FLEPPC Research Grant Competition Update

Last year, FLEPPC conducted its first annual competitive research proposal program for the study of invasive non-indigenous plants in Florida. The FLEPPC research committee reviewed a large number of submitted proposals and subsequently recommended four of the proposed research projects for funding. Following are brief reports on the progress of the four funded projects.

The effect of *Lygodium microphyllum* on wildlife forage and predation in South Florida *Taxodium* Swamps

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Old World climbing fern (*Lygodium microphyllum*) is a non-native fern in Florida with dark brown or black, wiry rhizomes and climbing, twining fronds of intermediate growth, to 30 meters long. *L. microphyllum* was reportedly introduced to Florida in the Loxahatchee River Basin in southern Martin and northern Palm Beach Counties and originated from Africa to southeast Asia, and south Pacific islands and Australia. The exponential spread of *L. microphyllum* in South Florida is beginning to be recognized by many public and private land managers. Near the origin of introduction, the Loxahatchee National Wildlife Refuge reported nearly 17,000 acres of fern blanketing entire tree islands by 1995. Sporadic patches of *L. microphyllum* totaling more than 300 acres have also been discovered in Everglades National Park and are currently undergoing aerial herbicide control. It is a common perception that invasive, non-native plant species such as *L. microphyllum* negatively impact native vegetation and other higher trophic levels within the ecosystems invaded. However, there is little quantifiable evidence of how these plant species affect other vegetation, insects or wildlife. We are currently conducting a study examining the effects of *L. microphyllum* on wildlife predation and forage in three South Florida cypress swamps, Corbett Wildlife Management Area, DuPuis Preserve and the Corkscrew Regional Ecosystem Watershed land. We will be identifying predator species and level of predation in cypress understories with and without *L. microphyllum* as well as in understories where *L. microphyllum* has been treated with herbicide. In addition, we will examine the amount of preferred and usable forage in these same study sites.

Genetic variation within *Melaleuca quinquenervia* in Florida, and its effect on performance of biological control insects

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Melaleuca quinquenervia (broadleaved paperbark, niaouli) was first imported into the United States from Australia during the 1880s. Horticultural nurseries near Sarasota, Florida, and San Diego, California, imported this species (then known as *M. leucadendron*) as a landscape tree because of its showy cream-colored bottlebrush flowers and spongy peeling white bark. During the subsequent 40 years, 10 more introductions occurred in Florida from 5 different sources including botanical gardens in France (3x), Italy (1x), and Australia (4x), and plantations in Australia (1x) and Madagascar (1x). By the mid-1920s, the plant had become naturalized on both coasts of southern Florida, invading diverse habitats within the Everglades ecosystem including freshwater and brackish wetlands as well as pine flatwoods. Preliminary isozyme analyses show that these naturalized weed populations differ genetically from one another. Chromatographic profiles of leaf essential oils show that these genetic differences partially result from the presence of two primary chemical varieties (called chemotypes) of *M. quinquenervia* in Florida. The essential oils of chemotype I plants contain the terpenoid *trans*-nerolidol as their principle constituent, whereas chemotype II plants contain the terpenoids 1,8-cineole and viridiflorol as their primary constituents. Laboratory bioassays with the biological control agent *Oxyops vitiosa* suggest that the insects currently in Florida may be better adapted to type I than type II plants. For instance, survivorship of *O. vitiosa* larvae fed type I plants was threefold greater than larvae fed type II plants. Also, adults reared on the type I plants weighed 40% more than those reared on type II plants. Similar decreases in fecundity have been noted. Studies are underway to determine the impact of these differences on *O. vitiosa* population dynamics at field sites in Florida.

Dispersal, reproduction and physiological ecology of two invasive non-indigenous fern species, *Lygodium microphyllum* and *Lygodium japonicum*

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One of the greatest threats to the integrity of native ecosystems is their invasion by non-indigenous species. Nowhere else in the continental United States is this threat more conspicuous than in Florida. *Lygodium microphyllum* and *L. japonicum* are two recent invaders that are currently spreading through Florida's native ecosystems. Once established in a community, these two species appear to displace native species and alter local fire ecology. *L. microphyllum*, in particular, can completely dominate a native habitat with time, causing the collapse of the natural community. We are studying both their reproductive strategies and their relative growth rate at different light levels. The results indicate that both species are capable of intragametophytic selfing, which supports the hypothesis that the reproductive strategy partially explains the continuing spread of both species. Since spores are dispersed readily by wind, the ability of a single spore to form a sporophyte will aid in the ability of both species of *Lygodium* to rapidly infest new habitat. In addition, *L. microphyllum* is capable of intergametophytic crossing. The results of the study suggest that outcrossing is promoted via the production of an antheridiogen pheromone. These pheromones are produced by mature female gametophytes and promote maleness in neighboring gametophytes. Early results also show that both *Lygodium* species have a growth advantage in low light irradiances compared to native species, the causes for this apparent advantage in low light are still being determined. With these studies, we expect to increase our understanding of the ecology and physiology of these highly invasive species. This, in turn, may assist land managers in developing strategies to prevent and control their rapid spread.

Predicting the potential distribution of a plant invader: integrating field studies and climate matching approaches

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Accurate prediction of the potential distribution of invasive species is important to their control. Field studies and a computer model (CLIMEX) were used to predict the potential distribution of the invasive Chinese tallow tree, *Sapium sebiferum*. Seedlings of *S. sebiferum* were planted in 4 microhabitats in a factorial design of open and closed canopy and upland and lowland microhabitats at 7 sites along a coastal (1,300 km) transect and an inland (400 km) transect in the southeastern U.S. These transects extend beyond the current geographic range of *S. sebiferum*. A reduced competition treatment was applied to half of the seedlings in each microhabitat at each site. Seedling survival and growth rates were measured 1-2 years after planting. In predicting the potential U.S. distribution of this invasive tree, model parameters for CLIMEX were based on greenhouse studies of seedling tolerances to key environmental conditions and on climate matching of the known global distribution of *S. sebiferum* with U.S. climatic records. Average seedling survival ranged from 20 to 100% and was 100% in at least one microhabitat at all sites. Average seedling basal diameter ranged from 3.3 to 7.5 mm with the largest seedlings occurring in open microhabitats and in sites beyond the present southeastern distribution of *S. sebiferum*. Reduced competition increases survival and growth rates particularly in upland microhabitats. Computer predictions match field results and suggest that *S. sebiferum* has yet to occupy its entire new range in the U.S.

(This year's competition is currently under way, however, if you are interested in conducting studies related to invasive exotic plant management in Florida, we strongly encourage you to submit a proposal for the next competition in spring 2002. For more information please contact John Volin at jvolin@fau.edu.)