Annotated Bibliography on the Ecology and Management of Invasive Species:

Creeping Bentgrass (*Agrostis stolonifera*)

Prepared by Kersti Vaino

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Peer-Reviewed Journal Articles

Beam, J. B., W. L. Barker, and S. D. Askew. 2006. Selective creeping bentgrass (*Agrostis stolonifera*) control in cool-season turfgrass (abstract). Weed Technology 20 (2): 340-344.

Abstract: Creeping bentgrass infestations in cool-season turfgrass are unsightly and difficult to control. Field tests were conducted at Stoney Creek Golf Course in Wintergreen, VA, in 2002 and 2003 on a Kentucky bluegrass rough and at the Turfgrass Research Center in Blacksburg, VA, in 2003 on a perennial ryegrass lawn to determine the efficacy of imazaquin, isoxaflutole, and mesotrione for creeping bentgrass control and turfgrass tolerance. Isoxaflutole and mesotrione each applied in two sequential applications at 280 g ai/ha or three sequential applications at 170 or 60 g/ha and imazaquin in two sequential applications at 390 g/ha controlled bentgrass at least 92% 14 wk after initial treatment (WAIT) at all locations. Sequential applications were applied at 2-wk intervals. Isoxaflutole and mesotrione, regardless of rate or sequential treatment, injured turfgrass less than 20% at all rating dates and locations. Imazaquin in two sequential applications at 390 g/ha injured Kentucky bluegrass and perennial ryegrass greater than 50% at all locations 14 WAIT. Results indicate isoxaflutole or mesotrione could be used for selective bentgrass control in Kentucky bluegrass or perennial ryegrass.

Clary, W. P. 1995. Vegetation and soil response to grazing simulation on riparian meadows (abstract). Journal of Range Management 48 (1): 18-25.

Abstract: Riparian areas have not responded consistently to grazing systems, suggesting that more knowledge is needed to explain how different areas respond to specific stresses. Several studies were conducted to determine herbaceous plant response to simulated grazing on riparian areas. One low-elevation redtop (*Agrostis stolonifera* L.) site in Oregon and 2 high-elevation sedge (*Carex* spp. L.) sites in Idaho were studied for 3 years. Several combinations of defoliation, compaction, nutrient return, and season of use were examined. The redtop community responded to spring, fall, or spring-fall defoliations by maintaining or increasing the following year's aboveground biomass production. The sedge communities maintained or decreased the following years's biomass production after spring, mid summer, or late summer defoliations. An increase in forbs occurred in 1 sedge community following spring defoliations to 1- or 5-cm residual stubble heights. The most consistent plant response among areas was reduction in height growth and biomass production following compaction treatments. When both defoliation and compaction are considered, it appears that spring, fall, or spring and fall grazing to a 5-cm stubble height on the redtop site would not decrease riparian herbage production. In contrast, when defoliation, compaction, and nutrient return effects are considered in the mountain meadow sedge-dominated communities, grazing once annually during the growing season to a 5-cm stubble height in the spring, or to a 10-cm stubble height in late summer, or at a utilization rate exceeding 30% of the total annual biomass production can reduce herbage production significantly. Results suggest that many of the land management agency riparian guidelines would maintain biomass productivity in these sedge-dominated communities.

Cooper, J. P. and D. M. Calder. 1964. The inductive requirements for flowering of some temperate grasses. Grass and Forage Science 19 (1): 6-14.

Abstract: A survey was made of the flowering responses of 47 annual, biennial and perennial grasses, to measure the extent of any winter requirement for floral induction, and to see how far this could be provided by controlled cold or short-day treatment. The annual species showed little or no inductive requirement, nor did the perennials *Arrheuatherum elatius*, *Ceratochloa unioloides*, *Phleum pratense* and *Poa nemoralis*. Most perennials possessed a definite inductive requircinent. A few species, such as *Lolium perenne*, responded to both cold

and short-day given to the young seedling, while others, such as *Phleum nodosum*, *Agrostis alba*, *A. canina*, *A. stolonifera* and *A. tenuis*, responded to short-day induction but not to cold.
Many temperate perennials, however, including *Cynosurus cristatus*, *Dactylis glomerata*, *Festuca pratensis*, *F. rubra*, *Poa pratensis* and *P. trivialis* did not respond to seedling induction and possibly have a juvenile stage before they are able to respond to inductive conditions.
The sequence of flowering responses in the temperate perennial grasses is evidently more complex than was previously thought, and the perennial habit can be achieved by many different developmental pathways.

Gremmen, N. J. M., S. L. Chown, and D. J. Marshall. 1998. Impact of the introduced grass *Agrostis stolonifera* on vegetation and soil fauna communities at Marion Island, sub-Antarctic. Biological Conservation 85: 223-231.

Abstract: The grass *Agrostis stolonifera* L. is the most successful introduced vascular plant at sub-Antarctic Marion Island. Since its accidental introduction, probably in the 1950s, it has spread over the northern half of the island, and presumably will eventually reach all parts of the island. It invades undisturbed native vegetation and reaches dominance in a range of habitats. It is most abundant on wet slopes and on river banks, where it replaces the rosaceous dwarf shrub *Acaena magellanica* communities by dense grassland. These communities show a reduction of 50% in the mean number of native plant species per sample plot, although more macroinvertebrate and more mite species were found where *A. stolonifera* was dominant. The invasion by *A. stolonifera* does not seem to pose an immediate threat to the survival of any of the native species on the island, but the changes induced in the drainage line communities significantly reduce the value of the island both from a conservation viewpoint and as a natural laboratory for fundamental ecological research. Therefore, it is important to keep Marion Island free of any further introductions. This is even more important for neighbouring Prince Edward Island, which, because of the negligible impact of aliens on this island, is of exceptional conservation value.

Jones, M. A. and N. E. Christians. 2007. Mesotrione controls creeping bentgrass (*Agrostis stolonifera*) in Kentucky bluegrass (abstract). Weed Technology 21 (2): 402-405.

Abstract: Creeping bentgrass creates a dense, high-quality playing surface on golf courses, but it often encroaches adjacent areas of Kentucky bluegrass. Mesotrione can control creeping bentgrass in Kentucky bluegrass, but more information is needed regarding the effect of herbicide rate and number of applications on creeping bentgrass control and the impact to Kentucky bluegrass. Field experiments were conducted to determine the effect of application rate and number of applications on creeping bentgrass control. One application of mesotrione controlled 7 to 43% of creeping bentgrass in Kentucky bluegrass, and two applications of mesotrione controlled 39 to 88% as rates increased from 70 to 1,120 g ai/ha. Gaps present in the canopy after the creeping bentgrass died reduced overall turfgrass quality 2 to 6 wk after treatment (WAT) before recovering. These data indicate the capability of mesotrione to selectively control creeping bentgrass while providing excellent safety to Kentucky bluegrass.

Keeley, J. E., M. Baer-Keeley, and C. J. Fotheringham. 2005. Alien plant dynamics following fire in Mediterranean-climate California shrublands. Ecological Applications 15 (6): 2109-2125.

Abstract: Over 75 species of alien plants were recorded during the first five years after fire in southern California shrublands, most of which were European annuals. Both cover and richness of aliens varied between years and plant association. Alien cover was lowest in the first postfire year in all plant associations and remained low during succession in chaparral but increased in sage scrub. Alien cover and richness were significantly correlated with year (time since disturbance) and with precipitation in both coastal and interior sage scrub associations.

Hypothesized factors determining alien dominance were tested with structural equation modeling. Models that included nitrogen deposition and distance from the coast were not significant, but with those variables removed we obtained a significant model that gave an $R^2 = 0.60$ for the response variable of fifth year alien dominance. Factors directly affecting alien dominance were (1) woody canopy closure and (2) alien seed banks. Significant indirect effects were (3) fire intensity, (4) fire history, (5) prefire stand structure, (6) aridity, and (7) community type. According to this model the most critical factor influencing aliens is the rapid return of the shrub and subshrub canopy. Thus, in these communities a single functional type (woody plants) appears to the most critical element controlling alien invasion and persistence. Fire history is an important indirect factor because it affects both prefire stand structure and postfire alien seed banks. Despite being fire-prone ecosystems, these shrublands are not adapted to fire per se, but rather to a particular fire regime. Alterations in the fire regime produce a very different selective environment, and high fire frequency changes the selective regime to favor aliens. This study does not support the widely held belief that prescription burning is a viable management practice for controlling alien species on semiarid landscapes.

MacDougall, A. S. and R. Turkington. 2007. Does the type of disturbance matter when restoring disturbance-dependent grasslands? Restoration Ecology 15 (2): 263-272.

Abstract: The reintroduction of burning is usually viewed as critical for grassland restoration; but its ecological necessity is often untested. On the one hand, fire may be irreplaceable because it suppresses dominant competitors, eliminates litter, and modifies resource availability. On the other hand, its impacts could be mimicked by other disturbances such as mowing or weeding that suppress dominants but without the risks sometimes associated with burning. Using a 5-year field experiment in a degraded oak savanna, we tested the impacts of fire, cutting and raking, and weeding on two factors critical for restoration: controlling dominant invasive grasses and increasing subordinate native flora. We manipulated the season of treatment application and used sites with different soil depths because both factors influence fire behavior. We found no significant difference among the treatments-all were similarly effective at suppressing exotics and increasing native plant growth. This occurred because light is the primary limiting resource for many native species and each treatment increased its availability. The effectiveness of disturbance for restoration depended more on the timing of application and site factors than on the type of treatment used. Summer disturbances occurred near their reproductive peak of the exotics, so their mortality approached 100%. Positive responses by native species were significantly greater on shallow soils because these areas had higher native diversity prior to treatment. Although likely not applicable to all disturbance-dependent ecosystems, these results emphasize the importance of testing the effectiveness of alternative restoration treatments prior to their application.

Tallowin, J. R. B. and S. K. E. Brookman. 1996. The impact of differences in nitrogen content, nitrogen utilization and loss from laminae on competition between four grass species in an old pasture (abstract). Journal of Agricultural Science 126 (1): 25-35.

Abstract: The concentration of nitrogen (N) within the emerging, youngest fully expanded and the youngest dead leaf laminae were examined in the grasses *Lolium perenne*, *Agrostis stolonifera*, *Holcus lanatus* and *Poa trivialis* in Devon, UK, in 1986 and 1987. Lamina growth, appearance interval and lamina utilization were also examined in each species. Marked tillers were measured in situ over 14-21 day periods in a continuously grazed permanent pasture under steady state management on plots receiving either zero (0N) or 400 kg nitrogen (400N) fertilizer/ha per annum. The concentration of N tended to be greatest in the distal half and least in the basal part of each lamina in each species. Total mass showed an opposite trend due in part to the shape of the lamina. Less than 40 % of the lamina N was lost through grazing either in the 0N or 400N plots in the four species, except once in *H. lanatus* when more was lost. In absolute terms, because *L. perenne* and *H. lanatus* maintained larger and longer laminae than either *A.*

stolonifera or *P. trivialis*, they lost more N through grazing. The four grass species recycled N from the senescing lamina with the same apparent efficiency; this meant that differences in lamina N concentration and carbon: nitrogen ratios were present in the dead laminae of the four species. *L. perenne* achieved the highest tissue growth rate per unit of N in the lamina in the 0N plot, not only in comparison with the three other grasses but also compared with the 400N plot. This high N-use efficiency in *L. perenne* was not translated into an ability to either expand or maintain its population in the 0N plot. *L. perenne* had a lower leaf appearance rate than the other species in both the 400N and 0N plots, but this inherent characteristic of the species was particularly pronounced in the 0N plot. A slower leaf appearance rate would limit the potential tillering capacity of *L. perenne* compared with the other species. A reduced tillering capacity, exacerbated by N deficiency, was probably the principal factor limiting the ability of *L. perenne* to exploit available niches in the 0N pasture.

Watrud, L. S., E. H. Lee, A. Fairbrother, C. Burdick, J. R. Reichman, M. Bollman, M. Storm, G. King, and P. K. Van de Water. 2004. Evidence for landscape-level, pollen-mediated gene flow from genetically modified creeping bentgrass with CP4 EPSPS as a marker. Proceedings of the National Academy of Science 101 (40): 14533-14538.

Abstract: Sampling methods and results of a gene flow study are described that will be of interest to plant scientists, evolutionary biologists, ecologists, and stakeholders assessing the environmental safety of transgenic crops. This study documents gene flow on a landscape level from creeping bentgrass (*Agrostis stolonifera* L.), one of the first wind-pollinated, perennial, and highly outcrossing transgenic crops being developed for commercial use. Most of the gene flow occurred within 2 km in the direction of prevailing winds. The maximal gene flow distances observed were 21 km and 14 km in sentinel and resident plants, respectively, that were located in primarily nonagronomic habitats. The selectable marker used in these studies was the *CP4 EPSPS* gene derived from *Agrobacterium* spp. strain CP4 that encodes 5-enol-pyruvylshikimate-3-phosphate synthase and confers resistance to glyphosate herbicide. Evidence for gene flow to 75 of 138 sentinel plants of *A. stolonifera* and to 29 of 69 resident *Agrostis* plants was based on seedling progeny survival after spraying with glyphosate in greenhouse assays and positive TraitChek, PCR, and sequencing results. Additional studies are needed to determine whether introgression will occur and whether it will affect the ecological fitness of progeny or the structure of plant communities in which transgenic progeny may become established.

Zapiola, M. L., C. K. Campbell, M. D. Butler, and C. A. Mallory-Smith. 2007. Escape and establishment of transgenic glyphosate-resistant creeping bentgrass (*Agrostis stolonifera*) in Oregon, USA: a 4-year study (abstract). Journal of Applied Ecology 45 (2): 486-494.

Abstract: 1. Gene flow from transgenic crops to feral populations and naturalized compatible relatives has been raised as one of the main issues for the deregulation of transgenic events. Creeping bentgrass, *Agrostis stolonifera* L., is a perennial, outcrossing grass that propagates by seeds and stolons. Transgenic Roundup Ready® glyphosate-resistant creeping bentgrass (GRCB), which is currently under USDA-APHIS regulated status, was planted in 2002 on 162 ha within a production control area in Oregon, USA. 2. We conducted a study to assess transgene flow from the GRCB fields. A survey within and around the production control area was performed during the year when the GRCB fields produced seed and for 3 years after the fields were taken out of production. Transgene flow was determined by testing creeping bentgrass and its relatives for expression of the glyphosate resistance transgene. 3. While GRCB seed-production practices were strictly regulated, evidence of transgene flow was found in all years. In 2006, 3 years after the transgene source fields were taken out of production and a mitigation programme was initiated, 62% of the 585 creeping bentgrass plants tested in situ were glyphosate-resistant (GR). Our results document not only the movement of the glyphosate resistance transgene from the fields, but also the establishment and persistence of high frequencies of GR plants in the area, confirming that it was unrealistic to think that containment or eradication of GRCB could be accomplished. 4. Synthesis and applications: These findings highlight the potential for transgene escape and gene flow at a landscape level. The survey provides empirical frequencies that can be used to design monitoring and management methods for genetically engineered (GE) varieties of outcrossing, wind-pollinated, perennial grasses and to evaluate the potential for coexistence of GE and non-GE grass seed crops. Such information should also be used in the decision-making process for authorization of field trials and deregulation of genetic engineering events.

Zhao, H., S. S. Bughrara, and J. A. Oliveira. 2006. Genetic diversity in colonial bentgrass (*Agrostis capillaris* L.) revealed by *Eco*RI–*Mse*I and *Pst*I–*Mse*I AFLP markers. Genome 49: 328-335.

Abstract: Colonial bentgrass (*Agrostis capillaris* L.) is a potential source for genetic improvement of resistance to environmental stress and disease for other bentgrass species (*Agrostis* spp.). To conserve and study the existing genetic resources of colonial bentgrass for use in breeding, genetic diversity was investigated using amplified fragment length polymorphism (AFLP) markers. Included in this study were 22 accessions from US Department of Agriculture germplasm collected from 11 countries, in conjunction with 14 accessions from northern Spain and 3 commercial cultivars. Ten *Eco*RI-*Mse*I and 6 *Pst*I-*Mse*I AFLP primer combinations produced 181 and 128 informative polymorphic bands, respectively. Cluster analysis of genetic similarity estimates revealed a high level of diversity in colonial bentgrass species with averages of 0.51 (*Eco*RI-*Mse*I) and 0.63 (*Pst*I-*Mse*I). Greater genetic diversity was detected by the *Eco*RI-*Mse*I AFLP primer combinations. A low but significant positive correlation ($r = 0.44$, $p = 0.0099$) between the 2 Jaccard similarity matrices was obtained by the Mantel test. Commercial cultivars of bentgrass showed a narrow genetic background. The assessment of genetic diversity among colonial bentgrass accessions suggested the potential value of the colonial bentgrass germplasm in turfgrass cultivar improvement.

Other Published Sources

Jones, M. A., Christians, N. E., Weisenberger, D., and Reicher, Z. J. 2005. Selective removal of creeping bentgrass from Kentucky bluegrass with sulfosulfuron. Master of Science in Horticulture. Iowa State University.

Abstract: Creeping bentgrass is well-adapted to golf course greens, tees, and fairways, but may become a weed in Kentucky bluegrass roughs and lawns. The objective of this study was to determine the effect of sulfosulfuron rate and application timing on control of creeping bentgrass and safety on Kentucky bluegrass. Field experiments were initiated in 2003 and 2004 in Ames, IA and West Lafayette, IN. Single applications of sulfosulfuron at 11 or 22 g ai/ha were applied over a nine-week period during the fall of each year. Phytotoxicity on Kentucky bluegrass was recorded weekly and control of creeping bentgrass was determined in the spring following fall treatments. No treatment provided greater than 31% control, and there were few differences in control between the two rates of sulfosulfuron. In West Lafayette, late fall applications were the most effective providing up to 31% control of creeping bentgrass. Sulfosulfuron provided less than 18% control in Ames in either year. Kentucky bluegrass was tolerant of all sulfosulfuron applications. Late fall applications of sulfosulfuron may be useful in partially removing creeping bentgrass from a heavily contaminated sward of Kentucky bluegrass.

Jones, M. A. and Christians, N. E. 2005. Mestrione controls creeping bentgrass in Kentucky bluegrass. Master of Science in Horticulture. Iowa State University.

Abstract: Creeping bentgrass creates a dense, high-quality playing surface on golf courses but it often encroaches adjacent areas of Kentucky bluegrass. Mesotrione can control creeping bentgrass in Kentucky bluegrass, but more information is needed regarding the effect of herbicide rate and number of applications on creeping bentgrass control and the impact to Kentucky bluegrass. Greenhouse experiments were conducted to determine the effect of mesotrione on the growth and development of creeping bentgrass and Kentucky bluegrass. In the greenhouse experiment, applications of mesotrione caused phtotoxicity of creeping bentgrass and reduced turfgrass quality 13 to 56% two weeks after treatment (WAT). Despite the observed phtotoxicity, mesotrione applications did not reduce clipping yield or root production, and creeping bentgrass was not completely controlled in the greenhouse. Kentucky bluegrass proved tolerant to all mesotrione applications. Shoot and root production were unaffected and remained similar to untreated controls. Field experiments were conducted to determine the effect of application rate and number of applications on creeping bentgrass control. One application of mesotrione controlled 16 to 60% of creeping bentgrass in Kentucky bluegrass and two applications of mesotrione controlled 26 to 96% as rates increased from 70 to 1120 g ai/ha. Gaps present in the canopy after the creeping bentgrass died reduced overall turfgrass quality 2 to 6 WAT before recovering. These data indicate the capability of mesotrione to selectively control creeping bentgrass while providing excellent safety to Kentucky bluegrass.

Jones, M. A. and N. E. Christians. 2008. Controlling creeping bentgrass in Kentucky bluegrass. Golf Course Management March 2008: 121-124.

Abstract: This article discusses the use of mesotrione to control creeping bentgrass (*Agrostis stolonifera)* in Kentucky bluegrass (*Poa pratensis)* turf. Experiments were conducted to evaluate the effectiveness of applications at different rates and frequencies. Two applications were found to achieve significantly more control of creeping bentgrass than just one. With applications of mesotrione at six-week intervals, 69-96% control was achieved when applied at rates of 0.6 to 2.4 litres/hectare. One year after treatment, control decreased slightly as remaining plants were reestablished. With applications at two-week intervals, at least 93% control was achieved, regardless of the rate of application. Kentucky bluegrass was not affected by the application of mesotrione.

Parminter, J. and D. Bedford. 2006. Fire effects on selected bryophytes, lichens and herbs in Garry oak and associated ecosystems. The Garry Oak Ecosystems Recovery Team and the Nature Conservancy of Canada. Victoria, BC.

Abstract: This paper summarizes the effects of fire on plant species in the Garry oak and associated ecosystems. It discusses the fire ecology of each species, the effects of fire on the plant, the response of the plant to fire and considerations for fire management.

Rice, P. M. 2005. Fire as a tool for controlling nonnative invasive plants. Centre for Invasive Plant Management. Bozeman, MT.

Abstract: This paper is a review of 235 available published papers about controlling invasive species with intentional burning. It is specified that knowledge of a plant's life history, plant morphology, and phenology is required to effectively prescribe management by burning, as is the promoting of desirable species in conjuction with burning. *Bromus hordeaceus* was found to increase after burning aimed at controlling medusahead, as it seeds much earlier. However, the removal of the mulch layer by burning or other method, reduced seed germination of *B. hordeaceus* and other exotic grass species.

Watrud, L. S., E. H. Lee, A. Fairbrother, C. Burdick, J. R. Reichman, M. Bollman, M. Storm, G. King, and P. K. Van de Water. 2004. Evidence for landscape-level, pollen-mediated gene flow from genetically modified creeping bentgrass with CP4 EPSPS as a marker. Proceedings of the National Academy of Science 101 (40): 14533-14538.

Abstract: Sampling methods and results of a gene flow study are described that will be of interest to plant scientists, evolutionary biologists, ecologists, and stakeholders assessing the environmental safety of transgenic crops. This study documents gene flow on a landscape level from creeping bentgrass (*Agrostis stolonifera* L.), one of the first wind-pollinated, perennial, and highly outcrossing transgenic crops being developed for commercial use. Most of the gene flow occurred within 2 km in the direction of prevailing winds. The maximal gene flow distances observed were 21 km and 14 km in sentinel and resident plants, respectively, that were located in primarily nonagronomic habitats. The selectable marker used in these studies was the *CP4 EPSPS* gene derived from *Agrobacterium* spp. strain CP4 that encodes 5-enol-pyruvylshikimate-3-phosphate synthase and confers resistance to glyphosate herbicide. Evidence for gene flow to 75 of 138 sentinel plants of *A. stolonifera* and to 29 of 69 resident *Agrostis* plants was based on seedling progeny survival after spraying with glyphosate in greenhouse assays and positive TraitChek, PCR, and sequencing results. Additional studies are needed to determine whether introgression will occur and whether it will affect the ecological fitness of progeny or the structure of plant communities in which transgenic progeny may become established.

Williams, A., N. Reed, J. Poenoe, and D. Roja. 2000. FY2000 Progress Report Exotic Plant Management. Division of Resource Management and Science Redwood National and State Parks. Orick, CA.

Abstract: This report details the management status of numerous exotic species in Redwood National and State Parks in California.

Online Resources

Clayton, W. D., K. T. Harman, and H. Williamson. 2008. GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html. The Board of Trustees, Royal Botanic Gardens, Kew.

E-Flora. 2008. E-Flora BC: Electronic Atlas of the Plants of British Columbia. http://www.eflora.bc.ca/. Klinkenberg, Brian. (ed.)Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. University of British Columbia, Vancouver, BC.

Esser, L. L. 1994. *Agrostis stolonifera*. In: Fire Effects Information System. http://www.fs.fed.us/database/feis/. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory.

Farmer, C. 2005. Skye Flora: Flowering plants and ferns recorded as growing wild on the Isle of Skye. http://www.plant-identification.co.uk/skye/index.htm.

Peeters, A. 2008. Grassland Species Profiles. http://www.fao.org/ag/AGP/AGPC/doc/GBASE/Default.htm. Food and Agriculture Organization.

Rice, B. 2006. Featured foe: *Agrostis stolonifera* L. - creeping bentgrass. http://tncinvasives.ucdavis.edu/products/featured/agrostis1.html. The Nature Conservancy.

UC IPM Online Statewide Integrated Pest Management Program . 2008. Pests in Gardens and Landscapes—Weeds. http://www.ipm.ucdavis.edu/PMG/menu.weeds.html. University of California Agriculture and Natural Resources.

U.S. Geological Survey Northern Priaire Wildlife Research Center. 2006. Northeast Wetland Flora. http://www.npwrc.usgs.gov/resource/plants/florane/list.htm#group2. U.S. Geological Survey.