FHP TECHNOLOGY DEVELOPMENT PROJECT PROPOSAL

PROJECT STATUS: New, not previously funded.

PROJECT NUMBER: R4-1999-01

PROJECT TITLE: Integrating Aggressive Biological Control Efforts into a Leafy Spurge Management Program, Fairfield Ranger District, Sawtooth National Forest.

SUBJECT: Biological Controls, Noxious Weeds

PROJECT OBJECTIVE(S): Overall Objective -To demonstrate the feasibility and effectiveness of integrating aggressive biological control efforts into an existing spurge management program. Specific Objectives - 1) to continue to determine the site characteristics which best describe areas where *Aphthona* spp. flea beetles will be most effective, 2) to evaluate helicopter releases of *Aphthona* spp. flea beetles as an effective method to distribute these agents to inaccessible areas, 3) to evaluate the feasibility of using digital imagery to monitor the impacts *Aphthona* spp. beetles have upon the density of spurge in inaccessible areas, and 4) to assess the effectiveness of *Oberea erythrocephala* releases in or near riparian areas.

BRIEF DESCRIPTION OF PROJECT: Leafy Spurge was first detected in the South Fork of the Boise River Drainage on private land in the 1950's. From this epicenter it began spreading to adjacent public lands. The current infestation is scattered in approximately 200 sites ranging in size from less than 1 acre to more than 50 acres. These pockets of spurge are located within an 23,000-acre area on a variety of sites including riparian areas, valley benches and steep hillsides. The District's spurge management program which began in 1968 has not kept up with the expanding spurge infestation. We are proposing to integrate aggressive and innovative biological control efforts into the existing spurge management program to improve the effectiveness of the management program and to demonstrate that biological control can be an important tool to be included in integrated management programs.

FHP PERSON WHO WILL LEAD THE PROJECT: Julie Weatherby, R4, Boise

JUSTIFICATION: Designing and implementing an effective spurge management program is extremely challenging. Until recently the Fairfield Ranger District has relied heavily on herbicides to control the spurge infestation in the South Fork of the Boise River drainage. Over 1 million dollars have been spent trying to reduce the density and prevent the expansion of the infestation, and yet the infestation continues to expand. Many of the newer infestations are scattered across steep hillsides which practically eliminates the possibility of ground-based applications of herbicides. Also leafy spurge frequently occurs in environmentally sensitive areas, such as near water, where the use of highly toxic, persistent, herbicides necessary to control it may be restricted. Therefore it is imperative that we investigate integrating other available management tools into management programs. One of these tools is of biological control. However there does appear to be a lack of confidence in many land managers concerning the effectiveness of biological control agents. A recent survey of ranchers, landowners and land managers found that two-thirds of the respondents felt biocontrol is economical but less than 20 percent rated biocontrol as very effective. The reasons given for not using biological control included 1) "it takes too long", 2) limited access to agents, 3) not knowing where to collect agents, and 4) not knowing how to use agents (Wendell & Anderson 1998). If we are going to advocate the use of these biological control agents, we need to develop guidelines for the operational use of these agents and where ever possible demonstrate that these agents can be an effective component in an integrated management program.

URGENCY: The Upper Columbia River Basin Assessment has found that the invasion of exotic, non-native, species is the number one resource problem in the basin. Leafy spurge is one of these exotic invaders which has a tremendous competitive ability to displace native vegetation thus reducing the productivity of the range and the amount of suitable habitat for wildlife and livestock. In the last 30 years the leafy spurge infestation in the South Fork of the Boise River drainage has spread from an area of 1,200 acres to an area in excess of 23,000 acres. We have a far better chance of successfully controlling this infestation and others like it, if we can implement an effective integrated management strategy when the infestation is small.

LINK TO NATIONAL FHP TECHNOLOGY DEVELOPMENT PRIORITIES: This project addresses the following STDP priorities: 1) Develop or refine biocontrol methods for established species (native and non-native) and established pest populations and 4) Proposals that deal with detection, analysis, and management of exotic weeds that result in technologies or methods that contribute to our ability to prevent introductions or to detect and eradicate new introductions.

SCOPE OF APPLICATION: "Infestations of leafy spurge extend from southern Canada through the northern United States, and is approaching areas as far south as Texas" (Rees et al. 1995). The guidelines and techniques which we develop would be applicable throughout much of this area, especially in forest to range transition zones.

RESEARCH BASIS: Once leafy spurge becomes established it dominates the site reducing herbage production by as much as 75% (Lym and Kirby 1987). Additionally the productivity of the range is further reduced because cattle refuse to graze where spurge makes up 10 - 20 % of the vegetative cover (Lym 1998). Efforts to eradicate or suppress leafy spurge have relied heavily on herbicides, but experience has shown that most successful control programs have used several control methods over several years (Lym 1998). A major program to develop biological controls for leafy spurge was initiated across the United States in the 1980's. In North Dakota *Aphthona nigriscutis* has been the most successful flea beetle for leafy spurge control (Lym and Zollinger 1995). Several species of biological control agents have been released within the South Fork of the Boise River drainage. Only the *Aphthona* spp. flea beetles have established and begun to suppress spurge densities in localized areas near some of the drier and exposed release points.

Because the literature suggests that *Oberea erythrocephala* prefers areas with trees and has established and increased best in riparian areas (Rees et al., eds. 1996), a few preliminary releases were made in 1998 in the South Fork drainage. These will require monitoring to determine establishment and effectiveness.

While research has evaluated and made available several biological control agents (Quimby 1997) and developed methods of sampling for purposes of monitoring these populations along with the affected vegetation (APHIS); the logistics of releasing and monitoring biological control agents in inaccessible areas as part of an operational program needs further refinement. Airdrops of biological control agents appears to be an efficient means of releasing and redistributing biological control agents. Likewise true color digital imagery may be an effective way to monitor affected vegetation (Wendell & Anderson 1998). This project proposes to utilize these techniques and to evaluate their usefulness.

METHODS: Forest Health Protection, the Fairfield Ranger District and Forest Service Research would like to demonstrate the feasibility and effectiveness of integrating biological control efforts into the District spurge management program. We propose to 1) continue to determine the site characteristics which best describe areas where *Aphthona* spp. flea beetles will be most effective, 2) evaluate helicopter release of *Aphthona* spp. flea beetles as an effective method to distribute these agents to inaccessible areas, 3) evaluate the feasibility of using digital imagery to monitor the impact *Aphthona* spp. flea beetles have upon the density of spurge in inaccessible areas, and 4) assess the effectiveness *Oberea erythrocephala* releases in and near riparian areas.

Phase 1. Determine site characteristics of successful *Aphthona* spp. releases. A Special Technology Development Project, R4-1997-02 (funded in 1997 and 1998), was designed to describe sites where flea beetles could be expected to successfully establish and suppress the density of spurge. Releases made in 1995 were monitored in 1998. We were able to monitor 25 of the 40 release sites and we did find that establishment had occurred on 10 of the sites but populations varied considerably. We would like to continue this investigation by visiting the remaining sites in 1999. The USDA-APHIS-PPQ 20 point sampling procedure will be followed. Five sampling points, along 4 lines in N, S, E, and W direction from the release point, will be sampled using 4 sweeps of a sweep net at each sampling point. The number of *Aphthona* spp. beetles collected in the net at each sampling point will be recorded. At the same sampling points the vegetation will be sampled within a 1/10 meter Daubinmire frame. The percent cover, the density and the average height of the leafy spurge plants will be recorded along with the percent cover of grasses, forbes, shrubs and bare ground. Site characteristics including slope, aspect and habitat type will be recorded for each release point. In addition, measurement of soil texture and composition along with feeder root development will be recorded. Soil samples will be evaluated for presence of soil-born pathogens. From this information we will attempt to describe the average site characteristics were the biocontrol agents have successfully established and shown some impact on the vegetation.

Phase 2. Evaluate the effectiveness of helicopter releases. In 1998, we released via helicopter 53,000 flea beetles over 53 sites in approximately 2 hours. The ease of this release method is very appealing and may be a very efficient means of establishing populations in inaccessible areas. Therefore we would like to evaluate the releases made in 1998 and to make new releases in 1999 and 2000 for further evaluation of this technique. We will visit a subsample of the 1998 release sites (~20 sites) and qualitatively determine, from direct observations and/or "sweep-netting", whether the flea beetles have successfully established. At these sites we will gather baseline vegetative and soil samples in a manner consistent with phase 1.

Phase 3. Feasibility of using true color digital imagery to monitor isolated leafy spurge infestations. In 1998, we took some digital imagery of infested areas to see if digital imagery might be an effective tool for monitoring spurge infestations. Flowering leafy spurge was easily detected using true color digital imagery. In inaccessible areas, we propose to evaluate the use of periodic true color digital imagery, taken from an aerial platform, to monitor the changes in infestations and to detect the "bomb blast" effect which typically occurs when *Aphthona* spp. flea beetles begin to reduce the spurge density around the release point. We are proposing to test digital imagery rather than conventional 35 mm photography because it is easily downloaded into the computer, it can be enhanced to increase the contrast between dense stands of flowering spurge and less dense stands where *Aphthona* spp. flea beetles may be having an effect, and the images can be geo-referenced. At 3 areas with heavy spurge cover, a visible object of known size will be placed on the ground to determine photoscale and 3 simulated release points will be visibly marked within each area. The spurge density at 1 release point will be undisturbed. At release point 2, the spurge density will be reduced by 50 percent within a 5 foot radius of the release point and at release point 3, the spurge density will be reduced by 70 percent within a 5 foot radius of the release point. A series of 3 images will be taken from different altitudes. Each image will be visually evaluated to determine whether density reduction can be detected.

Phase 4. Effectiveness of *Oberea* releases. Species of *Aphthona* flea beetles which have been released in the project area are more suited to drier habitat types. We would like to attempt to establish *Oberea erythrocephala* on these wetter or riparian sites. Three preliminary releases were made in 1998 and we would like to qualitatively monitor these sites for presence or absence of beetle lifestages. We will look for ovipositional holes in the stem and dig roots to determine if lifestages are present. Root sampling will be kept to a minimum because this technique is destructive, particularly to low population levels which are often found during the first 1-3 years after a release. The USDA-APHIS_PPQ 20 point sampling scheme will be used to monitor baseline vegetation characteristics as described in phase 1. If we are successful in establishing *O. erythrocephala* populations, we would hope to be able to assess the

effectiveness of these releases within 3 to 5 years by repeating the same vegetation sampling scheme. Additional releases will be made during FY99 and FY2000.

MEASURE OF SUCCESS: This project is designed to provide guidelines and to evaluate operational tools that could be useful in the biological control phases of an operational leafy spurge management program. If at the conclusion of this project certain tools and guidelines appear promising we will recommend these tools to other land managers as part of our technical assistance program.

COOPERATORS: Julie Weatherby, FHP Boise Field Office, Boise, ID
Tom Barbouletos, FHP Boise Field Office, Kalispell, MT
Gary Fullmer, District Ranger, Fairfield Ranger District, Sawtooth NF
John Shelly, Fairfield Ranger District, Sawtooth NF
George Markin, Intermountain Research Station, Bozeman, MT

PRODUCTS: The final report will be published as a Forest Health Protection Field Office Report. If the results merits inclusion in a refereed professional journal we will submit a report for publication. Oral presentations of the results will be made upon request. Hopefully the project area within the South Fork of the Boise River drainage will become a demonstration area where the successes of an integrated management program can be demonstrated to interested parties.

PUBLICATION: Refer to answer given for previous question about the products.

TECHNOLOGY TRANSFER: Products from this project will be distributed to land managers on Federal, State, and private lands. Products and methods will become support materials for our regular FHP technical assistance visits. Presentations and field trips to view the area and project results will be made available to interested parties.

PROJECT DURATION: Completion expected in fiscal year 2000. After year 2000 many of the aspects of this project may become operational aspects of the leafy spurge management program on the Fairfield Ranger District.

LONG TERM BUDGET: Estimated FHP funding needs for FY99 = $31,400.
Contributed funds for FY99 = $5,000.
Estimated FHP funding needs for FY2000 = $22,400.
Contributed funds for FY2000 = $5,000.

FY 1999 BUDGET REQUEST:

ITEMIZE as follows:

	Item	Requested FHP STDP Funding	Other Sources amount	Organization Name
Admin items:	Salary (2 GS5 Tech.)	$13,000		
	Salary (Researcher)		$2,000	Intermountain Research
	Overhead		$3,000	Sawtooth NF, FHP
	Travel	$1,400		
Procurements:	Contracting			
	Helicopter time	$2,000		
	Lab Analysis	$2.000		
	Equipment			
	Vehicle & Gas	$2,000		
	GPS & Software	$6,000		
	Laptop Computer	$3,000		
	Supplies	$2,000		
	Other			
TOTAL FY 1999 Budget		$31,400	$5,000	

FY 2000 BUDGET REQUEST:

ITEMIZE as follows:

	Item	Requested FHP STDP Funding	Other Sources amount	Organization Name
Admin items:	Salary (2 GS5 Tech.)	$13,000		
	Salary (Researcher)		$2,000	Intermountain Research
	Overhead		$3,000	Sawtooth NF, FHP
	Travel	$1,400		
Procurements:	Contracting			
	Helicopter time	$2,000		
	Lab Analysis	$2.000		
	Equipment			
	Vehicle & Gas	$2,000		
	Supplies	$2,000		
	Other			
TOTAL FY 2000 Budget		$22,400	$5,000	

BENEFIT AND COST: See STDP Production Function Enclosure.

LITERATURE, CITATIONS, ATTACHMENTS, etc:

Lym, R. G. 1998. Leafy spurge management options summary. TechLine.

Lym, R.G.; D.R. Kirby. 1987. Cattle foraging behavior in leafy spurge (*Euphorbia esula*)-infested rangeland. Weed Tech. 1:314-318.

Lym, R.G.; R.K. Zollinger. 1995. Integrated management of leafy spurge. North Dakota State University, Extension Service, Fargo, ND. Ext. Pub. W-866, 4pp.

Quimby, P.C. 1997. Project to target leafy spurge. C.H. Schmidt (ed.) Leafy Spurge News. North Dakota State University, Extension Service, Fargo, ND Vol. XIX, Issue 3, 8pp.

Rees, N.E.; P.C. Quimby, Jr.; G.L. Piper; E.M. Coombs; C.E. Turner; N.R. Spencer; L.V. Knutson (eds.). 1996. Biological Control of Weeds in the West. Western Soc. of Weed Sci. Bozeman, MT.

Wendell, L.; G. Anderson. 1998. Special TEAM leafy spurge edition. C.H. Schmidt (ed.) Leafy Spurge News. North Dakota State University, Extension Service, Fargo, ND. Vol XXI, Issue 3. 16pp.

STDP PRODUCTION FUNCTION

PROJECT NUMBER: R4-1999-01
PROJECT COST: $ 63,800 FY99 & FY2000 (STDP Funding + Contributed Funds)

PROJECT OBJECTIVE (BRIEF DESCRIPTION OF THE PROJECT AND EXPECTED OUTCOME):
Over-all Objective - To demonstrate the feasibility and effectiveness of integrating aggressive biological control efforts into an existing spurge management program. Specific Objectives - 1) to continue to determine the site characteristics which best describe areas where *Aphthona* spp. flea beetles will be most effective, 2) to evaluate helicopter releases of *Aphthona* spp. flea beetles as an effective method to distribute these agents to inaccessible areas, 3) to evaluate the feasibility of using digital imagery to monitor the impacts *Aphthona* spp. beetles have upon the density of spurge in inaccessible areas, and 4) to assess the effectiveness of *Oberea erythrocephala* releases in or near riparian areas. This project is designed to provide guidelines and to evaluate operational tools that could be useful in the biological control phases of an operational leafy spurge management program. If at the conclusion of this project certain tools and guidelines appear promising we will recommend these tools to other land managers as part of our technical assistance program.

ASSUMPTIONS:

- Assume 50% of the biological control releases established successfully.

- These 25 release sites are at least 50 acres in size and would have been treated with herbicides.

- The amount of time for released biological control agents to become established and effective on a site is generally considered to be 4 years.

- One release will expand to become effective over a 50-acre area.

- Without FHP involvement, 25 sites of 50 acres each will be treated annually with herbicides to control leafy spurge.

- With FHP involvement, 25 sites of 50 acres each will be treated once in 4 years with biological control agents to suppress leafy spurge.

BACKGROUND DATA:

- Average herbicide treatment cost = $100/acre.

- Average biological control agent release cost = $7.50 per acre.

CALCULATIONS

EXPENDITURE & OUTPUT VALUES (EOV) WITHOUT PROJECT:

[(number of treatment sites)(acres/site)(treatment cost/acre)] discounted 4% annually for 4 years =

[(25 sites)(50 acres/site)($100/acre)] discounted 4% annually for 4 years =

($125,000) + ($120,188) + ($115,575) + ($111,125) = $471,888

EXPENDITURE & OUTPUT VALUES (EOV) WITH PROJECT:

[(number of release sites)(acres/site)(release cost/acre)] discounted at 4% for 4 years =

[(50 sites)(50 acres/site)($7.50/acre)] discounted at 4% for 4 years = $16,028

BENEFIT (CHANGE IN EOV) ATTRIBUTABLE TO PROJECT:
B = $(without) - $(with)
Cost without program ($471,888) - cost with program ($16,028) = $455,860

BENEFIT/COST RATIO:
B/C = $(with) - $(w/o)
$(STDP cost) + $(treatment cost, where applicable)

($455,860) / ($63,800) = 7.14

BENEFIT ATTRIBUTABLE TO STDP:
Benefit attributable to STDP funds = $(STDP cost) x (B/C)

($63,800)(7.14) = $455,532

PNV OF PROJECT:
PNV of project = $(Benefit) - $(cost)

($455,860) - ($63,800) = $392,060

PNV OF STDP:
PNV of project = $(Benefit attributable to STDP) - $(STDP cost)

($455,860) - ($63,800) = $392,060