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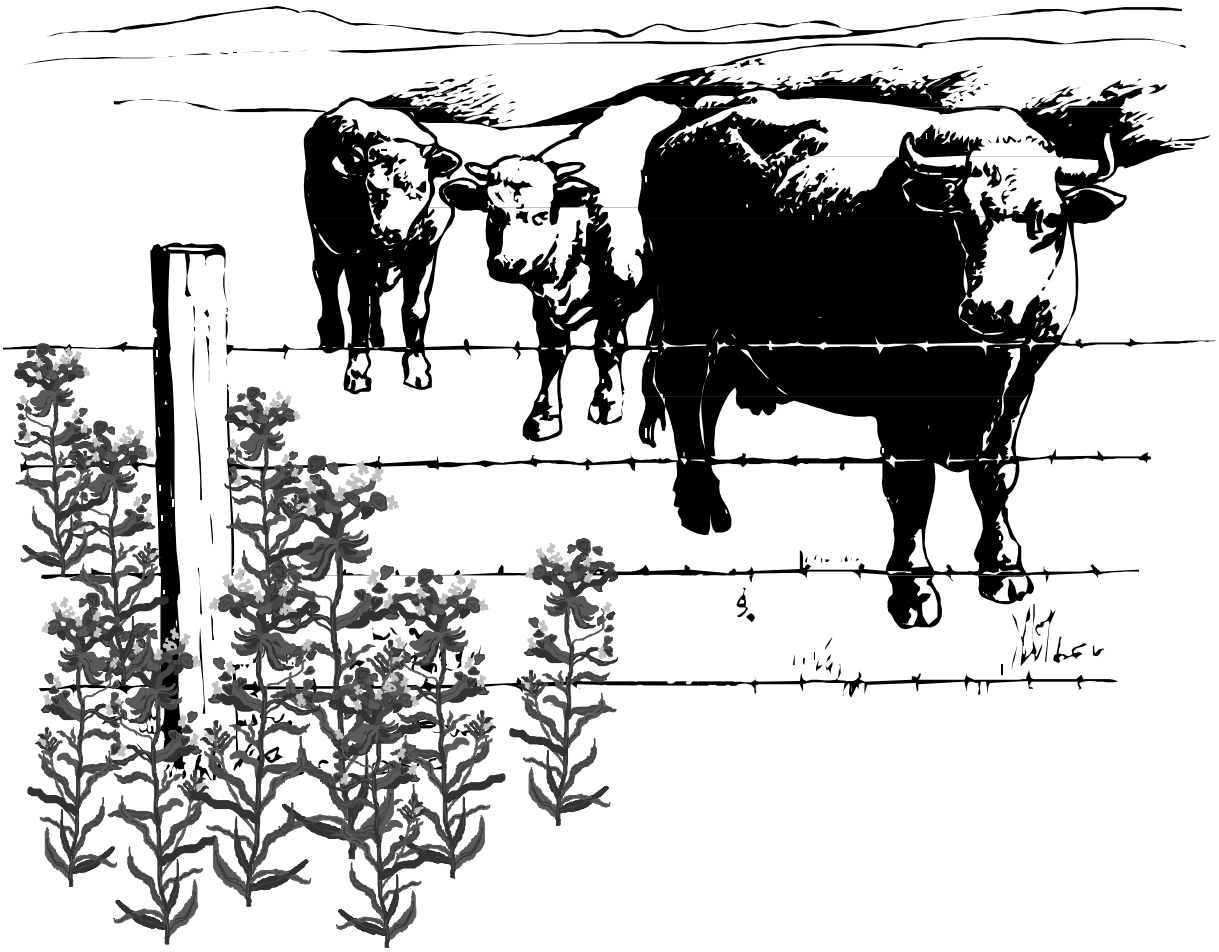
Perceptions of Leafy Spurge by Public Land Managers, Local Decision Makers, and Ranch Operators



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ABSTRACT

A survey of 459 ranchers, 56 local decision makers, and 50 public land managers (565 total) was conducted to evaluate managerial, institutional, and social factors that may affect the rate and extent of implementation of various leafy spurge (*Euphorbia esula* L.) controls. The study focused on a five-county region in Montana, North Dakota, South Dakota, and Wyoming. The questionnaire focused on weed management in general and specifically on the perceptions and attitudes of ranchers, land managers, and local decision makers who have been directly and indirectly affected by leafy spurge.

Key Words: leafy spurge, weed management, rancher opinion, public land manager opinion.

HIGHLIGHTS

Leafy spurge (*Euphorbia esula* L.) is an exotic, noxious, perennial weed which is widely established in the north central United States. It is estimated to infest 1.6 million acres in a four-state region including North and South Dakota, Montana, and Wyoming.

This study focused on a five-county area in North Dakota (Billings and Golden Valley counties), Montana (Carter County), South Dakota (Harding County), and Wyoming (Crook County). A total of 565 ranch operators, local decision makers (LDM), and public land managers (PLM) were surveyed, and 267 completed questionnaires were obtained (47 %). This sample was not a random sample but was intended to represent those producers, LDM, and PLM who ranch, represent, or manage property within the study area. The questionnaire focused on weed management in general and specifically on the perceptions and attitudes of ranchers, LDM, and PLM, who may have been directly and indirectly affected by leafy spurge.

Leafy spurge was recognized as the most important weed problem for ranchers, LDM, public land managers of grazing (PLMG) and non-grazing property (PLMNG) in the five-county study area. Acreage of leafy spurge relative to acreage operated varied by type of land manager. The PLMG had leafy spurge on about 1.5 percent of operated acreage while the PLMNG had leafy spurge on about 13 percent of operated acreage. Ranchers had leafy spurge on approximately 4 percent of operated acreage.

Fewer PLMG expect to use herbicides, biological control, and grazing of sheep and goats in the future to control leafy spurge than are currently using these practices. Also, fewer PLMNG expect to use biological control and grazing of sheep and goats in the future than are currently using these control methods. Reasons for not using herbicides included environmental restrictions, inadequate funding, and too large infestations. Biological control was often not used because the biological agents take too long to work and there was limited access to biological agents. Grazing sheep or goats was not used because of policy or logistical reasons and the PLMNG respondents did not believe grazing was an effective control method. The main reason that ranchers, LDM, and PLMG did not use grazing as a control mechanism was that they did not have the equipment to include sheep in their grazing strategies.

The PLMNG expected their land management budget would increase in the future (50 %), whereas only 4 percent of the PLMG expected their land management budget to increase in the future. More than 40 percent of both groups expected the relative share of their budgets spent on weed control to increase in the future. Both groups also indicated that most of the current weed control budget was spent on labor and that the most limiting factor in their ability to combat problem weeds was funding.

Overall, a vast majority of the respondents were concerned about controlling weeds on rangeland and understood leafy spurge is a long-term management problem. The PLMG were more interested in all types of information related to herbicides, biocontrol, grazing sheep and goats, and other methods of controlling leafy spurge. The LDM were more likely to believe that the weed problem in their area was a major problem and that leafy spurge was the most important weed. The PLMNG had a greater share of their operating acreage infested with leafy spurge,

spent a greater share of their budget on weed control, were more likely to believe that biocontrol was effective and economical, and were less likely to indicate funding as an impediment to combating problem weeds. However, environmental restrictions and damage to non-target species were indicated as impediments to herbicide treatments by more than two-thirds of the PLMNG.

The results of this survey and the survey of ranchers indicates that financial constraints on weed control are prevalent in both private and public land management. Also, the amount of knowledge needed to adopt various treatment programs appears to be lacking in both public and private managers. Education and awareness on how to use and where to find biological controls would facilitate more adoption of biological agents to control leafy spurge. Likewise, assistance in obtaining equipment and knowledge of sheep/goat management might enable some managers to use sheep and/or goats to curb further leafy spurge expansion.

Disagreements among the survey groups were not substantial, and many share similar concerns in controlling the weed. The TEAM Leafy Spurge project could enhance adoption of all leafy spurge control methods by addressing concerns exhibited by each of the groups surveyed. Although cooperation among private and public managers was not specifically addressed in this study, all survey groups recognized the threat leafy spurge presents and most agree on the causes of spreading. By facilitating cooperative efforts between managers of adjoining lands and by pooling resources, perhaps many of the hardships created by leafy spurge can be reversed.

PERCEPTIONS OF LEAFY SPURGE BY PUBLIC LAND MANAGERS, LOCAL DECISION MAKERS, AND RANCH OPERATORS

Randall S. Sell, Dean A. Bangsund, F. Larry Leistritz, and Dan Nudell *

INTRODUCTION

Leafy spurge (*Euphorbia esula* L.) is an exotic, noxious, perennial weed which is widely established in the northern plains. It is estimated to infest 1.6 million acres in a four-state region including North and South Dakota, Montana, and Wyoming. North Dakota has the greatest acreage of leafy spurge with nearly 6 percent of its untilled land infested (Leitch et al. 1994). The estimated annual economic impact of leafy spurge infestations in the four-state area is about $130 million (Leitch et al. 1994; Bangsund et al. 1993). Until recently, leafy spurge in the upper Midwest had been doubling in acreage every 10 years (Bangsund and Leistritz 1997). It is clear that leafy spurge can create serious economic losses for land owners and ranchers and pose management problems for both public and private land managers.

Leafy spurge has unique physiological characteristics which make it difficult to control; it can rejuvenate itself from extensive root reserves and sustain itself against repeated attacks. While current herbicides are incapable of eradicating established infestations, expansion can be controlled with a combination of biological and chemical technologies (Messersmith 1989; Lym and Messersmith 1994; Lym and Zollinger 1995; Lym et al. 1997). Eradication of the plant is possible using mechanical tillage; however, this control method is restricted to certain land. It has become evident that prevention of initial infestations and controlling the expansion of existing patches is critical to slowing the advance of this formidable weed.

Cost effective control of leafy spurge on rangeland (public and private), wildlands, and other public lands (roadways, historic sites, etc.) requires use of a combination of chemical and biological control mechanisms in an integrated pest management (IPM) framework. In 1997, a major IPM research and demonstration project (TEAM Leafy Spurge) was initiated to develop and integrate sustainable leafy spurge management methods and to transfer to land managers economically and ecologically proven technologies to manage leafy spurge. Initially, a survey of ranchers was conducted (Sell et al. 1998). Subsequently, local decision makers (LDM) and public land managers of grazing (PLMG) and non-grazing property (PLMNG) were surveyed to evaluate managerial, institutional, and social factors that may affect the rate and extent of implementation of various control strategies based upon respondents' perspectives.

METHODS

This study focuses on a five-county area in North Dakota (Billings and Golden Valley Counties), Montana (Carter County), South Dakota (Harding County), and Wyoming (Crook County) (Figure 1). In addition to the ranchers surveyed previously (see Sell et al. 1998), an additional 56 LDM, 29 PLMG, and 21 PLMNG were surveyed. The goal in selecting the group

* Sell and Bangsund are research scientists and Leistritz is a professor at Department of Agricultural Economics, North Dakota State University, Fargo; Nudell is a research station scientist at the Hettinger Research Extension Center, North Dakota State University.

of LDM was to solicit perspectives and opinions of individuals who were in a position to make or influence decisions about, or relating to, control of leafy spurge and other weeds. The survey pool of LDM included state legislators, county agents, county commissioners, county weed board members, and township board members. LDM were included in the potential survey pool if part of their district was within or included the five-county study area.

The survey of PLMG included those agencies which managed public grazing land in or adjacent to the five-county study area. These agencies/departments included the United States Department of the Interior - Bureau of Land Management (USDI-BLM), United States Forest Service (USFS), North Dakota Department of Corrections, United States Bureau of Indian Affairs, and State Land Departments in Montana, North Dakota, South Dakota, and Wyoming. The survey of PLMNG included Theodore Roosevelt National Park, Devils Tower National Monument, United States Department of Interior - Bureau of Reclamation (USDI-BR), United States Department of the Interior - Fish and Wildlife Service (USDI-FWS), Game and Fish Management Departments and Departments of Transportation in Montana, North Dakota, South Dakota, and Wyoming.

Each agency was contacted to determine who within their organization was responsible for land and/or weed management and to determine if those individuals would be willing to complete the weed management questionnaire. If the person was a willing cooperator, they were sent a questionnaire. Some federal agencies, such as USFS and USDI-BLM, had only one or two district offices within the five-county study area. Within these district offices, several people were directly involved in land and weed management. All individuals directly involved in land management within these agencies were included in the survey.

The individuals in the LDM, PLMG, and PLMNG survey pools were mailed the first questionnaire (Appendix A) and cover letter in March 1998; one follow-up questionnaire and cover letter was mailed to nonrespondents. The response rate for LDM was 68 percent (Table 1). After the second mailing, PLMG and PLMNG nonrespondents were contacted by telephone to confirm they had received the questionnaire and solicit their cooperation in the survey. The final response rates for the PLMG and PLMNG were 83 and 86 percent, respectively. It was not possible to determine the number of questionnaires not returned by ranchers due to incomplete or noncurrent addresses versus those who refused to participate, because of the survey mailing system used. However, for the LDM, PLMG, and PLMNG groups the surveys not returned were considered refusals.

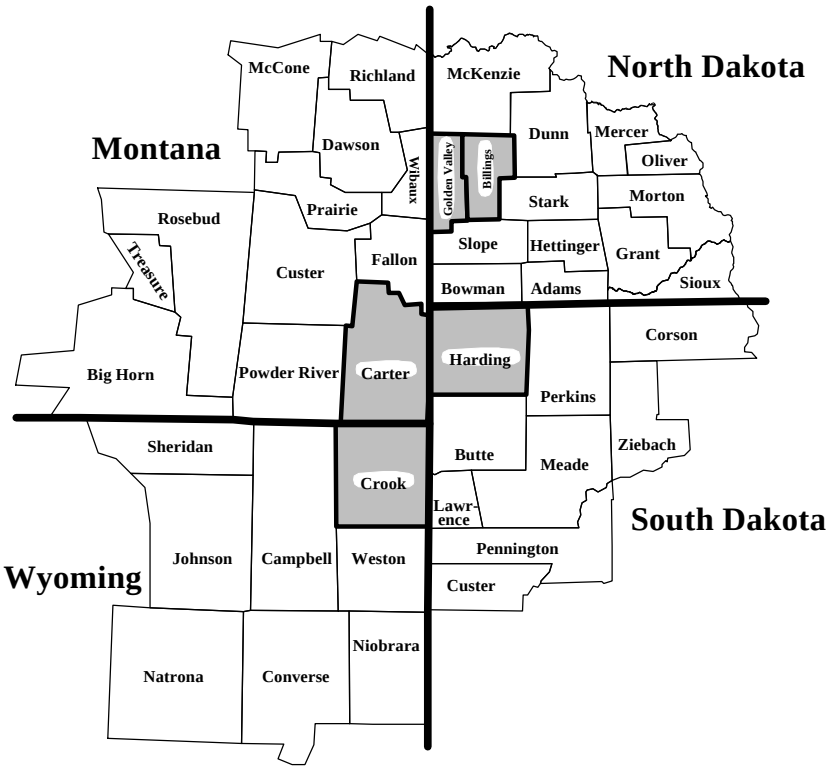

Figure 1. Study Counties for Perceptions of Leafy Spurge by Public Land Managers, Local Decision Makers, and Ranchers, 1998

RESULTS

The primary focus of the analysis presented within this report is comparative in nature among the ranchers, LDM, PLMG, and PLMNG. Additional analyses are presented for the LDM by state of residence (Appendix B).

Characteristics of Respondents

Nearly 70 percent of PLMG were from the USDI-BLM and USFS, while about 70 percent of PLMNG were from the USFWS, State Game and Fish Departments, and National Park Service (Table 1). The average age of ranchers was 53 years while the PLMG and PLMNG were about 11 years younger. Slightly less than 50 percent of the ranchers and LDM had college degrees while about 90 percent of PLMG and PLMNG had college degrees. The average acreage managed for PLMG and PLMNG was 1.3 million and 85,000 acres, respectively. Over 90 percent of all PLMG respondents reported managing more than 50,000 acres. Leafy spurge infestations were reported by most respondents. While only 56 percent of ranchers reported having leafy spurge, more than 90 percent of PLMNG reported having leafy spurge, and 100 percent of PLMG had leafy spurge. The highest infestation rate was 13 percent of acreage managed reported by PLMNG.

Table 1. Characteristics of Respondents to Weed Management Survey, 1998

Characteristic	Unit	Value
Response rates:		
Ranchers	percent	40.7
n		(187)
LDM	"	67.9
n		(38)
PLMG	"	82.8
n		(24)
PLMNG	"	85.7
n		(18)
Agency represented:		
PLMG		
Bureau of Land Management	"	47.8
Forest Service	"	21.7
State Land Departments	"	8.7
PLMNG		
Federal and State Game & Fish Depts.	"	37.5
National Park Service	"	31.3
State Departments of Transportation	"	18.8
Age:		
Ranchers	years	53
LDM	"	51
PLMG	"	42
PLMNG	"	42
Education (percent with college degree):		
Ranchers	percent	44.7
LDM	"	43.2
PLMG	"	95.8
PLMNG	"	88.9
Average acreage operated/managed (per respondent):		
Ranchers	acres	6,912
n		(187)
PLMG	"	1,306,404
n		(24)
PLMNG	"	84,905
n		(18)
Distribution of acreage operated:		
PLMG		
Less than 2,001 acres	percent	8.3
2,001 to 50,000 acres	"	0.0
More than 50,000 acres	"	91.7

– continued --

Table 1. Continued

Characteristic	Unit	Value
PLMNG		
Less than 2,001 acres	"	33.3
2,001 to 10,000 acres	"	16.7
10,001 to 50,000 acres	"	27.8
More than 50,000 acres	"	22.2
Currently have leafy spurge on acreage operated and/or managed:		
Ranchers	percent	55.6
n		(180)
PLMG	"	100.0
n		(24)
PLMNG	"	93.8
n		(16)
Average acreage operated infested with leafy spurge: [1]		
Ranchers	percent	3.9
n		(83)
PLMG	"	1.5
n		(17)
PLMNG	"	13.0
n		(10)

[1] Average acreage of infestation reported only for those respondents who reported acreage of leafy spurge on grazing land, hay land, and other public land (i.e., some respondents reported currently having leafy spurge but did not give the acreage of infestation).

Problems Faced by Land Managers

Respondents were asked to rate several grazing and weed management issues as *major* problems, *not* a problem, or *minor* problems. Exempting the 'other' category, LDM most often believed that livestock prices (87 %) were a *major* problem, which was also the ranchers' leading *major* problem category (Table 2). For PLMG, exempting the 'other' category, the issue most frequently indicated as a *major* problem was noxious or invasive weeds. PLMG and LDM were much more likely than ranchers to respond that noxious or invasive weeds were a *major* problem.

When asked to indicate which of the issues listed was the single *most* important, livestock prices were again indicated as the *most* important problem both overall and by each group (33 %). While less than 10 percent of all ranchers indicated that noxious and invasive weeds were the *most* important problem, more than one-fourth of all PLMG responded that noxious and invasive weeds were the *most* important problem. The greatest percentage of ranchers (67 %) and LDM (81 %) indicated that livestock prices had become worse over the past five years. Alternatively, the greatest share of PLMG (73 %) thought that noxious and invasive weeds had become worse. Furthermore, ranchers and LDM were nearly four times more likely than PLMG to believe that regulations affecting use of public land had become more of a problem in the past five years.

Table 2. Problems Faced by Ranchers and Land Managers in the Past Five Years, 1998

Problems/Issues	Ranchers	LDM	PLMG	Overall
	----- % indicated a *major* problem -----			
Livestock prices *	78.7	86.5	45.0	77.1
Others [1]	68.4	100.0	66.7	69.6
Adverse weather conditions **	62.5	51.4	34.8	58.2
Cost of feed and supplies *	52.8	62.2	17.7	51.7
Noxious or invasive weeds **	30.8	58.3	47.8	36.5
Predators	36.3	46.0	19.1	36.3
Regulations affecting use of public lands **	34.1	47.2	4.8	33.5
Availability of grazing land	26.3	34.3	9.5	24.5
Use of CRP for haying and grazing	13.6	8.6	14.3	12.8
	----- % indicated *most* important problem -----			
Livestock prices	32.0	37.9	30.4	32.6
Adverse weather conditions	24.4	24.1	13.0	23.2
Noxious or invasive weeds	8.1	10.3	26.1	10.3
Regulations affecting use of public lands	8.1	10.3	8.7	8.5
Cost of feed and supplies	9.9	3.5	0.0	8.0
Availability of grazing land	7.6	3.5	13.0	7.6
Predators	5.8	6.9	0.0	5.4
Others [1]	2.9	3.5	8.7	3.6
Use of CRP for haying and grazing	1.2	0.0	0.0	0.9
	-- % indicated problem became worse in past 5 years --			
Livestock prices **	67.0	81.1	40.0	67.0
Cost of feed and supplies **	64.8	81.1	38.9	65.4
Regulations affecting use of public lands *	53.7	58.8	13.6	50.5
Noxious or invasive weeds	42.0	66.7	72.7	45.5
Others [2]	50.0	50.0	0.0	44.4
Predators **	46.6	44.4	5.3	42.9
Availability of grazing land	35.8	22.9	16.7	32.3
Adverse weather conditions ***	26.1	8.3	11.8	22.4
Use of CRP for haying and grazing	9.8	6.3	6.7	9.0

[1] Other problems mentioned by LDM was the big difference in the quality and quantity of rangeland and pasture. The PLMG also mentioned; lack of education, ability or willingness to move livestock, and overstocking.

[2] Ranchers thought that grasshoppers and high cost of ag. land were other problems which had gotten worse in the past five years, while the LDM felt that the big difference in the quality and quantity of rangeland and pasture, and absentee landowners were problems which had gotten worse.

[*] Statistically different at P <=0.01 among all groups of respondents for each individual problem (Chi-square test statistic).

[**] Statistically different at P <=0.05 among all groups of respondents for each individual problem (Chi-square test statistic).

[***] Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).

Weed Species and Management Problems

Weeds other than leafy spurge pose problems to ranchers and public land managers. Some of those weeds specifically listed in the questionnaire included: field bindweed, thistles, annual bromegrass, sagebrush, knapweeds, prickly pear, and absinth wormwood. Across all groups, the weed most often mentioned as a problem by the respondents was leafy spurge (58 %) followed by thistles (27 %) and field bindweed (22 %) (Table 3). However, LDM, PLMG, and PLMNG were much more likely than ranchers to indicate that leafy spurge was a *major* problem. When asked to identify one weed which they felt posed the most serious problem, more than 60 percent of all respondents indicated leafy spurge, followed by thistles (11 %). LDM were most likely to list leafy spurge as their *most* important problem weed. This may be because individuals within this group are often faced with the issues of controlling expanding and persistent weeds.

Opinions varied on how invasive weeds spread in the area. The PLMG (48 %) and PLMNG (56 %) were more likely than ranchers (29 %) and LDM (24 %) to indicate that invasive weeds spread from man's action (Table 4). Also, PLMG and PLMNG were three to four times more likely than ranchers and LDM to respond that lack of competition from native plants was an important reason for the leafy spurge infestations. The most recognized cause of invasive weed problems was spreading from adjoining land.

When respondents were asked to indicate how serious they felt weed problems were on their ranch or in their area, more than one-quarter (28 %) indicated weeds were a *major* problem, while only 12 percent overall responded that weeds were *not a* problem (Table 5). More than 65 percent of LDM thought that weeds in their area were a *major* problem followed by 44 percent of PLMNG who indicated weeds were a *major* problem.

Respondents were asked the extent to which they agreed or disagreed with a variety of statements about weed management, public land management, government agencies' effect on land management, and leafy spurge management options. Several statements elicited significantly different responses depending on the group surveyed. The statement with which all respondents overall most strongly agreed (average score closest to 5 - strongly agree) was 'I am concerned about controlling weeds in rangeland' (overall average score 4.8) (Table 6). A difference in opinion was noted with the statement 'State and Federal government agencies are not doing enough to control problem weeds on public grazing land.' Ranchers and LDM indicated strong agreement with the statement (average scores were 4.5 and 4.3, respectively) while PLMG (average score 3.5) were about neutral, and PLMNG (average score 2.7) tended to disagree with the statement. Ranchers, LDM, and PLMG also had a difference of opinion regarding the impact of herbicides on the environment. Ranchers, LDM, and PLMG indicated that herbicides, when used properly, were not harmful to the environment, while PLMNG (average score 2.8) tended to disagree. The statement which showed the strongest difference of opinion between ranchers, LDM, and PLMG versus PLMNG was 'rangeland weeds represent a problem to all ranchers.' Ranchers, LDM, and PLMG agreed with the statement (average scores were 4.4, 4.3, and 3.7, respectively) while PLMNG disagreed (average score 2.1). Alternatively, ranchers, LDM, and PLMG disagreed with the statement 'weed infestations have no effect on the market value of rangeland' while PLMNG were about neutral. All groups except PLMG agreed with the statement 'restrictions affecting the use of herbicides on rangeland are too strict.' Only PLMNG

thought state and Federal government agencies are doing enough to help control problem weeds on private grazing land.

Respondents were asked to indicate their perceptions of (1) effectiveness and (2) economics of four methods of controlling leafy spurge. The methods included (1) herbicides, (2) biological control - insects and pathogens, (3) grazing - sheep or goats, and (4) tillage. Less than 50 percent of all groups thought that spraying with herbicides was 'very effective'; however, more than 60 percent of all groups thought 'it pays' to spray leafy spurge with herbicides (Table 7). While many respondents do not indicate herbicides are 'very effective' at controlling leafy spurge, herbicide use is perceived as being better than not attempting any control of the infestations. The PLMNG had the greatest share of respondents which indicated that biological control was very effective (62 %) and also indicated biological control pays (92 %). Less than one-third thought grazing with sheep or goats was a 'very effective' control. Within the individual groups, most ranchers thought spraying with herbicides offered a *very* effective and most likely 'to pay' type of control, most LDM also thought that spraying was a *very* effective control, but the greatest share of LDM believed that biological control would be most likely 'to pay,' and most PLMG thought grazing with sheep or goats would be a *very* effective and most economical type of control.

Ranchers, PLMG, and PLMNG were asked whether they used several preventative measures to thwart establishment or expansion of leafy spurge on their property. More than 95 percent of ranchers and 100 percent of PLMNG routinely checked their land for invading plants (Table 8). Over 80 percent of all groups spot sprayed near fringe or boundary areas. Ranchers were more likely to keep machinery/trucks clean and insist that local governments control leafy spurge in roadways and ditches than either PLMG and PLMNG. A greater percentage of PLMG and PLMNG had used biological control in the past and expect to use it as a control method in the future than the ranchers. Also, the PLMG were about twice as likely to have used grazing sheep and goats as a control in the past and expect to use in the future than either ranchers or PLMNG.

Ranchers were asked to indicate the reasons for not using these four main control methods. More than 60 percent of the respondents indicated that 'environmental restrictions' was the main reason for not using herbicide treatments (Table 9). However, within the LDM group, the greatest share of respondents (78 %) indicated 'acreage of infestations were too large' as the most common reason for not using herbicides. The PLMG group also mentioned factors related to a 'lack of funding' (71 %) and 'acreage too large' (71 %) as reasons for not using herbicides. Not having sufficient time, money, or equipment were not as much of a problem for herbicide application by the PLMNG as the other groups. However, along with 'environmental restrictions' (83 %) the second most common problem reported by the PLMNG for not applying herbicides was 'damage to non-target species' (64 %). Overall, the most common reasons for not using biological agents were 'limited access to agents' (47 %) and 'take too long to work' (46 %). An important reason to more than 50 percent of the LDM was that they did not know how to properly use biological agents. Nearly 75 percent of all respondents indicated that not having the right type of equipment was the most important reason for not using sheep and goats, although the second most often listed reason was a lack of expertise with sheep or goats (40 %). About 42

percent of PLMNG indicated that they could not consider grazing sheep or goats[1] as a control alternative; an additional 43 percent indicated that sheep and goats were not effective in controlling leafy spurge. The most common reason for not using other methods of control (i.e., tillage, planting competing grasses, burning, mowing) across all groups was that land was not suitable for tillage (86 %).

Table 3. Weeds Posing Greatest Problems to Land Managers, 1998

Weeds	Ranchers	LDM	PLMG	PLMNG	Overall
	---------- % indicated a *major* problem ----------				
Others [1]	65.7	0.0	33.3	100.0	65.1
Leafy spurge *	49.4	86.8	63.6	75.0	57.9
Thistles	25.3	37.8	15.0	33.3	26.8
Field bindweed	25.0	19.4	11.1	6.7	21.9
Annual brome grasses ***	13.3	15.2	30.0	38.5	16.4
Sagebrush *	8.1	11.1	10.0	7.7	8.7
Knapweeds *	6.3	5.9	9.5	33.3	8.3
Prickly pear	5.2	3.1	10.5	0.0	5.1
Wormwood (absinth) ***	0.0	4.6	5.9	0.0	1.3
	----------% indicated *most* important problem * ----------				
Leafy spurge	56.8	90.9	73.9	62.5	63.5
Thistles	11.2	3.0	13.0	18.8	10.8
Annual brome grasses	8.3	3.0	8.7	6.3	7.5
Others [1]	9.5	0.0	0.0	0.0	6.6
Sagebrush	7.1	0.0	0.0	0.0	5.0
Field bindweed	4.7	0.0	0.0	0.0	3.3
Knapweeds	1.8	0.0	4.4	12.5	2.5
Prickly pear	0.6	3.0	0.0	0.0	0.8
Wormwood (absinth)	0.0	0.0	0.0	0.0	0.0

[1] Other weeds listed included the following: hounds tongue, field pennycress, cheatgrass, burdock, Canada thistle, sandburs/cockleburs, tansy, ragweed, fringed sage, locoweed, smooth bromegrass, quackgrass, poison plants, Dalmatian toadflax, and crested wheatgrass .

* Statistically different at P <=0.01 among all groups of respondents for each type of weed considered a *major* problem (Chi-square test statistic). Statistical testing for the weed considered to be the *most* important problem was tested simultaneously (Chi-square test statistic).

*** Statistically different at P <=0.10 among all groups of respondents for each type of weed considered a *major* problem (Chi-square test statistic).

[1] Some agencies may be prevented because of policy or agency rules (e.g., Theodore Roosevelt National Park) and others may be prevented by logistics (e.g., Departments of Transportation).

Table 4. Percentage of Respondents Indicating the Manner in Which Leafy Spurge Infestations Expanded, 1998

Methods of Spreading	Ranchers	LDM	PLMG	PLMNG	Overall
	------ % indicated two *most* important problems -----				
Infestation spread from adjoining land	63.3	60.5	40.9	68.8	61.3
Not recognized as a problem/ threat until its too late	41.7	50.0	47.8	25.0	42.4
Spread by man's actions (e.g., vehicles, contaminated hay) **	28.9	23.7	47.8	56.3	31.5
Lack of cost effective controls	29.1	34.2	38.1	25.0	30.3
Other [1]	10.6	15.8	4.8	0.0	10.2
Overgrazing of rangeland	7.8	5.3	4.6	0.0	6.7
Lack of competition from native plants/grasses **	4.5	5.3	18.2	18.8	6.7

** Statistically different at P <=0.05 among all groups of respondents for each method of spreading (Chi-square test statistic).

[1] For those listing other reasons, 52 percent indicated spread by deer and birds, followed by 13 percent indicating lack of something to kill the invasive weed.

Table 5. Respondents' Perceptions of the Seriousness of the Weed Problem on Their Ranch or in Their Area, 1998

Perception of Weed Problem	Ranchers	LDM	PLMG	PLMNG	Overall
	---------- % ----------				
Not a problem	16.8	2.6	0.0	0.0	12.0
Minor problem	65.7	31.6	68.2	56.3	59.9
Major problem	17.5	65.8	31.8	43.8	28.1

Table 6. Respondents' Opinions and Perceptions about Weed Management, Leafy Spurge Infestations, and Methods of Leafy Spurge Control, 1998

Statement	Ranchers	LDM	PLMG	PLMNG	Overall
	---------- average score [1] ----------				
I am concerned about controlling weeds in rangeland	4.8 a	NA	4.7 a	4.9 a	4.8
State and Federal government agencies are not doing enough to control problem weeds on public grazing land	4.5 a	4.3 a	3.5 b	2.7c	4.8
Leafy spurge is a long-term management problem	4.6 a	4.7 a	4.8 a	4.8 a	4.7
Biological agents released to control leafy spurge are safe for crops and native plants	4.2 a	4.3 a	4.6a	4.5a	4.3
The expected payoff from biological control of leafy spurge justifies investment of public funds to develop the process	4.2 a	4.4 a	4.6 a	4.2 a	4.3
Rangeland weeds represent a problem to all ranchers	4.4 a	4.3 a	3.7 a	2.1 b	4.1
Leafy spurge negatively affects various agency's ability to effectively manage their land	NA	4.2 a	4.0 a,b	3.4 b	4.0
There needs to be more research on controlling weeds in rangeland	4.0 a	4.0 a	3.3 a,b	3.6 b	3.9
Herbicides, if used properly, are not harmful to the environment	4.0 a,b	4.2 a	3.4 b	2.8 c	3.9
Governments should help pay part of the cost to control leafy spurge, even if it means an increase in taxes	3.5 a	3.7 a	3.7 a	3.3 a	3.6
Restrictions affecting the use of herbicides on rangeland are too strict	3.6 a	3.3 a	2.6 b	3.6 a	3.5

– continued --

Table 6. Continued

Statement	Ranchers	LDM	PLMG	PLMNG	Overall
	---------- average score [1] ----------				
State and Federal government agencies are not doing enough to help control problem weeds on private grazing land	3.7 a	3.7 a	3.3 a	2.1 b	3.5
Weed problems in rangeland are generally the result of poor range management	3.2 a	3.4 a	3.0 a	3.4 a	3.3
Local governments are not effective in controlling problem weeds	3.4 a	2.8 a	3.3 a	3.0 a	3.3
Leafy spurge can be controlled but it is just too costly	3.2 a	3.0 a	2.8 a	2.6 a	3.1
It seldom makes economic sense to control weeds on other public land	NA	NA	4.3 a	2.6 b	3.0
Biological control will eventually eliminate the leafy spurge problem	2.8 a	2.9 a	2.8 a	2.8 a	2.8
It doesn't pay to control weeds on my land when my neighbor doesn't control his weeds	2.7 a	NA	2.6 a	4.1 b	2.8
Leafy spurge is virtually impossible to control with current control methods and techniques	2.7 a	2.4 a	2.4 a	2.6 a	2.6
It seldom makes economic sense to control weeds on rangeland	1.9 a	1.4 a	1.7 a	1.6 a	1.8
Weeds infestations have no effect on the market (sale) value of rangeland	1.7 b,c	1.4 c	2.0 b	3.1 a	1.8
Public land managers are doing a good job of controlling weeds on public land	1.7 b	1.9 b	2.8 a	1.6 b	1.8

NA means that question was not posed to that survey group.

[1] Based on a score of 1 to 5, where 1 is strongly disagree and 5 is strongly agree.

[**] Those groups of respondents with different letters following their average score are statistically different at P <=0.05 (T-test).

Table 7. Respondents' Belief in Most Effective and Economical Methods to Control Leafy Spurge, 1998

Control Methods	Ranchers	LDM	PLMG	PLMNG	Overall
Effectiveness of these practices in controlling leafy spurge	---------- % indicated *very* effective ----------				
Spraying with herbicide	27.3	31.4	27.3	43.8	29.0
Biological control with insects or pathogens **	20.3	22.9	19.1	61.5	23.4
Grazing with sheep or goats	23.9	30.3	33.3	14.3	25.2
Tillage &/or reseeding ***	5.6	4.0	12.5	0.0	5.6
Economical to use these practices in controlling leafy spurge	---------- % indicating "it pays" ----------				
Spraying with herbicide	70.1	60.5	68.2	82.4	69.3
Biological control with insects or pathogens	65.9	61.1	80.0	92.3	68.2
Grazing with sheep or goats	56.0	54.6	85.7	46.2	58.2
Tillage &/or reseeding *	19.8	4.4	58.3	14.3	20.3

* Statistically different at P <=0.01 among all groups of respondents for each control method (Chi-square test statistic).
** Statistically different at P <=0.05 among all groups of respondents for each control method (Chi-square test statistic).
*** Statistically different at P <=0.10 among all groups of respondents for each control method (Chi-square test statistic).

Table 8. Respondents Use of Preventative Practices and Control Measures in Past and Future, 1998

Preventative Practice	Ranchers	PLMG	PLMNG	Overall
	-- % indicated they use the following practices --			
Purchase only weed-free hay	71.3	66.7	NA	70.7
Keep machinery/trucks clean **	79.7	50.0	69.2	75.7
Aggressively destroy weeds when found	91.0	76.2	92.9	89.6
Spot spraying near fringe or boundary areas	82.3	87.0	92.9	83.7
Routinely check range for invading plants *	96.9	66.7	100.0	93.9
Insist that local governments control leafy spurge in road ways and ditches *	72.1	31.6	38.5	65.6
Other measures [1]	68.2	100.0	85.7	76.5
Used the following controls in the past				
Herbicides	97.2	100.0	100.0	98.1
Biological control *	54.0	95.2	77.8	65.6
Sheep or goats *	30.2	83.3	40.0	41.8
Tillage &/or reseeding with competing grasses	15.3	10.5	12.5	14.0
Expect to use the following controls in the future				
Herbicides	100.0	93.8	100.0	98.7
Biological control **	54.2	93.3	71.4	64.3
Sheep or goats *	26.1	71.4	37.5	36.8
Tillage &/or reseeding with competing grasses	16.7	13.3	25.0	16.9

[1] Overall percentages of other measures include; grazing (30%), biocontrol (24%), and control neighbors spots (12%).

* Statistically different at P <=0.01 among all groups of respondents (Chi-square test statistic).

** Statistically different at P <=0.05 among all groups of respondents (Chi-square test statistic).

Table 9. Based Upon What Respondents Experienced, Believed, or Had Been Told, Their Indication of Why the Following Controls Are Not Used on Leafy Spurge, 1998

Reasons for not using controls	Ranchers	LDM	PLMG	PLMNG	Overall
Reasons for not using herbicide treatments	------ % indicated reason for not using ------				
Environmental restrictions/concerns prevent me from applying herbicides (such as, spraying near water, trees, sensitive crops, etc.)	61.7	66.7	85.7	82.8	66.0
Lack funding to efficiently manage leafy spurge infestations **	NA	63.9	71.4	27.3	60.3
Acreage of infestations are so large that the cost of using herbicides would be prohibitively expensive **	51.8	77.8	71.4	45.5	57.9
Leafy spurge infestations are inaccessible to sprayers	41.8	47.2	66.7	54.6	45.9
Herbicides are not economical *	45.4	41.7	57.1	0.0	43.5
Damage to non-target species	NA	30.6	42.9	63.6	39.7
Do not have the time to treat the leafy spurge infestations	29.8	38.9	28.3	9.1	30.1
Herbicides are ineffective in controlling leafy spurge	24.8	27.8	38.1	36.4	27.3
Lack the equipment or expertise to apply herbicides	18.4	25.0	28.6	18.2	20.6
Cost-share programs for herbicides are no longer available or have been reduced	33.3	NA	NA	NA	NA
Others reasons [1] *	2.1	5.6	23.8	9.1	5.3
Reasons for not using biological controls					
Limited access to biological agents (cannot collect sufficient numbers of the agents)	45.1	60.0	41.2	33.3	46.8
Biological agents take too long to work	47.8	46.7	52.9	11.1	46.2
Do not know how to properly use the agents ***	30.1	53.3	29.4	22.2	33.7
Do not know how to obtain or where to obtain the insects	34.5	36.7	23.5	0.0	32.0
Do not have the time to work with biological agents	23.9	20.0	29.4	22.2	23.7
Biological agents will not likely work on my leafy spurge infestations	18.6	16.7	5.9	0.0	16.0
Afraid the agents will spread or attack other plants ***	16.8	6.7	0.0	0.0	12.4
Biological agents are not economical	10.6	3.3	0.0	22.2	8.9
Biological agents will eventually spread to my leafy spurge without my help	7.1	3.3	0.0	22.2	6.5
Other reasons [2] *	1.8	0.0	17.7	2.2	4.1
Reasons for not using sheep &/or goats					
Grazing cannot be or has never been considered	NA	NA	NA	41.7	41.7
Do not have the right equipment (fences, water, shelter) for sheep and goats *	71.3	83.3	76.2	14.3	72.0
Do not have the expertise/knowledge to work with sheep and goats	41.0	41.7	47.6	0.0	40.3
Sheep and goats are too time consuming to use	39.3	33.3	33.3	14.3	36.6

- continued -

Table 9. continued

Reasons for not using controls	Ranchers	LDM	PLMG	PLMNG	Overall
Sheep and goats will negatively affect non-target species	NA	25.0	19.1	28.6	23.4
Sheep and goats are too costly to manage/not economical to use	23.0	11.1	38.1	14.3	22.0
Sheep and goats are ineffective in controlling leafy spurge ***	25.4	13.9	4.8	42.9	21.5
Other reasons [3]	13.1	22.2	23.8	28.6	16.7
Departmental/agency policy prevents using sheep or goats	NA	11.1	9.5	28.6	12.5
Reasons for not using other control methods					
Land is not suitable for tillage (inaccessible, incompatible terrain, light soil, too rocky, etc) ***	84.7	97.2	81.0	73.3	85.6
These methods are ineffective ***	36.0	36.1	14.3	13.3	32.4
Damage to non-target species	NA	19.4	38.1	46.7	30.6
Lack the proper equipment *	24.0	44.4	52.4	20.0	29.7
Departmental/agency policy prevents using these alternative methods	NA	30.6	19.1	40.0	29.2
Do not have enough time to work with those methods	26.7	25.0	47.6	33.3	28.8
Do not know how to use these methods	21.3	25.0	14.3	20.0	21.2
Other reasons [4]	50.0	25.0	16.7	8.3	5.4

NA means that survey group was not asked that question.

[1] Other reasons listed include: too lazy to apply herbicides (14%), too much leafy spurge (14%), and federal land not funded for spraying (10%).

[2] Other reasons listed include: bugs too small to sustain a population (54%) and works great (17%).

[3] Other reasons listed include: too many coyotes/ predators (40%) and not enough leafy spurge (15%).

[4] Other reasons listed include: tilling stirs seeds and enhances spreading (19%), too much brush and timber (19%), and burning sets grass back too far (8%).

[*] Statistically different at P <=0.01 among all groups of respondents for each reason (Chi-square test statistic).

[**] Statistically different at P <=0.05 among all groups of respondents for each reason (Chi-square test statistic).

[***] Statistically different at P <=0.10 among all groups of respondents for each reason (Chi-square test statistic).

Weed Management Information and Knowledge Base

The Extension Service and county weed boards were major sources of weed management information to all respondents. More than 50 percent of all respondents indicated that they frequently use the Extension Service and county weed boards to obtain information about weed management on grazing or hay land (40 % indicated the Extension Service was the *most* important source followed by 30 % for county weed boards) (Table 10). However, the most important source of information on weed management for the PLMG was evenly divided among county weed boards, government agencies, and professional meetings (22 % each).

Table 10. Sources of Weed Management Information Most Often Used By Respondents, 1998

Sources of weed management information	Ranchers	LDM	PLMG	PLMNG	Overall
	---------- % indicated used frequently ----------				
Extension Service/county agent/universities ***	47.2	71.2	45.8	77.8	52.7
County weed board/officers	45.9	62.2	54.2	61.1	50.2
Professional meetings/ associations ***	NA	23.5	63.6	47.1	41.1
Other [1] **	21.4	0.0	100.0	0.0	38.9
Farm/ranch/trade magazines *	25.9	24.2	0.0	13.3	22.5
Private companies/consultants **	13.9	25.0	9.5	26.7	15.9
Government agencies *	11.7	6.3	53.3	42.9	15.8
Grazing associations ***	12.6	21.2	5.3	7.1	12.9
Public land managers (BLM, Forest Service) *	4.0	6.1	50.0	52.9	12.8
Internet/On-line computer services/DTN *	4.1	0.0	5.0	18.8	4.7
	--------- % indicated *most* important source ---------				
Extension Service/county agent/universities	37.7	62.9	17.4	56.3	40.6
County weed board/officers	31.2	31.4	21.7	18.8	29.5
Other ranchers	11.2	0.0	0.0	0.0	7.8
Private companies/consultants	6.5	2.9	4.4	0.0	5.3
Government agencies	2.4	0.0	21.7	18.8	4.9
Farm/ranch/trade magazines	5.3	0.0	0.0	0.0	3.7
Professional meetings/associations	0.0	2.9	21.7	6.3	2.9
Grazing associations	3.5	0.0	0.0	0.0	2.5
Other	1.8	0.0	4.4	0.0	1.6

[1] Other sources indicated were: ranchers that are treating, common sense, weed control seminars, and herbicide dealers.

* Statistically different at P <=0.01 among all groups of respondents for each information source (Chi-square test statistic).

** Statistically different at P <=0.05 among all groups of respondents for each information source (Chi-square test statistic).

*** Statistically different at P <=0.10 among all groups of respondents for each information source (Chi-square test statistic).

Types of information wanted most by respondents were effectiveness (55 %) and economics (50 %) of various herbicide treatment programs (Table 11). PLMG respondents were much more interested than the other groups in all categories of information. The form in which most respondents wanted information varied by group. The most desired form for the ranchers and PLMNG was a pamphlet or bulletin available through the local Extension Service office (48 %). Area demonstration plots were wanted most by LDM (71 %) and PLMG (78 %).

LDM were asked a series of questions about leafy spurge to determine the level of familiarity and knowledge of the invasive weed. Some of the questions were general while others were very specific and would probably require more than just a slight familiarity with the weed. All but one of the LDM (97 %) correctly answered the question, 'leafy spurge negatively affects rangeland output by?' (Table 12). Only one (3 %) correctly answered the question, 'leafy spurge can be eradicated using which method of control?'

Public Land Managers: Past and Future Budget Changes

To help understand the impacts that budgetary pressures may play in attempting to thwart the continued expansion of leafy spurge, public land managers were asked about their budgets and specifically about their weed control budgets in the past and future. A greater share of PLMNG (39 %) indicated that their land management budget had increased during the past five years versus 13 percent for the PLMG (Table 13). The PLMNG also expected their land management budget would increase in the future (50 %), whereas only 4 percent of the PLMG expected their land management budget to increase in the future. There was not a significant difference among the groups in the share of their budget spent on weed control in the past or expectations in the future. More than 40 percent of both groups expected the relative share of their budgets spent on weed control in the future to increase and less than 10 percent overall felt the percentage spent on weed control would decline. Both groups also indicated that most of the weed control budget was spent on labor and that the most limiting factor in their ability to combat problem weeds was funding. The public land managers indicated spending between 6 and 8 percent of their total land management budgets on weed control.

Table 11. Types of Weed Management Information Most Wanted By Respondents, 1998

Type of information	Ranchers	LDM	PLMG	PLMNG	Overall
	---------- % indicated very interested ----------				
Effectiveness of various herbicide treatment programs *	45.9	80.6	78.3	61.1	55.1
Economics of herbicide treatments *	43.8	75.0	69.6	31.3	50.2
How to get started with biological control ***	38.0	48.7	52.4	46.2	41.5
Others [1]	13.3	100.0	66.7	100.0	30.0
Techniques and effectiveness of control with sheep and goats *	21.8	27.0	62.5	28.6	27.8
Economics of using sheep and goats *	23.4	27.0	60.9	28.6	28.0
Techniques and effectiveness of cultivation and reseeding *	13.6	13.9	45.8	25.0	17.8
Economics of cultivation and reseeding *	13.0	14.3	37.5	31.3	17.0
Form of Information					
Pamphlet or bulletin available through Extension office or county agent **	48.0	34.3	60.9	62.5	43.7
Video cassettes demonstrating the various control methods	36.5	28.6	57.1	43.8	37.7
Area demonstration plots showing the effectiveness of various control methods *	38.3	71.1	78.3	33.3	47.1
Testimonials from fellow ranchers and other land managers *	40.1	62.2	42.9	14.3	42.3
Computer decision aids (programs) that can be used by ranchers/farmers to evaluate the feasibility or economics of various controls *	12.2	5.9	34.8	23.5	14.4
Personal visits and on-site help by range management specialists *	31.9	47.4	72.7	37.5	38.5
Others [2]	30.8	0.0	0.0	100.0	35.7

[1] Other types of information indicated was desire to know the long term effect, pest management, new biocontrol agents, effects of cattle grazing/trampling, and mapping techniques.
[2] Other forms of information specified included: at my request, and license renewal seminars, books, and World Wide Web.
* Statistically different at P <=0.01 among all groups of respondents for each type of information (Chi-square test statistic).
** Statistically different at P <=0.05 among all groups of respondents for each type of or form of information (Chi-square test statistic).
*** Statistically different at P <=0.10 among all groups of respondents for each type of or form of information (Chi-square test statistic).

Table 12. Local Decision Makers' Knowledge About Leafy Spurge, 1998

	LDM	Answer
	-- % correct --	
Leafy spurge originally came from?	84.2	*Europe*
Which state has the biggest leafy spurge problem (most acres infested) in the United States?	34.2	*North Dakota*
Leafy spurge can be eradicated using which method of control?	2.7	*Repeated tillage*
Leafy spurge negatively affects rangeland output by?	97.4	*Reducing available forage*
Which agency is responsible for screening biocontrol agents to ensure that they will not produce harmful effects on crops or native plants?	41.7	*Animal & Plant Health Inspection Service (APHIS)*
How do the most effective biological agents (insects) predominately control leafy spurge?	64.5	*Larvae destroy the root systems of plant*

	Number of Correct Answers						
	Six	Five	Four	Three	Two	One	Zero
Percentage correct	0.0	10.5	31.6	31.6	10.5	15.8	0.0

Table 13. Changes in Land Management and Weed Control Budgets of Public Land Managers - Grazing and Public Land Managers - Nongrazing, 1998

Item	PLMG	PLMNG	Overall
	---------- percent ----------		
Annual land management budget change in past five years ***			
Increase	13.0	38.9	24.4
Decrease	34.8	11.1	24.4
Remain the same	52.2	50.0	51.2
Expected change in annual land management budget in next five years *			
Increase	4.2	50.0	23.8
Decrease	33.3	22.2	28.6
Remain the same	62.5	27.8	47.6
Change in annual share of budget spent on weed control in past five years			
Increase	33.3	55.6	42.9
Decrease	29.2	11.1	21.4
Remain the same	37.5	33.3	35.7
Expected change in relative share of budget on weed control in next five years			
Increase	45.8	44.4	45.2
Decrease	4.2	11.1	7.1
Remain the same	50.0	44.4	47.6
Breakdown of weed control expenditures			
Labor	47.9	44.2	46.3
Herbicides	41.3	31.7	37.4
Other controls[1]	14.2	23.0	17.2
Biological controls	19.5	11.9	16.6
Mechanical control	4.7	7.9	6.6
Most limiting factor in ability to combat problem weeds			
Funding	50.0	35.3	43.9
Labor	25.0	29.4	26.8
Lack of effective controls	12.5	11.8	12.2
Other [2]	12.5	11.8	12.2
Limiting &/or restricting policies	0.0	11.8	4.9
Percent of overall budget spent on weed control	5.6	7.8	6.5
n	(20)	(15)	(35)

[1] Grazing/goats (50%), equipment and operating supplies (33%), and inventory (17%) .

[2] Knowledge about problem/lack of education (40%), commitment by lessee to do work (20%), time (20%), and discussion among local folks (20%).

CONCLUSIONS AND IMPLICATIONS

Leafy spurge is a problem for ranchers, local decision makers (LDM), public land managers of grazing land (PLMG), and public land managers of non-grazing land (PLMNG) in the five-county study area as evidenced by more than 60 percent who said it was their *most* important weed problem. The PLMG had leafy spurge on about 1.5 percent of operated acreage while the PLMNG had leafy spurge on about 13 percent of operated acreage. Noxious or invasive weeds were noted as the most important problem for approximately one-quarter of the PLMG. All of the groups thought that livestock prices were the most important problem currently facing themselves and ranchers in their area.

Ranchers and public land managers indicated concern about controlling weeds in rangeland and that leafy spurge was a long-term management problem; however, the PLMNG did not agree with the ranchers, LDM, and PLMG that rangeland weeds represented a problem to all ranchers. The PLMNG also disagreed that properly used herbicides are not harmful to the environment, and they believed that state and Federal governments were doing enough to control problem weeds on private and public grazing land. None of the respondent groups thought that public land managers were doing a good job controlling problem weeds.

The PLMG was more likely than the other groups to have tried both biocontrol and grazing of sheep and goats in the past and are more interested in trying to use biocontrol and grazing of sheep and goats as a potential leafy spurge control method in the future. While the practice of using repeated tillage has been successful in the eradication of leafy spurge, it is unlikely to be useful to most of the respondent groups because of the type of land leafy spurge infests. Although less than 50 percent of all respondents believe that use of herbicides is effective, more than 60 percent believe use of herbicides 'pays' to control weeds.

Fewer PLMG expect to use herbicides, biological control, and grazing of sheep and goats in the future to control leafy spurge than are currently using these practices. Also, fewer PLMNG expect to use biological control and grazing of sheep and goats in the future than are currently using these control methods. The most often mentioned reason for not using herbicides by PLMG and PLMNG was environmental restrictions. Inadequate funding and too large infestations were common problems listed by the PLMG but were seldom indicated as problems for the PLMNG. The most frequently indicated impediment for using biological control by PLMG was that the biological agents take too long to work, while the biggest problem for LDM and PLMNG was limited access to biological agents. The PLMNG were least likely to use the strategy of grazing sheep or goats primarily because of policy or logistical reasons and they did not believe grazing was an effective control method. The main reason that ranchers, LDM, and PLMG did not use grazing as a control mechanism was that they lacked the equipment to include sheep in their grazing strategies.

The type of information most wanted by respondents was the effectiveness and economics of various herbicide treatment programs. The PLMG were more interested in all types of information than the other groups. The most desired form of information for the ranchers and PLMNG was a pamphlet or bulletin available through the Extension Service. Area demonstration plots were the most important form of information to LDM and PLMG. The most important source of information about weed management for ranchers, LDM, and PLMNG was the

Extension Service. The most important sources of information for the PLMG was evenly divided among the county weed board, government agencies, and professional meetings.

A comparison of budgets and budgetary pressure affecting the ability to fight and control weeds revealed that a much larger portion of the PLMG had a decease in their overall land management budgets in the past and expected to have a decrease in the future when compared to the PLMNG. The percentage of their respective budgets spent on weed control was similar; however, 50 percent of the PLMG indicated that funding was the most limiting factor in combating problem weeds, while 35 percent of the PLMNG indicated it was their most limiting factor. A similar proportion of both groups of public land managers expected the relative share of their budget spent on weed control to either remain the same or increase in the future.

Overall, this survey has revealed that a vast majority of respondents were concerned about controlling weeds on rangeland and that leafy spurge is viewed as a long-term management problem. The PLMG were more interested in all types of information related to herbicides, biocontrol, grazing sheep and goats, and other methods of controlling leafy spurge than the other survey groups. The LDM were most likely to believe that the weed problem in their area was a major problem and that leafy spurge was the most important weed. More than one-half of all LDM were familiar with the origins of leafy spurge, how it negatively impacts rangeland, and how the most effective biological control agents acted to control leafy spurge. The PLMNG on average had a greater share of their operating acreage infested with leafy spurge, spent a greater share of their budget on weed control, were more likely to believe that biocontrol was effective and economical, and were less likely to indicate funding as an impediment to combating problem weeds. However, environmental restrictions and damage to non-target species was indicated as an impediment to herbicide treatments by more than two-thirds of the PLMNG.

A comparison of results with the earlier survey of ranchers indicates that financial constraints on weed control are prevalent in both private and public land management. Also, the amount of knowledge needed to adopt various treatment programs appears to be lacking in both private and public managers. Education and awareness of biological control options would facilitate more adoption of biological agents to control leafy spurge. Likewise, assistance in obtaining equipment and knowledge of sheep/goat management would help in allowing many managers to use sheep and/or goats to curb further leafy spurge expansion.

The TEAM Leafy Spurge project could enhance the adoption of all leafy spurge control methods by addressing the concerns exhibited by each of the groups surveyed. Although cooperation among private and public managers was not specifically addressed in this study, all survey groups recognized the threat leafy spurge presents and most agree on the causes of spreading. Facilitating cooperative efforts between managers of adjoining lands and pooling resources could perhaps reverse many of the hardships created by leafy spurge.

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Appendix A

Weed Management Questionnaires Used for Ranchers, Local Decision Makers, and Public Land Managers of Grazing and Nongrazing Lands

We would now like to ask a few questions about you for statistical purposes. This information will not be disclosed on an individual basis.

27. In what county and state do you live? _____County _____ State

28. How long have you lived in this county? _____ Years

29. What is your age? _____ Years

30. Which of the following categories best describes the highest level of education you have completed?

a. Did not complete high school
b. High school graduate
c. Vocational/Technical or 2-year college degree
d. Bachelor's Degree (4-year college program)
e. Graduate School (Masters and/or Doctorate Degree)

31. How many years have you been farming/ranching? _____

32. In 1996, did you work at an off-farm job?
_____ No

_____ Yes, about how many days did you work at least 4 hours per day off your farm/ranch? _____ days

Thank you for completing this questionnaire. Your cooperation is sincerely appreciated. If you would like a report summarizing the findings of this study, please provide your name and mailing address or send a separate postcard with your request:

_____

_____

_____

_____

_____

_____

_____

WEED MANAGEMENT SURVEY
Farm and Ranch Operators

The following questions pertain to grazing and weed management issues in **your area or region**.

1. Please rate each of the following problems/issues that may affect livestock grazing operations in your area: (circle the appropriate number)

	Not a Problem	Minor Problem	Major Problem	Don't Know
a. adverse weather conditions	1	2	3	4
b. availability of grazing land	1	2	3	4
c. cost of feed and supplies	1	2	3	4
d. livestock prices	1	2	3	4
e. noxious or invasive weeds	1	2	3	4
f. predators	1	2	3	4
g. regulations affecting use of public lands	1	2	3	4
h. use of CRP for haying and grazing	1	2	3	4
i. others (please specify _____)	1	2	3	4

2. Which problem/issue listed in Question 1 do you feel is the **most serious** problem affecting grazing operations in your area? (**Circle** the appropriate letter)

3. Have these problems/issues in your area improved, remained the same, or become worse over the past five years?

	Improved	Remained the Same	Become Worse	Don't Know
a. adverse weather conditions	1	2	3	4
b. availability of grazing land	1	2	3	4
c. cost of feed and supplies	1	2	3	4
d. livestock prices	1	2	3	4
e. noxious or invasive weeds	1	2	3	4
f. predators	1	2	3	4
g. regulations affecting use of public lands	1	2	3	4
h. use of CRP for haying and grazing	1	2	3	4
i. others (please specify_____)	1	2	3	4

4. Which weeds pose problems for livestock grazing operations in your area? (please rate each of following weeds)

	Not a Problem	Minor Problem	Major Problem	Don't Know
a. annual brome grasses	1	2	3	4
b. knapweeds	1	2	3	4
c. leafy spurge	1	2	3	4
d. prickly pear	1	2	3	4
e. sagebrush	1	2	3	4
f. thistles	1	2	3	4
g. wormwood (absinth)	1	2	3	4
h. field bindweed	1	2	3	4
i. others (please specify _____)	1	2	3	4

5. Which weed listed above currently poses the **most serious** problem for grazing operations in your area? (**Circle** the appropriate letter)

6. What do you think are the two most important primary causes of invasive weed (e.g. leafy spurge, knapweed) infestations in your area? (circle the two most important)

a. infestation spread from adjoining land
b. not recognized as a problem/threat until its too late
c. spread by man's actions (e.g., vehicles, contaminated hay)
d. overgrazing of rangeland
e. lack of competition from native plants/grasses
f. lack of cost effective controls
g. other (_____please specify)

The following questions pertain only to **your farm or ranch operation**.

7. How serious is the weed problem on your farm or ranch? (please circle)

not a problem minor problem major problem

Please estimate how many **acres** of the following weeds are on your farm/ranch?

	Grazing Land	Hay Land
a. annual brome grasses	_____	_____
b. knapweeds	_____	_____
c. leafy spurge	_____	_____
d. prickly pear	_____	_____
e. sagebrush	_____	_____
f. thistles	_____	_____
g. wormwood	_____	_____
h. field bindweed	_____	_____
i. others (specify _____)	_____	_____

8. What measures have you taken to prevent leafy spurge from establishing itself on your farm/ranch?

a. purchase only weed-free hay	Yes	No
b. keep machinery/trucks clean	Yes	No
c. aggressively destroy weeds when found	Yes	No
d. spot spraying near fringe or boundary areas	Yes	No
e. routinely check range for invading plants	Yes	No
f. insist that local governments control leafy spurge in road ways and ditches	Yes	No
g. other measures (please specify _____)	Yes	No

9. Do you currently have any leafy spurge on your farm or ranch?
____No (**if No**, go to Question 10)
____If **Yes**, please indicate if you have used or plan to use any of the following general control practices to control leafy spurge: (check all that apply)

	Have Used in the Past	Plan to Use
a. herbicides	Y / N (# of years _____)	Y / N
b. biological control	Y / N (# of years _____)	Y / N
c. sheep or goats	Y / N (# of years _____)	Y / N
d. tillage and/or reseeding with competing grasses	Y / N (# of years _____)	Y / N
e. other controls (please specify _____)	Y / N (# of years _____)	Y / N

10. Even if you currently have no leafy spurge, how would you rate the **effectiveness** of the following practices in controlling leafy spurge?

	Not Effective	Partially Effective	Very Effective	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

11. Even if you currently have no leafy spurge, do you think it pays to use the following leafy spurge control practices?

	Yes, It Pays	Marginal	Does Not Pay	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

12. Based on what you have experienced, believe, or have been told, please indicate the reasons for **not** using the following control methods on leafy spurge.

Reasons for **not** using **herbicide treatments**: (check all that apply)

___ Leafy spurge infestations are inaccessible to sprayers
___ Herbicides are not economical
___ Herbicides are ineffective in controlling leafy spurge
___ Environmental restrictions/concerns prevent me from applying herbicides (such as, spraying near water, trees, sensitive crops, etc.)
___ Do not have the time to treat the leafy spurge infestations
___ Acreage of infestations are so large that the cost of using herbicides would be prohibitively expensive → is
___ Lack the equipment or expertise to apply herbicides (such as restricted use permits)
___ Cost-share programs for herbicides are no longer available or have been reduced
___ Others reasons (please list _____)

Reasons for **not** using **biological controls**: (check all that apply)

___ Biological agents take too long to work
___ Do not know how to properly use the agents
___ Biological agents are not economical
___ Do not know how to obtain or where to obtain the insects
___ Limited access to biological agents (cannot collect sufficient numbers of the agents)
___ Do not have the time to work with biological agents
___ Biological agents will not likely work on my leafy spurge infestations
___ Afraid the agents will spread or attack other plants
___ Biological agents will eventually spread to my leafy spurge without my help
___ Other reasons (please list _____)

Reasons for **not** using **sheep and/or goats**: (check all that apply)

___ Do not have the expertise/knowledge to work with sheep and goats
___ Do not have the right equipment (fences, water, shelter) for sheep and goats
___ Sheep and goats are too time consuming to use
___ Sheep and goats will compete with cattle for the same forage
___ Sheep and goats are too costly to manage/not economical to use
___ Sheep and goats are ineffective in controlling leafy spurge
___ I do not like sheep or goats
___ Other reasons (please list _____)

Reasons for **not** using **other methods**, such as tillage, planting competing grasses, burning, mowing: (check all that apply)

___ Do not know how to use these methods
___ These methods are ineffective
___ Lack the proper equipment
___ Do not have enough time to work with those methods
___ Land is not suitable for tillage (inaccessible, incompatible terrain, light soil, too rocky, etc.)
___ Other reasons (please list _____)

13. When you need information about **weed management on grazing land**, which of the following sources do you use?

	Seldom	Sometimes	Frequently	Never
a. Extension service/county agent/universities	1	2	3	4
b. private companies/consultants	1	2	3	4
c. farm/ranch/trade magazines	1	2	3	4
d. grazing associations	1	2	3	4
e. public land managers (BLM, Forest Service)	1	2	3	4
f. Internet/On-line computer services/DTN	1	2	3	4
g. other ranchers/neighbors	1	2	3	4
h. county weed board/officers	1	2	3	4
i. government agencies	1	2	3	4
j. other (specify _____)	1	2	3	4

14. Which one has been the **most valuable** source of information for weed management on grazing land? (Circle the appropriate letter above)

15. What type of information would you like to obtain concerning weed management on grazing and hay land?

	Not Interested	Somewhat Interested	Very Interested
a. effectiveness of various herbicide treatment programs	1	2	3
b. economics of herbicide treatments	1	2	3
c. how to get started with biological control	1	2	3
d. economics of biological control	1	2	3
e. techniques and effectiveness of control with sheep and goats	1	2	3
f. economics of using sheep and goats	1	2	3
g. techniques and effectiveness of cultivation and reseeding	1	2	3
h. economics of cultivation and reseeding	1	2	3
i. others (please specify _____)	1	2	3

16. In what form would you like to receive the information?

	Not Interested	Somewhat Interested	Very Interested
a. pamphlet or bulletin available through Extension office or county agent	1	2	3
b. video cassettes demonstrating the various control methods	1	2	3
c. area demonstration plots showing the effectiveness of various control methods	1	2	3
d. testimonials from fellow ranchers and other land managers	1	2	3
e. computer decision aids (programs) that can be used by ranchers/farmers to evaluate the feasibility or economics of various controls	1	2	3
f. personal visits and on-site help by range management specialists	1	2	3
g. others (please specify_____)	1	2	3

The next set of questions asks what you think about general weed management issues and concerns dealing with leafy spurge.

17. Please indicate whether you agree or disagree with the following statements:

	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
Weed Management						
Weed problems in rangeland are generally the result of poor range management	1	2	3	4	5	0
I am concerned about controlling weeds in rangeland	1	2	3	4	5	0
State and Federal government agencies are not doing enough to control problem weeds on public grazing land	1	2	3	4	5	0
State and Federal government agencies are not doing enough to help control problem weeds on private grazing land	1	2	3	4	5	0
Local governments are not effective in controlling problem weeds	1	2	3	4	5	0
It seldom makes economic sense to control weeds on rangeland	1	2	3	4	5	0
Rangeland weeds represent a problem to all ranchers	1	2	3	4	5	0
It doesn't pay to control weeds on my land when my neighbor doesn't control his weeds	1	2	3	4	5	0
There needs to be more research on controlling weeds in rangeland	1	2	3	4	5	0
Restrictions affecting the use of herbicides on rangeland are too strict	1	2	3	4	5	0
Herbicides, if used properly, are not harmful to the environment	1	2	3	4	5	0
Weeds infestations have no effect on the market (sale) value of rangeland	1	2	3	4	5	0
Public land managers are doing a good job of controlling weeds on public land	1	2	3	4	5	0
Leafy Spurge						
Leafy spurge is virtually impossible to control with current control methods and techniques	1	2	3	4	5	0
Leafy spurge can be controlled but it is just too costly	1	2	3	4	5	0
Leafy spurge is a long-term management problem	1	2	3	4	5	0
Biological agents released to control leafy spurge are safe for crops and native plants	1	2	3	4	5	0
The expected payoff from biological control of leafy spurge justifies investment of public funds to develop the process	1	2	3	4	5	0
Biological control will eventually eliminate the leafy spurge problem	1	2	3	4	5	0
Governments should help pay part of the cost to control leafy spurge, even if it means an increase in taxes	1	2	3	4	5	0

We would now like to ask a few general questions about the characteristics of your farm/ranch. These responses will help us to compare differences and similarities of the survey respondents based on ranch characteristics.

18. In 1996, how many acres did you:

	Hay Land/ Cropland	Grazing Land	Total
a. Own	_____	_____	_____
b. Rent or lease from others	_____	_____	_____
c. Rent or lease to others	_____	_____	_____

19. How many head of livestock did you graze in 1996?

	Estimated Number of Head
Cattle and calves	_____
Sheep and lambs	_____
Horses	_____
Others (specify _____)	_____

20. Did you use any public (federal and/or state) land for grazing in 1996? Yes / No

If **Yes**, how many acres _____ or number of permitted AUMs _____ ?

21. What best describes your farm organization? (please circle)
   a. single proprietor
   b. partnership
   c. family corporation
   d. other (please clarify _____)

22. Do you use a computer to assist you in the operation of your farm or ranch? Yes / No

   If **yes**, do you have access to the Internet? Yes / No

The following questions ask for financial information pertaining to your farming/ranching activities in 1996. If you are in a partnership or corporation, please answer for the entity and **not** just for your share. PLEASE BE ASSURED THAT RESPONSES WILL BE AVERAGED OVER SEVERAL COUNTIES **AND YOUR INDIVIDUAL RESPONSES WILL BE KEPT STRICTLY CONFIDENTIAL**. These responses help compare attitudes and perceptions based on financial characteristics of survey respondents.

23. Which of the following categories best describes your **gross farm income** (exclude hunting and oil/gas lease income) in 1996?

   a. $50,000 or less
   b. $50,001 to $100,000
   c. $100,001 to $150,000
   d. $150,001 to $200,000
   e. $200,001 to $250,000
   f. $250,001 to $300,000
   g. $300,001 to $350,000
   h. Over $350,000

24. Which of the following categories best describes your **net farm income** (gross cash farm income less gross cash farm expenses) in 1996?

   a. negative
   b. $0 to $5,000
   c. $5,001 to $10,000
   d. $10,001 to $20,000
   e. $20,001 to $30,000
   f. $30,001 to $40,000
   g. $40,001 to $50,000
   h. Over $50,000

25. Approximately what percentage of your gross farm income in 1996 came from grazing livestock?
   _____ percent

26. About what percentage of your total family income (includes net farm income, off-farm earnings, oil or gas lease income, income from investments, etc.) in 1996 came from farming/ranching?
   _____ percent

26. How do the most effective biological agents (insects) **predominately** control leafy spurge?

a. eating the foliage off the plant (defoliation)

b. destroying the plant's ability to produce seeds by affecting pollination

c. insect larvae destroy the root systems of the plant

d. caterpillars cut the stems of the plant

e. beetles secrete enzymes that interfere with photosynthesis

f. b and d

h. don't know

Thank you for completing this questionnaire. Your cooperation is sincerely appreciated. If you would like a report summarizing the findings of this study, please provide your name and mailing address below or send a separate request to F. Larry Leistritz, Morrill Hall, North Dakota State University, Fargo, ND 58105:

_____

_____

_____

_____

_____

WEED MANAGEMENT SURVEY
(Local Decision Makers)

The following questions pertain to grazing and weed management issues **in your area**.

1. Please rate each of the following problems/issues that may affect livestock grazing operations in your area: (circle the appropriate number)

	Not a Problem	Minor Problem	Major Problem	Don't Know
a. adverse weather conditions	1	2	3	4
b. availability of grazing land	1	2	3	4
c. cost of feed and supplies	1	2	3	4
d. livestock prices	1	2	3	4
e. noxious or invasive weeds	1	2	3	4
f. predators	1	2	3	4
g. regulations affecting use of public lands	1	2	3	4
h. use of CRP for haying and grazing	1	2	3	4
i. others (please specify _____)	1	2	3	4

2. Which problem/issue listed above do you feel is the **most serious** problem affecting grazing operations in your area? (Circle the appropriate letter)

3. Have these problems/issues in your area improved, remained the same, or become worse over the past five years?

	Improved	Remained the Same	Become Worse	Don't Know
a. adverse weather conditions	1	2	3	4
b. availability of grazing land	1	2	3	4
c. cost of feed and supplies	1	2	3	4
d. livestock prices	1	2	3	4
e. noxious or invasive weeds	1	2	3	4
f. predators	1	2	3	4
g. regulations affecting use of public lands	1	2	3	4
h. use of CRP for haying and grazing	1	2	3	4
i. others (please specify_____)	1	2	3	4

4. Which weeds currently pose problems for livestock grazing operations in your area? (please rate each of the following weeds)

	Not a Problem	Minor Problem	Major Problem	Don't Know
a. annual brome grasses	1	2	3	4
b. knapweeds	1	2	3	4
c. leafy spurge	1	2	3	4
d. prickly pear	1	2	3	4
e. sagebrush	1	2	3	4
f. thistles	1	2	3	4
g. wormwood	1	2	3	4
h. field bindweed	1	2	3	4
i. others (please specify _____)	1	2	3	4

5. Which weed listed above currently poses the **most serious** problem for grazing operations in your area? (**Circle** the appropriate letter)

6. What do you think are the two most important primary causes of invasive weed (e.g., leafy spurge, knapweed) infestations in your area? (circle the **two** most important)

a. infestations spread from adjoining land
b. not recognized as a problem/threat until it's too late
c. spread by man's actions (e.g., vehicles, contaminated hay)
d. overgrazing of rangeland
e. lack of competition from native plants/grasses
f. lack of cost effective controls
g. other (_____ please specify)

7. How serious is the weed problem in your area? (please circle)

not a problem minor problem major problem

8. How would you rate the **effectiveness** of the following practices in controlling leafy spurge?

	Not Effective	Partially Effective	Very Effective	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

9. Do you think it pays to use the following leafy spurge control practices?

	Yes, It Pays	Marginal	Does Not Pay	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

10. Based on what you have experienced, believe, or have been told, please indicate the reasons for **not** using the following control methods on leafy spurge.

Reasons for **not** using **herbicide treatments**: (check all that apply)

___ Leafy spurge infestations are inaccessible to sprayers

___ Herbicides are not economical

___ Herbicides are ineffective in controlling leafy spurge

___ Environmental restrictions/concerns prevent application of herbicides (such as, spraying near water, trees, sensitive crops, etc.)

___ Most people/land managers do not have the time to treat the leafy spurge infestations

___ Acreage of infestations is so large that the cost of using herbicides would be prohibitively expensive

___ Most people/agencies lack the equipment or expertise to apply herbicides (such as restricted use permits)

___ Most people/agencies lack funding to efficiently manage leafy spurge infestations

___ Damage to non-target species

___ Others reasons (please list _____)

Reasons for **not using biological controls**: (check all that apply)

___ Biological agents take too long to work

___ Many ranchers and land managers do not know how to properly use the agents

___ Biological agents are not economical

___ Many ranchers and land managers do not know how to obtain or where to obtain the insects

___ Limited access to biological agents (cannot collect sufficient numbers of the agents)

___ Many ranchers and land managers do not have the time to work with biological agents

___ Biological agents will not likely work on leafy spurge infestations in this area

___ Many ranchers and land managers are afraid the agents will spread or attack other plants

___ Biological agents will eventually spread to leafy spurge in this area without assistance

___ Other reasons (please list _____)

Reasons for **not using sheep and/or goats**: (check all that apply)

___ Many ranchers and land managers do not have the expertise/knowledge to work with sheep and goats

___ Many ranchers and land managers do not have the right equipment (fences, water, shelter) for sheep and goats

___ Sheep and goats are too time consuming to use

___ Sheep and goats will negatively affect non-target species

___ Sheep and goats are too costly to manage/not economical to use

___ Sheep and goats are ineffective in controlling leafy spurge

___ Various agency's policies prevent using sheep or goats

___ Other reasons (please list _____)

Reasons for **not** using **other methods**, such as tillage, planting competing grasses, burning, mowing: (check all that apply)

___ Many ranchers and land managers do not know how to use these methods

___ These methods are ineffective

___ Many ranchers and land managers lack the proper equipment

___ Many ranchers and land managers do not have enough time to work with those methods

___ Land is not suitable for tillage (inaccessible, incompatible terrain, light soil, too rocky, etc.)

___ Damage to non-target species

___ Various agency's policies prevent using these alternative methods

___ Other reasons (please list _____)

11. When you, or people you represent, need information about **weed management on grazing land**, which of the following sources are used?

	Seldom	Sometimes	Frequently	Never
a. Extension service/county agent/universities	1	2	3	0
b. private companies/consultants	1	2	3	0
c. farm/ranch/trade magazines	1	2	3	0
d. grazing associations	1	2	3	0
e. public land managers	1	2	3	0
f. Internet/on-line computer services/DTN	1	2	3	0
g. professional meetings/associations	1	2	3	0
h. county weed board/officers	1	2	3	0
i. government agencies	1	2	3	0
j. other (specify _____)	1	2	3	0

12. Which one do you feel is the **most valuable** source of information? (**Circle** the appropriate letter above.)

13. When you, or people you represent, want information concerning weed management, what type of information do you feel they would like?

	Not Interested	Somewhat Interested	Very Interested
a. effectiveness of various herbicide treatment programs	1	2	3
b. economics of herbicide treatments	1	2	3
c. how to get started with biological control	1	2	3
d. economics of biological control	1	2	3
e. techniques and effectiveness of control with sheep and goats	1	2	3
f. economics of using sheep and goats	1	2	3
g. techniques and effectiveness of cultivation and reseeding	1	2	3
h. economics of cultivation and reseeding	1	2	3
i. others (please specify _____)	1	2	3

14. In what form would you, or people you represent, prefer to receive the information?

	Not Interested	Somewhat Interested	Very Interested
a. pamphlet or bulletin available through Extension office or county agent	1	2	3
b. video cassettes demonstrating the various control methods	1	2	3
c. area demonstration plots showing the effectiveness of various control methods	1	2	3
d. testimonials from other land managers/ranchers	1	2	3
e. computer decision aids (programs) that can be used by individuals to evaluate the feasibility or economics of various controls	1	2	3
f. personal visits and on-site help by range management specialists	1	2	3
g. others (please specify_____)	1	2	3

The next set of questions asks what you think about general weed management issues and concerns dealing with leafy spurge. Please respond based on your knowledge of weed issues in your area.

15. Please indicate whether you agree or disagree with the following statements:

General Weed Management	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
Weed problems in rangeland and other lands are generally the result of poor land management	1	2	3	4	5	0
State and Federal government agencies are not doing enough to control problem weeds on public grazing land	1	2	3	4	5	0

	Strongly Disagree	Neither Somewhat Disagree	Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
State and Federal government agencies are not doing enough to help control problem weeds on private grazing land	1	2	3	4	5	0
Local governments are not effective in controlling problem weeds	1	2	3	4	5	0
It seldom makes economic sense to control weeds on rangeland	1	2	3	4	5	0
Rangeland weeds represent a problem to all ranchers	1	2	3	4	5	0
There needs to be more research on controlling weeds on rangeland	1	2	3	4	5	0
Restrictions affecting the use of herbicides on rangeland are too strict	1	2	3	4	5	0
Herbicides, if used properly, are not harmful to the environment	1	2	3	4	5	0
Weed infestations have no effect on the market (sale) value of rangeland	1	2	3	4	5	0
Public land managers are doing a good job of controlling weeds on public lands	1	2	3	4	5	0
Leafy Spurge						
Leafy spurge is virtually impossible to control with current control methods and techniques	1	2	3	4	5	0
Leafy spurge can be controlled but it is just too costly	1	2	3	4	5	0
Leafy spurge is a long-term management problem	1	2	3	4	5	0
Biological agents released to control leafy spurge are safe for crops and native plants	1	2	3	4	5	0
The expected payoff from biological control of leafy spurge justifies investment of public funds to develop the process	1	2	3	4	5	0

	Strongly Disagree	Neither Somewhat Disagree	Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
Biological control will eventually eliminate the leafy spurge problem	1	2	3	4	5	0
Governments should help pay part of the cost to control leafy spurge, even if it means an increase in taxes	1	2	3	4	5	0
Leafy spurge negatively affects various agency's ability to effectively manage their land	1	2	3	4	5	0

We would now like to ask a few questions about you for statistical purposes.

16. In what county and state do you live? _____ County _____ State

17. How long have you lived in this county? _____ Years

18. What is your age? _____ Years

19. Which of the following categories best describes the highest level of education you have completed?

    a. Did not complete high school
    b. High school graduate
    c. Vocational/Technical or 2-year college degree
    d. Bachelor's Degree (4-year college program)
    e. Graduate School (Masters and/or Doctorate Degree)

20. Which of the following categories best describes your current occupation?

a. Farming/ranching
b. Agricultural services/supply
c. Professional/Business services
d. Government
e. Energy
f. Other _____ (please specify)

The following questions are designed to determine your familiarity with the leafy spurge problem. These questions will help us determine the level of understanding local decision makers have regarding leafy spurge. (please **circle** one answer for each question)

21. Leafy spurge **originally** came from?

a. Australia
b. South America
c. Europe
d. Africa
e. don't know

22. Which state has the biggest leafy spurge problem (most acres infested) in the United States?

a. Montana
b. Colorado
c. Nebraska
d. North Dakota
e. Texas
f. don't know

23. Leafy spurge can be **eradicated** using which method of control?

a. biological agents
b. grazing by animals
c. repeated cultivation/tillage
d. herbicides
e. herbicides and biological control
f. grazing and herbicides
g. yearly burning in conjunction with repeated mowing
h. no way--you can't get rid of it
i. don't know

24. Leafy spurge negatively affects rangeland output by?

a. reducing available forage for cattle
b. killing cattle that eat it
c. allowing other weeds to take over the land
d. don't know

25. Which agency is responsible for **screening biocontrol agents** to ensure that they will not produce harmful effects on crops or native plants?

a. Agricultural Research Service (ARS) - USDA
b. U.S. Environmental Protection Agency (EPA)
c. Forest Service (FS) - USDA
d. U.S. Fish and Wildlife Service (FWS)
e. Animal and Plant Health Inspection Service (APHIS) - USDA
f. State Universities
g. State Department of Agriculture
h. don't know

We would now like to ask a few questions about you for statistical purposes.

28. In what county and state do you live? _____County _____ State

29. How long have you lived in this county? _____ Years

30. What is your age? _____ Years

31. Which of the following categories best describes the highest level of education you have completed?

    a. Did not complete high school
    b. High school graduate
    c. Vocational/Technical or 2-year college degree
    d. Bachelor's Degree (4-year college program)
    e. Graduate School (Masters &/or Doctorate Degree)

32. How many years have you been involved with managing public land? _____

33. What is your current job title? _____, and how many years have you been at your current position/title? _____

34. What was your previous job-related or educational background? (circle one)

    a. agriculture/agronomy
    b. biology
    c. entomology
    d. ecology
    e. environmental studies
    f. range management
    g. wildlife conservation
    h. natural resource management
    i. other _____(Please specify)

Thank you for completing this questionnaire. Your cooperation is sincerely appreciated. If you would like a report summarizing the findings of this study, please provide your name and mailing address below or send a separate request to F. Larry Leistritz, Morrill Hall, North Dakota State University, Fargo, ND 58105:

_____

_____

_____

_____

_____

WEED MANAGEMENT SURVEY
(Public Grazing Land Management)

The following questions pertain to grazing and weed management issues **in your office's district**.

1. Please rate each of the following problems/issues that may affect livestock grazing operations in the district your office is responsible for: (circle the appropriate number)

	Not a Problem	Minor Problem	Major Problem	Don't Know
a. adverse weather conditions	1	2	3	4
b. availability of grazing land	1	2	3	4
c. cost of feed and supplies	1	2	3	4
d. livestock prices	1	2	3	4
e. noxious or invasive weeds	1	2	3	4
f. predators	1	2	3	4
g. regulations affecting use of public lands	1	2	3	4
h. use of CRP for haying and grazing	1	2	3	4
i. others (please specify _____)	1	2	3	4

2. Which problem/issue listed above do you feel is the **most serious** problem affecting grazing operations in the district your office is responsible for? (Circle the appropriate letter)

3. Have these problems in the district your office is responsible for improved, remained the same, or become worse over the past five years?

	Improved	Remained the Same	Become Worse	Don't Know
a. adverse weather conditions	1	2	3	4
b. availability of grazing land	1	2	3	4
c. cost of feed and supplies	1	2	3	4
d. livestock prices	1	2	3	4
e. noxious or invasive weeds	1	2	3	4
f. predators	1	2	3	4
g. regulations affecting use of public lands	1	2	3	4
h. use of CRP for haying and grazing	1	2	3	4
i. others (please specify_____)	1	2	3	4

4. Which weeds currently pose problems for livestock grazing operations in the district your office is responsible for? (please rate each of the following weeds)

	Not a Problem	Minor Problem	Major Problem	Don't Know
a. annual brome grasses	1	2	3	4
b. knapweeds	1	2	3	4
c. leafy spurge	1	2	3	4
d. prickly pear	1	2	3	4
e. sagebrush	1	2	3	4
f. thistles	1	2	3	4
g. wormwood	1	2	3	4
h. field bindweed	1	2	3	4
i. others (please specify _____)	1	2	3	4

5. Which weed listed above currently poses the **most serious** problem for grazing operations in the district your office is responsible for? **(Circle** the appropriate letter)

6. What do you think are the two most important primary causes of invasive weed (e.g., leafy spurge, knapweed) infestations in the district your office is responsible for? (circle the two most important)

   a. infestations spread from adjoining land
   b. not recognized as a problem/threat until it's too late
   c. spread by man's actions (e.g., vehicles, contaminated hay)
   d. overgrazing of rangeland
   e. lack of competition from native plants/grasses
   f. lack of cost effective controls
   g. other (_____please specify)

The following questions pertain only to **the land that you manage**.

7. How serious is the weed problem on the land that you manage? (please circle)
   not a problem minor problem major problem

   Please estimate how many **acres** of the following weeds are on land that you manage:

	Grazing Land	Other Public Land
a. annual brome grasses	_____	_____
b. knapweeds	_____	_____
c. leafy spurge	_____	_____
d. prickly pear	_____	_____
e. sagebrush	_____	_____
f. thistles	_____	_____
g. wormwood	_____	_____
h. field bindweed	_____	_____
i. others (specify _____)	_____	_____

8. What measures has your agency taken to prevent leafy spurge from establishing itself on the land that you manage?

a. allow only weed-free hay to be fed	Yes	No
b. keep machinery/trucks clean	Yes	No
c. aggressively destroy weeds when found	Yes	No
d. spot spraying near fringe or boundary areas	Yes	No
e. routinely check properties for invading plants	Yes	No
f. insist that private land owners and/or local governments control leafy spurge on adjacent land	Yes	No
g. other measures (please specify _____)	Yes	No

9. Does your agency currently have any leafy spurge on land that you manage?

____No (if **No**, go to Question 10)

____If **Yes**, please indicate if your agency has used or plans to use any of the following general control practices to control leafy spurge: (check all that apply)

	Have used in the past	Plan to Use
a. herbicides	Y / N (# of years ___)	Y / N
b. biological control	Y / N (# of years ___)	Y / N
c. grazing with sheep and/or goats	Y / N (# of years ___)	Y / N
d. tillage and/or reseeding with competing grasses	Y / N (# of years ___)	Y / N
e. other controls (please specify _____)	Y / N (# of years ___)	Y / N

10. Even if your agency currently has no leafy spurge, how would you rate the **effectiveness** of the following practices in controlling leafy spurge?

	Not Effective	Partially Effective	Very Effective	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

11. Even if your agency currently has no leafy spurge, do you think it pays to use the following leafy spurge control practices?

	Yes, It Pays	Marginal	Does Not Pay	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

12. Based on what you have experienced, believe, or have been told, please indicate the reasons for **not** using the following control methods on leafy spurge.

Reasons for **not using herbicide treatments**: (check all that apply)

___ Leafy spurge infestations are inaccessible to sprayers

___ Herbicides are not economical

___ Herbicides are ineffective in controlling leafy spurge

___ Environmental restrictions/concerns prevent application of herbicides (such as, spraying near water, trees, sensitive crops, etc.)

___ Do not have the time to treat the leafy spurge infestations

___ Acreage of infestations is so large that the cost of using herbicides would be prohibitively expensive

___ Lack the equipment or expertise to apply herbicides (such as restricted use permits)

___ Lack funding to efficiently manage leafy spurge infestations

___ Damage to non-target species

___ Others reasons (please list _____)

Reasons for **not** using **biological controls**: (check all that apply)

___ Biological agents take too long to work
___ Do not know how to properly use the agents
___ Biological agents are not economical
___ Do not know how to obtain or where to obtain the insects
___ Limited access to biological agents (cannot collect sufficient numbers of the agents)
___ Do not have the time to work with biological agents
___ Biological agents will not likely work on leafy spurge infestations in my district
___ Afraid the agents will spread or attack other plants
___ Biological agents will eventually spread to leafy spurge within my district without agency's help
___ Other reasons (please list _____)

Reasons for **not** using **sheep and/or goats**: (check all that apply)

___ Do not have the expertise/knowledge to work with sheep and goats
___ Do not have the right equipment (fences, water, shelter) for sheep and goats
___ Sheep and goats are too time consuming to use
___ Sheep and goats will negatively affect non-target species
___ Sheep and goats are too costly to manage/not economical to use
___ Sheep and goats are ineffective in controlling leafy spurge
___ Departmental/agency policy prevents using sheep or goats
___ Other reasons (please list _____)

Reasons for **not** using **other methods**, such as tillage, planting competing grasses, burning, mowing: (check all that apply)

___ Do not know how to use these methods
___ These methods are ineffective
___ Lack the proper equipment
___ Do not have enough time to work with those methods
___ Land is not suitable for tillage (inaccessible, incompatible terrain, light soil, too rocky, etc.)
___ Damage to non-target species
___ Departmental/agency policy prevents using these alternative methods
___ Other reasons (please list _____)

13. When you need information about **weed management on grazing land**, which of the following sources do you use?

	Seldom	Sometimes	Frequently	Never
a. Extension service/county agent/universities	1	2	3	0
b. private companies/consultants	1	2	3	0
c. farm/ranch/trade magazines	1	2	3	0
d. grazing associations	1	2	3	0
e. other public land managers	1	2	3	0
f. Internet/on-line computer services/DTN	1	2	3	0
g. professional meetings/associations	1	2	3	0
h. county weed board/officers	1	2	3	0
i. other government agencies	1	2	3	0
j. other (specify _____)	1	2	3	0

14. Which one has been the **most valuable** source of information? (**Circle** the appropriate letter above.)

15. What type of information would you like to obtain concerning weed management?

	Not Interested	Somewhat Interested	Very Interested
a. effectiveness of various herbicide treatment programs	1	2	3
b. economics of herbicide treatments	1	2	3
c. how to get started with biological control	1	2	3
d. economics of biological control	1	2	3
e. techniques and effectiveness of control with sheep and goats	1	2	3
f. economics of using sheep and goats	1	2	3
g. techniques and effectiveness of cultivation and reseeding	1	2	3
h. economics of cultivation and reseeding	1	2	3
i. others (please specify _____)	1	2	3

16. In what form would you prefer to receive the information?

	Not Interested	Somewhat Interested	Very Interested
a. pamphlet or bulletin available through Extension office or county agent	1	2	3
b. video cassettes demonstrating the various control methods	1	2	3
c. area demonstration plots showing the effectiveness of various control methods	1	2	3
d. testimonials from other land managers	1	2	3
e. computer decision aids (programs) that can be used by land managers to evaluate the feasibility or economics of various controls	1	2	3
f. personal visits and on-site help by range management specialists	1	2	3
g. others (please specify_____)	1	2	3

The next set of questions asks what you think about general weed management issues and concerns dealing with leafy spurge.

17. Please indicate whether you agree or disagree with the following statements:

General Weed Management	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
Weed problems in public grazing land and other public lands are generally the result of poor land management	1	2	3	4	5	0
Our agency is concerned about controlling weeds in grazing land or other public lands	1	2	3	4	5	0
State and Federal government agencies are not doing enough to control problem weeds on public land	1	2	3	4	5	0
State and Federal government agencies are not doing enough to help control problem weeds on private land	1	2	3	4	5	0
Local governments are not effective in controlling problem weeds	1	2	3	4	5	0
It seldom makes economic sense to control weeds on public grazing land and other public lands	1	2	3	4	5	0
Rangeland weeds on public lands represent a problem to all ranchers	1	2	3	4	5	0
It doesn't pay to control weeds on agency land when weeds are not controlled on adjoining lands	1	2	3	4	5	0
There needs to be more research on controlling weeds on public grazing land	1	2	3	4	5	0
Restrictions affecting the use of herbicides on public grazing lands are too strict	1	2	3	4	5	0
Herbicides, if used properly, are not harmful to the environment	1	2	3	4	5	0
Weed infestations have no effect on the market (sale) value of rangeland	1	2	3	4	5	0
Public land managers are doing a good job of controlling weeds on public lands	1	2	3	4	5	0
Leafy Spurge						
Leafy spurge is virtually impossible to control with current control methods and techniques	1	2	3	4	5	0
Leafy spurge can be controlled but it is just too costly	1	2	3	4	5	0

	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
Leafy spurge is a long-term management problem	1	2	3	4	5	0
Biological agents released to control leafy spurge are safe for crops and native plants	1	2	3	4	5	0
The expected payoff from biological control of leafy spurge justifies investment of public funds to develop the process	1	2	3	4	5	0
Biological control will eventually eliminate the leafy spurge problem	1	2	3	4	5	0
Governments should help pay part of the cost to control leafy spurge, even if it means an increase in taxes	1	2	3	4	5	0
Leafy spurge negatively affects our agency's ability to effectively manage our land	1	2	3	4	5	0

We would now like to ask a few general questions about the characteristics of the land that you manage. These responses will help us to compare differences and similarities of the survey respondents based on various characteristics.

18. In 1996:
    a. how many acres did you manage? public grazing land _____
       other public land _____
    b. how many AUMs did you lease/rent? _____
    c. what agency do you work for? _____

19. Do you use a computer in the management of the department/agency's land? Yes / No

20. Do you have access to the Internet? Yes / No

In this last section we want to learn more about your agency's resources available to control problem weeds.

21. How has your office's annual budget appropriated for overall land management changed during the past five years? (please circle one)
    increased decreased remained the same

22. How do you expect your office's annual budget appropriated for overall land management to change during the next five years? (please circle one)
    increase decrease remain the same

23. Approximately what portion of the your office's overall budget for land management is spent on weed control?
    %_____

24. What is the approximate breakdown of your weed control expenditures?
    _____% herbicides
    _____% biological control
    _____% labor
    _____% mechanical control (mowing, cultivating)
    _____% other _____(please specify)
    100% Total

25. How has the relative share of the budget used for weed control changed during the past five years (please circle one)
    increased decreased remained the same

26. How do you expect the relative share of the budget used for weed control to change during the next five years (please circle one)
    increase decrease remain the same

27. What is the most limiting factor in your office's ability to combat problem weeds? (please circle one)
    a. lack of effective controls
    b. limiting or restricting regulations/policies
    c. labor
    d. funding
    e. other _____(please specify)

35. What was your previous job-related or educational background? (please circle one)

a. agriculture/agronomy
b. biology/zoology
c. entomology
d. ecology
e. environmental studies
f. range management
g. wildlife conservation
h. natural resource management
i. civil/environmental engineering
j. other _____(Please specify)

Thank you for completing this questionnaire. Your cooperation is sincerely appreciated. If you would like a report summarizing the findings of this study, please provide your name and mailing address below or send a separate request to F. Larry Leistritz, Morrill Hall, North Dakota State University, Fargo, ND 58105:

_____

_____

_____

_____

_____

WEED MANAGEMENT SURVEY
(State and Federal Land Managers)

The following questions pertain to grazing and weed management issues.

1. Please select one of the following which best describes the type of land your agency manages.

a. pasture or rangeland
b. cropland
c. forest or wooded areas
d. lands associated with wildlife production (refuges, production areas, wetlands)
e. highways, roads, ditches, rest areas, other right of ways
f. historic sites or scenic areas
g. campgrounds and/or parks
h. other _____ (please specify)

2. Which of the following categories are major goals or priorities affecting your agency's land management strategies? (please circle those that apply)

a. soil and water conservation/watershed management
b. preservation of natural, historic, or scenic areas
c. create and support wildlife populations
d. livestock grazing
e. timber production
f. maintenance and safety of roads and highways
g. outdoor recreation and/or tourism
h. other _____ (please specify)

3. Please indicate which of the above goals is the **most important** to your agency? (please write the appropriate letter in the blank)

____ most important

10. Even if your agency currently has no leafy spurge, how would you rate the **effectiveness** of the following practices in controlling leafy spurge?

	Not Effective	Partially Effective	Very Effective	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

11. Even if your agency has no leafy spurge, do you think it pays to use the following leafy spurge control practices?

	Yes, It Pays	Marginal	Does Not Pay	Don't Know
a. spraying with herbicides	1	2	3	4
b. biological control with insects or pathogens	1	2	3	4
c. control with grazing animals such as sheep or goats	1	2	3	4
d. tillage and/or reseeding with competing grasses	1	2	3	4
e. other controls (please specify _____)	1	2	3	4

12. Based on what you have experienced, believe, or have been told, please indicate the reasons for **not** using the following control methods on leafy spurge.

Reasons for **not** using **herbicide treatments**: (check all that apply)

___ Leafy spurge infestations are inaccessible to sprayers
___ Herbicides are not economical
___ Herbicides are ineffective in controlling leafy spurge
___ Environmental restrictions/concerns prevent me from applying herbicides (such as, spraying near water, trees, sensitive crops, etc.)
___ Do not have the time to treat the leafy spurge infestations
___ Acreage of infestations is so large that the cost of using herbicides would be prohibitively expensive
___ Lack the equipment or expertise to apply herbicides (such as restricted use permits)
___ Lack the funding to efficiently manage leafy spurge infestations
___ Damage to non-target species
___ Others reasons (please list _____)

Reasons for **not** using **biological controls**: (check all that apply)

___ Biological agents take too long to work
___ Do not know how to properly use the agents
___ Biological agents are not economical
___ Do not know how to obtain or where to obtain the insects
___ Limited access to biological agents (cannot collect sufficient numbers of the agents)
___ Do not have the time to work with biological agents
___ Biological agents will not likely work on leafy spurge infestations in my district
___ Afraid the agents will spread or attack other plants
___ Biological agents will eventually spread to leafy spurge within my district without agency's help
___ Other reasons (please list _____)

❑ If using **sheep and/or goats** cannot be or has never been a consideration, please indicate by marking this box and skip to reasons for not using **other methods**.

Reasons for **not** using **sheep and/or goats**: (check all that apply)

___ Do not have the expertise/knowledge to work with sheep and goats
___ Do not have the right equipment (fences, water, shelter) for sheep and goats
___ Sheep and goats are too time consuming to use
___ Sheep and goats will negatively affect non-target species
___ Sheep and goats are too costly to manage/not economical to use
___ Sheep and goats are ineffective in controlling leafy spurge
___ Departmental/agency policy prevents using sheep or goats
___ Other reasons (please list _____)

Reasons for **not** using **other methods**, such as tillage, planting competing grasses, burning, mowing: (check all that apply)

___ Do not know how to use these methods
___ These methods are ineffective
___ Lack the proper equipment
___ Do not have enough time to work with those methods
___ Land is not suitable for tillage (inaccessible, incompatible terrain, road ditches, wooded areas, etc.)
___ Damage to non-target species
___ Departmental/agency policy prevents using these alternative methods
___ Other reasons (please list _____)

13. If you need information or help with weed **management** issues or problems, which of the following sources do you use?

	Seldom	Sometimes	Frequently	Never
a. Extension service/county agent/universities	1	2	3	0
b. private companies/consultants	1	2	3	0
c. farm/ranch/trade magazines	1	2	3	0
d. grazing associations	1	2	3	0
e. other public land managers	1	2	3	0
f. Internet/on-line computer services/DTN	1	2	3	0
g. professional meetings/associations	1	2	3	0
h. county weed board/officers	1	2	3	0
i. other professionals in your agency	1	2	3	0
j. other (specify _____)	1	2	3	0

14. Which one has been the **most valuable** source of information? (**Circle** the appropriate letter above.)

15. What type of information would you like to obtain concerning weed management?

	Not Interested	Somewhat Interested	Very Interested
a. effectiveness of various herbicide treatment programs	1	2	3
b. economics of herbicide treatments	1	2	3
c. how to get started with biological control	1	2	3
d. economics of biological control	1	2	3
e. techniques and effectiveness of control with sheep and goats	1	2	3
f. economics of using sheep and goats	1	2	3
g. techniques and effectiveness of cultivation and reseeding	1	2	3
h. economics of cultivation and reseeding	1	2	3
i. others (please specify _____)	1	2	3

16. In what form would you prefer to receive the information?

	Not Interested	Somewhat Interested	Very Interested
a. pamphlet or bulletin available through Extension service or county agent	1	2	3
b. video cassettes demonstrating the the various control methods	1	2	3
c. area demonstration plots showing the effectiveness of various control methods	1	2	3
d. testimonials from other land managers	1	2	3
e. computer decision aids (programs) that can be used by land managers to evaluate the feasibility or economics of various controls	1	2	3
f. personal visits and on-site help by range or weed management specialists	1	2	3
g. others (please specify_____)	1	2	3

The next set of questions asks what you think about general weed management issues and concerns dealing with leafy spurge.

17. Please indicate whether you agree or disagree with the following statements:

	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree	Don't Know
Weed problems in public grazing land and other public lands are generally the result of poor land management	1	2	3	4	5	0
Our agency is concerned about controlling weeds on its land	1	2	3	4	5	0
State and Federal government agencies are not doing enough to control problem weeds on public land	1	2	3	4	5	0
State and Federal government agencies are not doing enough to help control problem weeds on private land	1	2	3	4	5	0
Local governments are not effective in controlling problem weeds	1	2	3	4	5	0
It seldom makes economic sense to control weeds on public grazing land	1	2	3	4	5	0
It seldom makes economic sense to control weeds on other public land	1	2	3	4	5	0
Weeds on public lands represent a problem to all ranchers and other users of public lands	1	2	3	4	5	0
It doesn't pay to control weeds on agency land when weeds are not controlled on adjoining lands	1	2	3	4	5	0
There needs to be more research on controlling weeds on public lands	1	2	3	4	5	0
Restrictions affecting the use of herbicides on public land are too strict	1	2	3	4	5	0
Herbicides, if used properly, are not harmful to the environment	1	2	3	4	5	0
Weed infestations have no effect on the market (sale) value of rangeland	1	2	3	4	5	0
Public land managers are doing a good job of controlling weeds on public lands	1	2	3	4	5	0
Leafy Spurge						
Leafy spurge is virtually impossible to control with current control methods and techniques	1	2	3	4	5	0
Leafy spurge can be controlled but it is just too costly	1	2	3	4	5	0
Leafy spurge is a long-term management problem	1	2	3	4	5	0
Biological agents released to control leafy spurge are safe for crops and native plants	1	2	3	4	5	0
The expected payoff from biological control of leafy spurge justifies investment of public funds to develop the process	1	2	3	4	5	0
Biological control will eventually eliminate the leafy spurge problem	1	2	3	4	5	0
Governments should help pay part of the cost to control leafy spurge, even if it means an increase in taxes	1	2	3	4	5	0
Leafy spurge negatively affects our agency's ability to effectively manage our land	1	2	3	4	5	0

We would now like to ask a few general questions about the characteristics of the land that you manage. These responses will help us to compare differences and similarities of the survey respondents based on various characteristics.

18. In 1996:
    a. how many acres did you manage? public grazing land _____
    other public land _____

    b. if you lease or rent some of this land for livestock grazing, _____
    how many AUMs did you lease/rent? _____

    c. what agency do you work for? _____

19. Do you use a computer in the management of the department/agency's land? Yes / No

20. Do you have access to the Internet? Yes / No

In this section we want to learn more about your resources available to control problem weeds.

21. How has your office's annual budget appropriated for overall land management changed during the past five years? (please circle one)
    increased decreased remained the same

22. How do you expect your office's annual budget appropriated for overall land management to change during the next five years? (please circle one)
    increase decrease remain the same

23. Approximately what portion of your office's overall budget for land management is spent on weed control?
    %_____

24. What is the approximate percentage breakdown of your weed control expenditures?
    _____% for herbicides
    _____% for biological control
    _____% for labor
    _____% for mechanical control (mowing, cultivating)
    _____% for other _____(please specify)
    100% Total

25. How has the relative share of the budget spent on weed control changed during the past five years? (please circle one)
    increased decreased remained the same

26. How do you expect the relative share of the budget spent on weed control to change during the next five years? (please circle one)
    increase decrease remain the same

27. What is the most limiting factor in your office's/agency's ability to combat problem weeds? (please circle one)
    a. lack of effective controls
    b. limiting or restricting regulations/policies
    c. labor
    d. funding
    e. other _____(please specify)

We would now like to ask a few questions about you for statistical purposes.

20. In what county and state do you live? _____County _____ State

29. How long have you lived in this county? _____ Years

30. What is your age? _____ Years

31. Which of the following categories best describes the highest level of education you have completed?
    a. Did not complete high school
    b. High school graduate
    c. Vocational/Technical or 2-year college degree
    d. Bachelor's Degree (4-year college program)
    e. Graduate School (Masters and/or Doctorate Degree)

32. How many years have you been involved with managing public land? _____

33. What is your current job title? _____

34. How many years have you been at your current position/title? _____

Appendix B

Comparison of Survey Responses for Local Decision Makers By State of Residence

Appendix Table B1. Local Decision Makers' Perceptions of Problems Faced by Ranchers and Changes in Problems in Past Five Years by State, 1998

Ranching Problems	Montana	North Dakota	South Dakota	Wyoming	Overall
	---------- % indicated a *major* problem ----------				
Livestock prices	90.9	92.3	85.7	66.7	86.5
Cost of feed and supplies	63.6	53.9	71.4	66.7	62.2
Noxious or invasive weeds	45.5	61.5	66.7	66.7	58.3
Adverse weather conditions	63.6	38.5	42.9	66.7	51.4
Regulations affecting use of public lands	45.5	58.3	14.3	66.7	47.2
Predators *	54.6	0.0	71.4	100.0	46.0
Availability of grazing land	27.3	30.8	28.6	0.0	24.3
Use of CRP for haying and grazing ***	0.0	8.3	28.6	0.0	8.6
	---------- % indicated *most* important problem *** ------				
Livestock prices	25.0	50.0	50.0	20.0	37.9
Adverse weather conditions	37.5	10.0	50.0	0.0	24.1
Noxious or invasive weeds	12.5	10.0	0.0	20.0	10.3
Regulations affecting use of public lands	0.0	30.0	0.0	0.0	10.3
Predators	0.0	0.0	0.0	40.0	6.9
Availability of grazing land	0.0	0.0	0.0	20.0	3.5
Cost of feed and supplies	12.5	0.0	0.0	0.0	3.5
Others	12.5	0.0	0.0	0.0	3.5
Use of CRP for haying and grazing	0.0	0.0	0.0	0.0	0.0
	--Percentage indicated problem became worse in last 5 years--				
Cost of feed and supplies	90.9	61.5	85.7	100.0	81.1
Livestock prices	63.6	92.3	100.0	66.7	81.1
Noxious or invasive weeds	40.0	76.9	85.7	66.7	66.7
Regulations affecting use of public lands	50.0	66.7	42.9	80.0	58.8
Others	50.0	0.0	0.0	0.0	50.0
Predators *	70.0	0.0	42.9	100.0	44.4
Availability of grazing land	40.0	8.3	14.3	33.3	22.9
Adverse weather conditions	0.0	0.0	28.6	16.7	8.3
Use of CRP for haying and grazing	0.0	8.3	14.3	0.0	6.3

* Statistically different at P <=0.01 among all groups of respondents for each individual problem (Chi-square test statistic).

*** Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).

Appendix Table B2. Percentage of Local Decision Makers Indicating Specific Weeds Posing the Greatest Problem and How Serious the Weed Problem is in Their Area, By State, 1998

Weeds	Montana	North Dakota	South Dakota	Wyoming	Overall
	---------- % indicated a *major* problem ----------				
Leafy spurge	81.8	84.6	85.7	100.0	86.8
Thistles	20.0	38.5	57.1	42.9	37.8
Field bindweed	9.1	8.3	42.9	33.3	19.4
Annual brome grasses	22.2	9.1	28.6	0.0	15.2
Sagebrush	9.1	0.0	14.3	33.3	11.1
Knapweeds	0.0	8.3	0.0	16.7	5.9
Wormwood	0.0	9.1	0.0	0.0	4.6
Prickly pear ***	0.0	0.0	16.7	0.0	3.1
	---------- % indicated *most* important problem------				
Leafy spurge	90.9	100.0	60.0	100.0	90.9
Annual brome grasses	9.1	0.0	0.0	0.0	3.0
Prickly pear	0.0	0.0	20.0	0.0	3.0
Thistles	0.0	0.0	20.0	0.0	3.0
Knapweeds	0.0	0.0	0.0	0.0	0.0
Sagebrush	0.0	0.0	0.0	0.0	0.0
Wormwood	0.0	0.0	0.0	0.0	0.0
Field bindweed	0.0	0.0	0.0	0.0	0.0
	---------- % indicated a *major* problem ----------				
How serious is weed problem in my district/area ***	36.4	76.9	71.4	85.7	65.8

*** Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).

Appendix Table B3. Local Decision Makers' Perception of How Leafy Spurge Spreads By State, 1998

	Montana	North Dakota	South Dakota	Wyoming	Overall
	-------- % indicated two *most* important problems ------				
Infestations spread from adjoining land	72.7	53.8	71.4	42.9	60.5
Not recognized as a problem/threat until it's too late	54.6	38.5	57.1	57.1	50.0
Lack of cost effective controls	27.3	46.2	28.6	28.6	34.2
Spread by man's actions (e.g., vehicles, contaminated hay)	18.2	30.8	14.3	28.6	23.7
Other[1]	9.1	23.1	14.3	14.3	15.8
Overgrazing of rangeland	0.0	0.0	14.3	14.3	5.3
Lack of competition from native plants/grasses	0.0	7.7	0.0	14.3	5.3

[1] For those listing other reasons 38 percent indicated spread by deer and birds, followed by 25 percent indicating a lack of something to kill leafy spurge.

Appendix Table B4. Local Decision Makers' Perception of How Effective and Economical Leafy Spurge Control Methods Are, By State, 1998

	Montana	North Dakota	South Dakota	Wyoming	Overall
	---------- % indicated its *very* effective ----------				
Spraying with herbicides	27.3	46.2	20.0	16.7	31.4
Grazing with sheep or goats **	54.6	0.0	0.0	66.7	30.3
Biological control with insects or pathogens *	0.0	41.7	0.0	42.9	22.9
Tillage & or reseeding	0.0	0.0	0.0	16.7	4.0
	---------- % indicated it pays ----------				
Spraying with herbicides ***	45.5	84.6	57.1	42.9	61.5
Biological control with insects or pathogens *	0.0	91.7	100.0	71.4	61.1
Grazing with sheep or goats **	80.0	18.2	50.0	83.3	54.6
Tillage & or reseeding **	0.0	0.0	0.0	33.3	4.4

* Statistically different at P <=0.01 among all groups of respondents for each individual problem (Chi-square test statistic).

** Statistically different at P <=0.05 among all groups of respondents for each individual problem (Chi-square test statistic).

*** Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).

Appendix Table B5. Based Upon What Local Decision Makers Experienced, Believed, or had Been Told, Their Indication of Why the Following Controls Are Not Used on Leafy Spurge, By State, 1998

	Montana	North Dakota	South Dakota	Wyoming	Overall
Reasons for not using herbicide treatments	---------- % indicated reasons for not using ----------				
Acreage of infestations are so large that the cost of using herbicides would be prohibitively expensive	90.9	66.7	71.4	83.3	77.8
Environmental restrictions/concerns prevent appl. of herbicides (such as, spraying near water, trees, sensitive crops, etc)	54.6	75.0	71.4	66.7	66.7
Most people/agencies lack funding to efficiently manage leafy spurge infestations	45.5	83.3	57.1	66.7	63.9
Leafy spurge infestations are inaccessible to sprayers	63.6	50.0	42.9	16.7	47.2
Herbicides are not economical	54.6	33.3	28.6	50.0	41.7
Most people/land managers do not have the time to treat the leafy spurge infestations	45.5	41.7	57.1	0.0	38.9
Damage to non-target species ***	9.1	25.0	42.9	66.7	30.6
Herbicides are ineffective in controlling leafy spurge ***	45.5	16.7	0.0	50.0	27.8
Most people/agencies lack the equipment or expertise to apply herbicides (such as restricted use permits)	9.1	33.3	42.9	16.7	25.0
Others reasons	0.0	16.7	0.0	0.0	5.6
Reasons for not using biological agents					
Limited access to biological agents (cannot collect sufficient numbers of the agents)	63.6	62.5	42.9	75.0	60.0
Many ranchers and land managers do not know how to properly use the agents	45.5	62.5	57.1	50.0	53.3
Biological agents take too long to work **	81.8	25.0	14.3	50.0	46.7

------ Continued ------

Appendix Table B5. Continued

	Montana	North Dakota	South Dakota	Wyoming	Overall
Reasons for not using biological agents	---------- % indicated reasons for not using ----------				
Many ranchers and land managers do not know how to obtain or where to obtain the insects	27.3	25.0	71.4	25.0	36.7
Many ranchers and land managers do not have the time to work with biological agents	18.2	0.0	42.9	25.0	20.0
Biological agents will not likely work on leafy spurge infestations in this area **	45.5	0.0	0.0	0.0	16.7
Many ranchers and land managers are afraid the agents will spread or attack other plants	0.0	12.5	0.0	25.0	6.7
Biological agents will eventually spread to leafy spurge in this area assistance	0.0	12.5	0.0	0.0	3.3
Biological agents are not economical	9.1	0.0	0.0	0.0	3.0
Other reasons	0.0	0.0	0.0	0.0	0.0
Reasons for not using sheep and/or goats					
Many ranchers and land managers do not have the right equipment (fences, water, shelter for sheep and goats	90.9	91.7	71.4	66.7	83.3
Many ranchers and land managers do not have the expertise/knowledge to work with sheep and goats	63.6	50.0	14.3	16.7	41.7
Sheep and goats are too time consuming to use ***	54.6	41.7	0.0	16.7	33.3
Sheep and goats will negatively affect non-target species	27.3	33.3	28.6	0.0	25.0
Other reasons	36.4	8.3	14.3	33.3	22.2
Sheep and goats are ineffective in controlling leafy spurge ***	0.0	33.3	0.0	16.7	13.9
Sheep and goats are too costly to manage/not economical to use	9.1	16.7	0.0	16.7	11.1
Various agency's policies prevent using sheep or goats	9.1	25.0	0.0	0.0	11.1
Reasons for not using other methods, (i.e., tillage, planting competing grasses, burning)					
Land is not suitable for tillage (inaccessible, incompatible terrain, light soil, too rocky, etc)	90.9	100.0	100.0	100.0	97.2
Many ranchers and land managers lack the proper equipment	36.4	33.3	57.1	66.7	44.4
These methods are ineffective	54.6	25.0	28.6	33.3	36.1
Various agency's policies prevent using these alternative methods	27.3	50.0	0.0	33.3	30.6
Many ranchers and land managers do not know how to use these methods **	54.6	16.7	14.3	0.0	25.0
Many ranchers and land managers do not have enough time to work with those methods	27.3	8.3	57.1	16.7	25.0
Damage to non-target species ***	45.5	8.3	0.0	16.7	19.4
Other reasons	18.2	0.0	0.0	16.7	8.3

** Statistically different at P <=0.05 among all groups of respondents for each individual problem (Chi-square test statistic).

*** Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).

Appendix Table B6. Sources of Weed Management Information Most Often Used By Local Decision Makers, By State, 1998

	Montana	North Dakota	South Dakota	Wyoming	Overall
	---------- % indicated used frequently ----------				
Extension Service/county agent/universities ***	100.0	46.2	85.7	57.1	71.1
County weed board/officers	54.6	41.7	85.7	85.7	62.2
Private companies/consultants	20.0	18.2	0.0	66.7	25.0
Farm/ranch/trade magazines	27.7	18.2	20.0	33.3	24.2
Professional meetings/associations	18.2	30.0	14.3	33.3	23.5
Grazing associations *	10.0	50.0	0.0	0.0	21.2
Government agencies	10.0	0.0	0.0	16.7	6.3
Public land managers (BLM, Forest Service)	0.0	9.1	0.0	16.7	6.1
Internet/On-line computer services/DTN	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0
	--- % indicated *most* important information source ---				
Extension Service/county agent/universities	70.0	50.0	100.0	42.9	62.8
County weed board/officers	20.0	41.7	0.0	57.1	31.4
Private companies/consultants	0.0	8.3	0.0	0.0	2.9
Professional meetings/associations	10.0	0.0	0.0	0.0	2.9
Farm/ranch/trade magazines	0.0	0.0	0.0	0.0	0.0
Grazing associations	0.0	0.0	0.0	0.0	0.0
Public land managers (BLM, Forest Service)	0.0	0.0	0.0	0.0	0.0
Internet/On-line computer services/DTN	0.0	0.0	0.0	0.0	0.0

* Statistically different at P <=0.01 among all groups of respondents for each individual problem (Chi-square test statistic).

*** Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).

Appendix Table B7. Types of Weed Management Information Most Wanted By Local Decision Makers, By State, 1998

	Montana	North Dakota	South Dakota	Wyoming	Overall
Types of information wanted	---------- % indicated *very* interested ----------				
Effectiveness of various herbicide treatment programs	80.0	91.7	42.9	100.0	80.6
Economics of herbicide treatments	66.7	76.9	57.1	100.0	75.0
Economics of biological control **	12.5	81.8	85.7	50.0	59.4
How to get started with biological control *	9.1	75.0	85.7	28.6	48.7
Techniques and effectiveness of control with sheep and goats **	27.3	0.0	28.6	71.4	27.0
Economics of using sheep and goats **	27.3	0.0	28.6	71.4	27.0
Economics of cultivation and reseeding ***	11.1	8.3	0.0	42.9	14.3
Techniques and effectiveness of cultivation and reseeding ***	20.0	8.3	0.0	28.6	13.9
Desired form of information	---------- % indicated *very* interested ----------				
Area demonstration plots showing the effectiveness of various control methods	63.6	76.7	71.4	71.4	71.1
Testimonials from other land managers/ranchers	54.6	75.0	71.4	42.9	62.2
Personal visits and on-site help by range management specialists	36.4	61.5	42.9	42.9	47.4
Pamphlet or bulletin available through Extension office or county agent	45.5	10.0	57.1	28.6	34.3
Video cassettes demonstrating the various control methods	10.0	27.3	57.1	28.6	28.6
Computer decision aids (programs) that can be used by individuals to evaluate the feasibility or economics of various controls	10.0	0.0	0.0	14.3	5.9

* Statistically different at P <=0.01 among all groups of respondents for each individual problem (Chi-square test statistic).

** Statistically different at P <=0.05 among all groups of respondents for each individual problem (Chi-square test statistic).

***Statistically different at P <=0.10 among all groups of respondents for each individual problem (Chi-square test statistic).