CHICAGO BOTANIC GARDEN

Science Yearbook 2012

Compiled by Kayri Havens-Young
2012

Executive Summary


Post-wildfire restoration plots – Pine Ridge, CO

The Chicago Botanic Garden's Plant Science and Conservation department had a remarkable year in 2012. On the research front, a new weevil (*Rhinocyllus conicus*) introduced as a bio-control for weed thistles was discovered impacting the already threatened Pitcher's thistle (*Cirsium pitcheri*). Garden scientists have been working for over 15 years to recover this important dune species. In Colorado, experiments were set up to test new post-wildfire restoration methods as part of our ongoing work with the Bureau of Land Management. From exploring biodiversity benefits of green roofs in Chicago, to understanding the impacts of climate change on rare plants in the Western U.S., and from developing sustainable pollination strategies for crops to developing tools to better conserve fungi, Garden scientists and students are positively impacting plants and plant communities around the world.


CLM interns collecting seed in NM

Training the next generation of plant scientists and conservation biologists continues to be an important activity in the department. The joint graduate program with Northwestern University is growing and thriving. Many of our students received prestigious fellowships and awards in 2012. Over 120 interns contributed to important stewardship activities on public lands as part of our Conservation and Land Management Intern Program. Students from middle school through to post-doctoral researchers worked alongside Garden scientists as part of the Science Career Continuum. Garden scientists contributed their expertise to conservation meetings and workshops in Taiwan and Korea and beyond.


Garlic Mustard

On our own campus, shoreline restoration around the North Lake was completed, improving habitat for birds and aquatic animals and adding over 120,000 native plants to the collection. Over 36,000 pounds of invasive garlic mustard was pulled, earning the Garden first place in the U. S. Forest Service's Garlic Mustard Challenge. Over 181 seed collections were added to the Dixon National Tallgrass Prairie Seed Bank, bringing the total collection to 2,403 accessions of 1,208 species and, helping safeguard our native plant species for future generations.

Contents

SCIENTIFIC STAFF

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RESEARCH PROJECTS & CONSERVATION PROGRAMS

The Chicago Botanic Garden is a leader in the international effort to conserve and promote global biodiversity. The Garden's plant biology and conservation science program is providing national and international leadership in conservation and training, engaging critical natural resource management research, and offering a world-class science facility for researchers and students. The program aims to help mitigate the loss of plant diversity and to foster an improved relationship between humans and nature. Said another way, the Garden's goal is no less than to help save the planet by helping to save its plants.

To accomplish this goal, 37 staff, 38 graduate students, and over 150 interns and volunteers in the Garden's plant biology and conservation science program focused their efforts on the five interrelated research and action areas represented by the columns in the following figure.

Documenting and Understanding BioDiversity	Understanding threats to plants, fungi, and native habitats	Mitigation against threats	Using plants and fungi for human benefit	Building scientific capacity and understanding
• Genetic and species diversity • Plant/animal and plant/ fungal interactions	• Invasive species • Habitat fragmentation and destruction • Climate change • Loss of pollinators • Declines in population size	• Seed banking • Plant monitoring program • Soil restoration • Assisted migration • Restoration ecology • Urban ecology (e.g., green roofs)	• Crop genetics • Ornamental plant breeding and evaluation	• NU Graduate Program – MS and PhD • Conservation Land Management Program (BLM) • Undergraduate interns • Science First and College First

The following project summaries are organized under these areas.

RESEARCH PROJECTS & CONSERVATION PROGRAMS

Understanding Threats to Plants, Fungi and Native Habitats

Phenology Projects – In partnership with the National Ecological Observatory Network (NEON) and the Garden's Education Department staff, we continued work on the Project BudBurst and Floral Report Card projects. Project BudBurst is a national citizen science campaign that engages the public to collect important ecological data about the timing of leafing, flowering, and fruiting of plants (*plant phenophases*) – all of which are related to climate. The program has observers in all 50 states. The Floral Report Card project consists of a network of identical climate change monitoring gardens. In 2011 and 2012, gardens were installed in 12 locations (four in Chicago, four in Seattle, Boston, Washington DC, North Carolina, and Iowa). Data collection began in 2012 at some of the gardens and all gardens will be ready for data collection in 2013 (Havens-Young, Schwarz-Ballard, and NEON collaborators).

Cultivars of Invasive Species– It is well known that cultivars of invasive species can vary widely in fecundity (viable seed production) leaving many wondering if all cultivars should be banned from sale when the parent species of those cultivar is deemed invasive. In 2011 we published results of a modeling study to determine if reductions in fecundity of an invasive species can result in a plant that is no longer invasive (Knight, Havens and Vitt, 2011). We found that fecundity needs to reduced to zero or nearly so for long-lived species in order for that species or cultivar to be considered "safe" or non-invasive. Fecundity reductions of 60-70% often made an invasive annual or biennial "safe." We also completed work on a four-year study of *Miscanthus sinensis* cultivars that was published in 2012 (Madeja, Umek and Havens, 2012). In particular, we assessed fecundity and seed viability to determine if the cultivars are likely to be as invasive as the wild type. In our evaluation only three cultivars were determined to be safe, *Miscanthus* x *giganteus* and *M. sinensis* 'Silberpfeil' and *M. sinensis* var. *condensatus* 'Cabaret'. Since 'Cabaret' was not reliably hardy, we only recommend the former two cultivars for use in this region (Havens-Young, Vitt, Madeja, Hawke, Umek, and outside collaborators).

Genetic Diversity in Rare Species: The maintenance of biodiversity is an important objective of many conservation plans. We are working with a number of institutions to assess the levels of genetic diversity that currently exists in a number of rare species. This includes working with Mike Howard (New Mexico BLM) on the critically imperiled *Lepidospartum brugessi* which is only found a few locations in Southern New Mexico and North Texas, Dr. Tiffany Knight (Washington University) on the Federally Endangered *Cirsium fonitinale*, Christal Niederer (Creekside Center for Earth Observation) on the Federally Endangered *Castilleja affinis* subsp *neglecta* and Dr. Ori Fragman-Sapir (Jerulsalem Botanic Garden) on the globally rare *Iris vartanii.* These types of studies allow us to assess populations of critical concern and assist with management decisions (Fant, Skogen, Williams and collaborators).

Characterization of *Lepidospartum burgessii* genetic diversity - *Lepidospartum burgessii* is an endemic plant of the Salt Basin of West Texas and Southern New Mexico. The species occurs on various land ownerships including private lands (in Texas), State of New Mexico lands, public land managed by the Bureau of Land Management, and on National Park Service lands within Guadalupe Mountains National Park. BLM has observed and monitored a population of

approximately 5600 plants in New Mexico since the mid 1980's. Censuses have shown a prevalence of mature and decadent plants and few juvenile plants in the population. Further investigation has shown this species rarely produces seed, and that it appears to be sustained by asexual reproduction (cloning via root shoots). The Chicago Botanic Garden (CBG) has helped BLM-NM determine that populations are not genetically monocultures. We are working on comparing this genetic variability with the congener (*Lepidospartum squamatum*), determining degree of asexual growth in these populations (Number of clones and distance between clones), and determining relatedness within these population.

Gravel Hill Biodiversity- Much like wetlands, gravel hills prairies represent a microcosm within the tallgrass prairie. The drier conditions, due to soil make-up and topography, support a unique plant community, including a number of important endemic and rare species. With the fragmentation of the landscape, these habitats are becoming increasingly isolated and many of populations of these rare species are declining and we are seeing reproductive failure in a number of species. In a comprehensive study of community structure, demography and genetics we are investigating the decline of species within these communities with the Chicago Region and Wisconsin Driftless area, focusing on *Cirsium hillii*, *Asclepias lanuginosa, A. viridiflora* and *Castilleja sessiliflora.* This work will allow us to identify critical threats to populations (Invasive species, management, pollinator loss), identify areas suitable for restoring these critical species and improving reproductive fertility in current populations. A number of restorations projects have initiated with the help of this research which we will monitor (Fant, Masi, Skogen, Larkin and other collaborators).

Roof Top Ecosystems- City green spaces are being recognized as important components of the urban ecosystem providing usable habitat for many organisms, including migrating species. Green roofs are just one example of an urban green space, but they are both novel and rapidly increasing in area within North America. Graduate students, Rebecca Tonietto and Kelly Ksiazek have been documenting the ecological services that green roofs provide as well as describing the ecological services found on the green roofs. There work has resulted in three publications to date and Kelly is continuing to work on Green roofs for her PhD dissertation, including a Fulbright funded trip to German to work on some of Europe's oldest green roofs (Advisors: Skogen, Fant, Larkin).

Restoration Ecology of Native Bee Communities – We completed our third year of field work investigating controls on biodiversity patterns of native bees in remnant, degraded, and restored prairies in the Chicago area. If bee biodiversity is driven by *niche-based processes* (e.g., species interactions and, environmental filtering), then land managers may be able to target restoration efforts for composition and diversity within bee communities. In contrast, if *neutral factors* drive community assembly, then the effects of site-level management would be weak relative to broader landscape factors, such as site size and proximity. We conducted bee and vegetation sampling at 18 sites, analyzed surround land cover, and are now integrating phylogenetic and community-level data to address these issues (Tonietto and Larkin).

Wetland Plant Communities and Secretive Marshbirds – We completed a study in southern Wisconsin testing how vegetation and habitat characteristics of wetlands influence their suitability for secretive marshbirds (rails, bitterns, grebes, coots, and moorhens). As wetlands are

degraded by watershed disturbances and invasive-plant species, does their ability to support this under-studied group of birds of high conservation concern decline? And to what extent do wetlands in the region restored under the USDA's Wetland Reserve Program provide the conditions that secretive marshbirds require? Our vegetation, habitat, and landscape data from 60 natural and restored wetlands, along with four years of marshbird monitoring data collected by our collaborators are being analyzed and prepared for publication to answer these questions (Larkin, Glisson, and outside collaborators).

PhragNet: A cooperative learning network for *Phragmites* management – We established a new network for the adaptive management of the invasive wetland plant *Phragmites australis* (common reed). Participants from throughout the Midwest and into Canada are implementing a standardized monitoring protocol in *Phragmites*-impacted areas slated for control and restoration. Soil and leaf-tissue samples are being sent to the Garden for nutrient and genetic analyses, respectively. The goal of this cooperative effort is to "learn while doing", harnessing the collective efforts of wetland managers distributed over a broad geographic area to identify best practices for controlling *Phragmites* and reestablishing diverse native vegetation (Larkin, Lonsdorf, Fant, Jacobi, Hunt, and outside collaborators).

Controls on Wetland Denitrification – Denitrification is a valuable ecosystem service performed by wetlands that removes excess nitrate from waterways—a pollutant that causes eutrophication, algal blooms, and hypoxia. It is hypothesized that traits of wetland vegetation influence rates of denitrification. However, denitrification is difficult to study, and methodological limitations have produced a literature filled with null, conflicting, and unclear results. We are testing the hypothesis of vegetation effects on denitrification using promising biogeochemical approaches that are under-utilized in wetland ecosystems. We are comparing wetland systems dominated by a native ecosystem engineer, *Carex stricta* (tussock sedge), which imparts fine-scale topographic heterogeneity, with those dominated by the invasive grass *Phalaris arundinacea* (reed canarygrass), which leads to topographically and biotically homogenous sites. We have completed one year of field and mesocosm data collection and are investigating the efficacy of natural-abundance stable isotope methods for measuring denitrification in wetlands (Hartzog, Larkin, and outside collaborators).

Long Distance Gene Flow and Hawkmoth Pollination - Long-distance pollination has widespread implications ranging from limiting population divergence, accelerating the spread of adaptive traits, disrupting gene complexes and maintaining species cohesion. This is particularly the case for floral traits where long distance pollinators act as agents of selection while also constraining divergence. Since 2008, we've focused on *Oenothera harringtonii*, an endemic to southeastern Colorado and in 2011 we initiated similar studies in *Castilleja sessiliflora* in Colorado and Illinois. We use a combination of field, greenhouse, and molecular tools to assess long-distance pollination events via hawkmoths, the primary pollinator of both species. Analyses to date show little genetic differentiation range wide in *O. harringtonii,* implying high rates of gene flow among populations. However, data on floral scent shows a geographic pattern whereby populations in the south and east exhibit different scent compounds than those in the north and east. In addition, these results indicate that habitat fragmentation has not had a detectible effect on *O. harringtonii*, likely due to the fact that hawkmoth visitation still occurs in these populations. We

plan to pursue similar questions with *C. sessiliflora* and additional species to determine the extent to which these patterns are generalizable for species primarily pollinated by long-distance pollinators such as hawkmoths. (Skogen, Fant and outside collaborators).

Plants of Concern - In 2012, the Plants of Concern program (POC) completed its twelfth year. Since its inception through 2011, POC has trained and engaged 671 citizen scientists who have contributed 16,000 hours since the program's inception. The program has monitored 237 endangered, threatened and rare species at 308 sites throughout the Chicago Wilderness region – IL, WI, IN. As a strongly collaborative regional effort, POC has worked with 112 cooperating public and private landowners. Made possible by grant funding during 2012, the program placed special focus on monitoring at Midewin National Tallgrass Prairie for the tenth year, at the Openlands Lakeshore Preserve, Ft. Sheridan ravines, and Waukegan area dunes and ravines. Analyses of POC's 12-year dataset are yielding critical information on rare species' population trends in relation to management activities on a region-wide basis (Masi, Vitt, Hitzroth, Goad, Steffen, Rosenbaum, Yates, NU graduate student Radosavljevic, and interns).

Species Distribution Modeling – In 2011 we started research in modeling the species distribution of rare plants in the western United States. The project, funded by BLM, is examining the current and potential distribution of 400 rare plants, including many cacti species. In 2012 distribution models were created for most of the species being studied. In addition, four trips to the western US were taken to validate our distribution models for 10 of our rare species. In the process, we verified 112 rare plants occurrences, of which 50 are new (Still, Vitt, and Havens-Young).

Redistribution of Deep Soil Water by Tree Roots and Soil Fungi in Dry Seasonal Tropical Forests- Studies of plant water uptake have largely focused on the role of roots. However, mycorrhizal fungi can play key roles in moving water to plants and enhancing nutrient uptake under dry conditions. Our study is in the Yucatan Peninsula, where extreme seasonality limits growth in the dry season (January to June), and soil water levels drop 9 m below the surface to as to create an extremely dry surface soil. Most trees lose their leaves, but the evergreen trees appear to utilize deep water in subterranean caves. We are using this system as a proxy for climate change, particularly drought. Our objective is to determine which tree species can actively acquire water from depth and how much water is re-distributed within the dry upper soils by fungi (Egerton-Warburton, Beddows).

***Arisaema triphyllum* (Jack-in-the-Pulpit)-**This gender-switching species, though common, serves as a model species to understand the effects of reproductive choices on population dynamics. Reproductive individuals in this species may be either male or female, depending upon size, with the largest plants expressing as female. Environmental conditions are known to effect the expression of gender and we completed a two-year study in 2011 looking at the effects of pollen load on the sex ratio of two populations in Lake County Illinois. This study also examined the effects of habitat management on gender choices and population sex ratio. Management for an open-canopy, particularly by removing invasive buckthorn, appears to increase the number of females in population. In 2012, we initiated a study to determine the photosynthetic rates of males and females under field conditions. Due to the deep and extended drought, we were able to measure photosynthesis under drought conditions. (Begnel, Shin, Vitt and Tienes).

***Cirsium pitcheri* (Pitcher's thistle)** – In 2011 we completed work on a five-year grant to study the demography and genetics of *Cirsium pitcheri*, a threatened species that occurs around Lake Michigan. We found that the species is in decline, all monitored populations are below replacement rate due to numerous threats including invasive species, predation by goldfinches and predation by a biocontrol weevil (*Larinus planus*) introduced to control weedy thistles. In 2011 we began demographic monitoring of the weevil-infested population in Wisconsin to track weevil effects which continued in 2012. A second biocontrol weevil (*Rhinocyllus conicus*) was found predating plants in Indiana in 2012 (Havens-Young, Fant, Vitt and outside collaborators).

***Echinacea angustifolia* (Purple coneflower) –** Since 1995 Wagenius has investigated consequences of habitat fragmentation in tallgrass prairie, focusing *Echinacea angustifolia* and its associated herbivores, pollinators, and competitors. During summer 2012, twelve scientists, students, and teachers lived and conducted experiments in rural western Minnesota. This year we planted over 100 seedlings in an experiment designed to quantify fitness differences between native, non-native, and hybrid *Echinacea* plants. We also continued measuring over 10,000 *Echinacea angustifolia* plants in long-term experimental plots. We harvested 500 flower heads from experimental plots which are being analyzed by a dozen volunteers who will count and weigh the fruits. Results of this work will elucidate the interplay of evolutionary and ecological processes in fragmented populations. NSF will continue to fund this project until 2016 (Wagenius and Ruth Shaw at U. Minnesota).

***Lespedeza leptostachya* (Prairie Bush Clover)-** We have been monitoring populations of this Federally Threatened gravel-hill prairie species at Nachusa Grasslands in Franklin Grove, IL and Harlem Hills Nature Preserve, part of Rock Cut State Park in Rockford, IL, to determine best management practices since 2000. In 2012, we completed 5 years of an experimental demography study to elucidate the role of grass competition on vital rates, and have determined that reducing competition increase seedling recruitment, as does limited cattle grazing. In response, the stewards at Nachusa Grasslands are in the process of writing a management plant that will include bison. We will conduct an exclusion study at the time of bison introduction to determine the efficacy of this approach (Vitt, Havens-Young and outside collaborators).

***Viola conspersa* (Dog violet)-** Using ten years of volunteer-collected data, we have created a regional model of the state-threatened *Viola conspersa* to determine the effects of habitat management on vital rates and population viability, particularly removal of invasive buckthorn canopy. Invasion by buckthorn forms a densely closed canopy that reduces reproduction via open-pollinated flowers in favor of production of closed-pollinated flowers. The shade created by a buckthorn canopy also affects survivorship and patterns of seed set, potentially causing local extinction. Using ten years of "before and after" data from six populations of *Viola conspersa*, which had undergone buckthorn canopy removal at various points throughout the decade, we created integral projection models to understand the effects of management. Because management affects the ratio of open- to closed-floral ratio, we were able to explicitly model the effects of management on patterns of genetic diversity as well as population growth rate in light of the frequency of habitat restoration activities. Results showed that more open-pollinated flowers were produced when buckthorn canopy was removed periodically (every few years), suggesting that restoration activities such as removal of invasive species is favorable both to

population size and to maximizing genetic diversity. Such results show that management may result in populations with greater genetic diversity and therefore more resilience to more effectively respond to environmental changes, such as a warming climate (Vitt).

Mitigating Threats

Seed Banking –The Garden's Dixon National Tallgrass Prairie Seed Bank continues to collect and preserve germplasm of native plant species from the Upper Midwest. In 2012 we added 181 accessions of 145 species to the bank. Our total holdings include 2,403 accessions of 1,208 species. We also collected seeds on contract from the US Forest Service. We continue to be an active partner in the national "Seeds of Success" (SOS) program. Megan Haidet, hosted by the Bureau of Land Management, coordinates all Seeds of Success activities. The Seeds of Success National Collection contains more than 14,000 seed collections which are stored at USDA Agricultural Research Service facilities. In addition to long-term conservation storage, SOS collections are available for research, restoration, and rehabilitation (Havens-Young, Haidet, Vitt, Yates and Sollenberger).

Native Seed Farming –With an IMLS grant, the Garden is piloting a native seed increase project utilizing vacant city lots as urban native seed farms. In 2012, raised beds were constructed at the boot camp composting site and approximately 3000 plants comprising 4 species were propagated in the Botanic Garden production green houses for planting in the nursery. About a quarter of the plants delivered were planted in the nursery and the remaining will be planted in the spring of 2013. Seeds of one species that did not germinate were recollected and will be sown in 2013. Seed harvesting techniques were taught to students enrolled in the native seed farming program as seeds were harvested from the Pershing Road seed farm demonstration site (Havens-Young, Vitt, Sollenberger, Kirschner with Windy City Harvest staff).

Conservation and Restoration in Changing Environments (CARICE) – Garden scientists and graduate students have been working on conservation- and restoration-related research in the arid regions of the western United States since 2002. Much of the native habitat in the western United States is degraded as a result of changes imposed by invasive species, altered fire regimes and land use patterns, and a shifting climate. These changes will only become more prevalent in the future. To ensure the region's unique plant and animal diversity, and the ecosystem services it provides, is resilient in the face of these changes, restoration on a large-scale is needed. To help make restoration efforts as efficient and effective as possible, we conduct research using the tools of ecology and evolution to inform native plant materials development and restoration. Most of our work currently occurs on the Colorado Plateau and focuses on two broad themes: 1) Identifying and developing appropriate native plant material for restoration, including potential 'native winner' species that may improve restoration outcomes in degraded sites; and 2) Quantifying ecosystem function in restored and degraded habitats. We use a range of ecological and evolutionary tools and approaches to carry out this research, and work with partners across the country to ensure our research helps address high-priority restoration needs. In 2012, Becky Barak completed her MS thesis *Assessing restoration potential of native forbs from cheatgrass dominated habitats*, and garden scientists worked with botanists throughout the Colorado

Plateau to identify priority 'native winner' species for targeted research and native plant materials development. Working with the Colorado Plateau Native Plant Program, seed collections of these priority species were made, and study plots established on BLM land that was the site of a recent, large wildfire near Grand Junction, Colorado. We are testing whether the outcomes of post-fire revegetation work carried out by the BLM can be improved with the use of 'native winners' in seed mixes. Seed germination and competition trials at the Garden in 2013 (carried out by Alicia Foxx, MS student) will complement results from this field work (Kramer, Fant, Skogen, Larkin, Barak, Foxx, Havens-Young).

Grassland bird population and habitat management in the East Gulf Coastal Plain – With a grant from the American Bird Conservancy, we are collaborating with US Fish and Wildlife's East Gulf Coastal Plain Joint Venture (EGCPJV) to develop predictive models that relate focal species population dynamics to habitat dynamics and habitat management actions. A key component of this work includes communicating with partners of the EGCPJV to understand the kinds of decisions they make regarding grassland habitat management to ensure the utility of the project outputs to these decision makers. The model will ultimately link habitat management actions to grassland bird population dynamics and allow managers to evaluate habitat management strategies in terms of focal species population targets. (Lonsdorf)

Developing Sustainable Pollination Strategies for U.S. Specialty Crops – Funded by a grant from the US Department of Agriculture, we will work with collaborators from universities, industry, NGOs and government to develop decision-support tools for growers of specialty crops. Specialty crop pollination is dependent on honey bees for pollination, yet their future ability to meet crop pollination demands is uncertain and honey bee populations are facing significant challenges. Yet, there are many other strategies that growers may employ to diversify the sources of crop pollination. Our long-term goal is to develop and deliver context-specific Integrated Crop Pollination (ICP) recommendations on how to most effectively and economically deliver diversified sources of pollination to specialty crops. We define ICP as: *the combined use of different pollinator species, habitat augmentation, and crop management practices to provide reliable and economical pollination of crops.* Through this project, we aim to improve sustainability of U.S. specialty crops and thereby help ensure continued ability of growers to reap profitable returns from their investments in land, plants, and other production inputs. (Lonsdorf)

Reassembling Pollinator Communities to Promote Pollination Function at the Landscape Scale – Funded by a collaborative research grant from the National Science Foundation, we are working to develop a robust understanding of how both landscape composition and configuration influence pollination function. Pollinators provide enhanced fruit and seed production for roughly 35% of global crop production and 75% of crop diversity. We will predict and experimentally evaluate in one farming region how restoring different amounts and spatial configurations of pollinator habitat can influence pollinator communities and function. We are testing the predictive model on data sets from 30 different crops across six continents. Lonsdorf

Developing centralized databases and decision support tools for the National Wildlife Refuge system – Funding by a cooperative agreement with the US Fish and Wildlife Service, we are developing a centralized adaptive management tool for three different habitat management

projects the Midwest: 1) Grassland monitoring and management project; 2) Wetland restoration using sediment excavation and 3) Reed Canary Grass control. A main goal of each project is to develop a structured, iterative framework for managing invasive plants that targets areas of uncertainty, and reduces uncertainty over time. To achieve this goal, we are developing an innovative, streamlined decision support tool that facilitates site management to best achieve the core objectives identified by the refuge staff (Lonsdorf, Jacobi and Hunt).

Designing Decision Support Tools for Invasive Species Management – With a grant from the US Fish and Wildlife Service, we have developed several internet based decision support tools for land managers dealing with invasive species that integrates monitoring, management objectives and actions with predicted outcomes determined through the monitoring efforts – ultimately uniting scientific research with conservation practice. Developed after years of collaborative work, the tools promote cooperative learning and facilitate more rapid, adaptive management among land managers who would otherwise be dealing with a common problem on their own and learning more slowly. The tools are currently being used by National Wildlife Refuge managers throughout the Great Plains to more effectively control Kentucky Blue Grass and Smooth Brome Grass that have invaded prairies. The tools are also being used by land managers at Minnesota Department of Natural Resources and The Nature Conservancy. We are adapting the tool for application in the Midwest and Northeast to help managers remove Reed Canary Grass and *Phragmites* from wetlands (Lonsdorf, Jacobi and Larkin).

The Contribution of Fungal Macromolecules to Soil Carbon Sequestration– Fungi constitute a major portion of belowground biomass in many soils and thus, are considered to be a major contributor to carbon sequestration. While there has been substantial research directed toward defining the roles that fungi play in the soil carbon cycling, and especially toward measuring biomass and activity, there is very little information on how long fungal tissues persist in the soil and in what chemical form. We have completed the first step of a chemical analytical survey to document the abundance of key chemical groups during tissue decomposition. Information from this survey will be used to determine which fungi might produce materials that could persist in soils, and which fungal compounds persist. This study is supported by funding from the American Chemical Society (Egerton-Warburton, Levinson, Blair, Schreiner).

Soil Fungi as Novel Sources of Biodiesel– Fungi may produce biomass containing up to 50-60% lipid (fats). The bulk of the lipids is easy to extract and readily converted to biodiesel thereby making fungi ideal candidates for biofuel screening. We isolated and cultured more than 100 different molds and yeasts from prairie and forest soils, and analyzed their lipid content. The results show that, in general, yeasts are better candidates than filamentous fungi for biofuel production, and that one high-yielding isolate showed biofuel potential. This study was supported by funding from the Initiative for Sustainability and Energy, Northwestern University (Egerton-Warburton, Levinson, Blair).

Restoration of Soil Systems as Integral Components of Management Practice- Prairie and woodland restorations are typically assessed solely by their above ground visible characteristics, such as plant diversity and productivity. However, in neglecting to assess belowground

ecosystem health, we may be missing half of the picture. The importance of soil ecology has often been overlooked in restoration efforts, and often disregarded as a mere "black box". This project addresses belowground ecosystem health by examining the effects of restoration management on woodland and prairie soil quality (fertility, carbon storage, aggregation, fungal and microbial community composition). These results will better inform restoration practitioners about the outcomes of current management practices. (Palmer, Hevey, Egerton-Warburton).

100 Sites for 100 Years- This project investigates the above and belowground impacts of restoration practice on a regional scale and is conducted in collaboration with land managers in 6 counties in Illinois and Indiana (Umek, Heneghan and outside collaborators).

Using Remote Sensing to Quantify European buckthorn Invasion on a Landscape Scale- In this project, measures of vegetation structure collected from satellites will be compared with on the ground measures of vegetation to refine a model that detects and quantifies the distribution of the invasive shrub, European buckthorn throughout the Chicago metropolitan region (Umek, outside collaborators).

Assemblage and Diversity of Litter-Decomposing Fungi and Consequences for Nutrient Cycling in Restored Urban Ecosystems- This project investigates differences in decomposition of native plant material in remnant prairies and restored prairies along a restoration chronosequence. The functional diversity of the fungal community driving decomposition will also be compared between high quality prairies and abandoned old fields (Umek, Egerton-Warburton).

The Use of Soil Manipulation and Seeding in Restoring Exotic Shrub Invaded Woodlands- This project investigates multiple methods of soil manipulation and seed rates in a European buckthorn invaded woodland to determine the impact of restoration practices on belowground processes and explore more effective restoration techniques for ecological restoration. This research was conducted in part with the involvement of an NSF-funded REU student during the summer of 2012 (Umek, Egerton-Warburton, outside collaborators).

Building capacity for the conservation of mushrooms and related fungi – Fungi are rarely included in discussions or action plans for conservation. This is due to insufficient communication about the critical role that fungi play and the threats that they face, as well as an insufficient focus on research to obtain the needed data to better understand how fungi are responding to anthropogenic and other threats. 2012 was a landmark year for fungal conservation. Staff participated in three international meetings and the International Union for Conservation of Nature (IUCN) passed a resolution calling for increased attention to fungi by conservation groups and countries. The Garden's efforts continued to move this agenda forward through chairing the IUCN Specialist Group on "Mushrooms, Brackets, and Puffballs," participating in national and international conferences and workshops, and coordinating the new Global Fungal Red List Initiative. These efforts will continue in 2013. (Mueller).

Natural Areas Conservation and Management – The Garden's 225 acres of natural areas - including McDonald Woods, Dixon Prairie, Skokie River Corridor, and the Garden Lakes - are managed to enhance habitat quality and increase native flora and fauna diversity. Invasive

plants, in particular, pose significant threats to these ecosystems. During 2012, controlled burns were conducted in the Dixon Prairie and along the Skokie River. Reed canary grass (*Phalaris arundinaceae*), an invasive species, was treated with herbicide in most of the 22 acres of the Skokie River Corridor. In 2012, an award-winning amount of garlic mustard (over 36,000 pounds) was removed from the Garden campus, earning the Garden first place in the USDA Forest Services Garlic Mustard Challenge. Through a partnership with the U.S. Army Corps of Engineers' Ecosystem Restoration Program, shoreline repair and replanting along 1-1/4 miles of the Garden's North Lake was completed in 2012. (Kirschner, Steffen, O'Shaughnessy and McNulty).

Documenting and Understanding Diversity

Revision of the Genus *Artocarpus* (Moraceae) - With a NSF grant, the Garden is working with international collaborators in Southeast Asia to study the distribution and evolution of an economically important group of plants. With approximately 60 species, *Artocarpus* is the third largest genus in the plant family that contains figs and mulberries (Moraceae). *Artocarpus* contains numerous economically important species (grown for timber and fruit) native to Southeast Asia. Two species, jackfruit and breadfruit, are cultivated throughout the tropics. By collecting location data, herbarium samples and DNA from plants, the goal of this project is to produce a comprehensive taxonomic revision of *Artocarpus* with discussion of character evolution and ecology, distribution maps, identification keys, and online access to an image database. Information on breadfruit and jackfruit origins and cultivar diversity will also be included in the revision. This work will be published in hardcopy and on the web. In 2012, work on the project focused on fieldwork in Thailand and analyzing DNA fingerprinting and sequencing data (Zerega, Williams, and outside collaborators).

Fossil Plants in Mongolia – A team of paleobotanists from Chicago Botanic Garden, Yale University, and Niigata University (Japan) joined colleagues in Mongolia for field work to search for early fossil flowers and remains of other fossil plants. The origin and early evolution of flowers can only be documented from the fossil record. Mongolia has an abundance of fossil deposits that date to the early Cretaceous (about 100 to 130 million years ago), when flowering plants first appear in the fossil record and then rapidly diversity. Although much work has been done in Mongolia searching for dinosaurs, very little paleobotanical field work and research has been undertaken in Mongolia. This new project seeks to document fossil plants from several localities that have exceptional preservation of plant material (Herendeen).

Evolutionary Relationships and Diversity in the Legume Family – The legume family, which includes important crop plants (e.g., beans, peas, soybean) and many other economically important species, is the third largest plant family with approximately 730 genera and 19,400 species found in all parts of the world. In addition to being the source for economically important plants, the family is also important because legumes dominate many tropical ecosystems. An international team of botanists is working to develop a better understanding of the diversity and evolutionary relationships in this important family. During 2012 this team was working to organize data on diversity and evolutionary relationships in preparation for an International

Legume Conference in South Africa in January 2013 where we presented a new classification system for the family. (Herendeen, Radosavljevic).

Biodiversity of symbiotic and lignin-degrading fungi in seasonal dry tropical forests- Seasonally dry tropical forest systems are globally and regionally threatened by urbanization, land use change, and climate change, and they are of a high conservation value. There is little knowledge of fungal diversity in these systems. In Costa Rica, we are documenting the community composition and diversity of ectomycorrhizal communities in younger (~10 years old) and older (~26 years old) stands of oak (*Quercus oleoides*). In our Yucatan Mexico study, the focus is on investigating the diversity of arbuscular mycorrhizal and lignin-degrading fungi. These studies are using a combination of morphological, molecular and metagenomics approaches to documenting diversity. A grant was received from Northwestern' University's Initiative for Sustainability and Energy program to support this research through 2013 (Egerton-Warburton, Desai, Morgan, and Keever).

Biodiversity, Biogeography and Conservation of Cantharellacae – Cantharellace includes choice edible fungi such as chanterelles and trumpet fungi. They also are important beneficial symbionts of forest trees. Many species in the group are listed as threatened and endangered in countries that list fungi. Activities in 2012 focused on completing work on the species found in a unique forest in Guyana (1st paper published, 2nd in development) and submitting a NSF preproposal to expand the work globally. (Mueller, Wilson, and external collaborators).

Biodiversity, Biogeography and Conservation of *Laccaria* – *Laccaria* has been used as a model group to study fungi that form ectomycorrhizas (beneficial symbionts of forest trees). Mueller is regarded as the world expert of *Laccaria*. Activities in 2012 focused on generating the remaining DNA data and fieldwork needed to complete the most comprehensive study of diversity, evolutionary relationships, and biogeographic patterns of any genus of ectomycorrhizal fungi. A manuscript on Tibetan species of *Laccaria*, including several new species is in press. Several publications will be submitted in 2013, including a large synthesis biogeography paper. (Mueller, Wilson, and external collaborator Hosaka, Japan).

Developing tools to analyze the population biology of mushrooms and related fungi – Lack of information on the population biology of fungi has greatly hindered efforts to include them in conservation discussions and action plans. Studies have been severely limited by difficulties in obtaining enough genetic markers to differentiate among individuals and populations and to examine issues such as fragmentation and potential over-harvesting for food. A pilot project to use newly developed high-throughput DNA sequencing tools to obtain informative markers was undertaken in 2011 and 2012. A manuscript is in final stages of preparation. (Mueller, Wilson, Wickett, and Fant).

Ancient Diversification of Land Plants – As part of a collaboration with the 1KP project (a multidisciplinary consortium of plant biologists and bioinformaticians led by researchers at the University of Alberta and Beijing Genomics Institute-Shenzhen), we are developing methods to process large amounts of DNA sequence data that will be used to better understand the evolutionary relationships for all major lineages of land plants. Plants colonized land

approximately 470 million years ago, diverging from their aquatic, green-algal ancestors. Understanding how all land plants and their ancestral green algae are related will allow us to better understand how fundamental plant traits evolved. Over the past several decades, these relationships have been reconstructed primarily using a small amount of DNA sequence data or a small number of species. To overcome some of these limitations, the 1KP project is using tens of thousands of gene sequences, and targeting over 1000 species, to resolve the ancient events in land plant diversification with more confidence. (Wickett, with outside collaborators).

The Moss Tree of Life – Pleurocarpous mosses are traditionally defined as having short, lateral reproductive branches. Pleurocarps (Hypnanae) comprise the most speciose lineage of mosses, a result of an explosive radiation during the Jurassic, at a time when flowering plants began to dominate many terrestrial environments. Repeated, multi-directional habitat transitions occurred as this group evolved, leading to the loss of morphological characters that may be used to describe groups. Furthermore, phylogenetic analyses based on targeted gene sequencing have been unable to resolve many relationships, including those along the backbone, within the pleurocarps. A recently funded project by the NSF Assembling the Tree of Life program will use transcriptome sequencing and gene enrichment through solution-based hybridization to sequence organellar genomes, and over one thousand low-copy nuclear genes for phylogenetic analyses of the pleurocarps. (Wickett, with outside collaborators).

Diversification of diatoms, a hyperdiverse group of photosynthetic marine algae (brown algae, Heterokontophyta) – Diatoms account for roughly 20% of global primary production, while making up less than 0.2% of primary producer biomass. Additionally, they are the key drivers of biogeochemical silica cycling and have acquired a diverse set of metabolic pathways including a complete urea cycle (previously only known from animals), iron-concentrating mechanisms, and polyamine biosynthesis. Suprisingly, these diverse functional traits were all enabled by the acquisition of genes transferred horizontally from bacteria. We are currently using transcriptome sequencing to reconstruct the diversification of diatoms, both in species numbers and in functional diversity. Our goals are to characterize the relative importance of endogenous (novel genes acquired though duplications, e.g., polyploidy) and exogenous (transferred from bacteria) sources of genetic variation in the speciation and functional diversification of diatoms. (Wickett, with outside collaborators).

Diversification in floral color of *Castilleja coccinea* in Chicago Region – Flowering plants are the most diverse group in the plant kingdom which is reflected in the wide variety of floral shapes and color. Shifts in floral morphology, and associated changes in pollinator attraction, has been identified as one important driver in the diversification of this group. However what is still poorly understood how the transition occurs without resulting in a rapid decline in fitness. In the Chicago region, populations of the hemiparasitic species *Castilleja coccinea* are either red or yellow. Populations containing one morph or the other can occur in relatively close proximity to one another, suggesting that environmental factors, as opposed to temporal or spatial changes in pollinator communities are playing a role in maintaining this polymorphism. We are studying the biotic and abiotic differences in these populations and how they relate to the expression of anthocyanin, a stress induced pigment. This research has important implications for

understanding the processes by which population divergence and speciation may occur in *C. coccinea*, and for predicting the future evolutionary trajectory of this species. (Fant, Braun, Skogen).

Research Collections - Biological collections have multiple uses and take multiple forms. One area placing an increasing demand on collections is for the use of documenting genetic information; including phylogenetic studies, quantifying diversity in collections, identifying historic changes and origins, etc. To meet these demands we are beginning to collect and accession separate samples for express purpose of them being used for genetic studies. Currently we have accessioned over 4,500 genetic samples, which come from a broad variety of sources including: Living collections (Tankersely), Seed Bank (Vitt, Yates and Sollenberger), DNA collections (Fant), Herbarium (Zerega and Masi). Plans are also underway to begin to add important rare species and research samples which will increase the value of this collection (Fant, Rosendorn). In 2012 the herbarium increased its collections by 823 specimens, bringing the total collections to nearly 17,000. In addition, the herbarium continues to work toward digitizing its entire collection. Currently 70% of the collections are digitized. The herbarium serves as a resource for scientists, students, and conservation practitioners, hosting visitors throughout the year.

Building Capacity and Understanding

Conservation and Land Management Internship Program – In 2012**,** 668 applications were received for 95 internships. Twenty-eight interns that had been hired in 2011 were extended into 2012, bringing the total number of interns working in 2012 to 123. The majority of internships were with the Bureau of Land Management (BLM) (86), with 11 of these interns funded by the Washington office. Two interns were ultimately hired by the National Park Service (NPS), three by U.S. Fish and Wildlife Service (USFWS) and one by the Greenbelt Native Plant Center in New York, NY. Three interns were dismissed due to performance. CLM interns worked a total of **112,476** hours or 14,059 days or 639 months (there are 22 days in a CLM work-month), a 33% increase in hours from 2011.

When asked about the benefits of the CLM Internship Program, 100% of interns who responded said they were able to experience new landscapes, habitats and species diversity; 97% said they were able to explore their career goals and expand their resume; 93% said their internship helped them learn what it's like to work at a federal agency; and 89% said they were able to apply their education to important conservation questions and better define their career goals. When asked if they would request another CLM Program intern in the future, 100% of the program's mentors said they would.

Research Experiences for Undergraduates (REU) - A total of 237 applications were received and 10 interns were hired for NSF-funded REU positions at the Garden during 2012. Five additional interns funded from other sources also participated in the REU experience. Interns conducted research under the mentorship of 18 Garden and Northwestern University scientists and

graduate students on topics spanning genetic to ecosystem levels of plant biology and conservation.

Graduate Programs – The joint graduate program with Northwestern University continues to attract top students to conduct plant conservation research. In 2012, the program welcomed eight new MS and two new PhD students. The program currently has nine PhD and 23 MS students. Four MS students graduated in 2012; one of the recent graduates is attending the NU doctoral program, and three are working in careers in ecology and conservation. Graduates' research focused on the evolution and conservation of bryophytes, and best practices in wetland and woodland restoration. Students continue to be successful at procuring grants for their field and lab research. Recent student fieldwork has taken place in the Chicago Region, Wisconsin, Minnesota, the Great Basin, California, Guyana, and Mexico.

Botanic Gardens Conservation International (BGCI) – BGCI coordinates worldwide plant conservation efforts and is designated to lead the U.N.'s Global Strategy for Plant Conservation. It works as a global consortium of 700+ botanic gardens sharing expertise and best practices among large and small gardens in the developed and emerging world to understand, conserve, and sustainably utilize plant life everywhere on the planet. The Garden is a Patron Member of BGCI, and hosts the office of BGCI US (Kramer: Executive Director; Havens-Young: Board member). In 2012, BGCI US partnered with gardens across North America to launch a free, easy-to-use interpretation resource (Care for the Rare) that gardens everywhere can use to clearly communicate conservation stories of threatened plants in their collections, and the important role botanic gardens play in plant conservation. A NU/CBG PhD student (Umek) supported this project as part of an assistantship. Another NU/CBG PhD student (Morgan) supported a BGCI US project to identify and prioritize conservation and research efforts for threatened exceptional species in the United States. This project also involved partner gardens across the U.S., who contributed plant material of threatened oak species of known provenance held in collections to support micropropagation research with BGCI US partner Cincinnati Zoo and Botanical Garden. BGCI US is also driving the evolution of BGCI's GardenSearch and PlantSearch databases, the only online resource of the expertise, resources, and plant collections maintained by botanic gardens around the world. In 2012, these databases provided data to researchers around the world, including multiple projects at the Garden: the IMLS-funded project Planting for the Future: Investigating the Effects of Climate Change on Cultivated Trees and the research of Garden scientists and graduate students (Zerega, Radosavljevic).

Plant Conservation Alliance – The Garden continues its leadership of the NGO committee of the Plant Conservation Alliance, a public/private partnership dedicated to the conservation of our native flora. In 2011, the Garden organized a lobbying effort to advocate for maintaining plant conservation funding for important government programs (Siskel, Havens-Young).

Using Plants and Fungi for Human Benefit

Plant Breeding – the program develops and evaluates new perennial plants for introduction to the horticulture industry and gardeners. The program ended the year with 1,206 plants in the ground representing 232 accessions. The Production department is holding another 782 plants for the program that will be planted in 2013. Of the 64 crosses attempted this year, 34 were successful, producing a total of 2,748 seed, mostly from *Aster* and *Phlox*. A total of 2,838 seed representing 64 accessions was turned over to Production for germination and subsequent planting in 2013. This includes seed from the breeding program, wild-collections, commercial sources, and Index Semina. Backup seed from 350 accessions were transferred to the Seed Vault for longer term storage. Four plant selections from the program were propagated and distributed to licensed growers of Chicagoland Grows® for evaluation and potential introduction, and eight hybrid *Phlox* were selected for propagation for initial evaluation in-house at the garden as potential future introductions (Ault).

Plant Evaluation – The Garden's Plant Evaluation Program evaluates herbaceous and woody plants in comparative trials, ultimately recommending the top-performers to gardeners and the horticulture industry. Over 1,200 taxa (representing approximately 55,000 plants) were evaluated last year in the Lavin Plant Evaluation Garden, Pullman Plant Evaluation Garden, and green roof gardens. In 2012, new trials included a trial of shade-loving Japanese hydrangea (*Hydrangea serrata*) cultivars and a trial of prickly pear cacti (*Opuntia* spp.) on the green roof. *Fine Gardening* magazine has committed to publishing three stories a year through 2014. In 2012, the three articles included: avens (*Geum*), hardy geraniums (*Geranium*), and large-flowered clematis (*Clematis*) (Hawke).

Chicagoland Grows® Plant Introduction – The program markets itself and its plants to the horticulture industry with the goal of introducing new plants to the industry and providing royalty income to the Garden. Three new plants were introduced during 2012: *Echinacea* 'Burgundy Fireworks', *Veronica* 'Tidal Pool' – both developed at the garden – and *Polygonatum* 'Prince Charming'. The program was promoted to the horticulture industry and gardening public through trade booth exhibition at two trade shows, publication of four Plant Release Bulletins, webpage updates, and numerous printed and electronic media promotions. Nearly 3,000 stock plants and cuttings were shipped to 30 nurseries, which will increase future sales of the 12 plant selections distributed. Two plant patents were received, four plant patent applications were filed, and three trademark names were renewed. Royalty income for the year was $136,000, an increase over the previous year's income of $130,000.(Ault)

Economic Botany – With a grant from NSF, the Garden is working with international collaborators in Southeast Asia to study and conserve the genetic diversity of under-utilized crops. The two focal species, jackfruit (*Artocarpus heterophyllus*) and breadfruit (*A. altilis*), are cultivated throughout the tropics and may be under threat of genetic erosion. Plantings with low genetic diversity can be more susceptible to environmental stresses such as disease or droughts. This project aims to use field data and genetic evidence from jackfruit and breadfruit to identify their wild relatives, assess genetic diversity throughout their range, determine possible threats of genetic erosion, and make recommendations for germplasm conservation by working closely

with international collaborators. In 2012, work on the project focused on analyzing DNA fingerprinting and sequence data from plant samples collected in Thailand (Zerega, Williams, students, and outside collaborators).

Screening for Medicinal Compounds– through a cooperative agreement with Professor Djaja Djendoel Soejarto at University of Illinois at Chicago, we provide plant material left over from cleaning seeds for our seed bank, which is screened for various medicinal compounds at UIC. In 2012, we provided dried plant material from 181 species to be screened (Yates, Sollenberger, Vitt, and Havens-Young).

GRANTS AND CONTRACTS ACTIVE IN 2012

Grantor/*Title*	Awardee	Amount
American Bird Conservancy *Grassland bird population and habitat management in the East Gulf Coastal Plain*	Lonsdorf	$60,000
American Chemical Society	Egerton-Warburton	$100,000
Bureau of Land Management *CLM Conservation and Land Management Internship Program*	Havens-Young, Skogen	$4,800,000
Bureau of Land Management *Rare Plant Climate Envelope Modeling and Restoration on the Colorado Plateau*	Havens-Young, Vitt, Still, Yates Fant, Skogen, Larkin, Kramer	$1,682,000
Center for Plant Conservation *CLM Intern Program*	Havens-Young, Skogen	$15,000
Sally Mead Hands Foundation *Plants of Concern*	Masi	$10,000
Illinois Endangered Species Protection Board *Genetic diversity and pollination biology in Asclepias lanuginosa*	Fant	$7,000
Illinois-Indiana Sea Grant *PhragNet: A cooperative learning network for adaptive management of Phragmites-invaded coastal habitats*	Larkin, Fant, Lonsdorf	$22,000
Illinois Natural History Survey *Early Detection/Rapid Response Plan for Hydrilla verticillata in Illinois*	McGlynn, Kirschner	$119,476
Illinois Wildlife Preservation Fund *Plants of Concern*	Masi	$28,000
Institute for Museum and Library Services *Native Seed Farms*	Havens -Young	$150,000
Institute for Museum and Library Services *Conservation project with Montgomery Botanical Center*	Kramer	$12,376
National Aeronautics and Space Admin.	Schwarz, Havens-Young	$150,000

Climate Change Education		
National Aeronautics and Space Admin. *Climate Change Education*	Schwarz, Havens-Young	$29,720
National Ecological Observatory Network *Project BudBurst*	Havens-Young, Schwarz-Ballard	$39,000
National Fish and Wildlife Foundation *Seeds of Success National Coordination*	Haidet, Havens-Young	$63,000
National Fish and Wildlife Foundation *Optimal Rare Plant Monitoring Manual*	Havens-Young, Vitt, Skogen	$32,000
National Fish and Wildlife Foundation *Population rescue of rare endemic Lepidospartum burgessii*	Havens-Young, Fant, Williams	$40,000
National Fish and Wildlife Foundation Sustain our Great Lakes Program *Contract with Alliance for the Great Lakes, Plants of Concern*	Masi	$11,000
National Fish and Wildlife Foundation *Threatened oak conservation*	Kramer	$15,000
National Park Service *CLM Conservation and Land Management Internship Program*	Havens-Young, Skogen	$262,700
National Science Foundation – DEB *Collaborative Research: AToL: Assembling the Pleurocarp Tree of Life: Resolving the rapid radiation using genomics and transcriptomics.*	Wickett	$428,278
National Science Foundation *Reassembling Pollinator Communities to Promote Pollination Function at the Landscape Scale*	Lonsdorf	$31,845
National Science Foundation – LTREB *Echinacea angustifolia research*	Wagenius	$225,000
National Science Foundation – MRI *GIS Lab Equipment*	Vitt, Havens-Young, Fant, Larkin Skogen, Yates	$305,000
National Science Foundation – MRI *Seed X-Ray Equipment*	Havens-Young, Vitt Skogen, Yates, Sollenberger	$135,000

National Science Foundation – REU *Research Experiences for Undergraduates*	Larkin, Fant	$301,307
National Science Foundation – REU *Summer field research experience for an undergraduate student*	Wagenius	$7,425
National Science Foundation – RET *Summer field research experience for a high-school teacher*	Wagenius	$21,761
National Science Foundation – REVSYS *Phylogeny and revision of* Artocarpus	Zerega	$319,361
The Nature Conservancy *Plants of Concern*	Masi	$352
Northwestern University Institute for Sustainable Energy	Egerton-Warburton	$45,000
Openlands *Plants of Concern*	Masi	$20, 000
Royalty Income From Plant Introduction Program	Ault	$136,000
Stanley Smith Horticultural Trust *PlantSearch database*	Kramer	$20,000
U.S. Army Corps of Engineers *Shoreline Restoration*	Kirschner	$3,769,943
United States Botanic Garden *Conservation projects partnership*	Kramer	$80,000
U.S. Department of Education. *GAANN: Graduate Training in Evolutionary Environmental Biology* (at Univ. of Chicago)	Kidwell, Jablonski, LaBarbera, Herendeen, Johnson	$1,594,010
U.S. Environmental Protection Agency *Enhancing the capacity of wetland programs to assess and manage habitat for secretive marshbird support*	Larkin	$115,712
U.S. Environmental Protection Agency Great Lakes Restoration Initiative *Contract with Waukegan Harbor Citizens Advisory Group, Plants of Concern*	Masi	$16,200

U.S. Fish and Wildlife Service *Implementing adaptive control of Phragmites australis on stations in the Northeast Region of the U.S. National Wildlife Refuge System*	Lonsdorf, Jacobi	$363,381
USDA Farm Bill *PlantSearch and Int'l Sentinel Plant Network*	Kramer	$45,000
US Department of Agriculture *Developing Sustainable Pollination Strategies for U.S. Specialty Crops*	Lonsdorf	$21,980
USDA Forest Service *Conservation and Land Management Internship Program*	Havens-Young, Skogen	$61,000
USDA Forest Service *Seed Banking*	Havens-Young, Vitt, Yates, Sollenberger	$60,000
USDA Forest Service/Midewin Plants of Concern	Masi	$17,500
USDA Forest Service (CCS) *Threatened oak conservation*	Kramer	$10,000
US Fish and Wildlife Service *Developing centralized databases and decision support tools for the National Wildlife Refuge system*	Lonsdorf and Jacobi	$50,184
Wallace Genetic Foundation *Botanic Garden Collaboration for Conservation*	Kramer	$45,000
Total Grants Active in 2012		**$15,894,511**

Year	Total Grants	Number of Grants	Average Grant
2004	$5,410,452	29	$186,567
2005	$6,498,018	38	$171,000
2006	$9,415,030	31	$303,710
2007	$7,196,973	35	$205,628
2008	$10,415,756	31	$335,992
2009	$11,630,528	38	$314,339
2010	$13,290,572	43	$309,083
2011	$14,797,310	41	$360,910
2012	$15,894,511	49	$324,378

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"Chicagoland Grows introduces new perennials". http://www.nurserymanagementonline.com/chicagoland-grows-introduces-three-perennials.aspx?List_id=332 Jan. 25, 2012

"2012 plant introductions: New kids on the plot" (includes *Polygonatum* 'Prince Charming'). Chicago Tribune. January 30, 2012. http://articles.chicagotribune.com/2012-01-30/classified/ct-sun-garden-0129-new-plants-20120126_1_intrinsic-perennial-gardens-new-plants-varieties

"Latest and greatest from Chicagoland Grows". Video interview with Jim Ault to discuss this year's plant introductions. http://www.nurserymanagementonline.com/chicagoland-grows-three-new-perennialsl.aspx?List_id=332 . January 31, 2012 and February 22 2012 e-newsletters.

"Tree of the Year Accolades for the Accolade Elm." City Trees. January/February 2012. Pages 8-12.

"Alternatives to Ash" (lists seven trees from Chicagoland Grows). American Nurseryman. February 2012. 6-9.

"Ready for a Smashing Spring?" (mentions *Echinacea* 'Burgundy Fireworks' and *Veronica* 'Tidal Pool' as new introductions). Chicago Sun-Times. February 29, 2012.

"Bloom Time 2012 Gardeners, start your trowels" (includes *Veronica* 'Tidal Pool'). The Iowan. March/April 2012. 60(4): 49.

"Discover gardening trends and new plants to try this year" (includes *Echinacea* 'Burgundy Fireworks' and *Veronica* 'Tidal Pool'). The Daily Chronicle. DeKalb, Illinois. April 14, 2012.

"A Damp Monday" (mentions *Baptisia* Starlite and Chicagoland Grows). Rotary Botanical Gardens Horticulture Blog, May 7, 2012. http://rotarygardens.blogspot.com/2012/05/damp-monday.html

"An Insider's Guide to Echinacea (mentions the Meadowbrite series developed at CBG)". Northern Gardener. May/June 2012. 50-53.

"Purple Smoke, Solar Flare: baptisia is here." West Orange Chronicle, Orange, New Jersey. June 7, 2012.

"Jim Ault's Last Coneflower". The Hortiholic. July 23, 2012. http://www.hortiholic.com/2012/07/jim-aults-last-coneflower.html

"Four season gardening series continues" (mentions Orange Meadowbrite™). The Times Record, Alido, Illinois. August 1, 2012.

"Hoosier gardener: 'Pretty Lady' meets 'Prince Charming'". Jo Ellen Meyers Sharp, http://www.indystar.com/article/20120818/LIFE0102/208180306/Hoosier-gardener-Pretty-Lady-meets-Prince-Charming-?odyssey=nav|head. August 17th, 2012.b (promotes CLG introduction Polygonatum 'Prince Charming').

"New perennials are pretty, charming and evergreen." (includes three of the CLG perennial plants). Jo Ellen Meyers Sharp, http://hoosiergardener.com/?p=8147 , August 18th, 2012.

The Daily Journal (Kankakee). Outdoors Section, p. 1. R. Themer. Field Museum Builds Links with Region. S. Masi quoted about Plants of Concern in Kankakee County. November 2.

Other public outreach included:

P. Vitt, E. Yates, D. Sollenberger hosted group from MARS-B to tour the Seed Bank and discuss seed banking issues, May 9, 2012.

Dixon National Tallgrass Prairie Seed Bank Corporate Volunteer Days:

June 5 – Baxter volunteer day
June 7 – BMO Harris Bank volunteer day
June 23 – Board of Public Allies volunteer day
July 18 - ITW volunteer day
July 24 - Walgreens volunteer day
August 23 – Abbott Laboratories volunteer day
October 17 – Capitol One volunteer day

Dixon National Tallgrass Prairie Seed Bank hosted interns from Lake Forest Open Lands, seed bank and lab tour, June 29.

Dixon National Tallgrass Prairie Seed Bank involvement with HSBC Climate Partnership through the Earthwatch Institute

Dixon National Tallgrass Prairie Seed Bank participation in World Environment Day, June 2, provided demonstrations, slide shows of microscope seed images, a tour of the Dixon prairie for visitors.

E. Bialecki, S. Masi, and R. Goad attended End of Season Monitor Gathering, Volunteer Resource Center, Forest Preserve District of Cook County, Chicago. October 20.

Plants of Concern: newsletters of stewardship groups publicized POC workshops and opportunities: Gatherings Online (TNC); Habitat Herald (Chicago Audubon);; Grounds Cover (CBG Volunteer Newsletter); The Acorn (McHenry County Natural Area Volunteers), Meadowlark (Midewin National Tallgrass Prairie volunteer enewsletter), and others.

S. Masi and R.Goad staffed a Plants of Concern information table at World Environment Day, Chicago Botanic Garden, June.

S. Masi and R.Goad attended the annual gathering of the Volunteer Stewardship Network of the IL Nature Conservancy and reported on Plants of Concern. South Shore Cultural Center, October 23.

E. Yates – creation of screen displays and maps for GIS Lab, World Environment Day.

AWARDS & INVENTIONS

In 2012, the Chicago Botanic Garden won 1st place in the USDA Forest Service Garlic Mustard Challenge by removing over 36,000 pounds of garlic mustard.

Andrea Kramer received a Professional Citation from the American Public Gardens Association.

MS student, Matthew Rhodes, received $500 from Sigma Xi for his research focusing on how temporal variation in pollinator community structure influences reproductive dynamics and pollen movement in *Oenothera harringtonii*,

PhD student, Paul Hartzog, received $3,000 from the Initiative for Sustainability and Energy at Northwestern (ISEN) for his research on "Developing isotopic tools to investigate nitrogen removal in wetlands."

PhD student, Kelly Ksiazek, was awarded a fellowship from the Germanistic Society of America in conjunction with a Fulbright Travel Grant to spend 10 months in Neubrandenburg, Germany conducting comparative research on green roofs with a renowned international expert in the field. She also received the Phipps Conservatory Botany in Action award and the Western Ag Innovations Student Research Award.

PhD student, Becky Tonietto, was awarded the Presidential Fellowship from Northwestern University, its most prestigious award.

PhD student, Lauren Umek, was awarded a John N. Nicholson Fellowship, which recognizes outstanding Northwestern University graduate students enrolled in PhD and MS programs in the sciences.

PhD student, Paul Hartzog received a Society of Wetland Scientists, North Central Chapter Student Research Grant.

Undergraduate student, Tyr Wiesner-Hanks, was awarded an Undergraduate Research Grant from Northwestern University for his research on the characterization and conservation of *Artocarpus* germplasm.

Evelyn Williams received a travel award ($500) for the 2013 Symposium and Workshop on New Methods for Phylogenomics and Metagenomics.

PhD student, Becky Barak, received the Excellence in Rangeland Ecology Student Travel Award and the Plant Biology and Conservation, Chicago Botanic Garden and Northwestern University Travel Award to attend Ecological Society of America 2012

Nyree Zerega has been chosen as a Center for Civic Engagement Fellow at Northwestern University.

Jim Ault received a patent on *Monarda* 'Fire Marshall' PP23,286, which was assigned to the Chicagoland Grows® plant introduction program.

PRESENTATIONS & WORKSHOPS

J. Ault

Chicagoland Grows plant introduction program. Staffed display booth and discussed program and plant introductions with attendees during trade show. Mid-America Horticultural Trade Show, Chicago, Illinois. January 18-20, 2012.

Chicagoland Grows plant introduction program. Staffed display booth and discussed program and plant introductions with attendees during trade show. OFA Short Course and Trade Show, Columbus, Ohio. July 15-17, 2012.

Developing New Perennials for Midwest Gardens. Lecture for Plant Propagation and Introduction to Horticulture students at College of Lake County, Grayslake, Illinois, March 16, 2012. Invited guest lecturer.

Confessions of a Pollen Dabbler: Developing New Perennials for Midwestern gardens. Northwestern Indiana Nursery and landscape Association Annual Educational and CCH Seminar, Merrillville, Indiana. March 6, 2012. Invited speaker.

From Native Habitats to Your Landscapes: Domesticating our Natural Plant Heritage. Ornamental Growers Association Winter Seminar. Sugar Grove, Illinois. February 23, 2012. Invited speaker.

L. Egerton-Warburton

Soil fungi as novel sources of biofuel. Chicago Area Undergraduate Research Symposium, Chicago, IL April 2012.

Mycorrhizal community composition among Quercus oleoides, Western Mycorrhizal Gathering in Eatonville, WA, May 2012

Ectomycorrhizal communities among Quercus oleoides in the Costa Rican dry tropical forest, Mycological Society of America Meeting, New Haven, CT, July 2012

Ectomycorrhizal communities among Quercus oleoides in the Costa Rican dry tropical forest, Ecological Society of America Meeting, Portland, OR, August 2012

J. Fant

Post-glacial migration, biogeography and genetics of a narrow endemic thistle, Cirsium pitcheri (Asteraceae) : Consequences for restorations J Fant, K Havens BSA Symposium - Transplantations and relocation of species at risk: learning from the past to plan for the future

Genetic consideration for restoration of Rare Species Plant Material Sources for Ecological Restoration Conference - U. S. Army Corps of Engineers

R. Goad

A Test of Local Adaptation to Tallgrass Prairie Assemblages to Soil Microbial Communities. Oral presentation at Ecological Society of America Conference, Portland, OR, Aug 6-9.

Plants of Concern: A Volunteer-Based Regional Rare Plant Monitoring Program. Presentation to Wild Ones, DuPage County Chapter

Field Methods Class, Plants of Concern Applications. University of Wisconsin Parkside. With S.Masi.

M. Haidet

Seeds of Success. North American Orchid Conservation Center, Smithsonian Environmental Research Center, Maryland. June 2012.

Seeds of Success. Mid-Atlantic Regional Seed Bank, Storm King, NY. January, 2012.

K. Havens-Young

Demographic consequences of reducing fecundity on rare and invasive plant species. University of Indianapolis, IN.

Effects of climate change on plants. Workshop for Illinois educators organized by Illinois Department of Natural Resources, Chicago, IL.

Assessing invasiveness of cultivars. Northeastern Illinois Invasive Plant Partnership Symposium, Chicago, IL.

Species distribution modeling. Plant Conservation Alliance meeting, Washington, DC.

Demographic consequences of reducing fecundity on rare and invasive plant species. Joint Missouri Botanical Garden and Washington University workshop, St. Louis, MO.

The uses of Project BudBurst data. Phenology Conference, Milwaukee, WI.

Plant conservation in the United States and *Seed collecting to capture diversity*. Endemic Species Research Institute, Taiwan.

Restoration in a changing environment. EcoSummit, Columbus, OH.

Organized and moderated a symposium "*Fire Ecology: Answers to Burning Questions*", Chicago Botanic Garden.

Demographic consequences of reducing fecundity on rare and invasive plant species. Plenary presentation, Upper Midwest Invasive Species Conference, La Crosse, WI.

R. Hawke

Four-star Perennials. Invited lecture at Michigan Nursery Expo, Grand Rapids, MI, January 9, 2012.

The Absolutely Best Plants for Upper Midwest Gardens. Invited lecture at Porter County Gardening Expo, Valparaiso, IN, January 21, 2012.

The Importance of Plant Trials. Invited lecture at Ohio State University Nursery Short Course, Columbus, OH, January 24, 2012.

Proven Perennials from the Chicago Botanic Garden Trials. Invited lecture at Ohio State University Nursery Short Course, Columbus, OH, January 24, 2012.

Hydrangea paniculata Trial. Invited lecture for Women's Board, Chicago Botanic Garden, Glencoe, IL, February 2, 2012.

Four-star Plants. Keynote lecture at Green Up Your Winter Blues Seminar, Port Washington, WI, February 18, 2012.

Proven Perennials. Invited lecture at Garden Expectations Conference, Appleton, WI, March 24, 2012.

When Pretty Isn't Enough. Invited lecture at Wisconsin Hardy Plant Society, Madison, WI, April 18, 2012.

Proven Perennials for Northern Gardens. Invited lecture at University of Wisconsin Extension Service, Boerner Botanical Gardens, Hales Corners, WI, August 1, 2012.

New Plant Performance for 21st Century Green Roof Ecosystems. Lecture and participation in panel discussion, Green Roofs for Healthy Cities Conference, Chicago, IL, October 18, 2012.

P. Herendeen

Co-organizer (with Richard Ree), Chicago Plant Science Symposium. "*Major evolutionary transitions.*" The Field Museum.

Evolution of flowering plants; Research, education and internship opportunities at Chicago Botanic Garden. Indiana University South Bend, November, 2012.

Paleobotany and the Role of (Paleo)botanical Art. American Society of Botanical Artists, October, 2012.

Research in plant paleontology. Adlai Stevenson High School, Lincolnshire, IL. Science careers presentation, May, 2011 and 2012

Organizer, Roundtable Discussion, "*Electronic publication: is it time to kiss our paper journals goodbye?*" Botany 2012.

Exceptionally well-preserved Early Cretaceous seed plants from Mongolia and their evolutionary significance. Botany 2012.

G. Hitzroth

Plants of Concern: Monitoring Rare Plant Species in Chicago Wilderness. Presentation at IL Lakes Management Association Conference, Northern Illinois University, DeKalb IL. With co-authors S. Masi and P. Vitt.

R. Kirschner

The Garden on the Water: An Overview of the Chicago Botanic Garden's Lake Enhancement Program, Village of Glencoe Sustainability Working Group

A. Kramer

Current Issues in Botany: Botanical Capacity Shortcomings. Invited Presentation, Pennsylvania Botany Symposium. Pittsburgh, PA, USA. November 2012.

Learning from native 'winners' in degraded sites in the Colorado Plateau. Colorado Plateau Native Plant Program Annual Conference. Page, AZ, USA. March 2012.

D. Larkin

Plant-community change: Mechanisms and management. University of Nebraska–Omaha.

My career as an ecologist. 2012 STEM Symposium, Malcolm X College, Chicago, IL.

Restoration of a degraded oak woodland enhances carbon-storage services. Chicago Wilderness Congress, Chicago, IL.

Community and phylogenetic change in tallgrass prairie remnants. Tallgrass Prairie Restoration in the 21st Century, Morton Arboretum, Lisle, IL.

Restoration of a buckthorn-invaded woodland enhances carbon-storage ecosystem services. Forest Preserve District of Cook County Science and Research Symposium, Chicago, IL.

Determining habitat requirements and restoration targets for secretive marshbirds. Interagency Private Lands Meeting, Wisconsin Department of Natural Resources, Drummond, WI.

Habitat requirements and restoration targets for secretive marshbirds in southeastern Wisconsin. Annual Meeting of the Ecological Society of America, Portland, OR.

Habitat requirements and restoration targets for secretive marshbirds in southeastern Wisconsin. Midwest Bird Conservation and Monitoring Workshop, Milwaukee, WI.

Environmental and biotic factors affecting woodland legume restoration. Society for Ecological Restoration–Midwest Great Lakes Annual Meeting, Ann Arbor, MI.

Determining habitat requirements and restoration targets for secretive marshbirds. Wisconsin Wetlands Association Conference, Lake Geneva, WI.

S. Masi

Plants of Concern. Training Workshops for Citizen Science Monitors. Co-taught 4 training workshops held in different parts of the region during April/May. With G. Hitzroth.

Plants of Concern: Citizen Scientists Monitor Rare Species. Presentation to Lake County Audubon Society, May 7.

Plants of Concern in Kane County. Presentation and wildflower tour at Dixie Brigs Fromm Nature Preserve. For Kane County Wild Ones meeting. June 30.

Asters, Goldenrods and More. Presentation and tour of Dixon Prairie for North Branch Restoraion Project Class Series. August 11. Assisted by E. Bialecki.

Plants of Concern, a Citizen Science Monitoring program in Chicago Wilderness since 2001. Poster presentation at the Conference on Public Participation in Scientific Research, Portland, OR. August 4-5. And at the 2012 Indiana Dunes National Lakeshore Science Conference, Indiana University Northwest, Gary, IN. November 28. Co-author R. Goad.

Plants of Concern: Volunteers Monitor Rare Plants in a Standardized Regional Program. Presentation to Northwestern University Graduate Students, Chicago Botanic Garden. With R. Goad, J. Aaron and E. Bialecki. November 16.

G. Mueller

Using genotyping-by-sequencing techniques for population genetic studies in mushroom-forming fungi. Wilson, A.W. N. Wickett, P. Grabowski, J. Fant, J. Borevitz, G.M. Mueller. Mycological Society of America Annual Meeting, New Haven, CT.

Fungi – Diverse, Important, and Understudied. Mueller, G.M. IUCN World Conservation Congress, Jeju, Korea.

Macrofungi of Indiana Dunes. Mueller, G.M., P.L. Leacock, P. Avis. Indiana Dunes National Lake Shore Research Summit. Gary, IN.

The Science of Fungal Conservation. Cannon, P. and G.M. Mueller. Mycological Society of America Meeting, New Haven, CT.

K. Skogen

Vagrant pollinators and fragrant plants - geographic structure in floral scent despite hawkmoth-mediated gene flow linking isolated populations. Ecological Society of America, Portland, OR. – coauthors: J. Fant and R. Raguso

D. Sollenberger

Seed Collecting, Cleaning and Packaging, Native Seed Farming Grant, Technical Workshop, David Sollenberger, Emily Yates, September 27, 2012.

J. Steffen

Use and design of a new herbicide applicator. Invasive Plant Workshop, Chicago Botanic Garden.

S. Still

California's Desert Eschscolzia: Progress in this difficult taxonomic group. California Native Plant Society 2012 Conservation Conference. January 14, 2012.

Predicting the Effects of Climate Change on Cacti: Comparing Two Assessment Methods. NatureServe 2012: Biodiversity Without Borders. Portland, OR. April 24, 2012. Invited presentation.

Species Distribution Modeling of Western Rare Plants. NatureServe 2012: Biodiversity Without Borders. Portland, OR. April 24, 2012

Species Distribution Modeling of Western Rare Plants. Webinar for the Bureau of Land Management Plant Conservation Program. August 16, 2012.

Change for Western Rare Plants: Efforts to model future vulnerability to climate change for rare plants in the western United States. An invited presentation for the Applied Climate Change Research session at the Chicago Wilderness Congress 2012. November 15, 2012.

P. Vitt

Species Distribution Models: How Good Are They At Predicting Current Species Ranges? Illinois Natural History Survey, Prairie Research Center, Champaign, IL. November 2012.

Range Shrinkage and Shifts of Charismatic Plants, Lessons for Integrated Future Management Plans. Biodiversity Without Borders, NatureServe, Portand, OR. April 2012.

S. Wagenius

Variation in flowering phenology among fragmented prairie populations of Echinacea angustifolia, gave talk at international phenology meeting, September 2012, Milwaukee, WI.

A Minnesota perspective on seed sources for prairie restorations, invited to speak at the Plant Material Sources for Ecological Restoration Conference, July 2012, U. S. Army Corps of Engineers, Chicago, IL.

N. Wickett

Revisiting the origin of land plants using a transcriptome mining approach. Westfälische Wilhelms-Universität Münster, December 6, 2012.

Revisiting the origin of land plants: Reconstructing the relationships of embryophytes and their sisters using a transcriptome mining approach. University of Zurich, December 4, 2012.

Who got there first? Revisiting the origin of land plants using genomic data. Hosted by the Botanical Society of America Student Chapter at Bucknell University, October 18, 2012.

New insights in the evolution of parasitic plants. Chicago Plant Science Symposium 2012. The Field Museum, Chicago IL, April 20, 2012.

Scaling phylogenomics to over one thousand species: Relationships of Viridiplantae inferred from the 1KP (One Thousand Plants) Project pilot data set. Wickett NJ*, J Leebens-Mack, E Carpenter, S Mirarab, S Ayyampalayam *et al*. Meeting abstract in *Botany 2012 Abstracts*, Columbus, OH, July 2012.

Broomrape plastid genomes reveal distinct patterns of functional and physical gene deletion under relaxed selective constraints. Wicke, S*, K Mueller, D Quandt, NJ Wickett, C dePamphilis & G Schneeweiss. Meeting abstract in *Botany 2012 Abstracts*, Columbus, OH, July 2012.

Large-scale transcriptome sequencing and phylogenetic hypotheses for monocots based on analyses of 970 (and up to 1888) low copy nuclear genes. dePamphilis, C, NJ Wickett, J Duarte, J Der*, M Mckain *et al*. Meeting abstract in *Botany 2012 Abstracts*, Columbus, OH, July 2012.

The effect of paleopolyploidy on genome evolution in Agavoideae. McKain, M*, NJ Wickett, Y Zhang, S Ayyampalayam, R McCombie *et al*. Meeting abstract in *Botany 2012 Abstracts*, Columbus, OH, July 2012.

The Parasitic Plant Genome Project. Honaas, L, E Wafula, NJ Wickett, Y Zhang, Z Zhang *et al.* Meeting abstract in *Botany 2012 Abstracts*, Columbus, OH, July 2012.

E. Yates

Seed Collection Workshop. Western Illinois University, Kibbe Field Station, Macomb, IL, October 4, 2012.

Seed Banking with Chicago Botanic Garden's Dixon National Tallgrass Prairie Seed Bank in the Cook County Forest Preserve District. Forest Preserve District of Cook County Science and Research Symposium, Lincoln Park Zoo, April 19, 2012.

GIS-based spatial analysis of Oenothera perennis in northeastern Illinois. Illinois GIS Association Fall
Conference, Naperville, IL October 16-17, 2012. Co-authors: Hazel Levine and Susanne Masi.

Seeds of Success workshop for CLM internship training at Chicago Botanic Garden. Led 40 interns in seed collecting techniques in the field, with M. Haidet and D. Sollenberger, June 21, 2012

N. Zerega

Graduate Partnership in Plant Biology and Conservation. Presentation for the Northwestern Alumni Association, Chicago Botanic Garden, August 4, 2012.

Graduate Student Presentations:

Barak, RS and A Radosavljevic. Birds, Bees, Orchids and Trees! Junior Science Cafés: Cupid's Chemistry. Museum of Science and Industry, Chicago, IL February 9, 2013

Ask, S, RS Barak and A Viands. Life cycles, leaf litter and climate change: Tools for hands-on nature-based climate education. Symposium presentation at Chicago Wilderness Leave no Child Inside Conference. River Grove, IL Jan 12, 2013.

Larson, K, RS Barak and D Guritz. Citizen science and youth engagement in Chicago's wilderness. Symposium presentation at Chicago Wilderness Leave no Child Inside Conference. River Grove, IL Jan 12, 2013.

Barak, RS, KA Skogen and JB Fant. Assessing competitive potential of native forbs from cheatgrass-dominated habitats. Oral presentation at the 97th Annual Meeting of the Ecological Society of America. Portland, OR Aug 5-10, 2012.

Hirsch, J, and RS Barak. Climate clinic for classroom educators. Teacher Workshop at Field Museum, Chicago, IL June 20, 2012.

Ksiazek, K. Searching for Chicago's green roof analog among the dry prairies of northern Illinois. Green Roofs for Healthy Cities; CitiesAlive! 10th Annual Green Roof and Wall Conference Collegiate Café. Chicago, IL, October 2012.

Ksiazek, K. Replicating local ecosystems on green roofs. 4th International EcoSummit: Ecological Sustainability, Columbus, OH, October 2012.

TEACHING & MENTORING

L. Egerton-Warburton

High school students advised (College First):
Vanessa Duran
Deisy Williamson

Undergraduate students advised:
William Levinson (Lake Forest College)
Jenifer Yost (Lake Forest College)
Brionna Slocum (Ohio State University)

Major advisor for graduate students:

Robert Hevey (NU)
Nik Desai (NU)
Lauren Umek (NU) Progressed to doctoral candidacy July, 2012
Benjamin Morgan (NU)
Corey Palmer (NU)

J. Fant

Graduate students advised or committee member:

Anna Braum (Current MA, NU)
Kelly Ksiazek (Current PhD , NU)
Becky Barak (MA 2012, NU)
Joshua Drizin (Current MA, NU)
Eun Sun Kim (Current PhD, UIC)
Ricardo Rivera (MA 2012, NU)
David Zaya (PhD 2012, UIC)

Undergraduate students advised

Evan Eifler (University of Wisconsin – NSF REU)
Clément Kouyoumdjian (Univ of Renne, France)
Jesse Lundgren (Carthage College – NSF REU)
Febin Varughese (NEIU),

High School and College First students mentored

Marlene Arellano (College first)
Robert Harris (College First)

M. Haidet

Seed Collection for Conservation and Restoration Training Course. Las Vegas, NV. April 23-27, 2012.

Seed Collection for Conservation and Restoration Training Workshop. Chicago Botanic Garden. June 18-22, 2012.

K. Havens-Young

Conservation and Land Management Intern Training Workshop. Chicago Botanic Garden.

Graduate students advised or committee member:

J. Alyah (MS at NU)
J. Schwarz (MS at NU)

P. Herendeen

Plant Evolution and Diversity: Northwestern University (Winter 2012).

Graduate students advised or committee member:

Aleksandar Radosavljevic (PhD at NU)
Colleen Michael (MS at NU)

Bob Kirschner

Creating Sustainable "Lakescapes" at the Water's Edge; School of the Chicago Botanic Garden, June 14, 2012

Shorescaping at the Water's Edge: The Garden on the Water; seminar for Ecology and Materials Workshop I, Illinois Institute of Technology

It IS Important What the Neighbors Think: Creating Lake Shoreline Landscapes That Are Ecologically Diverse and Have Broad Aesthetic Appeal; Associated Colleges of the Chicago Area's Biology Division – Fall 2012 Seminar Series on Water, Benedictine University, Lisle, IL.

A. Kramer

Graduate students advised or committee member

Janet Backs-Rizner (PhD, UIC)
Raakel Toppila (MS, U of Delaware, completed spring 2012)
Alicia Foxx (MS, NU)
Ryan Disney (MS, NU)
Lindsey Darling (MS, NU)
Matt Rhodes (MS, NU)

D. Larkin

PI, Research Experiences for Undergraduates (REU) site Program in Plant Biology and Conservation

Plant Community Ecology (Spring 2012), Northwestern University

Field and Laboratory Methods in Plant Biology and Conservation (Fall 2012), Northwestern University

Ecology and Materials Workshop I: Plants and Planning (Fall 2012), Illinois Institute of Technology

Undergraduate students advised:

Laura Bofill (University of Oregon)
Hannah King (Stanford University)

Graduate students advised or committee member:

Jennifer Alyah (NU)
Rebecca Barak (NU)
Ryan Disney (NU)
Wesley Glisson (NU)
Melissa Gray (NU)
Paul Hartzog (NU)
Sam Isham (NU)
Rebecca Tonietto (NU)
Byron Tsang (NU)
Erin Vander Stelt (NU)

High School and College First students mentored

Rachel Sison (Niles West High School)

E. Lonsdorf

Graduate students advised or committee member:

Wesley Glisson (NU)
Victoria Hunt (UIC)
Brook Herman (UIC)
Rebecca Tonietto (NU)

S. Masi

Co-taught four Plants of Concern Volunteer Training workshops throughout the region in April/May.

With G. Hitzroth.

Coordinated and mentored group volunteer monitoring field forays throughout the season at Illinois Beach

State Park, Braidwood Dunes and Savanna, Lyman Woods, Dixie Briggs Fromm Nature Preserve, With R. Goad.

Students mentored

Daniel Fink, Northeastern Illinois University MA student; on thesis committee.
Erin Vander Stelt, Northwestern MS student, for her thesis project.
REU intern Hazel Levine. With E. Yates, R. Goad, M. Bialecki.

G. Mueller

Mycology, NU Graduate Level Special Topics Course

Fungi and Fungi-Like Organisms, Organization for Tropical Studies, Costa Rica (Co-instructor).

Students mentored

Rui Zhang
Chen Ning

J. O'Shaughnessy

Prairie Restoration Management Tour, Ecosystems Studies Teacher Workshop, June 26, 2012

Prairie Restoration Management Tour, Interns, Openlands of Lake Forest, June 29, 2012

Prairie Restoration Management Tour, "Conservation Field and Lab Methods in Plant Biology and Conservation" class for Northwestern-Chicago Botanic Garden Masters candidates, October 17, 2012

Prairie Restoration Management Tour, Illinois Institute of Technology Ecology Class, November 2, 2012

K. Skogen

Conservation and Land Management Internship Program – Training Workshop. Chicago Botanic Garden. June 18-22nd, 2011. 58 interns and 10 instructors attended this week-long workshop.

PBC 451/Biol Sci 355 Fundamentals of Plant Science & Conservation, *Instructor* Northwestern University, Evanston, IL Winter and Fall 2011 quarters

PBC 450 Field & Laboratory Methods in Plant Biology & Conservation*, Co-Instructor*
Northwestern University, Evanston, IL. Fall 2011

Graduate students advised or committee member

Rebecca Barak (MS at NU) Major Advisor
Anna Braum (MS at NU)
Kelly Ksiazek (Ph.D. NU) Major Advisor
Matthew Rhodes (MS at NU) Major Advisor
Ricardo Rivera (MS at NU) Major Advisor
Karen Taira (MS at NU)
Byron Tsang (MS at NU)

Undergraduates mentored:

James Medina (Oberlin College)

Mentored Research Assistants:

Evan Hilpman
Sadie Todd
Kathleen (KC) West

D. Sollenberger

College First student advised:

Rosy Herrera

J. Steffen

Woodland Management, School of the Botanic Garden, April 28, 2012.
Woodland Wildflower Walk, School of the Botanic Garden, May 12, 2012.
Bird Identification Walk, School of the Botanic Garden, May 12, 2012.
Woodland Ecology Tour for Summer Teachers Program, June 27, 2012.
Native Seed Collection and Propagation, School of the Botanic Garden, September 15, 2012.
Bird Walk for Lake Cook Audubon, September 15, 2012.
Spiders and Invasive Species talk and tour for gifted student, October 1, 2012.
Woodland Ecology Tour for Illinois Institute of Technology class, October 4, 2012.
IDNR Entice Woodland Ecology Teachers Workshop tour, October 13, 2012.
Woodland Ecology Tour for Northwestern Graduate Class, October 17, 2012.

Mentor/Graduate committee member

Byron Tsang NU

P. Vitt

Postdoctoral Fellows Advised:

Shannon Still

Graduate Students Advised:

Anne Nies

S. Wagenius

Quantitative Methods in Ecology and Conservation (Winter 2012), Northwestern University

Conservation Genetics (Spring 2012), Northwestern University

Major advisor for graduate students:

Joshua Drizin (MS, Northwestern University)

Karen Taira (MS, Northwestern University)

Katherine Muller (MS, Northwestern University)

Committee member for graduate students:

Rebecca Tonietto (PhD, Northwestern University)

Undergraduate students advised:

Sebastian Di Clemente (Lake Forest College, IL)

Jillian Gall (College of the Atlantic, ME)

Lydia Kan (Bethel University, MN)

Kelly Kapsar (Carleton College, MN)

Annemarie McDonald (Northwestern University)

Shona Sanford-Long (Middlebury College, VT)

Marie Schaedel (Carleton College, MN)

Maria Wang (Northwestern University)

High School students co-advised:

Jill Meyer (St Martin De Porres High School)

Secondary School Science Teachers Mentored:

Greg Diersen (Great Plains High School, SD)

N. Wickett

Understanding Evolution from Seaweed to Salad: Northwestern University (Winter, 2012 & Fall 2012)

The Nature of Plants: Northwestern University (Spring, 2012)

Graduate students advised:

Laura Briscoe (MS completed in 2012 at Northwestern)

Graduate student committee member:

Aleksandar Radosavljevic (PhD at NU)

Elliot Gardner (PhD at NU)

Ben Morgan (PhD at NU)

Undergraduate student research advisor:

Brian Caccioppo (Northwestern University)

E. Williams

Biology 220 Ecology Laboratories, Lake Forest College, (Fall 2012)

Undergraduates advised:

Brianna Lemond (Lake Forest College intern)

E. Yates

Field and Laboratory Methods in Plant Biology and Conservation, PBC 450 (Fall 2012), Northwestern University, section on GIS and spatial analysis.

Conservation and Land Management Intern Training Workshop. Chicago Botanic Garden, June 21.

Research Experience for Undergraduates (REU) student advised:

Hazel Levine

College First student advised:

Rosie Herrera, with D. Sollenberger

Project Assistantships (PAs), Northwestern University, co-supervised:

Ben Morgan (Seed Bank)

Paul Hartzog (Seed Bank)

N. Zerega

Spring Flora (PBC 415/BIO 316), spring quarter 2012 at Northwestern University (23 students)

Field and Lab Methods in Plant Biology and Conservation (PBC 450), fall quarter at Northwestern University (10 students)

*Plant Morphology Lecture***,** for Master's in Landscape Architecture students at Illinois Institute of Technology, September 2012.

Major advisor for graduate students:

Lindsay Darling (MS, Northwestern University)

Elliot Gardner (PhD, Northwestern University)

Kristen Laricchia (MS, Northwestern University)

Theresa Melhem (MS, Northwestern University)

Maria Wang (MS, Northwestern University)

Colby Witherup (MS, Northwestern University)

Committee member for graduate students:

Jennifer Alyah (MS, Northwestern University)

Rebecca Barak (MS, Northwestern University)

Laura Briscoe (MS, Northwestern University)

Emily Booth (MS, Northwestern University)

Aleksandar Radosavljevic (PhD, Northwestern University)

Undergraduate students advised:

Paya Sharaf (Northwestern University)

Tyr Wiesner-Hanks (Northwestern University)

PROFESSIONAL SERVICE

J. Ault

Chicagoland Grows®, Inc. Plant Introduction Program

Director and Manager

Liaison to Ornamental Growers Association of N. Illinois (OGA) Board of Directors

L. Egerton-Warburton

Proposal Reviewer

National Science Foundation

Research Associate, The University of California, Riverside

Manuscript Reviewer

Annals of Botany
Journal of Applied Ecology
Ecology
Plant and Soil
Applied Soil Ecology

J. Fant

Botanical Society of America

Member (2007-present)

Ecological Society of America

Member (2007-present)

DePaul Institutional Biosafety Committee

Committee Member (2009- present)

Manuscript reviewer

American Journal of Botany
Annales Botanici Fennici
Annals of Botany
Applied Vegetation Science
Aquatic Botany
Botanical Bulletin of Academia Sinica
Folia Geobotanica
International Journal of Plant Science
Molecular Ecology
Plant Systematics and Evolution
Preslia
Restoration Ecology
Telopea

Proposal reviewer

National Science Foundation

M. Haidet

Colorado Plateau Native Plant Program

Technical Committee

Mid-Atlantic Regional Seed Bank

Species Selection Committee

North American Orchid Conservation Center

Seed Banking Committee

Plant Conservation Alliance

SOS contact

K. Havens-Young

American Public Gardens Association

Member of Conservation Committee (1999-present)

Chair Conservation Committee (2006-2008)

Botanical Society of America

Chair, Conservation Committee (1996-1999)

Public Policy Committee (2011-present)

Botanic Gardens Conservation International

US Board of Directors (2005-present)

Chicago Wilderness

Co-chair of Science Team (2005-2009)

Chair of Seed Task Force (2002-2005)

Member, Global Climate Change Task Force (2007-present)

City of Chicago

Member of Chicago Department of Environment Invasive Species Advisory Group

Center for Plant Conservation

Member of recovery criteria for endangered plants team

Member of ecotype team

Fairchild Tropical Botanical Garden

Research Associate

Illinois Endangered Species Protection Board

Member of Scientific Review Panel (1999-present)

Invasive Plant Council of Illinois

Co-founder (2002-present)

Illinois Native Plant Society

Past President

Landscape, Ecological and Anthropogenic Processes (LEAP) Program Committees at University of Illinois Chicago

Admissions Committee

Curriculum Committee

Midewin National Tallgrass Prairie

Member of Scientific Review Panel (1999-present)

Midwest Invasive Plant Network

Board member and Treasurer (2002-present)

Midwestern Rare Plant Task Force

Founder and co-coordinator (1997-present)

North American Botanic Garden Conservation Strategy

Team member.

Plant Conservation Alliance

Cooperator contact

Plant Biology and Conservation (PBC) committees at Northwestern University

PBC Oversight Committee
PBC Admissions Committee

World Conservation Union (IUCN) Species Survival Commission,
Plant Committee, North American Rep. (2005 to 2010)
Conservation Breeding Specialist Group, Intensively Managed Populations (2010-present)

U.S. Fish and Wildlife Service Endangered Species Recovery Team member for Asclepias meadii, Platanthera leucophaea

Manuscript reviewer
American Journal of Botany
Biological Conservation
Conservation Biology
Conservation Genetics
Evolution
International Journal of Plant Sciences
New Phytologist

Proposal reviewer
National Science Foundation

External dissertation reviewer
University of Western Australia

R. Hawke

American Public Gardens Association
Member of Plant Collections Section
Member of Plant Nomenclature & Registration Section

Plants in Focus: Perennial Evaluation Committee
Member

Chicagoland Grows®, Inc. Plant Introduction Program
Member, New Plant Committee

P. Herendeen

American Institute of Biological Sciences (AIBS)
AIBS Ad Hoc Committee on Biodiversity-related Sciences

International Association for Plant Taxonomy
Ad Hoc Committee chair, to assess business model for IAPT publications
Secretary, Nomenclature Committee on Fossil Plants
Editorial Committee Member to write the new edition of the *International Code of Botanical Nomenclature*.

American Society of Plant Taxonomists
Program Director

Botanical Society of America
Secretary-Treasurer for Systematics Section of BSA

International Journal of Plant Sciences (University of Chicago Press)
Editor

PhytoKeys (open access journal)

Subject Editor (paleobotany, legume systematics), July 2011 – present

National Science Foundation

Panel member, Doctoral Dissertation Improvement Grants panel, February 2012

Grant proposal ad hoc reviewer

Manuscript Reviewer

American Journal of Botany

Annals of Botany

Annals of the Missouri Botanical Garden

Grana

International Journal of Plant Sciences

Systematic Botany

Plant Biology and Conservation (PBC) committees at Northwestern University

PBC Curriculum Committee

R. Kirschner

Chicago Regional Biodiversity Council (Chicago Wilderness)

Member of Natural Resources Management Team

Member of Aquatics Task Force

Event host for *Conservation and Native Landscaping Awards* program

Chicago Park District

Member of Natural Areas Advisory Committee

Lincoln Park Conservancy

Member of North Pond Master Plan Advisory Group.

A. Kramer

American Public Gardens Association

Chair, Plant Conservation Professional Section (2010-present)

Colorado Plateau Native Plant Program

Member, Technical and Research Committees (2012-present)

Manuscript reviewer

American Journal of Botany

Biological Conservation

Conservation Genetics

Ecological Applications

Ecological Restoration

Evolutionary Applications

Molecular Ecology

Plant Biology

Restoration Ecology

Trends in Plant Science

Trends in Ecology and Evolution

D. Larkin

Manuscript reviewer

Journal of Wildlife Management
Soil Science Society of America Journal
Wetlands
Restoration Ecology

National Science Foundation panelist

Graduate Research Fellowship Program
Coupled Human and Natural Systems

Northeastern Illinois Invasive Plant Partnership

Steering Committee

Great Lakes Phragmites *Collaborative*

Steering Committee, Research Subcommittee

Midwest Marsh Bird Monitoring Working Group

Plant Biology and Conservation, Northwestern University

PhD Admissions Committee

E. Lonsdorf

Manuscript reviewer

Ecological Applications
Oikos

S. Masi

Chicago Wilderness Natural Resource Management Team

Member

Endangered Species Protection Board Technical Expert Consultant (Plants)

Illinois Endangered Species Protection Board

Member

Illinois Native Plant Society

Member

Manuscript Reviewer

Erigenia

Natural Areas Association

Member

Participant in Citizen Science Networks

PPSR (Public Participation in Scientific Research – Cornell University), POC presence on website.

G. Mueller

Chicago Wilderness

Member Executive Council
Member Executive Advisory Committee

City of Chicago

Member Mayor's Nature and Wildlife Committee

Chicago Council for Science and Technology

Member of Board, Member of Membership Committee

Illinois Nature Conservancy

Member, Science Advisory Council

Illinois Mycological Association

Scientific Advisor

IUCN Species Survival Commission

Chair, Mushrooms, Brackets, and Pufballs Specialist Group

International Society for the Conservation of Fungi

Board Member

Mycological Society of America

Honors Committee

National Forest Foundation

Midewin National Tallgrass Prairie Stakeholders working group

Manuscript reviewer

Numerous journals as well as pre-reviews for colleagues

Proposal reviewer

National Science Foundation, National Geographic, others

K. Skogen

Botanical Society of America.

Karling and Graduate Student Research Awards. Committee member. 2010 - 2012.

Manuscript reviewer

American Journal of Botany

Oecologia

Plant Species Biology

Plant Biology and Conservation, Northwestern University

MS Admissions Committee

Curriculum committee member

J. Steffen

OpenLands

Researcher inventorying spiders and micro arthropods.

S. Still

Chicago Wilderness

Member, Global Climate Change Task Force (2011-present)

Applied Climate Change Research Session Chair, Chicago Wilderness Congress 2012

California Native Plant Society

Steering committee for CNPS 2015 Conference

Manuscript Reviewer

American Journal of Botany

Madroño
PLoS One

P. Vitt

Chicago Wilderness
Member, Global Climate Change Task Force (2009-present)

Chicago Climate Action Plan
Adaptation Advisory Committee

U.S. Fish and Wildlife Service Endangered Species Recovery Team member for Lespedeza leptostachya, Platanthera praeclara

World Conservation Union (IUCN) Species Survival Commission, Orchid Specialist Group (2005 to 2010)

Manuscript reviewer
American Journal of Botany
Biological Conservation
Conservation Biology
Ecology Letters

Proposal reviewer
National Science Foundation

S. Wagenius

Plant Biology and Conservation (PBC) committees at Northwestern University
PBC Curriculum Committee
PBC PhD Admissions Committee

Ecological Society of America
Member

Manuscript reviewer
Numerous

National Science Foundation panelist
LTREB program
Population and Community Ecology, Fall

N. Wickett

Plant Biology and Conservation committees
PhD Admissions Committee

Botanical Society of America
Member
Committee member – Technological Committee

American Bryological and Lichenological Society
Member

Manuscript Reviewer
American Journal of Botany
Journal of Molecular Evolution

Molecular Biology and Evolution
Molecular Phylogeny and Evolution
Phytotaxa
Systematic Biology
Trends in Plant Science

Proposal Reviewer

National Science Foundation

E. Williams

Botanical Society of America

Master Plant Science Team

Manuscript reviewer

American Fern Journal

E. Yates

GIS Certification Institute (GISCI)

Certified Geographic Information Systems Professional (GISP)

Association of American Geographers

Member & Annual Meeting presenter, *Topics in Biogeography* section

Illinois GIS Association

Member & conference presenter

Illinois Geographical Society

Member

N. Zerega

Committee Member at Northwestern University

Environmental Science, Engineering, and Policy Committee
Environmental Policy and Culture Committee
Curriculum Committee for Plant Biology and Conservation
Admissions Committee for Plant Biology and Conservation
The Graduate School Advisory Council on Academic Affairs

Manuscript Reviewer

Naturwissenschaften
Proceedings of the National Academy of Sciences
American Journal of Botany
Molecular Phylogenetics and Evolution
Systematic Botany
Economic Botany
Journal of Biotechnology

Grant Reviewer

National Geographic Society Research Proposal Review
National Science Foundation

Society Membership

Botanical Society of America
American Society of Plant Taxonomists
Society for Economic Botany

COLLABORATIONS

J. Ault

Kris Bachtell, Kunso Kim, and Joe Rothleutner (The Morton Arboretum), Ornamental Growers Association of Northern Illinois (OGA), 130-plus nurseries evaluating/growing the breeding program and other Chicagoland Grows® plant introductions.

L. Egerton-Warburton

Edith B. Allen (University of California, Riverside), Michael F. Allen (University of California, Riverside), Hormoz BassiriRad (University of Illinois Chicago), Kingsley Dixon (Kings Park and Botanic Garden, Australia), Arturo Gomez-Pompa (University of California, Riverside), Robert C. Graham (University of California, Riverside), Andrew Jacobson (Northwestern University), Nancy C. Johnson (Northern Arizona University), Ari Jumponnen (Kansas State University), José Ignacio Querejeta (CEBAS-CSIC, Spain), Rodrigo Vargas (University of California, Berkeley), Patricia Beddows (Northwestern University), Neal Blair (Northwestern University), Yun Wang (Northwestern University).

J. Fant

Mary Ashley (University of Illinois Chicago), Alona Banai (Loyola University), Tim Bell (Chicago State University), Justin Borevitz (University of Chicago), Marlin Bowles (Morton Arboretum), Diane Byers (Illinois State University) Julie Etterson (University of Minnesota, Duluth), Pam Geddes (NEIU), Alden Griffith (Wellesley College), Chrystal Ho Pao (Trinity International Univ.), Andrea Kramer (BGCI), Tiffany Knight (Washington University, St Louis), Joyce Maschinski (Fairchild Tropical Botanic Garden), Geoff Morris (University of Chicago), Christal Niederer (Creekside Center for Earth Observation), Christopher Preston (Centre of Ecology and Hydrology, UK), Eric Ribbens (WIU) David Tank (U. Idaho).

M. Haidet

Bill Brumback (New England Wildflower Society, Framingham, MA), Mike Cashman (Agricultural Research Service, Pullman, WA), David Ellis (Agricultural Research Service, Ft. Collins, CO), Brian Endress (Zoological Society of San Diego), Minnette Marr (Lady Bird Johnson Wildflower Center, Austin, TX), Ray Mims (US Botanic Garden, Washington, DC), Peggy Olwell (Bureau of Land Management, Washington, DC), Johnny Randall (North Carolina Botanical Garden, Chapel Hill, NC), Nita Rauch & Kayla Herriman (US Forest Service, Bend, OR), Rusty Russell (Smithsonian Institution), Ed Toth (NYC Department of Parks, New York, NY).

K. Havens-Young

Amy Ando (University of Illinois Urbana-Champaign), Mary Ashley (University of Illinois Chicago), Tim Bell (Chicago State University), Marlin Bowles (Morton Arb., Lisle, IL), Bill Brumback (New

England Wildflower Society, Framingham, MA), Bob Christian (East Carolina Univ., NC), Kingsley Dixon (Kings Park & Botanic Garden, Perth, AUS), Patricia DeAngelis (U.S. Fish and Wildlife Service, Arlington, VA), Tony Endress (University of Illinois Urbana Champaign), Don Falk (University of Arizona, Tucson, AZ), Jeremie Fant (CBG), Elizabeth Farnsworth (New England Wildflower Society, Framingham, MA), Ed Guerrant (Portland State University, Portland, OR), Sandra Henderson, (NEON, Boulder, CO), Kent Holsinger (University of Connecticut, Storrs, CT), Kristina Hufford (University of Wyoming, WY), Claudia Jolls (East Carolina University, NC), Lara Jefferson (Maunsell Environmental, Perth AUS), Jeff Karron (University of WI Milwaukee), Tom Kaye (Institute for Applied Ecology, OR), Bruce Kendall (University of California Santa Barbara), Kathryn Kennedy (Center for Plant Conservation, St. Louis, MO), Tiffany Knight (Washington University , St. Louis, MO), Andrea Kramer (BGCI, Chicago), Mike Maunder (Florida International Univ.), Kathryn McEachern (US Geological Survey, CA), Eric Menges (Archbold Biol. Station, Lake Wales, FL), Rachel Muir (US Geological Survey, Ft. Collins, CO), Sara Oldfield (BGCI, London, UK), Peggy Olwell (Bureau of Land Management, Washington DC), Barron Orr (University of Arizona, Tucson, AZ), Noel Pavlovik (US Geological Survey, IN), Marcello Pennacchio (Perth AUS), Kristina Schierenbeck (California State University, Chico, CA), Larry Stritch (US Forest Service, Washington DC), Marshall Sundberg (Emporia State University, KS), Pati Vitt (CBG), Jeff Walck (Middle Tennessee State University, TN).

R. Hawke

Allen Bush (Jelitto Perennial Seeds, Germany), Jack De Vroomen (De Vroomen Plants, Holland), Evan Elenbaas (Walters Gardens, Zeeland, MI), Raymond Evison (Guernsey Clematis Nursery Ltd, England), Dan Heims (Terra Nova Nurseries, Portland, OR), Chris Kelleher (Blooms of Bressingham, England), Michael Marriott (David Austin Roses, England), Jim Nau (Ball Horticultural, North Chicago, IL), Angela Treadwell Palmer (Plants Nouveau, Charleston, SC), Mary Walters and Chris Hansen (Great Garden Plants, Michigan), Dr. Mark Widrlechner (USDA North Central Plant Introduction Station, Ames, IA), Nicholas Staddon (Monrovia Growers, Azusa, CA), Steve Castorani (North Creek Nurseries, Landenberg, PA), Kerry Meyers (Proven Winners, St. Thomas, MO).

P. Herendeen

Anne Bruneau (University of Montreal), Peter Crane (Yale University), Else Marie Friis (Swedish Museum of Natural History), Vicki Funk (Smithsonian Institution) , Bente Klitgaard (Royal Botanic Gardens, Kew), John Kress (Smithsonian Institution), Matthew Lavin (Montana State University), Gwilym Lewis (Royal Botanic Gardens, Kew), Melissa Luckow (Cornell University), Richard Lupia (University of Oklahoma), Susana Magallon (Universidad Nacional Autónoma de México*)*, Steven Manchester (University of Florida), Lucinda McDade (Rancho Santa Ana Botanic Garden), Toby Pennington (Royal Botanic Garden Edinburgh), Karen Redden (Smithsonian Institution), Michael Sanderson (Arizona State University), Petra Sierwald (Field Museum), Doug Soltis (University of Florida), Pam Soltis (University of Florida), David Spooner (USDA, Madison, WI), Masamichi Takahashi (Niigata University, Japan), Scott Wing (Smithsonian Institution), Martin Wojciechowski (Arizona State University)

S. Jacobi

Marissa Ahlering (TNC), Daren Carlson (MN DNR), Cami Dixon (USFWS), Patricia Heglund (USFWS), Benjamin Hobbs (Johns Hopkins University),Tim Jones (USFWS), Jill Gannon (USGS), Melinda Knutson (USFWS), James Lyons (USFWS), Clint Moore (USGS), Carrie Reinhardt-Adams (University of Florida), Terry Shaffer (USGS), Wayne Thogmartin (USGS), Sara Vacek (USFWS), Peter Wilcock (Johns Hopkins University).

R. Kirschner

Patrice Charlebois (Illinois-Indiana Sea Grant Program)

A. Kramer

Mary Ashley (University of Illinois at Chicago), Eduardo Cires (Ghent Univ.), Nikki Grant-Hoffman (Bureau of Land Management), Ed Guerrant (Portland State University), Abby Hird (BGCI US at the Arnold Arboretum), Kristina Hufford (University of Wyoming), Ray Mims (United States Botanic Garden), Sara Oldfield (BGCI), Peggy Olwell (Bureau of Land Management); Wayne Padgett (Bureau of Land Management), Valerie Pence (Cincinnati Zoo and Botanical Garden), Marie-Stephanie Samain (Ghent Univ.), Nancy Shaw (USFS), Jeffrey Walck (Middle Tennessee State University), Larry Stritch (US Forest Service), Troy Wood (US Geological Survey), Barbara Zorn-Arnold (Ashford University)

D. Larkin

Marlin Bowles (Morton Arboretum), Ryan Brady (Wisconsin Dept. of Natural Resources), Pamela Geddes (Northeastern Illinois University), Andrew Hipp (Morton Arboretum), Kevin Kuehn (University of Southern Mississippi), Shane Lishawa (Loyola University Chicago), Clint Moore (USGS), Andy Paulios (Wisconsin DNR), Nancy Tuchman (Loyola), Joy Zedler (UW-Madison)

E. Lonsdorf

Norbert Cordeiro (Roosevelt University), Jane Goodall, Patricia Heglund (USFWS), Tim Jones (USFWS), Claire Kremen (U. California-Berkeley), Josh Lawler (U. Washington), David Lewis (U. of Puget Sound), Elizabeth Lonsdorf (Lincoln Park Zoo), Socheata Lor (USWFWS), James Lyons (USFWS), Clint Moore (USGS), Erik Nelson (Bowdoin College), Maile Neel (University of Maryland), Andrew Plantinga (Oregon State U.), Steve Polasky (U. of Minnesota), Anne Pusey (Duke University), Volker Radeloff (U. Wisconsin), Carrie Reinhardt-Adams (University of Florida), Taylor Ricketts (University of Vermont), Wayne Thogmartin (USGS), Dominic Travis (U. Minnesota), Denis White, Neal Williams (U. California-Davis)

S. Masi

Linda Masters, Openlands; Chris Mulvaney (Chicago Wilderness); Melinda Pruitt Jones (Chicago Wilderness); The Habitat Project, Audubon-Chicago Region; Laurel Ross and staff (The Field Museum); Susie Schreiber (Waukegan Harbor Citizens Advisory Group); Angela Larsen (Alliance for the Great Lakes); 79 landowner-partners of Plants of Concern, from federal, state, and local public agencies and private landowners.

G. Mueller

Jerry Adelmann (Openlands, Chicago), Cathie Aime (LSU), Martyn Ainsworth (Royal Botanic Gardens, Kew), Eef Arnalds (Emeritis Director of the Biological Station Wijster, The Netherlands), Peter Avis (Indiana University Northwest, Gary, IN), Hormoz Bassir Rad (U. Illinois at Chicago), Justin Borevitz (University of Chicago), Mayra Camino, (University of Havana, Cuba), Paul Cannon (CABI and Royal Botanic Gardens, Kew), Julieta Carranza (U. Costa Rica), Priscila Chaverri (University of Maryland), Michael Coates (University of Chicago), Anders Dahlberg (Swedish Species Information Centre, Upsala, Sweden), Cvetomir Denchev (Institute of Botany, Bulgarian Academy of Sciences, Bulgaria), Aaron Durnbach (Department of the Environment, City of Chicago), Ana Esperanza Franco (University of Antiochia, Medellin, Colombia), Roy Halling (New York Botanical Garden), Tsutomu Hattori (Forestry and Forest Products Research Institute, Japan), Terry Henkel (Humboldt State, California), Kentaro Hosaka (National Museum of Nature and. Science, Japan), Reda Irsenaite (Vilnius University, Lithuania), Carolyn Johnson (University of Chicago), Matthew Keirle (State College of Florida), Heikki Kotiranta (Finnish Environment Institute, Finland), Andrea Kramer (BGCI, Chicago and Sydney AUS), Patrick Leacock (Field Museum), Thorsten Lumbsch (Field Museum), Milagro Mata (INBio, Costa Rica), T. W. May (Royal Botanic Gardens, Melbourne), Joe McFarland (IDNR), David Minter (CABI, UK), Randy Molina (US Forest Service, Corvallis, retired), Sara Oldfield (BGCI, London, UK), Claudia Perini (University of Siena, Italy), Ron Petersen (U, Tennessee, Knoxville), Melinda Pruett-Jones (Chicago Wilderness), Laurel Ross (Field Museum), Christoph Scheidegger (Swiss Federal Research Institute for Forest, Snow and Landscape, Switzerland), Walter Sundberg (Southern Illinois University, Carbondale), Tatyana Svetasheva (Tula State University, Tula, Russia), Gavin van Horn (Center for Humans and Nature), Zhu-Liang Yang (Kunming Institute of Botany, China), Zhanna Yermakov (Chicago Park District)

K. Skogen

Tia Adams (US Fish and Wildlife Service), Nancy Brian (National Park Service), Shane Heschel (Colorado College), Kent Holsinger (University of Connecticut, Storrs), Diane Ikeda (Forest Service, CA), Sylvia Kelso (Colorado College), Peggy Olwell (Bureau of Land Management), Robert Raguso (Cornell University)

P. Vitt

Amy Ando (University of Illinois), Tim Bell (Chicago State University), Todd Bittner (Cornell Plantations), Marlin Bowles (Morton Arboretum), Kingsley Dixon (Kings Park & Botanic Garden, AUS), Tony Endress (University of Illinois), Ed Guerrant (Berry Botanic Garden), Marion Harris (North Dakota State University), Kent Holsinger (University of Connecticut), Bruce Kendall (University of California Santa Barbara), Kathryn Kennedy (Center for Plant Conservation), Bill Kleiman (TNC), Tiffany Knight (Washington University), Mike Maunder (Fairchild Tropical Garden), Eric Menges (Archbold Biol. Station), Peggy Olwell (Bureau of Land Management), Barron Orr (University of Arizona), Nancy Sather (Minnesota DNR), Kathryn Theiss (University of Connecticut), Arthur Weiss (University of Toronto)

S. Wagenius

Eric Lonsdorf (CBG), Gretel Kiefer (TNC), Kevin Kotts (Minnesota DNR), Mary Ashley (University of Illinois Chicago), Ruth Shaw (University of Minnesota), Charlie Geyer (University of Minnesota), Caroline Ridley (US EPA), Andy McCall (Denison University), Steph Lyon (University of Wisconsin – Madison), Jennifer Ison (University of Toronto), Amy Dykstra (Bethel University), John Stanton-Geddes (University of Minnesota), Lynn Westley (Lake Forest College).

N. Wickett

Andrew Alverson (University of Arkansas), Michael Barker (University of Arizone), Gordon Burleigh (University of Florida), Cymon Cox (University of Algarve, Portugal), Claude dePamphilis (Penn State), Bernard Goffinet (University of Connecticut), Gane Ka-Shu Wong (University of Alberta),Jim Leebens-Mack (University of Georgia), Chris Pires (University of Missouri), Jon Shaw (Duke University), Doug Soltis (University of Florida), Pam Soltis (Florida Museum of Natural History), Michael Timko (University of Virginia), Jim Westwood (Virginia Tech), John Yoder (University of California, Davis).

E. Yates

Mary Byrne Rager (Bioloque), Andrew Clark (US National Herbarium, Smithsonian), Thomas Croat (Missouri Botanical Garden), Carol Davit (Missouri Prairie Foundation), Diane Donovan (Shaw Nature Reserve, St. Louis, MO), Dave Ellis (National Center for Genetic Resources Preservation, CO), Megan Haidet (Seeds of Success, Bureau of Land Management), Jesse Kieft (CartoPac Field Solutions), Cheiko Maene (GIS Collaborative, University of Chicago), Jason McNees (Conservation Data Analyst, Nature Serve), Kelly Neil (IL Nature Preserves Commission), Andrew Robb (Seiler Instruments, Inc.), Susan Romano (Western Illinois University), Karen Tharp (Illinois Volunteer Stewards Network), Emma York (Herbarium, Royal Botanic Gardens, Kew), Phil Young (Advanced Geospatial Laboratory, Northern IL University), 20 seed collection permitting agencies: federal, state, local, and private landowners, 10 contract seed collectors across 9 states.

N. Zerega

Arunrat Chaveerach (Khon Kaen University, Thailand), Wendy Clement (Yale University), Jeremie Fant (CBG), Salma Hossain (University of Rajshahi, Bangladesh), Brian Irish (USDA) Ruby Khan (University of Rajshahi, Bangladesh), Tracy Misiewicz (University of California, Berkeley), Timothy Motley (Old Dominion University, Roanoke, VA), Susan Murch (University of British Columbia), Sara Owens (Argonne), Joan Pereira (Sabah Forestry Department), Brian Scheffler (USDA), Sheron Simpson (USDA), Diane Ragone (National Tropical Botanical Garden, HI), Nina Ronsted (University of Copenhagen, Denmark), Brian Scheffler (USDA) Nur Supardi (Forest Research Institute of Malaysia), Norman Wickett (CBG), Evelyn Williams (CBG), Tyr Wiesner-Hanks (NU), Colby Witherup (Northwestern University), Francis Zee (USDA), M. Iqbal Zuberi (University of Rajshahi, Bangladesh)

Appendix 1: Seed Bank and Plants of Concern Partnerships

Persons/Institutions Using Seeds From the Dixon National Tallgrass Prairie Seed Bank:

Prof. Djaja Djendoel Soejarto, University of Illinois at Chicago, chaff from 181 species in 2012.
National Center for Genetic Resources Preservation, USDA, Ft. Collins, CO – 181 accessions
Native Seed Farm Project, Chicago Botanic Garden, 6 accessions.

Plants of Concern Landowner and Agency Partners

Boone Creek Watershed Alliance
Cary Park District
CD McHenry County
Chicago Park District
Chicago Wilderness
City of Elgin
City of Lake Forest
City of Waukegan
Commonwealth Edison
Dale Shriver
Deerfield Associates
Downer's Grove Park District
Dundee Township
FPD Cook County
FPD DuPage County
FPD Kane County
FPD Kendall County
FPD Lake County
FPD Will County
Glenview Park District
Heidi and Dan Natura
Highland Park/Park District
Illinois DNR
IL Endangered Species Protection Board
IL Natural Heritage Database
IL Nature Preserves Commission
IN Department of Natural Resources
Jerry Kolar
John Clemetsen
Joliet Park District
Keenan Family
Lakowski Family
Libertyville Township
Lockport Township Park District/FPD Will County
Lorna Gladstone
Marsh Family
Marty Papanek
Masi/D'Alessandro Family
MWRD
Natural Land Institute
Nelsons
Nicole Williams/Larry Becker
North Shore School District 112
Northeastern Illinois University
Northwestern University
Oak Lawn Park District
Oakton Community College
Openlands
Palatine Park District
Plainfield Park District
Private properties (4)
Rendl Family
Rodney & Libby Aavang
Shaw Family
Shirley Heinze Foundation
St. Charles Park District
The Nature Conservancy
Tom Burroughs
US Forest Service (at Midewin National Tallgrass Prairie)
US Department of Energy (at Fermilab)
US Department of Interior (at Indiana Dunes National Lakeshore)
Village of Lake in the Hills
Village of Lincolnshire
Village of Long Grove
Village of Oakwood Hills
Waukegan Harbor Citizens Advisory Group
Wisconsin DNR
Wilmette Park District
Zion Park District