

Anne Marie Emery  
Conservation Biology 306  
Dr. Eric Yensen  
February 13, 2003

## **Ecological Implications of and Control Methods for *Euphorbia esula* L. in Idaho**

### **Abstract**

Noxious weeds have become an increasing problem in Southern Idaho. With quick adaptation rates, physical advantages, few predators and non-selective habitat requirements, exotic species have become the new epidemic of the west. One species in particular, Leafy Spurge (*Euphorbia esula* L.) has entered into Idaho from the east and is spreading at an alarming rate, reducing the biodiversity and viability of our lands. With an extended root system, no native predators, and a prolific seeder, Leafy Spurge is becoming a threat to Idaho's native plant species, wildlife and grazing industry in the habitats it becomes established in. In attempt to reduce the negative impacts of Leafy Spurge, researchers have exercised many control methods such as applying herbicides, burning controlled lots, sheep/goat grazing and introducing exotic insects in attempts to halt its spread and reproduction. Yet all efforts of eradicating Leafy Spurge have failed as the physical nature and aggressiveness of the plant make it difficult to exonerate without causing major disruptions to Idaho's native ecosystems. It is important to understand the nature of Leafy Spurge and what is being done to control it to help develop more efficient ways of controlling it while conserving the many native plants and wildlife from further disruption.

### **Introduction**

A member of the spurge family Euphorbiaceae, Leafy Spurge (*Euphorbia esula* L.) is a hostile perennial that contains a highly unique morphology allowing it to exist in varying environmental conditions (Colorado Weed Management Association 1999) (See Figure 1). An erect, perennial herb, standing 1-3 feet tall, spurge contains a re-sprout able shoot system that produces new shoots when under direct pressures. Adapted to benefit from disturbances caused by grazing and mowing, this herbaceous weed inhibits shoot growth when threatened, increasing overall plant density and surface area. This response often causes monocultures of leafy spurge to form that lower native plant diversity

(Biesboer 1996). Leafy spurge also contains an “extensive sprouting root system” that consists of networks of horizontal and vertical roots that can exceed depths of twenty feet (Colorado Weed Management Association 1999) (See Fig. 2). At these depths, the roots reap shorter rooted plants such as perennial grasses, of essential nutrients and water (Colorado Weed Management Association 1999). Also advantageous to spurges’ success is the toxic sap it produces throughout its root and shoot system. This sap discourages the presence of most animals as it causes blindness, dermatitis and even death when consumed or grazed upon. Recent studies have also concluded that leafy spurge inhibits a purgatory response in humans and if handled excessively, may act as a carcinogenic. ([www.wildflowersandweeds.com](http://www.wildflowersandweeds.com)). Able to reproduce via vegetative and sexual reproduction, spurge has a high success rate in spreading its dangers. In vegetative reproduction, crown buds and roots buds regenerate new growth when needed, while sexual reproduction allows spurge to re-locate to new areas and increase genetic diversity. Pollinated by eight orders, thirty-nine families and sixty species of insects, spurge has many means of cross-pollinating. (Biesboer 1996). When mature, each plant of leafy spurge can dispense up to 250 sticky seeds in an explosive display that result from the seed capsule disintegrating. Seeds are dispersed up to 4.6 meters from the parent plant in this process and can remain viable for up to seven years in the ground although “99 percent of germination occurs within the first two years” of dispersal (Biesboer 1996). Easily spread, seeds are palpable to birds, and are sticky and floatable thus capable of various means of dispersal via wildlife, humans and water (Biesboer 1996).

## **History and Consequences of Invasions**

Introduced to the United States from Eurasia in the mid 1800's as a possible seed contamination in imported oats, leafy spurge was first established in Massachusetts where it has since devastated over 2.5 million acres of American soil ([www.wildflowers-and-weeds.com](http://www.wildflowers-and-weeds.com)). Able to adapt to various soil and climate types, leafy spurge prefers "very dry situations where competition from native species is less intense" (Vegetative Management Guide 1996). Thus leafy spurge has profound effects on the Great Plain States of Montana, South Dakota, North Dakota, Wyoming and recently Idaho, where it is dry and heavily grazed (Bangsund 1999). Able to "spread rapidly, displace native vegetation and sustain itself despite repeated chemical treatments," leafy spurge is a huge economic and ecological burden in these regions as it has taken over approximately 1.6 million acres of useable land and transformed it into non-profitable wastelands (Bangsund 1999). Reducing land values, decreasing cattle production and replacing native species, leafy spurge is a major expense to manage, causing conservationists, ranchers, landowners and the government up to 130 million dollars annually to control ([www.colorado.edu](http://www.colorado.edu) and Bangsund 1999).

Locally, leafy spurge is threatening to devastate Idaho in the same manner, already invading nearly every county within the state (See Fig 3). First introduced as an ornamental decoration in Butte and Custer counties in the 1950's, leafy spurge has since "spread rapidly across public and private lands" already costing Idaho residents up to 100,000 dollars annually in management techniques (University of Idaho 2003). With few documented records of the direct biological and economical damage leafy spurge has

inflicted on Idaho's native lands, and little known on how to control it, Idaho is at risk of becoming severely infested and overrun by leafy spurge.

## **Implications of Leafy Spurge**

### **Effects on Native Plant Species**

Once Leafy Spurge establishes itself in an area, it quickly becomes the dominant plant species, as “the single greatest impact of leafy spurge is the reduction and populations of leafy plants.”([www.colorado.edu](http://www.colorado.edu) ). Most prominent in eradicating grass species found in graze lands, leafy spurge also infests vegetation in Idaho's delicate riparian zones and woodlands. With a fast and early growth rate, numerous seedlings, no natural enemies and impervious to cattle grazing, spurge replaces many native grasses and forbs such as blue bunch wheat grass, Idaho Fescue and bunchgrass within a few years of establishment. (Sheley and Petroff 14). With an elongated root system unlike those of native plants, spurge can access nutrients and water inaccessible to surrounding plants while also secreting toxins into the soil to prevent native-plant reestablishment. With this advantage over native plants, leafy spurge grows tall and dense, forming monocultures that shade out smaller plants, reducing the vegetative biodiversity (See figure 4). In Montana and some parts of Idaho leafy spurge has already yielded the production of desired forage species 10-100% and has reduced native grass production by up to 75% leading to a severe decline of native plants. These effects would not be so drastic if leafy spurge affected only one member of the plant community, but Leafy Spurge is competitively non-selective and affects most vegetation that surrounds it (Sheley and Petroff 9).

## Effects on Wildlife

Proliferation of this weed has direct implications on wildlife diversity and their habitat quality as well. As essential forage is lost to leafy spurge, wildlife domiciles become degraded and unsustainable, effecting those populations dependent on native perennial grasses. “Many animal species that co-evolved with a particular native plant community for forage, cover and shelter cannot shift their requirements rapidly enough to adapt to rapid changes in the plant community” (Sheley and Petroff 6). Therefore many wildlife species cannot maintain survival in their native communities due to spurge outbreaks ([www.fs.fed.us](http://www.fs.fed.us))(Table 1). In Theodore Roosevelt National Park in North Dakota bison, deer and elk were shown to avoid areas heavily infested with leafy spurge as “desired forage species were less productive” in those areas. (Sheley and Petroff 6) (See table 2). Leafy spurge poses health hazards to grazing wildlife as the “milky latex contains substances that act as irritants, emetics, and purgatives for many animals when eaten” and causes many species to become displaced from their native habitats ([www.colorsta.edu](http://www.colorsta.edu)) (See Table 1).

### Provided Cover Value by *Euphorbia esula L.*

	MT	ND	UT	WY
Pronghorn	-----	good	poor	-----
Elk	-----	-----	poor	-----
Mule deer	-----	good	poor	-----
White-tailed deer	-----	good	-----	-----
Small mammals	-----	-----	fair	poor
Small nongame birds	poor	-----	poor	-----
Upland game birds	-----	-----	poor	-----

Table 1 – Observed from above we see how much adequate plant cover *Euphorbia esula L.* provides for livestock and wildlife. ([www.fs.fed.us](http://www.fs.fed.us)).

## Effects on Cattle Grazing

Possibly the biggest problem concerning Idaho's economy is the effects leafy spurge has on the states cattle industry. By crowding out native grasses that ranchers depend on to feed their livestock, leafy spurge is reducing the carrying capacity of rangelands across the U.S. from 35-90 percent, "causing an estimated \$35 to 45 million loss per year in beef productions" (Asher 1998 and [www.wa.gov](http://www.wa.gov) ). Ranchers from Wyoming and Montana, who suffer from severe infestations of leafy spurge, stated that *Euphorbia esula* was "the most important weed problem" on their ranches as cattle avoid infested areas (Bangsund 1999). Spurge's "milky latex contains substances that act as irritants, emetics, and purgatives" ([www.colorado.edu](http://www.colorado.edu) ) that irritate cattle, sometimes causing death ([www.wildflowersandweeds.com](http://www.wildflowersandweeds.com)) (See table 2). This leads to "serious economic losses for land owners and ranchers" as a "range with 80 percent leafy spurge cover reduces the carrying capacity of the land to zero."(Bangsund 1999 and [www.wa.gov](http://www.wa.gov) ) In North Dakota, this drop in land value has already occurred as "almost 6 percent of the untilled land is infested with leafy spurge." ([www.wa.gov](http://www.wa.gov) ) Such infestations have affected the Great Northern Plain states as seen in 1994, when the grazing capacity lost to leafy spurge "would have supported a head of 90,000 cows" ([www.wa.gov](http://www.wa.gov) ). Therefore enhanced by cattle grazing, leafy spurge can easily consume large areas when not recognized and suppressed and results in increased costs in land management. (Sheley and Petroff 92).

### The degree of use among cattle and wildlife species

	MT	ND	UT	WY
Cattle	poor	poor	poor	poor
Domestic sheep	fair	fair	poor	poor
Horses	poor	poor	poor	poor
Pronghorn	----	poor	poor	----
Elk	poor	----	poor	----
Mule deer	poor	poor	poor	----
White-tailed deer	poor	fair	----	----

Table 2 – above we can determine that cattle, horses, mule deer, and Pronghorn sheep avoid feeding on or grazing upon areas infested with *Euphorbia esula L.* ([www.fs.fed.us](http://www.fs.fed.us)).

### Control Methods

Many biological and economical control methods have been exercised to help suppress the spread and infestations of leafy spurge. By using methods such as sheep grazing, herbicides, controlled burning and exotic natural predators of leafy spurge, landowners and conservationists are working to find the most efficient, long term suppressor of spurge.

Sheep grazing has shown to be an effective and efficient means of decreasing the density of leafy spurge, yet proves ineffective in destroying the entire plant (See figure 5). Beneficially, sheep are naturally unaffected by leafy spurge's toxic sap and can satisfy up to    of their diet from consuming leafy spurge alone while supplying ranchers with an alternative profit to grazing. (Olson and Wallander 1998). Although cost effective and practical, sheep are not 100% effective in eradicating the plant or preventive of its reoccurrence without continual grazing efforts that require long adjustment times (8). Sheep also exhibit selective feeding patterns, usually eating native grasses such as blue bunch wheatgrass, before eating spurge and show to spread viable spurge seed in

their manure. (Olson and Wallander 1998). Sheep grazing can have positive results when combined with other methods such as insect introduction as when combined, “sheep break up the canopy, allowing the beetles to work faster” (Hopkins Interview 2003).

Controlled burning alone on Leafy Spurge infested areas has shown to have little effect on leafy spurge infestations. Although burning proves successful in reducing the number of seedlings and seed viability by ten percent, it fails to damage the re-sproatable root system of the plant and may promote an increase in weed growth as the surface area becomes exposed while also increasing fire temperatures (Biesboer 1996). Also, seeds left undamaged by the fire would re-establish themselves in the same area and quickly re-sprout. (Biesboer 1996).

Chemical control through the use of Picloram and Dicamba herbicides prove effective in killing leafy spurge in applied frequently to spurge established areas, yet are also environmentally and physically threatening sensitive riparian areas and human health (Olson and Wallander 1998) Herbicides are also costly to land-owners and dangerous to native vegetation, making it hard to apply without negative effects. (USGS 2000). Yet recent management techniques have shown that when combining certain herbicides such as Dicamba (which is used widely in Idaho) with other less-toxic herbicides such as 2, 4D, you have significant results with less environmental impact.

The most popular method explored today is the introduction of some of leafy spurge’s natural predators such as *A. nigriscutis*, an exotic flea beetle from Europe and Asia (See figure 6). Highly responsive to leafy spurge, the flea beetle is successful in reducing the weeds progress down to levels that can be controlled by little herbicide use and does not affect much native vegetation (Programs and People 2001). “Extensive and



expensive species specificity testing has been done the continent where this agent originated and has proved in isolation labs to be very effective in protecting native and commercial species” (Cheney Interview 2003). Sustainable and inexpensive, adult beetles feed off of spurge’s leaves and shoots while beetles in their larval stage consume its root (Programs and People 2001). Establishing themselves quickly after introduction, researchers are considering “bug-bombing” hard to access infestations by dropping the insects from a helicopter (University of Idaho 2003).

### **Conclusion**

Having taken over most the Great Plains States, it is fair to conclude that leafy spurge has become a permanent part of Idaho’s ecosystem (See figure 5). With no natural predators and no species to compete with for resources, spurge is successfully adapting to the west at the expense of our economical and ecological resources. It is essential that we develop effective control and prevention methods to slow spurses progress. In response to leafy spurge and other exotic species, Idaho has recently created the Idaho Invasive Species Council that is “a joint effort between local, tribal, state and federal governments as well as the profit and not-for-profit private sectors” organized to minimize the effects of harmful exotic species while considering ways to halt their spread (Kempthorne 2002). It is through conservative methods such as these in which people become aware of the direct danger exotic species pose to our state and lands. Although leafy spurge shows little chance of ever becoming completely eradicated, we can develop ways to lessen its negative impacts on our environment through the practice of control methods and education.

**Acknowledgements**

Chad Cheney

Dr. Eric Yensen

Nancy Emery-Neu

Alfred Charles Emery

Mark Davidson

Jerry Hopkins

Idaho Department of Agriculture

Idaho Fish and Game

The Nature Conservancy





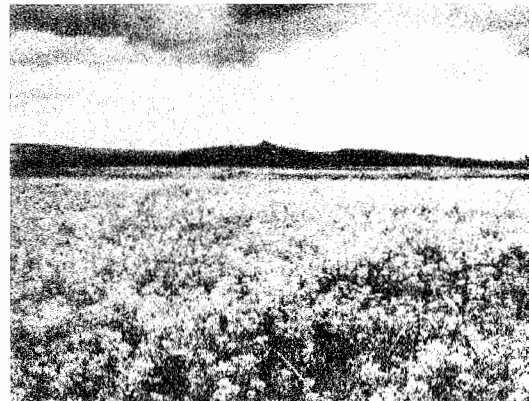
**Figure 1** – An adult *Euphorbia esula* plant ([www.cwma.org](http://www.cwma.org)).



**Figure 2** – Root system of leafy spurge ([www.wildflowers-and-weeds.com](http://www.wildflowers-and-weeds.com))



**Figure 3** – Distribution of leafy spurge in Idaho (<http://info.ag.uidaho.edu>).



**Figure 4** – field infested with leafy spurge monocultures ([www.wildflowers-and-weeds.com](http://www.wildflowers-and-weeds.com))



Figure 5 – Sheep grazing on Spurge infest ([www.wildflowers-and-weeds.com](http://www.wildflowers-and-weeds.com)).



Figure 6 – *A. nigriscutis* ([www.wildflower-and-weeds.com](http://www.wildflower-and-weeds.com))