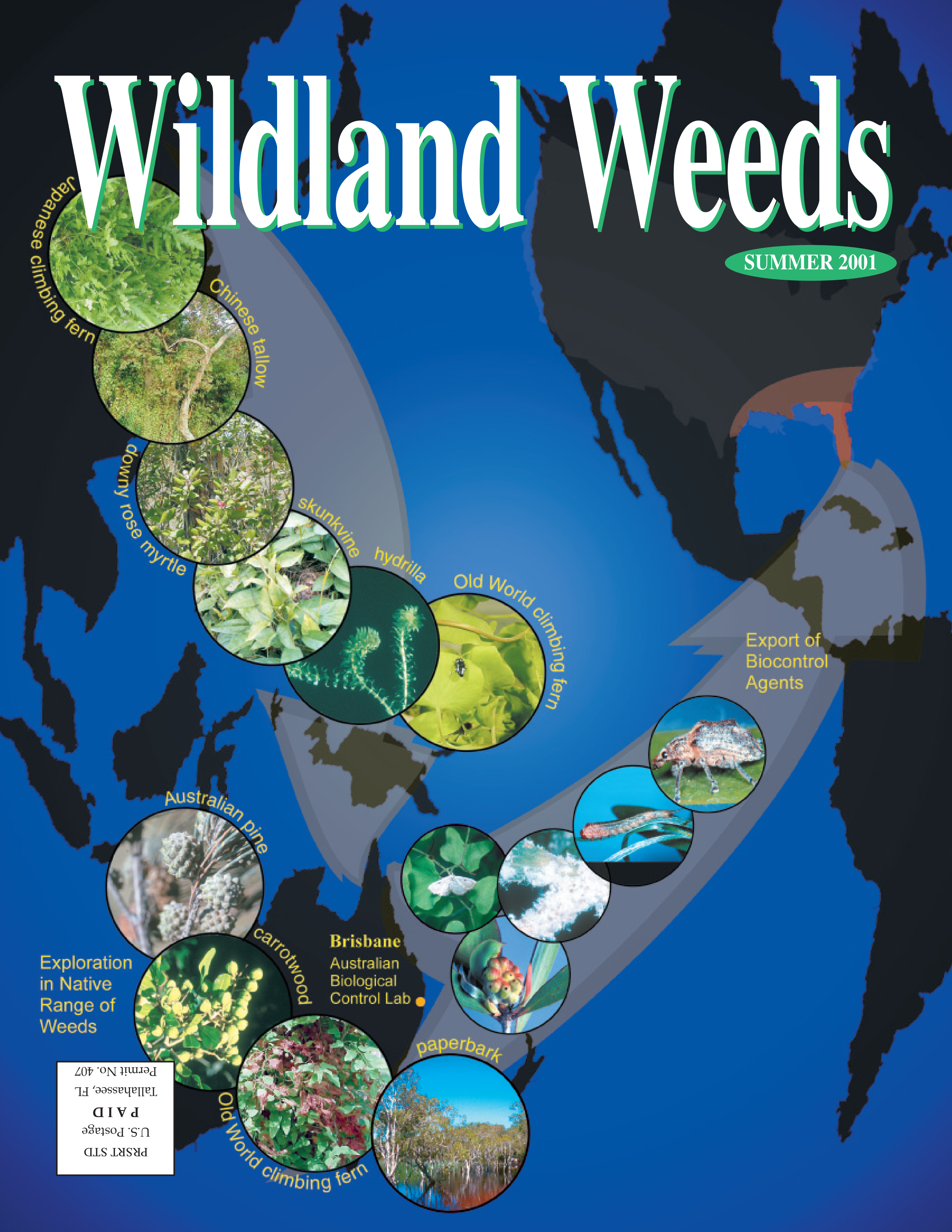
Wildland Weeds

SUMMER 2001



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Wildland Weeds

SUMMER 2001, Volume 4, Number 3

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Wildland Weeds (ISSN 1524-9786) is a quarterly publication of the Florida Exotic Pest Plant Council (EPPC)

Wildland Weeds is published to provide a focus for the issues and concerns regarding exotic pest plant biology, distribution and control. To become a member of the Florida EPPC and receive the Council newsletter and *Wildland Weeds* Magazine, contact the Treasurer.

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Cover
The staff of the Australian Biological Control Laboratory are actively searching natural areas of Australia and Southeast Asia for insects and other organisms which feed on plant species that are invasive in Florida. Cover created by John Goolsby.

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Prescription

P/U from Spring Aquatics

Controlling Tall Fescue, Common Bermuda, and Bahia

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Collectively, tall fescue (*Festuca arundinacea*), common Bermuda (*Cynodon dactylon*) and Bahiagrass (*Paspalum notatum*) have been seeded on more than 50 million acres throughout the southeast and midwestern United States. These exotic grasses have been seeded for hay, pasture, turfgrass, surface mine reclamation, conservation and roadside plantings, and for erosion control. As with many exotic organisms, these species are very aggressive and can quickly invade natural areas causing plant community degradation. Furthermore, these grasses do not provide quality wildlife habitat for grassland birds like the Northern Bobwhite quail or mammals such as the Eastern cottontail rabbit (Barnes *et al*. 1995, Randall 1996) . We (my graduate students and I) embarked upon an interesting journey eight years ago when we began our experiments with eradicating tall fescue using a variety of management techniques including fire, tillage, and herbicides (Madison *et al*. 2001). The results of our first studies indicated that a spring controlled burn followed by a single application of glyphosate at the maximum label rate was the most effective method of killing tall fescue at that time.

We monitored those initial plots for two years and by the end of study, tall fescue had reinvaded much of the herbicide treated plots. Because we were interested in developing wildlife habitat, we concluded that some other grass species should be seeded to keep the tall fescue from re-invading the plots. We determined that native warm season grasses were the best option for providing quality wildlife habitat. Our initial studies in killing fescue with glyphosate and establishing the

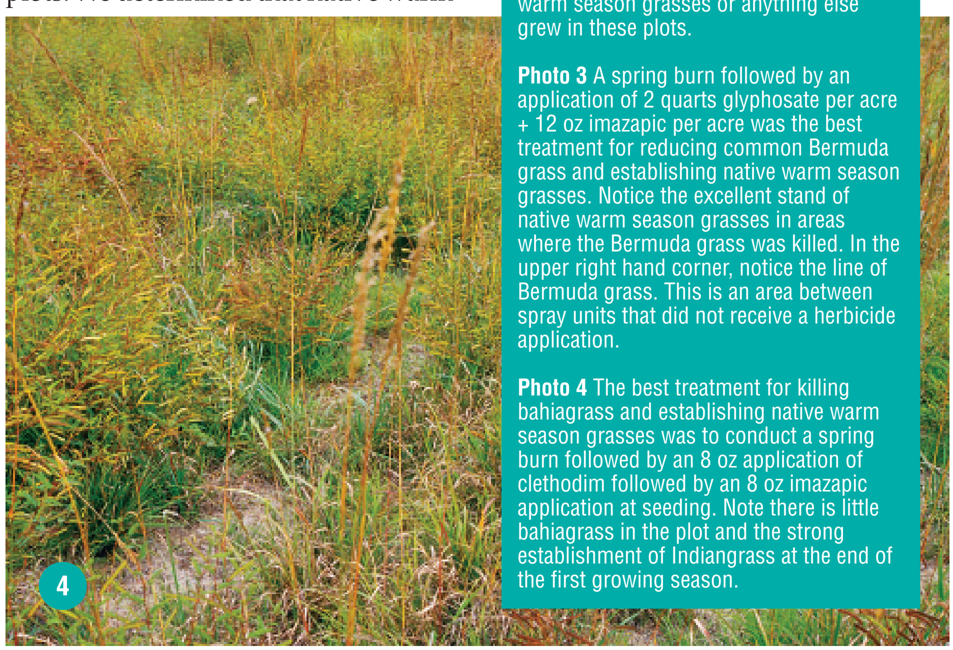


Photo 1 Typical no-till seeding of native warm season grasses six weeks after seeding. We used 12 oz imazapic + 1 qt surfactant + 1 qt 28-0-0 liquid fertilizer per acre four weeks prior to seeding. Note that the fescue has been completely eradicated and the native warm season grasses are flourishing.

Photo 2 This treatment of 1 quart imazapyr + 2 quarts glyphosate + 12 oz imazapic one month later was the most effective treatment for killing common Bermuda grass. However, neither the seeded native warm season grasses or anything else grew in these plots.

Photo 3 A spring burn followed by an application of 2 quarts glyphosate per acre + 12 oz imazapic per acre was the best treatment for reducing common Bermuda grass and establishing native warm season grasses. Notice the excellent stand of native warm season grasses in areas where the Bermuda grass was killed. In the upper right hand corner, notice the line of Bermuda grass. This is an area between spray units that did not receive a herbicide application.

Photo 4 The best treatment for killing bahiagrass and establishing native warm season grasses was to conduct a spring burn followed by an 8 oz application of clethodim followed by an 8 oz imazapic application at seeding. Note there is little bahiagrass in the plot and the strong establishment of Indiangrass at the end of the first growing season.

native grasses were met with disaster. As expected, severe weed competition from crabgrass (*Digitaria* spp.), johnsongrass, (*Sorghum halepense*), foxtail grasses (*Setaria* spp.), and ragweed (*Ambrosia* spp.) prevented the natives from becoming established and flourishing.

A chance meeting with scientists from American Cyanamid at a wildlife conference altered our research program forever. Drs. Joe and Jennifer Vollmer informed me that a new herbicide that contained the imazapic molecule would kill tall fescue and provide residual weed control for 45 to 60 days post-treatment. Like most scientists, I was skeptical of corporate marketing efforts, but I did agree that I would like to try some of their product for an upcoming research project. That first project consisted of two experiments: comparing the efficacy of imazapic to glyphosate for controlling tall fescue either singly or in combination. Because of limited space, readers are referred to our paper in *Weed Technology*, (Washburn and Barnes 2000) for specific information on methods and a complete discussion of the results.

In the first study we compared a single application during the spring and fall of glyphosate at label rates. Average pre-treatment tall fescue cover on the sites was 93%. Overall, tall fescue cover was reduced to less than 12% on average by a single postemergence spring or fall application. Tall fescue cover in the spring treatments averaged 1.3% remaining compared to 6% remaining in the fall treatments. These differences were not statistically different.

In the second study, we compared a single spring treatment using imazapic at maximum label rate (12 oz per acre) to a mixture of imazapic at label rate with either 1 quart or 2 quarts glyphosate per acre. We compared the efficacy of the treatments during the tall fescue spring vegetative growth stage, boot stage, summer dormancy stage, or fall vegetative stage. Average pre-treatment tall fescue cover was 91%. Imazapic alone and in combination with glyphosate reduced tall fescue cover to less than 3% regardless of application timing. The results of these two studies concluded that either glyphosate or imazapic kill tall fescue. The herbicides can be used alone or in combination and by using both herbicides, imazapic tolerant species would also be eliminated from the plant community.

Remember at the beginning of the article I mentioned the initial native warm season grass plantings were thought to be failures. Well, it turns out they were not. Even though we could not quantify their presence in the plots, the seedlings were being obstructed by the invasion of tall fescue and johnsongrass. At the beginning of the third growing season we applied the maximum label rate of imazapic without any fertilizer or surfactant in late April to the plots considered to be failures. In 7 of our 9 treatments, the imazapic reduced or eliminated the tall fescue and other exotic weeds including johnsongrass. Prior to applying the herbicide, native warm season grass cover ranged from 14 to 47%. That fall, native warm season grass covered had increased from 81 to 122% (Washburn *et al*. 1999).

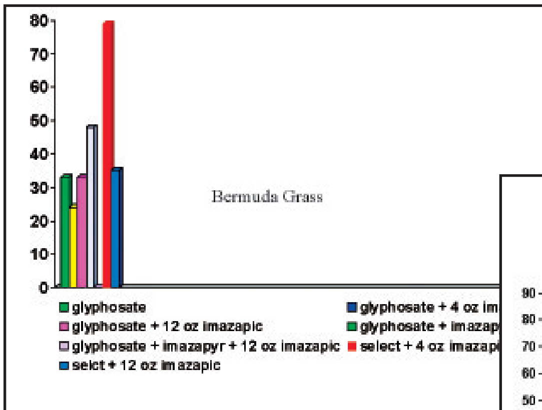
With this information in hand, we designed an experiment to determine the efficacy of prescribed burning, post-emergence imazapic applications, and combinations of prescribed burning and imazapic applications for eradicating tall fescue and increasing native warm season grasses in native prairie barrens. We implemented 16 different treatments that included different rates of imazapic with and without a non-ionic surfactant. The treatments also included burned and unburned plots. We observed that all 12 herbicide treatments had less tall fescue cover compared to the controls over a two year period. The best treatment for reducing tall fescue cover was spring burning followed by applying 8 and 10 oz of imazapic with a non-ionic surfactant. Prescribed burning alone did not decrease tall fescue cover. This has been documented in several other studies (Madison *et al*. 2001, Washburn *et al*. 1999). While we successfully reduced tall fescue cover in most treatment plots, another exotic cool-season grass, Kentucky bluegrass, that is tolerant to imazapic, became dominant in some plots.

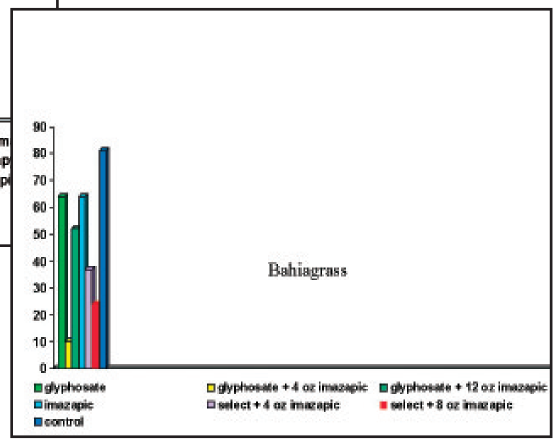
Our final fescue eradication experiment was implemented last spring. The goal of this project was to compare the efficacy of several herbicides including glyphosate, imazapic, clethodim, and sethoxydim for killing tall fescue. Our reasoning behind implementing this study was to determine if a grass-specific herbicide like clethodim or sethoxydim could be used to kill fescue and remove it from native grasslands. From our previous work we knew that both imazapic and glyphosate effectively kill tall fescue but both of these herbicides will kill many forbs.

This study was conducted at three locations throughout Central Kentucky in the outer bluegrass physiographic province. Specific treatments included maximum label rates of glyphosate and imazapic, 8 or 10 oz per acre clethodim, and 1 quart sethoxydim per acre. We also added 1 quart surfactant and 2.5 lbs Ammonium sulfate per acre in each herbicide tank mixture. The results of this experiment showed, to no ones surprise, that the glyphosate and imazapic effectively removed the tall fescue. Average tall fescue cover post-treatment for the glyphosate and imazapic treatments were less than 2% remaining and less than 5% remaining, respectively. Clethodim was also effective and at two locations reduced tall fescue cover to less than 20% fescue remaining. The sethoxydim treatments were largely unsuccessful and they left an average of 73% and 46% tall fescue at two sites and 6% at the third location.

In summary, we feel very comfortable that either a single spring application of glyphosate or imazapic at maximum label rates can effectively kill tall fescue. We know that you get better results if you burn the fescue field prior to herbicide application. We also know that you get better control if you add a surfactant and small amount of nitrogen fertilizer to the tank mixture. If you are trying to remove tall fescue from a native prairie or oldfield dominated by broomsedge bluestem (*Andropogon virginicus*), you can use 10 or 12 oz of imazapic per acre and it will do the job. However, if you have a diverse field with forbs, the jury is still out on the most effective treatment. Our information suggests that clethodim may be an appropriate herbicide but the others have not yet been tested for use in this situation. For example, if you apply glyphosate or imazapic in March prior to the warm season species breaking dormancy, more forb species may be tolerant to this treatment That is the subject for our next set of experiments that will begin this spring.

While most of our research has focused on tall fescue, we are now looking at controlling other exotic grasses and converting them to native warm season grasses. The first two exotic grasses we have worked on include common Bermuda and bahia. Our work on common Bermuda has been done in Alabama at Wheeler National Wildlife Refuge. The bahia work has been done along the South Carolina coastal plain.





Common Bermuda grass has proven to be a more difficult species to eliminate. The pre-treatment and control plots had an average of 80% Bermuda grass cover. All treatment plots in this study were burned in March and herbicides were applied the first week of April. We did find a treatment that did eliminate the Bermuda grass (1 quart imazapyr + 2 quarts glyphosate followed by 12 oz imazapic one month later) but there were few plants, of any species including the native warm season grasses, that survived the herbicide treatment. Total vegetative cover in these plots was less than 1% (see photo). Two treatments that showed tremendous promise were those treated with 2 quarts glyphosate per acre. These data are somewhat skewed because our spray unit did not overlap and in the small space between herbicide treatments the Bermuda grass escaped into the plots (see photo). Thus, where the herbicides reached the grass, we got almost complete control by burning and applying the maximum label rate of glyphosate per acre. When we added either 4 or 12 oz imazapic per acre we were able to successfully establish the native warm season grasses (see photo).

Another species that has proven difficult to control has been bahia grass. The protocol for this experiment was similar to the Bermuda grass trials. Average bahia cover pre-treatment was 81%. All fields were burned prior to herbicide application. One quart surfactant and 2.5 lbs Ammonium sulfate were added to each herbicide tank mixture. The best treatment for killing the bahia and establishing the native warm season grasses was using 8 oz clethodim per acre as a burn down followed by an 8 oz imazapic application at seeding. This reduced the bahia cover to 24% (see photo). Another promising treatment for killing bahia was to use 2 quarts glyphosate per acre as a burn down followed by a 4 oz imazapic application approximately 1 month later. This reduced the bahia cover to about 10% but the native warm season grass establishment was not as good as the clethodim treatment. Others that reduced the amount of bahia included a 12 oz per acre imazapic treatment (37% cover) and an 8 oz clethodim + 4 oz imazapic treatment (37%).

The results of these studies show that herbicides are an effective management tool for killing tall fescue. The results of the Bermuda and bahia grass experiments show there is promise in using herbicides for killing these species and establishing native warm season grasses. We still need to do some more work to develop the best management recommendations for these two species. In addition to this work, we are also looking at converting Old World bluestems to native warm season grasses. The next few years may hold the key to generating more information on the most effective methods to kill these exotic grasses.

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What's Up in the Literature?

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If one were to do a literature search on invasive plant species using most of the better commercial science databases, the number of citations found would be considerable. Why is it, then, that when one tries to find *relevant* references on the invasiveness of these species, one often comes up empty-handed?

What follows is a description of the process that the authors, in a cooperative effort, have gone through in order to begin the comprehensive collection of relevant literature on the FLEPPC Category I list of invasive, non-native species for inclusion in the Aquatic Plant Information Retrieval System (APIRS) database (see Box 1). This collection will include the retrospective (or historical) literature, as well as newly published material. However, for the purposes of this article, we will focus on the literature published prior to December 2000.

As staff members of the University of Florida, we have access to the vast resources of the university's library holdings. These holdings include electronic databases and indexes to the literature. The science databases that we have searched (with the date of earliest records in parentheses) include *Biological Abstracts* (1980), *Cambridge Scientific Abstracts - Plant Science* (1994 - includes URLs), *CAB* (Commonwealth Agricultural Bureau - 1972), *FirstSearch* (specifically the *Agricola* database - 1970), ISI's *Current Contents* (preceding 24 months), *Everglades Digital Network* (1997), *NISC Biblioline* (1971), *Web of Science* (1945), and *Zoological Abstracts* (1978). Each of these databases was searched using the genus *and* species name of the plant (as listed in Table 1). In this compilation, synonyms were not used except for *Pueraria montana* and *P. lobata*.

Initially, Jamey Carter-King compiled aggregate lists of citations by searching the above-named databases, downloading the citations into "Libraries" using the EndNote citation-management software (Niles Software Inc.), and rejecting duplicate and incomplete citations. In addition to the paper's title and source, the EndNote Libraries included abstracts for about 80% of citations. The total number of citations per species (Table 1) varied from 0 for *Jasminum fluminense* (although this species was featured in the Winter 2000 issue of *Wildland Weeds*) to 833 for *Casuarina equisetifolia*. Nine species had no more than 10 citations and the average number of citations was 162 per species.

The numbers of citations found in the APIRS database for aquatic species have been included to complete the table for FL EPPC Category I (3rd column in Table 1.) Of the seven wetland or upland species for which the APIRS collection has been ongoing, only for *Casuarina equisetifolia* and *Sapium sebiferum* were there more citations in the commercial databases. In both of these cases, many papers would not be relevant to APIRS because they focus on phytochemistry, biochemistry, or forestry utilization. For the other five species for which APIRS has more citations, such as *Melaleuca quinquenervia* and *Mimosa pigra*, the extensive APIRS database includes articles from agency reports and conference proceedings (commonly referred to as "gray literature"), journals not covered by commercial databases (especially foreign language ones), and articles published prior to the earliest records of most commercial electronic databases.

To confirm the validity of the extracted citations, Jamey searched the Endnote Libraries by genus *and* species (4th column in Table 1.) For at least two thirds of the species studied, the species name occurred in the title and/or abstract for at least 75% of articles. Of the remaining 18 species, half of them had the genus in at least 75% of titles and/or abstracts. That

What APIRS does

For twenty years, the staff at APIRS has collected, cataloged, stored hard copies, and created a searchable computerized database of the literature on aquatic and wetland plants around the world. More recently, we have begun the collection of literature on upland invasive species in Florida under a grant from the Florida Department of Environmental Protection, Bureau of Invasive Plant Management. Our primary focus in this realm is the FLEPPC Category I and Category II species.

The APIRS database now contains over 53,000 citations. Approximately 2,200 of these citations are related to 44 upland invasive plant species listed on the Category I list. To search the database, go to http://plants.ifas.ufl.edu and click on APIRS Database Online, or contact Karen Brown at *kpb@gnv.ifas.ufl.edu* to have a search performed for you.

leaves 9 species (indicated by * in Table 1) such as *Neyraudia reynaudiana*, *Senna pendula*, *Solanum torvum*, and *Syzygium cumini* for which the reliability of the extracted citations is somewhat suspicious. Commercial databases may include citations that do not include the species name in the title or abstract because some databases: automatically search for synonyms; search whole papers and not just titles and abstracts; or include citations cataloged by scientific name, even if only the common name was used in the article.

For a preliminary screening of citations, Jamey used the titles and abstracts to assign relevant category designations from the following list (terms in bold used as abbreviations in Table 1): **taxon**omy, morphology, and identification; **life**-history; **abiotic** ecology; **biotic** ecology; economic impacts; **eco**logical **imp**acts; chemical control; biological control; mechanical control; cultural control; **uses; phys**iology and biochemistry; and genetics.

Several categories may be assigned to each citation and they were interpreted very broadly (e.g., a paper with information about the toxicity of a plant to birds would be included under "physiology and biochemistry" and "ecological impacts" because of likely impacts on wildlife). Most of these categories are similar to the major categories used by APIRS (see Box 2) but the full list of categories and keywords used for cataloging citations in APIRS is much more detailed and is applied to the entire paper, as opposed to just the title and abstract, by APIRS science reader/cataloger, Mary Langeland.

The most commonly allocated of Jamey's categories was physiology and biochemistry, being assigned to an average of 68% of citations. In fact, a third of all species had at least 90% of their citations assigned to this category (5th column in Table 1.) For species such as *Sapium sebiferum* this emphasis could be explained by a characteristic of the species, such as potential toxicity, that is important to humans. At the other extreme, the categories of economic impacts and control methods were assigned to an average of less than 5% of citations. By including more of the gray literature, the control categories are likely to be better represented in APIRS than in the commercial databases.

When adding a new species to the APIRS database list for collection, Mary Langeland further culls Jamey's aggregate list of citations for relevant references. Why is this necessary? The articles selected for inclusion in the APIRS database address not only the invasiveness of the plant, but other basic research on physiology, ecology, morphology, reproduction, etc. Although researchers and administrators alike want "everything there is" on a weedy species, the fact is that much, and in some cases, most of the literature has little to do with a plant's weediness or basic biology.

We are proceeding through the FLEPPC Category I list alphabetically. For the purposes of providing examples for this article, we review some of the genera starting with 'A'. These examples demonstrate the rather small percentage of articles found to be relevant for our purposes, and why they are, or are not, relevant.

Abrus precatorius

Searching on *Abrus precatorius* in the commercial databases produced a list of nearly 300 citations. However, approximately 245 of them specifically studied phytochemistry/biochemistry, especially toxicity to animals and pharmacology. For example, *Activity of Abrus precatorius L. extracts against*

APIRS Subject Categories

The APIRS list of major categories is quite long. The categories are further subdivided into sub-categories. Some of them, such as lakes and eutrophication, are mostly specific to aquatic species, since our roots are in the water. The categories that we most often use for upland invasive species are as follows:

- **Control** (biological (including insects, pathogens, etc.); chemical; cultural (including hand-removal, cutting, etc); mechanical; integrated (combinations of strategies); government (legislation, regulation, permitting, agency reports, etc.))
- **Ecology** (ecosystem; host plants; nutrient cycling; phenology (life history, senescence, fruiting, dormancy); plant succession; primary production; productivity;)
- **Economics** (economic impacts of invasives; costs of management; values of areas or preservation)
- **Morphology** (cytology; histology)
- **Physiology** (photosynthesis; transpiration; respiration)
- **Remote Sensing** (GPS; GIS; aerial surveys)
- **Reproduction** (flowering; germination)
- **Review** (does not contain original research)
- **Survey**
- **Taxonomy**
- **Toxic Plants** (lethal; irritant; allelopathic)
- **Utilization**

Plant names mentioned in the text are *always* part of the cataloged record. If there are more than 40, we list a representative selection and use the keyword phrase 'over 40 species'.

Any significant word from the text can be used as a keyword when cataloging citations in the APIRS database. Examples include illustrations (used when a reference contains good plant drawings or photographs); chemical control methodologies (such as basal bark method or cut stump method); habitat (used when plant habitat is described, or when the plant species provides habitat for other species); community response (for example, the ecological response of a plant community to the removal of an exotic species); competition; flooding or disturbance or drought (the effects of); restoration; natural areas management; seed dispersal; range; naturalized species; endangered species; biomass; herbivory; prescribed burns; population studies; seedling establishment; genetics; and many, many more.

More detailed explanations of our subject categories and keyword combinations can be found within the database section of our website: http://plants.ifas.ufl.edu/categor.html

Table 1. Data related to citations found in commercial electronic databases and the APIRS database for FL EPPC category I species. (Aquatic species were not searched in the commercial databases because APIRS has covered them for many years.)

	Commercial databases	APIRS database[1]	% naming species[2]	Most cited category[3] (%)		2nd most cited category[3] (%)	
Abrus precatorius	294		90	Phys	99	Ecol imp	52
Acacia auriculiformis	718		79	Uses	53	Phys	32
Albizia julibrissin	154		86	Phys	97	Ecol imp	29
Albizia lebbeck	414		81	Phys	99	Abiotic	44
Ardisia crenata	33		76	Phys	91	Ecol imp	48
Ardisia elliptica	4		75	Abiotic	75	Ecol imp	50
Asparagus densiflorus	78		44	Phys	90	Abiotic	38
Bauhinia variegata	189		77	Phys	98	Uses	46
Bischofia javanica	85		94	Phys	85	Uses	47
Calophyllum antillanum	5		80	Taxon	80	(Several)	20
Casuarina equisetifolia	833	100	94	Phys	94	Abiotic	54
Casuarina glauca	216		63	Phys	98	Uses	72
Cestrum diurnum	43		88	Phys	100	Ecol imp	60
Cinnamomum camphora	212		91	Phys	93	Ecol imp	41
Colocasia esculenta	*not incl.*	301					
Colubrina asiatica	13	16	85	Abiotic	54	Phys	54
Cupaniopsis anacardioides	13	40	69	Phys	85	Abiotic	62
Dioscorea alata	440		75	Uses	46	Life	45
Dioscorea bulbifera	122		81	Phys	53	Taxon	49
Eichhornia crassipes	not incl.	4,064					
Eugenia uniflora	103		84	Uses	44	Ecol imp	34
Ficus microcarpa	86		92	Taxon	40	Biotic	30
Hydrilla verticillata	*not incl.*	3,022					
Hygrophila polysperma	*not incl.*	134					
Hymenachne amplexicaulis	*not incl.*	37					
Imperata cylindrica	467		97	Phys	88	Ecol imp	80
Ipomoea aquatica	not incl.	241					
Jasminum dichotomum		3	33*	Taxon	67	(Several)	33
Jasminum fluminense	0						
Lantana camara	25		76	Ecol imp	68	Phys	40
Ligustrum sinense	49		69	Taxon	45	Ecol imp	40
Lonicera japonica	244		77	Phys	55	Ecol imp	42
Lygodium japonicum	90		73	Life	74	Phys	69
Lygodium microphyllum	17		65*	Taxon	47	Ecol imp	47
Macfadyena unguis-cati	9		78	Phys	50	Taxon	40
Melaleuca quinquenervia	155	384	79	Ecol imp	60	Taxon	59
Melia azedarach	697		86	Phys	90	Uses	66
Mimosa pigra	191	323	88	Ecol imp	94	Taxon	55
Nandina domestica	85		93	Phys	79	Uses	55
Nephrolepis cordifolia	38		71	Taxon	78	Abiotic	78
Nephrolepis multiflora	7		43*	Abiotic	100	Taxon	86
Neyraudia reynaudiana	13		8*	Ecol imp	79	Abiotic	64
Paederia cruddasiana	10		30*	Ecol imp	100	Taxon	60
Paederia foetida	40		62	Ecol imp	87	Phys	74
Panicum repens	*not incl.*	355					
Pennisetum purpureum	676		92	Phys	95	Uses	83
Pistia stratiotes	*not incl.*	1,049					
Psidium cattleianum	51		92	Phys	77	Ecol imp	50
Psidium guajava	829		91	Phys	98	Uses	72
Pueraria montana	312		86	Phys	94	Ecol imp	59
Rhodomyrtus tomentosa	13		100	Phys	77	Abiotic	69
Rhoeo spathacea	57		91	Phys	86	Life	70
Sapium sebiferum	139	84	96	Phys	95	Ecol imp	50
Scaevola sericea	24		83	Phys	83	Abiotic	75
Schefflera actinophylla	66		59	Phys	92	Abiotic	71
Schinus terebinthifolius	125	285	85	Phys	92	Ecol imp	64
Senna pendula	18		28*	Abiotic	100	Ecol imp	78
Solanum tampicense	6		67	Ecol imp	100	Taxon	60
Solanum torvum	239		44*	Phys	79	Life	39
Solanum viarum	93		98	Phys	82	Ecol imp	45
Syzygium cumini	20		10*	Phys	90	Life	75
Tectaria incisa	5		40*	Taxon	100	Abiotic	100
Thespesia populnea	100		91	Phys	94	Ecol imp	34
Tradescantia fluminensis	82		87	Phys	98	Taxon	45
Urochloa mutica	*not incl.*	90					

[1] Data included only for species for which APIRS has been collecting for several years. APIRS collections are in progress for all FL EPPC Category I species but partial data are inconclusive and quickly out-dated.
[2] Percentage of articles for which the species name is found in the title and/or abstract when searched using EndNote software. * indicates that less than 75% of citations included the genus in the title and/or abstract.
[3] Full names of Jamey's categories are listed in the text.

the two-spotted spider mite Tetranychus urticae Koch (Acari: Tetranychidae) by S.A.A. Amer, et al in Acarologia (1989) 30(3):209-216 would not be considered relevant and would not be collected. There were no references specifically on the invasiveness of *Abrus precatorius*. There were 55 references that Mary deemed relevant and they fell into the following subject categories: physiology, utilization (human medical needs), reproduction (seed germination), morphology, taxonomy, ecology, and weed control (in citriculture).

Acacia auriculiformis

Searching *Acacia auriculiformis* in the commercial databases produced a list of 718 total citations. Of these, 491 focused on phytochemistry and forestry/reforestation in other countries (mostly propagation for forestry; nitrogen-fixation; wood characteristics; utilization for erosion control for disturbed, saline or mined areas). For example, *Comparison of volume production, basic density and stem quality between Acacia mangium and Acacia auriculiformis grown in Zanzibar* by M.S. Ali, et al in Journal of Tropical Forest Science (1997) 10:10-17 would not be acquired, nor would *Growth of three multipurpose tree species on tin tailings in Malaysia* by K. Awang in Journal of Tropical Forest Science (1994) 7:106-112. An example of a phytochemistry article that would not be collected is *Enhancement of membrane damage by saponins isolated from Acacia auriculiformis* by S. Babu Santi Prasad in the Japanese Journal of Pharmacology (1997) 75(4):451-454. There were 234 relevant citations in the following areas: physiology (transpiration, photosynthesis), ecology (primary production, phenology, host plants, nutrient cycling, plant succession), invasiveness (2), reproduction (germination, flowering, ontogeny, micropropagation), morphology (genetics, identification, root nodes), taxonomy, toxic plants (nematicide), and fire. An example of a relevant article on the invasiveness of Acacia is *The earleaf acacia, a fast growing, brittle exotic "weed" tree in Florida* by J.F. Morton in the Proceedings of the Florida State Horticultural Society (1985) 98:309-314.

Albizia lebbeck

Albizia lebbeck had a total of 414 citations in the commercial databases, primarily on forestry/reforestation, use as forage/fodder, and phytochemistry. There were 108 relevant citations on physiology, ecology, invasiveness, allelopathy, reproduction, morphology and taxonomy. Research which focuses on insects or pathogens of the plant is usually selected for inclusion. Such articles offer studies on herbivory, larval damage to the plant, disease symptoms, etc. which could lay the groundwork for biological control research. A good example is *Losses in Albizia lebbek due to leaf spot and pod diseases caused by Colletotrichum dematium and their control* by T. Mohd, et al (1996) in Impact of Diseases and Insect Pests in Tropical Forests; the IUFRO Symposium, Peechi, India, pp. 81-84. Another relevant article would be Julia Morton's *Woman's tongue, or cha-cha (Albizia lebbeck Benth.), a fast-growing weed tree in Florida, is prized for timber, fuel, and forage elsewhere* in the Proceedings of the Florida State Horticultural Society (1983) 96:173-178. This article describes the natural range

Dow Agroscience Ad
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for *Albizia lebbeck*, the history of its introduction into Florida, its distribution around the world, its utilization in the Old World, and its growth habits in south Florida as of 1983. The article also provides information on the climatic and soil requirements of the plant, nitrogen fixation, propagation, growth rate, economic uses and a valuable list of 76 references in the literature cited. As an interesting aside, Ms. Morton suggested that the common name of 'cha-cha' be adopted as "brief, pronounceable in any language, pleasantly expressive, and inoffensive to females." *[The authors support this adoption.]* She claimed that the various common names have been inspired by the "clatter of the persistent dry pods."

Ardisia crenata

Ardisia crenata had a total of only 33 citations in the commercial databases, most of which were about phytochemistry and utilization as an ornamental plant. While phytochemistry is considered physiology research, these references often comprise the bulk of the total literature available on a species. They are easily found in specific journals (for example, Phytochemistry) and are well indexed in electronic databases for those interested in this research. Also, there usually is a general lack of applicability to research conducted for control or management of invasive species. Some examples of such physiology/phytochemistry articles are *New bergenin derivatives from Ardisia crenata* by Z. Jia, et al, Natural Medicines (1995) 49(2):187, or *Minor triterpenoid saponins from Ardisia crenata* by K. Koike, Chemical and Pharmaceutical Bulletin (1999) 47(3):434-435. Much of this research is geared toward finding new products such as medicines, or antifeedants in stored crops. If the research appears to be about the allelopathic effects of an invasive species on other plant species, which would potentially be an invasive trait, it is of course deemed relevant. This type of research could be used to support the designation of a species as invasive.

Articles that deal with the horticultural propagation of *Ardisia crenata* are selected because they usually contain research on basic physiology of the plant. For example, *The study of photosynthetic CO2 exchange as a measure of the growth and yield of agricultural, ornamental, and horticultural plants* by R. Ceulemans and I. Impens, Revue de l'Agriculture (1982) 12(4):1-3 might be acquired if available. Articles are not selected if they deal with methodology and are directed toward the ornamental plant industry, for example, *Production and use of Ardisia crenata as a potted foliage plant* by C.A. Conover, et al, Foliage Digest (1989) 12(4):1-3.

Seemingly vague articles such as *Short comments on Ardisia (Myrsinaceae) of eastern Asia* by Y.P. Yang, Botanical Bulletin of Academia Sinica (Taipei) (1989) 30(4):297-298 are acquired because they offer valuable information about the plant in its native habitat or range.

Another good example of a relevant plant pathogen article would be *Foot rot of Ardisia crenata caused by Fusarium solani* by C. Fu, Taiwan Journal of Forest Science (1999) 14(2):223-227.

The process of obtaining full copies of articles for cataloging and entry into the APIRS database is another undertaking altogether. Only a small part of the retrospective literature has actually been collected, cataloged and added to the APIRS database. For the rest, newer articles may be available online or in current printed journals carried by the university library. Older items may be found in older printed journals in the library stacks. Where author addresses are available and current, articles can be requested in writing. But in some cases such as very old articles or those in obscure journals, articles simply may not be available. Articles that seem strongly relevant but can not be obtained may be cited in the database as 'citation only', and hopefully may be found in someone's collection at a later date. Because the truth is, bibliographies and indexes, even when cataloged, annotated or with abstracts, are not always useful to researchers unless the text of the document is available.

What we ultimately hope to create is a comprehensive collection of *relevant* references on Florida's invasive, non-native plant species, cataloged and computerized for easy searching of the literature, with hard copies available for research purposes. APIRS has done this for aquatics. Now we've taken on the task of upland invasives. It's a big job but, together, we're working on it!

A Note on "Growth Inhibition by *Schinus terebinthifolius*"

Karen Brown

Over the years here at APIRS, we have had numerous requests for the above titled paper by G.J. Gogue, C.J. Hurst and L. Bancroft. It is one of the very few publications on the allelopathic effects of *Schinus terebinthifolius*. The paper is cited in a few publications: one by Julia F. Morton in 1978 (*Brazilian Pepper - Its Impact on People, Animals and the Environment* - Economic Botany 32(4):353-359), and one by John J. Ewel, D.S. Ojima, D.A. Karl and W.F. DeBusk in 1982 (*Schinus in Successional Ecosystems of Everglades National Park*, Rept. T-676). Ms. Morton cites it as "Paper presented at annual meeting of American Society for Horticultural Science, Guelph, Ontario, Canada. Aug. 14, 1974," and Ewel cites it as Amer. Soc. Hort. Sci. 9:45. (1974). I could not find a copy of this paper. After numerous attempts, I finally checked with the American Society for Horticultural Science (ASHS) some time ago and their editor at the time could find no record of it. I determined that it was probably never published, but merely presented at one of the ASHS annual meetings as cited by Ms. Morton. But people kept asking me for it, and they kept asking Ken Langeland for it (who, in turn, asks me for it), so I decided to give it one more shot before writing a note for *Wildland Weeds* stating that the paper in question unequivocally does not exist.

There is a Journal of the ASHS, but it was not there. There is a Proceedings of the ASHS, but it was not there. There is a Proceedings of the Annual Meeting of the ASHS, but these were all from the 1920's, and it was not there. Finally, during a chance conversation with a researcher in horticultural science, it was pointed out that one of the official journals for the ASHS is *HortScience*. I decided to give it a try and thumbed through the 1974 issues of *HortScience* at the University of Florida's Marston Science Library. I found that Volume 9, Number 3 had two sections published, the second of which was the Program and Abstracts of the 71st Annual Meeting in Canada. On page 45 of the program, which is also page 301 of the journal, I found the coveted abstract by Dr. Gogue. It may be somewhat of an anticlimax, but the abstract is reprinted here with permission from the American Society for Horticultural Science.

Growth inhibition by *Schinus terebinthifolius,* by G.J. Gogue, C.J. Hurst and L. Bancroft. HortScience Vol. 9(3) Section 2:301. 1974.

Brazilian pepper tree (*Schinus terebinthifolius*), a woody ornamental, has demonstrated seasonal allelopathic effects in Everglades National Park. Water leachates from various *Schinus* parts, i.e. fruit, fresh leaves, litter, stems, etc. reduced germination of *Bromus rigidus* when the leachate supplied the moisture in germination studies. Radical elongation was also suppressed by the leachate. The greatest inhibition in both germination percent and radical elongation occurred from the fruit leachate. With thin layer chromatography, the fruit leachate was separated into nine components. The spots were removed and used in a bioassay with *B. rigidus* as a test plant. The results indicated that three spots contained allelopathic materials. Identification of these spots with a mass spectrometer showed galic and ferulic acid derivitives to be present.

SE-EPPC NEWS

The Third Annual Southeast Exotic Pest Plant Council Symposium was held March 21-23 at the Georgia Center for Continuing Education on the campus of The University of Georgia, Athens, Georgia. The 135 attendants represented a number of state and regional EPPCs, including Southeast, Mid-Atlantic, Tennessee, North Carolina, Kentucky, Mississippi, Georgia, and Florida. Other attendants represented government agencies, academia, private industry, and non-government organizations.

Lori Williams, Executive Director of the National Invasive Species Council and keynote speaker, opened the *Policy and Regional Action Plans* session with an update of the Council's activities since Clinton's Executive Order on Invasive Species was passed. Lori further stated that she was confident that invasive species would remain an important issue during the Bush Administration, and that no federal programs were anticipated to be cut in the foreseeable future as a consequence of the change in administration.

The *Policy* session addressed many concerns, such as inter-agency dialog and cooperation and the perceived rift between research and policy. The *Ecological Research and Monitoring* session featured plenary speaker **Dr. C. Ronald Carroll**, Director of the Institute of Ecology, UGA, who gave an overview of classic competition models and how can be they be integrated into invasive species research. Presentations featured a diverse range of interests, from natural history studies of *Ardisia crenata* to encouraging community participation in native species restoration efforts. **Todd Neel**, Exotic Plant Management Specialist with Carlsbad National Park explained the role of Exotic Plant Management Teams (EPMT) and their use of integrated control techniques on NPS lands, during his plenary address in the *Herbicide Technology and IPM* Session. The session concluded with an informative discussion panel entitled *Successful Invasive Weed Management Partnerships: Experience from Manufacturers, Contracts, and Resource Managers*, led by **Bill Kline**. The *Screening and Risk Management* session was highlighted by **Alison Fox's** update on assessment strategies for evaluating invasive plant species in Florida. The *Outreach and Public Awareness* session contained outstanding presentations, from using the popular media as a vehicle to capture the public imagination and interest in invasive species issues to encouraging community participation in landscaping and restoration efforts.

The Social Event was a lot of fun - we enjoyed excellent food and Americana tunes played by Athens based *String Theory*. The original venue was slated for the Institute of Ecology Courtyard, but some of our tender-footed Florida friends were already "freezing" in the mid-60 degree weather, so we moved the party inside - it was still a blast! (Incidentally, many of our Florida colleagues were so desperate that they were "forced" to purchase UGA Bulldog sweatshirts to keep warm - these were likely discarded at the Florida-Georgia state lines and airport bins all over Florida.) It was great to socialize, exchange ideas and resources, and "hit the town" with friends old and new. A good time has had by all.

We would like to extend a sincere thanks to all those who attended and presented their work at the annual symposium. Of course, this event could not be possible without the generous assistance of our sponsors, including:

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Invasive Plant Control, Inc.
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National Park Service
Novartis/Syngenta
U.S. Forest Service.

Next year's symposium will be held in Nashville, Tennessee. Be sure to visit the SE-EPPC Web site (http://www.se-eppc.org) for developments. Hope to see you there!

-Cheryl McCormick, 2001 Conference Chair

(Editor's note: Cheryl did an unbelievable job in pulling this conference together, and has just been named President of Georgia EPPC. Great, job Cheryl!)

Will the real John Randall please stand up? CalEPPC's John Randall (left) and NC-EPPC's Johnny Randall finally met face to face at the SE-EPPC conference, quashing rumors that they are actually the same person.

Conference organizer, Cheryl McCormick (left) and SE-EPPC Coordinator, Brian Bowen enjoy a much-deserved break.

Biocontrol Down Under

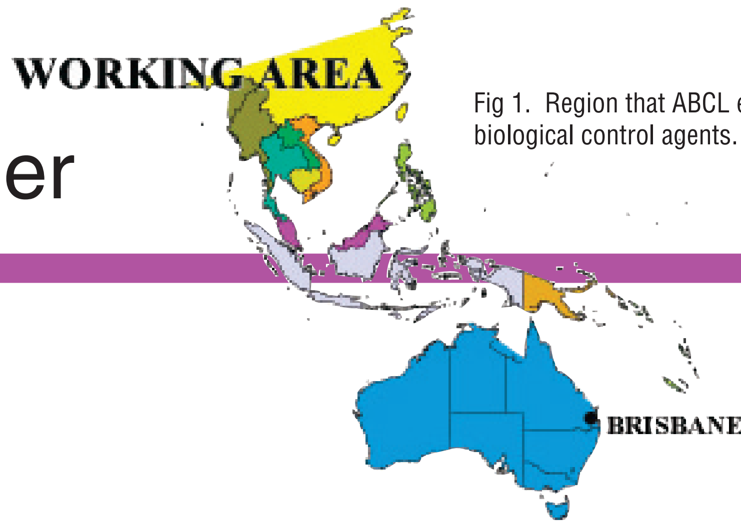

Fig 1. Region that ABCL explores for biological control agents.

John A. Goolsby[1], Matthew F. Purcell[2], & Tony Wright[2]

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'Down Under', the staff of the Australian Biological Control Laboratory (ABCL) are actively searching natural areas of Australia and Southeast Asia for insects and other organisms which feed on plant species that are invasive in Florida. Based in Brisbane, 14,000 miles away from the Southeastern USA, the ABCL is operated by the U.S. Department of Agriculture, Agricultural Research Service (USDA-ARS), hosted by the Commonwealth Industrial and Science Research Organisation (CSIRO Australia), and collaborating closely with USDA-ARS researchers at the Invasive Plant Research Laboratory in Ft. Lauderdale and Gainesville, Florida.

Many familiar Florida weeds such as the paperbark tree (*Melaleuca quinquenervia*), Old World climbing fern (*Lygodium microphyllum*), carrotwood, (*Cupaniopsis anacardioides*) and Australian pine (*Casuarina* spp.) are native to this area of Australia. However, the native distribution of many of weed species in this region continues northward from Australia into tropical and subtropical Southeast Asia, including Indonesia, Malaysia, Thailand, Vietnam, Papua New Guinea, New Caledonia, and southern China. ABCL scientists explore this entire region to find the most promising biological control agents (Fig. 1).

Research conducted at ABCL follows a sequence of events involving

Fig 2abcd. The ABCL has excellent research facilities including field plots, greenhouses, biocontrol quarantine, and specialized laboratories for entomology and plant pathology.

determination of the native distribution of a weedy plant species, exploration for natural enemies, DNA fingerprinting of newly discovered species, ecology of the agents and their weed hosts, field host-range surveys, and ultimately preliminary host-range screening of candidate agents. Our research determines what regulates the plant in its native environment, which brings to light the full array of potential biological control agents. Organisms with a narrow host range and good regulatory potential are intensively investigated further. The data we gather on potential agents is combined with information about the ecology of the weed where it is invasive. Our stateside USDA-ARS collaborators use a science-based process to make the final decision on which organisms are best suited to be biological control agents. This dual-continent approach ensures the most successful outcome.

Fig 3. Pictured here is Alex Racelis (ARS-Ft. Lauderdale) collecting seed rain samples from a native stand of *Melaleuca quinquenervia* in Queensland for comparative ecological studies.

Currently, we are conducting research on *Melaleuca quinquenervia* and *Lygodium microphyllum.* The biological control program for *M. quinquenervia* was initiated in 1985, and one insect, the melaleuca weevil, *Oxyops vitiosa* was released in 1997 and several additional agents have been exported to Florida and are in various stages of final quarantine screening. The biocontrol program for *L. microphyllum* was started in 1998. One agent, the leaf-defoliating moth *Cataclysta camptozonale*, was shipped to Florida in 1999 for quarantine screening. Several potential agents from Australia and Southeast Asia are currently being evaluated. (Fig. 2abcd) (Fig 3)

Melaleuca quinquenervia, the broadleaf paperbark tree

Since the early 1900s, melaleuca has invaded over half a million acres in southern Florida. Because melaleuca is native to Australia, scientists at the ABCL have been searching since the mid-1980s for insects in this country to topple melaleuca.

One of the insects discovered, the melaleuca snout beetle, *Oxyops vitiosa*, was released at many sites in Florida in 1997. Massive numbers of these weevils have been recovered from several sites (Center *et al*.

Ask the Readers

A note from Dr. Ted Center

Biological control projects against invasive weeds require a long-term commitment of resources. These resources, though, are generally limited so only a few projects can be undertaken at any one time. As a result, target selection must be prioritized so that funding, facilities, and personnel are allocated to address the most critical needs. The target chosen, though, isn't always the worst weed, because priorities sometimes conflict. The selection process often balances the need for control against the potential for success. As a result, a biological control approach might be more appropriate against a weed of lesser importance than a more severe one, simply because the likelihood of success is greater. In such cases, targeting the lesser problem becomes a more judicious use of resources.

Downy rose myrtle is a case in point. Tony Wright, of the USDA-ARS Australian Biological Control Laboratory, investigates natural enemies of various invasive plants that originated in Southeast Asia, including downy rose myrtle. He and his collaborators from Thailand have observed severely damaged downy rose myrtle plants and have found a number of potential biological control agents. This has led them to believe that the potential for successfully controlling downy rose myrtle is quite high. However, we know very little about this plant, particularly with regard to the damage that it causes or the extent of the problem. We are therefore seeking advice and guidance from resource managers. Is downy rose myrtle enough of a problem to warrant a full-scale biological control project? Is there sufficient interest on the part of land and resource managers for such a project? Would there be opposition to a project?

Conflicts of interest must be considered. Downy rose myrtle fruits purportedly provide a source of jelly and jam and it is purportedly grown for that purpose in some areas. It also might still be a valued landscape ornamental. We therefore need more information on potential conflicts of interest that might arise should we begin a project. Any information that you can provide would be appreciated. It can be sent me at the following:

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2000) and many have been released elsewhere. In their wake they have left behind hundreds of thousands of heavily damaged melaleuca saplings.

The melaleuca psyllid, *Boreioglycaspis melaleucae*, is a sap-sucking insect that has the potential to kill saplings. Both the adults and the nymphs feed on melaleuca, injecting toxic saliva before sucking the predigested sap. The juveniles form shelters beneath white flocculant threads excreted by these nymphs. Heavily infested trees take on the appearance of being smothered in snow. Eventually trees begin to wither under the onslaught of the psyllid, and many fail to recover. This insect has completed testing in quarantine and release in Florida is expected in the near future.

Quarantine host testing has also been completed on the defoliating sawfly, *Lophyrotoma zonalis*. Hundreds of thousands of larvae of *L. zonalis* infest trees in parts of northern Australia, stripping every leaf from the besieged trees. The vigor and flowering of the affected trees are significantly reduced. This sawfly completes its development on the tree and emerging adults are very mobile. This should enable this promising agent to colonize melaleuca in even the most remote wetland areas of Florida. Recently, concerns have been raised over the potential of this insect to poison animals that eat them, as the larvae carry toxins that are unique to several sawfly species related to *L. zonalis*. Further trials have been requested, and to that end over thirty thousand sawfly larvae have been specially hand picked from trees in far north Queensland, Australia (Fig. 4) to be used in toxicology studies of livestock.

One of the most promising new agents is the gall-making fly, *Fergusonina* sp. This fly and its symbiotic nematode attack melaleuca by galling leaf and flower buds that could limit branch growth and seed production (Goolsby *et al*. 2000). Through a concerted effort in the later half of 2000, 7000 galls were collected in Australia for shipment to the Gainesville quarantine where emerging flies were used in screening tests. So far the insects appear to be sufficiently host specific to allow release, though testing is incomplete.

Fig 4. Matthew Purcell collecting *Lophyrotoma zonalis* sawfly larvae from a melaleuca tree in north Queensland.

Research efforts are now being driven toward developing agents that could diminish the vast reproductive potential of melaleuca. Research conducted in collaboration with ABCL staff by Van, Rayachattery and Center (ARS-Ft. Lauderdale) compared reproductive potential of melaleuca trees in Florida and Australia. This work demonstrated that abortion of flower buds was a significant factor in reducing the regenerative potential of *M. quinquenervia* in its native habitat. Much of the flower abortion appears to be caused by small moth larvae that bore through buds and immature inflorescences which terminates flower formation and ultimately curtails seed development. At least one species, *Holocola* sp. (Fig. 5) attacks both leaves and flowers, allowing it to persist year round without dying out following the flowering season, an important factor if it is be released as and agent in Florida. Attempts will be made colonize and evaluate these moths over the next year.

Fig 5. Melaleuca flower bud which was has been consumed by the larvae of the tip-feeding moth, *Holocola* sp.

Lygodium microphyllum, Old World climbing fern

The native distribution of *L. microphyllum* extends from Australia northward through the tropics and subtropics of Southeast Asia. Other species of *Lygodium* are present too including *L. japonicum*, *L. flexuosum*, and *L. reticulatum*. The diversity of species in the genus *Lygodium* and the abundance of suitable habitat make this area ideal to explore for biological control agents. Tony Wright (CSIRO/ABCL) leads the exploration in Southeast Asia and John Goolsby (ABCL) covers Australia. Intensive fieldwork has already revealed more than 20 species of insects and mites feeding on the fern. However, many parts of Australia and Southeast Asia are still unexplored so the potential for more agents from this region is high.

Foreign exploration for *L. microphyllum* agents is carried out year round. Seasonal variation effects the abundance of insect species, so it is important to visit sites regularly in order to collect the maximize diversity of herbivores, especially in the tropics. The wet season, December through February makes it very difficult to get to many field sites. During 'the wet', rivers rise, billabongs fill with water and estuarine crocodiles swim upstream in search of food and nesting sites. You don't step out into the bush of Australia without some advanced planning and good advice from the locals. The fern grows luxuriantly during the wet, which coincides with a peak in insect activity. During this year's wet season we will be collecting in the monsoon rainforests in the Ord River area of Western Australia, and the lowland jungle habitat of Bukit Timah in Singapore.

Back in Brisbane, candidate agents are reared and tested for their ability to feed and reproduce on selected test plant species. Dr. Bob Pemberton (ARS-Ft. Lauderdale) developed a preliminary host test list, which includes most of the Florida fern species that are closely related to *Lygodium* or important commercially in the horticultural trade. Agents that show high specificity in these tests are exported to Dr. Gary Buckingham (ARS) at the Florida Biological Control Laboratory in Gainesville for final quarantine screening. The leaf defoliating pyralid moth, *Cataclysta camptozonale* is currently under study in the Gainesville quarantine. (Fig 6)

Fig 6. The pyralid moth, *Cataclysta camptozonale* was collected from in southeast Queensland and is being evaluated as potential biological control agent of *Lygodium microphyllum*.

One of the agents that shows excellent promise is an eriophyid mite, *Floracarus* sp. The mite feeds on the young growth, inducing the formation of fleshy tissue, which causes the pinnae (leaves) to curl. The mites live inside the curled leaf feeding on the fleshy gall-like tissue. Eggs are laid inside the curl, with the entire lifecycle taking 12 days at 27 degrees C. *Floracarus* sp. feeding appears to be associated with leaf necrosis and debilitation of the plant (Fig 7ab). We have noticed that after bush fires, *L. microphyllum* regrows vigorously and *Floracarus* sp. exists below detection levels. In time mites recolonize the *Lygodium* patches and the symptoms of plant disease and decline begin to reappear. We are conducting field chemical exclusion tests to investigate the relationship between *Floracarus* sp. and plant health. Replicated field tests will measure biomass production with and without the mite. The goal of the field research is to determine the effect *Floracarus* sp. might have on *L. microphyllum* if it was released in Florida.

Potential Weed Targets

Several other weeds important to Florida and the Southeastern U.S. are native to Australia and/or Southeast Asia including: Japanese climbing fern (*Lygodium japonicum*), Chinese tallow (*Triadica sebifera* (= *Sapium sebiferum*)), carrotwood (*Cupaniopsis anacardioides*), Australian pine (*Casuarina* spp.), skunkvine (*Paederia foetida*), downy rose myrtle (*Rhodomyrtus tomentosa*), hydrilla (*Hydrilla verticillata*), schefflera (*Schefflera actinophylla*) and Chinese privet (*Ligustrum* spp.). Biological control programs could be developed for these species. Some species such as carrotwood and schefflera are valuable ornamentals. Biological control agents which target plant reproduction only may be best suited to limiting their invasive characteristics, while still preserving their use in ornamental horticulture.

Environmentally adapted plant flora coupled with globalization of trade and travel between Australasia and the Southeastern U.S. is now and will continue to be the cause of many serious weed invasions. The Australian Biological Control Laboratory is committed to research and development of biological control solutions for U.S. weeds of Australian and Southeast

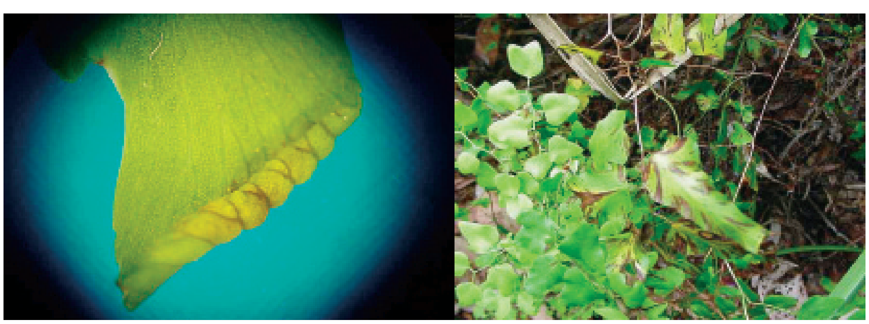

Fig 7a. The characteristic leaf-curling of *Lygodium microphyllum* that is caused by the eriophyid mite, Floracarus sp.

Fig 7b. Leaf necrosis and debilitation of *Lygodium microphyllum* associated with infestations of the mite Floracarus sp.

Asian origin. Our research is critical because not only does biological control offer the safest and most cost-effective approach to long-term management of widespread, invasive weeds, but in some instances it is the only viable control option.

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Internodes

XenoNET

New Book on Australian Plants

Visit the Weed Information website at www.weedinfo.com.au for the low-down on Australia's flora. The site lists a new book: Plants of Importance to Australia - a Checklist Complied by R.C.H. Shepherd, R.G. Richardson and F.J. Richardson It promises to provide an accurate botanical name, authority, family and a preferred common name for each plant that is or may be of importance to Australia. The species chosen include both weeds of agriculture, and the environment; crop species of all sorts and ornamental species that have, or may, become environmental weeds. This reference book will also help remove confusion that occurs where different plants have the same common name.

You'll also find the Plant Protection Quarterly here. PPQ is an Australian journal that publishes original papers on all aspects of plant protection. Topics represented cover all aspects of the protection of economic plants from weeds, pests and diseases and include the protection and ecology of vegetation on public land such as roadsides, railways, National Parks, gardens and reserves.

Interested in Conducting Research in a U.S. National Park?

The U.S. National Park Service (NPS) has created an Internet-based site for its Research and Collecting Permits. The site, http://science.nature.nps.gov/servlet/Prmt_pubIndex, covers all National Park Units in the United States. The site has been designed to be a comprehensive location for researchers to have the opportunity to review procedures, previous research efforts, policies and conditional requirements before submitting a new proposal; to search NPS-identified research preferences; to complete and submit an application for a permit; and to file required Investigator's Annual Reports via the Internet.

The NPS encourages scientists, agencies, non-profits and all researchers and research institutions to consider the National Parks as a good place for science that provides public benefits for all citizens. For additional information, contact Dr. John Dennis, Biologist, National Park Service, 1849 C Street NW, Washington, D.C. 20240; phone (202) 208-5193; john_dennis @nps.gov

Product Information at your Fingertips

Looking for an up-to-date copy of a herbicide label? Need quick information on an adjuvant? Chemical and Pharmaceutical Press, Inc. compiles pesticide product information provided directly by the companies in an unbiased presentation. The Greenbook portion of the web site contains full text product labels, supplemental labels, and MSDSs for roughly 1500 products from over 40 companies. The site also includes some 4400 labeled tank mixes for these products. These documents are available free, and can be located by brand and company name. http://www.green book.net

From the E-MailBox:

"Cultivated Plants of Florida," by D. Burch, D.B. Ward, and D.W. Hall was published in January 1988 as SP-33 by IFAS Florida Cooperative Extension Service. IFAS Publications still has over a thousand of these paperback books for sale for only $5.00. I thought it might be of interest to readers of *Wildland Weeds* because every woody plant on the FLEPPC Category 1 list is listed as a cultivated plant in this book. It could serve as an historical account of cultivated plants at some point in time. The authors state, "By the industrious efforts of plant enthusiasts and importers, and the appropriate niches awaiting suitably selected species, the abundance of the world's flora is well sampled in Florida." (Remember, this is in 1988!) At any rate, the contact info for IFAS Pubs. is 1-800-226-1764.

- Karen Brown
kpb@gnv.ifas.ufl.edu

MARK YOUR CALENDAR

41st Annual Meeting of the Aquatic Plant Management Society, **July 15-18, 2001**, Minneapolis, MN. Contact: David Tarver, davidptarver @worldnet.att.net.

American Society of Botany, Botany 2001 "Plants and People," **August 12-16, 2001**. Albuquerque Convention Center, Albuquerque, NM. Contact: www.botany.org.

16th Annual Symposium, Florida Exotic Pest Plant Council, **September 12-14, 2001**, St. Augustine, FL. Contact: Kathy Burks, kathy.burks @dep.state.fl.us

11th International Conference on Aquatic Invasive Species, **October 1-4, 2001**. Hilton Alexandria Mark Center, Alexandria, VA. Contact: Contact: Elizabeth Muckle-Jeffs, profedge@renc.igs.net, www.aquatic-invasive-species-conference.org.

28th Annual Natural Areas Conference, 2001: A Spatial Odyssey, **October 3-6, 2001**. Radisson's "Resort at the Port," Cape Canaveral , FL. Contact vickie.larson-1@ksc.nasa.gov, www.natareas.org.

SER 2001: Restoration Across Borders, **October 4-6, 2001**. Sheraton Fallsview Hotel, Niagara Falls Ontario, Canada. Contact: www.ser.org.

The Wildland-Urban Interface: Sustaining Forests in a Changing Landscape, **November 5-8, 2001** University of Florida Hotel and Conference Center, Gainesville, FL. Contact Mary L. Duryea (mlduryea@ufl.edu) or Susan W. Vince (svince@ufl.edu), conference. ifas.ufl.edu/urban/

Weed Science Society of America Annual Meeting, **February 10-13, 2002**. Reno Hilton, Reno, NV. Con-

NOTES FROM THE DISTURBED EDGE

Chapter 1

They dressed in individual elegance, as if fashion, social norms, the superficial concerns of the outer world, were of no consequence. They were one with their surroundings. He was a thing of beauty as he strode encumbered, and she bore her ever-lightening burden as if it were a graceful extension of her own sturdy frame. He swept through the grove, a maniacal ballerina samurai, swinging and cleaving a swath of progress and destruction, and she followed in his wake like a visiting angel from outer space, dispensing the potion in measured doses, moving from just-cut stump to stump. *Drink deeply my pretties*... The bodies stacked up, green leaves wilting in the mid-day heat, mirages forming and slipping away in the ever-widening corridors that they created. His boots, beloved boots, left shallow prints, and hers traced his steps, a waltz of blade and poison, a symphony of action, portending restoration as the sun swung it's arc. And then, as silently as they had arrived, they departed, retiring to renew their vigor, prepared to dance again on holy ground, it's solemn nature invaded by the uninvited. For their foes today the party was over, but the battle had just begun... -J.A.

An excerpt from "The Adventures of Hack Garlon and his buxom sidekick Squirt."

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