ITEM 1-1
Elk Disturbance

ACTIVITY, PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INDICATE FURTHER EVALUATION
Elk Productivity - total time of human disturbance created by management activities	5 years	Timber management disturbance occurring more than 4 out of 10 years

Introduction: Disturbances like timber sales result in elk leaving the affected drainage. Frequent disturbance may adversely affect elk productivity. The Lolo Forest Plan assumes that an area used by a particular elk herd ("herd unit") will be re-entered no more than every 17 years. This monitoring item displays (1) the interval between activities and (2) the proportion of time since the last entry when disturbance occurred in the herd unit.

Methods: The **"activity coefficient" = duration/interval**. The **interval** since the last sale equals the difference between the year beginning the last sale's activity and the current year. The **duration** is the number of years in which major activities occurred during the interval. Major activities include road building, felling, and skidding; but omit minor actions like planting and burning.

Results: Table 1-1A shows pertinent disturbance information for sales over 1 million board feet (mmbf) offered in fiscal year 99.

Table 1-1A. Past Disturbance in Elk Herd Units for Sales Sold in 1999.

Sale Name	**First Year of Last Major Entry**	**Interval**	**Duration of Last Entry**	**Activity Coefficient**
Chain of Lakes Salvage	none			0
Sunny Side Helio	none (some turn-of-the-century logging evident)			0
Rivulet	early '70's	25 years	4 years	.16
Billy Helo	1993	7 years	2 years	.29
Wee Tepee Helio Salvage	'88	11 years	4 years	.36
Shapes & Feathers	early '79 and '84	16 years	4 years	.25

Evaluation: No sale exceeded the 0.4 coefficient that would trigger further evaluation. The average disturbance coefficient is 0.18. With the exception of the Rivulet and Shapes and Feathers Timber Sales, avoiding disturbance to elk was not an issue. Projects were generally located in low elevation landscapes where the objectives focused on restoring natural stand structures and reintroducing fire.

ITEM 1-2
Elk Cover/Forage Ratio

ACTIVITY, PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INDICATE FURTHER EVALUATION
Elk Productivity - cover/forage ratios	5 years	Any cover/forage ratio below 40/60 in a minimum analysis area of 4,000 acres

Introduction: Elk need hiding cover for security to raise calves and to avoid hunters in the fall and they need thermal cover for warmth and snow interception in winter. The "cover:forage ratio" ensures that at least 40% of an area provides cover.

In the late 1980's, researchers showed that bull elk move into larger patches of cover away from roads during the hunting season. A second measure of cover, called "elk security," was developed which includes only patches of cover over 250 acres that are 1/2 mile to 1 mile from an open road (the distance depends on terrain). The desired level of hunting season "security areas" is 30% to 35% of the analysis area.

Methods: Biologists assessed all sales over 1 mmbf sold in 1999. The cover:forage ratio compares the area of forested land to the area in openings. "Elk security" measures the area of cover (area providing hiding cover) occurring in a block of at least 250 acres that is located more than 1/2 mile from a road that is open in hunting season.

Results: See Table 1-2A.

Table 1-2A. Cover:forage Ratio and Elk Hunting Season Security in Sales Sold in 1999.

Sale Name	**C/F Ratio**	**Was hunting season security assessed?**
Chain of Lakes Salvage	~80/20	No - not an issue. The project was located in a linear patch of MA9 (recreation emphasis) along the Clearwater River amidst summer homes. Objectives were to protect old growth western larch, restore natural structure and reduce wildfire severity.
Sunny Side Helo	~70/30	Yes, on two non-winter range units. In the non-winter range portion of the project area, road closures were done to raise the level of security from 22% to 25%. Increasing elk security was a major part of the broader (Two Joe EIS) landscape analysis. MDFWP bull carryover data indicates that bull carryover meets their Elk Plan objectives. While the 25% security level is below the recommended 30% average level (Hillis et al 1991), MDFWP data and public support suggest the 25% level is adequate.
Rivulet	65/35	Yes, the harvest in the project area is intensive but clustered within 35% of the landscape. All roads in the area are closed during the hunting season (B and C closures). Roads under a B-closure are closed yearlong and those under a C are closed from Oct. 15 through June 15. A sizeable patch (~600 acres) of security is available in the southwest corner of the project area and represents about 30% of the project area. Most of the herd unit is proposed wilderness. Bull carryover exceeds MDFWP standards.
Billy Helo	60/40	No. The area is 100% winter range. Security was not an issue.
Wee Tepee Helio	unknown	Yes. A combination of road eradication and road closures

Salvage	*	resulted in an increase in security from 39% to 47%. This was also driven by the need for increased grizzly bear security on critical grizzly bear spring range.
Shapes and Feathers	50/50**	Yes. Past harvest patterns left few options to restore security. Although access roads are generally closed yearlong, there are no large patches of cover within the project area. Within the next decade, there will be significant security after old units recover. Timber harvest units were located amidst concentrations of old harvest units (hence the low C/F) that had no security value. In some cases leave strips were thinned. In other situations, stands adjacent to existing units were thinned. The net effect was that units got bigger but no security was lost.

***Cover/forage was not calculated for three reasons: 1) the percent cover was unnaturally high due to fire suppression; 2) all treatments were improvement cuts designed to retain cover at the stand level; and 3) security needs for grizzly bears and elk took precedent over other concerns and made cover/forage somewhat moot.**

**** The 50/50 level is indicative of the project area only. The level of cover at the landscape and herd unit scale is much higher and well within Forest Plan landscape objectives.**

Evaluation: All but one timber sale (Shapes and Feathers) were in landscapes that were well within the desired level of cover:forage**.** Security was assessed on four of the six sales, where hunting season security was a significant issue.

Of the four projects where security was an issue, two of those met or exceeded average security objectives (30% and 49% assuming 30% is an average desired objective). The Shapes and Feathers project fell short because of activities completed in the 1980's, which left no options for improvement. The Sunny Side Helo project fell slightly short of the objectives (25% versus 30%), but the project analysis concluded that this level was adequate for meeting Forest Plan Standards based on existing bull carryover.

On those landscapes where elk security was an issue, the design of the projects adequately considered security and implemented appropriate measures to maintain or improve security. All projects implemented are considered compatible with Forest Plan standard 26, which is to maintain a variety of hunting opportunities.

ITEM 1-3
Old Growth Harvest

ACTIVITY , PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INDICATE FURTHER EVALUATION
Monitor effectiveness of old-growth habitat areas (MA 21) that are harvested	5 years	20 % degradation in short run and 10% in the long run

Introduction: The Lolo Forest Plan allows treatments like burning and logging in old growth forests. In this monitoring item, these treatments are assessed by forest biologists for any detrimental effects on old growth quality. In some forest types, removal of understory and underburning are beneficial to old growth quality and may occur in stands to reduce competition and the threat of stand-replacing fires.

Methods: For each sale, biologists described and assessed the quantity of old growth treated and the effects on old growth. The results are displayed for (1) all acres that are designated old growth in the Lolo Forest Plan (called "MA21") and (2) other acres that meet the regional definition of old growth for the specific forest type ("R1 OG").

Results: Old growth stands were treated in two of the four sales sold in FY 99; see Table 1-3A.

Table 1-3A. Old Growth Treated in Sales Sold in 1999.

Sale Name	**Treatment in OG?**	**In MA21?**	**Describe OG treatment and if beneficial**
Chain of Lakes	Yes	No. Area is all MA9 - recreation	Virtually 100% of the stands treated had residual old growth trees. One stand met R1 old growth definitions in terms of an adequate number of large trees/acre. No old growth trees were harvested. Treatment was limited to partial-to-total understory removal. This is consistent with the historic fire-dependent stand structures as defined by Arno (pers comm).
Sunny Side Helio	No	No	All of the old growth in this landscape was presumably removed near the turn-of-the-century by horse logging. All treatment prescriptions involved retaining pole-sized ponderosa pine, removing competing Douglas-fir, and reintroducing low intensity fire. This treatment is fully compatible with recruiting old growth ponderosa pine, on droughty, low elevation landscapes.
Rivulet	No	No	Old growth stands are in short supply in this landscape due to a combination of the 1910 fire and timber harvests in the late '60's. Consequently, no old growth stands were treated.
Billy Helo	No	No	Like the Sunny Side project, all of the old growth in this landscape was presumably removed near the turn-of-the-century by horse logging. All treatment

			prescriptions involved retaining pole-sized ponderosa pine, removing competing Douglas-fir, and reintroducing low intensity fire. This treatment is compatible with recruiting old growth ponderosa pine, on droughty, low elevation landscapes.
Wee Tepee Helio Salvage	Yes	Yes	578 acres of old growth ponderosa pine/Douglas-fir were enhanced - 327 acres were treated with an understory removal followed by underburning and 251 acres were underburned. Understory removal was consistent with presettlement old growth stand structures (Arno pers comm, Fischer and Bradley 1987).

Other Old Growth Treatments: Biologists evaluated two other projects that were implemented for old growth enhancement. These included: 1) the Whitehorse timber sale, sold in 1993, in which prescribed burning was completed in 1999; and 2) the Ranch Creek prescribed burn, completed in 1999.

Whitehorse- This 500-acre landscape is dominated with old growth ponderosa pine, western larch, and Douglas-fir. Selective logging removed the understory and some of the dominant large Douglas-fir in the mid '90's. Prescribed burning was completed in May 1999. Post burn surveys concluded that the live tree stocking was 100-120 square feet (optimal according to Arno for long-term survival of old growth ponderosa pine and western larch), and the snag density was 5-7 snags/acre (roughly triple the level specified in the 1996 snag standard). On the negative side, 12 acres suffered a stand-replacing burn, which killed most old growth trees on those acres. While this mortality was outside the burning prescription, this mortality is considered well within the normal conditions expected for large landscapes of low elevation old growth. These results are described in detail in the Proceedings for the National Silvicultural Workshop (in preparation, available summer 2000 at the Lolo National Forest Supervisor's Office).

Ranch Creek- This 500-acre prescribed burn was conducted in a stand of old growth ponderosa pine with a dense Douglas-fir understory. Post burn surveys indicated that the Douglas-fir understory was killed on 70-80% of the landscape. This substantially improved the stand's ability to survive wildfires. Scattered mortality (1-2 trees/acre) of old growth ponderosa pine occurred on 40% of the landscape. This recruited snags at the normal average density for low elevation landscapes according to the 1996 snag standard and reduced stocking slightly which should improve the stand's resistance to insects and disease according to Arno, Scott, and Hartwell (1995). On the negative side, 5 acres suffered a stand-replacing burn, which killed most old growth trees on those acres. While this mortality was outside the burning prescription, this mortality is considered well within the normal conditions expected for large landscapes of low elevation old growth.

Evaluation: Activities in old growth focused on restoring the structure typical of low-elevation ponderosa pine/Douglas-fir and mid elevation western larch/Douglas-fir forests before fire suppression began. The large old trees were retained and understories were removed or thinned to reduce fire hazard and reduce competition. The 17 acres of mortality from burning (12 acres on Whitehorse and 5 acres on Ranch Creek) should be considered as an unavoidable tradeoff when restoring fire to fire-dependent communities in which fires have been suppressed for 70

years. Overall, no degradation of old growth quality or reduction in the amount of old growth occurred at the stand level.

Wee Tepee Helio is a typical example of old growth restoration for the Lolo, and is also very representative of the Lolo NF's ecosystem-management-driven timber harvest program. Attributes of Wee Tepee Helio include: 1) helicopter access and road eradication to avoid introducing noxious weeds, protect big game security, and avoid sediment-related impacts; 2) improvement cuts designed to restore natural stand structures; and 3) reintroduction of low intensity burns.

Chain of Lakes is less typical since it involved old growth western larch in a landscape dominated by summer homes and intensive recreation activities. While the project emphasis was focused on protecting homes from fire and maintaining recreational values, the treatments were fully compatible with protecting old growth larch, some of which were 600 to 900 years old. While Billy Helo and Sunny Side Helo projects had no old growth, the treatments were fully compatible with recruiting old growth ponderosa pine on droughty, low elevation sites.

ITEM 1-4
Snag Retention

ACTIVITY, PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INDICATE FURTHER EVALUATION
Post-sale snag densities	5 years	30% or more of transects fail to meet Forest snag prescriptions

Introduction: In 1996, forest biologists revised snag and replacement-snag standards to better reflect the natural levels that occur in different types of forest. Stands of "pure" lodgepole typically lack overstory snags and different standards were developed for these stands. Lodgepole mixed with other species is treated as "moist forest" in the table below. The snag standard was reduced in dry forest and increased to a broader range in moist forest (Table 1-4A). The level of replacements was increased in all forest types.

Table 1-4A. Changes in snag and snag-replacement standards.

	Snags (dead trees)	**Replacements (live trees)**
Forest Plan Standard (1986)	dry forest - 4 snags/acre moist forest - 4 snags/acre	dry forest - 0.3 trees/acre moist forest - 1 tree/acre
Revised standard (1996)	dry forest - 1 to 2 snags/acre moist forest - 4 to 12 snags/acre lodgepole (pure stands) - retain only sound snags (type 2)	dry forest - 8 to 12/acre moist forest - 8 to 12 trees/acre lodgepole - none

Methods: Biologists and technicians counted snags and replacements on 17 units on two sales. Methods are outlined in the R1 snag protocol. Survey methods involve a 10% sample on pre-harvest units (one 1/5 ac plot/2 acres sampled, established at 132' intervals on a preestablished grid), and a 100% sample on post-harvest units (every snag is visited).

Results: Results are summarized in the following Table: Results below standard are **highlighted**.

Table 1-4B. Average snags per acre for each sale monitored.

Sale Name	Year Sold	Forest Type	Snags/acre	1996 target snags
Patty Blue	outyear	dry forest	1.5	1-2
Two Creek	late '80's	moist forest, lodgepole pine	**.53**	4-12
Big Flat	early '90's	moist forest	**.57**	4-12
Fisher	early '90's	moist forest	**1.05**	4-12
Border Peak	mid '90's	dry forest	1.02	1-2

Degree to which the 1996 Revised Standard Was Met for Snag Retention: The five sales monitored demonstrate a significant evolution in snag retention strategies on the Lolo NF. Pattee Blue is a new project designed in 1997/98 to restore old growth ponderosa pine communities. Snag protection measures implemented and monitored in 1999 reflect state-of-the-art information on the ecology of snags by disturbance regime. All contractual options were implemented into the project plan to protect existing snags and recruit desired levels of future snags.

Border Peak was designed and sold in the mid 1990's to restore old growth ponderosa pine stands, and reflects a strong objective to improve snag retention based on the shortcomings of snag retention as monitored in previous years' monitoring reports. While the design lacks some of the sophistication of Pattee Blue, the results in snag retention are clearly within the 1996 standard.

The Two Creek, Big Flat, and Fisher projects were designed and sold in the late '80's/early '90's. The most obvious point evident in the proceeding Table is that *few snags remained after logging*. Because all three projects were within landscapes burned in 1910, it's likely that few snags were present prior to logging. Unfortunately, there is no pre-harvest data to confirm whether or not this was the case.

REPLACEMENTS (LIVE TREES): The following Table summarizes snag replacements retained by project. Because the standard for replacements changed dramatically in 1996, and because three of the five projects were implemented before this date, the old standard is included in the Table. Results below standard are **highlighted**.

Table 1-4E. Average replacements per acre for each sale monitored.

Sale Name	Year Sold	Forest type	Replacements/ acre	1986 target replacements	1996 target replacements
Pattee Blue	outyear	dry forest	10.4	.3	8-12
Two Creek	late '80's	moist forest	**1.03***	1.0	8-12
Big Flat	early '90's	moist forest	**2.3***	1.0	8-12
Fisher	early '90's	moist forest	**.29**	1.0	8-12
Border Peak	mid '90's	dry forest	38	.3	8-12

***within the standard at the time of project design and implementation**

Degree to which the 1996 Revised Standard Was Met for Replacements: The five sales monitored also demonstrate a significant evolution in snag replacement strategies on the Lolo NF. Pattee Blue was designed after implementation of the 1996-revised standard. Border Peak was designed prior to that date, but a high number of replacements were retained as part of the objective to restore old growth ponderosa pine communities.

The Two Creek, Big Flat, and Fisher projects were designed and sold in the late '80's/early '90's. Like the snag retention data discussed previously, *very few replacements were retained after logging*. While two of the three projects met the standard for that period in time (1986), all 3 projects are substantially below the current 1996 standard.

Table 1-4C is a summary of how well timber sales met the 1986 and 1996 standard for snag retention and snag replacements.

Table 1-4C. Proportion of units meeting snag standards.

Sale Name	**Met or Exceeded the Forest Plan standard for snag retention/replacements**	**Met or Exceeded the 1996 standard for snag retention/ replacements**
Pattee Blue	yes/yes	yes/yes
Two Creek	**no**/yes	**no/no**
Big Flat	**no**/yes	**no/no**
fisher	**no/no**	**no/no**
Border Peak	yes/yes	yes/yes

Recommendations:

Continuation of the following four 1997 Recommendations:

1) Prior to opening areas to firewood collection, analysis of the status of snags on site and at the landscape level should be done according to a consistent method across the forest. A plan for limiting removal to a level consistent with habitat needs should be provided. This plan may include limiting access time to an area, monitoring snag removal and closing the area when a certain amount of wood has been taken, having forest personnel present in the area, signing wildlife trees, and restricting removal of wood to downed trees on decks.

2) Monitoring data should indicate causes of snag loss when known (for example, losses to windstorms, prescribed fire, or firewood collection).

3) Train personnel to be consistent with OSHA guidelines when marking wildlife trees and continue to monitor the results of marking.

4) Cooperate with fire personnel to ensure the effects of suppression activities on snags are understood, including locating fire lines and treating smoldering snags.

ITEM 1-5
Threatened & Endangered Species
Habitat Improvement

ACTIVITY, PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INDICATE FURTHER EVALUATION
Acres of threatened and endangered species habitat improvement	5 years	Forest must accomplish 75% of habitat improvement program for a 5 year period with at least 50% accomplished every year

Methods: Acres of habitat improvement are taken from the annual Wildlife, Fish, and Rare Plant Report, summarized in a spreadsheet filed in (/fsfiles/unit/fw/wlprog/98wfrp/98wfrp.as).

Results: See Table 1-5A.

Table 1-5A. Acres of grizzly bear habitat improvement.

	Plan Projected	**Percent of Projected**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**11 yr Average**
T&E Habitat Improvement Acres	**80**	**751%**	291	0	0	200	200	200	300	550	3870	1,000	**0**	**601**

All acres reported were a result of increased grizzly bear security resulting from elimination of roads

Evaluation: No habitat improvement for grizzly bears was accomplished in FY 99. Closure of roads in grizzly bear habitat comply with the Interagency Grizzly Bear Committee (IGBC) access guidelines and improved grizzly habitat at levels more than seven times over Forest Plan expectations.

Planning for additional road closures/obliterations to meet IGBC access guidelines continue on several projects. Some of those closures will be implemented in FY 2000.

Four loon-nesting structures were accomplished in FY 99 resulting in 200 acres of habitat protection for the common loon.

ITEM 1-5A
Threatened & Endangered Species Monitoring

Grizzly Bear Monitoring

In the Northern Continental Divide Ecosystem, four of the seven subunits meet the current IGBC road density guidelines for open and total road and for the percent of the area over 0.3 miles from a road ("core"). The current guidelines call for under 19% of a subunit to have a specific open road density over 1 mile/section; less than 19% to have a specific total road density over two miles/section; and 68% of the subunit to be over 0.3 miles from a road. These standards are being reviewed for possible revision of methods and numerical standards. As a result, the current status is described below in a qualitative way.

The Morrell-Dunham subunit is within a few percentage points of the open and total road density targets, but is lacking core in spring range. The Mission subunit exceeds the total road density;

however, because more than 25% of the subunit is private industrial land, the guideline for Forest Service land is "no net loss." The Swan subunit greatly exceeds the desired level of roads (open and total) under current guidelines. Some progress toward those guidelines is planned in the proposed Clearwater Project.

Actions for which planning is underway to meet the IGBC road density standards include:

1. Dunham Restoration Project, which will be completed in 2001;
2. Clearwater Restoration Project, which will be completed in 2003;
3. Clearwater Roads Project, which will be completed in 2002; and
4. The Seeley Backcountry Snowmobile Project, which will be completed in 2001.
5. Cave Point road eradication will be completed in 2001.

Peregrine Falcons

Both adults had returned to the Knowles Creek eyrie by late April. Two young were fledged.

Gray Wolves

The Thompson pack is no longer considered active. The Ninemile pack continues to produce pups. Three packs that the Lolo shares with Idaho continue to produce pups. These include the Kelly Creek pack, the Snowpeak pack, and the Bighole pack. The Bighole pack may have depredated on livestock that were grazing on public land, although this was not confirmed by USFWS. The permittee was given the option of taking non-use. He may utilize that option in FY 2000, eliminating the potential for further depredation. Three adult wolves have taken up residence in the lower Clearwater/Blackfoot River area on the Seeley Lake RD. One of the wolves is a female (in estrus in February). This brings the total active packs on the Lolo NF to five, assuming that the Blackfoot pack produces pups in the spring of 2000.

Loon Nesting Success:

Loon territories are monitored by Forest Service personnel and by volunteers from the Montana Loon Society during April-June and signs are placed around the nest sites asking that boats avoid the area. All the lakes are visited on the third Saturday in June and the number of adults and chicks are recorded. Table 1-5A-A is a summary of loon nesting success in FY 99.

Table 1-5A-A. Loon Nesting Success in 1999.

Territory/Lake Name	Pair Present	Young Produced (mid-July)
Rainy	yes	0
Alva	yes	1
North Seeley	yes	2
Mid Seeley	no (3rd year unoccupied)	0
Salmon	yes	0
Inez	yes	0
Upsata	yes, banding indicates new adults from those banded in the past	1
Shoup	yes	1
Placid	yes	2
Little Doney	yes	1
Kleinschmidt	yes	1
Marshall	yes	0

Loons were very successful on these lakes in 1999, producing nine chicks on eleven occupied territories. (On average, both in this area and across the loon's range, each pair produces only one chick every other year.)

Inventory: Survey of bald eagles.
Nest production surveys were done for all active nests on the Lolo NF. Fledglings produced continued to increase as in past years. Nest-by-nest results are on file with MDFWP, threatened and endangered species division, Bozeman, MT. Two new nests were found including one in the middle Clark Fork (which produced two fledglings) and one at Seeley Lake (which failed).

Inventory: Survey of goshawks.
The Lolo participated in a study of goshawks in cooperation with other western states. The study explored the accuracy of models designed to predict nesting habitat. Of the Lolo's 16 known nest territories, ten were submitted for analysis. The other six were disregarded because the actual nest tree hadn't been located. An additional ten random sites were identified to see how well the model could predict which nests were real and which were random. The study concluded that the model was 60% accurate in predicting which of the nests were "real" versus random.

ITEM 1-6
Big Game Winter Range Habitat Improvement

ACTIVITY, PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INDICATE FURTHER EVALUATION
Treated acres of big game winter range	5 years	Forest must accomplish 75% of habitat improvement programmed for a 5 year period with at least 50% accomplishment every year

Methods: Acres of habitat improvement for big game are taken from the Wildlife, Fish and Rare Plants (WFRP) report spreadsheet for 1999 (/fsfiles/office/forest/wildlife/wfrp/1999/99_wfrp.as). Improvement acres represent burns in the Boyd Mountain, Munsen Creek, and Ranch Creek projects.

Results: A total of 1,971 acres of winter range burning were accomplished in FY 99. On average, 2,736 acres of big game habitat per year were improved by burning or herbicide treatment over the last 13 years (1987-1999). This exceeds the Forest Plan projected value of 1,600 acres by 71% (see Table 1-6A). About half of the planned burns were not accomplished in FY 99 due to an uncommon high pressure system and inversion that settled in western Montana in April of 1999. Although burning conditions were good, the air quality limitations prevented many of the burns from being completed.

Table 1-6A. Summary of habitat improvement acres (Actual vs Projected).

ACTIVITY	UNIT	PLAN PROJECTED (ANNUAL AVERAGE)	ACTUAL AVERAGE to DATE (FY 87-99)	PERCENT OF PROJECTED
Big Game Habitat Improvement-Burning	acres	1600	2,736	171%

Partnership Funds: In 1999, $12,300 of partner funds was spent on big game habitat improvement projects. These monies were collected from Montana Fish, Wildlife and Parks Sheep Auction funds and Rocky Mountain Elk Foundation.

Monitoring Habitat Improvement Projects
Forage Production

Methods: In past years, forage production was monitored using ECODATA plots (Hillis and Applegate 1998). In 1999, no such quantitative monitoring was done. Instead biologists conducted "walk-through's" of prescribed burns. Observations included: 1) percent shrub top kill across the landscape; 2) small understory tree mortality; 3) large tree mortality; and 4) ceanothus sprouting. Projects surveyed included the Munsen Ecosystem Management Burn (EMB), McGinty EMB, Whitehorse Activity Burn, Ranch Creek EMB, and the McCormick EMB.

Results: EMB's sampled were unusually consistent for shrub top kill which was 90-100% across all landscapes. Understory mortality averaged 50-100%. Large tree mortality averaged 1-2 trees/acre. All four burns sampled had pockets of total mortality. Whitehorse was the only burn with significant amounts of ceanothus sprouting. The observations suggest that EMB's are producing huge increases in big game winter forage consistent with the results monitored in 1998 (Hillis and Applegate 1998).

Weed Spraying on Mormon Ridge
The application of Tordon in 1997 to a knapweed-infested winter range has been heavily monitored each year since application. Results are recorded in changes in weed biomass, grass biomass, and forb biomass and are displayed annually in Table 1-6C.

Table 1-6C. Forage Production Plot Results.

	9/18/96 (Pretreatment)	**9/10/97 One growing season after treatment**	**7/15/98 Two growing seasons after treatment**	**8/11/99 Three growing seasons after treatment**
	lbs/acre (% of total biomass)	lbs/acre (% of total biomass)	lbs/acre (% of total biomass)	lbs/acre (% of total biomass)
Weed Biomass	1075 (56%)	25 (3%)	55 (2%)	130 (7%)
Forb Biomass	495 (26%)	99 (9%)	70 (2%)	150 (8%)
Grass Biomass	350 (10%)	928 (88%)	2850 (96%)	1663 (85%)
Total Biomass	1920	1052	2975	1943

Additional monitoring was done on plots that were seeded with native grass. Two of the three plots were heavily dominated by cheatgrass. Since native grasses may not germinate for a few years, monitoring will continue for several more years.

Overall Evaluation: The forest is exceeding Forest Plan projections for big game habitat improved in all but the wettest years. Monitoring indicates that burns are increasing forage available on winter range. The results of herbicide treatment also indicate significant increases

in per acre forage production. The impacts on herbicides on forbs need further monitoring and analysis.

Recommendations: Continued monitoring of the response of weed spraying on Mormon Ridge should be done to follow the response of native species and the abundance of cheatgrass.

ITEM 1-7
Threatened, Endangered, and Sensitive Plants and Plant Diversity

ACTIVITY, PRACTICE OR EFFECT TO BE MEASURED	REPORTING PERIOD	VARIABILITY (+/-) WHICH WOULD INITIATE FURTHER EVALUATION
Review of monitoring projects established by the Lolo botany program.	Annual	Any adverse effects on forb diversity or TES plants from project implementation or lack of habitat maintenance or restoration projects.

Introduction: This is a new monitoring item reported from the Lolo Botany Program. Information for this item will focus on current monitoring projects that were established to monitor project activities that may have beneficial or adverse affects on threatened, endangered, and sensitive (TES) plants and/ or plant diversity.

The list of sensitive plants for the Northern Region (Region One) of the Forest Service was revised in March of 1999. Seven new plants were added to the Lolo Forest's sensitive plant list. These seven species are: Beck water-marigold *(Bidens beckii)*, watershield *(Brasenia schreberi)*, beaked sedge *(Carex rostrata)*, Iceland-moss lichen *(Cetraria subalpina)*, sand springbeauty *(Claytonia arenicola)*, western pearl-flower *(Heterocodon rariflorum)*, and pale laurel *(Kalmia occidentalis)*. Three species were removed from the forest sensitive plant list, fringed onion *(Allium fibrillum)*, Mingan Island moonwort *(Botrychium minganense)*, and green-keeled cottongrass *(Eriophorum viridicarinatum)*. In addition, the US Fish and Wildlife Service published a proposal to list Spalding's catchfly (Silene spaldingii) as threatened in the December 3, 1999, Federal Register. This proposal affects the Lolo NF as potential habitat for this plant occurs in/near the Plains/Thompson Falls District. A list of the current sensitive, proposed threatened, and threatened species for the Lolo National Forest is included in Table 1-8A. The table also documents the number of occurrences per sensitive plant documented on the Lolo NF. One reported occurrence can include several observations of a rare plant. For example, common clarkia and clustered lady's slipper grow in small clusters or groups and several observations of these plants are common in one local and are reported as one occurrence. An occurrence reported here is unique if it is separated by more than one square mile from another occurrence.

Table 1-8A. List of sensitive, proposed threatened, and threatened plant species for the Lolo National Forest (2/2000) and number of occurrences reported on the Lolo NF.

Plant Species	**Common Name**	**Number of Occurrences on Lolo**
Adoxa moschatellina	Musk-root	1
Allium acuminatum	Tapertip onion	1
Allotropa virgata	Candystick	1
Amerorchis rotundifolia	Round-leaved orchis	
Arabis fecunda	Sapphire rockcress	
Athysanus pusillus	Sandweed	
Bidens beckii	Beck water-marigold	3

Botrychium paradoxum	Peculiar moonwort	
Brasenia screberi	Watershield	3
Carex chordorrhiza	Creeping sedge	
Carex livida	Pale sedge	1
Carex paupercula	Poor sedge	2
Carex rostrata	Beaked sedge	1
Cetraria subalpina	Iceland-moss lichen	
Clarkia rhomboidea	Common clarkia	6
Claytonia arenicola	Sand springbeauty	1
Cypripedium fasciculatum	Clustered lady's-slipper	14
Cypripedium parviflorum	Small yellow lady's-slipper	
Cypripedium passerinum	Sparrow's-egg lady's-slipper	
Dryopteris cristata	Buckler fern	3
Epipactis gigantea	Giant helleborine	
Eupatorium occidentale	Western boneset	
Gentianopsis simplex	Hiker's gentian	
Grindelia howellii	Howell's gumweed	12
Heterocodon rariflorum	Western pearl-flower	
Howellia aquatilis	Water howellia	
Idahoa scapigera	Scalepod	
Kalmia occidentalis/polifolia	Pale laurel	1
Mertensia bella	Oregon bluebells	3
Orogenia fusiformis	Tapered-root orogenia	1
Phlox kelseyi v. missoulensis	Missoula phlox	
Potamogeton obtusifolius	Blunt-leaved pondweed	
Scheuchzeria palustris	Podgrass	2
Scirpus subterminalis	Water bulrush	1
Silene spaldingii	Spalding's campion/catchfly	
Trifolium eriocephalum	Wooly-headed clover	
Trifolium gymnocarpon	Hollyleaf clover	1
Viola renifolia	Kidney-leaf white violet	1
Waldsteinia idahoensis	Idaho barren strawberrry	1

Proposed project activities that were surveyed and/or monitored in FY 99 include: commercial thinning, prescribed burning, trail construction, road construction, herbicide treatment, grazing allotments, land exchange, and salvage sales.

To avoid adverse impacts to TES plants, surveys are conducted for those plants with the highest likelihood of occurring in a proposed project area and where proposed activities would have an adverse affect on TES plants if they were present. If a rare plant is found, project mitigation can include protecting the plant by buffering the plant's location from activities.

In order to understand how rare plants adapt to management activities and/or the consequences of no management activity, Lolo botanists have established monitoring plots for three sensitive plants. Monitoring plots have also been established to determine the short- and long-term effects of herbicide treatments on non-target forb species.

Lolo botanists started establishing monitoring plots for clustered lady's slipper in 1994. Several occurrences of this plant have been found on the Superior District in forest habitats, mainly the

Douglas fir (*Pseudotsuga menziesia) /* ninebark *(Physocarpus malvaceus)* habitat type. Prior to the early 1990's, this plant was believed to inhabit wetter habitat types. To date, 28 plots have been established which include control (no treatment areas) and treatment plots. Treatments consist of graze and underburn, thin and underburn, clearcut and underburn, and underburn. Since 1994, only two plots have been treated with timber harvest and underburn. Nine treatment plots did not burn during burn treatments. Therefore, most plots are currently serving as controls.

In 1989, the forest botanist established a monitoring plot for Howell's gumweed on the Seeley Ranger District. This plant is found in various natural and human-disturbed habitats including grasslands, forest openings, river terraces, grazed pastures, and roadsides. On the Lolo, Howell's gumweed is currently known along roads. These sites support between one and a few hundred plants. Most populations are small colonies of a few individuals. The monitoring plot was established at a population in an abandoned road to determine whether human-disturbed sites are providing long-term habitat for the species. It also offers a chance to see how Howell's gumweed competes with spotted knapweed since this plant is present in the plot.

In FY 99, 24 mature plants and 47 seedlings of Howell's gumweed were sprayed during the summer with one pint/acre of Tordon along a roadside in Seeley Lake Ranger District. These plants will be monitored in 2000 and outyears, to determine any short-term and long-term impacts to this plant from this herbicide and rate of application.

In FY 99, common clarkia was found in future herbicide treatment areas and plots were established. Sixteen separate plots of clarkia were established on the Plains/Thompson Falls Ranger District. Thirteen of these plots will be part of a monitoring strategy to help assess the effects of herbicide treatments on clarkia.

In FY's 97-99, herbicide treatment of the Mormon Ridge Winter Range was monitored for effects on forb diversity. In October of 1996, five circular plots were established on Mormon Ridge with the express purpose of monitoring forb response to herbicide application. This winter range was sprayed with 1.5 pints/acre of Tordon on June 2 and 3 of 1997. The range was resprayed with 1 pint/acre of Tordon on October 4, 1999. Two plots were not resprayed and three others were sprayed. These plots will continue to be monitored yearly. We will assess long-term impacts from the initial herbicide application on the two plots that were not resprayed and short and long-term impacts of herbicide reapplication on the other three plots.

In addition, three macroplots were established in October, 1997, to test the effectiveness of seeding after herbicide spraying and prescribed fire.

Methods: Methods for establishing monitoring plots are described as follows:

<u>Clustered lady's slipper plots</u>: This plant grows in clusters as the name implies. A permanent marking stake is placed in the center of a cluster. From the center of the stake, overhead canopy cover is measured using a densiometer. Starting in 1999, we also ocularly estimated the percent of understory canopy cover (shrub, grass, and forb) in the plot area. Photos are taken of the surrounding vegetation at the four cardinal directions from plot center. Starting at North, we measure the distance and record the angle to the nearest clustered lady's slipper stem. For each stem we measure the longest leaf length, note if the plant is flowering or fruiting, if fruits are fertile or unfertile, note any herbivory of the plant, and also note any other interesting observations (e.g. potential pollinators on the plant).

<u>Howell's gumweed plot</u>: The 10 foot square plot is marked with steel spikes at the corners. Photographs of the plot are taken from a permanently marked camera point.

A vegetative species list was taken at this plot in 1989. The canopy cover of these plants was also estimated. Concerning Howell's gumweed, all individuals are mapped and the size class, vigor, and flowering success are also recorded. Individual plants are counted and recorded as seedlings, vegetative, or flowering plants.

Common clarkia plots: Clarkia also grows in scattered clumps and plots are established around a cluster of plants. The plot perimeter is staked and measured and plants are counted or estimated within the plot.
Photos of plots are taken.

Forb diversity plots: Five circular plots were established in five separate areas containing no to high (80% canopy cover) of spotted knapweed. A permanent marking stake is placed at plot center and a radius of 37 feet is used to establish the plot perimeter for a 0.1-acre plot. Canopy cover of forbs is ocularly estimated for each species of plant. Photos of the plot are taken at the four cardinal directions from plot center.

Native revegetation plots: Three macroplots were established in three separate areas. Each macroplot was 20 foot by 40 foot and was divided into two 20 square foot plots. Prior to seeding, all plots had good spray coverage and few native bunchgrasses. The native bunchgrass seed mix was applied at 20 pounds/acre. One plot was trampled after seeding and one was not to determine if trampling promoted germination.

Results:
Clustered lady's slipper plots: one control (no treatment) and two treatment plots (tree harvest and underburn). The treatment plots were harvested in 1997 (prior to 7/21/97) and the burn was done in May 1998 (prior to 5/13/98). Clustered lady's slipper plants had emerged prior to burning.

Table 1-8B. Clustered lady's slipper plots on the Ninemile District.

	Number of Stems			
	7/15/95	**7/21/97**	**5/13/98**	**8/23/99**
Control plot (#1)	44	81	100	37
Harvest and burn treatment plot (light burn) (#2)		78	54	81
Harvest and burn treatment plot (hot burn) (#3)		37	0	0

Howell's gumweed plots: The plot established in 1989 has been read in 1991 and 1995. Results from these readings are tallied in Table 1-8C.

Table 1-8C. Howell's gumweed plot on the Seeley District.

	8/10/89	**8/16/91**	**10/17/95**
Seedlings	120	13	9
Small vegetative individuals	20	47	31
Large vegetative individuals	26	18	12
Flowering individuals	9	4	4
Total	175	82	56

Common clarkia plots: No results to report to date.

Forb diversity plots: Prior to herbicide treatment, individual forb species in plots were commonly recorded as having trace to three percent canopy cover. In three plots, two forb species had higher canopy covers. Monitoring results documented several perennial forbs that were present in 1996 and/or 1997 were not present in 1999. These plants include: yarrow *(Achillea millefolium)*, nodding onion *(Allium cernuum)*, aster *(Aster spp.)*, dodder *(Cuscuta spp.)*, yellowbell *(Fritallaria pudica)*, hawkweed *(Hieracium spp.)*, nine-leaf lomatium *(Lomatium triternatum)*, and death camas *(Zigadenous venenosus)*. Several other perennial forb species experienced reductions in canopy cover or remained or were reduced to trace amounts. These plants include: arrowleaf balsamroot *(Balsamorhiza sagittata)*, paintbrush *(Castilleja spp.)*, prairie smoke *(Geum triflorum)*, puccoon *(Lithospermum ruderale)*, lupine *(Lupinus spp.)*, potentilla *(Potentilla spp.)*, yellow salsify *(Tragapogon dubious)*, common mullein *(Verbascum thapsus)*, and spotted knapweed *(Centaurea maculosa)*. In one plot, tumblemustard *(Sisymbrium spp.)* increased from 1% cover in 1997 to 30% cover in 1999. Tumblemustard is a non-native plant.

Native revegetation plots: Only one of the three plots burned hot enough to remove standing litter. Observations in the 1999 noted this plot had lower densities of cheatgrass within the plot as compared to immediately adjacent to the plot. Planted seed had also germinated and Idaho fescue *(Festuca idahoensis)*, western wheatgrass *(Agropyron smithii)*, and sandberg's bluegrass *(Poa sandbergii)* were growing. There was no apparent increase in seed germination in the trampled versus untrampled parts of the plot. Concerning the other two plots, no visual difference could be seen concerning the vegetation present inside or outside the plots. Also, the cheatgrass density was greater in both these plots as compared to the aforementioned plot.

Evaluation:

Clustered lady's slipper plots:

Results from control plots indicate that there can be a wide variation in the number of stems naturally from year to year. Therefore, it is important to try and sample at the same time each year. Plants start to grow by early May and senesce and dry by the end of August. Sampling is best performed in July. Short-term results (less than 3 years after final treatment) indicate that light mosaic burns are not harmful to clustered lady's slipper but hot fires that consume the duff layer are harmful.

Howell's gumweed plots: There has been a noticeable downward trend in total population size of gumweed at this monitoring site. This drop is apparent in all four-size categories. The downward trend is most prominent for seedlings and large vegetative individuals. Using plot photos from 1989 and 1991, the forest botanist determined that spotted knapweed cover didn't increase greatly from plot establishment. Spotted knapweed is the dominant vegetation in the plot, with an estimated 52% canopy cover.

Common clarkia plots: No evaluation, no treatment to date.

Forb diversity plots: Herbicide treatments of Tordon at 1.5 pint/acre reduce overall forb diversity in the short-term (three years or less). All native perennial plants experience decreases in biomass. Herbicide application at this rate dramatically increases the biomass of desirable native and non-native grass plants but can also increase biomass of weed species such as cheatgrass and tumblemustard. Long-term monitoring is needed to determine if short-term forb reduction is permanent or transitory and to document increases in desirable and undesirable plant species.

Native revegetation plots: Initial results indicate that the presence of cheatgrass in treatment areas can overwhelm any attempts to establish native grasses. Also, burning may be essential to establish a seedbed prior to seeding.

Recommendations:

Clustered lady's slipper plots: Continue sampling the Ninemile plots on a yearly basis to evaluate long-term results. Perform sampling in July. Establish new plots when the opportunity arises in areas that will receive treatments.

Howell's gumweed plots: Sample 1989 plot every five years to maintain trend information. Estimate cover of all species in plot area to determine to what degree spotted knapweed and shrub cover has increased. Monitor road occurrences of Grindelia on the Seeley District every ten years to help determine the viability and/or transitory status of these populations.

During FY 00, revisit gumweed plants sprayed with Tordon in FY 99 to assess herbicide effects.

Forb diversity plots: Monitor five plots yearly for at least 10 years to determine long-term effects from herbicide treatments. Set up additional monitoring plots in future herbicide treatment areas.

Native revegetation plots: Continue monitoring the three plots for a total of five years. Monitor any plot showing signs of successful regeneration up to ten years.