and other exotics in that community? (3) When the herbivore and pathogen enemies of a plant community

are excluded do invasive exotics lose their competitive advantage? Our results will lead to a better understanding of a potentially important mechanism of certain plant invasions. M.S. Thesis Research, Dr. Gretchen Meyer, Major Professor.



The Impact of Interpopulation Crossing Distance on the Fitness of First and Second Generation Offspring in *Impatiens capensis* Meerb. (Balsaminaceae)

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Restoration, reintroduction, and hybridization rescue are important tools for the conservation of wild populations. There is currently a great deal of uncertainty in the selection of appropriate populations for use in restorations, reintroductions, population augmentations, captive breeding programs and in nursery establishment efforts that support restoration efforts. Of special concern are possibly detrimental genetic impacts that crossing between distinct populations could have on often small remnant populations. The potential for hybrid vigor and outbreeding depression limit our ability to apply many of these important conservation tools. Despite these concerns, little research has been conducted using wild populations to explore the relationship between interpopulation outcrossing distance and the level of hybrid vigor and/or outbreeding depression expressed in the offspring. In

this experiment, thirteen wild populations of the common annual plant *Impatiens capensis* Meerb. (Orange jewelweed) are used to examine the effect of interpopulation distance on two generations of offspring fitness. The research design includes the production of first and second-generation offspring by randomized crossing between each of three local populations and two replicate populations from distances of 50, 100, 200, 400 and 800 kilometers. Fitness impacts are being assessed by comparing the fitness of individuals produced by crossing within each population (P1) with the fitness of hybrids produced by crossing between populations separated by increasing distances. The separate effects of hybrid vigor, and two components of outbreeding depression will be partitioned by comparing the fitness of non-hybrid P1 plants with the fitness of both first generation (F1) and

second generation (F2) offspring. In the final field season of this experiment, the fitness of all cross-types was tested during the 2001 growing season at the UWM Field Station. Fitness was measured in the context of both a local parental environment and in a more controlled shade lattice environment. The resulting data are currently being analyzed

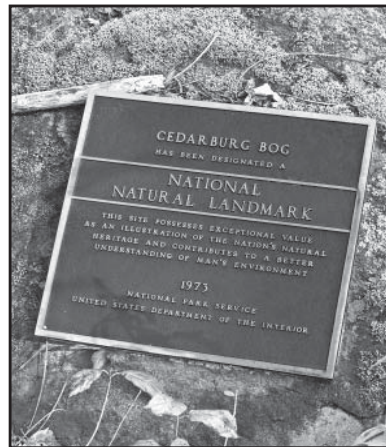
Long Term Ecological Change in a Vulnerable Wisconsin Wetland

Erica Young¹, Jim Reinartz², Jason Mills¹, and Gretchen A. Meyer², ¹Department of Biological Sciences, UWM, ebyoung@uwm.edu, mills@uwm.edu, ²UWM Field Station, jimr@uwm.edu, gmeyer@uwm.edu

Cedarburg Bog is a wetland representing a southern outlier of a unique vegetation community type. It is inhabited by a large number of species at or near the southern limits of their distribution which are particularly vulnerable to ecological change, driven by factors including climate and land use changes, atmospheric deposition and displacement by invasive species. We are assessing change in the plants and animals of the Cedarburg Bog by updating several long-term datasets. We repeated a vegetation survey of the bog in 2006 using the same methods and sampling points of a similar survey carried out in 1991. We also surveyed the birds of the Cedarburg Bog, to extend the records collected by Charles Weiss (see abstract by W.P. Mueller). In addition, we are also collating and analyzing long-term data drawn from other sources, such as other research projects carried out at Cedarburg Bog, historical and current aerial photographs, and records from the Field Station weather station. This project will enable us to determine what changes have occurred in the ecological communities in the bog over the past few decades, and

and will be used to test existing theories in conservation genetics and inform biologists involved in habitat restoration, population reintroduction, and hybridization rescue efforts. PhD Dissertation research, James Reinartz, Major Professor.

to generate hypotheses about mechanisms driving change for particular functional groups of plant and animal species. Funded by Research Growth Initiative, UWM.



WDNR/UW-Stevens Point Peatlands Project

Stephanie B. Zolkowski; UW-Stevens Point, College of Natural Resources, Stephanie.B.Zolkowski@uwsp.edu

The Wisconsin Department of Natural Resources has teamed up with the University of Wisconsin-Stevens Point to conduct a multi-taxa baseline inventory designed to assess the effects of climate change on peatland biotic communities. Baseline surveys were conducted during 2004, 2005, 2006, and 2007, and occurred statewide at two levels of intensity. Thirteen intensive survey sites were visited twice per year during all three years, whereas 120-180 extensive survey sites were visited only one time during the time of the inventory. I conducted the bird surveys for the inventory during 2006 and 2007. The bird surveys consisted of standard point count methods as well as some vegetation sampling. One of the thirteen intensive sites is the Cedarburg Bog State Natural Area.

Two surveys were conducted during the 2006 breeding season and two more were conducted in the 2007 breeding season. Now that all of the field research has been completed, I am beginning to analyze the results to model the habitat relationships of the bird communities in peatlands throughout the state of Wisconsin. The data is being analyzed using canonical correspondence analysis and logistic and linear regression with Akaike's Information Criteria (AIC) model selection. In 2007, the following species were observed at the Cedarburg Bog SNA: Alder flycatcher, American crow,

American robin, Black-capped chickadee, Blue jay, Blue-headed vireo, Canada goose, Cedar waxwing, Chipping sparrow, Common Yellowthroat, Connecticut warbler, Downy woodpecker, Gray catbird, Great crested flycatcher, Le Conte's Sparrow, Mallard, Mourning dove, Nashville warbler, Northern cardinal, Ovenbird, Red-winged blackbird, Ruby-Crowned Kinglet, Ruffed grouse, Rusty blackbird, Sandhill crane, Savannah sparrow, Sedge wren, Veery, Warbling vireo, and White-throated sparrow.



Recent Publications and Theses

— Recent Publications Resulting from Field Station Projects —

- Ellison, A. M., N. J. Gotelli, J. S. Brewer, D.L. Cochran-Stafira, J. M. Kneitel, T. E. Miller, A. C. Worley and R. Zamora.** 2003. The evolutionary ecology of carnivorous plants. *Advances in Ecological Research* 33: 1-74.
- Jass, J. and B. Klausmeier.** 2003. Utilization of lotic, lentic, and temporary habitats by the Amphipod *Crangonyx gracillis*. *Journal of Freshwater Ecology* 18: 635-638.
- Jass, J. and B. Klausmeier.** 2003. The terrestrial isopod *Hyloniscus riparius* (Osopoda: Oniscidea: Trichoniscidae) in Wisconsin. *Great Lakes Entomologist* 36: 70-75.
- Meehan, T.D., R.N. Rosenfield, V.N. Atudorei, J. Bielefeldt, L.J. Rosenfield, W.E. Stout, and M.A. Bozek.** 2003. Variation in hydrogen stable-isotope ratios between adult and nestling Cooper's Hawks. *Condor* 105:567-572.
- Poirier, N. E., L. A. Whittingham and P. O. Dunn.** 2003. Effects of paternity and mate availability on mate switching in House Wrens. *Condor* 105: 816-821.
- Pytte, C. L., K. M. Rusch and M. S. Ficken.** 2003. Regulation of vocal amplitude by the Blue-throated Hummingbird, *Lampornis clemenciae*. *Animal Behaviour* 66: 703-710.
- Whittingham, L. A., P. O. Dunn and E. D. Clotfelter.** 2003. Parental allocation of food to nestling Tree Swallows: the influence of nestling behaviour, sex and paternity. *Animal Behaviour* 65: 1203-1210.
- Jakobs G, E. Weber and P.J. Edwards.** 2004. Introduced plants of the invasive *Solidago gigantea* (Asteraceae) are larger and grow denser than conspecifics in the native range. *Diversity and Distributions* 10: 11-19.
- Jass, J. and B. Klausmeier.** 2004. Response to Kalisz and Powell. *Natural Areas Journal* 24: 176.
- Karron, J. D., R. J. Mitchell, K. G. Holmquist and J. M. Bell.** 2004. The influence of floral display size on selfing rates in *Mimulus ringens*. *Heredity* 92: 242-248.
- Mitchell, R. J., J. D. Karron, K. G. Holmquist and J. M. Bell.** 2004. The influence of *Mimulus ringens* floral display size on pollinator visitation patterns. *Functional Ecology* 18: 116-124.
- Poirier, N. E., L. A. Whittingham and P. O. Dunn.** 2004. Males achieve greater reproductive success through multiple broods than through extra pair mating in House Wrens. *Animal Behaviour* 67: 1109-1116.
- Pytte, C. L., M. S. Ficken and A. Moiseff.** 2004. Ultrasonic singing by the Blue-throated Hummingbird: a comparison between production and perception. *J. Comp Physiol A* 190: 665-673.
- Weise, C. M., G. A. Meyer and H. O'Brien.** 2004. A long-term survey of the breeding birds of the Cedarburg Bog and Cedarburg Beech Woods State Natural Areas. *Passenger Pigeon* 66: 101-112.
- Bell, J. M., J. D. Karron and R. J. Mitchell.** 2005. Interspecific competition for pollination lowers seed production and outcrossing in *Mimulus ringens*. *Ecology* 86: 762-771.
- Dunn, P.O. and L. A. Whittingham.** 2005. Radio-tracking of female tree swallows prior to egg-laying. *Journal of Field Ornithology* 76: 259-263.
- Hovick, S. M. and J. A. Reinartz.** 2005. Combination of treatments influence survival of woody species planted to suppress reed canarygrass (Wisconsin). *Ecological Restoration* 23: 126.
- Hunter, T. A. and J. Picman.** 2005. Characteristics of the wing sounds of four hummingbird species that breed in Canada. *Condor* 107: 570-582.
- Joppa, L. N. and S.A. Temple.** 2005. Use of upland habitat by the Butler's gartersnake (*Thamnophis butleri*). *Bull. Chicago Herp. Soc* 40: 221-227.
- Meyer, G. A., R. Clare and E. Weber.** 2005. An experimental test of the Evolution of Increased Competitive Ability hypothesis in goldenrod, *Solidago gigantea*. *Oecologia* 144: 299-307.
- Mitchell, R. J., J. D. Karron, K. G. Holmquist and J. M. Bell.** 2005. Patterns of multiple paternity in fruits of *Mimulus ringens* (Phrymaceae). *American Journal of Botany* 92: 885-890.
- Nooker, J. K., P. O. Dunn, and L. A. Whittingham.** 2005. Effects of food abundance, weather and female condition on reproduction in tree swallows. *The Auk* 122: 1225-1238.
- Stout, W.E., A. Cassini, J.K. Meece, J.M. Papp, R.N. Rosenfield, and K.D. Reed.** 2005. Serologic evidence of West Nile virus infection in three wild raptor populations. *Avian Diseases* 49:371-375.

- Tarof, S. A., P. O. Dunn and L. A. Whittingham.** 2005. Dual functions of a melanin-based ornament in the Common Yellowthroat. *Proceedings of the Royal Society of London B* 272: 1121-1128.
- Torti, V. and P.O. Dunn.** 2005. Variable effects of climate change on six species of North American birds. *Oecologia* 145: 486-495.
- Whittingham, L.A., P.O. Dunn, and J. K. Nooker.** 2005. Maternal influences on brood sex ratios: an experimental study in tree swallows. *Proceedings of the Royal Society of London B* 272: 1775-1780.
- Whittingham, L.A. and P.O. Dunn.** 2005. Effects of extra-pair and within-pair reproductive success on the opportunity for selection in birds. *Behavioral Ecology* 16: 138-144.
- Youngsteadt, E. and P.J. Devries.** 2005. The effects of ants on the entomophagous butterfly caterpillar *Feniseca tarquinius*, and the putative role of chemical camouflage in the *Feniseca-Ant* interaction. *Journal of Chemical Ecology* 31: 2091-2109.
- Garvin, J., B. Abroe, M. Pedersen, P. O. Dunn and L. A. Whittingham.** 2006. Immune response of nestling warblers varies with extra-pair paternity and temperature. *Molecular Ecology* 15: 3822-3840.
- Güsewell S., G. Jakobs and E. Weber.** 2006. Native and introduced populations of *Solidago gigantea* differ in shoot production but not in leaf traits or litter decomposition. *Functional Ecology* 20: 575-585.
- Jass, J.P.** 2006. Prevalence of invasive slugs in the leaf litter of Wisconsin State Natural Areas. *Tentacle* 14:7-8.
- Jass, J. and B. Klausmeier.** 2006. Determining the presence of fairy shrimps (Crustacea: Anostraca) at ephemeral pond sites in Wisconsin. Wisconsin Department of Natural Resources Research Report 188: 1-5.
- Kapfer, J. M.** 2006. Herpetofauna of the University of Wisconsin-Milwaukee Field Station, (Saukville, Wisconsin): A preliminary report. *Bull. of the Chicago Herpetological Society* 41: 3: 45-49.
- Kapfer, J. M. and T. Muehlfeld.** 2006. The herpetofauna of the University of Wisconsin-Milwaukee Field Station, (Ozaukee County, Wisconsin): an updated report. *Bull. of the Chicago Herpetological Society* 41: 198-202.
- Karron, J. D., R. J. Mitchell, and J. M. Bell.** 2006. Multiple pollinator visits to *Mimulus ringens* (Phrymaceae) flowers increase mate number and seed set within fruits. *American Journal of Botany* 93: 1306-1312.
- Pedersen, M., P. O. Dunn, and L. A. Whittingham.** 2006. Extra-territorial forays are related to a male ornamental trait in Common Yellowthroats. *Animal Behaviour* 72: 479-486.
- Redell, D., D. Shurilla, H. Guenther, S.R. Craven, J.A. Reinartz, and M. Rowe.** 2006. Detecting directional movement at a hibernaculum with an infrared beam-break system. *Bat Research News* 47: 71-80.
- Schwartz, M. D., R. Ahas, and A. Aasa.** 2006. Onset of spring starting earlier across the Northern Hemisphere. *Global Change Biology* 12: 343-351.
- Snyder, B.A., M.L. Draney and P. Sierwald.** 2006. Development of an optimal sampling protocol for millipedes (Diplopoda). *Journal of Insect Conservation* 10: 277-288.
- Stout, W.E., R.N. Rosenfield, W.G. Holton, and J. Bielefeldt.** 2006. The status of breeding Cooper's Hawks in the metropolitan Milwaukee area. *Passenger Pigeon* 68:309-320.
- Whittingham, L. A., P. O. Dunn and M. Stapleton.** 2006. Repeatability of extra-pair mate choice by female Tree Swallow. *Molecular Ecology* 15: 841-849.
- Casper, G. S.** 2007. On the herpetofaunal history of the University of Wisconsin-Milwaukee Field Station (Ozaukee County, Wisconsin). *Bulletin of the Chicago Herpetological Society* 42:21-30.
- Casper, G. S., J. M. Kapfer, and T. Muehlfeld.** 2007. Geographic distribution. *Emydoidea blandingii* (Blanding's turtle). *Herpetological Review* 38:99-100.
- Gallant, A. L., R. W. Klaver, G. S. Casper, and M. J. Lannoo.** 2007. Global rates of habitat loss and implications for amphibian conservation. *Copeia* 2007:967-979.
- Hull-Sanders, H.M., R. Clare, R.H. Johnson, and G.A. Meyer.** 2007. Evaluation of the Evolution of Increased Competitive Ability (EICA) hypothesis: loss of defense against generalist but not specialist herbivores. *Journal of Chemical Ecology* 33: 781-799
- Johnson, R.H., H.M. Hull-Sanders and G.A. Meyer.** 2007. Comparison of foliar terpenes between native and invasive *Solidago gigantea*. *Biochemical Systematics and Ecology* 35: 821-830

Mascaro, J. and S. A Schnitzer. 2007. *Rhamnus cathartica* L. (Common Buckthorn) as an ecosystem dominant in southern Wisconsin forests. *Northeastern Naturalist* 14:387-402

Mitchell, D. P., P. O. Dunn, L. A. Whittingham and C. R. Freeman-Gallant. 2007. Attractive males provide less parental care in two populations of the common yellowthroat. *Animal Behavior* 73: 165 -170

Placyk, J. S. Jr., G. M. Burghardt, R. L. Small, R. B. King, G. S. Casper and J. W. Robinson. 2007. Post-glacial recolonization of the Great Lakes region by the common gartersnake (*Thamnophis sirtalis*) inferred from mtDNA sequences. *Molecular Phylogenetics and Evolution* 43:452-467.

Recent Theses

Bell, John M. 2003. The effect of interspecific competition for pollinator service on seed production and outcrossing rates in *Mimulus ringens* (Scrophulariaceae). Ph.D dissertation.

Brylawski, Alice M. J. 2003. The effectiveness of mate guarding as a paternity guard for male house wrens. M.S. thesis.

Casper, Gary S. 2003. Analysis of amphibian and reptile distributions using presence-only data. Ph.D dissertation.

Clare, Robert. 2003. An evaluation of the Evolution of Increased Competitive Ability (EICA) hypothesis: Insect performance on native and introduced populations of *Solidago gigantea* (Asteraceae). M.S. thesis.

Nooker, Jacqueline K. 2003. The effects of environmental variation and female condition on reproduction in tree swallow. M.S. thesis.

Youngsteadt, Elsa. 2003. The effects of ants on the carnivorous butterfly caterpillar *Feniseca tarquinius* and the role of chemical camouflage in the *Feniseca*-ant interaction. M.S. thesis.

Pedersen, Marc C. 2004. Extraterritorial movements of male and female common yellowthroats in relation to a male ornamental trait. M.S. thesis.

Abroe, Betsy. 2005. Do more attractive males have more sons in the common yellowthroat *Geothlypis trichas*. M.S. thesis.

Holmquist, Karsten G. A. 2005. The effect of floral display and pollinator behavior on pollen-mediated gene dispersal in *Mimulus ringens*. Ph.D dissertation.

M. D. Schwartz. 2007. Development of Intercomparison Strategies for Multiple Measures of the Onset of Spring. Wisconsin Forest Health Highlights 2007, Wisconsin Dept. of Natural Resources.

Stout, W.E., R.N. Rosenfield, W.G. Holton, and J. Bielefeldt. 2007. Nesting biology of urban Cooper's Hawks in Milwaukee, Wisconsin. *Journal of Wildlife Management* 71:366-375.

Yoder, H. R., J. R. Coggins. 2007. Helminth communities in five species of sympatric amphibians from three adjacent ephemeral ponds in southeastern Wisconsin. *J. Parasitology* 93(4): 755-760.

Hovick, Stephen M. 2005. Restoring forest in wetlands dominated by reed canary grass: the effects of pre-planting treatments on early survival. M.S. thesis.

O'Brien, Heather L. 2005. Assessment of white-tailed deer (*Odocoileus virginianus* Zimmerman) density and browse damage at University of Wisconsin-Milwaukee Field Station. M.S. thesis.

Redell, David N. 2005. Behavioral ecology of bats using the Neda Mine hibernaculum. M.S. thesis.

Garvin, Julia C. 2006. Male ornaments, extra-pair mating, and immunocompetence in the common yellowthroat. Ph.D dissertation.

Bott, Terry. 2007. Morphological diversity of the northern pitcher plant (*Sarracenia purpurea* L.) in two contrasting wetlands. M.S. thesis.

Hapner, Jill A. 2007. Factors influencing plant community development and wildlife use in small conservation wetlands in southeastern Wisconsin. Ph.D dissertation.

Kapfer, Josh. 2007. The Ecology of Bullsnares (*Pituophis catenifer sayi*) in Upper Midwestern Prairies. Ph.D dissertation.

Maurer, Joan K. 2007. Detection of avian blood parasites in the common yellowthroat (*Geothlypis trichas*): A comparison of multiple methods. M.S. thesis.

Mitchell, Dan. 2007. Attractive males provide less parental care in two populations of the common yellowthroat. M.S. thesis.

Cooperation with Other Groups and Agencies

Service to the local community, and to the state-wide community of individuals, groups, and organizations engaged in natural area study and preservation is a major part of the Field Station's mission. To the extent that our staff has time available, we provide natural area consulting services to the community. The demand for these services exceeds our capacity to help, but we feel that these cooperative efforts are a very important part of our mission.

- 1. Friends of the Cedarburg Bog.** The Field Station cooperates with and helps to support this non-profit organization that has a mission to initiate and support activities that will enhance the natural history, public appreciation, and scientific study of Cedarburg Bog in cooperation with the Wisconsin DNR and UWM.
- 2. Department of Natural Resources.** The Station continued its wide range of planning and management activities in conjunction with the DNR. These activities include the day-to-day surveillance of the Cedarburg Bog performed by Station staff and some assistance with maintenance activities such as snowplowing.
- 3. Natural Areas Preservation Council.** The Station participates in the State Natural Areas program, since the Station owns and manages five properties that have State Natural Areas status.
- 4. Ozaukee Washington Land Trust.** The Land Trust is a non-profit, land conservancy for Ozaukee and Washington Counties. The Field Station helps to support the organization's activities in various ways. Jim Reinartz served on the Conservation and Stewardship Committees and aids in development of stewardship plans and natural area management.
- 5. Invasive Plants Association of Wisconsin.** This non-profit organization works to stop the spread of invasive plants in Wisconsin. Reinartz serves on the Board of Directors and is editor of the IPAW newsletter, "Plants out of Place".
- 6. Riveredge Nature Center.** This year there were a number of cooperative programs. Field Station personnel participated in Riveredge naturalist training programs. Gretchen Meyer and Jim Reinartz both serve on the Riveredge Research and Stewardship Committee, and Reinartz serves on the Board of Directors.
- 7. Regional School Systems.** Advanced biology classes from several high schools in the region (Milwaukee and Ozaukee counties) use the Field Station for ecology field classes.



Rearing beetles for biological control of purple loosestrife for Wisconsin Department of Transportation.

8. Ozaukee County Department of Environmental Health. The Field Station continues to provide monthly rainfall totals from our weather station for use in soil test requirements.

9. Town of Saukville. J. Reinartz serves on the Town's Gravel Pit Review Committee.

10. Village of Saukville. Daily rainfall totals are provided on a regular basis to the Village of Saukville engineers.

11. Port Washington Power Plant. Weather records are provided monthly.

12. Organization of Biological Field Stations. The Station is an active member of this national organization and cooperates in the exchange of information on programs.

13. Sierra Club-Milwaukee Chapter. The Field Station provides a site for the Club's annual retreat, and volunteer opportunities for members.

14. The Nature Conservancy. Jim Reinartz serves on the Science and Stewardship Committee of the Wisconsin Chapter.

15. City of Mequon – Mequon Nature Preserve. Jim Reinartz serves on the MNP science and stewardship planning committee.

16. Wisconsin Department of Transportation. The Station raises beetles for biological control of purple loosestrife for WDOT.

17. Urban Ecology Center—Milwaukee. G. Meyer serves on the Science Advisory Board.

18. U.S. Fish and Wildlife Service. G. Meyer assists in surveys for the federally-endangered Hine's emerald dragonfly (*Somatochlora hineana*), and provides support for monitoring efforts.

19. Wisconsin Governor's Task Force on Invasive Species. Reinartz serves on the task force and on the Science and Research Subcommittee of the task force.

20. Great Lakes Earth Institute. G. Meyer served on the Steering Committee of the Great Lakes Earth Institute and participated in the development of a new course, "Sustainable Wisconsin: Building the Legacy".



Friends of the Cedarburg Bog volunteers worked in the Field Station Maintenance Shop constructing boardwalk sections.

Class and Group Use

Spring 2007 Number of Student Hours

Winter Ecology Hike and Friends Chili Dinner	660
FOCB – Spring night hike	50
Spring frogs and woodcock	80
Spring Migration Bird Walk	70
Full moon night hike	80
Natural History of the Bog Walk	30
Friends of Cedarburg Bog – Work Parties	150
Meetings	90
Riveredge Research & Stewardship Committee	40
Riveredge Nature Center – Teacher Naturalist Training	60
Sierra Club – Annual Retreat	420
Chicago hiking club – Bog tour	50
Mayville Historical Society – History of Neda Mine	50
Wisconsin Wetlands Association & FOCB – Frogs of the Bog	40
Wisconsin Phenological Society – Conference	50
Mequon Nature Preserve – Invasive plant identification	70
Milwaukee Area Technical College – Natural Landscaping	40
University of Illinois-Chicago– Animal behavior – Neda bats	120
UW – Eau Claire – Ecology	450
UWM – SARUP – Planning for the Cedarburg Bog	180
UWM – Plant Systematics and Evolution	60
UWM – Geophysical Exploration, Neda Mine and Woods	600
UWM – Introduction to Earth, Neda Mine	300
TOTAL	3,740

Summer 2007

Vegetation of Wisconsin Workshop	1,240
Lichens: Identification and Ecology Workshop	360
Biology of Insects Workshop	360
Grasses: Identification and Ecology	360
Spiders: Identification and Ecology Workshop	360
Ecological Geology Workshop	900
Summer Solstice Walk	80
Medicinal plants of the Cedarburg Bog	40
Friends of Cedarburg Bog – Canoe Mud Lake	60
Friends of Cedarburg Bog – meetings	60
Sierra Club – Leadership training course	520
Schlitz Audubon Society – Bog tour	80
Wild Ones – Bog walk	40
Ozaukee Washington Land Trust – Monitor training	90
Sally Ride Academy – Teacher Training Bog Ecology	130
UW-Madison – Plant Ecology	110
TOTAL	4,790

Fall 2007**Number of Student Hours**

Techniques in Mammal Censusing Workshop	360
Biological Sciences/Field Station Picnic	120
Friends of Cedarburg Bog – meetings	80
Friends of Cedarburg Bog – work parties	310
Friends of Cedarburg Bog – Annual Meeting	80
Bird Banding demonstration	30
Riveredge Nature Center – Teacher naturalist training	90
Riveredge Research & Stewardship Committee	70
Important Breeding Bird Areas – Owl Banding	60
Parkway Christian Academy	60
Kettle Moraine Lutheran High School	40
Milwaukee Institute of Art and Design – Ecology	130
Alverno College – Wetland Ecology	50
University of Illinois-Chicago– Ecology field trip	420
UW – Platteville – Ecology	270
UWM–Ecology	380
UWM – Limnology	60
UWM – Geography – Soils	110
UWM – Geology – Hydrogeology	90
TOTAL	2,810
TOTAL 2007 Class & Group Use Hours	11,340

2007 Natural History Workshops

This is a series of intensive workshops on specialized topics which provide a continuing education opportunity and a meeting place for biologists. Seven workshop topics were offered this season. Each of our workshops was filled to the capacity of 20 people.

Workshop	Instructor	Date
Vegetation of Wisconsin	James Reinartz Marc White	June 4 - 9
Lichens: Identification and Ecology	Susan Will-Wolf Marie Trest	June 22 & 23
Biology of Insects	Gretchen Meyer Robert Clare	July 13 & 14
Grasses: Identification and Ecology	Robert Freckmann	July 27 & 28
Spiders: Identification and Ecology	Michael Draney	August 3 & 4
Ecological Geology	Roger Kuhns	August 20 - 25
Techniques in Mammal Censusing	Christopher Yahnke	September 8 & 9

Meteorological Data for 2007

This yearly summary is modeled, where possible, after the summaries provided by the National Oceanic and Atmospheric Administration (NOAA). Some differences between the two reports reflect differences in available equipment. Records for the Field Station are reported in degrees Celsius and in other metric measures. In addition, growing degree-days at 5° and 10°C, (see below for description) were substituted for the heating and cooling degree-days used by NOAA. The variables reported in the summaries are defined as follows:

Temperature

Average Daily Maximum: Monthly mean of the 30-min period in each day with the highest mean temperature.

Average Daily Minimum: Monthly mean of the 30-min period in each day with the lowest mean temperature.

Daily Average: Monthly mean of all 30-min means. (NOAA uses the midpoint between the daily minimum and maximum for this measure.)

Highest(Date): Highest 30-min mean temperature. (Day of month with highest temperature.)

Lowest(Date): Lowest 30-min mean temperature. (Day of month with lowest temperature.)

Degree Days

Sum at 5°: Sum of the number of degrees by which the daily average temperatures exceeded 5° C.

Sum at 10°: Sum of the number of degrees by which the daily average temperature exceeded 10° C.

Radiation (kW/m²)

Mean: Mean of all 30-min means in the month.

Maximum: Maximum 30-min mean during the month.

Relative Humidity

Monthly mean of the 30-min means for each quarter of the day.

Number of Days

Precipitation of 0.25 mm or more

Temperature-Maximum

32° and above: Number of days with a maximum 30-min mean temperature of 32° C or above.

0° and below: Number of days with a maximum 30-min mean temperature of 0° C or below.

Temperature-Minimum

0° and below: Number of days with a minimum 30-min mean temperature of 0° C or below.

-18° and below: Number of days with a minimum 30-min mean temperature of -18° C or below.

Mean Pressure (mbars)

Mean of all 30-min means in the month.

Precipitation (mm)

Total: Sum of all precipitation during the month.

Greatest (24 hrs) (Date): Total precipitation on the day with the most precipitation and the date on which it occurred.

Wind

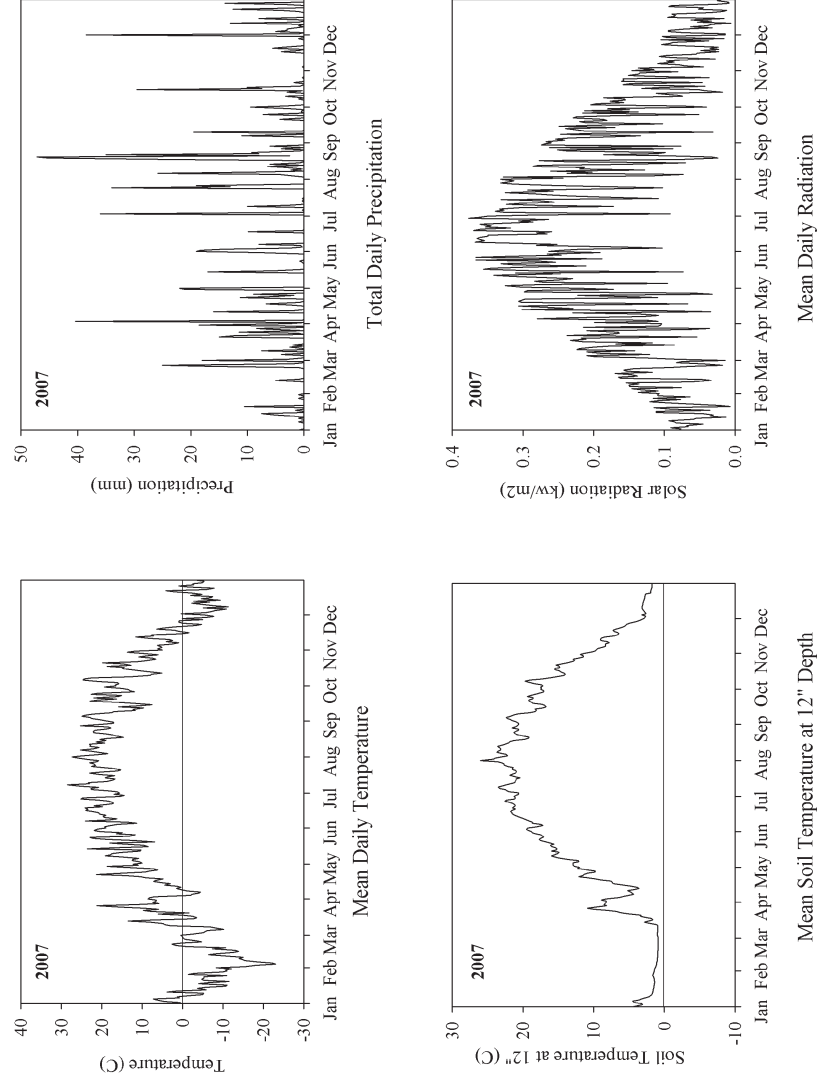
Mean Speed (m/s): Monthly mean of all 30-min means

Maximum Speed (m/s): Highest mean wind speed during a 30-min period.

The Field Station can provide weather data in electronic format; datasets go back to 1989. Please contact us if you would like to receive the weather data.

Meteorological Data for 2007

	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
Temperature (C°)												
Average Daily Maximum	-0.4	-5.4	8.4	11.3	21.0	24.9	26.0	25.5	23.2	18.3	5.9	-1.2
Average Daily Minimum	-7.9	-13.0	-1.8	1.5	8.4	12.4	14.4	15.8	11.0	8.4	-2.3	-8.9
Daily Average	-3.9	-9.0	3.2	6.3	15.1	19.4	20.5	20.6	17.2	13.3	2.2	-4.6
Highest (Date)	10.9 (3)	9.4 (21)	25.9 (26)	28.4 (29)	30.1 (14)	30.3 (16)	33.8 (6)	32.3 (28)	31.9 (5)	30.3 (6)	14.6 (12)	6.8 (23)
Lowest (Date)	-16.6 (31)	-26.4 (5)	-18.7 (8)	-7.2 (7)	2.6 (13)	6.3 (30)	7.4 (22)	10.2 (31)	1.6 (15)	-0.3 (28)	-12.2 (30)	-21.8 (6)
Degree Days												
Sum at 5°	3.6	0.0	67.4	96.5	312.5	431.0	479.9	483.9	366.2	258.0	19.2	0.0
Sum at 10°	0.0	0.0	21.7	33.4	162.4	281.0	324.9	328.9	218.9	126.2	1.6	0.0
Radiation (kW/m2)												
Mean	0.07	0.11	0.16	0.19	0.27	0.31	0.26	0.19	0.19	0.12	0.08	0.05
Maximum	0.62	0.64	0.81	0.95	1.01	1.05	1.02	0.94	0.84	0.70	0.56	0.56
Relative Humidity												
Hour 00-06 mean	83.7	77.7	81.8	81.6	76.4	90.3	91.0	95.9	89.0	85.9	81.2	90.6
Hour 06-12 mean	78.4	73.7	72.2	66.5	59.9	63.9	71.4	80.5	71.7	74.8	71.3	87.1
Hour 12-18 mean	66.8	63.1	60.2	56.5	52.0	55.6	59.8	70.4	59.8	63.8	61.9	82.8
Hour 18-24 mean	82.0	70.9	77.6	72.3	69.6	79.9	84.0	92.1	84.5	79.4	75.8	89.7
Number of Days												
Precip. 0.25mm or more	10	6	14	13	6	10	9	20	8	12	6	15
Max Temp 32° and above	0	0	0	0	0	0	0	1	0	0	0	0
Max Temp 0° and below	20	20	6	2	0	0	0	0	0	0	0	5
Min Temp 0° and below	27	28	16	13	0	0	0	0	0	1	21	29
Min Temp -18° and below	0	10	1	0	0	0	0	0	0	0	0	1
Pressure (mbars)												
Mean	1016.14	1015.89	1017.99	1014.09	1019.15	1015.23	1015.67	1018.65	1017.96	1014.98	1017.12	1023.34
Precipitation (mm)												
Total	31.5	50.0	108.4	119.0	53.3	73.1	115.8	242.0	45.8	70.0	15.3	110.0
Greatest (24 hrs) (Date)	10.5 (21)	25.0 (25)	18.5 (31)	40.4 (3)	22.0 (1)	19.0 (1)	36.0 (3)	47.2 (20)	19.5 (10)	29.5 (16)	5.5 (20)	38.5 (1)
Wind												
Mean Speed (m/s)	2.0	2.4	2.3	2.4	2.0	1.4	1.2	1.1	1.4	1.7	2.1	1.8
Maximum Speed (m/s)	6.4	7.5	7.0	8.2	6.0	4.8	4.6	5.9	5.1	6.7	6.7	7.5

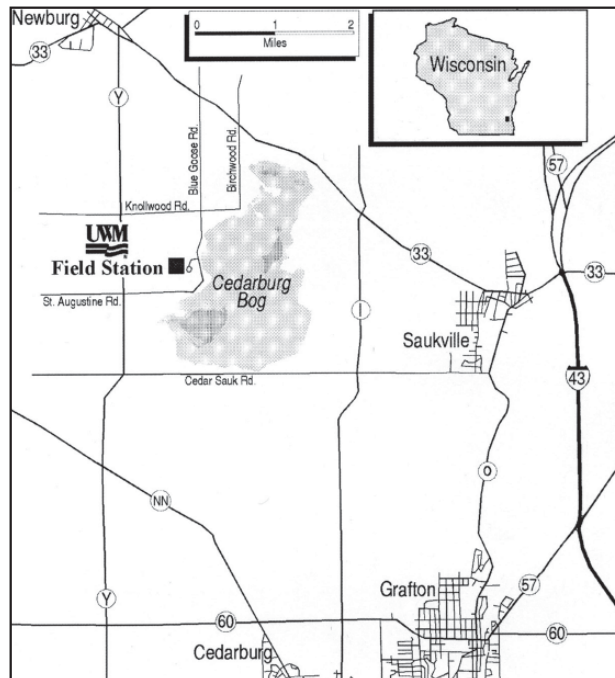




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