

MULTI-SPECIES GRAZING

and Leafy Spurge

A comprehensive,
easy-to-read
manual on using
multi-species grazing as
an effective leafy spurge
management tool.

A product of the USDA-ARS TEAM Leafy Spurge Area-Wide IPM Program



Introduction

Leafy Spurge

If you've had any experience with leafy spurge, you already know it's a pretty tough customer.

A native of Europe and Asia, leafy spurge emerges early in the spring and gets a head start on other vegetation in a race for space, sunlight, nutrients and water. Prolific seed production and an extensive root system give the plant a huge competitive advantage and make consistent, long-term control difficult. Deep tap roots –

which can exceed 20 feet in depth – store reserves of nutrients to see the plant through hard times, while lateral roots form a network that enables it to rapidly reproduce and spread. And, perhaps worst of all, leafy spurge is highly adaptable and can thrive in a variety of conditions and situations.

In short, this exotic invader is extremely competitive and quite capable of completely displacing desirable plants.

The economic and environmental impacts of leafy spurge are significant. It invades a variety of land types, reduces

range productivity and species diversity, threatens sensitive species, degrades wildlife habitat and reduces land values. Infestations in Wyoming, Montana and the Dakotas alone are estimated to cost agricultural producers and taxpayers more than \$144 million a year in production losses, control expenses and other impacts to the economy.

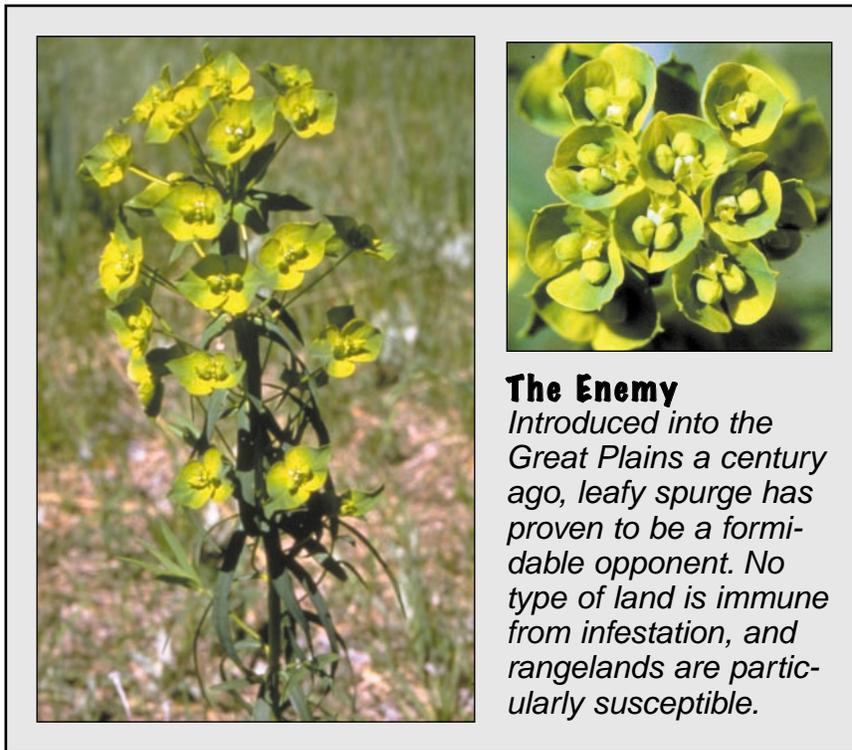
Multi-Species Grazing

Producing more with less while using environmentally sustainable techniques is a goal of most agricultural operations. Multi-species grazing can help fulfill this goal.

Multi-species grazing, simply defined, is the use of more than one type of herbivore to graze a common resource. In the northern Great Plains, the term gener-

ally refers to pairing cattle and sheep or cattle and goats.

The results can be impressive. A properly managed multi-species grazing program can contribute to improved range health, more efficient forage utilization, noxious weed control, enhanced livestock perform-



The Enemy

Introduced into the Great Plains a century ago, leafy spurge has proven to be a formidable opponent. No type of land is immune from infestation, and rangelands are particularly susceptible.

ance and production, and increased ranch profitability.

As such, multi-species grazing is an important component of TEAM Leafy Spurge, a USDA-ARS area-wide Integrated Pest Management program focused on leafy spurge in the northern Great Plains.

Our Goal

The goal of this manual is simple: We want to provide you, the rancher, landowner or land manager, with the information you need to evaluate multi-species grazing. Will it work for you?

We'll start by providing some basic information about how multi-species grazing works, potential benefits, and the kinds of results that can be expected. We'll then move into more detail with information about economic considerations, diet selection and stocking rates, fencing, and predator control.

The key is STARTING. Multi-species grazing is not a cure-all or overnight solution, and it won't work every time in every situation. It is, however, a sustainable tool



The Root of the Problem...

An extensive root system capable of storing nutrient reserves and producing numerous shoots makes leafy spurge extremely versatile and persistent. Multi-species grazing taxes the root system and will ultimately result in significant spurge reductions.

that offers many potential benefits, and it should always be considered when planning a long-term leafy spurge management program. But it won't work unless you give it a try, and the sooner you try, the sooner it can start working for you.

Good luck!

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How Does It Work?

Cattle, sheep and goats have different dietary preferences and grazing behaviors. Cattle prefer grasses, sheep prefer forbs, and goats are browsers. Multi-species grazing exploits the complementary aspects of these dietary differences.

Cattle won't eat leafy spurge, and generally avoid heavily infested patches. Infested land thus loses some of its economic potential – by reducing the production of desirable grasses, leafy spurge ultimately limits the number of cattle the range can support.

Sheep and goats, however, will readily graze leafy spurge, thus converting a noxious weed into an economic gain rather than an added expense for control. The weed, in fact, has high crude protein and feed values, and provides excellent forage for sheep (especially lactating ewes) and goats.

Grazing by sheep or goats

stresses leafy spurge, taxes its root system, reduces seed production, and increases its vulnerability to other control tools (such as biological control or herbicides). It can be used to prevent the spread and reduce the density of leafy spurge infestations, and will ultimately provide a long-term management tool that reduces the weed to tolerable levels.

Instead of investing precious time and money to manage the weed, ranchers can integrate sheep or goat grazing into exist-

ing operations to control leafy spurge while improving range health and potentially generating an economic return.

Potential Benefits

Multi-species grazing offers many benefits when compared to single-species grazing. Some of these benefits are quite significant:

- **Control:** When incorporated as a long-term management tool, multi-species grazing can reduce leafy spurge



We're Here to Help Ewe!

Unlike cattle, which won't eat leafy spurge and generally avoid dense infestations, sheep will readily graze the weed once an aversion to the taste is overcome. Leafy spurge, in fact, is quite nutritious: It has good crude protein values and is highly digestible, and it provides excellent forage for lambs and lactating ewes. Sheep generally show good weight gains after grazing spurge.

<u>Growth Stage</u>	<u>% Crude Protein</u>	<u>% Phosphorous</u>	<u>% Dry Matter Digestibility</u>
Vegetative	27.3	0.53	80
Flowering	23.4	0.46	73
Mature	19.5	0.39	66
Regrowth	15.6	0.32	60



Notice Any Difference?

This fence line contrast provides an excellent example of the control that can potentially be achieved with multi-species grazing. Spurge densities on the left are inhibiting the production of desirable grasses and drastically reducing the pasture's value to a cattle producer. On the right side of the fence, sheep are being used to reduce, then maintain, a significant reduction in leafy spurge densities, resulting in a pasture that can once again be utilized for cattle grazing.

densities by 80-90% after three to five years of grazing.

- **Sustainability:** Multi-species grazing can be used year after year, and can be used in inaccessible or environmentally sensitive areas where other control tools won't work or can't be used. Riparian areas provide a good example. Herbicide use in such areas is often restricted by environmental regulation, and biological control can be hampered by high water tables and sandy soils. In these situations, grazing provides a viable alternative.

- **Range utilization:** Multi-species grazing improves range efficiency by using different species to graze different parts of the range – i.e., it uses sheep to utilize forage that cattle will not use. With proper management and monitoring, this improvement in range efficiency can contribute to a healthier, more productive range. Well-managed multi-species grazing programs often result in the ability to increase cattle numbers, as shown by studies at the NDSU-

Hettinger Research Extension Center and other research facilities.

- **Livestock performance:** Combining cattle with sheep or goats generally results in increased performance for one or both species. In widely dispersed and replicated studies in the U.S. and Canada, cattle grazed with sheep had weight gains as much as 21 percent more than cattle grazed alone. The same studies show that sheep grazed with cattle had gains of 12-36 percent more than sheep grazed alone.

Flexibility: Multi-species grazing systems offer flexibility by allowing range managers to adjust cattle and sheep numbers depending on the desired

outcome. If spurge control is the primary objective, for example, ranchers can "turn up the heat" by increasing sheep numbers for a certain period of time.

- **Integration:** Multi-species grazing is an excellent tool to combine with other management tools, such as biological control or herbicides. TEAM Leafy Spurge demonstration sites using combinations of multi-

Potential Benefits

- Improved range health
 - Increased forage production
 - Improved forage utilization
 - Enhanced livestock performance
 - Sustainability
 - Leafy spurge control
 - Control of other noxious weeds
 - Works well with other tools
-

**Sentinel Butte, N.D.
1998**



Grazing + Biological Control

This fence line contrast provides examples of several important leafy spurge management concepts.

An aggressive, long-term herbicide-based approach prevented spurge from becoming a problem on the right side of the fence. This approach provided good leafy spurge control, but was relatively expensive and reduced ecological diversity.

The lack of persistent management efforts on the left side of the fence result-

ed in dense, widespread leafy spurge infestations that ultimately reduced the production of desirable grasses. Flea beetles were released in the mid-1990s, but significant control was not achieved until a multi-species grazing program was implemented in 1998. The results since integrating grazing and biological control have been quite impressive.

The lesson is simple: The sooner you start an aggressive, integrated leafy spurge management program, the sooner you'll benefit.



species grazing with biological control and herbicides have produced promising results.

- *Other weeds:* Leafy spurge is not the only weed sheep and goats will consume. Other weeds include spotted knapweed, ragwort, larkspur, fringed sage, wormwood, and some thistles and mustards.

What Should I Expect?

First off, there are no management tools that will completely eradicate leafy spurge – it's just not that easy or simple. Different tools offer different types of benefits, but there are no "silver bullets" that will work every time in every situation.

Multi-species grazing, however, can be an effective part of the solution. A properly managed multi-species grazing program

that is in harmony with the environment will slow and eventually prevent the weed's spread, enabling native grasses to reestablish, proliferate and ultimately contribute to increased carrying capacity.

And, much the same as other management tools, multi-species grazing is not an overnight solution. It takes a commitment and time.

Here's a brief chronology of what can be expected after implementing a multi-species grazing program:

- **Year One** – Sheep will typically not be aggressive grazers of leafy spurge, especially early in the grazing season. At some point, sheep will overcome their initial aversion to leafy spurge and begin consuming larger quantities of the plant. Defoliation should be evident late in the

season.

- Year Two – Sheep will be more aggressive, and grazing of leaves, shoots and whole stems should be evident by season's end. This will stimulate increased leafy spurge growth, and the emergence of new plants early in the season. However, this new growth will likely be removed by grazing sheep as the season progresses.

- Year Three – Leafy spurge densities should be noticeably reduced from original pre-sheep levels. Cattle will begin grazing in areas previously dominated by dense

spurge infestations.

- Year Four – The plant and its root system has now been stressed to the point of extensive reductions. Leafy spurge densities should be much lower, and native grasses will begin re-establishing in areas once dominated by leafy spurge.

- Year Five and Beyond – Multi-species grazing programs need to be monitored and maintained to prevent leafy spurge from re-establishing. At this point, multi-species grazing can be considered a maintenance program.

Economic Considerations

There are many economic considerations to keep in mind when evaluating leafy spurge and how it affects your operation.

The impact on individual operations varies depending on a number of factors, but one thing is certain: If you've got leafy spurge, you're either losing money or aren't making as much as you could, and ignoring the problem will only make matters worse. In addition to reducing productivity, infestations will ultimately, and perhaps drastically, reduce the value of your land.

In regard to the bigger picture, leafy spurge has a significant economic impact on cattle producers throughout the northern Great Plains, and on the economy in general. Infestations in just four states, for example – the Dakotas, Montana and Wyoming – are estimated to cost agricultural producers and taxpayers more than \$144 million a year in production losses,

control expenses and other impacts to the economy.

Obviously, there should be plenty of economic incentive for managing leafy spurge.

Estimating Potential Losses

As an example of the losses that can result from leafy spurge infestations, let's take a look at the following figures.

AUM Loss from a 100-acre leafy spurge infestation with 25% canopy cover over 10 years

<u>Carrying Capacity</u>	<u>Lost AUMs</u>
0.2 AUMs/ac	192
0.4 AUMs/ac	384
0.6 AUMs/ac	576

Most rangeland in the western U.S. falls somewhere in this range (granted, some will be more or less productive). Let's assume your rangeland has a sustainable carrying capacity (i.e., properly stocked

and not over-grazed) of 0.3 AUMs/acre. If you have 100 acres of leafy spurge, you can expect to lose about 300 AUMs over a 10-year period. If an AUM is worth \$15, you lose \$4,500 (.3 AUM/acre x 100 acres x 10 years x \$15 loss/acre = \$4,500).

Note that this is a minimal estimate which does not include any losses associated with expansion of the spurge infestation, expenses for control efforts or potential benefits generated from recovered AUMs.

Let's now consider the issue of what is "economically feasible." There are two criteria to determine if leafy spurge control is economical.

The first criteria – **benefit-cost** – requires you to add the benefits from control (in this case, AUMs recovered and retained from treatment) and the costs of control. If benefits exceed costs, the control is considered economical.

The second – **least-loss** – determines if you'd lose less money treating leafy spurge than by doing nothing at all.

Let's use our earlier example of a 100-acre infestation on rangeland with a carrying capacity of 0.3 AUMs per acre and AUMs valued at \$15. You already know you'll lose about \$45 per acre of leafy

spurge over a 10-year period (\$45 x 10 years = \$4,500). If you implement a multi-species grazing program, you'll want to spend less than \$4,500 to treat the infestation over a 10-year period. If you do, the treatment costs less than the loss, and can thus be considered economical.

Using the same example, if you spend \$5,000 on a multi-species grazing program to treat the 100-acre infestation but only recover 50% of the lost grazing output, losses will total \$2,500 (\$5,000 treatment costs less \$2,500 in benefits). In this case, benefits do not exceed treatment costs, BUT... you're still better off – doing nothing will cost you at least \$4,500, whereas treatments using the least-loss scenario cuts that loss to about \$2,500.

Hopefully, these examples have helped illustrate how to determine if treatment can be "economically feasible."

Dollars and Sense

This manual spends a significant amount of time covering economics, and with good reason: Economics is a primary consideration when evaluating leafy spurge and long-term management strategies. For more information, see the following reports by the North Dakota State University Department of Agricultural Economics:

- **"Impediments to Controlling Leafy Spurge in the Northern Great Plains,"** Miscellaneous Report 185.
- **"Feasibility of a Sheep Cooperative for Grazing Leafy Spurge,"** Report 435 (summarized in 435-S).
- **"Economic Analysis of Controlling Leafy Spurge,"** Report 432 (summarized in 432-S).
- **"Perceptions of Leafy Spurge by Ranch Operators and Local Decision Makers,"** Report 406 (summarized in 406-S; updated in Statistical Series Report 56).
- **"Ranch Operators' Perceptions of Leafy Spurge,"** Report 400.

These and other reports are available on the WorldWideWeb at agecon.lib.umn.edu/cgi-bin/view.pl and www.team.ars.usda.gov and may also be obtained by calling, e-mailing or writing to NDSU/Department of Agricultural Economics, Fargo, ND 58105-5636 (701/231-7441; cjensen@ndsuxt.nodak.edu).

Is It Right for Me?

Now we need to go through some questions to help determine if multi-species grazing is the right tool for you.

- **1.** Do you really want to control leafy spurge? Are you willing to make the long-term commitment required to reduce existing infestations, stop the spread and start

reclaiming lost grazing land? Remember, in cases involving marginal land, the cost of some management tools may exceed the potential return.

• **2.** If you're committed to doing something, how much spurge do you have? Where are your infestations located? Are they contained to a few small patches, or do you have entire pastures infested? Knowing the level of infestation will help determine which tools or combination of tools are most likely to work in your situation.

• **2a.** Do you have minimal infestations, such as small 1-2 acre patches scattered here and there? If so, depending upon other environmental factors (e.g., water, trees), herbicides will likely be the best, most effective, affordable and quickest tool for containing and controlling infestations.

• **2b.** Do you have a lot of spurge – i.e., numerous large patches and/or widespread infestations? If so, herbicides will likely cost more than the benefits returned, and other management tools will need to be considered as the cornerstone of your management program. If the scale of infestations rules out herbicides, it's time to consider the next most logical management options, biological control and multi-species grazing.

• **3.** Leafy spurge flea beetles can usually be obtained for free, and do not require large investments of time or money. Simply put, there is no valid economic reason for not trying biological control. Flea beetles won't work every time in every situation, but should ALWAYS be considered as part of your management plan. If flea beetles do not solve the problem, or are not solving the problem as quickly as you'd like, other options should

be considered. Before abandoning flea beetles, however, make sure you're picking good release sites, releasing at the right time of year, etc. Also, keep in mind that flea beetles can often be used in combination with other tools to enhance control.

• **4.** The next option is to evaluate whether multi-species grazing can or will be economical for your operation. There are three likely ways to incorporate multi-species grazing on your rangeland; all three have advantages and disadvantages, and different economic ramifications.

There's one common denominator – existing cattle fences will need to be modified to hold sheep.

The first two options are the best from the standpoint of labor needed and the potential for economical control.

– Find a sheep producer who will provide free sheep for summer grazing. Remember, he's getting free forage for his sheep, so this is a win-win situation for both parties.

– If you can't find "free" sheep, consider renting or leasing sheep.

– Finally, if you're interested in more than the first two options can provide and are willing to make a serious, long-term commitment, it's time to consider sheep as a permanent addition to your operation.

Let's take a closer look at these options.

"Free" Sheep

This one doesn't take a lot of thought – if you can find a source of sheep or goats to graze your leafy spurge for free, you'll benefit, even after modifying existing fences.

Advantages: You don't have to manage a sheep enterprise; you get the benefits of control at minimal expense (i.e., what you

Options

If you're interested in multi-species grazing, you'll have to determine which option provides the best fit for your operation:

- **Free sheep**
 - **Fee sheep (renting or leasing)**
 - **Sheep as a permanent addition to your existing operation**
-

spend on fencing); it's economically advantageous to both you and the sheep producer; there are low labor and capital requirements.

Disadvantages: You'll need a formal agreement with a sheep producer to guarantee access to sheep for several years. This helps ensure that you'll have long-term access to sheep after investing in fence modifications. Things to consider in such an agreement include, but are not limited to, timing and length of seasonal grazing, number of sheep needed, and the number of years involved. Responsibilities – i.e., water access, predator control, transportation to/from range, etc. – should be spelled out.

“Fee” Sheep

Can you lease sheep or goats to graze your leafy spurge?

This one requires more thought since you're paying for the use of sheep or goats. A good number to start with is the break-even rental rate for sheep, which on rangeland with carrying capacities of less than 0.4 AUMs per acre is about \$4/head/year (based on the cost of modifying existing fences). The break-even rental rate goes up to about \$8/head/year for rangeland with carrying capacities of around 0.7 AUMs acre. Remember, fencing costs influence the break-even rental rate – the more you spend on fencing, the less you can afford to pay for sheep.

Averaged out over 10 years, it looks like this:

<u>Carrying Capacity</u> <u>AUMs/Acre</u>	<u>Break-Even Rental Rate</u> *	<u>Least-Loss Rental Rate</u> *
0.2	\$2/hd/year	\$4/hd/year
0.4	\$4/hd/year	\$6/hd/year
0.6	\$6/hd/year	\$8/hd/year

* **Break-even** rental rate means that control costs equal treatment benefits; if you spend more, costs will likely exceed benefits. If your rate is less than the rate listed, benefits are likely to exceed costs.

* **Least-loss** rate means the most you could pay and still lose less than you would by doing nothing.

Advantages: You don't have to manage a sheep enterprise; it's economically advantageous to both you and the sheep producer; there are low labor and capital requirements.

Disadvantages: Some of the economic benefits of control are now being paid to the sheep producer. This option can still produce control benefits that will exceed treatment costs, but you need to know what you can afford to pay per animal when negotiating a rental rate. And again, some form of

formal agreement will be needed to guarantee long-term access to sheep.

Permanent Sheep

If you're interested in multi-species grazing but want more than the free sheep or leased sheep scenarios can provide, **AND if you are willing to make a long-term commitment**, you're now to the point of considering sheep as a permanent addition to your operation. This is obviously the most complicated of the three scenarios, and as such, requires careful consideration and planning.

First off, let's consider some of the advantages and disadvantages of adding sheep as a permanent component of your grazing operation.

Advantages: You control all aspects of sheep grazing and flock management; the sheep enterprise itself can return positive net returns, thereby enhancing your

“Free” vs. Fee

Although “free” sheep always pencil out better than fee sheep, leasing can still be economically attractive. Remember, you can break even or lose money on sheep and still come out ahead if the benefits from leafy spurge control are significant.

returns from leafy spurge control and/or adding to the profitability of your ranching operation.

Disadvantages: Requires careful planning and organization; requires substantial time commitment; requires up-front investment in breeding stock, facilities and equipment.

It's important to get advice from professionals when considering this option (see the list of contacts on the back page of this manual). Sheep/livestock production specialists and other experts can help you develop a management plan that works for your specific situation. Much of this preliminary work will focus on estimating the financial performance of your operation by evaluating your existing resources, management plan, flock proficiency (lambing rate, death loss, etc.), livestock prices and anticipated production costs.

The following discussion will help you start thinking about the kinds of things you need to consider.

One last note: Before we start gathering information and wrestling with all the things to consider, it is important to realize the bottom line or net result of adding a sheep enterprise will be different for each operator. That's why it's difficult to predict results or provide precise economic figures for your operation. And remember, your sheep enterprise doesn't have to turn a profit or have positive net revenues for you to get economical leafy spurge control.

Before you consult with a sheep production specialist, let's try to gather some of the information that will be needed to help develop a strategy for adding a sheep

component to your operation.

First, three major questions need to be addressed: Labor, facilities and feed supply.

- *Labor* – The bottom line is that adding another component to your operation will increase labor needs. However, with a relatively small sheep component – like what is needed for leafy spurge control – scheduling is as important as hours required. Lambing is the most labor-inten-

sive aspect of sheep production, and you'll need to decide when and how much time you can invest. Scheduling labor needs is a balancing act: You might, for example, decide to lamb ewes before calving and spring planting, or when they're on pasture after calving and spring planting but before the first cutting of hay. The

amount of time needed for different aspects of the new component varies based on the specific operation; general figures, however, suggest labor requirements of 3-5 hours/ewe/year, with about 40-60 percent of that time occurring during lambing.

- *Facilities* – Determine what facilities you already have and additional facilities that may be needed. Some of these requirements will, of course, depend on when you decide to lamb. If you opt for lambing in late January or February to avoid labor scheduling conflicts, you'll need lambing shelter; if ewes lamb on pasture, these requirements are greatly reduced. Requirements for a lambing shelter are roughly 15-20 square feet per lambing ewe, with 30-50 square feet per ewe of attached outdoor lot. Equipment is another issue. Most ranchers already have much of the equipment needed to care for

Research Required

Sheep as a permanent addition to your operation is the most complicated multi-species grazing option, and as such, requires careful consideration before making a long-term commitment. You'll probably want to consult with local experts.

sheep (i.e., livestock trailer, bailer, tractor and loader, corrals, gates, etc.). Specific needs may include a waterer and feed bunks.

- *Feed* – Adding sheep means additional feed requirements to consider. In general, 160-175 pounds of forage (silage, grass hay, alfalfa) is required per ewe per month when sheep are not on pasture. Exact feed requirements will vary depending upon feed quality, ewe size, etc.

After assessing labor, facility and feed requirements, you're ready to consider specific management and strategic issues. And, as always, solutions to these issues will vary depending on the operation.

- *Management Plan* – There are as many different management plans as there are sheep producers. Some examples of the most common strategies are late winter or summer lambing, with each having different labor and facility requirements. Another consideration is figuring out how to handle your lambs. The two best options are selling them as feeders or retaining them to sell as slaughter lambs. Again, both options have different facility and labor requirements. Your best option will depend largely on the facilities you have and how much labor you can devote to the flock.

- *Breed Selection* – The four most common breeds in the western U.S. include the Columbia, Rambouillet, Suffolk and Hampshire.

Suffolk and Hampshire are black-faced and are primarily raised for meat production. The white-faced Columbia and Rambouillet are generally smaller than black-faced sheep, and are better wool producers. Many operations now cross-

breed white-faced ewes with black-faced rams to get the benefits of both types.

- *Scale of Operation* – Hopefully, economies of scale (i.e., what size is best for your operation from an economic standpoint) will not be an issue, as the size of the sheep enterprise should closely match the grazing needs for leafy spurge control.

- *Financial Considerations* – Spend some time evaluating cash flow and capital requirements. A sheep enterprise may

help with cash flow if lambs can be sold when other income is limited; conversely, adding a sheep component can complicate cash flow problems. The best scenario is to purchase breeding stock and equipment without incurring any debt, but that may not be realistic. Most sheep enterprises, especially

those added to a cattle operation primarily for leafy spurge control, can handle some debt because there is no charge for existing equipment or summer grazing. Also, keep in mind that you can break even or even lose a little on the sheep and still come out ahead financially because of the benefits associated with leafy spurge control.

- *Predation* – Predation should ALWAYS be considered when evaluating the addition of a sheep grazing component to your operation. For an in-depth discussion, see pages 19-20.

- *Animal Husbandry* – Cattle and sheep are obviously different critters, and there are some differences in handling and care. If you're new to sheep, you'll learn with time and experience, and several options exist for obtaining additional information.

The North Dakota State University-

Economics

This manual spends a considerable amount of time on economics. That's because economics is the most important aspect of evaluating multi-species grazing as an addition to your operation. Make sure it works on paper before you make any decisions.

Hettinger Research Extension Center, for example, offers a 2-day workshop for beginning sheep producers that covers many of the issues involved with day-to-day sheep management issues; other states offer similar programs.

See the list of contacts on page 27 for sources of additional information and educational opportunities.

Economic Barriers

Despite obvious benefits, some cattle producers say they just aren't interested in adding sheep or goats to their operations. The three most common barriers, according to surveys conducted by the North Dakota State University Department of Agricultural Economics, include (listed in order given):

- Lack of proper equipment and/or facilities:

Most cattle ranchers feel they do not have the proper equipment – fences, shelter, water sources, etc. – to get started in sheep or goat production.

- Competition: Many ranchers feel sheep and goats compete with cattle for available forage.

- Lack of expertise: Many cattle ranchers feel they simply do not have enough knowledge about sheep/goat production to make it a viable addition to their existing cattle operations.

All are legitimate concerns, but none impose insurmountable problems, and valid counterpoints should be considered.

The expense of proper equipment, for example, becomes more economically attractive when viewed as a long-term investment and cost-averaged over a number of years. The investment should also be measured against potential long-term benefits.

Competition for forage can be minimized with proper stocking rates and range monitoring. In addition, long-term benefits generally outweigh concerns over competition: Improved range efficiency will contribute to improved range health, which leads to increased grass production, which ultimately leads to increased numbers of cattle. It is important to note that the goal, at least for many cattle producers, is using multi-species grazing to achieve an acceptable level of leafy spurge control;

once achieved, sheep numbers can be reduced to maintain control while cattle numbers can be increased as range conditions improve.

The point is simple: Don't let preconceived ideas stop you from considering multi-species grazing as a component of your leafy spurge management plan.

Be Objective!

Some cattle producers have preconceived ideas that preclude them from seriously considering multi-species grazing. But if you've got leafy spurge, you've got a problem, and all potential solutions should be examined objectively.

Summary

Economic considerations will obviously be a significant factor when deciding if multi-species grazing can play a productive role in your operation. Multi-species grazing requires a long-term commitment, and will require more "hands on" management than other forms of control. If you're not prepared to battle leafy spurge for the next five to 10 years, then implementing a multi-species grazing system may not be for you.

And keep in mind that sheep, regardless of the scenario used, do not necessarily have to be profitable to produce an economic benefit. In other words, you can lose money or break even on sheep and still come out ahead when improved range conditions, forage production and forage utilization are factored into the long-term equation.

Diet Selection

The Objective

The primary objective of multi-species grazing is to improve grazing efficiency, or the utilization of available range resources, while maintaining or improving animal production.

As stated earlier, multi-species grazing can provide economic and ecological advantages over single-species grazing due to differences in dietary preferences and foraging behavior of cattle, sheep and goats. In general, cattle prefer grasses, sheep prefer forbs and goats favor shrubs. Since most typical rangeland includes two, and often all three, classes of vegetation, multi-species grazing may be more productive than single-species grazing – forage avoided by one species, for example, can be converted into profit by adding a class of livestock that will utilize it.

This scenario is especially true when leafy spurge is part of the plant community. Sheep and goats graze leafy spurge, consuming 50-95 percent of the weed's above-ground growth, allowing desirable grasses to re-establish and be productive for cattle grazing. Other potential benefits include reduced leafy spurge control costs, potential profits from sheep or goat grazing, etc.

In General

Numerous studies show that grazing cattle and sheep are complementary in intensive, rotational grazing of mixed-grass prairie. Most studies show that, when properly managed and monitored, multi-species grazing can result in stocking rate increases of 10-15 percent (either cattle, sheep or a combination of both). If

leafy spurge is present, the increase is even more prominent – if spurge comprises 30 percent or more of the land resource, increased stocking rates (AUMs) of 30-40 percent for sheep may be achieved.

The key to effectively using multi-species grazing is understanding the dietary and behavioral differences between cattle and sheep, recognizing seasonal variations, and properly monitoring and managing the range to balance grazing pressure and prevent potential problems like carrying capacity deficiencies and inefficient stocking rates.

Following are brief descriptions of dietary preferences for cattle and sheep:

- Cattle prefer grasses in all seasons regardless of availability. Based on research conducted on a variety of range types by researchers at North Dakota State University, season-long cattle diets average about 75 percent grass, 15 percent forbs and 10 percent shrubs or browse. Cattle will consume some forbs early in the season, but generally avoid most shrubs regardless of the season.
- Sheep are more opportunistic, and will graze a greater variety of plants in all seasons. Most studies show a preference for forbs early in the season and shrubs late in the season, while grass consumption can vary significantly depending on the availability of other preferred species.

Dietary Overlap

A key concern expressed by cattle producers when discussing multi-species grazing centers on dietary overlap. While this is a legitimate concern, especially for

ranchers who want to “save” grasses for cattle, research shows that dietary overlap can be managed and minimized.

Most studies show that, when properly monitored and managed, dietary overlap between cattle and sheep averages about 10-12 percent. This number, however, can be much higher depending on forage species availability and numerous environmental factors, again stressing the need for proper monitoring and management.

The degree of dietary overlap between cattle and sheep varies by season – it’s generally lower in the spring and early summer when more browse is available, and higher in the late summer and fall when considerable amounts of grass have been consumed.

In studies relevant to the northern Great Plains, most dietary overlap between cattle and sheep generally occurs in the fall or late fall for blue gramma, a common

grass that is quite resistant to grazing. Cattle tend to prefer western wheatgrass and Junegrass early in the season, and western wheatgrass, blue gramma and Junegrass later in the season. The overlap generally occurs late in the season as sheep begin reducing their intake of forbs and increasing their intake of grasses. A common strategy to minimize this overlap, or competition, is to remove sheep from the grazing allotment before they begin increasing their intake of grasses.

In General...

Keep in mind that these are only general guidelines and that forage selection and grazing pressure can vary significantly depending on species availability, environmental conditions and other factors. Also, there are exceptions to every rule. Again, vigilant monitoring and proper management will help prevent potential problems.

What Others Say...

TEAM Leafy Spurge believes sheep and multi-species grazing can be an effective component of integrated leafy spurge management programs. Here’s another view, from the American Sheep Industry Association.

“**S**heep are a natural, low-cost means of managing America’s federal, state and private lands, even as they produce other resources, such as wool, meat and lanolin. Proper grazing can benefit the environment, wildlife, the tax-paying public, and consumers.

Noxious weeds are a major threat to both public and agricultural lands, killing surrounding vegetation and triggering soil erosion. The weeds not only make the land unfit for agriculture and cattle, they threaten to drive out native plant species and destroy wildlife habitat. Sheep are unique in that they readily consume plants other animals avoid or find toxic. As a result, sheep are used extensively to control noxious plants.

Leafy spurge is an invasive, indestructible weed that infests an estimated 3 million acres of farm and public lands in 26 northern states. The problem is particularly severe in Montana, Wyoming, and the Dakotas. While leafy spurge is toxic to most animals, sheep thrive on the weed. In Montana, the Bureau of Land Management (BLM) found that proper sheep grazing resulted in up to 90% control of leafy spurge, greatly reducing the need for costly herbicides.

Montana State University researchers report that sheep will also graze a variety of other noxious weeds. In the West, sheep can provide 85% control of spotted knapweed, another invasive and poisonous plant species.”

Printed with permission of the American Sheep Industry Association, Inc. (6911 S. Yosemite St., Suite 200 Englewood, CO 80112-1414; 303/771-3500).

The ASI web site can be found at
www.sheepusa.org/

To see this excerpt, go to the home page, click on “Fast Facts,” then click on “Facts About Sheep Ecology.”

stocking rates

Proper stocking rates are important for any grazing operation, and are particularly important when multi-species grazing is used. Over-stocking can result in over-grazing and deterioration of range health, while under-stocking can result in less efficient utilization of available forage resources. Proper stocking rates and vigilant monitoring of range conditions will help ensure that long-term goals are being fulfilled.

Stocking rates for operations grazing a combination of species, such as cattle and sheep, include some varying calculations. An average stocking rate of 1 to 2 sheep per acre of leafy spurge over a four-month grazing season is generally recommended for acceptable control, with lighter stocking rates west of the Missouri River and heavier east of the Missouri River. Sheep stocking rates for one month would be 6 to

8 sheep per acre. Keep in mind that stocking rates vary widely based on geography, environmental factors and long-term management goals.

To determine the stocking rate for a specific time, adjust animal numbers per acre by dividing the one-month stocking rate by the number of months intended to graze.

Stocking rates should be based on actual infested acreage rather than on total pasture size! This will minimize grass consumption by sheep, thus allowing maximum grass production for cattle. A four-month grazing season is recommended because it corresponds with the growing season and is the most effective and efficient system for leafy spurge control with a multi-species grazing situation.

The chart on page 17 can be used to estimate the most appropriate stocking rates for your operation and goals.

Fences are an important part of multi-species grazing, as planning and controlling livestock movement is essential for proper grazing and pasture rotation. Select a type of fence that will meet your needs and help you more effectively manage your operation.

There are many types of fences, varying from permanent to temporary, at a wide

range of costs. Fencing requires an investment of time and money, and as such, should be thoroughly researched before any decisions are made. Some key points to consider include:

- Topography
- Livestock
- Breeds of sheep used
- Cost

fencing

Recommended Sheep & Goat Stocking Rates for Leafy Spurge Control

West of Missouri River

Animals Per Acre	
Sheep	Goats
4	12
2	6
1.5	4.5
1	3
.875	2.625
.75	2.25

Months Grazed

1
2
3
4
5
6

East of Missouri River

Animals Per Acre	
Sheep	Goats
8	16
4	8
3	6
2	4
1.75	3.5
1.5	3

The Formula

This simple formula can be used to estimate the proper sheep and goat stocking rates for leafy spurge control. **Keep in mind that these estimates can vary** depending on your location (geography), range conditions, environmental factors and long-term management goals.

$$\text{_____ acres of leafy spurge} \times \text{_____ sheep/acre} \\ \text{for \# of months to be grazed} = \text{_____ sheep}$$

- **Example 1:** A 600-acre cow/calf pasture with 200 acres of leafy spurge near Lemmon, S.D. (west of the Missouri River). Producer plans to graze sheep from May 15 to August 15 (three months). Here's the formula: 200 acres of leafy spurge X 1.5 sheep/acre for planned months grazed = 300 sheep.
- **Example 2:** A 200-acre cow/calf pasture with 65 acres of leafy spurge near Valley City, N.D. (east of the Missouri River). Producer plans to graze sheep from May 15 to September 15 (four months). Here's the formula: 65 acres of leafy spurge X 2 sheep/acre for planned months grazed = 130 sheep.

- Availability of power
- Maintenance
- Flexibility
- Watering facilities

Types of Fences

Following are brief descriptions of the most popular types of fences.

• **Portable electric** – Portable electric fencing is lightweight, portable and easy to arrange. It is reasonably priced, although the cost of electric or solar power must be considered. Temporary electric fence may

require more upkeep and maintenance due to a more rigorous use of material. Typical material costs are 16-18¢/foot for a 3-strand portable electric fence with T-posts and insulators every 30 feet. Example: One mile of 3-strand portable electric wire fence at 18¢/foot is \$950 (not including H-braces and corner posts).

• **High-tensile wire** – Electrified high-tensile wire fencing is often used for interior boundaries. Multi-strand high-tensile wire (4-5 wires) is used for boundaries. High-tensile wire fences are easy to install

but require regular maintenance. Interior fences should consist of two to three wires for sheep or goats, one to two for cattle. Border fences should be three to four for sheep, four to five for goats, and three for cattle. Typical material costs are 13-15¢/foot for a 5-strand high-tensile fence with T-posts and insulators every 30 feet.

Example: One mile of 5-strand high-tensile fence at 15¢/foot is \$792 (not including H-braces and corner posts).

• **Barbed wire** –

Barbed wire fencing works well for controlling cattle, sheep and goats. Labor and material costs are high, and periodic maintenance is required. Border fences should be 4-strand wire for cattle, 5- to 6-strand wire for sheep, and 6-strand wire for goats. Interior fencing should be 3-strand for cattle, 3- to 4-strand for sheep, and 4- to 5-strand for goats. Typical material costs are 27-30¢/foot for a 6-strand fence with T-posts every 15 feet. Example: One mile of 6-strand barbed wire fence at 30¢/foot is \$1,584 (not including H-braces and corner posts).

• **Updated Barbed wire** – Many pastures already have a 3- or 4-strand barbed wire fence and may only require an additional 2-3 strands to secure the pasture for sheep or goats. When updating such fences, wires are typically added to the lower two feet. It is recommended that the bottom be six inches from the ground, the second wire 13 inches, third wire 21 inches,

and fourth wire 30 inches from ground surface. The fifth and sixth wires should be 42 inches and 54 inches from the ground surface, respectively. This design will provide a secure border fence for a combination of sheep, cattle, or goats. Typical material costs for adding three strands of

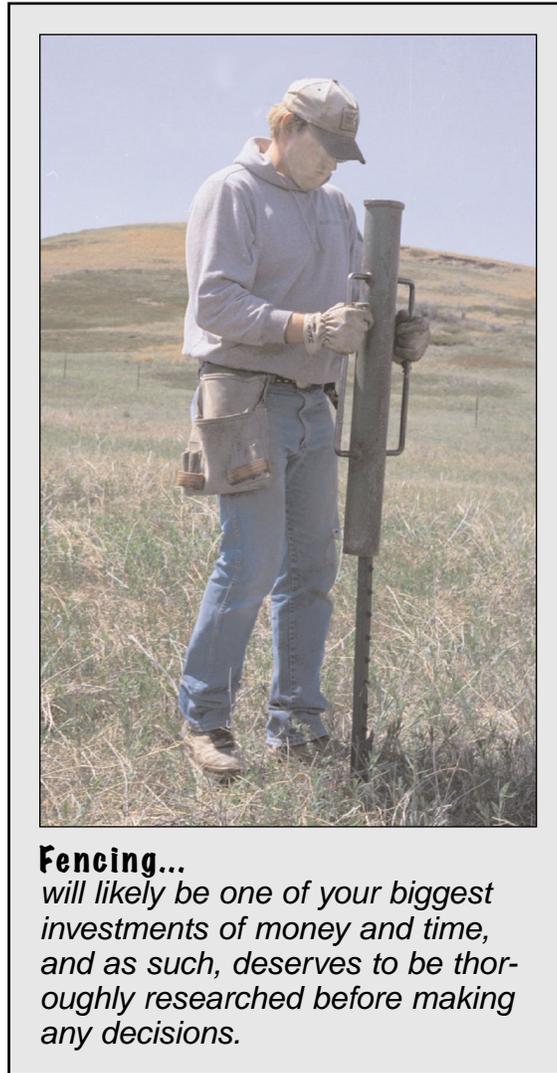
barbed wire to an existing 3-strand barbed wire fence are about 7¢/foot for the wire. Example: 1 mile of an added 3-strand barbed wire fence at 7¢/foot is \$370.

• **Woven wire** – Woven wire provides excellent fencing for sheep and goats; however, a top electric or barbed wire is needed with cattle.

Woven wire is considered the most expensive of the fencing options, but maintenance is low. Sheep and goats can get their head or legs tangled in the netting, causing injury and even death. Typical material costs for woven wire with the addition of 1-strand of barbed-wire placed 6-12 inches above woven wire is estimated at 43¢/foot (39 inches, 12.5 gauge wire) and 48¢/foot

(47 inches, 12.5 gauge wire), including T-posts spaced 15 feet apart). Example: One mile of 47-inch woven wire fence plus one strand of barbed wire at 48¢/foot is \$2,534 (not including H-braces or corner posts).

NOTE: None of the above estimates include labor. In addition, prices for materials may vary according to location and season. Shopping around to get the best buy can result in substantial savings!



Fencing...
will likely be one of your biggest investments of money and time, and as such, deserves to be thoroughly researched before making any decisions.

predation

Homework Required!

Predation of sheep and goats can cause significant economic losses, and research is required before investing in multi-species grazing. Talk with local wildlife and livestock experts, assess potential problems and discuss possible solutions. Can an effective predator control program be developed for your operation? If the risks are too great, multi-species grazing may not be an economically feasible addition to your operation.

Solutions to predator problems do exist, and can generally reduce or eliminate livestock losses. Common strategies include guard animals, eradication, modification of operational approaches and herders.

A Simple Solution?

Some producers believe running sheep and cattle together reduces predation losses, and recent studies support this theory. This strategy works well in smaller-scale operations; it's less effective if the scale is too large, as cattle and sheep are more likely to disperse and separate. Some producers are now making efforts to "bond"

cattle and sheep so that they are more likely to stay close together.

Guard Animals

The use of guard animals, like dogs or donkeys, is one of the most commonly used forms of predator control, and can be extremely effective.

Dogs – Dogs have been used to protect livestock for thousands of years.

A guard dog generally stays with sheep and aggressively repels predators.

The dog stays with its flock because it's been reared and trained to do so. Its protective behaviors are largely instinctive, with little formal training needed other than the correction of undesirable behaviors. A guard dog is not a herding dog, but rather a full-time member of the flock with little, if any, herding skills.

The characteristics of each operation will dictate

the number of dogs required for effective protection. If predators are scarce, one dog is generally sufficient for most fenced-pasture operations. Range operations often use two dogs per band of sheep.



Guard animals... like llamas and dog, are commonly used for protection from predators. Other options include fall lambing, the use of herders, and trapping or shooting.

Size, topography and habitat of the pasture or range must also be considered. Relatively flat, open areas can generally be covered by one dog. If hiding cover is present, several dogs may be required, particularly if sheep are scattered. Sheep that flock and form a cohesive unit, especially at night, are much easier to protect than scattered sheep that bed in a number of locations.

Advantages: Reduced predation; reduced labor costs; increased utilization of areas where predators have made grazing prohibitive; reduced fencing costs; increased potential for alerting owners to predators or other flock disturbances.

Disadvantages: Good guard dogs are relatively expensive, and do require an investment of time to rear, train, supervise and maintain.

Donkeys – Donkeys and burros have not been researched as extensively as dogs, but are gaining popularity as guard animals.

Donkeys are generally friendly to people, but seem to have an inherent dislike for dogs and other canines, including coyotes and foxes. Donkeys are likely not acting so much to protect the sheep as acting out their aggression to the intruder. Donkeys are cheaper to obtain and care for than guard dogs, don't require training and are less prone to accidental or premature death.

The following guidelines are recommended for the use of guard donkeys:

- Use only a jenny or gelded jack;
- Select a donkey of medium-sized stock (i.e., no miniatures);
- Use one donkey per band of sheep;
- Allow 4-6 weeks for a naïve donkey to bond with sheep. Stronger bonding generally occurs when a donkey is raised from birth with sheep;
- Test a new donkey's instincts by challenging it with a dog in a pen or small pasture. Consider only donkeys that show

aggression during this test;

- Use donkeys in smaller (less than 600 acres), relatively open pastures with no more than 200-300 head of livestock.

Llamas – Llamas have been used successfully as guard animals, but little information about their use exists. In general, guidelines for donkeys can be applied to llamas.

Eradication

Direct control of predators by shooting and trapping can be an effective technique for reducing predation losses. When considering this option, consultation with local APHIS-Wildlife Services (formerly Animal Damage Control) personnel is recommended.

Operational Approaches

If predators are common, altering the approach of your operation may reduce losses. Obviously, young stock are more vulnerable to predators, and utilizing a program with dry females or wethers can reduce losses. If the enterprise includes breeding females, utilize fall or winter lambing so that lambs are older and bigger when turned out to pasture. Another option is simply not turning lambs out to pasture – they're far less susceptible to predators when contained in a feedlot.

Herders

Herders can provide excellent predator control, but may not be practical for smaller, fenced-pasture operations.

And Finally...

As you can see, there are many tools to help minimize predation losses.

It is extremely important, however, to evaluate the potential impact of predators BEFORE making a large investment of time and money into a multi-species grazing program. Homework up front will definitely pay off in the long run.

IPM, IPM and more IPM

As mentioned earlier, there are no "silver bullets" or cure-alls for managing and controlling leafy spurge – simply put, there just isn't any single tool that will work every time in every situation.

TEAM Leafy Spurge believes biologically based **Integrated Pest Management** provides the most effective, affordable and flexible approach for controlling leafy spurge. IPM works because it combines the best elements of different tools, and because it enables ranchers and land managers to tailor management programs to fit their specific needs and goals.

In most IPM scenarios, a tool like grazing, herbicides or mowing is used to reduce spurge densities and open up the canopy, giving more desirable plants a chance to re-establish. The stress and damage that occurs during this process weakens leafy

spurge, thus making it more susceptible to damage by other tools.

In many cases, multi-species grazing can provide a solid foundation for other tools to build on. There's nothing new or revolutionary about the concept – sheep and goats eat leafy spurge, and when properly managed and monitored, can provide an excellent complement to cattle grazing operations. Improved range health, increased forage production and

enhanced profit potential are all realistic and achievable goals.

Following are brief summaries on combining multi-species grazing with other leafy spurge management tools.



IPM

Multi-species grazing is easy to incorporate with other management tools, particularly biological control and herbicides.

Studies at TEAM Leafy Spurge demonstration sites have shown that combinations of grazing+herbicides and grazing+biological control can provide economically significant control much quicker than any of the three tools used alone.



Biological Control

In ideal situations, biological control can maintain leafy spurge densities below economically significant levels.

But flea beetles aren't going to work every time at every site, and integra-

tion with other management tools, or simply using other tools, may be required.

TEAM Leafy Spurge demonstrations and other research has shown that multi-species grazing and biological control can be an extremely effective combination. Sheep grazing reduces spurge densities, giving flea beetles improved chances of establishing large populations capable of providing significant control.

Herbicides

Herbicides are the most commonly used leafy spurge management tool, and are the preferred tool for containing/preventing the spread of infestations and for eradicating new invasive weeds.

Unfortunately, herbicides are generally expensive, and use on large infestations may not be economically feasible. In addition, herbicides are non-selective and may adversely impact non-target species, and use in some areas may be restricted by environmental regulations or inaccessibility to infestations.

Studies have shown that herbicides and multi-species grazing can be combined to provide excellent leafy spurge control. Timing is the most important factor. General recommendations call for grazing spurge infestations as normal (mid-May through mid-August, for example), then applying herbicides in the fall after some regrowth of the spurge has occurred.

It is important to note that grazing may be restricted following the application of certain herbicides; as always, read the herbicide label and follow recommended guidelines.

It should be stressed that herbicide use **SHOULD NOT BE ABANDONED** simply because other tools are being used. Herbicides should **ALWAYS** be considered as the first line of defense when small, scattered patches are found, and when attempting to contain the spread of larger infestations.

Burning

Prescribed burns can be used to reduce spurge densities and remove ground litter that can inhibit the establishment of desirable plants.

If sheep production is a primary goal, timing of burns needs to be considered – burns should generally be performed in the fall or early spring so that leafy spurge top growth is available for sheep or goats.

Similarly, if multi-species grazing is being used in combination with biological control, burns should not be conducted from mid-May through mid-August to avoid interference with the adult phase of the flea beetle life cycle.

Reseeding

Regardless of the tool or tools being used to reduce leafy spurge infestations, reseeding can be used to speed range recovery. Desirable grasses can re-establish more quickly after reseeding, thus providing competition for less desirable species that may emerge as reductions in leafy spurge infestations occur.

Some homework is recommended when considering reseeding as a leafy spurge or noxious weed management tool. Seed mixes for range recovery can be expensive and will vary depending on geography, climate, long-term management goals and other factors, so careful planning will pay off in the long run.

Consultation with local experts, such as Cooperative Extension Service range specialists, USDA-Natural Resource Conservation Service personnel and/or other range specialists is recommended to help select seed mixes and plan reseeding strategies.

In some cases, financial assistance for reseeding and range recovery may be available from various state and federal programs and agencies. Check with local sources to see if your weed management/range recovery program qualifies.

Summary

At this point, it should be obvious that TEAM Leafy Spurge believes multi-species grazing can be an important part of an **effective, affordable and sustainable** leafy spurge management program. It can be used as a stand-alone tool, or combined with other tools such as biological control or herbicides.

TEAM Leafy Spurge program participants have supplemented existing research with new data, then applied those findings to on-the-ground demonstrations that people can actually see. These demonstration sites clearly show that multi-species grazing and multi-species grazing + biological control works, and that both approaches can be used in an economically and ecologically beneficial manner.

Keep in mind that there are no easy

solutions or “silver bullets” to help solve the leafy spurge problem. Achieving significant control won’t be as easy as throwing a few sheep or flea beetles at the problem and expecting it to go away. Solving the problem will take time, work and a long-term commitment.

As always, prevention is the best solution for avoiding problems with leafy spurge and other invasive weeds. Prevention, combined with hard work and persistence, will help return your range lands to a more productive, natural state.

It is also important to recognize the benefits of **WORKING TOGETHER**. The war against leafy spurge and other noxious weeds will not be won individually – it will take a collaborative, integrated and area-wide approach to ultimately solve a costly problem that is shared by all.

Q – Where can I find good quality sheep to graze leafy spurge?

A. There are a number of breeders and livestock auctions in the northern Great Plains that handle high quality animals. Ranchers interested in grazing sheep as a leafy spurge management tool will need to do some planning. Those interested in raising and breeding will need to select good quality females and rams. When pur-

chasing sheep or goats, select the breed and/or sex that best fits your goals and objectives.

It’s also a good idea to contact your county Extension agent for recommendations and guidance when expanding into a new livestock enterprise. Local Extension agents can sometimes provide information on local sources of sheep, and may know of sheep that are already trained to graze

Rams

leafy spurge. In addition, each state in the northern Great Plains has an Extension sheep specialist who can provide advice and information.

Q – Can mature sheep intended for the kill market be used?

A. Absolutely. Studies show that sheep gain a lot of weight during a season of grazing leafy spurge. In fact, leafy spurge is high in crude protein and easily digested, and provides especially good forage for lactating ewes and lambs.

Q – Will grazing leafy spurge impact normal sheep functions such as growth, breeding, etc.?

A. No. In fact, sheep grazing leafy spurge will actually outperform sheep grazing native range. This is simply due to the high quality of forage that leafy spurge exhibits.

Q – Do I have to completely re-fence my operation, and do I have to use woven wire?

A. Woven wire is not required, but does prove excellent fencing for containing sheep or goats. Woven wire is generally the most expensive option, however, and other alternatives may provide adequate fencing at a more reasonable cost. These options include adding one or two wires to existing 3- and 4-strand barbed wire fences, and using a 4- to 5-strand electric fence. Keep in mind that five to six strands are generally recommended for keeping sheep enclosed. It's also recommended that perimeter fences be more substantial than interior fences. *See pages 16-18 for more details on fencing.*

Q – What stocking rate is recommended, and how much diet overlap between cattle and sheep can be expected?

A. An average of 1.5 to 2 sheep per acre of leafy spurge for a four-month grazing season is generally recommended for leafy spurge control. This number will vary depending on the situation; see the discussion on page 16 for more information.

Dietary overlap will also vary depending on a number of factors, including plant types and species, diversity, availability, environmental conditions and the management strategies being used. An overlap of 10-12 percent can be expected, and may range as high as 70 percent. It should be noted that overlap generally remains low until a significant reduction in leafy spurge occurs; once infestations have been reduced,

ranchers/land managers should consider reducing the number of sheep (or the amount of time sheep are grazed) to reduce overlap and competition for forage.

IT CANNOT BE OVER-EMPHASIZED that proper stocking rates, and subsequent range monitoring, are essential for leafy spurge management and long-term goals of range improvement. *More information on diet overlap and stocking rates can be found on pages 14-16.*

Q – Do sheep need to be trained to consume leafy spurge?

A. There is some debate on this subject, and no clear-cut right or wrong answer. Many people believe that sheep need to be trained to enhance grazing results during the first year. Research studies using

State Weed Web Sites

Try these web sites for additional information on leafy spurge and noxious weed control in your state:

[Montana Weed Control Association](http://www.mtweed.org)

www.mtweed.org

[North Dakota Weed Control Association](http://www.ndweeds.homestead.com/index.html)

www.ndweeds.homestead.com/index.html

[Wyoming Weed & Pest Council](http://www.wyoweed.org)

www.wyoweed.org

both "naive" and experienced sheep concluded that results largely depend on the diversity of the plant community (and sometimes the breed of sheep). Sheep are generally slower to accept leafy spurge when grazing in plant communities with a good diversity of broadleaf plants; in these situations, sheep eventually acquire a taste for the weed and will begin seeking it out.

Q – What can one expect to see in the control of leafy spurge using sheep?

A. Typically, and depending on the type of grazing treatment and stocking rate used, you may see an increase in leafy spurge densities after the first year of grazing. A reduction should be noticeable after the second or third year. Depending on the management and growing seasons, 75 to 90 percent reductions in stem densities and canopy cover can be expected by years five and six. *A year-by-year outline of what can be expected can be found on pages 6 & 7.*

Q – When should I begin grazing sheep on leafy spurge?

A. Sheep should begin grazing leafy spurge as soon as it reaches 3 to 4 inches in height, typically in mid-May. Turning sheep or goats out to pasture when the plant is 3 to 4 inches tall allows the grazers to prevent a majority of the plants from flowering and producing seed, and from developing dense canopy covers that inhibit the growth of desirable species.

Q – What do you use for predator control?

A. Many techniques are used to reduce predation. Most common is the use of guard animals like dogs, donkeys or llamas. Using mature animals can also reduce predation losses – for example, grazing dry mature ewes with cow/calf pairs. Other options include the use of a

herder, and the use of trapping and/or utilization of local USDA-Animal Damage & Control personnel. *See pages 19-20 for more details on predator control.*

Q – When using a rotational grazing system, should sheep be run before cattle or with cattle?

A. Sheep can graze with cattle, but some precautions are necessary. Producers that offer supplemental feed to calves may want to run sheep ahead or behind cattle in the rotation to prevent the sheep from consuming the supplement. Also, sheep are sensitive to copper. This may cause a problem in areas where copper is deficient and producers are using a high copper mineral program for their cattle; in this case, running the cattle and sheep separately is recommended.

Q – Will leafy spurge come back if sheep/goat grazing is stopped after three or four years?

A. Yes. Unless additional control measures are taken to replace the grazing, leafy spurge will return to its original densities. The use of sheep as a long-term management tool is essential. Although you might not see any leafy spurge after 10 years, you still have a viable seed bank and viable adventitious roots.

Q – If I implement multi-species grazing on my leafy spurge infested rangeland, do I need to do any spraying?

A – Absolutely. In fact, research shows that combinations of grazing and herbicides provide excellent results. In one study, angora goats were grazed from mid-May to mid-August, then removed to allow some re-growth. A mixture of 2,4-D and Picloram at a rate of 1qt + 1pt rate was applied in mid-September. This treatment worked extremely well, and has since been replicated with both sheep and goats.

The “TEAM”

TEAM Leafy Spurge is a USDA-Agricultural Research Service research and demonstration program focused on the Little Missouri River drainage in Wyoming, Montana and the Dakotas, and other spurge-infested drainages in the region. Its goal is to research, develop and demonstrate ecologically based Integrated Pest Management strategies that can be used to achieve effective, affordable and sustainable leafy spurge control.

TEAM Leafy Spurge is built on three important concepts:

- ***Integrated Pest Management (IPM)*** - IPM combines management tools to provide more effective control than any single tool could produce. Biological control provides the foundation: Biocontrol agents like the flea beetle are used with other tools – multi-species grazing, herbicides, etc. – for effective, affordable and ecologically sustainable control. IPM offers the flexibility landowners need to devise different strategies for different situations.

- ***Teamwork*** - TEAM Leafy Spurge has assembled some of the nation’s most experienced leafy spurge researchers into a focused, goal-oriented team. This collaboration allows participants to share expertise, data and resources to more effectively work toward a common goal. TEAM Leafy Spurge stresses that EVERYONE, from private ranchers and landowners to local, state and federal agencies, must work together to solve the problem.

- ***Regional Approach*** - TEAM Leafy Spurge is an area-wide program, and as such, is evaluating the leafy spurge problem on a regional rather than a local, or place-by-place, basis.

Partnerships!!!

TEAM Leafy Spurge is funded by USDA-ARS and managed in conjunction with USDA-APHIS. Other TEAM members include the U.S. Forest Service, National Park Service, Bureaus of Land Management and Reclamation, U.S. Geological Service, state departments of agriculture and other state agencies, Cooperative Extension Services, land grant universities, county weed managers, ranchers and landowners.

The Approach

TEAM Leafy Spurge research and demonstration projects are designed to build on existing data and explore promising new areas of leafy spurge research. These projects cover a range of topics, including biological control, multi-species grazing, herbicides, range management, and the integration of various control tools.

TEAM Leafy Spurge demonstration sites (Sentinel Butte, N.D.; Ekalaka, Mt.; Buffalo, S.D. and Devil’s Tower, Wyo.) give ranchers, landowners and land managers a first-hand look at results produced by various IPM strategies. Tours of the sites are periodically held to provide updates about new and improved management strategies.

The Bottom Line

Leafy Spurge is a formidable opponent that cannot be controlled or eliminated by any single entity or management practice – a collaborative, integrated and area-wide approach is essential to solving this costly problem. TEAM Leafy Spurge exists to promote these concepts, and to serve as a clearing house for proven management strategies.

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Biological Control

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- See the *TEAM Leafy Spurge website* at www.team.ars.usda.gov for information about local contacts for obtaining leafy spurge flea beetles.

Herbicides

- **Rod Lym**, North Dakota State University/ Dept. of Plant Science, Loftgard Hall, Fargo N.D. 58105 (701/231-8996; lym@plains.nodak.edu).
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Web Sites

The following web sites provide good information and links to other informational sites.

- **TEAM Leafy Spurge** (<http://www.team.ars.usda.gov/>) for information on Integrated Pest Management of leafy spurge, related topics and an extensive listing of other informational sources and web sites.
- **USDA-APHIS Noxious Weeds Home Page** (<http://www.aphis.usda.gov/ppq/weeds/facts.html>) for general information about noxious weeds and APHIS management programs.
- **NDSU-Hettinger Research Extension Center** (<http://www.ag.ndsu.nodak.edu/hettinger/>) for information on multi-species grazing, sheep and range health.
- **NDSU-Dept. of Agricultural Economics** (<http://agecon.lib.umn.edu/index/html>) for information on the economic impacts of leafy spurge and various management tools.

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For information on obtaining additional copies of this manual, call 406/433-2020, e-mail teams@sidney.ars.usda.gov or visit the TEAM Leafy Spurge web site at

<http://www.team.ars.usda.gov/>

The manual can be viewed, printed and downloaded as a PDF (Adobe Acrobat reader required) from the TEAM Leafy Spurge web site at

<http://www.team.ars.usda.gov/grazingmanual.html>

