FE671

Management of Melaleuca by Professional Land Managers in South Florida[1]

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The Melaleuca Management Survey

Although the invasive plant Melaleuca has been in Florida for over 100 years, very little information exists on the extent of its coverage, area treated, control methods used, treatment costs, and the negative economic and environmental effects caused. To help remedy this lack of information, a survey of professional land managers in south Florida was undertaken in 2003. This research was undertaken as part of the Areawide Management Evaluation of Melaleuca (TAME Melaleuca), in collaboration with the USDA-Agricultural Research Service and the South Florida Water Management District. Surveys were conducted for both residents and professional land managers (see companion report on results for professional managers, FE672).

Written questionnaires were developed for the survey in consultation with cooperating agencies. The questionnaires and informed consent protocol for the survey were reviewed and approved by the University of Florida Institutional Review Board. Following Dillman's (1978) Total Design Method, each survey had an arrangement of colored photographs on the front cover, an introductory statement explaining the purpose of the study, and general instructions for completing and returning the questionnaire in an enclosed postage-paid envelope. The survey was a total of nine pages long.

The study area for the survey included the ten (10) southernmost counties in Florida: Broward, Charlotte, Collier, Glades, Hendry, Lee, Martin, Miami-Dade, Monroe, and Palm Beach (Figure 1). This area contains over 2.5 million households (BEBR, 2004). Both agricultural owners/operators and managers of public parks/preserves were targeted for the survey. Agricultural landowners were selected from a list compiled from county property appraisers by the Florida Department of Revenue in Tallahassee. A random sample of 2,000 of these landowners was selected for the survey. This number represented 17 percent of the total population of about 11,500 landowners. For public lands, a list of 285 managers was obtained from the United States Department of Agriculture-Agricultural Research Service (USDA-ARS) representing managers of parks and preserves for local, state, and federal government agencies, and managers of rights-of-way

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for public utilities. Surveys were mailed to all managers on this list. A total of 435 responses were received (Table 1). Thirty-two percent of park mangers and 22 percent of agricultural mangers responded to the survey. Results of the survey are described herein.

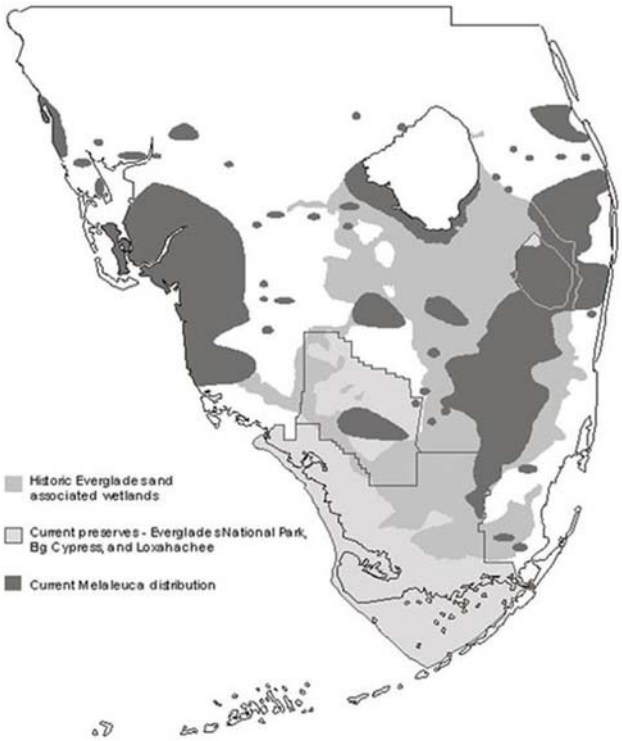

Figure 1. Map of Melaleuca distribution in south Florida (http:www.invasive.org).

Land Area and Land Use

Land area owned and leased by professional owners/managers responding to the survey is summarized in Table 2. A total of 5.4 million acres were reported, which consisted of about 5.1 million acres controlled by park managers and 317,000 acres controlled by agricultural managers. The vast majority (98%) of land managed by park/preserve managers was publicly owned, although 86,372 acres were privately owned. In contrast, most of the land managed for agricultural purposes was privately owned. Publicly-owned landholdings managed as parks/preserves averaged 74,488 acres per manager and ranged in size from 4 acres to 1,400,000 acres. Privately-owned agricultural landholding averaged 775 acres per manager and ranged from less than 1 acre to 140,000 acres. A relatively small amount of land was being privately leased by both park and agricultural managers. When these numbers are expanded to represent the full population of agricultural managers in the 10-county study area of south Florida, an estimated 1.74 million acres would fall under private ownership, 73,893 acres would be privately leased, and 8,884 acres would be classified publicly owned.

In terms of specific land uses, 6.94 million acres were reported as managed by park/preserve managers, while 319,771 acres were reported as managed by agricultural managers, giving a total of 7.26 million acres (Table 3). The largest type of land-use by area as reported by park/preserve managers was for parks/preserves, comprising a total of 4.80 million acres. Miscellaneous other uses, totaling 356,262 acres, included target ranges, recreational areas, and office buildings. Some park/preserve managers indicated that some of their land was used for pasture/range land, crop production, fruit/citrus groves, and nurseries, but none indicated that their land was being used as forest for commercial timber production.

The most commonly reported land use by agricultural land managers was pasture/rangeland, with 38 percent of respondents reporting a total of 143,243 acres (Table 3). Miscellaneous other uses, totaling 18,272 acres, reported by agricultural managers included residences, ponds, horse farms, and barns. When these numbers are expanded to represent the population of agricultural managers in south Florida, it is estimated that a total of 1.83 million acres were being managed. This would include 823,647 acres for pasture/rangeland; 669,231 acres for crop land; 197,081 acres for fruit/citrus groves; 26,145 acres for rights-of-way; and 105,064 acres for miscellaneous other uses.

Factors Affecting Land Management

Survey respondents were asked to rate various factors that influenced their land management decisions as *significant*, *moderate*, or *none*. These factors included agency funding; adverse weather conditions; availability of agricultural land; encroachment of urban land uses; foreign or other state competition; cost of inputs or supplies; prices for

crops, fruit, or livestock; invasive plants; predators; insect pests; and the ability to conduct prescribed burns.

For park/preserve managers, it was not surprising that agency funding was the most influential factor in land management decisions, being rated as significant by 77 percent and moderate by 19 percent of the respondents. Invasive plants were rated as a significant factor by 73 percent of park managers, while 25 percent rated them as a moderate influence. The ability to conduct prescribed burns was rated as significant by 39 percent of park managers and as moderate by 23 percent. Input costs were considered significant by 36 percent and moderate by 53 percent of park/preserve mangers. Urban encroachment was rated as a significant or moderate influence by 28 percent and 40 percent of these respondents, respectively. Adverse weather was viewed as a moderate influence (71%), although this may be considered more important after the 2004 hurricane season. Only 8 percent indicated that predators or insect pests were a significant factor in their management, while 42 percent rated them as moderate and 50 percent considered them of no significance.

For agricultural managers, the factors influencing their land management decisions were rated lower overall. The price for crops, fruit, and livestock was the most important factor, with 29 percent indicating it was significant and 33 percent as moderate. The cost for inputs or supplies was rated as a significant factor by 24 percent of agricultural managers and as moderate by 41 percent. Adverse weather conditions were a significant factor for 23 percent, urban encroachment was rated as significant by 23 percent, and availability of agricultural land was significant for 20 percent. Some 19 percent of agricultural managers rated predators and insect pests as a significant factor, with 46 percent rating them as moderate. Invasive plants were rated as significant by 16 percent and as a moderate influence by 43 percent. Foreign or other state competition was generally not viewed as important, which is somewhat surprising, given the significance of commodity prices.

Area of Invasive Plants Occupied And Treated

The importance of Melaleuca as an invasive plant was assessed in relation to other invasive plants, based on the area currently occupied or infested in 2003, and the area treated during the period between 1990 and 2003 (Table 4). The area occupied was intended to represent the areas of contiguous stands, not small isolated patches or individual outlying trees. The ratio of the area treated since 1990 to the area currently occupied was also taken as a gauge of the intensity of treatment by land managers.

For park/preserve managers, Melaleuca was the invasive plant reported to occupy the largest area (619,317 acres) in 2003. Melaleuca also had the largest area treated between 1990 and 2003 (402,088 acres), which represents 65 percent of the area currently occupied. Brazilian Pepper was the second most common invasive plant, occupying 425,805 acres in 2003, with 75,215 acres treated between 1990 and 2003. This represented 18 percent of the area occupied in 2003. Among other species, Old World Climbing fern (*Lygodium*) occupied 113,884 acres, and 49,213 acres were treated (43% of area occupied). Australian Pine (*Casuarina*) occupied 111,782 acres, with 16,598 acres treated (15%); Cogon grass (*Imperata*) occupied 20,147 acres, with 6,527 acres treated (32%); Tropical Soda Apple (*Solanum*) occupied 15,418 acres, with 3,475 acres treated (23%); and miscellaneous other plants occupied 11,433 acres, with 7,094 acres treated (62%). Some of the other plants frequently listed were Air Potato (*Dioscorea bulbifera*), Downy Rose Myrtle (*Rhodomytrus tomentosa*), Latherleaf (*Colubrina asiatica*), Carrot Wood (*Cupaniopsis anacardioicles*), and Cattail (*Typha*).

For agricultural managers, 94 managers reported a total area of 2,134 acres occupied by Melaleuca in 2003, and 57 managers reported treating a total of 1,460 acres between 1990 and 2003 (Table 4). This represented 68 percent of the total area occupied. This suggests that agricultural managers have treated *Melaleuca* at similar rates as park managers; however, other indicators in this survey and research by other scientists imply that park managers have acted much more aggressively. Tropical Soda Apple (*Solanum*) was reported by agricultural managers to

occur on 10,393 acres in 2003, and 7,855 acres (76%) were treated. Brazilian Pepper (*Schinus*) occupied 7,096 acres and 2,768 acres (39%) were treated. Miscellaneous other invasive plants, including air potato, dog fennel, and smut grass, occupied 2,561 acres, and 2,094 acres (82%) of those plants were treated. When these numbers are expanded to represent the total population of agricultural managers, Melaleuca is estimated to cover 12,271 acres of agricultural land in south Florida during 2003, and 8,395 acres were treated between 1990 and 2003. The area infested by other invasive plants on agricultural lands is estimated at 139,058 acres, including 59,760 acres for Tropical Soda Apple and 40,802 acres for Brazilian Pepper (*Schinus*).

Methods Used for Treating Melaleuca

Managers were asked indicate if they had used a specific method for controlling Melaleuca, and then to indicate the area they treated with that method in 2003 and cumulatively from 1990 to 2003 (Table 5). Respondents were given a choice of several options:

- Mechanical removal (felling, mowing, tilling, grubbing, disking, etc.).
- Foliar or soil applied herbicides.
- Basal frill followed by herbicide treatment (hack-and-squirt).
- Girdling followed by herbicide treatment (a ring of bark is removed from the base of the tree and then treated with an herbicide).
- Felling followed by herbicide treatment on the cut stump (stump treatment).
- Biological control with beneficial insects (natural enemies of the tree are released which may cause stress in established trees and death of younger saplings).
- Biological controls combined with one or more other methods.

Since respondents were given the opportunity of indicating more than one control method, a count was taken to see how many managers chose at least one control choice, and this number was used to compute the percentage of managers responding in the affirmative for using a particular control method.

Among park/preserve managers, 82 percent indicated that they had employed a stump treatment; 59 percent used hack-and-squirt; 51 percent used mechanical control methods; 28 percent employed biological control; 21 percent used biological control combined with one or more other form(s) of control; and 7 percent reported using some other method of control, such as fire. Many agricultural managers did not have Melaleuca on their property and, if they did, a substantial percentage chose not treat it. So, it was not surprising that 71 percent of agricultural managers had not used any particular control measures for Melaleuca. Among agricultural managers who did use controls, 33 percent indicated they had employed mechanical methods for control, 10 percent used foliar or soil applied herbicides, 8 percent reported using stump treatment, and 4 percent used hack-and-squirt (Table 5).

The area of Melaleuca treated using various control methods in 2003 and cumulatively from 1990 to 2003 is summarized in Table 6. For park/preserve managers, the total area treated in 2003 was 84,740 acres, and the area treated since 1990 was 419,741 acres. The stump treatment (felling + herbicide) was used over the largest area (303,933 acres) since 1990, followed by hack-and-squirt (52,476 acres), foliar or soil applied herbicides (36,622 acres), mechanical methods (16,625 acres), and biological control (12,642 acres). Biological controls combined with one or more other method(s) were used on 80,575 acres, and together with the area treated strictly by biological control represented 93,217 acres. For areas treated in 2003, the most important method used was stump treatment (46,958 acres), followed by foliar/soil herbicides (15,987 acres) and hack-and-squirt (11,494 acres). In comparing the area treated in 2003 with the average annual rates since 1990, it is apparent that the use of all treatment methods accelerated in 2003 for parks/preserves.

For agricultural managers, the overall area of Melaleuca treated by any particular method since 1990 was significantly less than the area treated by park/preserve managers. Agricultural managers

treated about 2,707 acres in total, including 1,957 acres by mechanical methods, 274 acres with stump treatments, and 355 acres using foliar/soil-applied herbicides. The smaller area treated from 1990 to 2003 in some cases was apparently due to reporting errors.

Managers were also asked to indicate whether they planned to use or continue using various control methods. Among park/preserve managers who answered this question, the largest share intended to use stump treatment (85%), followed by hack-and-squirt (72%), mechanical control (50%), biological control (45%), and biological control combined with other methods (40%). For agricultural land managers, the majority intended to use mechanical methods (70%), with much fewer intending to use foliar/soil applied herbicides (29%), stump treatment (27%), or hack-and-squirt (16%). Very few agricultural managers expressed interest in biological control.

Managers were asked whether they were interested in receiving additional information about any of the specific Melaleuca control methods. Most park/preserve managers were interested in learning more about biological control (74%). A majority was also interested in foliar/soil applied herbicides and stump treatment (65%), hack-and-squirt (58%), and mechanical methods (52%). Among agricultural managers who responded to this question, around 50 percent wished to learn more about biological control, stump treatment, soil/foliar herbicides, and hack-and-squirt. The low interest in learning more about mechanical control (this group expects to continue using this method extensively) suggests that this method is well understood.

Barriers to Controlling Melaleuca

Land managers were asked to choose from a list of factors that may have limited their ability to control Melaleuca (Table 7). Among park/preserve managers, the biggest barriers identified were inaccessibility to infestations (22%), expense (18%), excessive size of infestations (15%), lack of cost-sharing programs (13%), and lack of time (12%). However, a significant proportion of these respondents (32%) indicated that they encountered other types of barriers not specifically identified in the question, such as infestations are too small, lack of needed equipment or knowledge to use controls, fear of harming other beneficial plants, fear/dislike for using chemicals, and environmental regulations. Although they were listed in the question, some respondents wrote in that lack of money and lack of time were barriers to implementing controls. Only 13 percent of park/preserve managers said that Melaleuca was not a problem for them.

Agricultural land managers responded quite differently to the barriers to control question. Seventy-four percent indicated that they did not have Melaleuca on their property, and 31 percent reported that Melaleuca was not a problem for them even it they did have it. Some 5 percent indicated a barrier other than those listed in the survey. It is interesting to note that one respondent stated that Melaleuca trees provide shade in pastures, which suggests that there may be some benefits of Melaleuca for agricultural use.

Sources and Usefulness of Information for Melaleuca Control

Park and agricultural land managers were asked to classify various sources for Melaleuca information as *useful*, *somewhat useful*, or *not useful* (Table 8). These classifications were scored on a scale of 2, 1, or 0, respectively, in order to compute a weighted average rating in Table 8. For park/preserve managers, 88 percent rated information from state and federal agencies as a useful source, 10 percent rated it as somewhat useful, and 2 percent indicated it was not useful, representing an overall average score of 1.9. Other information sources with high average usefulness ratings were UF/IFAS Extension (1.9), manager observations (1.8), land manager advice (1.8), weed professionals (1.8), professional organizations (1.7), internet websites (1.7), pamphlets/bulletins (1.6), and the TAME project (1.6).

In terms of usefulness of information for agricultural managers, the top rated sources were UF/IFAS Extension (1.4), manager observations (1.1), state/federal agencies (1.1), weed professionals (1.1), land manager advice (1.1), and internet

websites (1.1). None of the agricultural managers indicated they considered area demonstration plots, computer software/decision aids, or email/direct notifications as being useful sources of information.

Costs for Melaleuca Control

Managers were asked to indicate the costs incurred during 2003 for the control of Melaleuca. The total annual cost for controlling Melaleuca for surveyed park/preserve managers was $10,866,113 (Table 9). This included $8,066,544 for contract services; $837,000 for labor costs; $796,000 for herbicides; $308,000 for equipment; $330,000 for indirect costs; and $528,000 for other miscellaneous costs.

Surveyed agricultural managers reported spending $204,790 in 2003 to control Melaleuca, with $129,900 for contract services; $28,975 for labor; $21,610 for herbicides; $17,855 for equipment; $5,950 for indirect costs; and $500 for other costs. If these numbers are expanded to represent all agricultural managers in south Florida, a total of $1,177,543 is estimated to have been spent by these managers on controlling Melaleuca in 2003.

Managers were also asked to indicate expenses for any special equipment or heavy machinery purchased since 1990 specifically to control Melaleuca. It is important to note that these expenses may be partly captured in the previous section under annual costs for equipment expenditures. Park/preserve managers surveyed reported spending an approximate total of $1.44 million for special equipment, with a maximum expenditure of approximately $1.20 million. Agricultural managers reported spending $244,000 on special equipment, which would represent an approximate total of $1.40 million when expanded to represent the population in the region.

Managers were asked how costs for controlling Melaleuca on their land had changed over the past five years: whether the costs had increased, decreased, or remained the same. If there had been a change, they were asked to indicate the percentage change. Among park/preserve managers, 21 percent indicated that costs had increased, 26 percent indicated that costs had decreased, and 32 percent indicated no change in costs. For those indicating a change in costs, the average estimated increase was 253 percent and the average estimated decrease was 117 percent. Among agricultural managers, 11 percent indicated that costs had increased, 9 percent indicated that costs had decreased, and 41 percent indicated that costs had stayed about the same. For those indicating a change in costs, the average increase was 81 percent and the average decrease was 87 percent.

These results suggest that costs for Melaleuca control may be increasing more for park/preserve managers than for agricultural land managers. A plausible explanation could be the fact that most park/preserve managers are managing sensitive ecosystems and are mandated to control invasive plants such as Melaleuca to keep their management area in a more naturally pristine state. Many agricultural managers do not seem to think Melaleuca is much of a problem so they are probably less interested in removing it, along with the fact that some managers find it sometimes provides benefits for their operations.

Impacts of Melaleuca

Information was sought from managers regarding any negative impacts Melaleuca had on their land and management over the past five years. The first part of the question provided the respondents with a list of options as well as giving them the opportunity to specify any other adverse impacts. The second part of the question sought to quantify the impact in terms of the percentage change in function. Among park/preserve managers, 88 percent of those who indicated any impact reported that Melaleuca had impaired the ecological function of their management area, while 35 percent indicated a reduction in the recreational use or value of their land (Table 10). A small number of park/preserve managers reported other impacts such as increased fire danger, restriction of necessary clearances, and smoke management issues with prescribed burns. Among agricultural land managers who answered this question, 59 percent indicated that Melaleuca had reduced their land's agricultural productivity, 39 percent said it impaired the ecological function of their land and diminished its recreational use, and 20

percent said that their land market values were reduced. Some of the other negative impacts listed included allergies caused by pollen and various maintenance problems such as damage by falling trees to fences.

As a follow-up, managers were asked to estimate the percentage change in value or utility due to Melaleuca infestations. Averages were derived from the responses (Table 11). Park/preserve managers estimated that the loss of ecological function and recreational use averaged 23 percent, while agricultural managers estimated that Melaleuca had caused an average loss of 25 percent in recreational use and 24 percent in agricultural productivity.

Annual Income or Budget and Comparison of Reported Melaleuca Control Expenses

Park/preserve managers were asked to indicate their agency's budget for land management activities, and agricultural managers were asked about their gross income from agricultural operations for the year 2003, or to indicate the appropriate range of values (Table 12). A small percentage (16%) of park/preserve managers reported their actual budgets, which totaled $9,105,400. Among park preserve managers, 30 percent indicated their budget was less than $50,000; 7 percent said it was within the range of $50,000 to $99,999; 11 percent said $100,000 to $249,999; 9 percent said $250,000 to $499,999; 5 percent said $500,000 to $999,999; and 29 percent indicated their annual income/budget was $1,000,000 or more. Among agricultural managers, 10 percent reported actual income totaling $7,829,795. Some 55 percent indicated their income was less than $50,000; 6 percent indicated $50,000 to $99,999; 12 percent indicated $100,000 to $249,999; 2 percent indicated $250,000 to $499,999; 3 percent indicated $500,000 to $999,999; and 6 percent indicated $1,000,000 or more.

Reported expenses for the control of Melaleuca were compared to reported income or budget in order to gauge the relative level of effort allocated to this effort. If managers chose to write in their income, that exact figure was used in the comparison. However, if their income/budget was reported for a range of values, then the midpoint for that range was used, and for the highest and lowest ranges (less than $50,000; $1 million or more), $25,000 and $1.5 million were used, respectively. Only managers who reported both expenses and budget/income information could be used for this analysis.

The analysis revealed that a weighted average of 38 percent of park managers' budgets was expended on control measures for Melaleuca. For some managers, reported expenses were as much as three to eight times more than their budget. A few of the respondents indicated that less than 1 percent of their income/budget was used on controlling Melaleuca. These outliers may be due to reporting errors or may simply be due to the fact that some agencies/operations are involved in deficit spending, such as spending more than their budget provides (e.g., unbudgeted emergency expenditures).

For agricultural managers, an average of 4 percent of their income was spent controlling Melaleuca. The majority of these managers fell into the 1 to 5 percent range, and some reported their control expenses were less than 1 percent. However, some indicated that 60 to 100 percent of their income went to controlling Melaleuca.

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Table 1. Population size and response rates for Melaleuca management survey.

	Park Managers	Agricultural Managers
Population Size	285	11,500
Sample Size	285	2,000
Number of Responses	90	445
Response Rate (%)	32%	22%

Table 2. Land area managed by surveyed professional land managers.

Classification	Respondents	Sum	Mean	Minimum	Maximum
	(*Number*)	(*Acres*)	(*Acres*)	(*Acres*)	(*Acres*)
Park/Preserve Managers	80	5,084,967			
Privately Owned	10	86,372	8,637	7.0	70,000
Publicly Owned	67	4,990,670	74,488	4.0	1,400,000
Privately Leased	3	7,925	2,642	105.0	7,500
Agricultural Managers	431	316,528			
Privately Owned	390	302,132	775	0.3	140,000
Publicly Owned	3	1,545	515	5.0	1,380
Privately Leased	38	12,851	338	1.0	2,700
Overall Total	511	5,401,495	10,570		

Table 3. Land use types and areas managed by professional land managers.

Land Use Type	Park Managers			Agricultural Managers			All Managers
	Number	Sum	Mean	Number	Sum	Mean	Sum
		(*Acres*)	(*Acres*)		(*Acres*)	(*Acres*)	(*Acres*)
Park/Preserve	65	4,802,389	73,883	8	30	4	4,802,419
Right-of-Way	16	871,483	54,468	36	4,547	126	876,030
Lakeshore	6	508,272	84,712	7	19	3	508,291
Mitigation/Wetland	14	373,017	26,644	9	251	28	373,268
Pasture/Range	4	25,210	6,503	168	143,243	853	168,453
Crop	2	900	450	50	116,388	2,328	117,288
Fruit/Citrus	3	1,908	636	98	34,275	350	36,183
Nursery	5	19	4	103	1,395	14	1,414
Forest	0			10	1,351	135	1,351
Other Use(s)	16	356,262	22,266	83	18,272	220	374,534
Total of All Uses		6,939,460			319,771		7,259,231

Table 4. Land area infested with and treated for invasive species by professional managers.

Species	Park/Preserve Managers				Agricultural Managers			
	Area Currently Occupied		Area Treated Since 1990		Area Currently Occupied		Area Treated Since 1990	
	#	Acres	#	Acres	#	Acres	#	Acres
Paper Bark or Punk Tree (*Melaleuca*)	59	619,317	54	402,088	94	2,134	57	1,460
Australian Pine (*Casuarina*)	55	111,782	50	16,598	29	34	15	5
Brazilian Pepper (*Schinus*)	68	425,805	65	75,215	146	7,096	104	2,768
Cogon Grass (*Imperata*)	33	20,147	31	6,527	14	320	9	73
Old World Climbing fern (*Lygodium*)	45	113,884	40	49,213	23	178	16	24
Torpedo Grass (*Panicum*)	33	25,060	31	11,008	40	1,468	31	888
Tropical Soda Apple (*Solanum*)	32	15,418	25	3,475	37	10,393	32	7,855
Other Plants	37	11,433	36	7,094	33	2,561	18	2,094
Total	362	1,342,846	332	571,218	416	24,184	282	15,167

Table 5. Methods used for treatment of *Melaleuca* by professional land managers.

Method Used	Park Managers		Agricultural Managers	
	Number	Percent	Number	Percent
Mechanical	31	51	70	33
Foliar/Soil Herbicides	22	36	20	10
Hack-and-Squirt	36	59	8	4
Felling and Herbicides (stump treatment)	50	82	16	8
Biological Control	17	28	3	1
Biological Control + Other Method	13	21	0	0
Other Methods	3	7	4	2
No Controls	13	21	149	71

Table 6. Number of professional managers using various control methods and area of *Melaleuca* treated, 2003 and 1990-2003.

Method Used	Park Managers				Agricultural Managers				Total Area Treated 1990-2003
	Area Treated 2003		Area Treated 1990-2003		Area Treated 2003		Area Treated 1990-2003		
	#	Acres	#	Acres	#	Acres	#	Acres	Acres
Mechanical	20	4,592	22	14,669	43	1,367	37	1,957	16,625
Foliar/Soil Herbicide	15	15,802	15	36,267	15	185	8	355	36,622
Hack-and-Squirt	23	11,454	28	52,437	7	40	5	39	52,476
Felling + Herbicide	37	46,562	37	303,659	14	396	10	274	303,933
Biological Control	7	6,310	10	12,600	2	3	2	42	12,642
Biological + Other	4	4,242	6	80,575	0	0	0	0	80,575
Other Control	3	20	3	110	0	0	1	40	150
Total*	109	84,740	121	419,742	81	1,991	63	2,707	442,449

* Total area excludes biological plus other control methods to avoid double counting.

Table 7. Barriers to controlling *Melaleuca* by professional managers.

Barriers	Park Mangers		Agricultural Managers	
	Number	Percent*	Number	Percent*
No Melaleuca on property	17	28	227	74
Not a problem	8	13	96	31
Don't care	0	0	13	4
Infestations too small	5	8	28	9
Infestations too large	9	15	8	3
Controls won't work	0	0	3	1
Don't know how to use controls	7	12	3	1
No time to use controls	3	5	8	3
Afraid of harm	3	5	5	2
Afraid/Dislike	3	5	5	2
Infestation inaccessible	13	22	6	2
Lack equipment	5	8	16	5
Environmental regulations	2	3	4	1
No cost sharing	8	13	12	4
Controls too expensive	11	18	19	6
Other reason	19	32	14	5

Table 8. Usefulness of information received by professional land managers.

Source	Park Managers			Agricultural Managers		
	Useful	Somewhat Useful	Not Useful	Useful	Somewhat Useful	Not Useful
	Percent of Respondents			*Percent of Respondents*		
State/federal agencies	88	10	2	41	26	33
Professional organizations	77	19	5	37	20	43
Land manager observations	79	19	2	47	19	34
UF/IFAS Extension	88	10	2	61	16	23
Weed professionals	79	18	3	52	4	44
TAME Melaleuca	63	30	7	13	7	80
Land manager advice	81	15	4	47	20	33
Palmphlets or bulletins	62	33	4	26	41	33
Video cassettes or CDs	43	36	21	14	7	79
Area demonstration plots	53	29	18	0	21	79
Computer software	14	43	43	0	14	86
Website/Internet	79	15	6	40	16	44
E-mail/Direct notification	47	37	15	0	14	86
Other information source	75	25	0	21	21	57

Table 9. Costs of *Melaleuca* control reported by professional land managers, 2003.

Expense	Park Managers				Agricultural Managers			
	#	Sum	Mean	Max	#	Sum	Mean	Max
		($)	($)	($)		($)	($)	($)
Contract services	34	8,066,544	237,251	4,060,000	8	129,900	16,238	100,000
Labor	29	837,470	28,878	400,000	17	28,975	1,704	20,000
Equipment	26	308,428	11,863	225,000	18	17,855	992	5,000
Herbicides	33	796,401	24,133	425,000	19	21,610	1,137	15,000
Indirect	19	329,770	17,356	110,000	5	5,950	1,190	5,000
Other	7	527,500	75,357	500,000	1	500	500	500
Total		10,866,113				204,790		

Table 10. Negative impacts of *Melaleuca* reported by professional land managers.

Impact	Park Managers		Agricultural Managers	
	Number	Percent	Number	Percent
Reduced agricultural productivity	0	0	24	59
Lowered marekt value	0	0	8	20
Impaired ecological function	35	88	16	39
Diminished recreational use	14	35	16	39
Other impacts	4	10	8	20

Table 11. Reduction in utility due to Melaleuca infestation reported by professional land managers.

Impact	Park Managers				Agricultural Managers			
	#	Mean	Min	Max	#	Mean	Min	Max
		(%)	(%)	(%)		(%)	(%)	(%)
Reduced agricultural productivity	0				18	24	3	100
Lowered market value	0				6	11	5	20
Impaired ecological function	24	23	1	100	11	22	1	50
Diminished recreational use	8	23	1	100	12	25	5	100
Other impact	1	30	30	30	3	43	5	100

Table 12. Annual income or budget for land management by South Florida professional managaers, 2003.

Income/Budget Range	Park Managers		Agricultural Managers	
	Number	Percent	Number	Percent
Less than $50,000	17	30	105	55
$50,000–$99,000	4	7	12	6
$100,000–$249,999	6	11	22	12
$250,000–$499,999	5	9	3	2
$500,000–$999,999	3	5	5	3
$1,000,000 or more	16	29	12	6
Don't know	5	9	32	17
Approximate Amount Reported	Number	Mean	Sum	Max
		($)	($)	($)
Park Managers	14	650,386	9,105,400	4,385,000
Agricultural Managers	46	170,213	7,829,795	2,450,000