

Volunteering to Manage Rangeland Weeds

Results of a citizen survey in the southwestern United States

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Increasing occurrence of invasive plants has affected rangelands by threatening the health of both ecosystems and economies. Invasive weeds can degrade habitat for wild animals, reduce plant and animal diversity, curtail forage resources, and alter ecosystem function.¹ Attacking infestations early is considered vital to managing invasive plants and conserving healthy rangelands. However, land managers often lack resources for monitoring, restoration, and control programs. Involving volunteers in rangeland weed management can provide critical information on the size and scope of infestations as well as essential labor for early intervention, education, control, and restoration efforts. To assist land managers and education/extension professionals in identifying opportunities for volunteer participation in weed management, we surveyed citizens in parts of the southwestern United States, where rangeland weeds are not as widely established as elsewhere, and where the need as well as the value of volunteers may be especially great.

Weeds and Volunteers

A weed is simply a plant that interferes with management objectives for a given area at a given time.² This definition covers situations as varied as dandelions in a suburban front lawn to leafy spurge incursions on ranch land. Weed invasions in a natural ecosystem can be compared to wildfires: They spread outward from ignition points with an expanding perimeter as wind and topography allow. Blowing embers and sparks create hotspots outside the fire's perimeter and eventually merge with the main fire body, or

smolder beneath the surface for an indefinite period and occasionally flare up.² In much the same way, weed seeds can remain dormant in the soil for years or be carried over considerable distances by humans or animals, creating "ignition points" for invasions spreading outward depending on wind and other vectors. Just as a wildfire is easiest to control before it sparks hotspots beyond its perimeter, weed infestations are best controlled if identified early, before infestations grow large enough to provide a steady source of propagules for new invasions.

The southwestern United States has seen repeated invasions by nonnative plants. Yet with the exception of riparian areas invaded by tamarisk (*Tamarix* spp.), the region's rangeland plant communities and ecosystems remain comparatively unaltered. Some nonnative species are widely distributed throughout Arizona, New Mexico, southern Utah, and southwestern Colorado, but individual populations are typically small. This smaller scale of infestation creates opportunities to eradicate populations and thereby curtail weed spread.

Volunteers can provide critical information on the size and scope of weed infestations as well as essential labor in control and restoration efforts. Land management agencies can use volunteers not only to supplement staff but also to develop long-term, community-based groups committed to environmental stewardship. Although volunteer programs may require high initial resource inputs, over the long term these programs can provide a significant contribution to the management of invasive plants.³ To promote sustained participation by volunteers, land management and extension

professionals need an understanding of the needs and characteristics of current and potential volunteers, including levels of citizen knowledge about invasive plants, attitudes toward options for control, and willingness to volunteer in different aspects of rangeland weed management.

Previous Studies of Citizen Knowledge and Volunteerism

Research on public knowledge regarding invasive plants is quite limited, and most studies are limited in scope. A North Dakota study focused on leafy spurge (*Euphorbia esula*) infestation found that most landowners and decision-makers were concerned about controlling invasive plants on rangelands and felt that leafy spurge was a long-term problem, but in many cases a simple lack of knowledge kept managers and ranchers from using the most effective control method.⁴ A study of general public knowledge in Montana found that most respondents knew invasive plants were a problem and could name at least one problem weed species and spread factor. Knowledge was greater among people who participated regularly in outdoor recreation.⁵ However, a survey of visitors to the University of California's Bodega Marine Laboratory concluded the general public has a low awareness of biological invasions due to a lack of personal impact by weeds, absence of effective education programs, and a public perception that the ecological impacts of invasions are not as serious as reported.⁶

Volunteerism is defined as sustained, nonmandatory behavior intended to provide a service to someone or something other than the volunteer. The reasons people volunteer for environmental stewardship activities can be complex, including factors of personal benefit as well as a moral obligation to help solve a problem. Typically participants in ecosystem restoration or other outdoor service programs see themselves as doing valued work that can make a difference for the environment, but they also enjoy developing a sense of community and sharing newfound knowledge and skills. Most importantly, they want to spend time outdoors.⁷⁻¹⁰

Volunteer activities in weed management can include 1) *control*—physical removal or alteration of plants to deter future growth and expansion; 2) *restoration*—reversal of biodiversity loss or ecosystem degradation by reassembling an affected ecosystem to a state that more closely resembles the original; 3) *education*—delivery of information to interested audiences that may otherwise not be reached by professionals due to time, resources, or other constraints; and 4) *monitoring*—the collection and accumulation of data over time for the purposes of planning, evaluation, or change detection. Individuals and groups can take part in weed control efforts, most notably mechanical control via hand-pulling, tilling, mulching, mowing, or burning plants. Mechanical control can be friendlier to the environment than biological or chemical control but requires the highest input of human labor. Restoration activities can be more

difficult to teach and supervise due to the complexities of ecosystems, but citizen involvement can not only benefit the land but help foster long-term commitment to a natural setting.^{11,12} Weed education efforts typically involve a train-the-trainer approach in which agency staff, university faculty, and/or extension personnel conduct workshops and short courses for educators who then in turn teach the information to others.³ The use of interested volunteers in monitoring provides baseline data on weed distribution. Although these activities also can require a high initial resource input, results can significantly improve management effectiveness and efficiency.¹³ Many volunteers participate in more than one type of activity; for example, members of the Tucson-based Sonoran Desert Weed Whackers provide a volunteer workforce for mechanical weed control but also participate in education and restoration activities.

Survey Approach

Our survey was part of the Southwest Rangeland Invasive Plant Initiative (2000–2004), which sought to foster low-cost, community-based approaches to invasive plant management. The study focused on the following 11 counties where rangeland weeds are an identified problem and where an extension cooperators was identified: Arizona—Cochise, Coconino, Graham, Greenlee, and Yavapai; Colorado—LaPlata; New Mexico—Grant and Colfax; Utah—Garfield, Iron, and Kane. These counties covered a wide variety of arid and semiarid environments from the southeastern corner of the Great Basin in Utah to the southern edge of the Rocky Mountains in New Mexico, including portions of the Colorado Plateau, Sonoran Desert, and Chihuahuan Desert. Socioeconomically they ranged from rapidly growing amenity towns (Durango, CO; Flagstaff and Prescott, AZ), to retirement communities (Benson and Sierra Vista, AZ), to rural farm/ranch towns (Panguitch, UT; Raton, NM; Safford, AZ). Most, but not all, of the communities have existing volunteer activities or local weed management authorities that may include volunteer boards.

Using a random sample of households with telephones, we mailed 2,700 copies of a survey that measured knowledge of plant ecology, attitudes towards control methods, willingness to participate in community efforts, and demographic characteristics such as age, education, land ownership, agricultural income, and type of residence. Sample sizes differed between counties to account for differences in population; however, for this analysis of volunteerism we were able to combine results after finding few (less than 5%) statistically significant differences in responses across counties.

Results

Of the 2,700 surveys mailed, about 15% were undeliverable because the intended recipients were no longer at those addresses. We received 630 usable surveys, with response rates ranging from 18% in Colfax County, NM, to 35% in Iron County, UT. The low response was not entirely

unexpected, as response rates have been declining for unsolicited surveys on natural resource issues,¹⁴ and this is especially true when the survey is on a highly specialized topic such as rangeland weed management. Nonetheless, to address a concern that our responses would not be representative of the overall study population we contacted by telephone 10% of the persons in our sample who had not responded, and administered an abridged version of the original survey. We found no statistically significant differences in results between the original mail survey sample and the telephone sample; therefore, we believe our results are representative of the overall study population.

Two-thirds (66%) of our respondents were male, even though we had tried to remove a gender effect by asking that the survey be completed by whichever adult in the household had the birthday that comes earliest in the year. The gender imbalance may exist because our address list was drawn from a list of telephone customers, in which phone listings are typically in a male name, or may simply be due to a societal bias which holds that natural resource management is a “man’s issue.” The average age of respondents was 56. They had lived in their respective states for an average of 27 yr and at their current addresses for 14 yr. In comparison to US census data for the same counties, respondents were more highly educated, with a majority having taken college classes. A majority lived in town or suburban settings, and reported earning \$20,000–\$60,000 per yr.

When asked if they currently participate in volunteer work, nearly half said yes (Table 1). These individuals average roughly 5 h of volunteer work per week and 20 h

per month. More than 80% of those who volunteer (38% of the total sample) had volunteered to work in the environment, most commonly with the USDA Forest Service or Boy Scouts of America, including 21% who had volunteered in an activity involving invasive plants. Nearly half said they would be willing to participate in future volunteer efforts to manage rangeland invasive plants. Of those, the most popular activities were direct control and monitoring (Table 1) while somewhat fewer were interested in education and restoration.

To better understand the factors that influence whether people are interested in volunteer weed management activities, we compared how interested and noninterested respondents answered a number of other survey questions related to knowledge and concern about invasive plants, as well as demographic characteristics. Knowledge about weeds (Table 2) was greater among those who were willing to volunteer, who scored significantly higher on sections of the survey that measured knowledge of factors influencing weed spread and invasive plant impacts, and who had a greater ability to recognize locally important weed species. (Recognition was based on correct identification of four color photographs included in each survey, with different species pictured in surveys sent to different regions of the Southwest.)

Persons who were willing to volunteer for rangeland weed management activities were also more likely to believe invasive plants are a serious problem in their county, and more likely to report that they had previously thought

Table 1. Percentage of survey respondents reporting participation, or willingness to participate, in volunteer activities (n = 571)

Do you participate in <i>any type</i> of volunteer work in your community?			47%
Have you ever done any volunteer work associated with the <i>environment</i> ?			38%
Have you ever done any volunteer work with <i>invasive plants</i> ?			10%
Would you be <i>willing to participate</i> in volunteer invasive plant management?			43%
Activity (n = 245):	Control		57%
	Monitoring		55%
	Education		39%
	Restoration		38%

Table 2. Average number of correct answers to knowledge items, comparing persons interested in participation in weed control with those who are not (Student’s t tests)

	Interested	Not interested	t	Significance
Factors influencing weed spread (7 items)	5.8	5.0	2.20	0.03
Impacts of invasive plants (6 items)	4.4	3.8	2.24	0.03
Identification of weed species (4 items)	2.9	2.4	4.80	<0.01

about invasive plants as an issue. When asked about concern for specific impacts, willing respondents had slightly higher levels of concern about wildlife and recreation impacts (Student's *t* tests, $P < 0.05$) but not about impacts on native plants, crop values, wildfire danger, or forage for livestock. Willing respondents were 8 yr younger on average, but did not otherwise differ from those who were not willing to volunteer in terms of gender, education, length of residency, property ownership, overall income, or farm/ranch income.

We also wanted to learn more about why different respondents might have different preferences for weed management activities. Because respondents could indicate interest in more than one type of activity, we could not compare categories directly. Instead we examined the subset of respondents who checked at least one of the four activity types, and within that group compared those who had checked that activity with those who had not (χ^2 tests for differences in frequency distribution, $P < 0.05$). This analysis focused on how persons preferring different activities might differ in terms of their demographic characteristics, knowledge about invasive plants (Table 3), and general or specific concerns about invasive plants.

Control

Prospective volunteers in weed control were younger (average difference = 3.8 yr) than those who did not check that option. Their knowledge of the impacts of invasive

plants was significantly greater, and they were more likely than other prospective volunteers to report that they had thought often about invasive plants prior to receiving the survey. However, we did not find any differences from other prospective volunteers in their level of concern about specific impacts.

Education

Prospective volunteers in education were more likely than other willing respondents to hold a graduate degree and less likely to have concluded their education with high school. This group was more knowledgeable than other prospective volunteers about the factors involved in weed spread, but they did not score higher on scales measuring knowledge of weed impacts or ability to identify locally important weeds. Persons interested in education as a volunteer activity did not differ from other prospective volunteers in terms of either general or specific concern about rangeland weed invasions.

Monitoring

Prospective volunteers in monitoring did not differ significantly from others in terms of either demographics or knowledge. However, they were significantly more likely than other prospective volunteers to express concern about specific impacts of rangeland weeds on native plants, crop values, wildlife habitat, recreation experiences, and livestock forage.

Table 3. Average number of correct answers to knowledge items, comparing persons who selected specific types of weed management volunteer activities to those who did not select those items (Student's *t* tests)

	Selected	Not selected	<i>t</i>	Significance
Factors influencing weed spread (7 items)				
Control	5.9	5.6	1.77	NS
Education	6.1	5.6	2.48	0.014
Monitoring	5.9	5.6	1.34	NS
Restoration	6.1	5.5	2.79	0.006
Impacts of invasive plants (6 items)				
Control	4.6	4.2	2.13	0.034
Education	4.6	4.3	1.15	NS
Monitoring	4.5	4.4	1.34	NS
Restoration	4.5	4.3	0.90	NS
Identification of weed species (4 items)				
Control	2.9	2.9	0.16	NS
Education	3.0	2.9	0.89	NS
Monitoring	2.9	2.9	0.47	NS
Restoration	3.0	2.8	1.51	NS

Restoration

Prospective volunteers in restoration were more likely to hold a bachelor or higher degree, and more likely to have grown up in a city, large town, or suburban area. They were much less likely to earn any income from agriculture. They were considerably younger (average difference = 7.3 yr) than those who did not check that option. Perhaps due to the age difference, they also had lived significantly fewer years at their present address (4.2 yr) and in the same state (8.7 yr). They were more knowledgeable than other prospective volunteers about the factors involved in weed spread, but not about weed impacts or identification. They did not differ from other prospective volunteers in terms of their overall concern about weeds, but they did express significantly higher levels of concern about wildlife habitat and range forage.

Discussion

Volunteer weed control is not a panacea. For example, the Southwest Rangeland Invasive Plant Initiative conducted a parallel study,¹⁵ which found that programs run by counties or other local weed management authorities treated a greater percentage of their infestations than all-volunteer programs, primarily because volunteers are not well suited for managing plants that are best controlled by herbicides. Nonetheless, at a time when nonnative plant invasions of rangelands are increasing even as the resources available for range management are declining, there is a great need for volunteers who can assist managers with detection, monitoring, and control of weeds as well as restoration of affected environments. For that reason, perhaps the most important finding of our study is the large percentage of respondents who would consider participating in volunteer activities related to rangeland invasive plant management. Although expressing an interest is not the same as actually participating, it is encouraging that nearly half of respondents to our survey are interested in volunteering in weed management. Consistent with other studies,^{9,10,13} prospective volunteers are younger than the population as a whole, but they otherwise come from across the spectrum of citizens in the Southwest. Not surprisingly, they also tend to be more concerned about invasive plants than other citizens, and to know more about weed ecology and identification. It makes sense that individuals recognizing and understanding a problem would seek to help reduce its impact. Furthermore, those who are concerned about invasive plants and their spread are also more likely to obtain information about them.

Beyond assessing the level of interest in the Southwest regarding volunteer opportunities in rangeland weed management, we also measured willingness to participate in specific aspects of management that might be part of a volunteer program. We found greater interest in control and monitoring activities than in education or restoration. Previous research has shown that volunteerism in wildland settings is strongly driven by a desire for an outdoor leisure

experience that also “gives back” to nature,^{7,8,10} and this may explain respondents’ preference for types of activities that require relatively little training; can be done on an intermittent basis; and in the case of monitoring, can simply be a part of any picnic outing, day hike, or camping trip. Even so, more than one-third of prospective volunteers expressed interest in the more complex activities of weed education and restoration, suggesting that there is a willing workforce in the Southwest for any sort of volunteer project in rangeland weed management. One high-profile volunteer activity in the region is the work of the Sonoran Desert Weed Whackers, a group of Tucson-area residents who have been pulling buffelgrass (*Pennisetum ciliare*) in national parks since 2000.¹⁶ However, it’s useful to note that the same interest can be found in the more rural counties where we conducted our survey.

An important consideration for managers thinking about a weed management program is to find the best avenue for recruiting volunteers. Some valuable clues can be found in our findings that not all volunteers are the same—i.e., there are differences between people who show interest in control, education, monitoring, or restoration. Perhaps due to time and resource constraints, the primary method for recruiting volunteers in invasive plant management has been to look to existing extension clientele possessing knowledge of plant and weed ecology, such as Master Gardener program participants, or members of church and scouting groups that are consistently looking for certain activities and volunteer tasks to perform. Our findings suggest there may be other audiences who would embrace a chance to enlist in the fight against rangeland weeds.

Volunteer behavior that seems similar on the surface may actually reflect differing attitudes, beliefs, and values. To illustrate this, consider the variation in motivations that might explain a person’s “interest” or “stake” in an issue such as rangeland conservation. One person might feel an attachment for sagebrush-dominated landscapes and native ungulates because they enjoy hunting, while another may value these things for aesthetic or intellectual reasons. While arriving at the issue of rangeland conservation from different directions, the end result is a desire to protect the same environment.

In the case of rangeland weed invasion, it appears that individuals interested in weed control are younger, concerned citizens who can come from anywhere in the region. This may be a good activity for Boy Scout or church groups, because supervised control activities can be implemented with only task-specific training.

Monitoring—an activity that was also especially popular with respondents—is not as easily supervised. However, depending on the goals of the monitoring project, it may require only a single weed-identification session along with provision of carefully designed reporting forms. We found no particular demographic predictors of interest in monitoring as a volunteer activity, but we did find that prospective

monitors have an especially high level of concern about specific weed impacts. Accordingly, the best source of monitoring volunteers might be existing organizations that attract people who are concerned about native plants, crops, wildlife, recreation, or forage, including outdoor sports groups, agricultural organizations, native plant societies, and so on.

Conversely, persons interested in education were not more concerned about weeds than other prospective volunteers, but they were more likely to be highly educated and to enjoy the opportunity to share their knowledge with others. In addition to groups such as Master Gardeners that already offer classes on plant-related topics, it may be possible to find education volunteers on college campuses (students or faculty/staff) and other educational venues.

Restoration activities often require the highest level of ongoing commitment as well as more extensive training and supervision. In our study, the persons most interested in joining a restoration effort were already well-educated, and were also younger and more likely to be newcomers to an area. Again, colleges and universities are good sources of restoration volunteers, but managers might also look to residents of exurban subdivisions and amenity communities that are home to relative newcomers looking for a way to connect more closely to the land in an adopted landscape.

Conclusion

A volunteer base capable of assisting in the management of invasive plants does exist in the southwestern United States. It appears that those willing to take part in efforts represent a broad spectrum of the overall population, although different populations are attracted to different aspects of weed management. Those willing to participate generally possess a “stake” in the management of invasive plants; therefore “stakeholder” groups can be targeted for participation in particular management areas based upon their recreational activities, affinity for the environment, and concern for the impacts of invasive plants. The challenge for resource professionals is to provide engaging volunteer programs designed to fit the diverse interests of these groups.

Support exists for invasive plant management activities, but, as in other areas of resource management, it can be further strengthened. The potential for attitude change towards management exists in the involvement of volunteers insofar as an environment conducive to change is allowed to exist and flourish. Allowing individuals to see the impacts of invasive plants on the environment through volunteer participation in a setting tied to their personal interests can help immeasurably in the alteration of negative attitudes.

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