BEAVERHEAD-DEERLODGE NATIONAL FOREST

FOREST MONITORING AND EVALUATION REPORT
Vegetation Treatment

FISCAL YEAR 1998

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INTRODUCTION

This year marks 12 years of monitoring under the current Beaverhead Forest Plan and 11 years of monitoring under the current Deerlodge Forest Plan. Reports prepared over the years since 1986 and 1987, respectively, have identified where implementation of the Forest Plan is or is not achieving the Desired Forest Conditions and helped evaluated the effects of management practices. As we prepare to revise our Forest Plans, we have well documented information addressing monitoring items laid out by both Forest Plans. There are, however, forest issues that have not been addressed by the monitoring items laid out when the Plans were written.

Over the last five to ten years, land management concepts in the scientific community and the Forest Service have shifted from being resource based to ecosystem based. Concepts like landscape ecology, ecological process, biodiversity and forest fragmentation, all of which offer a new vision for the desired future condition of the Forest, were not incorporated as such in the current Forest Plans. As early as 1991, the Beaverhead National Forest Five Year Review recognized ecosystem management principles and found that "the Forest Plan provides the flexibility to apply ecosystem management principles but the Forest Plan may need to be adjusted to more fully address these concepts."

Landscape analysis has provided the Beaverhead-Deerlodge Forest a bridge to move from the traditional way of addressing the vegetation resources to addressing ecosystem health. The Forest has been divided into 10 different landscapes. The analyses completed or underway on 7 of these landscapes reveals several forest health issues not addressed by current Forest Plans. Those of most immediate concern being loss of aspen and changing stand structure and health of dry site Douglas-fir. Because the Forest Plans don't address these concerns, monitoring and evaluation of management practices related to Forest Planning have not either.

In an effort to answer some of the questions regarding the scale and effectiveness of recent treatments designed to improve ecosystem health, this years report looks at ecosystem management treatments in general and aspen and sagebrush treatments in particular. The Forest needed to improve its information about ecological based vegetation treatments in order to better achieve goals, and to be more defensible in environmental analysis.

MONITORING ITEMS

Because this is not a standard Forest **Plan** Monitoring and Evaluation Report, you will not find an evaluation of specific Monitoring Items and results by resource. This report is organized as a source of data, information, conclusions, and recommendations to be forwarded to Forest Plan Revision. The report tracks the following items:

Vegetation Treatments for Ecosystem Health
- A. Status of vegetative health on the Forest
- B. Summary of Accomplishments in 10 years using fire

Aspen Treatments: Success, Failure and Future Strategies
- A. Status of Aspen Health on the Forest
    - Problem Statement
    - Process for monitoring, evaluation and recommendation
    - Factors affecting Aspen Health

SUMMARY OF FINDINGS

Vegetation Treatments for Ecosystem Health

In recent years, the Forest has dramatically increased the number of acres treated by management-ignited prescribed fire. The primary purpose for these projects tends to be ecosystem restoration, recognizing fire as a primary ecological process essential to maintaining vegetation health. The Beaverhead-Deerlodge Forest burned about 49,000 acres of vegetation for purposes other than timber production during the ten year period from 1989 to 1999. The number of acres treated accelerated since 1996, almost 70% occuring in the last 3 years. The improvement of shrublands (23,127 acres) or Douglas-fir and aspen stands (10,964 acres) made up the majority of projects. These projects are scattered widely across the Forest.

Stands affected by burning over the last decade were mapped using GIS. Mapping difficulties arise due to the nature of the TSMRS data base. Treatment acres reported in the data base are based on planned unit boundaries. Within these units, only a percent is blackened. Without site specific digitizing of each unit, the GIS map is only able to display the total stand affected, which may be much larger than the planned unit. For this reason, the map only displays spatial relationships and relative scale of treatment types.

Aspen Treatments

Monitoring of past aspen treatments on the Forest has been variable. Quantitative data was only available on 20 of 140 project sites. Files documenting aspen work are found under a number of file codes: wildlife improvement, range improvement, fuel treatment, and timber stand improvement or simply in "the aspen box" on someone's desk. In most cases, past monitoring data has not been collected together, compared, and/or analyzed.

Under an intensive monitoring program this summer, data was gathered on an additional 80 treatment sites. As a result of this years monitoring and evaluation work, the Forest also develped a strategy for treating and monitoring aspen. District specialists now have a consistent process that leads them from evaluating the priorities for stand treatment, identifing risks of treatment, establishing a target stand, designing strategies for treatment, monitoring effectiveness, and finally, reporting and filing the information. This strategy was developed by the Forest Monitoring Team with assistance from research (Rocky Mountain Experiment Station) and specialists forest wide.

Effectiveness of aspen treatment on the Forest has been variable and highly site specific. We have two types of aspen situations which allow some generalization about treatment techniques and success. In the Gravellys, Lima Tendoys, and North Flints aspen is a larger component of the landscape and responds better to larger scale treatments without fencing. These sites tend to be more productive and have better water-holding capabilities. Most treatments in this zone have an acceptable degree of sprouting and survival. Burning up to the perimeter or through portions of aspen stands in conjunction with burning sagebrush or Douglas-fir has been effective as has cutting down standing trees. Browse impacts need to be evaluated on a site specific basis.

On the rest of the Forest, aspen is usually a small and isolated component of the landscape. Aspen suckers draw in deer, elk and moose. Fencing is essential to survival of sprouts. Fencing has been somewhat effective when applied to either treated or untreated sites as long as its designed for the right browse species and is maintained. On the whole, aspen treatment in this zone has not been successful. An important strategy here will be leaving the existing stems on site, disturbing the auxin flow through techniques less traumatic (burning or ripping around the perimeter, removing conifer shade) than stand replacement, and fencing the site until sprouts are six to eight feet tall.

Sagebrush Treatments

Monitoring of sagebrush burns on the south zone of this Forest is a requirement of the recently signed Memorandum of Understanding between the Beaverhead-Deerlodge National Forest and Montana Fish, Wildlife and Parks, April 1998. The agreement lays out guidelines for accomplishing mosaic burn patterns with the objective of maintaining sufficient mature and old growth sagebrush for sage dependent wildlife species. The purpose of monitoring sagebrush treatment is to focus specifically on whether we are meeting the terms of the MOU.

As a result of this years monitoring effort, a protocol for reporting to MT FWP annually has been developed. Effectiveness of the burn program in meeting the terms of the MOU as well as Forest Service ecological restoration objectives was evaluated. This reporting protocol will be refined this winter and in place for future years.

Effectiveness was evaluated based on compliance with objectives. Compliance was measured by acres blackened, mosaic pattern, and narrative description of whether vegetative objectives were met. In 1998 the south zone of the Beaverhead-Deerlodge Forest proposed treating 5,383 acres, of sagebrush under the guidelines of the Memorandum of Understanding (MOU) with Montana Fish, Wildlife and Parks (Mt FWP). Of those acres, 2,286 were actually blackened, an average 42% burned. MOU objectives were fully met on all but two units. Mt FWP biologists were consulted and other planned areas left unburned as mitigation. Two of these seven projects also fully met Forest Service project objectives for vegetative restoration. The remaining were less than successful because they did not burn as much targeted as planned (aspen or Douglas-fir colonization) .

Thirteen projects ***not*** subject to the MOU were also proposed for burning. Of those, 1210 acres were actually blackened of the 3102 acres proposed. With two exceptions, these vegetation treatments ALSO fell within the limits of the MOU guidelines. All of these projects also met Forest Service objectives for vegetative restoration

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VEGETATION TREATMENTS FOR ECOSYSTEM HEALTH

A. Status of Vegetation Health on the Forest

Vegetation management in both the Beaverhead (1986) and Deerlodge (1987) Forest Plans focus on harvesting lodgepole pine to provide a timber product and maintain forest health in light of mistletoe and mountain pine beetle problems. Clear-cutting is the primary method emphasized. Landscape analyses completed since 1995 (Tobacco Root Mountains, Madison, Pioneers, Boulder River, Gravelly, Clark Fork/Flints) found the most immediate forest health concerns result from lack of fire in aspen and Douglas-fir stands. Use of fire in conjunction with selective harvests are suggested as the primary tools. Lack of disturbance in other vegetation cover types are also a concern, but risk of losing ecological function in these stands is not as imminent.

Prior to landscape analysis, the concept of ecosystem management was implemented on smaller vegetation projects independent of each other. On the Beaverhead Forest, the Trail Creek (1990) and Bender-Retie (1991) Environmental Impact Statements were the first on the Forest to base their analysis of effects on modeling of historical disturbance regimes On the Deerlodge, in 1994, an analysis of the North Flints Landscape Ecology Unit also set the stage for an ecosystem management based vegetation project. Since then, numerous other smaller vegetation management projects conducted within the guidelines of the Forest Plans utilized ecosystem management concepts to design treatment strategies in lodgepole pine, Douglas-fir, and sage/grass/aspen ecotones. The acres treated over the last decade using these strategies has been summarized for the Forest in the table below and displayed by District on the attached maps.

This section does not address harvest of conifers using standard methods for the purpose of providing wood products as prescribed by the current Forest Plan. Nor does it include burning related to slash disposal and fuel treatments in timber sale units.

Figure 1. Ecosystem burn treating a mix of Douglas-fir, aspen, and sagebrush Freezeout drainage, Madison Ranger District, 1996

B. VEGETATION TREATMENTS USING FIRE

Beaverhead-Deerlodge Forest Summary

1989-1999

(based on TSMRS query by activity code - 8/6/99, duplicate reports excluded)

PURPOSE	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Spring 1999	**TOTAL**
Ecosystem Imp. - Grassland		111			278	251	95	1400	958	733	345	**4,261**
Ecosystem Imp. - Shrubland				191	1046	3697	1112	4557	4396	5361	2767	**23,127**
Ecosystem Imp. - Stand Modific. (Dougfir,aspen)				225	750	937	439	930	3775	3078	830	**10,964**
Understory Burn					422	287	621		341	348	160	**1,831**
Wildlife Improvement	600	405	210	81	72	63	529	89	10	455	330	**2,644**
Range Improvement	695				1011	106		140	1126	571	437	**4,086**
Shrubland Grassland Burn				390	72	1187	10		25			**1,684**
TOTAL	**1295**	**516**	**210**	**887**	**3651**	**6528**	**2806**	**7116**	**10631**	**10546**	**5069**	**48,855**

VEGETATION TREATMENTS USING FIRE

Beaverhead-Deerlodge Forest Summary

1989-1999

(based on TSMRS query by activity code - 8/6/99, duplicate reports excluded)

NORTH ZONE

YEAR	PURPOSE	DISTRICT	ACRES
1989	Range improvement	Jefferson	505
	Annual TOTAL		**505**
1991	Wildlife improvement	Jefferson	210
	Annual TOTAL		**210**
1992	Ecosystem Imp.-Stand Modification	Jefferson	185
		Deer Lodge	24
	Shrubland/Grassland Burn	Jefferson	48
	Annual TOTAL		**257**
1993	Ecosystem Improvement-Grassland	Jefferson	13
	Ecosystem Improvement - Shrubland	Jefferson	621
	Ecosystem Imp. Stand Modification	Jefferson	467
	Understory Burn	Deer Lodge	170
		Philipsburg	252
	Annual TOTAL		**2123**
1994	Ecosystem Imp.Stand Modification	Deer Lodge	123
	Shrubland/Grassland Burn	Jefferson	1124
	Understory Burn	Philipsburg	57
		Jefferson	230
	Annual TOTAL		**1534**
1995	Wildlife Improvement	Philispburg	413
	Understory Burn	Jefferson	463
		Philipsburg	158
	Annual TOTAL		**1034**
1996	Ecosystem Improvement-Shrubland	Jefferson	1776
	Ecosystem Imp.Stand Modification	Philipsburg	930
	Annual TOTAL		**2706**
1997	Ecosystem Improvement-Grassland	Jefferson	243
		Deer Lodge	382
	Ecosystem Improvement-Shrubland	Jefferson	773
		Philipsburg	489
	Ecosystem Imp.-Stand Modification	Jefferson	1035
		Philipsburg	1275
	Understory Burn	Philipsburg	100
	Annual TOTAL		**4297**

1998	Ecosystem Improvement-Grassland	Jefferson	400
	Ecosystem Improvement-Shrubland	Deer Lodge	916
		Jefferson	78
		Philipsburg	799
	Ecosystem Impr.Stand Modification	Deer Lodge	564
		Jefferson	1336
	Annual TOTAL		**4093**
1999	Ecosystem Improvement -Grassland	Deer Lodge	345
	Ecosystem Improvement - Shrubland	Philipsburg	618
		Deerlodge	344
	Ecosystem Imp. Stand Modification	Jefferson	721
	Annual TOTAL		**2028**

SOUTH ZONE

YEAR	PURPOSE	DISTRICT	ACRES
1989	Wildlife Improvement	Wisdom	400
	Range Improvement	Madison - west	130
		Madison - east	60
	Annual TOTAL		**590**
1990	Ecosystem Improvement -Grassland	Dillon	111
	Wildlife Improvment	Madison - west	405
	Annual TOTAL		**516**
1992	Ecosystem Improvement - Shrubland	Madison - east	191
	Ecosystem Imp. Stand Modification	Madison - east	16
	Wildlife Improvement	Wise River	81
	Shrubland/Grassland Burn	Madison - east	232
		Wise River	110
	Annual TOTAL		**630**
1993	Ecosystem Improvement -Grassland	Wise River	265
	Ecosystem Improvement - Shrubland	Madison - east	425
	Ecosystem Imp.Stand Modification	Madison - east	283
	Wildlife Improvement	Wise River	72
	Range Improvement	Madison - east	1011
	Shrubland/Grassland Burn	Wise River	72
	Annual TOTAL		**2128**
1994	Ecosystem Improvement -Grassland	Wise River	251
	Ecosystem Improvement - Shrubland	Madison - east	3697
	Ecosystem Imp.Stand Modification	Madison - west	389
		Madison - east	425
	Wildlife Improvement	Wise River	63
	Range Improvement	Madison - east	106
	Shrubland/Grassland	Wise River	63
		Annual TOTAL	**4994**
1995	Ecosystem Improvement -Grassland	Wisdom	95
	Ecosystem Improvement -	Wise River	157
	Shrubland	Wisdom	105
		Madison - west	850
	Ecosystem Imp. Stand Modification	Madison - west	40
		Madison - east	399
	Wildlife Improvement	Wisdom	116
	Shrubland/Grassland	Wise River	10
		Annual TOTAL	**1772**
1996	Ecosystem Improvement -Grassland	Dillon	1400
	Ecosystem Improvement -	Wise River	89
	Shrubland	Madison - west	1205

		Madison - east	1487
	Wildlife Improvement	Wise River	89
	Range Improvement	Wise River	140
		Annual TOTAL	**4410**
YEAR	**PURPOSE**	**DISTRICT**	**ACRES**
1997	Ecosystem Improvement -Grassland	Dillon	65
		Wise River	50
		Madison - east	218
	Ecosystem Improvement -	Dillon	860
	Shrubland	Madison - west	1369
		Madison - east	905
	Ecosystem Imp.Stand Modification	Dillon	625
		Wise River	122
		Madison -west	337
		Madison - east	381
	Wildlife Improvement	Wise River	10
	Understory Burn	Dillon	100
		Wise River	85
		Madison - east	56
	Range Improvement	Wise River	65
		Wisdom	226
		Madison - west	337
		Madison - east	498
	Shrubland/Grassland Burn	Wise River	25
		Annual TOTAL	**6334**
1998	Ecosystem Improvement -Grassland	Dillon	10
		Wise River	160
		Madison - east	163
	Ecosystem Improvement -	Dillon	425
	Shrubland	Wisdom	174
		Madison - west	1076
		Madison - east	1893
	Ecosystem Imp.Stand Modification	Dillon	1120
	or Understory Burn	Wise River	151
		Wisdom	185
		Madison - east	70
	Wildlife Improvement	Wise River	80
		Madison - east	375
	Range Improvement	Wisdom	176
		Madison - east	395
		Annual TOTAL	**6453**
1999	Ecosystem Improvement -	Wise River	131
	Shrubland	Wisdom	110
		Madison - west	966
		Madison - east	598
	Ecosystem Imp.Stand Modification	Madison - east	109

	Wildlife Improvement Understory Burn	Madison - east Wise River Wisdom	330 92 68
	Range Improvement	Wisdom	437
		Annual TOTAL	**2841**

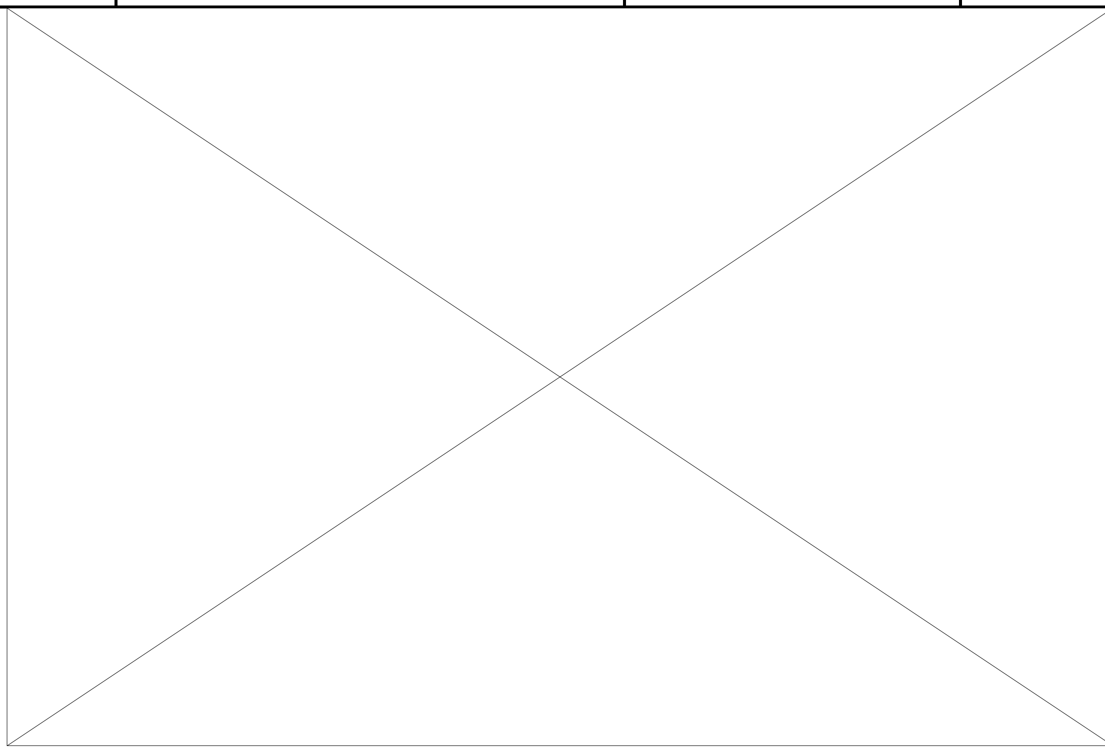

Figure 2. High risk aspen clone, overtopped by conifers, Dillon Ranger District, 1999

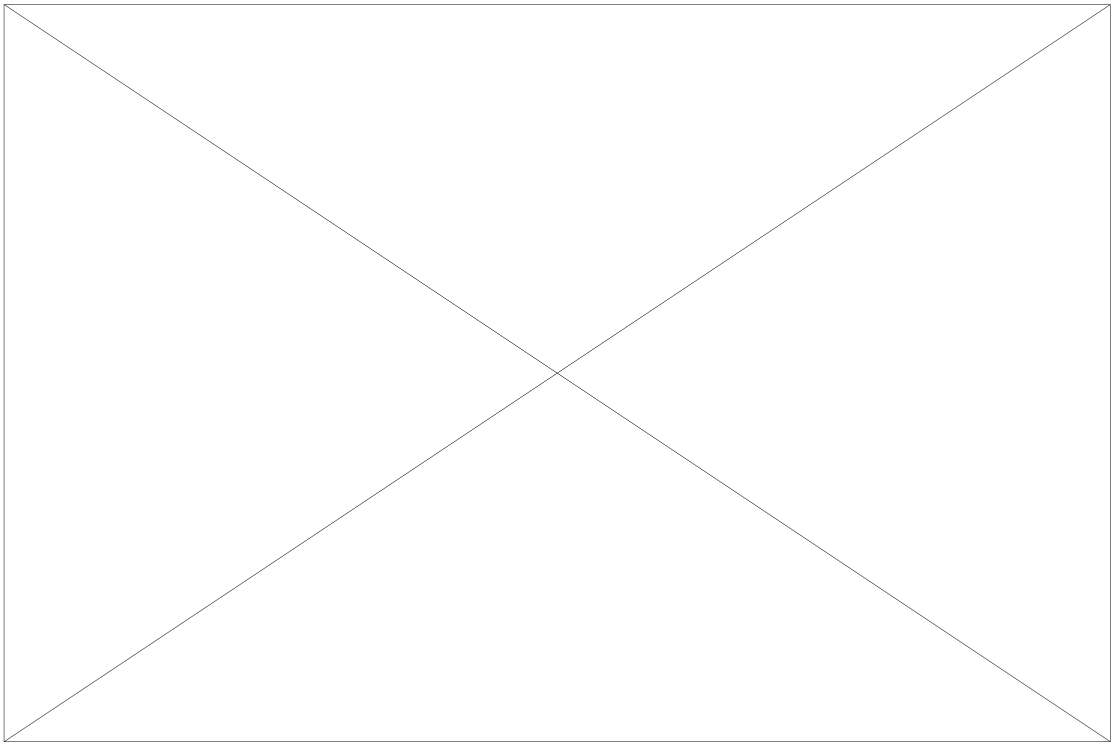

Figure 3. Healthy aspen clone, several age classes, Dillon Ranger District, 1999

ASPEN TREATMENTS
Success, Failure and Future Strategies

A. STATUS OF ASPEN HEALTH ON THE BEAVERHEAD-DEERLODGE FOREST

Problem Statement:

Aspen is an important element of landscapes in southwest Montana, primarily for biodiversity, wildlife habitat, scenery and recreation. Our 1986 (Beaverhead) and 1987 (Deerlodge) Forest Plans made only cursory mention of aspen's value or the need to regenerate aspen. Research conducted since the Plans were written verify aspen is declining at an increasing rate due to lack of disturbance (primarily succession to conifers) and browsing. At a large scale, the Forest has been essentially fire free for 125 years. At 100 years old stands begin to decline without disturbance. A study conducted by the Beaverhead-Deerlodge National Forest and the Remote Sensing Applications Center in Salt Lake showed declines in aspen populations of 45% in the southern Gravelly Range between 1947 and 1992. The Rocky Mt Research Station in Logan reports an estimated loss of 75% of aspen throughout the Rockies in the last 100 years: USDA, 7140 RSAC, March 1997. The Northern Region Overview (October 1998) reports aspen health as a Very High Risk and a number 1 priority for restoration work throughout forests in Montana and Idaho.

Aspen regeneration projects have been conducted on all 8 districts of the Forest over the last decade with mixed success. A number of different techniques used on different sites have produced both success and failure. The two primary causes of failure are browsing and *cytospora* canker. Because of some of these failures, forest specialists debate internally whether we should continue to treat this unique plan community. Are the risks of losing the clone higher than the benefits of restoring the clone? Some data has been collected over the years to address monitoring requirements of specific projects. The data is in various formats, responding to differing objectives. It has been difficult to use the data to answer forest-wide questions, primarily because the data has not been collected consistently, compared, and/or analyzed.

We set out to study what works and what doesn't, and more importantly, are our aspen treatments buying us anything? Where they are failing, can we improve our success?

The process for monitoring, evaluation and recommendation:

The Forest convened an Aspen Monitoring Team in the Fall of 1998. Their purpose was to evaluate the success of past years of aspen treatments and make recommendations for future treatment strategies and consistent monitoring techniques. The team had representatives from 5 districts and the Supervisors Office and represented the disciplines of ecology, silviculture, general forestry, soils, fire management, wildlife biology, land use planning, and range management.

Existing aspen treatment information and monitoring data was collected from all Districts and tabulated for review in March and April. Project data was gathered for 140 aspen treatments. The size of the treatments ranged from 1/100 acre to over a hundred acres. Some of these were not intentional, such as large clear-cuts where aspen regenerated following treatment. Others were incidental inclusions of aspen in sagebrush treatments. More recent treatments specifically targeted aspen. Of the 140 sites, 17 were sampled quantitatively. Several others had permanent photo plots.

Eighty of the treatment sites were revisited this summer. Supplemental quantitative data was gathered on sprouts per acre, sprout height, browse impacts, type of site, and type of treatment. Permanent photo plots were installed. These sites were distributed across all 8 districts on a number of treatment types. This data and the resulting conclusions are found in section B on page 15. In addition, the team compiled data relating to some of the factors that affect aspen health on our Forest that may help forest specialists prioritize stands and predict success. These include soils, browse impacts, a way of classifying the types of aspen stands by landscape, and pertinent research findings. This information follows in the next section.

The team used this monitoring, their own experience, research findings, and scientific review (Rocky Mountain Research Station) and peer review (Forest Aspen Workshop and Field Trip) to develop a "Recommended Strategy for Aspen Treatment & Monitoring on the Beaverhead-Deerlodge Forest". This draft document is included in Section C.

Participation by research was critical in analyzing the results of our monitoring and developing recommendations for future strategies. Aspen specialists from the Rocky Mountain Research Station, Dale Bartos (Logan) and Wayne Shepperd (Fort Collins), assisted in several phases of the project. They reviewed both data and anecdotal information about our successes and failures. They provided interpretations of the results of specific treatments. They supplied the most current research findings and shared their knowledge and experience. They assisted in developing treatment strategies and monitoring techniques. At our request Dale Bartos developed a photo index for visually assessing aspen suckering called "visual Guide to Aspen Monitoring". Dale also assisted us in sponsoring both a forestwide aspen workshop (May 1999) and a field review (September 1999) of our proposed monitoring strategy with specialists from numerous disciplines across the Forest.

Factors Affecting Aspen Health:

Soils

Beaverhead Zone (Dan Svoboda)
Most of the aspen acreage, as well as the largest stands on the Beaverhead-Deerlodge Forest, occur in the Gravelly Range and the Lima Peaks areas on the Forest. Gross soil characteristics in both these landscapes include domination by "fine-silty" and "fine" particle size classes. Soil textures are typically silt loams, clays, and silty clay loams. The relationship between amount of area and size of stands with soil particle-size classes appears to hold. Soil parent materials are usually shales, sandstones, and volcanics.

These particle size classes have high internal surface area compared to most of the other portions of the Forest. They hold high amounts of moisture under tension and have a large ionic exchange capacity, making them more chemically reactive than other kinds of soils. Their organic matter content is commonly higher than less well-weathered soils with more resistant mineralogies, attesting to their productivity.

Stands in the North Big Hole, particularly from Mt. Haggin down to about Mudd Creek, often have older soils that have been buried by till from alpine glaciation. These soils, like many of those in the Gravelly and Lima Peaks areas, have argillic subsoil horizons. These illuviated clay layers hold moisture and most everything else that moves down through the surface soils. Timber plots on these sites have higher productivity than glacial till without these relatively shallow buried soils. These areas also seem to have more and larger aspen stands compared to similar land forms without the till/buried argillic soils.

There are other kinds of characteristics of the Gravelly and Lima Peaks soils that intuitively are different, but no data has been collected to verify it. For example, the fungal to bacterial ratio would seem to be lower in the riparian and shrubland habitat aspen stands compared to the coniferous habitat type aspen stands.

Deerlodge Zone (John Hamann)
Most of the aspen on the north zone are relatively narrow linear stands in drainages on alluvial soils or soils that have developed from glacial till. Significant acres of aspen are on upland positions, also often on disturbed soils. The majority of the upland stands are less than 3 acres with notable exceptions in the Willow Creek/Rock Creek area of the North Flint Creek Range and on the highly disturbed slopes above Butte and Anaconda. The parent materials of aspen soils vary widely from mixed till and alluvium, to granitics, volcanics, Belt series quartzites, and mixed sedimentary rocks. Common themes of aspen soils are dark surfaces, argillic horizons or fine-loamy or

finer textures, and deep depths. As noted for the aspen soils of the south zone, typical aspen soils have high organic matter contents and high water holding capacities which make them highly productive.

The aspen soils of highly disturbed sites, often associated with historical mining and smelting, seem to only have disturbance in common. Much of the aspen on the north zone appear to be seral and many of these stands are 80 to 100 years old, deteriorating and have little regeneration initiated. Small aspen stands younger than 80 to 100 years can be found, usually associated with nivational hollows, slope failures with shallow water tables and wetter portions of clear cuts.

Browsing

Elk population trends show that from 1890 - 1930 elk were almost gone from the area due to subsistence hunting. In the 1940's there were 22,000 head in Montana. Today there are 125,000 elk in the state with a harvest of 32,000 elk annually. In 1984, Montana Fish Wildlife and Parks goal for elk summering on the Beaverhead National Forest was 12,000 (Beaverhead Forest Plan). Today, there are an estimated 23,000 elk summering on that same area (Ken Hamlin, pers. comm). Browsing by both elk and livestock has affected aspen heavily in many areas.

Since the late 1980's, riparian surveyors have noted what they described as "high browse use" on riparian shrubs and aspen on the Beaverhead-Deerlodge National Forest. Forest ecologists have begun to note these observations and measurements in the "Existing Condition" chapter of environmental assessments and impact statements.

Montana Department of Fish, Wildlife, and Parks (MtFWP) and Rocky Mountain Elk Foundation sponsored a research project, conducted by Dr. Richard Keigley, USGS, Biological Resources Division to evaluate browse effects on willow, aspen, and birch in southwest Montana.

Beginning in 1997, Dr. Kiegley began taking browse history data and setting up exclosures in South Steel Creek, near Wisdom, MT, on the Beaverhead NF. He has since expanded data collection to other sites in southwest Montana. He has also worked extensively in Yellowstone National Park. Richard and Mike Frisina (MtFWP range coordinator) have published "Browse Evaluation by Analysis of Growth Form" (1997; 1998). This method has been adopted to replace the browse evaluation method in the Beaverhead Riparian Guidelines (1990; 1998).

Raw data sets for the southwest Montana sites show that for all sites and species (willow, aspen, birch), the regeneration and younger age classes are *arrested* or *retrogresse*d in their height growth. Only older and now taller shrubs and trees have uninterrupted height growth. *Arrested* height growth is produced by chronic, intense browsing where a complete annual segment is killed. Unless browse conditions change, these plants will not reach their typical stature. Under chronic intense browsing, the entire plant eventually dies. *Retrogressed* height growth is produced when browsing level changes from light-moderate to intense. During the initial period of light - to -moderate browsing, the plant grows taller than arrest-height. But when browsing increases to intense, the upper stem or stems are killed. This information has significant implications for the survival of natural aspen suckers and treated stands.

Classification of aspen clones:

The Beaverhead-Deerlodge has two distinct clonal situations on its landscapes:

Situation A: Most aspen are small clones, decadent, in poor health. Remnant stands in conifer have almost disappeared. Because these stands are small and scattered, they are more susceptible to browse impacts. It is difficult to treat a large enough area to spread out the browsing. In several areas, this situation also overlaps with moose habitat, increasing browse pressure and the difficulty of protecting suckers. Examples: Pioneer Mountains, North Bighole, Highlands.

Situation B: Large aspen stands are more common on this landscape, though small stands do occur. Aspen health is good to poor. Conifer stands are less dominant, other forage is available to browsers (grass, willow, sagebrush, dogwood, etc). Larger scale treatments have been more successful because fencing is not always necessary.

Examples: Gravelly Range, Lima Peaks, Tendoys, North Flints.

B. RESULTS OF 1999 MONITORING OF PAST TREATMENTS

District	Site Name*	Trt Date	Sprouts/Acre**	Sprout Ht	Browse	Site Type***	Stand Replaced?	Treatment Type
Dillon	S.Fork Mdn	1991	3,500	6	H	R	Y	slash aspen
Dillon	Gorge Creek	1997	700	1.5	H	R/U	Y	burn, fence
Dillon	Middle Mtn	1997	100	1	H	U	N	slash/burn
Dillon	Willow Div	1997	21,000	2.5	L/M	U	Y	slash/burn
Dillon	French Creek	1997	900	1	L	U	Y	slash conifer
Dillon	Gorge Creek	1997	700	1.5	H	R/U	Y	burn, fence
Dillon	M Fk Mdn	1989	2000	2.5	H	R/ST	Y	slash aspen
Dillon	Black Mt	1991	800	1.5	M	U	Y	slash conifer
Dillon	S Fk Mdn	1991	6,000	6	M	U	Y	slash aspen
Dillon	Swamp Creek	1975	200	2.5	H	U	Y	fenced
Dillon	Gorge Creek	1997	700	1.5	H	R/U	Y	burn, fence
Wise River	Pintlar Lake	1998	20	.5	H	R	N	logged
Wise River	Pintlar Lake	1998	2500	2	L	R	Y	logged
Wise River	Pintlar Lake	1998	50	2	H	R	N	slash/logged
Wise River	Adson	1997	750	1.5	H	R/ST	Y	burned
Wise River	Pattengail	1988	300	.8	H	U	Y	logged
Wise River	Adson	1997	2,000	2	M	R	N	logged
Wise River	Pintlar Lake	1998	50	1	H	U	N	logged
Wise River	East Fk Fishtr.	1997	20	.5		U	N	burned
Wise River	Pintlar Lake	1998	150	1	H	U	Y	logged
Wise River	Crozier Creek	?	400	.8	H	R	Y	logged
Wise River	Knobby Park	1996	3,000	.8	L	R	Y	slash conifer
Wise River	Lincoln Park	1998	300	.8	L	R	Y	slash conifer
Wise River	Bryant Creek	1998	800	1.5	M	U/R	Y	logged
Wise River	Harriet Lou	?	3500	.8	H	U/R	Y	slash conifer
Wise River	Panama	1978	500	35	H	U	Y	logged
Wisdom	Foothills	1994	500	1	M	ST	N	slash conifer
Wisdom	Doolittle	1998	6,700	.5	H	U	N	slash conifer
Wisdom	Steel Horse P	1985	100	8	H	R	Y	sl/burn/fence
Wisdom	Steel Horse P	1985	400	3	H	R	Y	slash/fence
Wisdom	Steel R.S.	1998	1200	1	H	U	N	slash conifer
Wisdom	Doolittle	1998	2,700	1	H	U/R	N	slash conifer
Wisdom	Doolittle	1998	2,500	1.5	H	U	N	slash conifer
Wisdom	Doolittle	1998	1,100	.5	H	U	N	slash conifer
Wisdom	Big Swamp	1992	800	1.5	H	U/R	N	slash conifer

District	Site Name*	Trt Date	Sprouts/Acre**	Sprout Ht	Browse	Site Type***	Stand Replaced?	Treatment Type
Wisdom	North #5	1997	200	.8	H	U/R	Y	slash conifer
Wisdom	Isaac Meadows	1992	1,500	1.5	H	U	N	slash conifer/fence
Wisdom	Doolittle	1998	2,000	.5	H	U	N	slash conifer
Wisdom	Mystic Aspen	1999	750	.5	H	R	Y	slash/burned
Wisdom	Doolittle	1998	1,350	1	L/M	R	N	girdled con
Wisdom	Steel Horse P	1985	1,800	1	H	U	Y	slashed
Madison	Gold Butte	1996	3,500	3.5	M	U	Y	burn
Madison	Antelope Basin	1993	9,000	5	M	U	N	burn
Madison	Bogus Basin	1994	500	1.5	M	U	N	burn
Madison	Doubtful	1980	400	4	H	U	Y	burn
Madison	Doubtful	1980	2,800	3	H	U	Y	burn
Madison	Doubtful	1980	5,200	5	H	U	Y	burn
Madison	Doubtful	1980	4,000	7	M	U	N	burn
Madison	Doubtful	1980	3,700	7	H	U	Y	burn
Madison	W Fork Madison	1997	4,800	1	M	U	Y	burn
Madison	Antelope Basin	1993	2,000	6	L	U	Y	slash aspen
Madison	Gold Butte	1996	1,800	2.5	H	U	N	burn
Madison	Antelope Basin	1993	6,000	5	L	U	Y	slash aspen
Madison	Antelope Basin	1993	2,500	3	H	U	N	burn
Madison	Antelope Basin	1993	3,200	2	M	U	N	disease
Madison	Antelope Basin	1993	3,500	4.5	M	U	Y	slash aspen
Madison	Antelope Basin	1993	500	4.5	M	U	Y	slash aspen
Madison	Elk Lake	1994	600	2	M	U	Y	burn
Madison	Divide Creek	1989	200	2	H	U	Y	burn
Madison	W Fork Madison	1994	700	1	M	U	N	burn
Madison	W Fork Madison	1994	500	1	M	U	Y	burn
Madison	W Fork Madison	1997	3,400	2	M	U	Y	burn
Madison	W Fork Madison	1997	1,800	1.5	H	U	N	burn
Jefferson	South Pony	1994	300	2	M	U	N	burn, fence
Jefferson	Del Salvage b	1991	0			R	N	burn, fence
Jefferson	Del Salvage a	1991	0			R	N	burn, fence
Jefferson	Del Salvage TS	1991	100	2.5	M	R	N	logged
Jefferson	Hells L Ex	1995	1,000	2	H	R/U	N	fence
Jefferson	South 3rd Creek	1995	100	2	H	U	N	logged, burn
Jefferson	Hells U Ex.	1993	300	1.5	H	R	Y	burn, fence
Jefferson	N 3rd Creek	1995	20	1.5	H	R	Y	slash, burn

District	Site Name*	Trt Date	Sprouts/Acre**	Sprout Ht	Browse	Site Type***	Stand Replaced?	Treatment Type
Jefferson	NW Bull	1995	30	1	H	R	N	slash, burn
Deer Lodge	Blum Dreen	1993	1,800	5	M	U	Y	logged
Deer Lodge	Willow Creek	1964	2,500	30	H	U	Y	logged
Deer Lodge	Jackson Peak	1991	550	3	H	R/U	N	slash, fence
Deer Lodge	Crevice Creek	1994	2,100	2	M	U	Y	sl aspen,log
Deer Lodge	Douglas Creek	1981	750	7	M	R	Y	slash, fence
Philipsburg	Happy Creek-5d	1995	16,400	.5	H	R/ST	N	cl conifer
Philipsburg	Happy Creek-5c	1995	700	1	H	R	N	sl con/fence
Philipsburg	Happy Creek-5b	1995	500	1	H	R	N	sl con/fence
Philipsburg	Happy Creek-5a	1995	3,600	1	H	R	N	sl con/fence
Philipsburg	Happy Creek-2a	1995	3,200	.75	H	R	N	cl conifer
Philipsburg	Happy Creek-2b	1995	4,600	1	H	ST	N	cl con/fence
Philipsburg	Happy Creek-2c	1995	600	.5	H	U	Y	burn/fence
Philipsburg	Happy Creek-2d	1995	3,600	1.5	H	U	Y	burn/fence
Philipsburg	Happy Creek-6	1995	1500	.8	H	U	Y	sl as/burn

*Site Name - specific site id with original report, fsfiles/unit/plan/forest_monitoring/aspen_monitoring/1999_data_table

Sprouts/Acre - for the purposes of this report: 0-2500 = in danger, 2,500-5,000=questionable 5,000+=likely to succeed * Type R=Riparian U=Upland

Preliminary* Findings:

The success of our aspen treatments is highly site specific. Two generalizations can be made, however. Aspen responds best to traditional treatments in the southern portion of the forest. On the Madison District, aspen is a major component of many landscapes. Patch size, especially of the upland clones tends to be larger than on the northern portion of the forest. Treatments are fairly large and while wildlife populations are high, browse activity can be somewhat dispersed. Landscape scale vegetation treatments which use fire to treat a variety of cover types (sagebrush, colonization, aspen, Douglas-fir) are generally successfull at regenerating aspen stands. The question of whether we can regain aspen acreage lost over the last few decades on these sites will need to be answered by periodic monitoring at landscape scales.

Regenerating aspen using stand replacement techniques has been problematic in many areas on the northern portion of the forest where soils have less moisture holding capability. Landscapes on the north end of the forest have a more limited aspen component. Patch size tends to be small, usually less than five acres in upland clones and many riparian clones are even smaller. Because patch size is small and wildlife populations are high, it is difficult to treat enough of the area to disperse browse activity. In some areas aspen regeneration is likely to experience both insufficient and excessive moisture leading to lethal infections of *Cytospora.*

More specifically:

- Aspen treatments on the north end of the forest have not been consistently successful.
- Problems range from poor responses to treatment to large scale sucker mortality due to browsing and *cytopsera* in the years following treatment.
- We DO have to fence in most instances.
- Fencing has been somewhat effective when applied to both treated and untreated sites. Effectiveness depends on selecting the right fence design and keeping the fence maintained.
- Deer had the greatest browse impact in surveys done this year. There was not much evidence of cattle being a problem this summer, except for instances of trampling.
- None of the treatments in riparian areas have been unsuccessful. If you do treat these types of stands, leave the majority of the original clone.
- We CAN leave the parent clone and get good sprouting (Doubtful Reservoir example).
- Stand replacement at larger scales is successful in the Gravelly Mountains and Lima Tendoys. Successful treatments were on productive sites with lots of grass and forbs. Soils here had greater moisture holding capability.
- Stand density is correlated with the height of remaining suckers. The less dense the sprouts, the more vulnerable they are to browsing.
- Leaving slash concentrations only protected sprouts until they reached higher than the slash. It also shaded the soil, potentially reducing the amount of sprouting.
- Mechanical scarification has proven successful in several areas.
- Acidic soils do not seem to inhibit aspen regeneration.
- Sometimes we just can't explain success and failure (Antelope Basin example of partial clone failure).

**These findings were based on monitoring of past aspen treatments. Monitoring of these plots was completed in early September and has not been reviewed by ALL members of the Monitoring Team since final data was compiled*.

C. RECOMMENDED STRATEGY FOR FUTURE ASPEN TREATMENT AND MONITORING on the BEAVERHEAD-DEERLODGE FOREST

Problem: Aspen is an important element of our landscapes in southwest Montana, primarily for biodiversity, wildlife habitat, scenery and recreation. We are losing aspen at an increasing rate due to lack of disturbance (primarily succession to conifers) and browsing. (Aspen populations declined 45% in the southern Gravelly Range since 1947 - its estimated there has been a loss of 75% of aspen throughout the Rockies in the last 100 years: USDA, 7140 RSAC, March 1997). We recognize we can't save every clone, but we need to treat those areas we can. Objectives for maintaining or increasing aspen need to be set by Landscape and based on the current situation.

On landscapes where current aspen health is poor and browse pressure is high, the ecological need for preserving clones is high. The cost of maintaining these aspen clones will also be high. Fencing for ALL browsers will be critical. It will be important to capitalize on timber harvest opportunities to improve aspen health (share cost with KV). Where that can't happen, it will be important to share fence costs between benefiting resources.

Current Situation: We have two different situations on our Forest.

Situation A: Most aspen are small clones, decadent, in poor health. Remnant stands in conifer have almost disappeared. Because these stands are small and scattered, they are more susceptible to browse impacts. It is difficult to treat a large enough area to spread out the browsing. In several areas, this situation also overlaps with moose habitat, increasing browse pressure and the difficulty of protecting suckers. Examples: Pioneer Mountains, North Bighole, Highlands.

Objective: Maintain current levels of aspen as a minimum. Maintain existing stems on site and protect the stand.

Best Opportunities: Remove conifers from within the stand and adjacent and protect the stand (with fencing). If sprouting doesn't occur in 2 or 3 years, rip the perimeter. Larger treatments with fire and conifer removal are acceptable if some existing clones can be protected from browsing. Individual trees or remnant clones would be sacrificed. Monitor the first year and fence successful sprouts.

Situation B: Large aspen stands are more common on this landscape, though small stands do occur. Aspen health is good to poor. Conifer stands are less dominant, other forage is available to browsers (grass, willow, sagebrush, dogwood, etc). Larger scale treatments have been more successful because fencing is not always necessary. Examples: Gravelly Range, Lima Peaks, Tendoys, North Flints.

Objective: Increase aspen coverage to 1947 levels as a minimum. This is a mappable, measurable point. Select stands are healthy enough to risk aspen stand reinitiation (removal of mature trees) to encourage resprouting and seeding in of new stands. These landscapes provide us an opportunity not only to maintain existing genotypes, but improve our genetic variation.

Best Opportunities: Larger scale treatments of several vegetation cover types to meet ecological objectives will incorporate aspen clones scattered across the landscape. Monitor seeding, sprouting and the need for protection the fall of the first year. Our best opportunity for improving genetic diversity is identifying and protecting seeding in after fires.

Priorities for treatment

High Priority

- Low risk stands with high chance of success
  - -conifer competition is still in the understory, mature trees with less than 50% mortality, suckering is present, evidence of browsing is light or nonexistent
- High risk stands with good chance of success if fenced

-see through clones, one age class, dead stems are present, conifer competition in the overstory, OR evidence of browsing is moderate to high

Low Priority

Low risk stands, these are healthy stands doing fine on their own

- multiple age classes with some stems are less than 10 years old, no conifers present, suckering evident, browsing is light or nonexistent.

High risk stands, unhealthy stands with high risk of losing entirely

- lone trees overtopped by conifers, no suckers evident, browsing is moderate to high. (Even these stands *could* be saved on an individual basis as Wayne Shepperd proved, but the cost compared to what you gain is extreme. Burning large acreages which include these types of stands can be successful).

Planning Strategies:

·Maintain existing mature stems on site *in riparian areas or stands described in Situation A*. Removing the existing stand poses a risk of losing the whole clone.
·Integrate treatment of numerous aspen clones with other vegetation objectives *in Situation B.* Monitor for sprouting and browsing the first year and take any additional steps.
·Minimize shade within the stand by removing conifers and slash.
·Determine vulnerability to browsing by all animals prior to treatment, plan for fencing and monitoring if browse pressure is evident
·Select phenotypes capable of suckering

Operational Strategies:

·Cut conifer back enough to provide sunlight to the clone, minimum 100' from the clone.
·Consider ripping IF suckers don't come in after 2 years. Rip one line close to stands.
·Consider burning away from the clone to reduce shade from slash and warm the soil. Caution: if your objective is to retain mature stems, its difficult to burn WITHIN the clone without killing mature trees because of the small burning window).
·If browse pressure is evident before treating, FENCE and maintain the fence. Determine before hand if it needs to be wildlife proof as well as cattle proof.

Monitoring Success of Treatments

The Forest's goals are:

-to have qualitative and quantitative information on all of our aspen treatments, gathered in a way that the data is comparable and answers critical questions.
-to outline a monitoring process simple enough it encourages data gathering rather than discouraging it.
-to revisit sites soon enough to take action if stand survival is threatened by browsing.

Priority questions to answer:

are treated aspen stands sprouting?
are aspen sprouts surviving?
if not, why. What action needs to be taken?
are treatments increasing aspen acres on a landscape scale?

STEP 1:
·Assess risk of treatment. Evaluate which situation you're in and how the stand fits the priorities. If you're in situation A and browsing is evident, can you afford to fence it? If not, don't treat.
STEP 2:

·conduct pre-exam. Establish where the stand is, on photos or map. Establish permanent photo point with stake or GPS on projects where treatment is predictable (it may be more practical to establish permanent photo point *after* the fact on large landscape burns, fire may miss your photo point location). Determine presence or absence of suckers or saplings and degree of current browsing.

STEP 3:

·write a silvicultural prescription with emphasis on the target stand,

STEP 4:

·monitor success following treatment, using the Aspen Pre and Post Treatment Monitoring Form. First year exam is a Fall walk through (browsing may not be evident until August, suckering may not occur the 1st year with a June treatment,). Map the clones again, noting where suckers came in, where fire removed stems, etc. Retake or establish the photo plot. Use the recommended monitoring form to document number of stems per acre, sucker growth and damage. Quantitative sampling will be either circular plots or belt transects. Browse damage will be documented using Keigleys Browse Evaluation Form or noting current and historic browse by plot.

·After the first year, follow this schedule for surveys using the same form. If treatment is fenced, check fences annually.

MONITORING SCHEDULE

YEAR 1

Good ✷ Bad ✹

YEAR 2

Good ★ Bad

YEAR 3

Good ★ Bad ✹

YEAR 3

Good ✹ Bad ✷

YEAR 5

Good ★ Bad ✷

Take action if possible (fence if not fenced)

YEAR 10

SUCCESS FAILURE

YEAR 10

SUCCESS FAILURE

Reevaluate fencing OR Leave fencing & recheck next year

D. Research FIndings Pertinent to Our Aspen Treatment Success:

Apical Dominance Explained

In order for aspen to reproduce vegetatively, apical dominance must be reduced or eliminated. Suckering is stimulated when a high ratio of cytokinins to auxins exists in the root (Schier et al. 1985). Interrupting the flow of auxins can be accomplished by quickly killing the stem or simply by severing the root. This prevents auxins from entering the root and also prevents cytokinins from exiting the root via the xylem. The resulting higher than normal ratio of cytokinins to auxins stimulates suckering. If the auxin flow is interrupted but the cytokinin flow is not (as is the case with girdling and often with incomplete burns) the ratio of cytokinins to auxins will not increase and suckering will generally not be stimulated (Schier et al. 1985). Once sprouting is stimulated, aspen requires as much available sunlight as possible.

Existing aspen trees <u>do not</u> have to be cut to stimulate sprouting.

Nearly all aspen clones exhibit some degree of sprouting in the absence of disturbance. This type of sprouting is stimulated by warm soil temperatures in the spring before leaf flush. The warm temperatures stimulate root function and cytokinin levels increase before any new auxin is produced in the aspen canopy. Auxin in the root system from the previous growing season breaks down during the winter. When these conditions exist, (warm temperatures before leaf flush) the effect is the temporary reduction of apical dominance. Sprouting is stimulated but after leaf flush, further sprouting is suppressed (Schier 1985). A spring frost which kills the new leaf growth will reduce the amount of auxin produced and suckering will also be stimulated (Despain 1990). In either of these cases, sprouts that are at the perimeter of the clone may continue to grow and expand the area occupied by the clone. Severing the roots within and around the perimeter of aspen clones has proven a very successful treatment when mature aspen trees need to be retained (Shepperd, personal communication).

All trees in an aspen clone are not connected at the roots.

Recently sprouted aspen suckers depend on the parent root for water and nutrients (Jones and DeByle 1985d). As the suckers grow the distal parent root enlarges and branch roots form in this thickened portion. Eventually the sucker 'adopts' this portion of the root as its own. As the suckers continue to grow and compete for available nutrients and growing space the clone begins to self thin. This thinning results in the death of some of the sprouts. When the sprouts die the portion of the parent root <u>may or may not also die</u> resulting in a clonal root system where many but not all of the trees are connected through the root system (Jones and DeByle 1985d).

Browse conditions.

Browse is one of the most limiting factors for aspen survival across the forest. The majority of our aspen stands show some evidence of browse. Effects of heavy browse on sprouting are obvious, but even light browse activity may be lethal to sprouts that are somewhat moisture stressed (Jacobi 1996). Wounds from browse activity provide infection sites for pathogens including sooty bark canker (*Cenangium singulare*) and *Cytospora* (Krebill 1972). Sparsely stocked aspen clones experience a higher degree of browse than do dense clones. Shepperd (1993) found that sparsely stocked clones also experience less height growth than dense stands allowing the effects of browse to continue for a longer time.

Wildlife fencing.

Wildlife fences are essential to protect suckers where browse conditions are limiting growth. Even in areas where browse is light, the combination of browse and any other type of environmental stress such as moisture availability will lead to fatal outbreaks of *Cytospora* (Jacobi 1996). Leaving concentrations of slash on a site is generally ineffective. High concentrations of slash will significantly inhibit sprouting (Shepperd 1996). Where sprouting does occur suckers are often browsed when they begin to emerge from the slash.

Removal of conifer in combination with wildlife fencing with no other treatment has been used extensively in the Southwest to stimulate aspen suckering. Generally 7' hog wire fences have been used but other materials are becoming available that are as effective and may be less costly. One such material is 7' black plastic mesh. The plastic sells for $45.00 for a 100' roll and has been effective where it has been applied (Shepperd, personal communication).

Treating large areas of surrounding vegetation has been suggested to disperse browse. In some portions of the forest this may be feasible, but for over 2/3 of the forest, where aspen clones are surrounded by heavy timber it is difficult to treat enough area to disperse browse. For example, we assume that across the forest aspen occupies 0.5% of the total area. This means that for every 1,000 acres of our timbered landscapes that are treated there are about 5 acres of aspen. Wildlife fencing in this type of situation is critical because there just isn't enough palatable vegetation to lure elk amd deer away from the aspen.

Riparian sites are difficult to regenerate.

Increased soil moisture inhibits aspen growth and sucker production (Fralish 1972, Jacobi 1992). Aspen sprouting is generally low in areas where wet site indicator species such as bluejoint or horsetails are present (Jacobi, Shepperd, Bartos, personal communication). Aspen regeneration failures relate to stress brought on by both excess and insufficient soil moisture (Jacobi 1996). Hydric soils increase the likelihood of canker infections. These infections are caused by species of canker (primarily *Cytospora*) that are normally present but are not usually lethal to the clone.

Prolific sprouting followed in 2-3 years by extensive die back.

Cytospora canker (*Cytospora chrysosperma*) is the most common canker found throughout the range occupied by aspen (Hinds 1985). In 1942, *Cytospora* infection was thought to be the main cause of aspen "dieback" in the Rocky Mountain National Park (Packard 1942). The fungus is considered a normal inhabitant of aspen bark (Anderson 1972). Fire, frost, drought and leaf diseases cause aspen trees to become susceptible to *Cytospora* canker, with young trees becoming the most seriously affected (Anderson 1972). *Cytospora* is associated with wounds to trees caused by elk feeding, logging activity, frost cankers, sunscald and slash fires and it may also be associated as a secondary parasite with other cankers (Hinds 1985). Large vigorous aspen trees are least susceptible to the disease and when infected may effectively limit canker growth or form calluses to contain the infection (Hinds 1985, Anderson 1972).

In Colorado, *Cytospora chrysosperma* has been associated with aspen regeneration failure in which over 90% of the aspen sprouts died (Jacobi and Shepperd 1991). Stressed sprouts may be more affected by *Cytospora* than healthy sprouts (Guyon 1990). Guyon (1990) found that when aspen sprouts which had been inoculated with *Cytospora* were subjected to stress by excess moisture, insufficient moisture and defoliation, the stressed plants showed increased canker size (Guyon 1990).

Jacobi (1996) found that stresses to aspen regeneration brought on by both excessive moisture and drought predisposed the suckers to infection by canker. Jacobi contends that regeneration failures due to *Cytospora* are not just isolated chance incidents. Conditions for excessive soil moisture occur approximately 26% of the time and conditions for low soil moisture occur 8% of the time on the sites studied in Colorado.

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SAGEBRUSH TREATMENT

A. STATUS OF SAGEBRUSH ON THE FOREST

Problem Statement:

Landscape analysis on the Beaverhead-Deerlodge Forest revealed two concerns with our sagebrush communities. Most mountain big sagebrush stands on the Forest are currently outside a balanced range of structural classes (based on disturbance regimes described by Arno & Gruell, 1983, Gruel, 1983, Northern Region Overview, 1998). Most of the type presently occurs as mature plants in sites with more than 15 percent sagebrush cover. These sagebrush stands have also declined in extent where they interface at the higher elevations with the dry conifer cover types (Douglas-fir and juniper). Region-wide, invasion of these stands by tree seedlings have decreased the extent of these cover types by a magnitude of 20-30% (Northern Region Overview, 1998). Both these conditions are primarily due to fire exclusion. The Northern Region Overview rates the departure of sagebrush/grasslands from natural conditions regionally as "High". The opportunity to restore natural conditions through fire is "High". The risk of losing function if natural conditions are not restored is "Moderate" in our area with a number "2" priority.

Sagebrush is also valued in southwest Montana as habitat for sage dependent wildlife species. Montana Fish, Wildlife and Parks has been particularly concerned with Forest Service efforts to restore some sagebrush stands to earlier seral conditions, in light of those values and a different view of the historic role of fire in vegetation composition. The management challenge is to balance ecological goals for composition, structure, and distribution of sagebrush/grassland communities with wildlife populations which may be dependent on mature sagebrush stands.

Current Management Situation:

Sagebrush burning has been conducted on the south zone of this Forest under the guidance of a Memorandum of Understanding between the Beaverhead-Deerlodge National Forest and Montana Fish, Wildlife and Parks, signed in April 1998. The agreement lays out restrictive guidelines for accomplishing mosaic burn patterns with the objective of maintaining sufficient mature and old growth sagebrush for sage dependent wildlife species. We need to be able to respond to Montana FWP and appellants whether we are able to accomplish burns according to these guidelines.

The purpose of monitoring sagebrush treatment is to focus specifically on whether we are meeting the terms of the MOU. Those terms for post treatment monitoring are: *All burns will be mapped within one year of treatment and mosaic and patch size will be calculated. A report by burn unit, which compares burn objectives with the accomplishment will be prepared by each ranger district yearly. This report will be provided to Fish, Wildlife & Parks by February 15 each year. Treatments where prescriptions were significantly exceeded will be mitigated through modifying adjacent future treatments.*

We have chosen to compile the results from and report on ALL burning projects accomplished on the south zone of the Forest in 1998, rather than just those treatments required under the MOU Objectives. The following table reports first on sagebrush treatments under the MOU, second burning conducted in other vegetation types.

B. RESULTS OF POST TREATMENT MONITORING OF 1998 SAGEBRUSH TREATMENTS: (following page)

SAGEBRUSH CONSERVATION
POST TREATMENT MONITORING
Beaverhead-Deerlodge National Forest Montana, Fish, Wildlife & Parks, Reporting Form

Forestwide Summary
Reporting Year FY98
(Individual Project Evaluation Sheets located in Appendix)

Unit	Project	Purpose	Total Acres in Prescription (Treatment) Area	Total Acres Acres Blackened	% of Treatment Blackened	*Mosaic objective Met? Yes/No
Wisdom	McVey Creek	Range improvement	120	40	30%	Yes
	Clam Valley Sage	Range improvement	264	105	40%	Yes
	Sheila Ridge	Range improvement	74	25	30%	Yes
Madison	Fawn-Upper Ruby	Reduce Sagebrush, regenerate aspen	875	377	43%	Yes
	North Willow	Reduce fuels, regenerate aspen, wildlife habitat	1000	213	21%	Yes
	Shackelford	Ecosystem, aspen, range	1950	619	32%	Yes
	Bearing Tree	Regenerate aspen, reduce Df encroach., reduce fuels	1100	907	80%** **MOU applied to 10% of acres	Yes
		TOTAL	5383 acres	2286 acres		

*Burn patterns will be in the irregular shape of mosaics with no point within blackened area more than 600 feet from unburned area.

SAGEBRUSH CONSERVATION
POST TREATMENT MONITORING

Beaverhead-Deerlodge National Forest Montana, Fish, Wildlife & Parks, Reporting Form

Forestwide Summary
Reporting Year FY98

(Individual Project Evaluation Sheets located in Appendix)

THE FOLLOWING PROJECTS DO NOT FALL UNDER POST TREATMENT REQUIREMENTS OF THE MOU, THEY ARE PROVIDED AS INFORMATION ONLY

Unit	Project	Purpose	Total Acres in Prescription (Treatment) Area	Total Acres Acres Blackened	% of Treatment Blackened	*Mosaic objective Met? Yes/No
Dillon	Badger Pass	Sensitive species (Pen lem)	10	6	60%	Yes
	Thief Creek	Douglas-fir encroachment	25	15	60 %	Yes
	Kate Creek (Middle)	Douglas-fir encroachment	550	200	36%	Yes
	M Fk Little Sheep	Douglas-fir encroach	1550	200	13%%	Yes
	M Fk Little Sheep	Douglas fir understory/aspen	"	400	26%	Yes
	French Creek Aspen	Aspen restoration	40	4	10%	Yes
	Painter Creek	Douglas-fir understory	80	30	38%	Yes
Wise River	Flume Creek	Grass park restoration	100	30	30%	Yes
	Cherry Creek Sikes	Sage park restoration	60	30	50%	Yes
	Henley Ridge Sikes	Mule deer habitat improve.	151	100	66%	N/A
Wisdom	Doolittle	Sage park restoration for elk	239	70	30%	Yes
	Clam Valley UnderB.	Fuel hazard reduction	272	100	37%	Yes
	Squaw Creek	Understory fuel hazard red.	25	25	100%	N/A
		TOTAL	3102 acres	1210 acres		

Figure 4. Poison Creek Sagebrush Burn, Madison Ranger District, October 1998

C. FINDINGS

MOU objectives:

In 1998, the south zone of the Beaverhead-Deerlodge Forest proposed treating 5383 acres of sagebrush under the guidelines of the Memorandum of Understanding with Montana Fish, Wildlife and Parks. Of those acres, 2286 were actually blackened.

The Forest complied with both the mosaic guidelines and the distance from black guidelines on all but two units. Clam Valley Sage project on Wisdom exceed the 600 foot to unburned edge, so the district agree not to burn the adjacent proposed unit. Bearing Tree project on the Madison District exceeded the 50% mosaic limit, but only 10% of the acres reported as "blackened" were in the sagebrush vegetation type.

A total of 3102 acres not subject to the MOU were also proposed for burning. Of those, 1210 acres were actually blackened. With two exceptions, these vegetation treatments ALSO fell within the limits of the MOU guidelines. The two projects which exceeded a 50% mosaic were for fuel reduction and mule deer habitat improvement (understory burn in open Douglas-fir to stimulate snowberry response).

Forest Service objectives:

Seven projects fell under the guidelines of the MOU. Of those, two fully met Forest Service objectives. The remaining were less than successful because they did not burn as much aspen or Douglas-fir colonization as planned. As one Fire Management Officer (FMO) reported in the Burn Monitoring and Evaluation, "burned too late in the season for good Douglas-fir mortality, but burned sagebrush right at the MOU upper limit. This means we will have problems with obtaining aspen, Douglas-fir encroachment, and Douglas-fir overstory objectives while reducing sagebrush mortality."

Thirteen projects did not fall under the MOU guidelines. All of these projects met Forest Service objectives for vegetative restoration

Reporting strategies:

Protocol for reporting sagebrush accomplishments to Montana Fish, Wildlife and Parks, as required by the MOU had not been set up prior to this year.   A draft form was developed as part of this monitoring effort. It was reviewed with Montana Fish, wildlife and Parks, District Fire Management Officers, and the Forest Monitoring Team.   A finalized version of the form was distributed to the Districts for completion by FMO's. Projects accomplished in Fiscal Year 1998 were reported. The Forest Monitoring Team Leader compiled the data on a Forest Summary form and submitted it to Montana Fish Wildlife and Parks at the end of Fiscal Year 1999.

Final procedures and assignment of responsibilities for Annual MOU Reports will be developed at the December Forest Fire Management Officer meeting.   The Forest Monitoring Team recommends the Forest Fire Management Officer be responsible for compiling District FMO reports into a Forest Summary for submission annually in September.

Reporting by fiscal year creates some confusion in understanding how the projects were completed on the ground. For example: a project may be started in September and completed in October. Reports on the two phases would come in a year apart.   Reporting by calendar year conflicts with the way burn accomplishments are reported in the data base and requires more work on the part of the reporting unit, to sort out.

References

Arno, Stephen F., and Gruell, George F. 1983. Fire History at the Forest-Grassland Ecotone in Southwest Montana. J. Range Management (Sept 1983).

Gruell, George F. 1983. Fire and Vegetation Trends in the Northern Rockies: Interpretations from 1871-1982 Photography. USDA FS, Gen. Tech. Rpt. INT-158.   Int MT Forest and Range Experimental Station, Ogden, UT.

USDA, Forest Service, Northern Region. October, 1998. "Northern Region Overview - a detailed report"

APPENDIX

SAGEBRUSH TREATMENTS
Individual project evaluation sheets for FY 98