Enclosure 3

Special Technology Development Program
Progress Report

PROJECT NUMBER: R6-99-02

PROJECT TITLE:

Developing Technologies for Early Detection and Predicting Occurrence and Spread of Yellow Starthistle

PROJECT STATUS: Continuing (funds are being requested for the next fiscal year to continue the project)

EXPECTED PROJECT DURATION (total years for project)**:** 4

EXPECTED COMPLETION DATE OF THE PROJECT (fiscal year): 2002

SUBJECT:
Weed prevention (Yellow Starthistle), detection and management of exotic weeds.

STATUS OF SUBJECT SPECIES:

Yellow starthistle is a non-native noxious plant

PROJECT OBJECTIVES:

To evaluate several sampling strategies and technologies designed to locate yellow starthistle (YST). Methods will be evaluated for accuracy and cost effectiveness. The project is also developing a predictive model to aid in finding nascent infestations. A hazard/risk rating process will be imbedded into a final predictive model so that lands with high risk of YST invasion can be identified and closely monitored.

Specific Objectives:

1. Develop methodologies for identifying weed populations by using an integrated approach including ground surveys, remote sensing, GIS, and landscape modeling techniques.
2. Compare the methodologies tested by determining the strengths, weaknesses, and costs of each method.
3. Develop a model for predicting the occurrence and spread of YST.
4. Use the information collected to develop an integrated weed management strategy, and to create alliances with landowners.

BRIEF DESCRIPTION OF THE PROJECT:

Control of noxious weeds on forests and rangelands is simplified if "nascent infestations" or new populations are identified quickly, before native (or resident) vegetation is lost and weeds are able to build a reservoir of seed in the soil. Small isolated populations are often relatively easy to control with small inputs of time, resources, and money. Unfortunately, small, isolated populations are very difficult to find. Weed monitoring and surveys can be prohibitively expensive and survey techniques are not well established. This project will develop methodologies to identify weed populations using an integrated approach that includes ground survey, remote sensing, GIS, and landscape modeling techniques. We will also compare methods to determine the strengths, weaknesses, and costs of each. The information generated from this project will be used to create

alliances between landowners and prepare an integrated weed management strategy. The development of a model to predict the occurrence and spread of YST will also occur with this project.

100% Ground Survey

Detailed maps of YST distribution have been produced in cooperation with Ms. Barbara Mumblo (USFS) by 100% cruise of selected areas in the watershed. Observers have examined a variety of land types covering the full range available within the watershed. This information serves as part of our base map of YST distribution, which includes both areas of occurrence and areas that are known to be YST free. This is in contrast to typical weed distribution maps that show areas of occurrence, and areas that are presumed to be weed-free. Known infestations and areas known to be YST free serve as test locations for other sampling techniques to determine their effectiveness. The 100% cruise is technician intensive and therefore very costly. Because of the roughness of the terrain and limited distance that can be fully observed, an individual can survey only a small area each day. Our estimates are that 2 person days are required to survey 1km^2 in the Applegate region using this technique. Level, open ground would be surveyed more rapidly while rough terrain more slowly. Since so much of the Applegate is steep it is impossible to use the 100% cruise for more than limited areas. This sampling technique however, can be used effectively on sensitive or critical areas if volunteers are available.

Stratified Random Sampling by Observers on the Ground

We acquired GIS data themes for the Applegate watershed including: 1) elevation, 2) highways, 3) roads, 4) streams, 5) lakes, 6) land ownership, 7) vegetation cover type, 8) percent cover, 9) watershed boundary, 10) townships, and 11) quad sheets. From this data we are deriving land slope and aspect and distance from roads for all locations in the test area. In addition to this data we procured five Landsat 5 scenes and a Landsat 7 scene, which are being analyzed for spectral categories used in the risk assessment model.

GIS data layers were used to stratify the watershed into a series of nine classes which represented all combinations of three distances from roads classes (0-50m, 50-100m, and >100m) and three over-story cover classes (Dense Forest, Sparse Forest, and Open). Maps were created in ArcInfo and are compatible with existing USFS data. Developed map zones were used to identify 5 random locations in each zone for a total of 45 locations. At each location, we sampled ten 100 m^2 plots for YST placed along a transect line. YST was searched for and any occurrence was recorded as were site variables such as plant community, plant overstory, percent overstory cover, slope, aspect, etc. As field sampling progressed, we realized that the two forest cover classes had substantial overlap, i.e. overstory cover was higher in some sparse forest stands than in dense forest. Both sparse and dense forest classes were therefore combined as "Forested" and the 45 random locations to be sampled were reduced to 30.

Starthistle was encountered on only two randomly selected sites. Both of these were within 50m of a road. All sites sampled away from roads or abandoned roads were YST free. Because of the linear distribution pattern of YST along roadways, random sampling is a poor choice for detection. The most difficult and time-consuming aspect of stratified random sampling was getting to the site that was to be sampled. Only two new infestations of YST were found during the stratified random sampling using a crew of four people over three days. If the sampling had not been stratified with a GIS road layer we probably would not have found any infestations because YST is so closely aligned with the road network. Concentrating on areas near roads and abandoned roads substantially improves the probability of finding new infestations, as do roadside surveys.

Aerial Photography (Color and Infrared)

We obtained high resolution (1:4000) color aerial photographs taken at selected locations in the Applegate watershed where YST was known to occur. Photographic over-flights occurred at four times during the year, which were scheduled to correspond to the most distinctive color phases. In addition, one overflight using infrared film was made.

Early work indicated that there was a window of about three weeks in early/mid summer (June/July) between the time when annual grasses dry and when YST is gray-green in color during which infestations could be identified. Infestations are somewhat distinctive at this stage of development, however an experienced photogrammetrist could only identify dense patches on images at this scale. Individual plants cannot be detected using color or infrared photography. Infestations with YST cover less than 30% and a diameter of several

meters will not be detectable.

Ms. Jeanette Williams Brucker (Applegate Ranger District, USFS) who is very familiar with the Applegate Region and knows the location of numerous infestations, was an aerial observer on a flight over the Applegate Test Area during the early/mid summer identification window. During this flight she also photographed suspected infestations with a 35mm camera and color film. Pictures were low angle oblique but could be used to locate sites on 7.5 minute USGS topographic quad maps. Because she knew where some major infestations were located, she could first verify what an infestation looked like from the air, then visually identify and locate other infestations. As with aerial photography, individual plants could not be identified, only patches of YST several meters across. The location of core infestations may however be important when modeling the risk of infestation in surrounding lands.

Probably the most cost-effective aerial detection procedure would be to use an observer in a aircraft equipped with a differential global positioning system receiver (DGPS) attached to a data logger. The observer would mark the suspected infestation on a map, photograph it, and DGPS the aircraft. Ground observers could subsequently verify the sighting and DGPS its location so it could be logged in the USFS weed database and control measures initiated. These infestations could also be used in the Landscape Risk Model for predictive purposes.

Road Survey

In the summer/autumn of 1999, we surveyed 155 km of roads, both paved and graveled, within the Applegate watershed to identify YST infestations. Infestations were positioned using GPS and mapped into an ArcInfo data theme. This information was combined with both USDI BLM weed data layers and information compiled by MS. Barbara Mumblo (USDA Forest Service) to produce a comprehensive YST map for the watershed. This map is the most complete map of starthistle distribution in the watershed. We also evaluated information gathered from sighting reports from landowners by contrasting it with this map. Additional road surveys are being conducted in the summer/autumn of 2000.

The road survey is the most effective and efficient technique for surveying yellow starthistle in the Applegate watershed that we have used thus far. This technique is superior for a number of reasons. 1) The technique is not nearly as time intensive as the 100% cruise, or the stratified random sampling. Using this technique 155 km roads of interest were surveyed by 2 crews of 2 persons each in a period of 8 days. 2) Because the majority of infestations lie along roadsides, it is more efficient to focus survey efforts along roads. 3) The accuracy obtained from road surveys is very high. Because most infestations were mapped using a GPS in conjunction with USGS topographic quad maps, most infestation positions are mapped to within 2 meters of their true location. In those areas where a GPS position was not available, infestation locations were estimated using USGS topographic quad maps and USGS orthographic photo quad maps, and we feel locations are within 10 meters of their true location. 4) Areas that are not often visited can be carefully examined. As shown by our mail surveys, large infestations that are visible from main thoroughfares are commonly known by many of the individuals living in the Applegate watershed. However, less significant infestations on roads seldom traveled are usually overlooked. It is important to document these smaller infestations, so that they can be controlled before the infestation spreads. The road survey is an excellent method for finding and documenting these hard to find infestations. 5) Small infestations are detectable by road survey that are not detectable with most other methods. Often nascent infestations may be comprised of no more than six plants that are less than six inches high. It is unlikely that such infestations will be noticed by landowners or agency employees, and they are undetectable from aerial photography. Because of this road surveys provide the only reasonable method for documenting these infestations.

A road survey team consists of a driver and an observer who records locations on paper maps and in the DGPS data loggers. Care must be taken when doing road surveys because the vehicle moves slowly and may pose a traffic hazard. It is not appropriate for heavily traveled highways. We suggest using a vehicle equipped with warning lights on an overhead light bar.

In order to develop a landscape risk model, it is important to have information from infestations across a broad spectrum of environmental conditions. Smaller infestations on high mountain roads are just as important to the model as large infestations in the fields along well traveled roads. The roads survey is the only effective method for gathering data on this cross section of conditions. For this reason we feel that the road survey has been the most effective survey method we have evaluated thus far.

Landowner Questionnaires/Sighting Reports

Because most methods of starthistle survey were restricted to public lands, we felt in necessary to obtain information regarding starthistle on private lands. Distance from core infestations may be an important variable to include in a landscape risk model. Therefore, it is important to document all core infestations that may exist. In order to gather data on private lands, 100 surveys were sent to landowners in the Applegate watershed in March of 2000. Recipients of the survey were individuals who were known to own some property and reside in the Upper Applegate watershed. Each survey contained a brief letter, a questionnaire, and a series of 9 township maps. The letter requested recipients to fill out the questionnaire and mark infestations of starthistle on the maps provided.

Out of the 100 surveys, 52 responses were received, and 5 letters were returned undeliverable. The overall percentage of responses out of the surveys delivered was 55%. Of those surveys returned, 67% of them returned at least one map.

The questionnaire consisted of 4 questions and an area for additional comments. The first question addressed the familiarity of the individual with the Applegate area. The second question dealt with the familiarity of the individual with the plants in the area. The third question dealt with the ability of the individual to correctly identify yellow starthistle. The final question requested the opinion of the individual regarding the seriousness of noxious weed invasion. In addition to recording an individual's responses to the four questions, note was made of those individuals who voluntarily offered to cooperate with efforts to stem the spread of yellow starthistle, as well as any other comments that were made.

Each returned map was digitized into an Arc/Info coverage for comparison with the data from the road survey/100% cruise. Reported infestations were verified on the ground, and the helpfulness and accuracy of each map submitted was evaluated. Overall helpfulness was ranked on a scale of 1 to 4 from misleading to very helpful.

In order to establish the accuracy of the maps, two descriptors were evaluated. These descriptors were evaluated with respect to each township map submitted, as to the accuracy across the entire map. Errors that described infestations where none existed were called errors of inclusion. Errors that failed to describe infestations where they did exist were called errors of exclusion. A third descriptor of the reports evaluated the overall tendency of the reporter with regards to each infestation reported, specifically whether the individual tended to overestimate or underestimate the size of those infestations reported. Finally, the acreage reported on each township map was estimated.

Over 80% of the individuals considered themselves either familiar or very familiar with the Applegate and its plants, and 98% could usually or always recognize starthistle. 88% considered noxious weeds a very serious problem that ought to be addressed. Over half (53%) of the maps returned were considered not very helpful. The most common errors were errors of exclusion, where large areas of starthistle were poorly described or not described at all. Most reports seemed to focus on particular areas they were familiar with, and as was expected did not make an effort to survey additional areas.

Overall, we considered the survey to be extremely successful. The high level of response and the extreme level of concern regarding noxious weeds indicate that the issue of yellow starthistle invasion is a very important one to landowners. While most reports of infestations were not particularly helpful or accurate, a few were, and using all reports together, only the remotest of sites were not described. We were somewhat disappointed in that most reports described areas that were easily accessible, whereas we had hoped to gain information about more remote or harder to reach areas. In general the reports were useful for getting a general description of the weed's distribution, however, if more specific information were needed, such as for the development of our predictive model, a road survey or 100% cruise would still be necessary.

Weed Map Server

In order to facilitate information exchange among federal, state, and county weed authorities, as well as private citizens, we have developed an interactive weed mapping server (Weed Mapper) that is located at http://www.weedmapper.org/. Weed Mapper uses Intergraph's GeoMedia® WebMap® software to deliver weed infestation information through a series of map interfaces. Currently, our server provides maps of the known

distribution of yellow starthistle within Jackson County, Oregon to anyone with an Internet connection. Using detailed maps generated from TIGER® line files, it allows users to locate any site within ± 100 m of its true location and report weeds via an email message through a text and graphical report post form. Weed Mapper requires users to have a personal computer with a 486, Pentium® or equivalent processor, Windows® 98, 2000 or NT® 4.0, and a video card that supports a minimum of 256 colors. The PC should be equipped with Internet Explorer® version 4.0 or higher or Netscape Navigator® 4.6.1 or higher. The first time a user accesses Weed Mapper they need to download CGI viewer software that is available free on the internet.

We have been cooperating with the Oregon Department of Agriculture's Plant Division/Weed Control in the development of this internet site. Our hope is that in the future this site will provide these capabilities statewide, for all noxious weeds on Oregon's A and B lists.

Weed Mapper operates within Microsoft® Internet Information Server® installed on a Pentium® system running NT 4.0 Server® and is connected to the Internet via OSU wide area network. GeoMedia WebMap® software is an open GIS application that uses no proprietary languages or data formats. It reads MGE, FRAMME, ARC/INFO®, ArcView®, MicroStation®, ORACLE® Spatial Cartridge/Spatial Data Option (SC/SDO), and ACCESS® data directly, without translation.

GeoMedia WebMap® is implemented using standard Web tools, making it capable of integrating aerial and satellite images, photos, video, and audio with published GIS data. Descriptive information can be linked to map features through standard relational database techniques to create hyperlinked features that are accessible to clients using any industry-standard Web browser.

End-users access GIS weed data through standard Web browsers such as Microsoft® Internet Explorer® and Netscape Navigator® running under Windows® 95, 98 or Windows NT®. Since these tools are already on most desktops, individuals can access GIS formatted weed information. They can also download weed maps to their home machine for printing. Maps can also be magnified, zoomed or annotated by right clicking the mouse while the cursor is on a map. The "redline" feature permits drawing circles, rectangles, lines or compound lines as well as text on the map. Polygons can be drawn on maps using the multi-line feature in the "redline" menu. Users therefore, can annotate a weed map, save it to the clipboard or to a file, and send it via email to the project or to USFS or County Weed Specialists.

Weed Mapper also allows users to report weeds though the weed sighting report form on the web page. When a user completes and submits a report on the net, a line is added to a file on the server. The line contains information in a comma-delimited format that can be copied to a database. We can therefore printout reports that can be verified by weed professionals or botanists in the county. Verified infestations would then be added to the master database. We are coordinating with Pam Corey of the USFS Natural Resource Information System -TERRA to ensure that our weed database is compatible with USFS standards.

Oregon Department of Agriculture's weed division asked that we prepare a funding proposal that would support and expand the Weed Mapper Internet site. The funding source was the State of Oregon Weed Board. This proposal was not funded because the State Weed Board felt that it was not a "control" program and thus did not qualify for funding under their mandate. We reworked the proposal and submitted it to the USDA's National Research Initiative (NRI) Competitive Grants Program. The project was not funded because it was not regional in scope and a reviewer questioned the Oregon Department of Agriculture's commitment to long term maintenance of the database. We will continue to seek funding for a statewide expansion of this endeavor.

Weed Mapper currently resides on a dedicated net server in the Department of Rangeland Resources. At this location we do not have adequate internet bandwidth to supply maps to users quickly thus screens refresh relatively slowly. We have asked Information Services at OSU to allow us to place the server on the fiber optic connection for a trial period. If this improves performance substantially we will request permanent access.

Landscape Risk Model

Surveys of yellow starthistle infestations can be greatly streamlined if areas of likely infestation could be determined prior to the survey. One way to determine the most effective areas to perform searches for weed infestations is to develop a "Landscape Risk Model." Such a model takes into account a number of variables that influence a weed's presence, and uses those variables across a landscape to determine areas that are prone

to invasion by the weed.

In order to begin building such a model for yellow starthistle in the Applegate, a number of GIS layers were obtained. Elevational data were obtained from a USGS Digital Elevation Model. Using Arc Grid, these elevational data were used to determine slope and aspect for each location in the Applegate watershed.

Because yellow starthistle tends to be spread by vehicular traffic along roadways, it is important to know the distance of a particular location from a core infestation along the road. Knowing that core infestations existed near Ruch, and became less frequent as the road proceeded south, distances were calculated from the north end of upper Applegate road. Arc Grid was used to calculate the distance of each observation along the road from the north end of the road.

In order to determine vegetative communities that are associated with starthistle infestations, overall canopy cover density, percent shrub cover, percent barren and percent herbaceous cover were extracted from a data set provided by Applegate Ranger District. The data set had been determined for them by Geographic Resource Solutions® using Landsat TM imagery, Digital Elevation Models, and measured field data. These data had a resolution of 30x30 meters. We do not have an accuracy assessment of this data.

A class variable was also developed from an unsupervised classification of a Landsat 7 TM scene. ERDAS® Imagine® was used to formulate a classification of 20 spectrally distinct classes by combining spectral data from the blue, green, red, near infrared, and 2 middle infrared bands. These data are also at a resolution of 30 meters. There has been no ground verification of these classes, so the specific representations of each class are unknown. If these data prove to be useful in predicting starthistle locations, ground verification will be performed in the coming field seasons.

The final variable to be obtained for the model was the presence or absence of yellow starthistle infestations. Because the data were tied closely to the road we decided to test our first formulation of the model on areas close to the road. To this end Arc/Info® was used to create a buffer of 30 meters on either side of the road. The road segment was extracted from 1:100K Tiger line files of Jackson County. After the buffer was made, the polygon file was rasterized and Arc Grid® was used to update the raster file with infestation information from the road survey along the upper Applegate road. In order to bring all these data together in a format that could be used in a statistical model, ARC GRID® was used to combine each layer on the basis of the infestation data, and the data were output to a text file.

After the data were extracted from the GIS layers, they were imported into SAS, where they were used to predict presence or absence of starthistle by fitting them to the logistic regression model:

$$\text{logit}(p) \equiv \log\left(\frac{p}{1-p}\right) = \alpha + \beta' \chi$$

The full model contained 9 variables, listed in Table 2. Stepwise regression with backward elimination was used to evaluate the usefulness of all 9 variable for determining presence. Variable were dropped if Pr > Chi Square was greater than 0.05. Elevation and Density dropped out, leaving the remaining variables in the final model (Table 3, Appendix 5). The fact that elevation and density dropped out is to be expected. Elevation was highly correlated with distance, as in this case the road goes consistently uphill from the beginning. Most of the variation in density can be described by a combination of % barren, % herbaceous, and % shrub ($R^2 = 0.82$).

Table 2. These variables were collected for locations adjacent to upper Applegate road and used to develop a model for predicting the presence of yellow starthistle.

Variable	Type	Description
Density	Continuous	Percentage of overhead canopy cover
%Shrub	Continuous	Percent shrub cover
% Herbaceous	Continuous	Percent herbaceous cover
% Barren	Continuous	Percent barren ground
Aspect	Categorical	Direction of slope divided into 8 45° slices
Slope	Continuous	Inclination of the slope, measured in degrees
Elevation	Continuous	Height above the ellipsoid
Presence	Binary Response	Presence or absence of Yellow Starthistle
Class	Categorical	Grouping based on unsupervised classification of a Landsat 7 scene.
Distance	Continuous	Distance from the beginning of the road.

Table 3. Variable used in the final model for predicting presence or absence of yellow starthistle with the probability of being greater than the chi-square distribution.

Effect	DF	Wald Chi-Square	Pr> Chi-Squre
Aspect	8	60.96	<.0001
Classes	17	59.08	<.0001
Distance	1	172.57	<.0001
Slope	1	4.61	.0318
Barren	1	21.46	<.0001
Herbaceous	1	10.20	.0014
Shrub	1	8.11	.0044

In order to test the model, SAS proceeds through each record, fits the model without that record, and uses the resulting model to predict that point. The percentage of correct predictions is then reported. The final model was able to predict infestations correctly 85% of the time. One must keep in mind that if one chose to predict all pixels as having no starthistle, the prediction would be correct 77% of the time, as 77% of the observations are starthistle free. Thus, the model improves this estimation by 8%.

A clearer view of the accuracy of the model is gained by looking at the R^2 value for the model. This model had a Max Rescaled $R^2 = 0.43$. This Max Rescaled R^2 has been rescaled to account for the fact that for discrete models, such as this one, R^2 has a maximum value of less than 1 (Cox and Snell 1989, Nagelkerke 1991).

At this time there are a number of steps we may take in an effort to improve upon this model. One shortcoming of the data used in this model is that due to the presence of infestations only along the road, observations are highly correlated with one another, and with the presence of the road. In order to address this issue, we have started road surveys in the Bear Creek watershed, along the I-5 corridor where starthistle infestations began earlier and have expanded farther. In this valley YST has therefore had more opportunity to establish infestations across the range of available sites, often considerable distances from well traveled roads.

Another question to be addressed has to do with the resolution of the data. Infestations were documented on a plant by plant basis, and often occupied only 1 or two meters directly adjacent to the road. The data extracted described a 30x30 meter plot, that could have included many areas that were not representative of areas prone to starthistle invasion. Further, the accuracy of much of the data is unknown. We think that it is unwise to rely completely on these data until their accuracy is known.

In order to address the difficulties of data resolution and accuracy, a sample of infestations will be taken and

data will be gathered for these locations on the ground. Information regarding elevation, slope, aspect, vegetative community, land use, and soils will be gathered for each location, and used in a model similar to the one here to predict occurrence of yellow starthistle.

CHANGES TO ORIGINAL PROJECT SCOPE OR OBJECTIVES (changes that need to be made to the original proposal and reasons for the changes): None

ADDITIONS TO ORIGINAL PROJECT SCOPE OR OBJECTIVES (describe additional accomplishments expected from the project)**:**

We will expand the geographical area that will be used to build the risk model to include areas that have been exposed to YST for a longer period of time. This is necessary to identify the landcover types or habitat types that are subject to invasion.

FHP LEAD CONTACT (FHP person submitting proposal)**:**

Name	Affiliation (Office or Dept.)	Phone, E-mail, Fax
Don Goheen	SWOIDSC	

PRINCIPAL INVESTIGATOR(S) (add lines as necessary)**:**

Name	Affiliation (Office or Dept.)	Phone, E-mail, Fax
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COOPERATORS (contributing to, but not leading, the project) (add lines as necessary)**:**

Name	Affiliation (Office or Dept.)	Phone, E-mail, Fax
Steve Bulkin	Silviculturist Rogue River National Forest	V 541-858-2200 sbulkin@fs.fed.us F 541-858-2220
David Thomas	Dept. of Statistics (Emeritus) Oregon State University	V 541-737-1608 dave.thomas@orst.edu F 541-737-0504
Dennis Isaacson	Oregon Department of Agriculture	V 541-752-6864 disaacso@oda.state.or.us
Paul Korbulic	Jackson Co. Native Plant Society	
Lee Bradshaw	Cattlemen's Association of Jackson Co. Oregon	

COOPERATOR INVOLVEMENT (add lines as necessary)**:**

Funding for this project has come from STDP and Oregon State University. Other organizations, such as Oregon Dept. of Agriculture (ODA), Jackson County Cattlemen, and Jackson County Native Plant Society, cooperate with the project by providing information and support. They do not provide funding.

Name	Role	Time Commitment
Randy White	Facilitator/Extension	2 weeks per year
Dennis Isaacson	Liason with ODA	1 week per year
Paul Korbulic	Jackson Co. NPS	Variable
Lee Bradshaw	Cattlemen's Association of Jackson Co.	Variable

PRODUCTS AND DUE DATES (from original application form)**:**

The product of this research will be a thorough, documented, examination of several survey methods, the development of a predictive model of where yellow starthistle is likely to invade, and a map of starthistle populations on the target area within the Applegate landscape. This weed map will facilitate information exchange

and cooperation. Locations of weeds, their relative abundance and other observations will be identified by map coordinates or map overlays on an accurate base map.

STATUS OF PRODUCTS/PRESENTATIONS:

We have completed tasks that were scheduled during the first twon years phase of the project (see project timeline in project proposal). The project is on track and is proceeding according to plan. FY 2001 funding will permit us to complete the yellow starthistle mapping and modeling effort. Weed sighting report forms will continue to be distributed and verified infestations will be added to the YST database. We will continue development of the weed map/reporting server and follow the research plan found in the original project proposal.

ACCOMPLISHMENTS TO DATE:

Products: Yellowstar thistle distribution map in the Applegate Watershed

Weed map server at http://www.weedmapper.org

preliminary landscape risk model of YST

Publications:

Casady, G.M. and D.E. Johnson. 2001. Comparison of Methodologies for Yellow Starthistle (*Centauria solstitialis* L.) Detection and Mapping. Abstr. of Papers, International Knapweed Symposium, Western Society of Weed Science. Coeur d'Alene, Idaho.

Technology Transfer:

Technology transfer will employ the OSU Extension Service and USFS personnel. Training sessions, brochures, and training video, ect. will be used to transfer the technology developed by this project.

FIRST FISCAL YEAR FUNDED: 1999

FUNDS OBLIGATED FROM BEGINNING OF PROJECT THROUGH CURRENT FISCAL YEAR (extend table as needed)(Ignore this section if not requesting funds)**:**

	Item	Requested Funding	Expended Funding	Unused Funding
FIRST YEAR				
Administration	Salary	$22,487	$22,487	0
	Overhead	9,516 (OSU)	9,516 (OSU)	0
	Travel	1,738	1,738	0
Procurements	Contracting	0	0	0
	Equipment	0	0	0
	Supplies	7,800	7,800	0
	Other	4,575	4,575	0
First Year Totals		46,116	46,116	0
SECOND YEAR				
Administration	Salary	$19,225	$19,225	0
	Overhead	6,266 (OSU)	6,226	0
	Travel	1,739	1,739	0
Procurements	Contracting	0	0	0
	Equipment	0	0	0
	Supplies	3,136	3,136	0
Second Year Totals		$30,366	$30,366	0

CURRENT YEAR		Requested FHP STDP Funding	Other Source Funding	Source
Administration	Salary	$30,733		
	Overhead		$13,026	OSU
	Travel	$1,739		
Procurements	Contracting	0		
	Equipment	0		
	Supplies	$2,128		
	Tech./Video	$15,500		
Year Totals		$50,100	13,026	
PROJECT TOTALS				

FUNDS NOT USED FROM PREVIOUS FISCAL YEAR

There will be no unused funds

Fiscal Year	STDP Funding Allocated	Funds Obligated	Funds Unused

EXPECTED BUDGET FOR NEXT FISCAL YEAR (FY2002):

	Item	Requested FHP STDP Funding	Other-Source Funding	Source
Administration	Salary	$19,225		
	Overhead	0	$6,226	OSU
	Travel	2,739		
Procurements	Contracting	0		
	Equipment	0		
	Supplies	4,136		
Totals		$26,100	$6,226	

DIFFERENCE BETWEEN ORIGINAL AND AMENDED REQUESTS AND JUSTIFICATION:

No changes from the original proposal are needed at this time.

STDP FUNDING NEEDED:

Total estimated additional future funding needed beyond the current fiscal year:

Estimated STDP funding needed in remaining year(s) of the project by fiscal year. Show separately the funding to be requested/provided from other sources (extend the table as necessary).

Fiscal Year	STDP Funding	Other-Source Funding	Source
2002	$26,100	$6,786	OSU