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AREA-WIDE EBIPM
SCIENCE-BASED SOLUTIONS FOR INVASIVE ANNUAL GRASSES

Establishing a Weed Prevention Area

A step-by-step user's guide

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A 2011 Product of the AREA-WIDE PROJECT

layout design and editing Ryan Jay Steineckert

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Establishing a Weed Prevention Area: A step-by-step user's guide

The Area-wide project is a USDA-ARS funded program to encourage and support enduring invasive annual grass management throughout the Great Basin.

What is a Weed Prevention Area?

The strategy of preventing weed infestations is nearly as old as weeds themselves. Preventing weeds is easier said than done, as there are very few effective ways to implement prevention programs.

The idea of Weed Prevention Areas (WPAs) is a new approach to implementing an effective prevention program. WPAs involve people who have a common goal of maintaining or creating healthy land resources where they live. Weed prevention areas help slow the spread of weeds into non-infested areas and minimize environmental and economic costs. Defined, weed prevention areas are cooperatively managed areas that focus on preventing weed invasions and implementing early management efforts (3).

As this user's guide will highlight, there is more to WPAs than simply keeping weeds out. The concept of WPAs is about changing a long-held way of thinking about weeds, especially invasive species.

Traditionally, weed management efforts are only initiated after a weed has become a major economic problem in an area. In forming WPAs, people in a community take a proactive approach and their planning efforts concentrate on keeping land without invasive species free from invasion. It seems like a subtle shift in thinking, but it can have huge payoffs for landowner groups working to keep their land and resources healthy.

The intent of this user's guide is to provide groups interested in setting up a viable prevention program in their area with the steps and resources to initiate and develop a weed prevention area.

WPAs can be part of, or organized similarly to, a Cooperative Weed Management Area (CWMA), but focus is placed on

One of the most important keys of a WPA is to involve people in the community as much as possible. The more individuals that get involved, the lighter the load for each of those individuals.

The dedication of people in the community can make all the difference in the success of a WPA.

implementing prevention and early infestation management methods within a localized area. Landowners and local citizens develop and implement a weed action plan which identifies site-specific strategies to reduce the susceptibility of land to weed invasion, interrupt weed invasion pathways, and prevent the spread of invasive weeds into new areas.

Some of these strategies include, early detection and eradication of satellite patches, limit weed seed dispersal and soil disturbances, contain neighboring weed infestations, establish and properly manage competitive plants, develop vegetation monitoring programs, and education and awareness programs targeting the general public to curb the spread of invasive species.

Rural areas and the people who live in them face different challenges and circumstances than do urban dwellers, but whether a rural community is virtually weed free or moderately to heavily infested by damaging invasive plants, a WPA can be developed to fit the situations. WPA plans are put together by the people who are managing weed infestations.

"Intellectuals solve problems, geniuses prevent them."

-Albert Einstein

Two important points are central to the success of a WPA. The first, is being able to prioritize management efforts to focus on prevention and early detection to effectively utilize limited resources. The second is the dedication of the community to get behind the idea and implement the multi-faceted plan.

How to Develop a Successful WPA

- Make people in the community the center of the WPA
- Re-prioritize weed management efforts to emphasize prevention
- Develop a well-designed action plan
- Put a reliable person in charge of implementing the plan
- Realize that protecting rural communities is a long-term, ongoing commitment

What are the Advantages of a WPA?

Typically, it is not until an invasive weed has become well established in an area that major weed management efforts are initiated in an attempt to limit damages. Managing and restoring these heavily-invaded landscapes requires a large amount of time, energy, and resources. Unfortunately, the success rate of these efforts is extremely low. In 1993, the Office of Technology Assessment reported that, on average, every dollar spent on early weed intervention prevented $17 in later expenses. Clearly, taking a proactive approach toward weed control can potentially save millions of dollars in damage and control costs while preserving valuable community resources.

WPAs are typically created and operated within watersheds or county boundaries. This works as an advantage to a WPA because local citizens and landowners are the most knowledgeable about the area, the people, the environment, and the challenges or limitations they face. WPAs give community members the opportunity to apply their knowledge to create an effective program by developing a plan and deciding how to implement the plan to keep infestations from advancing. The result is a prevention program that fits the needs and circumstances of the people in the community, allowing it to successfully operate into the future.

In addition, WPAs provide the structure and leadership necessary to encourage cooperation between people in the community and coordinate weed management efforts. As people work together toward common goals, they are able to pool limited time and resources to maximize effectiveness.

An established WPA can make it easier for groups to apply for grants and other programs that will secure additional funding. Additional funds help to minimize costs associated with initiating prevention by providing funds to make treatments, develop awareness campaigns or even to employ a WPA coordinator who can assure that projects are being completed. This, in turn, encourages more people to become involved in prevention and early control efforts.

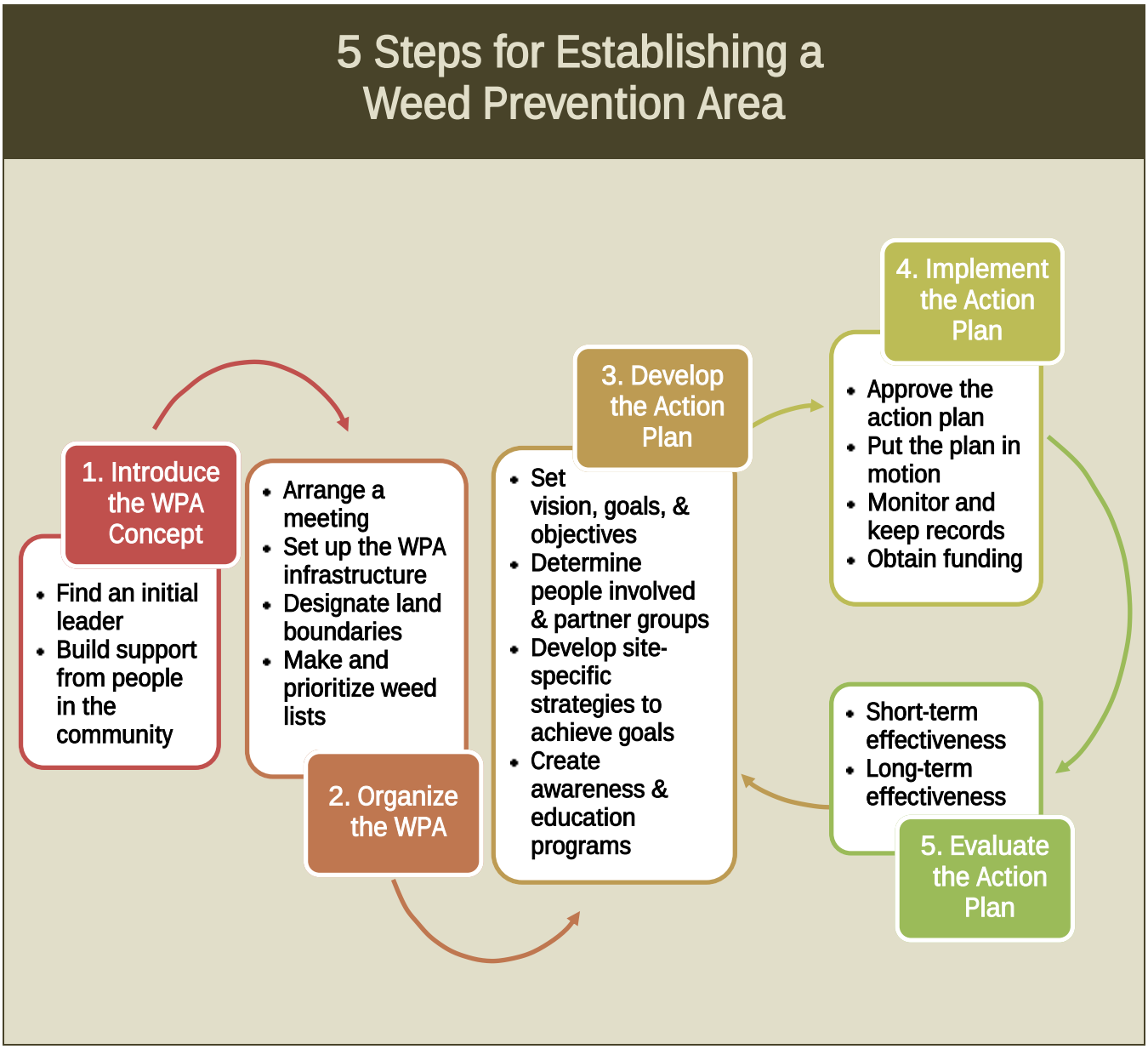
Money spent on prevention can provide excellent returns on investment when you consider that every dollar spent on early intervention saves $17 dollars in later expenses.

Steps to establish a WPA

The steps for forming a WPA are shown in the figure below. Each step is also discussed in detail in the following pages. At the end of each step, additional resources are provided for WPA organizers to utilize in developing an effective prevention plan.

By following these steps, concerned citizens will find establishing a WPA and developing proactive weed management plans a process that is straightforward to implement.

The emphasis on prevention and early detection/rapid response makes it easier for people to protect and preserve the land and resources they love and rely upon for their livelihoods.



4 - 5 Steps for Establishing a WPA

Step 1: Introduce the WPA Concept

The first step to getting a WPA established is to introduce the concept and build interest with as many land owners and people living in the area as possible to gain support for the idea. It is the people within a community that a successful WPA focuses upon and their involvement ultimately determines the success of a WPA.

Find an initial leader or "WPA champion"

Talk to influential people and identify someone who is excited about the WPA idea and would like to get involved. This person becomes a key player in facilitating involvement from a broad base of people as they talk to others and share their enthusiasm about the idea. Leadership can be provided by a county weed supervisor, government agency coordinator, extension agent, or concerned landowner. Successful WPAs require leaders with good communication skills, integrity, and the ability to work with a diverse group of people.

If a CWMA is already active within the community, consider forming a WPA as a CWMA sub-committee. In this scenario, members of a steering committee provide the initial leadership until the WPA becomes fully organized.

Invasive species such as medusahead possess the ability to reduce grazing capacity by up to 80% while decreasing biodiversity and creating monocultures of nearly worthless land.

Invasive Plants and their Negative Impacts

Plant Impacts

- Leafy spurge infestations with 80% cover reduce the livestock carrying capacity of land to zero (9).
- Medusahead reduces grazing capacity by up to 80% while also decreasing biodiversity (10).
- 7 rare plant species were eliminated in 3 years by spotted knapweed invasion in Glacier National Park (8).

Economic Impacts

- Direct and secondary annual economic impact of leafy spurge on the livestock industry in Montana, Wyoming and North Dakota exceeded $129 million (9).
- North Dakota loses more than $3.5 million annually in revenues from wildlife-related recreation due to non-native plant infestations (9).

Watershed Impacts

- Invasion of downy brome (cheatgrass) increased rangeland wildfire frequency from once in 40-60 years to once in 3 years (9).
- 56% increase in water runoff and 192% increase in soil erosion on knapweed-infested land (4).
- Water consumption of saltcedar infestations can cause pools, rivers and streams to dry up (2).

Wildlife Impacts

- There is a 98% reduction in elk grazing on land invaded by spotted knapweed (6).
- Bison and deer use is reduced 83% and 70% respectively, on land invaded by leafy spurge (7).
- Salmon spawning beds are threatened by increased amounts of silt in water from knapweed-related erosion (8).

Build support for the idea

The "WPA Champion" leads the efforts to introduce the WPA concept and will know best how to convey how a WPA can be an effective program to manage invasive species among the residents in their area.

Highlighting negative impacts invasive weeds have on economic and aesthetic values can often rally and bring people together for the common cause. Negative impacts include decreased forage and crop yields, reduced wildlife habitat, reduced land value, and degradation of natural resources. In turn, these impacts can increase production and management expenses and reduce recreation and tourism revenue (see the previous for additional information on negative impacts of invasive weed infestations).

It is important to identify the specific resources at risk within an area of concern and emphasize how a WPA can help protect them. An organized WPA can also appeal to people's sense of responsibility and stewardship. A good message to emphasize is that a WPA cannot be successful without member's individual support and participation. Also stress how a WPA can personally benefit individuals, regardless of whether they are land owners or not. This initial step is an important beginning as part of building a strong foundation of support for a WPA.

One effective approach for sharing ideas and information is talking to people one-on-one. This could be as simple as talking to friends and neighbors about the benefits of a WPA and inviting them to become involved. The WPA champion and supporters can also speak at meetings or set up an informational booth at gathering places and special functions and community events. These interactions open the line of communication and demonstrate to people their thoughts and concerns are important, and ultimately how the WPA directly benefits everyone.

If funds are available, prevention messages can be conveyed through printed materials, such as fliers or posters and distributed throughout the community. The main purpose of fliers and posters is to catch people's attention and encourage them to contact a leader for more information on how to get involved.

Invasive species can negatively impact crop yields and forage; they can reduce wildlife habitat and land value and they degrade the natural resources of the area.

Additional Resources to Build Community Support

Information about weed invasions and the need for early intervention:

Center for Invasive Plant Management (CIPM). The Invasive Plant Resource Guide: A Big Book for a Big Problem. http://www.weedcenter.org/resource_guide/rg_cover.html

Lake Tahoe Basin: Weed Coordinating Group. Impacts and Spread of Invasive Weeds. http://tahoeinvasiveweeds.org/weeds/impacts.php

U.S. Fish and Wildlife Service. Havasu National Wildlife Refuge. How do Invasive Species Spread? http://www.fws.gov/southwest/refuges/arizona/havasu/invgethere.html

Additional information outlining consequences of invasive weed infestations on the land and resources:

Alonso, A., F. Dallmeier, E. Granek, and P. Raven. 2007. Biodiversity: Connecting with the Tapestry of Life. Smithsonian Institution/Monitoring and Assessment of Biodiversity Program. 2nd Edition. Washington, D.C., U.S.A.
http://www.weedcenter.org/resource_guide/biotapestry.pdf

Cows and Fish. Alberta Riparian Habitat Management Society. http://www.cowsandfish.org/

Natural Resource Conservation Service. Soil Quality Concepts.
http://soils.usda.gov/sqi/concepts/concepts.html

U.S. Environmental Protection Agency (EPA). Wetlands.
http://water.epa.gov/type/wetlands/index.cfm

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Washington, D.C. 109 pp.
http://www.weedcenter.org/resource_guide/Invasive%20Plants%20Factbook.pdf

Step 2: Organize the WPA

Arrange a meeting

Once the WPA idea has been introduced and enough people are interested in organizing a WPA, meetings can be coordinated. The purpose of these meetings is to organize a WPA and develop a weed prevention action plan.

Usually, the first meeting is an organizational meeting and all interested groups should be invited to participate. This includes land owners, county weed supervisors, government agency representatives, and special interest groups. Top agenda items at this meeting are to identify the WPA structure, leadership, WPA boundaries, and begin designing a WPA action plan.

Holding meetings in a participatory style increases the discussion of ideas and builds cooperation between individuals and/or groups. This format gives people the chance to share ideas, ask questions, and get involved. Consider having the meeting facilitated by

The primary difference between a CWMA and a WPA is the focus. The focal point of a Cooperative Weed Management Areas is, as defined by its name, management, while a Weed Prevention Area's focus is to *prevent* the need for that management.

someone who is impartial about the weed prevention area so as to encourage as much participation as possible. County extension offices often have trained facilitators or serve as good resource to find a facilitator.

Prior to or during the first meeting, it is also helpful to encourage conversation, and for those in attendance to fill out a quick survey about their perceptions of weeds and invasive species in the local area and the challenges they face. A sample survey is provided as an example below.

Set up the WPA infrastructure

The basic infrastructure of CWMA is a perfect model from which to develop the structure for a WPA. If a CWMA currently exists within the area, consider how a WPA could be integrated into the existing structure. On the following pages (12 and 13) we offer two scenarios under which a WPA can be structured depending on whether a CWMA is already in existence.

Landowner Survey to Use at a WPA Organizational Meeting

- Do you have land that is not impacted by invasive species that you would like to keep free of invasion?

  Approximately how many acres?
- Approximately how many acres of small infestations of invasive species would you estimate that you have?
- What are the 3 most likely ways they are spreading? (other than from current infestations)
- Would you be willing to work cooperatively with neighbors to keep your land free from infestations?
- Would you be willing to scout your land for potential new occurrences of these species?
- What groups would you want to partner with to develop projects or plans to prevent further infestations or new infestations?
- Who should know about the WPA activities?
- What species should be on the list?
- Do you have ideas for projects that will prevent weed invasions in our community?

In a weed prevention area, organizers prioritize weeds based on invasion status and potential economic and environmental damage specific to their particular situation.

Designate the land boundaries of the WPA

It is important to establish clear land boundaries for the WPA and ensure that a map illustrating those boundaries is easily accessible to participants. Unclear WPA boundaries leads to confusion concerning the extent of the area included and the people involved. Ultimately, this can decrease the cooperation among involved individuals and the effectiveness of the WPA. The clearest boundaries would be those established by following political or landscape features such as county lines or rivers.

Make and prioritize weed lists

A large number of undesirable plants exist but, because of limited resources and time, it would be unreasonable to target each of them. Making and prioritizing weed lists early on allows the group to limit the scope of the WPA to the weeds which are the greatest threats environmentally and economically. Prioritization makes planning future activities easier and allows limited resources to be used most effectively.

Initially, if no weed maps or other information exist, weed lists can be developed from compiling landowner information. Discuss the weeds that landowners know are currently on their property and which they view as problematic or damaging. Refer to department of agriculture lists or county and state noxious weed lists to identify invasive weeds that may not be found within the target area but are known to be a problem nearby.

Leadership Structure When a CWMA Does NOT Exist

When a CWMA does not exist, it's essential to establish a steering committee. All interested parties must be represented for the WPA to be effective. Members should be rotated periodically allowing everyone the opportunity to become more involved. This committee organizes members, schedules and directs management activities, and helps establish operating procedures and priorities.

A chairperson is appointed by the steering committee and will be responsible for scheduling meetings, securing further funding, and overseeing the organization and coordination of efforts. It is suggested to rotate these positions every two years with the vice-chairperson assuming the role of chairperson while another vice-chairperson is appointed, ensuring continuity as well as increased participation.

As the WPA progresses, sub-committees can be formed to develop and implement specific projects as outlined in the action plan, such as public education and awareness or invasive weed mapping. Project leaders are assigned to direct committee meetings, manage expenditures, and provide documentation and final reports. When a project is completed, the sub-committee can be disbanded. This provides the opportunity for members of the community to volunteer and become more involved in the WPA. Delegating specific projects to sub-committees also provides the steering committee more time to devote toward administrative and coordination duties.

Leadership Structure When a CWMA DOES Exist

When a CWMA is established, one option is to form a CWMA sub-committee comprised of individuals interested in the successful implementation of a WPA within the designated area. A committee chairperson could then be elected to direct the affairs of the WPA. It will be important for the committee chair to work closely with the CWMA to coordinate resources and management activities.

This structure allows landowners and public land managers within the smaller defined area to unite and focus on developing and implementing prevention and early detection strategies while the larger CWMA does business as usual. In addition, the framework may already be in place for publishing educational materials, collecting weed data, and acquiring and depositing funding. There may also be an individual already hired that can act as the weed coordinator for the WPA action plan.

An alternative option is for the CWMA as a whole to consider moving toward a WPA distinction. When a CWMA forms a WPA, weeds are prioritized based upon invasion status and potential economic and environmental damage to first protect weed-free land through prevention and early detection/rapid response techniques. Management efforts then target satellite patches and then larger, well-established infestations themselves. The existing infrastructure of the CWMA will remain unchanged.

Prioritize Weed Species

When making weed lists, prioritize each species according to the WPA management objectives. The following method for prioritizing weed species is recommended.

Early Detection/Rapid Response

This priority status is for plant species currently not found within the WPA, or in very small patches (less than 2 acres in size). They are species known to be particularly aggressive and capable of causing significant changes in the landscape.

These species receive the highest priority because they have not yet established within the area and minimal resources are needed to prevent or eliminate them.

Control

Species in this category are aggressive plants which are established within a WPA but are present in localized patches and can be controlled or at least significantly reduced.

Containment.

Any species that are well established within the WPA and are causing significant losses in production or utilization of valuable resources are placed in this category. The goal with species given a containment priority is to keep them from spreading by focusing efforts on the perimeter of the infested area.

Participation from local landowners is especially helpful in making and prioritizing a weed list because they are familiar with invasive weeds they view as problematic or damaging.

Identify Invasion Status

Once the group creates and prioritizes a weed list, it is important to determine how extensively the area is infested by each of the listed species. Having a rough estimate of the extent that each species has infested aids in the development of feasible priorities and goals for the WPA.

Weed Free

If the designated area is virtually weed free of the species of concern, this provides an ideal opportunity to take a proactive role in keeping weeds out, preventing costly negative impacts. Goals and objectives emphasize delineating and protecting weed-free areas. Focus on developing and applying prevention and early detection/rapid response strategies.

Small Isolated Infestations

When areas have small infestations of less than 1 acre in size, setting up management strategies to eliminate these stands is a primary objective.

Moderate to Heavy Infestations.

If the designated area is moderately to heavily infested by multiple invasive species, identifying and protecting large tracts of weed-free land may not be possible, but the WPA concept can still be applied. Goals and objectives focus first on small, easily-eradicated infestations, as well as on satellite patches bordering the perimeters of larger infestations to prevent further spread. Over time, as new invasive plants are prevented from establishing,, more resources will become available to target larger, well-established infestations and reduce their size to acceptable levels.

Additional Resources for Organizing a WPA

Additional information and tips on how to build effective groups:

Natural Resource Conservation Service (NRCS). Social Sciences Team Publications. People, Partnerships, and Communities Series. http://www.ssi.nrcs.usda.gov/publications/#ppcs

Rebori, M.K. 1997. How to Organize and Run Effective Meetings. Fact Sheet 97-29. Cooperative Extension. University of Nevada-Reno. http://www.unce.unr.edu/publications/files/cd/other/fs9729.pdf

Skelly, J. 2000. Motivating Volunteers. Fact Sheet-00-30. Cooperative Extension. University of Nevada-Reno. http://www.unce.unr.edu/publications/files/cd/2000/fs0030.pdf

Kaner, S., L. Lind, C. Toldi, S. Fisk, and D. Berger. 2007. Facilitator's Guide to Participatory Decision-Making. 2nd ed. San Francisco, CA: Wiley. Search for book at: http://books.google.com/books

Additional information on the risks of weed invasion:

USDA. Natural Resource Conservation Service. Plant Database. Invasive and Noxious Weeds. http://plants.usda.gov/java/noxiousDriver --Provides Links to Federal and State Noxious Weed Lists

Hiebert, R.D., and J. Stubbendieck. 1993. Handbook for Ranking Exotic Plants for Management and Control. Denver, CO. National Park Service: Natural Resource Report NPS/NRMWRO/NRR93/08. http://www.nature.nps.gov/pubs/ranking/ranking.htm

Prather, T. 2007. Risk Assessment and Decision Making for Invasive Plant Management Planning. Chapter 6 in CIPM (ed.), Invasive Plant Management: CIPM Online Textbook. Bozeman, MT: Center for Invasive Plant Management. http://www.weedcenter.org/textbook/index.html

Step 3: Develop the Action Plan

Developing a comprehensive action plan provides the framework and guidelines to implement projects within the WPA. A well-developed action plan is a valuable resource to obtain funding for projects. Holding additional meetings or group discussions continues to encourage involvement from more people. During these meetings, WPA leaders are able to share information and gather project recommendations for different segments of the action plan.

The leaders of the WPA will be responsible for compiling the information and recommendations to create the WPA action plan. During the development of the action plan, be realistic in what strategies and activities can be implemented successfully. A worksheet for Developing a WPA Action Plan can be found on page 37 of this booklet.

Set vision, goals and objectives

An action plan begins with a vision statement reflecting what the group sees as the positive outcome of a WPA. It is important to state a vision with a positive perspective. An example vision statement might be "With our WPA, we will reduce acreages of invasive species in our area and increase the awareness about invasive species."

Goals are generally stated as the overall impacts or achievements a WPA wants to accomplish. One example of how a goal could be stated is: "The rangeland health is maintained and production capacity is increased by reducing invasive infestations for continued cattle production and wildlife habitat enhancement."

Objectives are more specific activities, describing projects that will achieve the goals of the WPA.

Objectives could look like this:

- We will identify and delineate high-priority areas.
- We will initiate awareness programs directed at the recreational users of our area.

Determine the people involved and partner groups

This section of the action plan includes the names of people actively involved in the WPA. Potential partners that can also be listed might include:

- People and groups that should be aware of WPA projects.
- Groups that can assist in project development and resource acquisition.
- Groups that benefit from knowing about programs including, but not limited to: road departments, environmental groups, watershed councils, federal agencies, schools, and user groups.

When these relationships are recognized and developed early on, these organizations can often provide funding or help in obtaining operating funds for the WPA.

Prevention Strategies:

Prevention strategies are specifically intended to reduce the number and frequency of weeds moving into the WPA by interrupting weed pathways and spread vectors. As the plan is developed, serious consideration should be given to the following questions:

- How will patches occurring near the borders of existing infestations, or in new locations, be found? How will the movement of these infestations be interrupted?
- What actions can be implemented to prevent invasive spread or infestation and what vectors are the most important dispersers? What programs can be implemented to limit the spread of these species?
- How will disturbances be minimized, such as along roadsides? When they do occur, will they be reseeded?
- How will dispersal be limited along waterways?
- How will livestock be managed to reduce seed dispersal? Can they be diverted from areas with infestations during seed set? Can they be held in a central area before moving from a weed infested area to a “weed-free” area?”
- How will movement of equipment be handled? Could there be designated cleaning sites?
- What actions can be taken to reduce the dispersal of seeds through recreational activities? Can awareness signs, brochures, or other programs be developed? Could there be designated cleaning areas for recreational vehicles?

For more on prevention strategies, the Weed Wheel (pictured at right) offers solutions based on preventing the dispersal methods of invasive and undesired species. Create or request your Weed Wheel at www.ebipm.org.

The Weed Wheel is adapted from Fig. 2 of "A Conceptual Framework for Preventing the Spatial Dispersal of Invasive Plants" by Kirk Davies and Roger Sheley. 2007 Weed Science 55:178-184

Set site-specific strategies to achieve goals

Early detection/ rapid response strategies

A WPA plan must consider what actions will be taken when an invasive species has spread from containment zones or from outside the WPA boundaries. Detection efforts should be directed toward areas where weeds are most likely to be introduced and become established.

Part of the early detection/rapid response strategy will require putting a reporting system in place so new populations can be flagged, marked on a map or pinpointed with a GPS and reported. One idea used by a WPA in Montana was to set up a 1-800 hotline where new infestations could be reported. During this part of the planning process, consider how early detection/rapid response strategies can be carried out in conjunction with the mapping program.

To help WPA members develop effective early detection/rapid response strategies, answering the following questions will guide the process:

- Where are the high risk sites (pathways of weed invasion) located within the WPA?
- To whom or where will new infestations be reported?
- Who will record the location of new infestations? How will they be recorded?
- How will these new infestations be eradicated?

One of the major benefits of prevention is that it can be accomplished at the same time as other work.

Efforts to prevent invasive species from infesting areas that are already weed free will save in time, energy, resources and money that would otherwise have to be spent on costly restoration.

Mapping strategies

An effective weed management plan requires a clear picture of the relative abundance and distribution of the invasive plants present. For this reason, invasive weed detection is the most intensive activity within a WPA and should be initiated as soon as possible. Initially, CWMA or other weed maps of the area can be utilized if they are available.

Comprehensive distribution maps of invasive species are valuable to identify weed-free areas, discover routes or pathways of seed dispersal, and help prioritize management of invasive species based upon their distribution and the overall number of acres infested. Maps also provide important baseline data from which the long-term success of the WPA can be evaluated.

A useful weed map requires four key ingredients:

- species
- location
- approximate infestation size
- canopy cover

To establish a long-term mapping program for a WPA, some baseline information should first be decided:

- Who will conduct the weed mapping?
- What techniques will the WPA use to collect weed data?
- Where will mapping begin?
- How many acres should be mapped each year?
- Could the WPA be divided into zones and mapped individually each year?

A more in-depth discussion on specific mapping strategies follows.

Hiring a private contractor in the region is one way to conduct the weed inventories, analyze the collected information, and create the distribution maps. An alternative may be for the group to develop their own funded program. High school students or other interested individuals can be hired and trained to map each summer within the WPA boundaries.

Workshops could also be held to train landowners to identify invasive weed species and record patches using simple Garmin GPS units or a 7.5 minute topographic map. All collected information would then be managed by either the WPA committee or the weed coordinator.

If the WPA chooses to develop their own mapping program, be aware of several associated costs. These include providing equipment, global positioning system (GPS) units, rangefinders, and compasses, hiring crews, training, and time spent processing data and preparing reports. Some hidden costs include equipment maintenance, site licenses for GIS software, field maps, and notebooks (1).

A variety of weed mapping methods and techniques exist and it can be difficult to determine the best approach. For the WPA to identify which approach will work best for their situation, answering the following questions should help guide the final determination:

- Will the information be used primarily to develop treatment strategies or will it be used for monitoring purposes?
- How much detail is required?
- What are your possible constraints, including how much time, labor, and funding is available?

Other information can be collected for monitoring purposes, but the cost of mapping per acre increases as the level of detail required increases. In addition, the simpler the

Regardless of the technique used to collect weed data and begin mapping the infestations, the sooner you can start collecting that data and preventing weeds, the better.

program is, the easier it will be to manage and maintain.

Weed infestations can be hand-drawn on topographic maps, recorded using GPS technology, or mapped using remote sensing. Selecting the best method depends largely upon the equipment available, terrain, and personal preferences. Individual weed patches can be depicted using point, line, or polygon features.

- **Point features** are typically the fastest and most cost-effective technique, and can indicate the location and approximate size category of the infestation. They do not represent the actual shape of the patch and are not the best for detailed monitoring of patch perimeters.

- **Line features** are useful to depict continuous, uniform infestations that follow linear shapes such as along roads, trails, or waterways.

- **Polygons** can be used to illustrate the approximate shape and location of a patch, which is useful for measuring changes over time. The accuracy of patch size varies depending on whether the polygon was simply drawn on a GPS screen or by walking the patch perimeter (1).

Although every situation is different, there are basic elements to help ensure that quality weed data is collected. Outlined briefly on the following pages are several components of Utah State University's Wildland Weed Mapping Methods developed by Andersen and Dewey (1). No matter what mapping method is used, consideration of these basic components helps in the development of a weed mapping program.

It's important to make sure all individuals involved in mapping agree on how the data will be collected, recorded, and reported .

Basic Elements for Collection of Quality Weed Data

Effective Detection Distance

Before beginning, the surveyor should determine the maximum distance at which the targeted plant species can still confidently be detected in the given terrain. This is the effective detection distance (EDD). Multiplying the EDD by two gives the maximum width of a walking search pattern called an effective detection swath width (EDSW). A typical EDSW is 50 yards, but this will vary according to the terrain, vegetative cover, and size and visibility of targeted weed species. If terrain is rough, vegetative cover is thick, or the size of the targeted species is small, visibility decreases, requiring a decrease in the EDD.

Patch Size Resolution

Determine the minimum distance required between two weeds or patches of the same species to be considered separate infestations. This is called the patch size resolution (PSR). Plants separated by the PSR or more should then be mapped as separate infestations. A PSR of 25 or 50 yards is recommended. A smaller PSR provides greater detail in weed distribution.

Flat Terrain

For full coverage surveys on relatively flat terrain, follow straight parallel lines, called transects, determined by a compass bearing or a UTM Northing or Easting. Transects should be spaced one EDSW apart to ensure a full coverage search.

Rough Terrain

For full coverage surveys in hilly terrain, surveyors should walk as perpendicular to the direction of the slope as possible following contours spaced one EDSW apart to minimize physical exertion.

Roads and Trails

When conducting surveys along roads, trails, or waterways, visually search the area thoroughly 25 yards to the left and right as you travel.

Recording Patches

Weed infestations can be recorded as points, lines, or polygons. Points are the simplest method and are sufficient in most cases. To map an infestation as a point, walk to the center of the patch. Determine if the patch more closely resembles a square or a circle. Using a handheld laser rangefinder, measure to multiple locations on the patch's edge. The average of these measurements provides an approximate estimate of the square yards or radius of the patch. The patch can then be assigned a patch size category (Table 1 below). Patch size categories have established upper and lower limits set in both square yards and radius. For example, 0.1 of an acre has a lower limit radius of 1.75 yards and an upper limit radius of 5.3 yards. Any average patch measurements which fall between these limits would be considered a 0.1 acre patch.

Table 1. Patch size categories for buffered points used by USU Wildland Weed Mapping.

Acres	Sq yards	Radius (yds)	Visual estimate
single plant	N/A	N/A	single plant
0.001 (few)	4.8	1.25	1 arm span
Limit	9.7	1.75	
0.01	48	4	4 person tent
Limit	87	5.3	
0.1	484	12	2 full-size trucks
Limit	881	16.8	
0.25	1,120	20	1 small house
Limit	1,539	28	
0.5	2,420	28	2 small houses
Limit	3,301	32.4	
1.0	4,850	39	1 football field
Limit	6,379	45.1	
2.5	12,100	62	1 city block

Canopy Cover

Percent canopy cover is calculated by visualizing the shape and size of the infestation, estimating the percentage of the surface areas covered by the weed canopy, and then assigning the closest canopy cover category (Table 2 at right). Canopy cover provides an estimate of the percentage of land within the infested area that would need to be treated.

Table 2. Canopy cover categories used by USU Wildland Weed Mapping.

Canopy cover	**Percentage**
Not applicable	Not applicable
Trace	< 1%
Low	1-5%
Moderate	6-25%
High	26-50%
Majority	51-100%

With limited resources, it is probably not feasible to survey an entire WPA in one season, but the goal should be to map as many acres as possible each year. The most cost-effective method is to prioritize areas so that high risk sites are inventoried first. The possibility of detecting new invading species decreases as you move away from these areas.

High-risk sites act as pathways of weed dispersal and are often high-use areas or disturbed sites, such as roads, trails, waterways, recreation sites, and animal migration or livestock trails.

Large portions of low-risk land, when inventoried each year, confirm weed-free status or detect satellite infestations. By maintaining a detailed schedule, high-risk sites are re-inventoried every 3-5 years and low-risk sites every 10 years. As information is collected, sub-areas can be delineated, allowing specific prevention objectives and outcomes to be developed for more manageable areas. This could even include

Did You Know?

WPAs are an important component in ecologically-based invasive plant management (EBIPM). EBIPM is a decision-making model developed to help land managers apply ecological principles to the problem of weed invasion. With this model, land managers can address the underlying causes of weed invasion by implementing site-specific weed management strategies that influence basic ecological processes. The EBIPM model is based on three general causes of succession. Succession is the process of change in plant species growing on a landscape over time):

- **Site availability**: niches (safe sites) providing the necessary resources for a plant to grow.
- **Species availability**: the presence or absence of viable propagules in the soil seedbank.
- **Species performance**: how well a species responds to different environmental conditions.

WPAs can have a significant impact on the species availability in an area. Using weed prevention and early detection strategies allows land managers to interrupt the production and dispersal of weed seeds over the landscape. This reduces the number of viable weed seeds in the soil seedbank and gives desirable plant species a chance to establish and become more competitive. For more information on EBIPM visit www.ebipm.org.

Field tours are an excellent way to get community members and landowners out to see the land and some of the problems with invasive plants. It also gives them an opportunity to share knowledge and evaluate the effectiveness of their efforts in a WPA.

developing ranch/farm weed management plans with landowners.

Ecosystem management strategies

Maintaining healthy and competitive plant communities discourages weed establishment and increases the effectiveness of weed control. Management strategies should integrate a combination of methods to encourage the persistence of desirable ecosystems.

Strategies include proper grazing management such as pasture rotation, altering season of use, or multi-species grazing, or the promotion of natural disturbance regimes such as fires. Roadside and waterways, the primary pathways to spread of invasive species, are all part of integrated vegetation management strategies.

For more in-depth information on managing invasive species using integrated methods or to learn more about EBIPM, visit www.ebipm.org.

Create awareness and educational programs

A major component of a WPA action plan is the development of awareness and education programs. It is this aspect of the WPA where many people and civic groups can be involved helping raise the level of

awareness in protecting the area's natural resources. The sky is the limit and the ideas and programs generated by these groups are encouraged.

Projects that are developed that incorporate a cooperative, team-type effort generally are successful and contribute to the overall success of a WPA. There are many ways to insert weed awareness programs and are great avenues to encourage community service projects.

Increasing the number of people involved enhances the WPA's education and awareness efforts.

Ways to Increase WPA Education and Awareness in the Community

- Strategically placed signs, fliers, and roadside kiosks explaining the need for weed prevention and what people can be do to help prevent invasive species infestations.
- A monthly newsletter or section in the local newspaper providing weed prevention tips, management strategies, and basic information on invasive species within the WPA.
- Calendars highlighting important natural resources in the WPA and what can be done to protect them.
- Annual field tours allowing private citizens and county weed leaders to share knowledge and evaluate the effectiveness of weed prevention and early management efforts.
- A small booth at area events (i.e. county fairs) providing information on invasive weeds in the area, weed prevention, WPAs, and upcoming activities.
- Workshops teaching interested individuals how to identify weed species, record weed infestations using a basic GPS unit or topographic map, and apply control techniques.
- Youth summer employment opportunities to map weeds within the WPA.
- A poster drawing competition for grades K-6 emphasizing the need for weed prevention.
- Service opportunities for scouts, FFA, and 4-H to help control patches of invasive weeds or restore disturbed areas in order to prevent invasive weeds from becoming established.

Resources for Developing the WPA Action Plan

Sources for more information concerning invasive weed prevention strategies:

Clark, J. 2003. Invasive Plant Prevention Guidelines. Center for Invasive Plant Management. http://www.weedcenter.org/store/docs/CIPM_prevention.pdf

Goodwin, K. and J. Jacobs. 2007. Developing Invasive Weed Prevention Areas for Rangeland Ecosystems. Invasive Species Technical Note Number MT-15. http://www.mt.nrcs.usda.gov/technical/ecs/invasive/technotes/invasivetechnotemt15/

McNamara, D. 2007. Invasive Free Zone Guidebook. U.S. Fish and Wildlife Service. http://www.fws.gov/midwest/whittleseycreek/documents/IFZGuidebook.pdf

USDA. Forest Service. 2001. Guide to Noxious Weed Prevention Practices. Version 1. http://www.fs.fed.us/rangelands/ftp/invasives/documents/GuidetoNoxWeedPrevPractices_07052001.pdf

USDA. Agricultural Research Service. 2010. Area-Wide Ecologically Based Invasive Plant Management (EBIPM). The Weed Wheel. http://www.ebipm.org/content/1105

Source for more information regarding early detection/rapid response strategies.

Federal Interagency Committee for the Management of Noxious and Exotic Weeds. 2003. A National Early Detection and Rapid Response System for Invasive Plants in the United States: Conceptual Design. http://www.fws.gov/ficmnew/FICMNEW_EDRR_FINAL.pdf

Several sources of information about weed mapping methods, protocols and programs:

DiPietro, D., M. Kelly, S. Schoenig, D. Johnson, and R. Yacoub. 2002. California Weed Mapping Handbook. California Department of Food and Agriculture. http://cain.ice.ucdavis.edu/weedhandbook

Rew, L.J., and M.L. Pokorny. 2006. Inventory and Survey Methods for Non-indigenous Plant Species. Bozeman, MT: Montana State University Extension. http://www.weedcenter.org/outreach/docs/InventorybookCvrToc.pdf

North American Weed Management Association (NAWMA). 2002. North American Invasive Plant Mapping Standards. www.nawma.org/Mapping/MappingMain.pdf

The Nature Conservancy. 2007. The Global Invasive Species Team. Weed Information Management System v.3.0. An Application Tool for Invasive Species Management. http://www.imapinvasives.org/GIST/WIMS/index.html

* A worksheet for Developing a WPA Action Plan can be found on page 37 of this booklet.

Additional Resources for Developing the WPA Action Plan

Tools and other resources to help develop ecosystem management strategies:

USDA. Agricultural Research Service. 2010. Area-Wide Ecologically Based Invasive Plant Management (EBIPM). http://www.ebipm.org/content/1105

ATTRA. National Sustainable Agriculture Information Service. Pasture, Rangeland, and Grazing Management. http://www.attra.ncat.org/attra-pub/livestock/pasture.html

Rangelands West. http://rangelandswest.arid.arizona.edu/rangelandswest/

Center for Invasive Plant Management (CIPM). Resource Directory. Management. Principles of Ecologically-Based Management. http://www.weedcenter.org/management/ecological.html

Examples and resources for use in development of education and awareness programs:

Montana's Statewide Noxious Weed Awareness and Education Program. Pulling Together Against Noxious Weeds. http://www.weedawareness.org/

Idaho Weed Awareness Campaign. Pulling Together Against Invasive Weeds. http://www.idahoweedawareness.com/

The Nature Conservancy (TNC). The Global Invasive Specie Team. Volunteer Coordination and Outreach Tools. http://www.invasive.org/gist/outreach.html

USDA. National Agricultural Library. National Invasive Species Information Center. Plants. Educational Resources. http://www.invasivespeciesinfo.gov/plants/education.shtml

Links for information on general invasive weed identification, biology, and control:

Center for Invasive Plant Management (CIPM). Definitions, Identification, and Biology. http://www.weedcenter.org/inv_plant_info/definitions.html

USDA. National Agricultural Library. National Invasive Species Information Center. Plants. Management. http://www.invasivespeciesinfo.gov/plants/control.shtml

Step 4: Implement the Action Plan

Approve the WPA action plan

Your group is now ready to get to work on actual projects. Even though many people may be involved throughout the development of the WPA, they may not be aware of the entire plan. Once the WPA action plan is completed, holding another meeting for anyone to view the final document and provide feedback helps encourage people to begin implementing the plan. At this point in the process everyone involved will know what is expected of them in the approved document.

Put the plan in motion

The leaders of the WPA are responsible for managing the projects outlined by the action plan. For each project, a timeline for implementation and completion, expected expenses, and expected outcomes will need to be specified. A project planning sheet is provided on page 38 of this booklet.

The group or a WPA coordinator will also need to organize adequate help (hired or volunteers) to carry out each project. If funding allows, the WPA could hire or appoint a WPA coordinator. This person would be in charge of the day-to-day responsibilities such as scheduling and spraying weed infestations, overseeing weed mapping, and managing maps, data, and duties related to completing projects.

Monitoring and keeping records

Monitoring weed infestations and keeping good records are a vital part of any

Providing community members and landowners the opportunity to give feedback and to get involved in developing the action plan will lead to better participation in implementing the plan.

weed management plan. Any time a weed infestation is treated, basic information regarding the species treated, its location, and treatment method should be noted.

This information is useful in evaluating the effectiveness of treatment methods and planning future applications. It also provides organization to the WPA and ensures that resources are utilized efficiently. For this reason, all WPA members should be encouraged to record treatment information.

A weed treatment form is provided on page 39 of this booklet.

Funding WPA activities

No matter how enthusiastic individuals are about becoming involved and sharing resources, the WPA will likely fail if adequate funding is not available to support management activities outlined in the action plan. For this reason, WPA leaders should make securing additional funds a top priority.

When Applying for Grants: Utilize WPA Selling Points

- **Partnership** - A WPA is a cooperative prevention system and fosters collaboration across boundaries to include public and private land managers, government agencies, special interest groups, and concerned citizens.
- **Grassroots** - A WPA is created and implemented at the local level, allowing it to better fit the needs and circumstances of specific areas and the residents of that area.
- **Proactive** - A WPA is a new approach to an old problem. Rather than waiting for invasive weeds to become a major problem, members take steps to protect valuable resources from becoming degraded or altered.
- **Weed Free** - The land within a WPA is essentially weed-free but is threatened by invasion. By investing in protecting this land and its resources now, large damage and control costs can be avoided.

Where to obtain funding and how to apply is listed under the Additional Resources on the following page.

Additional Resources for Implementing a WPA Action Plan

Potential sources of funding for invasive species management programs:

Center for Invasive Plant Management (CIPM). Resource Directory. Funding Opportunities. http://www.weedcenter.org/funding/funding.html

National Fish and Wildlife Foundation. Grant Programs. Pulling Together Initiative. http://www.nfwf.org/AM/Template.cfm?Section=Charter_Programs_List&TEMPLATE=/CM/HTMLDisplay.cfm&CONTENTID=16527

Sustainable Agriculture Research & Education (SARE). Apply for Grants. http://www.sare.org/grants/

USDA. National Agricultural Library. Rural Information Center. A Guide to Funding Resources. http://www.nal.usda.gov/ric/ricpubs/fundguide.html#fdatabase

USDA National Invasive Species Information Center, Manager's Tool Kit—Grants and Funding. http://www.invasivespeciesinfo.gov/toolkit/grants.shtml

Tips and other information for writing and submitting grant proposals:

Center for Invasive Plant Management (CIPM). Resource Directory. Grant Writing Tips. http://www.weedcenter.org/funding/grantW.html

USDA. National Agricultural Library. Rural Information Center. A Guide to Funding Resources. http://www.nal.usda.gov/ric/ricpubs/fundguide.html#fdatabase

Marshall, M.I., A. Johnson, J. Fulton. 2006. Writing a Successful Grant Proposal. Purdue University Extension. http://www.agecon.purdue.edu/newventures/Grant_Writing/EC-737%5B1%5D.pdf

Western Sustainable Agriculture Research & Education (SARE). Tips on Writing a Competitive Grant Proposal. http://wsare.usu.edu/grants/docs/WritingTips.pdf

Step 5: Evaluate the Action Plan

The final step in creating a successful WPA is to create a mechanism for evaluating completed projects. The success of a WPA depends upon stopping invasive plants before they have a chance to spread and become well established in an area. The challenge is that invasive plants are a dynamic problem and are constantly changing in response to environmental factors and management strategies.

If a WPA is reactive rather than proactive in addressing these challenges, management efforts will fail to make a difference. For this reason, it is important for the WPA action plan to be dynamic as well. To achieve this, it will be critical for the plan to be evaluated at least once annually to determine how effective the implemented strategies are and if the WPA goals are being met.

If strategies are not helping the WPA meet its goals, alternative strategies should be developed and implemented. Using adaptive management is one way to track the effectiveness of WPA projects. For more information on incorporating adaptive management into WPA projects, a guideline entitled "Adaptive Management for Invasive Annual Grasses" is available at www.ebipm.org.

Short Term

Annual WPA meetings review progress toward meeting objectives and goals and to evaluate the effectiveness of the action plan. In the short-term, the plan can be evaluated by considering the prevention strategies implemented and determining if there are critical components missing.

Are there strategies or steps that have proven not to be practical and should be changed? Efficacy can also be measured by the number of landowners participating in the WPA and the number of new invasions located, reported, and controlled due to inventory efforts.

Long Term

The long-term effectiveness of the WPA will require several years to document. After the WPA has collected several years' worth of

Evaluating the effectiveness of a WPA on a short and long-term basis can help lead to short and long-term success of weed prevention.

data, it can be compared and evaluated to determine if implemented strategies are causing a decrease in the abundance of invasive species.

Comparisons and progress can be tracked by calculating and comparing the approximate number of acres infested and the total number of infestations between the years of interest. Patterns can also be analyzed to determine if there are gaps in the management plan that need to be addressed.

Summary

Invasive weeds are a serious environmental and economic threat to rural communities as they displace desirable species, alter ecological processes, decrease forage and crop yields, reduce wildlife habitat, and diminish land value. Although prevention is not a new idea, starting a WPA opens the door to many new, exciting possibilities. When people can begin to work together, more resources, energy, creativity, and support become available to stop the continued spread of invasive weeds. Through proactive, coordinated management efforts, rural livelihoods and valuable natural resources can be protected from the costly, damaging effects of invasive weeds while also being preserved for the future.

Literature Cited

1. Andersen, K.A. and S.A. Dewey. 2007. USU Wildland Weed Mapping Methods Training Supplement. Master Thesis. Utah State University. Logan, UT. 107 pp. plus appendix.

2. DiTomaso, J.M. 1998. Impact, Biology, and Ecology of Saltcedar (*Tamarix spp*.) in the Southwestern United States. Weed Technol. 12: 326-336.

3. Goodwin, K. and J. Jacobs. 2007. Developing Invasive Weed Prevention Areas for Rangeland Ecosystems. Natural Resource Conservation Service, Montana. Technical Note-Invasive Species-MT-15.

4. Lacey, J. R., C. B. Marlow, and J. R. Lane. 1989. Influence of spotted knapweed (*Centaurea maculosa)* on surface runoff and sediment yield. Weed Technol. 3:627–631.

5. Office of Technology Assessment. 1993. Harmful non-indigenous species in the United States. OTA-F-565. Government Printing Office, Washington, D.C.

6. Sheley, R. L., J. S. Jacobs, and M. F. Carpinelli. 1998. Distribution, biology, and management of diffuse knapweed (*Centaurea diffusa*) and spotted knapweed (*Centaurea maculosa*). Weed Technol. 12:353–362.

7. Trammell, M. A. and J. L. Butler. 1995. Effects of exotic plants on native ungulate use of habitat. J. Wildl. Manage. 59:808–816.

8. Tyser, R. W., and C. H. Key. 1988. Spotted knapweed in natural area Fescue grasslands: an ecological assessment. Northwest Science 62(4):151-160.

9. Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Washington, D.C. 109 pp.

10. Davies, K.W., and D. D. Johnson. 2008. Managing Medusahead in the Intermountain West is at a Critical Threshold. Society for Range Management. pp 13-15.

Appendix

WPA Action Plan

WPA Name: _____

WPA Coordinator Contacts: _____

Vision: _____

Goals: _____

_____

Objectives:_____

_____

_____

People Involved and Partner Groups:

Person or Group	Primary Role/Commitments

Prioritized Weed List:

Common Name	Scientific Name	Management Objective

Prevention Strategies: _____

_____

_____

Early Detection/Rapid Response Strategies: _____

_____

_____

Mapping Strategies: _____

_____

_____

Ecosystem Strategies: _____

_____

_____

Education and Awareness Programs: _____

_____

_____

Project Planning Sheet

WPA Name: _____

WPA Coordinator Contacts: _____

Goals: _____

Objectives: _____

_____

Prevention Strategies:

Activities	People Involved	Expected Cost	Timeline	Expected Outcomes

Early Detection/Rapid Response Strategies:

Activities	People Involved	Expected Cost	Timeline	Expected Outcomes

Mapping Strategies:

Activities	People Involved	Expected Cost	Timeline	Expected Outcomes

Ecosystem Strategies:

Activities	People Involved	Expected Cost	Timeline	Expected Outcomes

Education and Awareness Program:

Activities	People Involved	Expected Cost	Timeline	Expected Outcomes

Weed Treatment Form

WPA Name: _____

Date: _____ **Time:** _____

Location of Application (include GPS or map coordinates and land description):

_____

_____

_____

_____

Landowner Information: _____

_____

_____

People Involved: _____

_____

Species Information:

Target Species: _____

Growth Stage: height_____ leaves rosette boot early headed headed
anthesis shoot bud flower senescence

Treatment Method: _____

_____

_____

_____

Herbicide Information (*If applicable)*:

Herbicide Trade Name: _____ Active Ingredient: _____

Concentration: _____ Application Rate: _____

Method of Application: _____ Applicator: _____

Weather Conditions: _____

Acres Treated: _____

Additional Information: _____

_____

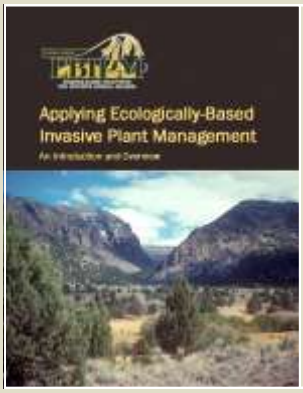
_____

_____

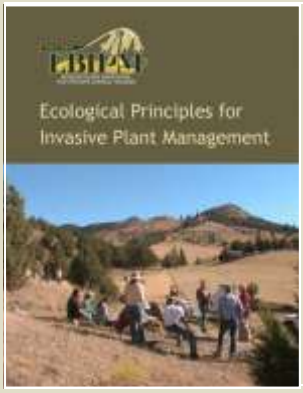
_____

Additional Resources in our EBIPM Series:

[Revegetation Guidelines for the Great Basin: Considering Invasive Weeds]

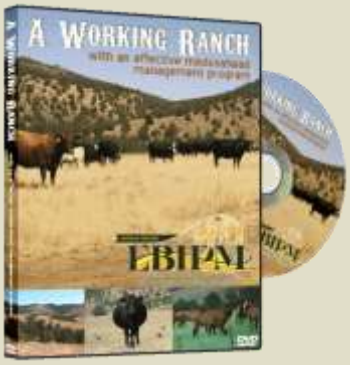


[Applying Ecologically -based Invasive Plant Management: An Introduction and Overview]



[Ecological Principles for Invasive Plant Management]

[Adaptive Management for Invasive Annual Grasses: A Step-by-Step User's Guide]



DVD Video:
A Working Ranch with an Effective Medusahead Management Program

DVD Video:
Implementing EBIPM
In the Field
tackling invasive plants with science-based solutions

[A Working Ranch with an Effective Medusahead Management Program]

All of the above products are available to request or download at www.ebipm.org. Also, more resources are in development; www.ebipm.org offers the most up-to-date listings.