



Department of Defense Legacy Resource Management Program

PROJECT NUMBER 13-622

DOD Early Detection Rapid Response Invasive Species Strike Teams-A Pilot Demonstration Year 2

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FINAL REPORT and Suggested Protocol for DoD Early Detection Rapid Response Invasive Species Strike Teams

DoD Legacy Project # 13-622

DoD Early Detection Rapid Response Invasive Species Strike Teams – a Pilot Project Year 2

I. Background and Purpose

Invasive species have become a tremendous burden on the approximately 420 military installations managing over 30 million acres in the United States. DoD lands provide a sanctuary for many rare and endangered species including some found only within DoD boundaries.

To address the invasive species dilemma, the DoD has effectively implemented multiple training courses and research projects annually concerning invasive species. The courses are often research based and educate land managers on techniques to control invasive species on their installation. The research and training have provided the incentive and knowledge to control invasive species. What they lack is the next step, the actual control and restoration of the affected land. The implementation of the DoD EDRR Strike Teams is the logical next step following conferences such as the DoD Legacy sponsored strategic training conference attended by DoD land managers in the Chapel Hill, NC in late 2009. Each military installation present honed in on the species of concern on their installation and a strategic plan was initiated. The DoD EDRR Strike Team is the tool that implements these plans.

The National Wildlife Federation (2005) notes that “Invasive Species divert funding from other natural resources or operation priorities, destroy habitats and decrease biological diversity, and pose a security risk and/or create potentially life-threatening situations.” The Strike Teams will decrease each of these threats by providing on the ground control and long term planning and execution of invasive species management.

Invasive species can radically change landscapes and can even make training and operations difficult or in some cases impossible. DoD EDRR Strike Teams offer a tool to increase installation managers’ knowledge of invasive species and not only find solutions to management problems but just as importantly, engage in the control and restoration of infested sites. Because military services require healthy natural landscapes on which to train, conservation through the control of invasive species is an operational necessity. The DoD EDRR Strike Team will promote native habitats and the restoration of native species in ecosystems that have been invaded and encourage interagency cooperation through the organization of Cooperative Invasive Species Management Areas.

This year, 2013 (Year 2), The DoD EDRR Strike Teams were able to reconnect with four installation natural resources managers to expand on Year 1 treatments by monitoring and maintaining the sites, then move onto other critical sites designated by participating installations. This project provides evidence that applicability is not only for the installations chosen for the pilot project, but all installations within DoD. Year 2 challenged the DoD EDRR Strike Teams to provide EDRR control in the Pacific Northwest at Camp Rilea, OR. The resulting test proved that the DoD EDRR Strike Teams have the ability to eventually impact all military installations in the United States and abroad. While the species



and control measures may be different, most installations have similar management challenges concerning invasive species. If this concept is developed and expanded to other regions in the future, the Strike Team's impact could be as far reaching as the estimated 420 installations in the US and beyond. The DoD EDRR Strike Teams will offer natural resource managers the education and on the ground tools and staff needed to support military readiness and training. Each installation manager is required to preserve and protect the critical natural resources on their installation while allowing for successful implementation of the military mission. The Strike Teams will provide these managers with education and planning for the species of concern. Species that are impeding training areas or consuming areas with fragile and rare species will be selectively treated allowing the desirable species to thrive.

Invasive Plant Control staff has completed its obligation to Department of Defense (DoD) Legacy Program (DoD Legacy) by partnering with five (5) facilities (1) Fort Detrick [Frederick, MD], (2) Naval Air Station Patuxent River [Patuxent River, MD], (3) Marine Corp Air Station Cherry Point [Havelock, NC], (4) Arnold Air Force Base [Tullahoma, TN], (5) Camp Rilea OANG [Warrenton, OR]. The following objectives have been achieved as of December 17, 2014.

- Reviewing of current Invasive species management plans
- Providing on-the-ground control of invasive species at four installations in the eastern US.
 - Fort Detrick have been controlling invasives for more than 12 years. Many sites have been treated and managers are now working on new species that have come in after the initial treatments. Therefore Fort Detrick has focused on treatment of various invasives; such as winter creeper, bush honeysuckle, and Japanese barberry, followed by restoration with native grasses. There will also be a focus on maintenance of previously treated sites on this installation. Retreatments, expansion treatments, and test plots were established to determine chemical efficacy on winter thistle rosettes.
 - Cherry Point MCAS' main focus for the strike team's efforts was to monitor and maintain 2012 treatments.
 - Work at Arnold Air Force Base included the follow up and continued expansion treatments of the invasive tree species, loblolly pine
 - Patuxent River Naval Air Station worked on herbicide retreatment of tree-of-heaven and Bradford pear, with treatment expansions to control tree-of-heaven and paper mulberry.
 - In addition to revisiting the four about installations, the DoD EDRR Strike Teams provided initial treatments to Camp Rilea OANG, which included English ivy and English holly
- Maintained of previously worked sites.
- Monitored the promotion of native species regeneration
- Initiated of partnership development and onsite training of local stakeholders and assisted in the development of Cooperative Invasive Species Management Areas (CISMA's.)
- Used IPCCConnect, an online tracking tool, as a pilot project for installations chosen for invasive plant management on DoD Lands.
- Updated the Standard Operating Procedures Manual for the proposed DoD EDRR Invasive Plant Strike Team.



II. Management Plan Review

Invasive Plant Control, Inc. (IPC) staff was able to discuss various invasive plant control strategies with the natural resource managers and facility staff, including the plans to manage invasive species. Each partner facility has an invasive species management plan dictated by their Integrated Natural Resources Management Plan (INRMP). Although the task of invasive species management may seem daunting; the control and financial constraints overwhelming, there is considerable evidence that instituting management plan recommendations would provide the most effective and economically feasible control of invasive species. Furthermore, with the advances in research, information sharing technology, emerging threat education and protocol, management modernization, and collaboration among federal, state, local agencies and private entities only benefits DoD.

Because of technical advancement and ever changing environment/climate, today's management plans have to be more dynamic than just a 5 year review. IPC recommends the use of an online management plan tool that can be accessed by a mobile tablet in the field. Instead of compiling notes throughout the course of the year and taking valuable resources to update the hard copy of the management plan, it could be updated in the field by a mobile tablet. Once submitted, the plan is automatically saved and available for all specified parties. Maps and historical references, identification guides, property boundaries and any other relevant information would be able to provide field staff with up to date information.

III. On-the-Ground Management

IPC consulted with the installation natural resources point-of-contact (POC) before management operations began to determine the priority of the facility to keep with the DoD mission of providing the military forces appropriate training areas void of invasive plants, as well as managing ecosystems to protect the security of the United States. Because Early Detection Rapid Response is the objective of strike teams, IPC suggested managing areas where the objective of controlling certain species would be attainable and manageable in future years. The table below provides a glimpse of the level of work IPC EDDR Strike Teams were able to achieve with very limited time.

| PARTNER | ACRES | SPECIES MANAGED |
|---------------------------|--------------|--|
| Arnold AFB | 9682.9 | Loblolly pine, Chinese privet |
| Camp Rilea OANG | 143.90 | English holly, spurge laurel, Darwin's berberis, English ivy, black locusts |
| Fort Detrick/Forest Glenn | 25.641.35 | Bush honeysuckle, , Japanese honeysuckle, oriental bittersweet, Callery pear, Japanese flowering cherry, Japanese honeysuckle, multiflora rose, Norway maple, sweet cherry, burdock, Canada thistle, white mulberrywhite mulberry, winter creeper, Norway maple, Japanese barberry, princess tree, olive autumn, callery pear, and multiflora rose |
| MCAS Cherry Point | 44.061.6 | Wisteria, Chinese tallowtree, Japanese stiltgrass, kudzu, mimosa, beefsteak plant |
| NAS Patuxent | 80.471.97 | Olive autumn, callery pear, Chinese privet, multiflora rose, Japanese honeysuckle, tree-of-heaven, paper mulberry |



Therefore, IPC Strike Teams initially controlled twenty-three (23) invasive species in 384.18 acres on five DoD facilities representing four branches for the DoD: Army, Navy, Marines, and Air Force.

A. Fort Detrick/Forest Glen: Lynn Hoch, Natural Resources Manager, requested that IPC Strike Team further protect Fort Detrick's investment of tree plantings that were going to be used for screening from the general public. IPC Strike Teams therefore focused on controlling invasive vines that would impact the survivability of the tree saplings as well as provide general maintenance on other previously treated sites. Once the strike teams completed this task, Lynn Hoch moved the strike team to Forest Glen to begin controlling trees, shrubs, and vines along a railroad corridor to provide line-of-sight access for security purposes.

B. NAS Patuxent: Jacqueline Smith, Natural Resources Specialist, requested that IPC Strike Team provide EDRR control focusing on callery pear scattered throughout the air station. Focusing on callery pear before the ability to manage the species further increased NAS Patuxent to keep the callery pear under control. In addition to controlling callery pear, the strike team also treated other invasive species as they came across them.

Although the scope indicated tree-of-heaven be treated and followed up by native plant installation, consultation between the strike team and the PAX environmental office determined that due to the seasonality and concern of the spread of callery pear that plantings should be postponed to the 2013 growing season.

C. MCAS Cherry Point: Carmen Lombardo, Natural Resource Specialist, requested that IPC Strike Team provide EDRR control focusing on wisteria growing along the forest edge and encroaching on a housing area. Since the wisteria was in a locally isolated area, management was performed on this site. Control and maintenance of this site will enable once hinder regeneration of tree species, provide survivability of mature forest edge trees, and limit possible tree injury or death there increasing the probability of structural damage or possible human injury or death.

D. Arnold AFB: John Lamb, Conservation Biologist, requested that IPC Strike Team to continue to provide EDRR control focusing the non-native loblolly pine at Salt Well Hollow (a once World War II German prisoner of war camp) in the Barrens of Middle Tennessee. In addition retreatment and monitoring of 2012 treatments were provided Loblolly seedlings can create monocultures in grasslands and thus threaten the already endangered/endemic species of this unusual plant community, i.e. Eggert's sunflower.

E. Camp Rilea ONGA, William Vagt, Natural Resources Specialist, requested that IPC Strike Team begin its initial treatment focusing on English ivy, English holly, Spurgelaurel and Darwin's barberry. A patch of Black locust that was previously unknown to the base was located around a beaver pond in the woods on the immediate north side of the cantonment area. English holly and English ivy are throughout the wooded areas of the camp. Darwin's barberry and Spurgelaurel are scattered lightly across the wooded areas. Most of the open training areas are heavily infested with Scotch broom and the sand dunes are covered with European beachgrass. Wooded areas and wooded edges are infested with Himalayan blackberry. None of these species were addressed during this treatment.

IV. Maintenance



The IPC Strike Team provided maintenance on previously controlled areas at Fort Detrick, Cherry Point MCAS, Patuxent River NAS, and Arnold Air Force Base. All the partner facilities recognize the importance of annually maintaining the areas that were treated in the past. Therefore, following the treatments mentioned above, IPC recommends that DoD Legacy consider at the least an additional 3 years (2014, 2015, 2016) for EDRR DoD Strike Team project to allow for quality assurance, follow up treatments and maintenance on previously worked sites. It is important that this cooperative effort be continued in year 3 and following for multiple reasons; 1. Invasive species have seed banks that require long term management. 2. New species of concern that were not visible prior to treatment will also emerge on the site from the seed bank or neighboring properties. 3. The third year funding would allow for furthering of the strike team concept to become self-sufficient and allow for a third year of quality control and management of the pilot sites.

V. Native Species Enhancement

As mentioned above (On-the-Ground Management), all the treatments were to facilitate the enhancement, regeneration, and survivability of already established native plants at all 5 facilities. The EDRR Strike Teams continued to monitor regeneration and noted that no replanting is needed at this time at the aforementioned facilities.

VI. Partnership Development

After the completion of the on-the-ground management of invasive plant, the IPC Strike Team Leader was able to coordinate a meeting with each partner facility and stakeholders to discuss treatment methodology and the development of Cooperative Invasive Species Management Areas (CISMAs). During these meeting, the emphasis was discussing the advantages of having a CISMA and brainstorming on additional stakeholders that would be interested in participating. Each facility had an interest in beginning the framework with the assistance of Invasive Plant Control, Inc. Also, each of the facilities was at different levels of development when it comes to CISMA's. For example, MCAS Cherry Point has not considered a CISMA, yet when brainstorming for possible cooperatives the Onslow Bight Conservation Forum came up. Onslow Bight has numerous stakeholders on various subcommittees along the coast of NC including MCAS Cherry Point. Carmen Lombardo of MCAS Cherry Point will ask to be added to the agenda to propose the addition of an Invasive Species Subcommittee with the conservation forum. On the other hand, NAS Patuxent is surrounded by private property with land conservation groups on the distant periphery of the air station. Jacqueline Smith of NAS Patuxent and her staff provided a plot map to determine the likelihood of developing a CISMA, but more marketing of the concept is in need to begin a CISMA there.

Invasive Plant Control, Inc. will continue to nurture the relationships developed with the partnering facilities to continue the development of CISMAs through emails, phone conversation, networking through Webinars. The goal is to have partnering agreements set up a framework to formally create a CISMA through their organization.

As mentioned, all the facilities would like to begin the development of CISMAs, but during the economic hard times resource managers are once again being asked to do more with less. With resources



dwindling, the partners have less time to be promoting CISMAs and yet CISMAs are essential because they allow for:

- Leveraging funding and reducing the high maintenance cost caused by re-infestations;
- Sharing resources, such as funds, equipment, personnel;
- Treating invasive species across property boundaries;
- Expanding public awareness of invasive species.

VII. Online Tracking Tool

In 2012, Invasive Plant Control, Inc. entered into a private/public partnership with The University of Georgia's Center for Invasive Species and Ecosystem Health to develop advanced web-based tools to assist in the management of invasive plants. With the framework of EDDMapS (Early Detection Distribution Mapping System) already in place, IPC was able to create IPCConnect that would allow land managers and IPC staff the ability to have real-time access to data, data uploads, navigation to invasive plant populations, and daily reporting. Because EDDMapS and IPCConnect work with the basic framework, the invasive plant points uploaded into IPCConnect can then be added to the EDDMapS database for recording distribution analysis which is essential for EDRR. (Appendix A)

IPCConnect can be accessed by authorized managers only and access will be granted upon request.

VIII. Standard Operating Procedures (SOP) Manual for DoD EDRR Strike Teams

During the visits at each partner facility, the IPC Strike Team Lead took notes and provided thoughts to be efficient and effective when asked by a DoD facility to provide a strike team to control EDRR species. Appendix B provides a copy of the *Standard Operation Procedures for DoD EDRR Strike Teams*.

The SOP can also be accessed online through IPCConnect. Access will be granted upon request.

IX. Conclusion

Invasive Plant Control/DoD EDRR Strike Teams were/are being able to work independent of in-house staff after the initial work plan has been agreed upon. The team and its leader are either registered or certified to apply pesticides without having the DoD provide an overseer that is certified. Because EDRR Strike Teams are a self-sustained entity, all tools, chemicals, vehicles, and other essentials are provided by the Strike Team further enabling the project manager to distance themselves from the project if the need arises. Also, with the ability to provide progress reports in real-time to the project manager via IPC's latest software IPCConnect this alleviates guess work as the status of the project, cumbersome data entry from data sheets, and provides pesticide reports at the end of each day. Furthermore, the Department of Defense Commanders *Guide on Invasive Species* emphasized the need for cooperatives by stating, "A key theme that runs throughout all invasive species management and control efforts is that prevention and partnerships are the basis for success." Invasive Plant Control Strike Teams have begun the dialogue concerning CISMAs and plan on pursuing CISMA creation through the offseason. The DoD Strike Team Pilot Program was a success. It is this project's goal to continue the success of the



previous treatments and the opportunity to create CISMAs similar to those six CISM's associated with DoD in Florida. Continued funding would be beneficial and is recommended.



Appendix A – DoD EDRR Strike Team Site Sheets





Appendix B –

DOD Early Detection Rapid Response Invasive Species
Strike Teams- Suggested Protocol (13-622)

DOD Early Detection Rapid Response Invasive Species Strike Teams- Suggested Protocol (13-622)

I. Introduction

Invasive Plant Control, Inc., funded by and in cooperation with DoD Legacy, provided an on-the-ground management invasive species strike team at five (5) partnering facilities: (1) Fort Detrick [Frederick, MD]/Forest Glenn [Silver Spring, MD], (2) Naval Air Station Patuxent [Patuxent River, MD], (3) Marine Corp Air Station Cherry Point [Havelock, NC], (4) Arnold Air Force Base [Tullahoma, TN] (5) Camp Rilea ONGA [Warrenton, OR]. The Strike Team Lead was charged with producing documentation that would enable DoD Natural Resource Managers and contract personnel the ability to refer to a Standard Operation Procedure (SOP) or protocol in the event a strike team was required in a crucial situation. Early Detection Rapid Response (EDRR) requires the identification of an aggressive invasive species that is recently discovered in the national landscape or even in the local management area where critical ecological protection is required. Once a positive identification is confirmed for an early detection species, expedited management is necessary. A rapid response or strike team should be activated to control the undesired species. The suggested protocol is a tool to provide questions to be answered or a checklist for both the strike team and the DoD staff to initiate the strike team in an efficient and effective manner with minimal preparation required. Each DoD facility should have immediate access to an in-house or contracted strike team that is trained according procedures contained in this document in order to alleviate possible invasion of non-native species in sensitive DoD landscapes.

II. Strike Team Personnel

A typical strike team will consist of three crew members: one crew leader and two technicians. The crew leader will have sole responsibility for communication between the strike team and the site manager, and may act as mediator between the site manager and the strike team company manager. The crew leader will also be responsible for selecting an approved herbicide for use at the treatment site, logging herbicide use information and other data at the end of each day, and managing the application of herbicide and mechanical control techniques by the technicians.

This position includes one crew leader and two crew members with the ability to perform the necessary management of invasive species in a time-efficient manner. The following responsibilities are required of the Invasive Management Crew:

- Be legally allowed to work, a citizen of the United States of America, without any standing warrants for arrest.

- Operates transportation equipment such as 4X4 truck with or without trailer for the purpose of traveling to work sites in a safe and courteous manner.
- Operates field transportation equipment for the purpose of transporting him/herself and up to a ten member work crew.
- Conducts daily inspection and maintenance of truck and equipment.
- Conducts daily inspection and inventory of safety equipment for him/herself and crew.
- Certified in pesticide application for the state the installation is located in.
- Transfers, mixes, transports, and applies non-restricted use herbicides (NRH) and adjuvants or directly supervises
- Operates equipment as needed for the proper application of herbicides and adjuvants or directly supervises
- Operates spray apparatus, including electric pump, gas powered pumps, and hand pumps or directly supervises
- All strike team members anticipating operating utility vehicles such as ATV's and RTV's will have passed a safety certification course.
- It is suggested that each member of the strike team will have completed first aid/CPR training. DOD policy states that at least two members of the strike team must be certified in first aid/CPR if the site is more than five minutes away from a hospital.
- Conducts daily inspections and maintenance of equipment and spray apparatus.
- Assumes responsibility for crew safety, navigation, and training.
- Properly completes daily work logs and reporting logs for equipment maintenance and delivers to Project Manager.
- Properly completes Daily Progress Reports (DPR's) for each job for each day and delivers to Project Manager.
- Adheres to label instructions and IPC Safety Guidelines in all aspects of work.
- Maintain driving record in compliance with insurance carrier's criteria.
- Project planning and execution including material management (herbicides, biocontrol agents, equipment, tools) and mapping.
- Discuss goals and desires to passersby in an understanding way.
- Ability to correctly identify all invasive plant with minimal review, and to discriminate invasive plants from any native vegetation of similar appearance.
- Have a sound academic knowledge of ecological principles as they relate to vegetation management.
- Have a working, current knowledge of resource management methods, biological processes and vegetation sample techniques.
- Have knowledge of data organization, record keeping, and global positioning system (GPS).
- Knowledge, ability, and willingness to handle herbicides in the course of vegetation management.

- Knowledge of treatment history of previously treated sites.
- Familiarity with invasive plant data management protocols and requirements of the client.
- Ability to mix, handle, and apply herbicides in accordance with label directions and crew supervisor instructions.
- Ability to handle and maintain tools, equipment, and supplies in good working order for daily operations.
- Perform on-the-ground management

The members of the strike team are expected to adhere to certain standards of professionalism, maturity, and etiquette as distinct from typical workers in related fields. This includes acceptable behaviors and language expected in any professional environment, and each member of the strike team, including the strike team leader, is expected to hold the other members accountable to these requirements.

III. **Pest Identification**

A. **Native and Exotic Pest Plants**

An invasive plant is any non-native plant species that outcompetes and displaces native flora and fauna. They typically have rapid rates of growth and reproduction, and this coupled with a lack of native predators result in aggressive population increases in introduced areas. Depending on the growth form (ie tree, vine, bush, shrub, grass...), the impacts of the spread of that invasive plant will alter the ecosystem to the detriment of the plants and animals residing there. An invasive vine may pull down native trees, or completely enshroud native trees and bushes, preventing sunlight from reaching the tree or bush, and choke them out. An invasive tree will overcrowd and outgrow native trees, replacing all the native trees in an environment with a homogenous stand of the invasive tree. Native grasses and shrubs will prevent the growth of native grasses, wildflowers, and understory plants, many times, not being edible themselves by the native fauna. Plants with growth forms that threaten the condition of the habitat or the wildlife within are “pest plants”. Pest plants from a different geographic range are “invasive plants”, and pest plants currently within their original geographic range are “native pest plants”.

B. **Pest Plant Identification**

The identification of a pest plant ought to be followed up with a positive identification of the species. A local certified naturalist, dichotomous key, invasive plant identification book, or other competent sources may all be used to confirm the identity of the potential pest. Many such resources exist in book or digital form, and are available for purchase. Native plants may act as a pest species, but themselves are not technically invasive plants, because it is not possible to invade a native region. Native pest plants, when threatening a natural resource, may still be considered for treatment. For the purposes of the DOD Strike Team, invasive plants and native pest plants threatening natural resources, or newly appearing on a site not previously known to contain that plant, are the priority targets for treatment, and these new infestations will be referred to as Early Detection, Rapid Response (EDRR) infestations. Some species of invasive plants are new invaders into a specific geographic region, and their spread into

that geographic region is minimal, but has the potential to become a widespread threat. These new, potentially invasive species of plant are referred to as EDRR species.

Many invasive plants have native plants that appear very similar to the invasive variety, and can be particularly difficult to distinguish because of minor or subtle differences in a variety of characteristics. Identification of the invasive rather than the native variety is usually discernible through the same means as the original identification. For example, native Grape Vines (*Vitis spp.*) are remarkable similar to the invasive Amur Peppervine (*Ampelopsis brevipedunculata*), and a close examination of the bark of the vine is one of the few sure ways of telling them apart. Literature helping to identify invasive plants will usually cite the differences between the native and non-native versions of the plant, and any certified naturalist ought to be able to distinguish them as well.

C . Post-Identification Guidelines

Once a positive identification has been made, the last step is to make sure that the invasive plant is known to reside in the geographic range its identification was made in. This is to update contemporary online databases that detail current geographic distribution maps for invasive plants. Online databases such as www.eddmaps.org contain these geographic distribution maps. If the plant is occurring outside of the range of what is depicted there, follow the directions provided on that website to alert the organization about the spread of that plant. This likely includes photographic evidence that is geo-referenced. It may be wise to print out and keep the plant profile provided by the resource used to identify the plant for your own records. The use of IPCCConnect is beneficial as a resource for cataloguing and referencing plants on site. It is recommended that this be done for every invasive plant on site that the site manager wishes to be treated. The collection of plant species and their profiles creates an Invasive Species Inventory (ISI). The importance of this ISI will be detailed later.

IV. Site Preparation

After the identification of the pest plant has been completed, including distinguishing between native and non-native versions, it is important for the site manager to walk the site and determine what resources are currently being threatened. This includes potential harm to wildlife, natural and unnatural resources, and human health.

A . Threatened Resources

a . Wildlife

Depending on the growth form, different wildlife on site may be severely impacted by the presence of the pest plant. Mature trees are potential targets for certain vines, and an understory of native wildflowers is a potential target for certain ground-cover shrubs and grasses. Invasive plants that alter the habitat may pose serious threat to certain endangered plants and animals which rely on the habitat being in pristine condition in order to thrive. If the site is part of a restoration zone or contains tree plantings, consider rapid management of the pest plant.

b . Natural Resources

If the site is relatively healthy, has not been impacted by pests, and is used for recreational purposes, the presence of an invasive plant species is a threat to the quality of the resource. In time, the land may become unusable as a resource, impassible to human and animal traffic, or lose its integrity as a natural area. Such sites are characteristically EDRR sites if pest plants are present.

c . Man-made Resources

Many invasive plant species are also damaging to human resources. Tree roots can damage foundations of adjacent buildings, vines can engulf and damage buildings and fences, and some can infest areas meant to be grass only.

d . Human Health

Some invasive plant species are toxic to humans, by ingestion (such as Jimson Weed, *Datura stramonium*) or even physical contact (such as Giant Hogweed, *Heracleum mantegazzianum*).

B . Public Notification

If the site experiences regular human traffic, it is important to notify the public about the upcoming treatment by hanging signs around the site explaining the method of treatment to be utilized, as well as the specific dates of treatment and chemicals being used. The site manager may desire to hang these signs several days prior to the arrival of the strike team to give the public ample notice about the upcoming treatment. Local residential areas may also be notified by door-to-door visits or mailing of fliers explaining the treatment. If this is not possible, the strike team will have general pesticide warning signs which can be placed in the ground on short, black, plastic stakes. Typical re-entry times do not exceed one day, and are as short as four hours. The stakes are not biodegradable, and either the site manager or the strike team must remove these signs and stakes after treatment.

The site manager may desire to stress the upcoming treatment with the public because of herbicide toxicity. Animals not kept on a leash may roam the site and can ingest herbicide through the mouth or absorb it through the skin. Advanced notification may be helpful in encouraging pet owners to keep their animals on a leash. The strike team can communicate this with pet owners on site during treatment, and are typically using the least toxic herbicide during treatment that will still have effective results.

If the site is regularly patrolled by security personnel, they too should be notified that there will be workers on site. The presence of workers in wooded areas can be alarming to security personnel if they are not informed of their presence before arrival, particularly if foliar applications are involved in the treatment.

C . On-site marking

If the site contains plants that are valued, such as tree plantings or rare species, the site manager may consider flagging off the individual plants or areas containing them with high-visibility, biodegradable flagging tape. Flagging tape may also be used to indicate other features, such as site boundaries, wetlands, or individual pest plants whose location may be difficult to discern during treatment. It is important to use biodegradable markers because non-biodegradable markers must be retrieved, either by the site manager post-treatment, or by the strike team during treatment.

D . Pass & ID Access

In general, the strike team will give the Contracting Officer Representative (COR) adequate notification as to when to allow the team facility access. Security access to the installation is required for each member of the strike team, and is not given on a company-wide basis. The strike team would ask the COR to contact the security office and to provide the strike team personnel what is required to get onto the installation.

This may include:

- An online background check for each strike team crew member

- Valid driver's license
- Birth certificate, social security card, or a passport
- Current vehicle registration and proof of insurance
- Company data for processing

Any of these requirements for security access should be made known to the strike team prior to their being dispatched to the installation. It may take a long period of time to obtain the necessary documents and have the information processed by the security office before the strike team is allowed onto the installation. The keys to any locked gates leading to the infestation should also be obtained and handed to the strike team on their first day. If the site manager does not wish to relinquish keys to the strike team, the site manager may choose to ensure the necessary gates are unlocked in some other way.

E. **Water Access**

The location of a clean water source for use by the strike team is necessary for most treatments. An unclean water source may have negative impact on the herbicides that are in solution prior to application, and may impact the effectiveness of treatment. Workers using herbicides are required to have pure water available for personal use to remove herbicide from their bodies in case herbicides are splattered onto garments or into their eyes, so not having access to clean water poses a significant health threat. A preferred water source is a standard water spigot that a Ford F-150 truck pulling a 9 foot trailer can access from a 30 ft. hose without impeding traffic or driving on turf.

F. **Approved Chemicals**

The herbicides to be used for treatment must be approved for application by the installation. Military installations have a base-specific list of herbicides approved for use on the installation, and adding herbicides to that list may take time.

The following herbicides are standard for the treatment of terrestrial invasive plants:

- Rodeo (Glyphosate) EPA Reg: 62719-324
- Garlon 3A (Triclopyr) EPA Reg: 62719-37
- Garlon 4 Ultra (Triclopyr) EPA Reg: 62719-527
- Transline (Clopyralid) EPA Reg: 62719-259
- Habitat (Imazapyr) EPA Reg: 241-426
- Metcel VMF (Metsulfuron) EPA Reg: 352-439-85588
- Escort (Metsulfuron) EPA Reg: 352-439
- Milestone VM (Pyridine) EPA Reg: 62719-537

The presence of water on site, such as a river, a tidal marsh, or a pond, will impact the selection of herbicide for use during treatment. Not every herbicide is safe for treatment in these areas, and proper selection of herbicide will require advanced notice about their presence given to the strike team prior to dispatch.

V. **Data Collection**

A. **Site Maps**

There is some data collection that should be accomplished by the site manager prior to the commencement of work on site. It is recommended that the site manager generate detailed maps that the strike team can use to navigate around the installation and arrive at all of the treatment sites, the site manager's office, and their water source used for treatment. The first map to be made is a map of the entire installation. It may be black and white or full color, but detailed enough for the crew to get from the main gate of the installation to the treatment sites. Road names and building numbers are all valuable in determining the route. This map should also indicate the location of the water source the site manager identified for use during the site preparation stage. If creating this map is not possible for the site manager, the GPS location of the treatment site alone is an acceptable alternative.

A second map of each site to be treated is also valuable. This map should be a full-color satellite image clearly depicting the boundaries of the infestation, where the strike team can park their truck, where access to the site can be obtained, and the locations within the site of any of the flagging off of sensitive areas or individual plants took place. Site access is only significant if there is a single, specific location the site can be accessed through, but this is rare. These maps can easily be produced using software such as Google Earth. An example of this is below.

IPConnect, some online websites, or a hand-held GPS unit can be used to calculate acreage or determine GPS coordinates. This, plus an estimation of the density by percent coverage of the invasive plant within the site boundaries of the infestation should be included with the acreage estimates. A zero percent coverage means that the plant is not on the site, and a 100% coverage means that the site is a homogenous infestation of that plant. It is recommended that this be provided for every species of plant on the ISI that the site manager intends to be treated, and for each site on the installation.

B. Safety

Working with power equipment and chemicals poses a health risk to the strike team. The strike team will have their own first aid kit and clean water for incidents. Accident and emergency protocol are detailed in the comprehensive safety plan submitted by the strike team company manager. It is also important that the emergency contact information be made available to the strike team. This includes the name and address of the nearest hospital or any emergency phone numbers for the installation if 911 is not sufficient. Some military installations have a special phone number for medical emergencies and calling 911 is a slower means of finding medical help. For communication with the site manager, contact information, including their phone number, physical address, and email address should be given to the strike team.

C. Staging

The strike team leader may request to stage equipment on the installation over night during the treatments. It is the prerogative of the site manager to grant staging access to the strike team. If this is not possible, the strike team will be responsible for the staging of equipment at a safe and secure location. The details of this can be discussed by the site manager and the strike team leader.

VI. Strike Team Equipment

The strike team will be utilizing a variety of control methods and gear to operate a successful treatment plan. All equipment will be operated in a safe, responsible manner, and will be owned and managed by the strike team. This section will detail suggested pieces of equipment that can be utilized by the strike team.

A. Backpack Sprayer

The back pack sprayer is a 4 to 5 gallon plastic container with two nylon straps, an internal pump, and a spray wand. This tool is used both for foliar applications of low-concentrate chemical, and for basal bark applications of oil-soluble herbicide as well. The details of the chemical mixtures will be discussed in the “Treatment Methods” section.

The arm crank on the side of the back pack is levered up and down, forcing fluid from the backpack into the pump, which builds pressure. The squeezing of a metallic trigger on the handle of the spray wand releases the pressure, forcing the chemical mixture out of the pump, through the hose connecting the pump to the wand, and out the tip of the wand in either a jet or stream pattern.

B . Hand Sprayer

The hand sprayer is a 4-pint plastic sprayer functioning much like a back pack sprayer. The arm crank on the side has been replaced with a vertical pump on the top of the hand sprayer, and the two straps have been replaced with a single plastic handle. The trigger rests on the top of the sprayer, and can be pressed with the thumb while holding the handle. This piece of equipment is used when cutting and treating alongside of power equipment. Cutting and treating practices will be discussed in the “Treatment Methods” section.

C . Machete

A sharp machete is used to hack and squirt (see Treatment Methods), clear plant growth impeding progress, and on rare occasions, cut and treat. Obvious dangers in the use of the machete are to be met with the mature and responsible use of this as a tool.

D . Chainsaw

The chainsaw is the most dangerous piece of equipment the strike team will be utilizing during treatment. The Stihl arborist saw, ms200t with a 12-inch bar, will be used for the majority of cutting work during treatment. Mixed gas powers the saw, and bar oil lubricates the chain. A safety brake on the top of the saw stops the spin of the chain and prevents chain movement, even with the trigger depressed.

E . Brush Cutter

The brush cutter is powered by mixed gasoline, and hangs from a harness on the technician’s torso. A trigger on the handle causes a circular blade at the end of a long shaft to rotate, which cuts into the plant tissue, much like a chainsaw.

The brush cutter is also one of the safer pieces of power equipment utilized for treatment, because the circular blade at the end of the shaft is extremely difficult to get close to the technician’s body, and a debris guard prevents objects from being kicked up by the blade and flung at the technician.

F . Hedge Trimmer

The hedge trimmer is an important power tool when encountering large concentrations of climbing vines not directly adhered to the surface of a tree. The hedge trimmer works just like a brush cutter, only a long, barbed piece of steel runs back and forth along a second barbed piece of steel, and any plant tissue caught in between the two is severed. The safety benefits of the hedge trimmer are identical to the brush cutter, and for the same reasons.

G . Ford F-150 w/Camper Top

The Ford F-150 with 4 wheel drive capability is the standard vehicle for transport of both the strike team and their equipment. This truck safely seats 5, and is powerful enough to tow a trailer with any equipment used by the strike team.

H . ATV Spray Rig

This spray rig is an ATV with a 16 gallon tank on the front and a 24 gallon tank on the back, each of which is strapped to the frame of the ATV.

Tubes connect each tank to a battery-powered pump on the rear, underneath the back tank, which can be used to force mixed herbicide through either two rear boom spray nozzles, or a hand gun. This will be towed by the F-150 on a trailer, has 4 wheel drive capability, and a front cable winch.

I . RTV Spray Rig

This is the most advanced piece of equipment the strike team will be utilizing during treatment. Similar to the ATV spray rig, the RTV spray rig has a rear-mounted, custom designed spray rig bolted in. It has two, remote controlled, automatically winding reels of high-pressure hose, each of which is 300 ft. long. The rig itself can store 100 gallons of mixed herbicide, seats two technicians safely, and can be altered to use two booms from the rear, just as the ATV spray rig can.

VII. Site Visit Preparation

A . Material Acquisition

Prior to being dispatched to the installation, the strike team leader will confirm with the company manager about the scope of work to be done and what equipment will be necessary to complete the initial control of the infestation. The strike team leader will make sure the necessary power equipment for the treatment is obtained and in working-order, and the correct herbicides are purchased in sufficient quantity. The strike team leader will then confirm that access to the site has been secured by the site manager, and the necessary documentation for access is obtained by each member of the strike team.

If the strike team will be in the area for more than a day, the strike team leader will reserve rooms at either a hotel or a motel in the area of the installation, preferably no more than 30 minutes from the site. On the day of arrival, the strike team will meet with the site manager and discuss the results of data collection and site preparation. The strike team leader will learn the locations of the treatment site and the water source, and if they desire to do so, go over the maps with the site manager.

B . Confirmation Meeting

Depending on the complexity of the installation and the treatment site, it may be advisable for the site manager to visit the treatment site with the strike team leader and verify the site boundaries, the locations of any sensitive areas or valued plants, and confirm the identity of any invasive plant species not yet verified by the site manager. Any extra details about the treatment, the plants present, or hazards to the strike team should be discussed at this time as well. Any questions the site manager has about how the treatment will progress, and what can be expected during the treatment may be asked during this visit.

When the strike team leader has all the information needed to commence treatment, it is the strike team leader's responsibility to manage the strike team in the dividing up of the labor, the order of the treatment, and maintain quality control during the treatment. Any issues that arise during treatment will be discussed by the site manager and the strike team leader.

At this time, if the site manager did not post the signs alerting foot-traffic to the use of herbicides on site, the site manager may do so prior to starting treatment. When the site manager and strike team leader have all of the information needed to begin treatment, and all necessary treatment protocols are in place, the strike team can commence control of the infestation.

VIII. **Treatment Methodology**

The strike team will utilize a combination of chemical and mechanical techniques to control the invasive plant infestation. All members of the strike team will adhere to OSHA safety regulations, and the following treatment protocol will be utilized in accordance with local, state, and federal laws discussing, limiting, and regulating the use of pesticides.

A. **Cut-and-Treat**

Cut-and-treat is the process of completely severing the stump of a tree, bush, or vine where it enters the soil, and treating the cambium layer of the cut stump of the plant with herbicide immediately after the cut. Trees and bushes cut in this way will fall over and lay on the ground until decomposition occurs. This is done using either the chainsaw, brush cutter, and on very rare occasions, a machete. The benefits of this form of treatment are immediate, as the leaves of the plant will wilt rapidly, and the results of the treatment are significantly more visible. The chemical used to treat the stump is typically at least a 25% solution of either Glyphosate or Triclopyr (Rodeo or Garlon 3A). Plants treated in this way are either too tall to foliar spray, or have demonstrated difficulty in treating via foliar application of chemical.

B. **Hair-Cut Trimming**

Climbing vines can completely engulf a native tree or bush. In time, the reduced sunlight the tree is receiving can choke the tree; the weight of the vines on the tree can cause limbs to fell the entire tree. To control vines climbing a tree that are not directly adhered to the surface of the tree, the strike team will perform what is known as "hair-cut trimming". This process completely severs all climbing vines from eye-level down, and everything above the trimming height will die. The technician will then track down the largest of the vines that were below the trimming height, find where they enter the soil and perform cut-and-treat on them as well. The hair-cut trimming is typically done using a hedge-trimmer, but may also be done with a chainsaw or, on rare occasions, a machete.

C. **Girdling**

Girdling treatments is a form of cut-and-treat that leaves the tree or bush standing up right when it dies. Almost always performed using a chainsaw, a groove is cut into the stump of the tree or bush deep enough to completely sever the cambium layer, usually less than an inch, and continues all the way around the circumference of the plant, and as close to the ground as the technician can make it. This cut groove is then sprayed with a chemical mixture identical to that used in cut-and-treat applications. After the plant dies, it will eventually fall over on its own and decay. The purpose and value of treatments such as girdling, basal-bark spraying, and hack-and-squirting (mentioned below) that leave the tree standing upright are detailed at the end of this section.

D. **Hack-and-Squirt**

This is a simpler form of girdling that also leaves the tree standing upright, and doesn't use power equipment. A hand axe or a machete cuts into the cambium layer at a minimum rate of DBH (diameter at breast-height) plus one, also as close to the ground as the technician can safely and accurately swing. A tree whose DBH is four inches should receive five cuts with the machete. Ideally, these cuts will either overlap or connect along the outside of the tree, but this is not always necessary to ensure effectiveness of the hack-and-squirt. Chemical is sprayed into the cuts, just as with girdling.

E. **Basal Bark Application**

This fourth and final method of treating large invasive plants utilizes no power equipment, and does not physically damage the bark of the plant being treated. The purpose of this will be explained at the end of

this section. Using a back pack sprayer, a mixture of vegetable oil and oil-soluble triclopyr is slowly sprayed onto the outer bark of the tree or bush until the coating is heavy enough that it freely flows down the bark. The entire outside of the bark is treated this way until the bark is soaked with the oil solution from the ground up to a height ranging anywhere from six inches to six feet, depending on the species being controlled and its size.

F . Foliar Application

For plants that are shorter than six feet, a foliar application of chemical may be used to control the infestation. Using a back pack sprayer or one of the ATV/RTV spray rigs discussed in the “Strike Team Equipment” section, a low-concentration of chemical is sprayed onto the leaves of the plants, achieving at least 80% coverage on 80% of the leaves on every invasive plant present. The chemical is rapidly absorbed by the plant through the thin membrane on the leaf surface and the stomata, which are the small, microscopic breathing pores on the leaves. No physical damage is sustained by the plant in foliar applications. The heaviness of the coat of herbicide sprayed onto each plant, and the concentration of herbicide mixed in the tanks of the back pack sprayer or the ATV/RTV spray rig depends on the hardiness and tolerance of the plants being treated.

G . Treatment Details

Some species of plant react negatively to physical damage of the bark, such as *Ailanthus altissima*, the Tree of Heaven, which rapidly generates new sprouts from the roots or stump to compensate. The purpose of basal bark applications of oil soluble herbicide is to penetrate the bark of the plant without damaging the plant tissue. In cases where plants like *Ailanthus altissima* are present, basal bark application will be performed on those plants. Another benefit of basal bark applications is that they can also be used on plants that cannot be safely accessed with a chainsaw, or completely cut down because of hazards to work equipment or technicians, such as plants leaning out over a cliff face, or tangled in rusty wire. The strike team leader will determine which plants require which form of chemical and mechanical control based on company experience and time of year treatment is occurring in. Any concerns about treatment methods and plants present can be discussed by the site manager and the strike team leader prior to treatment.

Girdling or hack-and-squirting is typically performed on plants that are too large to cut down, or cutting them down would result in them falling over a trail, sidewalk, street, or fence. It is also performed if dropping the plant would make continuing treatments, such as foliar spraying, difficult with the fallen tree or bush present on site. Large trees and bushes that might damage human-made structures should be made aware to the site manager, who may choose to allow such plants to go untreated. Any such decisions will be brought to the attention of the site manager.

Treatments that result in the damaging of the tree with power equipment, such as cut-and-treat or girdling, will require a high concentration of chemical to kill the plant. The hand sprayer (see Strike Team Equipment) will be mixed with at least 25% glyphosate or triclopyr. This chemical mixture may also contain a blue marking dye so that stumps that have been treated are easily recognizable. Basal bark application of oil-soluble chemical is done at a rate of at least 17.5%, and may be as high as 25%. This too may contain a marking dye. Foliar applications of chemical may be as low as .25% Glyphosate for certain grasses, and as high as 5% glyphosate or triclopyr for plants whose leaves have a thicker, waxy cuticle which reduces chemical uptake. These foliar applications may contain several additional additives, such as a spreader which reduces the surface tension of the water and helps it to spread out

over the leaf surface, a sticker which helps the herbicide cling to the leaf surface, or an acidifier or penetrating agent which helps the chemical break through the leaf cuticle and penetrate into the plant's system.

A strike team successfully following all treatment protocol can guarantee a 90% kill of every invasive plant treated while using the lowest possible rate of chemical for effective control. Typical resources used following this protocol include herbicide and additives such as surfactants and dyes, and gasoline (for power equipment), all of which are provided for treatment by the strike team. Some treatments cannot be performed during inclement weather. Severe winds in wooded areas pose health threats to the crew, and drift can cause damage to off-target plant communities. Rain or actively dripping water from the leaves of the target plants can cause the herbicide to run off the plant and severely reduce effectiveness of treatment. The strike team leader will be responsible for assessing environmental conditions and hazards, and responding accordingly, first for the safety of the crew, then for the effectiveness of the treatment.

During treatment, the strike team leader is responsible for keeping record of how the work hours were spent on site, the environmental conditions experienced throughout the day, the amounts of each type of herbicide applied on the site, the species treated at each site, taking photographs prior to and during the treatment, and logging area covered through online GPS analyzing software, such as ipconnect.org. All of the information recorded by the strike team leader will be made available to the site manager during or after treatment is completed.

IX. Post Treatment Review

After the strike team has completed treatment of the invasive plant infestation, the strike team leader will contact the site manager and discuss the results of the treatment. If the site manager wishes, a meeting may take place between the site manager and the strike team leader to review the treatment. A walk-through of the sites treated is advisable to confirm that the treatment was completed to the satisfaction of the site manager. The strike team leader can discuss the methods utilized to control the infestation and any complications that arose during the process, as well as provide a time-line for results of the treatment to be visible at the site.

At this time, the strike team leader may discuss with the site manager future expectations for treatment. No individual invasive plant infestation can be completely controlled following an initial treatment, and long-term results typically require four to five years of regular treatment. Plants that were missed or survived the initial treatment will require treatment during a follow-up site visit. All invasive plants maintain a seed bank in the soil, and these seeds will sprout when the mature plants die from the initial treatment. Additional treatments will be spent targeting new growth, regrowth, and surviving plants in the treatment site, as well as any plant growth coming from a continual influx of invasive plant seeds from surrounding plant communities not being treated by the strike team. Different plant species and growth forms are best targeted during specific times of year. Foliar applications of chemical on deciduous plants cannot take place during winter months when the leaves are gone, and most treatments on woody plants have reduced effectiveness when performed in early spring during new plant growth. The strike team leader will indicate to the site manager a recommended site-specific treatment schedule based on the ISI.

When the site manager is satisfied with the treatment and the information given by the strike team leader, any keys given to the strike team for access to the site will be returned, temporary security



passes allowing access to the installation will be discarded as per base security standards, and the maps for the site may be returned to the site manager, if desired. When the site manager has confirmed that treatment is completed, the strike team may remove all signage put in place prior to treatment if the site manager has not done so, and depart the installation. The company manager will bill for the work completed in accordance with the contract agreement. Fulfillment of the contract concludes the treatment.