

Evaluating Monitoring Techniques Proposed for Use by FWS Regional Invasive Species Strike Teams: Wedelia EDRR, J.N. “Ding” Darling NWR, Sanibel, Florida

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Introduction

Invasive species monitoring can be simply defined as regular or repeated observations of areas where invasive species treatments have occurred, and includes the collection of detailed records of observations. Monitoring is essential to achieve both short- and long-term goals, and to support evaluations of treatment effectiveness, and ultimately, restoration of native plant communities. Conversely, effective monitoring provides relevant data on non-effective treatments and non-target damage to desirable natives, enabling treatment protocols to be modified. Overall, monitoring programs permit the repeatable collection of site specific data regarding treatment methods and species targeted to improve future management decisions.

The purpose of this project was to test two commonly used monitoring techniques: photo points, and 4 x 5 meter quadrats, and a new monitoring method, Refuge Lands-Geographical Information System (RL-GIS), developed by FWS Region 6. All three monitoring methods have been proposed for use by FWS Regional ISSTs in the draft guidance document. They were evaluated after completion of a wedelia (*Sphagnetica trilobata*) Early Detection and Rapid Response (EDRR) project completed by the Region 4 Invasive Species Strike Team (R4 ISST) on J.N. “Ding” Darling NWR (the Refuge) on February 28, 2007.

Background

The two inventory methods used by the R4 ISST to document the presence or absence, and locations of infestations of invasive and/or exotic plants are aerial Systematic Reconnaissance Flights (SRFs), and detailed ground mapping surveys. Detailed ground surveys provide comprehensive coverage and, more importantly, the types of invasive and/or exotic plants present, and accurate data on locations of in-

During Fiscal Year 2007, U.S. Fish and Wildlife Service (FWS) Regional Invasive Species Strike Team (ISST) Leaders assisted the FWS National Invasive Species Coordinator with the development of a “standard operating procedure”-type guidance document for Regional ISST operations. One component within the draft guidance document provides language for the implementation of standardized monitoring methodologies to be used by all FWS ISSTs.

festations. In January 2006, the Refuge contracted with a private company, NorthWind, Inc., Idaho Falls, Idaho, for a comprehensive ground inventory of all invasive and/or exotic plants on the Refuge. Locations of all exotic plants were collected using Trimble GeoXT® Global Positioning System (GPS) units for increased accuracy. Data was later downloaded using ArcGIS® software, and used to produce detailed GIS maps to prioritize and coordinate exotic plant management operations.

During ground mapping efforts, several significant infestations of wedelia were detected along Sanibel-Captiva Road and at the 184 acre State Botanical Site within the Refuge. Figure 1 depicts wedelia infestations as individual points, whereas Figure 2 represents shape files of total acreage infested with wedelia, and indicates the location of the quadrat for study purposes.

To evaluate the proposed monitoring techniques, the R4 ISST targeted wedelia



Figure 1. General inventory ground map depicting locations of wedelia infestations – J.N. “Ding” Darling NWR.



Figure 2. Detailed GIS map depicting wedelia infestations as shape files – J.N. “Ding” Darling NWR.

infestations on the Refuge west of the shop complex and adjacent to the public sidewalk that parallels Sanibel-Captiva Road as an EDRR project. A wedelia infestation at the old Island Water Association water treatment facility was treated the previous fiscal year under contract with Southeastern ChemTreat, Inc, Chiefland, Florida. Crews applied a 3% glyphosate mixture Kinetic HV® surfactant using backpack sprayers. In an effort to duplicate the excellent results achieved, the R4 ISST

utilized the same herbicide and surfactant. However, due to the high volume nature of the 50-gallon HyPro® spray unit employed, final application rate fell below 1%. The herbicide rate could not be increased without exceeding the recommended label rate for glyphosate. The spray wand was set to a wide fan to ensure thorough coverage of all wedelia foliage. Weather conditions were superb: light wind, cool and sunny. A long period without rain on Sanibel likely contributed to an increased uptake of herbicide. Excellent results were achieved.

Monitoring Techniques

1) Photo points

A single photo point location was established for the purpose of this study, and was situated in a location that would enable the majority of the plot to be visually depicted in the photograph. In the interest of time, no official photo point method was utilized; however, for more technical studies, specific methodology is available. The R4 ISST met its photo point objective for determining treatment effectiveness using this simple procedure. A latitude-longitude point was taken with a Trimble GeoXT® GPS unit where the camera tripod was set up to duplicate the photo point pre- and post-treatment (6 months). In addition, a measurement was taken to record the distance from the ground to the top of and center of the camera lens to enable replication and collection of the same visual plot information. A Canon Power Shot® S2 15 digital camera was used.

2) 4 x 5 meter quadrats (plots)

4 x 5 meter quadrats were selected for this study because of the simplicity, ease of installation and previous use in monitoring FWS exotic plant treatments. The 6-meter circular plots currently being evaluated by the National Park Service's Florida/Caribbean Exotic Plant Management Team (T. Pernas, pers. comm.) would suffice equally well for the purpose of this study. The quadrat was established in an area severely infested with wedelia since the primary objective of the treatment was to control the wedelia infestation, document treatment effectiveness, and measure impacts to wedelia and native vegetation within

the plot. There was no attempt to select the quadrat location randomly. Quadrat corners were marked using rebar, pounded firmly into the ground. The area of the quadrat was established using a meter tape for accuracy. Fluorescent pink flagging was then stretched tightly around all four corners of the rebar to define the quadrat area for collection of pertinent data.

Plot data were collected by calculating overall percent cover of wedelia and various native species present pre- and post-treatment (6 months). In addition to wedelia, four (4) native species were present in the study plot: cabbage palm (*Sabal palmetto*), giant leather fern (*Acrostichum danaeifolium*), white indigo berry (*Randia aculeata*) and wild olive or Florida privet (*Forestiera segregata*).

3) Refuge Lands-Geographic Information System (RL-GIS)

A new GIS data model and supporting data management and collection tools have been developed by the FWS refuge

system for tracking various refuge management techniques in a spatial manner. They include adaptations for tracking Integrated Pest Management techniques used to manage invasive species. For monitoring purposes, treatment effectiveness can be tracked using the point, line or polygon (shape) features within RL-GIS. Initial polygons, lines or points (infestations or single outlier populations) can be secured prior to treatment operations, or during initial invasives mapping efforts. They can be duplicated later at predetermined time intervals to determine treatment effectiveness on targeted invasive weed infestations, and impacts to, or recruitment of, either invasive or native species.

For this study, information was collected prior to wedelia treatment operations using a Trimble GeoXT® GPS unit. Collected information stored in the RL-GIS data model was subsequently assembled using ArcGIS® software to produce maps pre-and post-treatment (6 months). This monitoring method of repeated site visits



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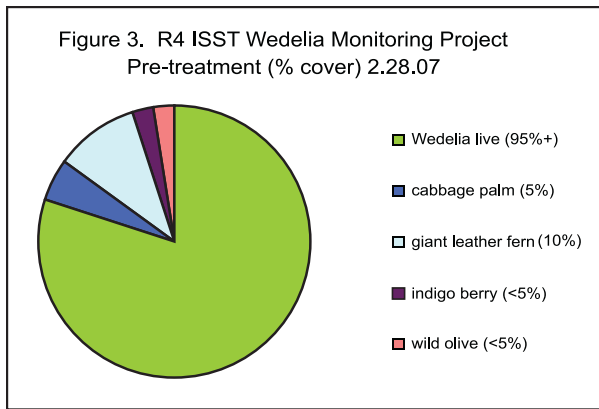


Figure 3. Wedelia pre-treatment plot data.

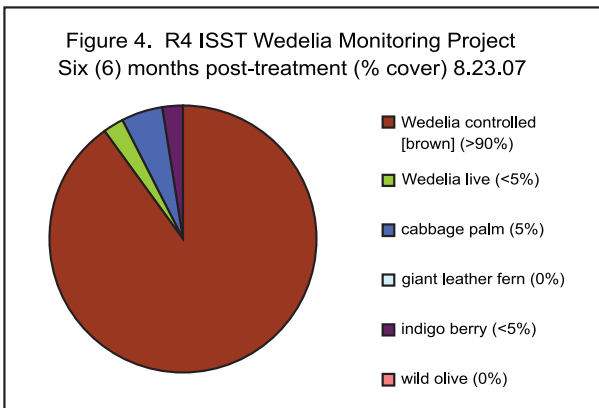


Figure 4. Wedelia post-treatment plot data.

and temporal comparisons of infestations using GIS techniques is fairly simple, and allows treatment success to be easily evaluated over time. The system requires that staff have experience using Trimble GPS units and a working knowledge of RL-GIS. RL-GIS provides a quantitative measure of treatment effectiveness similar to simple plot methodologies in an easy to understand mapping format depicting increases or decreases in targeted weed infestations. RL-GIS currently is not a FWS-wide standard, however, training and support of RL-GIS is being delivered in all regions.

Evaluation and Results

Pre- and post-treatment (6 months) photo points, depicted in Figure 5, clearly show that treatments were effective in the short-term. Before treatment, wedelia is shown infesting the entire quadrat. The post-treatment photo point shows brown wedelia, indicating short-term treatment success.

Overall percent cover data pre- and post-treatment was entered into MS Excel and displayed graphically in simple pie

charts (Figures 3 and 4). Pre-treatment data indicated that wedelia coverage was $\geq 95\%$, and that total coverage for all species in the plot was greater than 100%. This can be explained by wedelia's growth habit of climbing over native species; the wedelia within the plot was not restricted to the ground. Four native species were present: cabbage palm (5%), giant leather fern (10%), white indigo berry (<5%), and wild olive (<5%).

Percent coverage of wedelia post-treatment was as follows: >90% wedelia controlled (brown), and <5% wedelia live. Wedelia within the plot was extremely dense, and it was most likely that some foliage or runners were not contacted by the herbicide mixture, and therefore, were unaffected. In addition, the dense upper layer of wedelia could have shielded lower plants from the spray mixture.

Percent coverage of native species post-treatment was as follows: cabbage palm, 5%, and white indigo berry, <5%, the same as pre-treatment levels. Giant leather fern and wild olive were absent post-treatment, indicating that these species succumbed to overspray, or that they are highly sensitive to the foliar glyphosate formula. Overall, quadrat data indicates that the treatment was highly effective with a minimal level of non-target damage.

The RL-GIS map, Figure 5, both graphically and quantitatively indicates a significant reduction in the wedelia infestations. The map illustrates the power of this GIS software tool to document the effectiveness of exotic plant treatment programs. Locations of the four corners of the quadrat were secured using a Trimble GeoXT[®] GPS unit, permitting the plot to be accurately depicted within the wedelia infestation and project treatment area. Wedelia density is indicated in Figure 5 as >60% pre-treatment, and as individual points ranging from 1-10% coverage post-treatment; confirming that the treatment

was effective. Numbers vary somewhat from the plot information, but this is attributed to the standard plant density coverages currently available in the RL-GIS program. The database could potentially be modified to use plant density coverages currently being used by most South Florida agencies conducting exotic plant treatments.

Recommendations and Conclusion

For the purposes of this study and in the interest of time, comparison of the three ISST treatment monitoring techniques was only carried through the six month period. Based upon this evaluation, it is recommended that ISSTs utilize a combination of photo points and quadrats (primary), or photo points and Refuge Lands-Geographical Information System (RL-GIS; secondary). Photo points alone only provide visual, subjective information on treatment effectiveness, and do not show the level of detail to accurately determine treatment effectiveness or impacts to native species. Photo point results could be supplemented by the quantitative data collected using quadrats. Quadrat information can be easily collected and analyzed and treatment effectiveness depicted in simple graphics as presented in this study to determine treatment effectiveness quantitatively, and to permit adjustments to management methodologies should they be needed. Although RL-GIS has the same capability to graphically depict treatment effectiveness using standardized plant density coverage classifications, it does require expertise and skill in using both Trimble GPS units and advanced knowledge of GIS software, ArcGIS[®] and specific training in RL-GIS. RL-GIS training is available only a few times per year, limiting exposure to this powerful data storage and mapping tool. The draft ISST guidance document recommends all ISST staff be trained in using RL-GIS.

If monitoring is determined to be a priority, methodologies and protocols employed should be kept at the simplest level for team effectiveness and efficiency, be consistent amongst ISSTs, and those used should be considered standard for the monitoring type proposed. It is recom-



Figure 5. RL-GIS map, with photo point inserts, depicting pre- and post treatment results.

mended that monitoring be carried out at regular intervals; pre-treatment, 6 months, 1 year (minimum), 1.5 years, and 2 years (maximum). Rarely should monitoring be carried past 2 years. Monitoring should

increase the rapid response capability for invasive species management, using a highly trained, equipped, and mobile response force that refuge managers can summon to support control efforts on newly discovered

only be implemented if it will provide relevant or new information with regard to the targeted invasive pest plant, specific herbicide effectiveness, or to improve or modify treatment actions or management decisions.

Monitoring should not detract from the original purpose for which ISSTs were established through Congressional appropriation language: “to

and satellite (“spot fire”) infestations.” This mandate will be jeopardized if monitoring becomes the sole focus of ISSTs following completion of initial treatments.

Other innovative ideas should be evaluated to enable refuges to meet monitoring requirements for Integrated Pest Management programs without placing additional burden on ISST and refuge staff already reduced by current budget constraints.

Acknowledgements

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