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Florida Nursery Sales and Economic Impacts of 14 Potentially Invasive Landscape Plant Species[1]

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Abstract

The Florida Nurserymen and Growers Association (FNGA) and the Florida Exotic Pest Plant Council (FLEPPC) recently asked nurserymen to stop production of 45 potentially invasive plant species that are relatively insignificant in the ornamental horticulture market. Controversies surround 14 additional species designated as invasive by the FLEPPC, but which are highly ornamental, widely used in landscaping, or have high economic value according to the FNGA. A mail survey of Florida ornamental nursery growers identified sales volume and value for each of these species. Economic output and employment impacts were calculated to determine the effect phasing-out these species may have on Florida's nursery industry. Total statewide sales of the 14 species were estimated at $45 million in 2001, with $34 million in-state and $11 million out-of-state. These sales translate into combined economic output impacts of $59 million and employment impacts of 800 jobs for Florida's economy, accounting for about 3% of total statewide output and employment impacts created by the ornamental nursery industry. These estimated impacts should not be interpreted as the expected industry loss from a phase-out of these species. If a species is not available for purchase, consumers will probably substitute alternative species, reducing the effect of any phase-out.

Index words: exotic plants, economic output impacts, employment impacts.

Species used in this study: Coral ardisia (*Ardisia crenata* Sims); Asparagus fern [*Asparagus densiflorus* Kunth (Jessop)]; Camphor tree [*Cinnamomum camphora* (L.) J. Presl]; Taro [*Colocasia esculenta* (L.) Schott]; Surinam cherry (*Eugenia uniflora* L.); Laurel fig (*Ficus microcarpa* L.f.); Lantana (*Lantana camara* L.); Chinese privet (*Ligustrum sinense* Lour.); Japanese honeysuckle (*Lonicera japonica* Thunb.); Heavenly bamboo (*Nandina domestica* Thunb.); Strawberry guava (*Psidium cattleianum* Sabine); Mexican petunia (*Ruellia brittoniana* Leonard ex Fernald); Beach naupaka (*Scaevola sericea* Vahl); Schefflera, Umbrella tree [*Schefflera actinophylla* (Endl.) Harms].

Significance to the Nursery Industry

This project assesses the economic significance of 14 potentially invasive landscape species to Florida's nursery industry and state economy. This research also provides prioritized recommendations for research to identify sterile or non-invasive cultivars or substitute species, based on the economic value of each of the species of concern. Findings may also provide direction for future economic research on invasive landscape plant species.

Introduction

An invasive plant species can be defined as a non-indigenous species that has the ability to establish self-sustaining, expanding populations and may cause economic and/or environmental harm (12, 16). Over the past 200 years, several thousand foreign plant and animal species have become established in the United States. It is estimated that about one in seven has become invasive, causing problems that cost the United States more than $138 billion each year. Invasive plant infestations cover 100 million acres in the United States and are spreading at a rate of 14 percent per year (1). According to information compiled by the Florida Governor's Office, a total of $90.8 million was spent by nine Florida state agencies to manage invasive plant and animal species in FY 1999–2000 (2).

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Although some invasive plants became established in the United States through natural migration or accidental introduction, many of the exotic North American invasive species, including some of the most damaging and costly invasive plants in Florida — Brazilian pepper (*Schinus terebinthifolius*) and Melaleuca (*Melaleuca quinquenervia*) — were purposely brought in for use as ornamental plants (4, 10). Invasive exotic plant species introduced for landscape use have collectively disrupted thousands of acres of natural ecosystems throughout Florida (9).

The Florida Exotic Pest Plant Council (FLEPPC) maintains a list of plants considered invasive in the state, each designated as Category I or Category II. Category I species are defined as invasive exotic plants that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. Category II species are defined as invasive exotics that have increased in abundance or frequency but that have not altered Florida plant communities to a significant extent. Category II species may be upgraded to Category I if ecological damage is demonstrated (5). The FLEPPC relies upon the expert opinions of specialists in botany and natural area management to assign plant species to Category I or Category II. In addition, the Invasive Plants Working Group in the University of Florida Institute of Food and Agricultural Sciences (IFAS) has developed an assessment mechanism that provides well-defined and consistent criteria for categorizing non-native plants that are invading natural areas in Florida (6). The Florida Department of Agriculture and Consumer Services (FDACS) is responsible for developing the official state list of noxious weeds and invasive plants, with the assistance of IFAS.

Florida ranks second in the United States in total grower cash receipts for floriculture and nursery crops, claiming

11.9% of total U.S. receipts in 2001 (3). As a national leader in ornamental plant production, the Florida environmental horticulture industry is aware of rising concerns over escaped non-native plants displacing native species and disrupting ecosystems. The Florida Nurserymen and Growers Association (FNGA) and the Tampa Wholesale Growers have endorsed the Saint Louis Declaration and the voluntary codes of conduct designed to curb the use and distribution of invasive plant species through self-governance and self-regulation by the groups concerned. FNGA has asked growers to voluntarily stop production of 45 ornamental plant species that are identified by the FLEPPC as invasive in Florida and that are considered relatively insignificant in the ornamental horticulture market (15). Controversies surround 14 additional ornamental plant species that are: 1) designated as Category I invasives by the FLEPPC, 2) widely used in landscapes, and 3) believed to be economically important to the nursery industry. If any of these species are declared invasive by FDACS, a phase-out may have significant consequences on the nursery industry and thus may adversely affect Florida's economy.

The purpose of this study is to assess the economic value and impacts of the production and sales by Florida's nursery industry of the 14 species of concern. This study does not address the invasive potential of any of the 14 species, but was designed to assess their economic significance to Florida's nursery industry and state economy. Results will be used to provide prioritized recommendations for research to identify sterile or non-invasive cultivars or substitute species, based on the economic value of each of the species of concern. Previous studies have evaluated the impact of invasive plant infestations from a *cost* perspective, e.g., costs of control of invasive plants on public lands or crop losses associated with non-native weeds (13, for example). To our knowledge, no impact studies have addressed the economic *value* of invasive or potentially invasive ornamental plant species. This survey design and analysis may be used as a template for similar economic impact research across the nation.

Materials and Methods

Survey development. A mail survey instrument and cover letter were mailed in February 2002 to all ornamental nurseries in Florida registered by the Division of Plant Industries (DPI) in FDACS, with the exception of those designated as 'exempt' or 'own use only'. A total of 5674 nurseries were included in the mailing, 36% of which were wholesale businesses, 36% retail, and 28% classified as both wholesale and retail. A thank you/reminder postcard was mailed to each nursery one week after the survey.

Growers were asked to provide general information about their business. These data included the location of the nursery, the size in terms of employees and total annual sales, and the distribution of sales to various wholesale and retail outlets, by region within Florida and out-of-state. Growers were then asked to indicate which of the 14 potentially invasive ornamental species are currently grown or sold by the nursery and, for each of the species currently grown or sold, to indicate total sales of that species and the distribution of those sales by in-state region and out-of-state. The study determined sales and impacts at the species level and did not discriminate between cultivars.

Economic output and employment impact analysis. Economic impacts are a measure of the total effect on a local economy of changes in output of local industries. The total impact is the sum of *direct effects* (which represent the direct output and employment of the industry), *indirect effects* (which result from reverberations in supporting industries), and *induced effects* (which capture changes in local spending and employment that result from changes in directly and indirectly affected industries). Only non-local (in this study, out-of-state) sales contribute indirect and induced effects as 'new' money is brought into the local (state) economy. These impacts were calculated using output and employment multipliers for the nursery production and retail sectors of the Florida horticulture industry produced by *IMPLAN Pro* software and databases (7, 8).

Only reported sales that were characterized in terms of percent wholesale in-state, percent wholesale out-of-state, and percent retail were included in the impact analysis, since the effect is different for each outlet. All retail sales were assumed to be local and, hence, to have only direct economic effect on the state economy. An error in this assumption may work to underestimate impact slightly, as export sales have a greater impact on the local economy than do local sales. However, retail sales are low for most of the species (data not shown), so the effect should be small. It was further assumed that reported retail sales were of nursery stock that had been cultivated in-house rather than purchased wholesale and resold retail. Thus, the full retail sales value was considered output rather than adjusted to reflect the customary 30% gross margin on retail sales. This will tend to inflate impact estimates although, again, the effect should be small.

Results and Discussion

Survey response rate. Of the 5674 landscape nurseries included in the mailing, 1110 nurseries (20%) responded, but only 946 (85% of respondents) indicated that they were currently active.[5] About one-half of these nurseries (52%) were located in central Florida, 32% were located in south Florida, and 16% were in north Florida, which mirrored the geographic distribution of the mailing list. Only 21 surveys were returned by the postal service as undeliverable.

Current nursery sales of the 14 species. About 37% of responding nurseries indicated they grow or sell at least one of the named species, with 11% growing only one of the 14 species and 0.1% (a single nursery) selling all 14 species. The percent of respondents who grow each species is shown in Table 1, with mean and standard deviation of reported sales. *Lantana camara* is grown by 19.0% of responding nurseries, the highest percentage growing any of the named species, with 10% or more of nurseries growing or selling *Ruellia brittoniana* (15.9%), *Nandina domestica* (14.9%), *Asparagus densiflorus* (13.0%), or *Schefflera actinophylla* (10.0%). One or more growers reported total sales in excess of $100,000 for each of *Ardisia crenata*, *Ficus microcarpa*,

[5]The response rate, while typical for mail surveys of businesses, may have been affected by the controversies associated with sales of invasive ornamental plants in Florida. By chance, administration of the survey occurred at a time when some elements of the nursery industry were disturbed by pressures in Palm Beach County, FL, to pass an ordinance prohibiting the production, sale, installation and shipping of over a hundred plant species the county deemed invasive, including the 14 species named in this survey (14).

Table 1. Number and percent of responding Florida growers who sell each species, mean and standard deviation of reported annual sales, and maximum reported single grower annual sales of each species.

Species	No. and % respondents who grow or sell species	Mean reported annual sales ($)	Standard deviation of reported annual sales	Maximum reported annual single grower sales of species ($)
Ardisia crenata	50 (5.3%)	19,500	53,100	200,000
Asparagus densiflorus	123 (13.0%)	4,400	13,400	77,600
Cinnamomum camphora	62 (6.6%)	3,200	8,800	50,000
Colocasia esculenta	32 (3.4%)	4,300	18,500	85,100
Eugenia uniflora	85 (9.0%)	4,000	10,300	65,000
Ficus microcarpa	35 (3.7%)	17,000	50,000	220,000
Lantana camara	180 (19.0%)	22,000	132,800	1,400,000
Ligustrum sinense	83 (8.8%)	2,800	7,900	50,000
Lonicera japonica	51 (5.4%)	300	700	3,000
Nandina domestica	141 (14.9%)	3,200	6,300	30,000
Psidium cattleianum	79 (8.4%)	7,000	17,400	100,000
Ruellia brittoniana	150 (15.9%)	9,500	37,100	370,000
Scaevola sericea	28 (3.0%)	3,600	7,300	25,000
Schefflera actinophylla	95 (10.0%)	17,600	61,600	384,000
Total	345 (36.5%)			

Psidium cattleianum, *Ruellia brittoniana*, and *Schefflera actinophylla*, and single-grower reported sales of *Lantana camara* exceeded $1 million. On average, among growers who sell one or more of the 14 species, combined sales associated with these species account for about 5% of the grower's total sales. The distribution of sales of these 14 species is highly skewed across the population of Florida nursery growers, as evidenced by the large standard deviation in reported sales (Table 1) and the geographic clustering of sales (data not shown). Thus, a ban on production of any of these species will have a differential effect among growers, depending on their size, location, and specialization.

Estimated statewide nursery sales of the 14 species. Based on the survey response, it is estimated that 4818 nurseries were operational at the time of the survey.[6] This estimate is quite comparable to the number of Florida nurseries that reported sales in the USDA 1997 Census of Agriculture (11). When census figures are adjusted to exclude producers of plant products exempt from registration with Florida's DPI, the total number of nurseries in the census is between 4281 and 5121.

Of the 946 active nurseries responding, 708 nurseries disclosed their total annual sales for 2001. Further economic analyses were done on the 655 nurseries that characterized those sales by outlet. Mean annual reported sales for those 655 growers was $716,832. Expanding this mean to a population of 4818 nurseries yields estimated statewide total industry sales of $3.45 billion. However, the distribution by sales category for responding growers was statistically different by chi-square analysis ($p < 0.0005$) from that reported by the USDA in the 1997 Census of Agriculture for nursery and greenhouse crops grown and sold in Florida (11). Responding nurseries in this survey were significantly more likely to report annual sales of $100,000 or more (Table 2). Response to the USDA census was mandatory, so the departure from the census distribution for annual sales suggests a non-response bias in this study. To compensate for this apparent bias, reported sales were weighted to achieve the distribution shown in the census. With this revision, mean annual nursery sales fall to $333,398 and estimated total industry sales are $1.61 billion. This estimate is consistent with the 1997 census report of industry sales between $1.14 billion and $1.45 billion (again adjusting census figures to exclude plant products exempt from registration with DPI).

Table 3 shows estimated statewide sales of the 14 species of interest, based on sales as reported by responding growers and weighted as indicated in Table 2. Table 3 also shows the percentage of total statewide industry sales accounted for by sales of each species. With either calculation, only sales of *Lantana camara* account for more than 1% of total industry sales, and the combined sales of all 14 species account for about 2.8% of total industry sales.

Economic impact of Florida nursery sales of the 14 species. Total annual sales were characterized sufficiently for economic impact analysis by 655 responding growers, but within that group the number of respondents indicating they grow or sell each species and the number reporting and characterizing their sales of that species varied. Analysis of variance revealed no statistically significant difference in reported sales of each species among those growers who characterized their sales of that species by outlet and those who did not. Thus, exclusion of those growers who did not characterize their sales should not compromise these calculations. These estimates of economic impact are based on the *revised*

Table 2. Distribution of reported total annual sales for responding Florida growers compared to distribution in 1997 Census of Agriculture, with weight applied to reported sales to correct for apparent non-response bias.

Reported annual sales	% Responding nurseries	% Nurseries in 1997 census	Weight applied to reported sales
$1–$2,499	10.8	10.4	0.97
$2,500–$9,999	9.2	18.3	1.99
$10,000–$39,999	17.1	24.2	1.41
$40,000–$99,999	12.2	15.9	1.31
$100,000–$199,999	12.1	10.3	0.86
$200,000–$499,999	15.6	9.7	0.62
$500,000–$999,999	8.4	5.1	0.60
$1,000,000 or more	14.7	6.0	0.41

[6]Surveys were mailed to all 5674 certified FL nurseries, but 21 were returned as undeliverable. Of 1110 that responded, only 946 were active. Thus we estimate (5674 – 21) × (946 / 1110) active nurseries.

Table 3. Estimated sales of the 14 potentially invasive species in Florida, based on reported sales and revised reported sales weighted as shown in Table 2.

Species	Est. statewide total sales ($1,000)	Species % of est. total industry sales	Revised est. statewide total sales ($1,000)	Species % of revised est. total industry sales
Ardisia crenata	5,044	0.15	2,480	0.15
Asparagus densiflorus	5,173	0.15	3,000	0.19
Cinnamomum camphora	923	0.03	579	0.04
Colocasia esculenta	2,027	0.06	868	0.05
Eugenia uniflora	2,042	0.06	1,029	0.06
Ficus microcarpa	653	0.02	372	0.02
Lantana camara	40,856	1.18	17,774	1.11
Ligustrum sinense	1,790	0.05	1,321	0.08
Lonicera japonica	107	0.00	69	0.00
Nandina domestica	3,247	0.09	1,940	0.12
Psidium cattleianum	3,446	0.10	1,835	0.11
Ruellia brittoniana	11,977	0.35	5,643	0.35
Scaevola sericea	1,730	0.05	728	0.05
Schefflera actinophylla	16,424	0.48	7,480	0.47
Total sales – 14 species combined	95,439	2.76	45,118	2.81
Total industry sales	3,453,696		1,606,309	

reported sales, weighted as indicated in Table 2 to compensate for apparent non-response bias. Finally, it is very important to note that all sales and impact calculations ultimately depend on estimates of mean sales, the standard deviations of which are quite large in the survey sample (refer to Table 1).

Economic output and employment impacts associated with sales of each of the species are shown in Table 4. Total economic output impact is greatest for *Lantana camara* at about $21 million, followed by *Schefflera actinophylla* at $13 million and *Ruellia brittoniana* at about $6 million. Research to identify sterile cultivars or suitable replacements of these three species, in particular, may be warranted in the event that they are deemed invasive by FDACS. Both *Lantana camara* and *Schefflera actinophylla* were subjected to the IFAS Assessment mechanism, with conclusions that they should not be used in central and south Florida. For North Florida, it was recommended to use *Lantana camara* with caution (this will be reassessed in two years), whereas *Schefflera actinophylla* was deemed okay to use. *Asparagus densiflorus* and *Ardisia crenata* also have substantial output impacts of almost $5 million each.

Economic output impact is lowest for sales of *Lonicera japonica*, at about $71,000. This data suggests that production and sales of *L. japonica* could be phased out with little effect on the nursery industry or Florida's economy. Total combined economic output impact for all 14 species is $59 million. Economic output impacts for the entire Florida ornamental nursery industry were calculated in the same way, based on revised sales, at about $2 billion, so these 14 species account for 2.8% of total nursery industry economic impact.

Employment impacts are estimated from the weighted reported sales for each species. The largest number of jobs, 288, is associated with sales of *Lantana camara*, followed by 174 associated with sales of *Schefflera actinophylla*. Sales of *Lonicera japonica* result in only 1 job. The total employment associated with sales of the 14 species combined is estimated to be 814 jobs. Employment associated with total nursery industry sales was calculated at about 31,000 jobs.

Table 4. Economic output and employment impacts of Florida landscape nursery sales of 14 potentially invasive species.

Species	Species total output impact ($1,000)	Species % of total industry output impact	Species total employment impact (jobs)	Species % of total industry employment impact
Lantana camara	20,929	0.98	288	0.94
Schefflera actinophylla	12,802	0.60	174	0.57
Ruellia brittoniana	5,735	0.27	79	0.26
Asparagus densiflorus	4,874	0.23	66	0.22
Ardisia crenata	4,804	0.23	65	0.21
Nandina domestica	2,347	0.11	33	0.11
Psidium cattleianum	1,838	0.09	26	0.08
Ligustrum sinense	1,572	0.07	22	0.07
Colocasia esculenta	1,506	0.07	20	0.07
Eugenia uniflora	1,029	0.05	14	0.05
Scaevola sericea	792	0.04	11	0.04
Cinnamomum camphora	591	0.03	9	0.03
Ficus microcarpa	389	0.02	5	0.02
Lonicera japonica	71	0.00	1	0.00
Total impact – 14 species combined	59,281	2.78	814	2.66
Total industry impact	2,135,326		30,618	

Thus, the 14 species combined account for 2.7% of employment associated with the ornamental nursery industry.

The impacts estimated here measure economic activity associated with current sales of these species and should not be strictly interpreted as the expected loss to the industry in the event of a phase-out of production and sales of these species. If one or more of these species are not available for purchase, alternative species will likely be substituted by the consumer, reducing the effect of a phase-out. However, the market potential of alternative species has not been evaluated.

In summary, as a group, the 14 species of potentially invasive landscape plants evaluated in this study have substantial value to the nursery industry. Total statewide sales of the 14 species were estimated at $45 million in 2001, with $34 million in-state and $11 million out-of-state. These sales translate into combined economic output impacts of $59 million and employment impacts of 814 jobs for Florida's economy. While the economic output and employment impacts of these 14 species are considerable, they represent only a small fraction (3%) of the total impacts of Florida's landscape nursery industry. The economic output and employment impacts estimated in this study should not be used as the sole economic basis for establishing new government policies or regulations. Resource regulation and policy decisions should be based on objective evaluations of the relative total benefits versus total costs of any proposed new policy. Several important categories of costs were not evaluated in this study, but must be considered in policy-making, including the costs of control of these species in natural environments and on private property, and the costs of implementation and enforcement of any regulatory actions.

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