LOCAL GOVERNMENTS IN HABITAT RESTORATION: CASE STUDY OF 3-ACRE HARDWOOD SWAMP RESTORATION PROJECT BY THE CITY OF ST. PETERSBURG

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ABSTRACT

This paper presents the purpose, methodology and results of a 3-acre hardwood swamp habitat restoration project undertaken by the City of St. Petersburg, Florida. This project is part of an ongoing environmental enhancement program begun by the City in 1988. The project consultant is the DSA Group, Inc. The project includes removal of approximately 2 acres of Brazilian pepper (Schinus terebinthifolius) monoculture, herbicide treatment, dredging a 0.5 acre (0.2 hectare) man-made pond, and planting approximately 750 native trees, shrubs and herbaceous plants in the area.

The project was completed between February and July, 1990 and is in a 3-year maintenance and monitoring program. Regeneration of Brazilian pepper is minimal. The success rate for the 17 tree and shrub species planted ranges from 20% for shrubs to >100% for aquatic plants in the newly-dredged pond.

The unique features of the project include its role as part of an ongoing municipal government habitat restoration program, the restoration of a marginal quality hardwood (red maple/sweet bay) swamp, the consideration of a variety of exotic plant control methods, the use of labor force from a non-profit agency (a residential treatment facility for adjudicated youth), and the involvement of the local government instead of a private contractor to perform the permitted dredging work. Of particular applicability to other habitat restoration projects is the methodology for treatment of Brazilian pepper and the cost effectiveness of the labor source for hand removal. Problems encountered in this project include permitting delays, access to the site, which is located in a public park, and rapid colonization by volunteer herbaceous plants upon release of the Brazilian pepper canopy.

INTRODUCTION

Encroachment by the invasive exotic species Brazilian pepper (Schinus terebinthifolius) into native Florida ecosystems has been documented by

local, state and federal agencies. The species was first introduced to Florida during the mid-1800's as an ornamental shrub (Ewel et al., 1982). Since that time it has become widespread throughout Florida due to edible berries and distribution of the seeds by birds (Myers & Ewel, 1990). An opportunistic species, it is most likely to invade areas disturbed by human activity such as grading, dredging or agricultural use (Cassani, 1986). It is a highly adaptable species, outcompeting native vegetation for available sunlight, water, space and nutrients. It provides minimal wildlife value for shelter, nesting sites or food source. The wood has no commercial value and its tendency to form a monoculture limits vegetation and wildlife diversity.

Efforts to control Brazilian pepper have been expensive, with limited effectiveness. Don Schmitz, chair of the Florida Exotic Pest Plant Council, indicates Florida has spent more than $112 million since 1980 to combat exotic plants. Mechanical and chemical treatments to control Schinus are highly labor intensive. There is no funding for a consolidated statewide effort to eradicate Brazilian pepper, despite its threat to native ecosystems which support resources such as aquifer recharge and commercial and recreational fisheries. A prolific seed source and natural threats to native vegetation (fire, drought, freeze) make areas cleared of Schinus vulnerable to reinvasion (Ewel et al., 1982).

The City of St. Petersburg has documented loss of environmental preservation areas due to Brazilian pepper encroachment from 1977 to 1989 at approximately 3.7 acres (1.5 ha). The City designated areas on private and public property as environmental preservation based on presence of the 100 year flood plain, depth of water table and vegetation. Approximately 200 environmental preservation areas were established in 1977, totaling about 1400 acres (566.6 ha). There has also been significant encroachment of Brazilian pepper in areas which retain the environmental preservation status. Loss of preservation acreage to Brazilian pepper (3.7 acres/1.6 ha) rivals loss of preservation acreage to permitted development 3.8 acres/1.5 ha). Until 1988, the City had no dedicated funding source to control Brazilian pepper on city-owned environmental preservation areas. Since this time, the City has also made eradication of Brazilian pepper from preservation areas a condition for development approval on private property.

In 1987, the City of St. Petersburg sold property to Pinellas County for enlargement of the Resource Recovery Plant between 28th Street and I-275, south of Roosevelt Boulevard. Of the property sold, several areas were environmental preservation. To mitigate the loss of these preservation areas, the City identified the capital from the sale of the preservation areas ($1.32 million) to be placed in an interest bearing account. The annual interest from this capital is directed by City Council to be used for environmental enhancement projects such as urban forestry and habitat restoration. In March, 1988 the City Council approved a resolution directing administration to implement the Environmental Enhancement Program. The Planning Department developed a multi-year plan which identifies annual habitat restoration projects. In

August, 1990 the City Council adopted the City's Urban Forestry Plan, also funded through the Environmental Enhancement Fund.

In May, 1989 the City issued a request for proposals for the first project to be implemented through the Environmental Enhancement Program. The purpose of the project is to restore a 3-acre hardwood swamp at Boyd Hill Nature Park through elimination of Brazilian pepper and revegetation of native plant species. The City sought innovative and cost efficient means to accomplish this purpose. The park is located on the south border of Lake Maggiore in south St. Petersburg. The hardwood swamp system had been severely encroached by Brazilian pepper. In July, 1989 the City chose the DSA Group, Inc. to conduct this project. DSA Group, Inc. identified the Pinellas Marine Institute (PMI), a residential program for adjudicated youth, as a subcontractor for the Schinus removal task of this project.

STUDY SITE

The study site (Figure 1) is an approximately circular area of 3 acres within the Boyd Hill Nature Park in St. Petersburg. Boyd Hill Nature Park is a 216-acre (87.5 ha) environmental education and passive recreation area operated by the City of St. Petersburg Leisure Services Department. The park is located on the south and west shore of Lake Maggiore, which, at 385 acres (155.8 ha), is the largest lake in St. Petersburg. Boyd Hill Nature Park includes six distinct natural ecosystems, including the unusual hardwood swamp and sand pine scrub communities. This project is located immediately adjacent to a picnic area, at the southeast corner of the park.

The site was chosen for habitat restoration due to its location on public property, its high visibility and the related educational opportunity, its location adjacent to good quality hardwood swamp habitat, and its high degree of Brazilian pepper encroachment. This project was ranked first on the county restoration priority list due to the scarcity of hardwood swamp habitat in southern Pinellas County. Other than Boyd Hill Nature Park, the only remaining portion of this once commonly occurring habitat in southern Pinellas County is within Sawgrass Lake Park.

City desired to maintain public access to the adjacent boardwalk during construction, while chainsaw crews cut and removed Schinus. The problem was addressed by using two access points to the project area. Cut material was removed to the south for the majority of the work; only a limited area of Schinus was removed through the pedestrian access area.

The site includes several distinct features: An approximately 0.5-acre (0.2 ha) man-made pond, a natural stream and an approximately 2.5-acre (1 ha) low swampy area. Figure 1 is a map of the site indicating features and vegetation. Vegetation in the pond was a monoculture of large (6'-9'/1.8 m-2.7m) Primrose willow (Ludwigia peruviana) and infrequent, immature Punk (Melaleuca quinquenervia) trees. A fringe of

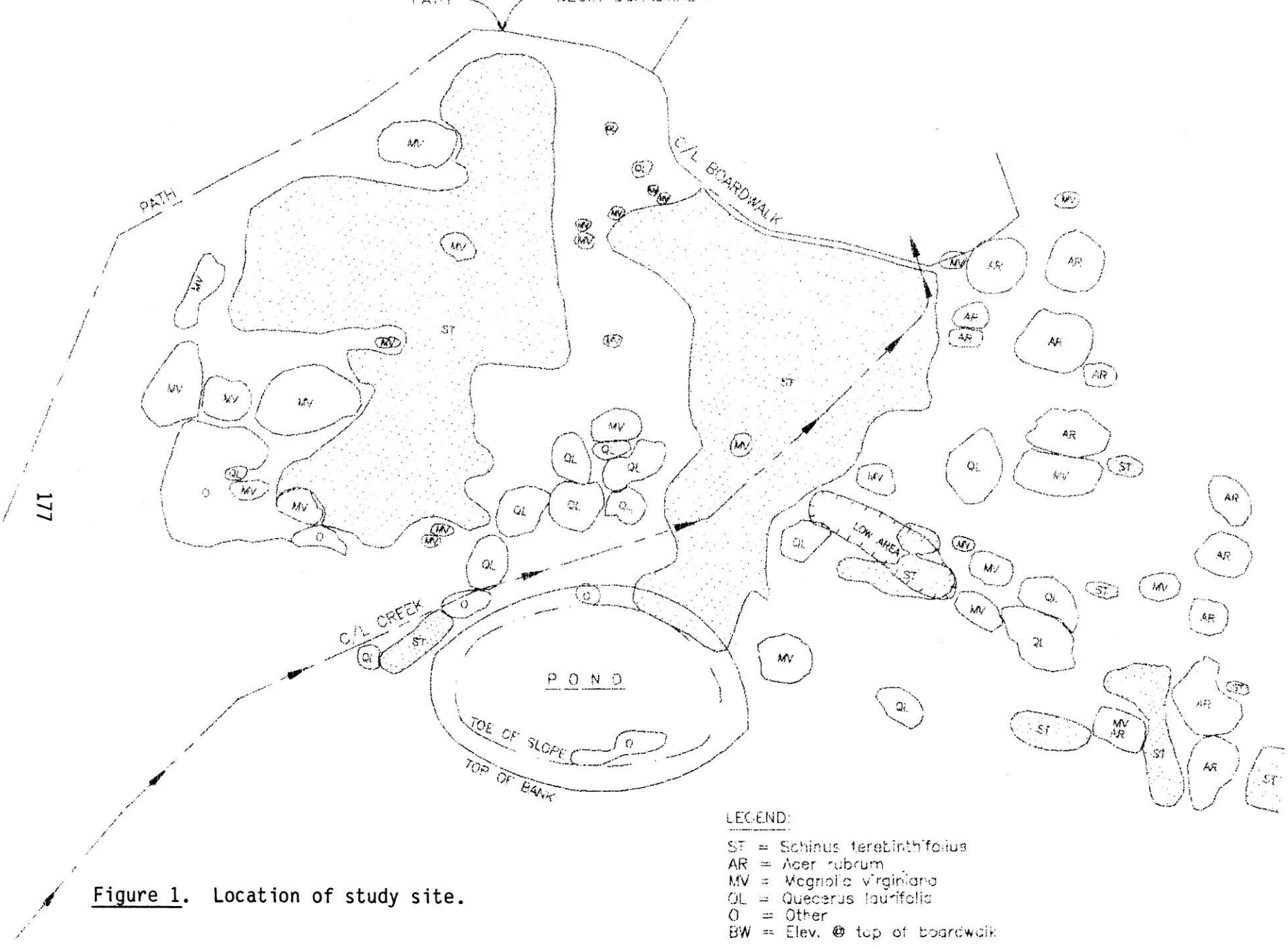

Figure 1. Location of study site.

mature Coastal Plain willow (Salix caroliniana) also exists. The pond water depth was 1"-4" (2.5 cm-10.2 cm), with an underlying layer of loose organic material of approximately 1' (30.5 cm) depth. A small stream traverses the site, carrying water from the low density residential area to the south of Boyd Hill Nature Park, through the Park, to Lake Maggiore. The creekbed has a typical elevation of 0.8' (24.4 cm), with top of bank elevation of 4.9' (1.5 m) where the stream flows next to the pond. The elevation change from stream bed to top of bank decreases in the remainder of the site. In this swamp area, high creek elevations sheet flow across the swamp floor, leaving standing water in this area during the summer rainy months. Vegetation in the swamp area is dominated by Brazilian pepper, with infrequent mature sweet bay magnolia (Magnolia virginiana) and red maple (Acre rubrum). The herbaceous layer was negligible, shaded out by a solid canopy of Schinus. An exotic vine, Syngonium spp., existed in the project area as a ground cover and climbing vine on the mature Sweet Bay trees. Elevations in this area ranged from 1.5' (45.7 cm) to 3.4' (103.6 cm) above mean sea level.

Water depth in the study site is controlled by the elevation of Lake Maggiore and by water inflow from adjacent areas. The lake level is regulated by a control structure where 9th Street South crosses Salt Creek. The mean lake stage elevation is 1.43' (43.6 cm). The lake elevation was lowered through control structure manipulation during this project to expose larger littoral areas for mosquito control. The stream which flows through the study site has a constant baseflow of an average 4"-6" (10.2 cm-15.3 cm) depth. During heavy rains, the creek rises several feet within an hour, scouring the creek banks of vegetation and sheet flowing across the swamp floor.

MATERIALS AND METHODS

This project was divided into two phases: Work in the swamp area consisting of removal of Brazilian pepper and replanting with native vegetation; and work in the man-made pond consisting of dredging vegetation and organic material from the pond and replanting with native vegetation. All work was conducted between February 20 and July 27, 1990.

Prior to commencement of work, vegetation and elevation surveys were conducted, and field meetings were held with representatives of permitting agencies (Southwest Florida Water Management District, Florida Department of Environmental Regulation, Army Corps of Engineers). The original concept for Brazilian pepper management in this site was control of water elevation by placing a structure along the creek. This idea was not endorsed by the permitting staff of the DER and was subsequently eliminated from the project. A permit application was submitted to DER on March 23, 1990 for dredging work in the pond. The permit was issued on June 19, 1990. Permit applications were completed and submitted to SWFWMD and ACOE; each agency determined permits were not required. No permit was required from the Department of Natural Resources.

In the first phase of the project, Brazilian pepper was removed from

the swamp area. Figures 2 and 3 indicate views of this site before and after, respectively, the Schinus was removed. Trees were cut with chainsaws and removed from the area by hand. The vegetation was stored for later transport to the Pinellas County Resource Recovery Plant, an incinerator which burns refuse to provide energy. Tipping fees to dispose of this material totaled $3,500. All cut stumps were immediately treated with a 50% solution of Garlon 3A, mixed with water. Treated stumps were marked with orange paint for easy future identification. This phase also included removal of the vine Syngonium from mature trees by girdling the fibrous mat circling the tree. With a crew of nine youths from PMI and two chainsaw operators, approximately 80% of the Brazilian pepper was removed in eight work days. The PMI crew provided 664 hours of labor, at a cost of $6,428. The cost for chemicals to treat cut stumps throughout the project (20 gallons/75.8 liters Garlon 3A, 2 gallons/7.58 liters Roundup) totaled $1,550.

Figure 2. View into project area from boardwalk prior to Brazilian pepper removal.

Figure 3. View from same position as Figure 2 after Brazilian pepper removal.

During March the remainder of the Schinus was removed from the swamp area and on March 30 the area was planted with 228 trees and shrubs (Table 1). Trees planted were 3-5 gallon (11.4-18.95 liter) size and shrubs were 1 gallon (3.79 liter) size. The plants were purchased from a native plant nursery in Pinellas County and were planted by the PMI crew who did the removal work. Total cost for the plants was $1,215. Two plant species, red maple and sweetgum, were provided by the City's horticultural operations division. These trees had been grown in near proximity to the project site and were approximately 10 gallon size. Species for planting were chosen based on known tolerance of water elevations and appropriateness for the hardwood swamp habitat. A diversity of tree and shrub species was selected, with the goal of forming a dense canopy quickly, to replace the Schinus canopy removed.

Table 1. Species planted in swamp area, March 30, 1990.

Species	Common Name	Tree/ Shrub	Number
Acer rubrum	Red maple	tree	25
Gordonia lasianthus	Loblolly bay	tree	25
Ilex cassine	Dahoon holly	tree	29
Liquidamber Styraciflua	Sweetgum	tree	30
Nyssa sylvatica	Swamp tupelo	tree	17
Quercus laurifolia	Laurel oak	tree	16
Quercus nigra	Water oak	tree	15
Ulmus americana	Florida elm	tree	16
Taxodium ascendens	Pond cypress	tree	38
Myrica cerifera	Wax myrtle	shrub	20
Ilex glabra	Gallberry	shrub	11
Lyonia lucida	Fetterbush	shrub	10
Rhapidophyllum hystrix	Needle palm	shrub	8

Inspections of the swamp area and additional treatment of Brazilian pepper stumps occurred during May and June. Regeneration of Schinus was very limited, indicating high success of Garlon 3A treatment. Several cut stumps which had not been treated were identified and treated. Minimal seed sprouting was noted. Inspections of the plantings included baseline data at the time of planting and installation of numbered aluminum tags on each plant to facilitate future project monitoring. The first quarterly monitoring event was conducted in June.

The second phase of the project, dredging of the man-made pond, began on July 5. Figure 4 is a "before" picture of the pond. This work was conducted by the City's General Maintenance Department, using city equipment and staff. To facilitate removal of vegetation and the underlying organic layer, an access road was constructed into the circular pond. The road consisted of fill dirt and shell. This allowed equipment to set up in the center of the pond and reach the pond edges to remove vegetation and organic material. Figure 5 shows this work in process. This work took 7 days. A gradall was positioned on the access road in the pond to scoop out organic material and place it into waiting dump trucks. The material was transported to the City's equipment yard on the northwest side of Lake Maggiore, where it was allowed to de-water. The gradall then removed the road as it worked back from the center of the pond to the edge. The last task was to remove organic material from the pond edges and regrade the pond bank. This was completed by the gradall from immediately adjacent to the pond edge. The mature Willow trees along the pond bank were able to be preserved due to extremely delicate work by the gradall. Figure 6 shows the pond after this work was completed.

Figure 4. View of man-made pond prior to excavation.

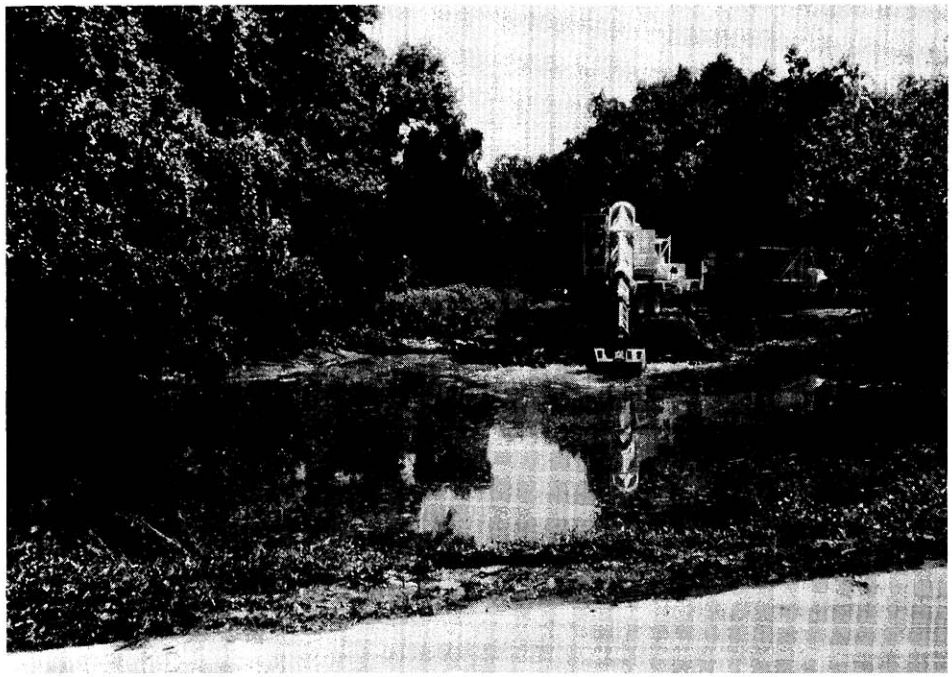

Figure 5. View of man-made pond during excavation. Gradall is removing fill road created in pond to reach perimeters of pond.

Figure 6. View of man-made pond with dredging complete. Note high turbidity and preservation of existing Willow trees.

Water quality in the pond immediately after dredging showed extremely high turbidity. This condition diminished within 5 days. On July 24, the pond was planted with vegetation indicated in Table 2. The vegetation was purchased from two native plant nurseries in the Tampa Bay area and was planted by a crew from PMI. Cost of plant material for the pond was $1,060. Cost for the planting crew was $271. Since the planting, the quarterly monitoring for species survivorship and Schinus recurrence has continued. The following section summarizes survival and regeneration data.

Table 2. Species planted in man-made pond, July 24, 1990.

Species	Common Name	Size	Number
Fraxinus caroliniana	Pop ash	15 gal.	10
Taxodium ascendens	Pond cypress	15 gal.	20
Pontederia cordata	Pickeralweed	2" cells	400
Thalia geniculata	Arrowroot	2" cells	20
Nymphaea odorata	Water lily	bare root	10

RESULTS AND DISCUSSION

Species Survival and Condition

Table 3 presents survival and growth (height) data for selected tree species planted in the wooded wetland area. The pond cypress (Taxodium ascendens) had the highest survivorship and growth rate, 97% and 71%, respectively. The American elm (Ulmus americana) had the second highest average for survivorship at 81% and the third highest growth at 64%. The majority of the other tree species had survivorship rates that averaged approximately 70%; Loblolly bay (Gordonia lasianthus) was an exception to this general trend with a survivorship of 21%. The reason or reasons for the high mortality of this species are not entirely clear, but the occurrence of very dry weather following planting was certainly a major factor that led to this poor survivorship.

Many of the plants installed were relatively large size. During this first year of monitoring, fruiting and subsequent seed production was noted for some individual red maples, most Dahoon holly, and some pond cypress. The viability of the seeds produced was not determined, and except for red maple none of these species have recruited to the area as yet. Seed viability investigations are planned for this year.

Table 3. Survivorship and growth of selected tree species.

Species	Common Name	Survivorship*	Growth**
Acer rubrum	Red maple	70%	14%
Taxodium ascendens	Pond cypress	98%	71%
Ulmus americana	American elm	81%	64%
Quercus laurifolia	Laurel oak	75%	36%
Nyssa sylvatica	Swamp tupelo	65%	19%
Liquidamber styraciflua	Sweetgum	66%	13%
Ilex cassine	Dahoon holly	90%	26%
Gordonia lasianthus	Loblolly bay	21%	7%

* survivorship is based on complete consensus
** growth rate calculated as differences in height between baseline and monitoring event

Seedling Recruitment

Monitoring the colonization of the area by various tree and herbaceous species is a continuing part of this project. During the first phase of this project, the large areas that had been Schinus monocultures were replanted with native trees and shrubs. The Schinus canopy removal allowed several vines, including the introduced Syngonium, to proliferate

in the study area. To combat this problem a herbicide maintenance program was initiated. Herbicide treatment was necessary because of the growth habit of Syngonium. This species has nodes scattered all along its stem. Attempts at hand removing this species had been made as part of a past work program in the Park. The net result had been an increase in the density of Syngonium because of the broken stems and nodes. Treatment of this species required a concerted program usually requiring two herbicide applications. This extended control program therefore may have somewhat limited recruitment of desirable vegetation during the first portion of this program. Recent monitoring events indicate that tree seedling recruitment is occurring in the area. Seedling species noted thus far include red maple (Acer rubrum, Laurel oak (Quercus laurifolia), Hackberry (Celtis laevigata), and Laurel cherry (Prunus caroliniana). In addition, Lizard's tail (Saururus cernuus) has reestablished large populations in much of the site, and this spring numerous Jack-in-the-pulpit (Arisaema triphyllum) were also observed in areas that were previously dominated by Syngonium.

Recurrence of Brazilian Pepper

Because there are proximal seed sources for Schinus, some recruitment has occurred. Presently, seedling recruits have been found in two small areas. Both occurrences were very localized, and may reflect bird roosting areas. Approximately 25 seedlings were removed during the first year after project completion. This serves to illustrate an importance that continued monitoring and maintenance is required, especially if proximal seed sources exist. An additional program to further extend the area of control of Schinus will be conducted by the City in 1991-1992. This additional area is located near this project, and once completed will greatly extend the aerial extent of a "Schinus free zone" at Boyd Hill Nature Park.

Brazilian Pepper Treatment Methods

As mentioned earlier, several methods were originally considered for treatment of Schinus. The original proposal was installation of a control structure on the creek to pond water in the swamp are. This proposal was eliminated from consideration due to concerns expressed by permitting staff of the Florida Department of Environmental Regulation. Other treatment methods such as prescribed burn and mechanical clearing were eliminated from consideration due to the location of the project site in a swampy area. Selection of a chemical for Schinus treatment was made after numerous consultations with regional and national habitat restoration and chemical application experts.

Project Cost

Total cost for this project to date is $44,266. This includes the cost of the project consultants for design, survey, supervision, permit application, and monitoring costs. It also includes the labor of Pinellas

Marine Institute crews for Schinus removal and planting native vegetation, permit application fees, blueprint costs, chemicals for Schinus treatment, vegetation planted, and miscellaneous materials. This cost was paid for by the City from the Environmental Enhancement Fund. Maintenance of exotic plant exclusion and project monitoring will continue through July, 1993. The project is within the established budget.

Cost Minimization Through Use of Non-profit and City Labor

A primary goal of the City's Environmental Enhancement Program is to conduct habitat restoration projects, using the most cost efficient and effective labor and materials available. This was accomplished by hiring the Pinellas Marine Institute to provide labor for Schinus removal and planting, and by using City staff and equipment for dredging the pond. Both these efforts proved extremely successful and established excellent working relationships with these organizations. Future habitat restoration projects conducted by the City will include participation by these organizations.

Permitting Considerations

Time frames associated with agency permit reviews for habitat restoration projects generally follow the procedures prescribed by the Florida Administrative Code for the State of Florida Agencies and the Code of Federal Regulations for Federal Agencies. Project design and project time schedules need to include an estimate of the time required to process the appropriate environmental permits. These considerations, i.e., time frames, may provide an incentive to modify the project design to eliminate permit requirements.

The effort expended within this project for permitting highlight the advantages of establishing a separate set of permitting procedures to review habitat restoration projects on a "fast track" program. Presently, manpower shortages and extreme workloads within regulatory agencies preclude this approach. Therefore, if a project will require permits, the project schedule needs to reflect the potential permitting time lag in putting the project in the ground.

CONCLUSIONS

This project initiated the City of St. Petersburg's habitat restoration program, funded by a local government revenue source dedicated to environmental enhancement. The program provided many opportunities to the City, including educational, public relations, habitat restoration project management and implementation experience, improved wildlife habitat and reduction of the Schinus seed source. The program is also an excellent funding source available to match regional and state funding for larger projects.

The experience of this project has provided many guidelines for future projects, including: The need for ongoing maintenance of invasive exotic species, the need for control of rapid colonization by volunteer herbaceous species when a canopy is opened, the impact of secondary invasive exotic species such as Syngonium and the need to control them, and the great potential for seedling recruitment in healthy native habitats from both adjacent seed sources and from newly planted individual trees of a relatively large size.

The educational opportunities provided include disseminating information about habitat restoration and invasive exotic removal programs. This was accomplished in person and through the media to park visitors, the PMI crew and print and television media audiences. Through personal contact and media attention, the City's environmental enhancement program gained greater awareness and support. The project was also valuable experience for City staff in habitat restoration project management and implementation for City Planning and General Maintenance Department staff.

The project demonstrated the ability to conduct projects with cost efficiency by utilizing local government staff to perform construction tasks, and by using labor from a private non-profit organization to perform labor intensive Schinus removal. This project also highlights the economic and timing need for a "fast track" permitting system within the regulatory agencies for habitat restoration projects.

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