C. Vegetation

1. Existing Condition

The vegetative resource of any landscape is a complex combination of (1) the vegetation existing on an area, (2) the forces of disturbance that interacted upon past vegetation that resulted in the existing vegetation, (3) the successional processes that continually attempt to change existing vegetation to a different seral stage, and (4) the pattern of vegetation resulting from those forces of change. The type of vegetation (e.g. grassland, forest, riparian) is the result of the interactions of temperature, moisture, and to some extent soils. Because temperature differences result from changes in aspect, slope, elevation, and topographic features, and moisture differences result primarily from elevation changes, soils, and topography, vegetation types change accordingly.

Vegetative composition and forest stand structure continually change over time. Sometimes changes are hastened by disturbance while at other times changes happen so slowly they are hardly noticeable on a human timescale. Changes in the vegetative component of a landscape cause succession to move either forward or backward and impact all other resources. When that change is relatively sudden, such as from wildfire, mining, or logging, the impact on other resources is dramatic. When changes in the vegetation are subtle, such as fire suppression or tree seedlings becoming established in a grassland, the impact upon other resources is also subtle on the human timescale.

In the landscape, long range health of all vegetative communities is a primary concern of the USFS. That health involves maintenance of the structure, composition, and function in all vegetative communities as well as the natural processes that work upon the communities. Human induced disturbances such as domestic livestock grazing, mining related activities and introduction of noxious weeds cause long term site changes, some of which may be irreparable on the human timescale. Invasion of native vegetation by noxious weeds may be the most devastating ecological change on this landscape in the long term. The application of prescribed fire is one human disturbance which may provide some of the functions of natural disturbance. However, prescribed fire has not yet been applied over a large enough area to be effectual in replicating natural fire regimes because of concerns for fire damage to private lands and public and private infrastructure and because of a lack of consensus among the public and political leaders as to how much fire and smoke is acceptable.

Vegetative Patterns

Vegetation from the valley bottom to about 6000 ft elevation is characterized by alternating grasslands, shrubland and forests. Native grasslands are dominated by either rough fescue *(Festuca scabrella)* or Idaho fescue *(Festuca idahoensis)*. Generally the fescue grasslands occupy the south and west aspects while forests dominated by Douglas fir *(Pseudotsuga menziesii)* occupy the cooler north through east aspects and narrow stream valley draws. Rocky Mountain juniper *(Juniperus scopulorum)* occupies lower elevation rocky outcrops and similar aspects as Douglas fir. Shrublands are predominantly big sagebrush *(Artemisia tridentate)* with some bitterbrush *(Purshia tridentate)* as well as *Festuca* species grasses. Introduced grasses were brought to the area as a result of reclamation and revegetation work on mining prospecting trenches and drill sites and for hay on private lands. Road construction revegetation work introduced still other grasses. Most of the introduced grasses are confined to hay fields, road right-of-ways and old prospect sites. The grassland areas are where the most noxious weeds have been established. Vehicle travel continually transports seeds in the landscape and new infestations are continually occurring. Grasslands are also subject to increased colonization by conifers with fire exclusion as succession advances and Rocky Mountain juniper and Douglas fir seedlings and saplings become established in increasing numbers.


Photo: Natural grasslands on the large benches of the EDLV grade into conifer forest.

At elevations above 6000 ft, grassland openings are smaller and confined to the most extreme southerly and westerly aspects where soils are more conducive for grasses. Forests of lodgepole pine *(Pinus contorta)* dominate all aspects, but those forests include Douglas fir on west and south aspects and subalpine fir *(Abies lasiocarpa)* and Engelmann spruce *(Picea engelmannii)* on easterly and northerly aspects. Natural openings in these forests were large, if transitory, as fires would sweep through entire drainages and in places completely replace the existing trees. Lodgepole, subalpine fire, and Engelmann spruce in combination with limited whitebark pine *(Pinus albicaulis)* comprise the forests at the upper elevations. These forests vary from relatively open to closed depending upon the aspect with ridge tops, southern, and western sites being open while the remainder is quite dense.

Aspen stands *(Populus tremuloides)* are a relatively small component (less than 1%) of the forested vegetation in the landscape. Aspen clones occur on isolated moist microsites at the mid and upper elevations. Stands are typically located on alluvial soils or soils that have developed from glacial till. Aspen on upland areas are often on disturbed soils with most upland stands less than 3 acres (BDNF, 1998). Effective fire suppression over the last century has allowed conifer forest types to encroach on existing aspen stands.

Riparian areas include wetlands adjacent to streams in the landscape. Lotic wetlands contain a perennial, ephemeral, or intermittent stream with a defined channel and floodplain. Beaver ponds, seeps, springs, and wet meadows on the floodplain are associated with these lotic wetlands. Lentic wetlands occur in the upper elevations where seeps and springs emerge on flatter slopes at the headwaters. These lentic wetlands lack a defined channel and floodplain and the riparian vegetation community may be a combination of sedges, shrubs, forbs, and trees. On the smaller streams in the landscape and on the Clark Fork River floodplain above Deer Lodge, riparian vegetation is often dominated by willow types, namely Geyer willow *(Salix geyeriana)*, Booth willow *(Salix boothii)*, or Drummond willow *(Salix drummondiana)* accompanied by beaked sedge *(Carex rostrata)*, water sedge *(Carex aquatilis)*, bluejoint reedgrass *(Calamagrostis canadensis)*, and tufted hairgrass *(Deschampsia cespitosa)*. Other shrubs including red-osier dogwood (Cornus stolonifera) are also present. On the Clark Fork River floodplain below Deer Lodge and along Cottonwood Creek narrowleaf cottonwood *(Populus angustifolia)* and black cottonwood *(Populus trichocarpa)* dominate the riparian species.


Photo: Upper Peterson Creek riparian corridor with aspens present.

Riparian areas in forested communities are being shaded by conifers and as a result some species are being lost. Willow species and red-osier dogwood are susceptible to over-topping and increased shade. Cattle grazing and clearing for agriculture has altered much of the natural riparian vegetation on private lands and to a lesser degree on national forest lands. Riparian health assessment using the Hansen Lotic method (Hansen, 2002) was performed on approximately 75% of the streams within the landscape, not including the Clark Fork River. PFC assessment (BLM, 1993) was performed by the USFS on additional stream reaches. These assessments are described in detail in section B-1 Watershed Health and Aquatic Habitats - Existing Condition.

Forest Vegetation

Stand Description

The most recent stand classification performed for the national forest lands within the landscape is a mid-1980's airphoto interpretation performed by the USFS. Stand species and size classification from this is shown in figure IIC-1 provided in appendix 1. Acreage for specific stand classes is shown in table IIC-1. Many of the lodgepole logs identified as a sawtimber in the figure and table are now standing dead due to mountain pine beetle infestation.

Table IIC-1: BDNF stand data.

	Strata	Acres
Doug Fir	Saw timber single Story	3,920
	Saw timber 2-storied	158
	Sawtimber unsuitable	1512
	Pole timber	294
	Pole timber unsuitable	136
Lodgepole	Saw timber single Story	7,069
	Saw timber 2-storied	452
	Saw timber unsuitable	360
	Pole timber	9,315
	Pole timber unsuitable	535
Alpine fir and Spruce	Saw timber single Story	1,925
	Saw timber unsuitable	477
	Pole timber	293
	Pole timber unsuitable	133
Other	Whitebark and Limber pine (all stock)	69
	Seedling/sapling (no species id)	3,268
	Aspen	297
Non-stand	Rock	402
	Wet meadow	114
	Dry Meadow	7,404
	Unknown	7,363
	TOTAL	***45,496***

Stand strata data only for BDNF lands.

Table IIC-2: SILC3 stand and size class data for BDNF lands.

Forest Cover	Size Class	Acres	BDNF Diversity Matrix Group[1]
Aspen	Not classified	294	Upland Hardwood
Douglas-fir / Lodgepole Pine	Sapling 1" - 4.9"	47	Douglas Fir
	Pole 5" - 8.9"	142	
	Medium 9" - 14.9"	42	
	Large 15" - 20.9"	63	
Douglas-fir	Sapling 1" - 4.9"	579	Douglas Fir
	Pole 5" - 8.9"	941	
	Medium 9" - 14.9"	918	
	Large 15" - 20.9"	225	
	Very Large 21"+	37	
Lodgepole Pine	Sapling 1" - 4.9"	5,649	Lodgepole Pine
	Pole 5" - 8.9"	15,406	
	Medium 9" - 14.9"	4,029	
	Large 15" - 20.9"	1,112	
	Very Large 21"+	210	
Mixed Lower Subalpine Conifer Forest	Sapling 1" - 4.9"	404	Douglas Fir
	Pole 5" - 8.9"	1,857	
	Medium 9" - 14.9"	259	
	Large 15" - 20.9"	226	
	Very Large 21"+	31	
Mixed Upper Subalpine Conifer Forest	Sapling 1" - 4.9"	37	Subalpine Fir
	Pole 5" - 8.9"	351	
	Medium 9" - 14.9"	72	
Mixed Xeric Conifer Forest	Pole 5" - 8.9"	9	Douglas Fir - Limber Pine
Ponderosa Pine	Large 15" - 20.9"	8	Ponderosa Pine
Subalpine Fir / Spruce	Sapling 1" - 4.9"	8	Subalpine Fir
	Medium 9" - 14.9"	14	
Whitebark Pine	Sapling 1" - 4.9"	188	Subalpine Fir
	Pole 5" - 8.9"	188	
	Medium 9" - 14.9"	74	

1- Diversity matrix group is described in the Range of Natural Variability discussion.

Alternatively, the Satellite Land Classification SILC3 can be used to describe the existing condition of forest vegetation in the landscape. Table IIC-2 shows SILC3 forest cover type and size class information for BDNF lands within the landscape. SILC3 was originally derived from a mosaic of Landsat images captured between 1994-2000. The accuracy of the land cover type and conifer tree size cover classification given in SILC3 was assessed using a leave-one-out cross-validation using the training data used to classify the Landsat image. The results of this accuracy assessment suggest that accuracy ranges from a low of 48% for Mixed Upper Subalpine Conifer Forest and Mixed Lower Subalpine Conifer Forest to 74% for Whitebark Pine. Alternatively, the BDNF indicated that they had compared SILC3 with FIA data and that most species classified in SILC3 were <8% in error but that Douglas Fir was approximately 25% in error. The uncertainty analysis performed on the SILC3 data indicate the potential problems associated with using the data for quantifying the existing condition of the forested landscape.

However, at a landscape scale the SILC3 data is considered the best available data for describing forest vegetation and structure and should provide a picture of the existing condition adequate for identifying departure from the range of natural variability.

Lower elevation forested areas (generally from 5000-7000 ft) are typified by multiple story structure with young Douglas fir filling in most stands. Because the sites are being occupied by Douglas fir, regeneration of ponderosa pine *(Pinus ponderosa)* is extremely limited. Ponderosa pine was never a dominant species throughout these lower elevation forests and its numbers are being reduced as it yields to the more competitive Douglas fir. These lower elevation Douglas fir dominated forests grade into lodgepole pine at middle elevations.

Photo: Lower elevation Douglas fir encroaching on grasslands.

Middle elevation forested areas (generally from 6000-7500 ft) are predominantly even-aged lodgepole pine with younger subalpine fir and spruce moving into the understory and perhaps into the overstory as well. Lack of fire has allowed those more shade tolerant species to advance and increase stand densities. Over a century of relatively successful fire suppression has allowed stands to grow dense. Overstocked stands make it difficult for trees to compete for a limited source of nutrients and water. Lodgepole and whitebark pine susceptibility to mountain pine beetle *(Dendroctonus ponderosae)* is increasing as the pine becomes larger and older. Risk of major defoliation of the Douglas fir by western spruce budworm *(Choristoneura occidentalis)* and mortality due to Douglas fir beetle *(Dendroctonus pseudotsugae)* is also an increasing probability.

Upper elevation forested areas (generally above 7500 ft) include lodgepole and spruce-subalpine fir forest types with limited Douglas fir and whitebark-limber pine. The BDNF air photo interpreted strata data shown in figure IIC-1 and table IIC-1 indicates that a very small portion of the landscape, on the order of 69 acres on BDNF land is whitebark-limber pine. The introduced fungus white pine blister rust *(Cronartium ribicola)* is infecting and decimating whitebark pine through its range in Montana and has the potential to completely eliminate whitebark pine from the landscape. There are currently no reasonable management methods for preventing blister rust from spreading throughout the range of whitebark pine. Therefore, strategies are needed to help whitebark pine survive in the presence of blister rust. Although rare, natural blister rust resistance has been found in sugar pine and western white pine; initial tests of whitebark pine using similar methodology at Forest Service nurseries in Oregon and Idaho have found evidence that natural resistance to blister rust also occurs in whitebark pine (Schwandt, 2006).

Photo: Dense stands of pole sized lodgepole pine.

Aspen

The reduction in natural disturbances owing to lack of fire has prevented conditions favorable for aspen regeneration. Increases in grazing over natural levels owing to livestock use of aspen forests also limit regeneration. These combined effects have reduced both the area of aspen and the structural complexity of these stands and have lead to conifer encroachment of stands. GIS analysis of SILC3 aspen cover on the BDNF and past prescribed burning and timber harvest activities indicates that 47% of the SILC3 classified aspen on the BDNF in the landscape is in an area which experienced one of these activities in the past half century. Specific examples include aspen in burn unit #14 (figure IIC-11) where a 143 acre clear-cut in 1969 followed by a post-harvest burn/broadcast burn in 1972 appears to have regenerated as aspen as shown by aerial photos and the SILC3 dataset. In burn unit #15, a 52 acre clear-cut in 1964 has partially regenerated as aspen. There is an additional area just east of unit #15 where a 1964 clear-cut and 1967 site preparation burn appears to have regenerated aspen. This relationship suggests that in the absence of fire, these human disturbances are helping to perpetuate aspen in the landscape.

The 1998 Forest Monitoring and Evaluation Report (BDNF, 1998) categorizes aspen on the forest into two major situations. Aspen in the landscape generally mimic situation A in which most aspen are small clones which are decadent and in poor health. Situation A stands are small and scattered are therefore susceptible to browse impacts. This focused browsing creates challenges in designing effective treatments to regenerate the aspen because treatments are generally too small to disperse browsing impacts to suckers. Forest monitoring and evaluation has also shown that 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. In riparian areas, increased soil moisture has also been shown to have negative effects on treatments by inhibiting aspen growth and sucker production and causing increased likelihood of canker infections. However, none of the riparian sites treated and evaluated in BDNF (1998) were considered unsuccessful. These examples show that treatments in the landscape to regenerate aspen will need to be selectively applied given site specific conditions. The 1998 Forest Monitoring and Evaluation Report provides a recommended strategy for future aspen treatment and monitoring on the BDNF.

Old Growth

Old growth forests are distinguished by old trees and structural characteristics developed over time. The FP (1987) defines old growth as those stands that are past full maturity and are showing decadence, often with two or more stories, eight or more large diameter trees per acre, and where the largest trees are 200 years old or older. FP (1987) standards state that areas managed as old growth are normally large, from 10 to several hundred acres (pp II-26). An analysis of old growth occurrence on the BDNF was performed as part of forest plan revision using FIA data (Bush and Leach, 2003). The 2003 old growth analysis estimated the proportion of old growth with a minimum diameter breast height of 10.0 inches or larger. The old growth analysis results are presented for the larger Clark Fork-Flints Landscape which includes the EDLV Landscape. In the Clark Fork-Flints landscape, Bush and Leach (2003) estimate that 20.0% of the forest is in old growth with a 90% confidence interval of 13.2 – 27.0%. FP (1987) standards call for 5% of each timber compartment to be managed as old growth; all or parts of 7 timber compartments are included in the landscape. No old growth mapping specific to these timber compartments is available. However, the regional Clark Fork-Flints old growth estimate indicates that the old growth component of the forest is not deficient at the regional scale.

Forest Disease

Figure IIC-2 in appendix 1 depicts USFS Aerial Disease Survey (ADS) data showing the progression of forest insect infestation from 1999 – 2006. Table IIC-3 summarizes annual affected acreage totals over the entire landscape including non-federal lands for these years. Appendix 5 tabulates mountain pine beetle and western spruce budworm damage for 2004 – 2006 for all BDNF land in the landscape and also categorized by FP (1987) management area and forest stand type from table IIC-1. 2007 ADS data was not available at the time of this assessment. All trees surveyed as affected by mountain pine beetle are current year mortality. All trees surveyed as affected by western spruce budworm are damaged by defoliation. In both instance, not all trees in a delineated area are killed or defoliated by the forest pests. The trees per acre (TPA) information in table IIC-3 gives average number of trees affected per acre.

The recent spate of above average winter and spring temperatures has led to increasing over wintering of mountain pine beetle as well as more effective flights of this species. Continuing drought stress has led to increased lodgepole and whitebark susceptibility to beetle infestation. Although, mountain pine beetle typically attack trees with a diameter of 8 inches or more first, the current epidemic is severe enough that trees down to 4 inches in diameter have been killed. As discussed further in the Forest Stand Size Class Distribution analysis in section IIC-2 below, there is an overabundance of pole sized lodgepole pine relative to seedling/sapling in the landscape compared to the RNV indicating a disproportionally high amount of suitable host trees for this beetle. To complicate matters, as described under the Fire Regime Condition Class discussion below, much of the landscape has a significant departure from natural condition class and the resulting stands are more dense and storied than historically. As such, individual trees are competing for fewer resources and are less resilient to insect attack.

Table IIC-3: USFS Aerial Disease Survey data.

	1999		***2001***		***2002***		***2003***		***2004***		***2005***		***2006***	
	Acres	*TPA*	**Acres**	*TPA*	**Acres**	*TPA*	**Acres**	*TPA*	**Acres**	*TPA*	**Acres**	*TPA*	**Acres**	*TPA*
Western pine beetle	**-**	-	**-**	-	**-**	-	**4**	*1.0*	**-**	-	**-**	-	**2**	*0.5*
Mountain pine beetle	**8**	*2.5*	**2**	*0.5*	**618**	*1.8*	**807**	*5.3*	**3,684**	*2.5*	**9,655**	*2.9*	**8,178**	*3.6*
Douglas fir beetle	**59**	*1.9*	**-**	-	**18**	*1.4*	**2**	*4.9*	**33**	*2.4*	**41**	*4.9*	**18**	*2.4*
Spruce beetle	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Western balsam beetle	**2**	*2.5*	**-**	-	**-**	-	**-**	-	**4**	*6.2*	**19**	*4.7*	**4**	*4.9*
Western spruce budworm	**-**	-	**-**	-	**-**	-	**-**	-	**10**	-	**2,467**	-	**10,154**	-

Note- no aerial survey performed in 2000.
TPA- average number of dead trees per acre. TPA not recorded for budworm damaged area because the damage is typically defoliation not mortality.

Given the recent climate conditions and forest size class and structure, mountain pine beetle infestation is epidemic. The annual acreage affected shown in table IIC-3 does not yet show a significant decline in beetle killed tree acres suggesting that expansion of the beetle epidemic may not have reached a climax. In addition, the trees per acre (TPA) data in table IIC-3 suggests that the intensity of the infestation is continuing.

To compare the beetle killed acreage to total acreage of host species, satellite derived land cover from the Gap Analysis Project (GAP) (Redmond et al, 1998) was used to derive potential maximum host tree acreage for the landscape. The GAP analysis indicates there are approximately 32,000 acres of suitable mountain pine beetle host trees (Table IIC-4). According to aerial survey data, 14,600 total acres have been affected by the current mountain pine beetle outbreak (table IIC-3 totals include the overlap in annual acreage shown in figure IIC-2 as additional trees die in areas infected during prior years). Given this, mountain pine beetle still has the potential to expand into an additional 17,500 acres of pine forest. Figure IIC-3 in appendix 1 shows the ADS insect data overlain on the GAP host tree acreage indicating that there are large areas of potentially suitable host trees in Baggs, Cottonwood, and Peterson Creek drainages that have not been infected by the current beetle outbreak. The areas of Baggs, Cottonwood, and Peterson Creeks that are not infected are for the most part the higher elevations of these drainages. Additionally, there are large areas of forest unaffected by mountain pine beetle in between patches of infected trees within Peterson, Orofino, and Dry Cottonwood drainages. In adjacent areas of the Boulder Mountains near Butte as well as in the Fleecer Mountain area the current mountain pine beetle epidemic has progressed into higher elevation stands once the beetles get a foothold in the lower elevation areas. This suggests that the beetle epidemic will continue to spread into unaffected pine stands in the landscape. Most of the acreage of suitable host species in Sand Hollow and Perkins and Girard Gulches has been infected by mountain pine beetle.

Table IIC-4: GAP analysis of potential forest insect host tree acreage.

Mountain Pine Beetle host	Acres	**Western Spruce Budworm host**	Acres
Lodgepole	13,900	Douglas-fir	8,500
Douglas-fir/lodgepole	3,900	Douglas-fir/lodgepole	3,900
Mixed whitebark pine forest	80	Conifer riparian	700
Mixed subalpine forest[1]	14,000	Mixed xeric forest	800
		Mixed broadleaf and conifer riparian	400
Totals	31,880		14,300

1- Mixed subalpine forest is predominantly lodgepole based on comparison of GAP and BHDL stand data.

Western spruce budworm became active in 2005 and increased significantly in 2006. As described in the discussion of budworm bio-ecology in section IIC-2 Range of Natural Variability below, research has shown that winters such as 2005 with below average precipitation followed by wet springs are conducive to budworm outbreak. No dead trees per acre (TPA) data are recorded for budworm damaged areas because the damage is typically defoliation not mortality. Most budworm defoliation in 2005 was rated low severity (less than 50% defoliation) with a relatively continuous pattern of damage suggesting that there is room for the epidemic to expand within affected acreage. No severity information is recorded for budworm defoliation in the 2006 data but the survey did again record a relatively continuous pattern of damage within affected areas.

Table IIC-4 shows that there are approximately 14,000 acres of suitable budworm host trees in the landscape. According to ADS data, 10,400 acres have been affected by the current budworm outbreak. The extent of the budworm outbreak within the landscape may have nearly reached a limit as much of the acreage of host species is infected. Figure IIC-3 shows that most of the suitable budworm host tree acreage at low elevations has been affected by the current outbreak. It appears that the budworm has been somewhat less aggressive at higher elevations. Budworm host tree stands are discontinuous at higher elevations and the isolation may protect these trees. Whether or not climate at the higher elevations limits suitable budworm habitat is unknown. Bulaon and Sturdevant's (2006) recent study states that aerial disease survey records and flight trapping indicate a strong potential for current budworm outbreaks in Montana to intensify and expand if weather conditions favorable to budworm persist. Given the low severity and relatively continuous pattern of current budworm defoliation, the outbreak may continue as additional trees become infected within the current extent of the outbreak.

Western pine beetle, Douglas fir beetle, and western balsam beetle appear to be at endemic levels (table IIC-3).

Photo: Western spruce budworm damaged Douglas fir on left and mountain pine beetle killed lodgepole pine.

Photo: Mountain pine beetle mortality in mixed lodgepole pine/Douglas fir.

Timber Harvest

There is a long history of timber cutting on National Forest lands in the Upper Clark Fork River Basin. As reported in Losensky (1993), beginning in the 1870's mining and smelting operations in Butte had cause major changes to the surrounding forest. By the 1890's, smelter operations in Anaconda alone were consuming over 250,000 cords of wood a year. Additional lumber was needed for mine framing timber. By the 1930's it is reported forests in Deer Lodge County were 90% harvested. The affects of this huge timber cutting is still seen in the age-class distribution on many of the forest stands in the landscape today. Tables IIC-1 and IIC-2 show the existing condition of Douglas fir and Lodgepole Pine stands in the landscape. In lodgepole forest types, there is a predominance of stands in the pole size class, presumably resulting from the widespread timber cutting about 100 years ago. The SILC3 data shown in table IIC-2 also indicates a high percentage of the Douglas fir stands in the pole and medium size classes (5-15") which also suggests the present size class distribution is affected by the historic timber cutting. The affects of historical timber harvest on forest size class distribution is further described under Range of Natural Variability in section C-2 below.

Figure IIC-4 in appendix 1 shows timber harvest and thinning documented by the BDNF since the 1940's. Table IIC-5 shows acres harvested and thinned by decade. According to these records total acreage actively managed for timber harvest on the Forest peaked in the 1970's. Most of the harvest has been shelterwoods and clearcuts. Round wood harvesting in the form of posts and poles has resulted in many areas of thinning. All of these previously harvested stands have regenerated.

Table IIC-5: Timber harvest and thinning by decade (BDNF GIS data).

	1940's	1950's	1960's	1970's	1980's	1990's
Clear cut	-	137	721	1937	687	125
Select cut	8	-	-	703	646	252
Precommercial thinning	-	-	1	173	467	300
Thinning	-	-	2	-	879	261
Totals	*8*	*137*	*724*	*2813*	*2679*	*938*

Fire

Figure IIC-5 in appendix 1 shows the fire history and fire type documented by the BDNF. Table IIC-6 gives total acres burned each decade 1950-1999. Both the figure and table show that natural wildfire has been almost completely absent over the last half century and indicates the effectiveness of fire suppression efforts within the landscape. Figure IIC-5 shows numerous wildfires in the 1960's and 1970's adjacent to the landscape on the east side of the continental divide. Wildfire activity has been very limited in the area for the last 27 years. Recently the most acreage burned has been post harvest slash burning and prescribed fire associated with forest thinning. In the 1990's half as many acres were treated with fire for ecosystem improvement or to control understory growth as were burned in association with harvest. In the 1990's approximately 1,500 total acres saw prescribed fire.

Table IIC-6: Fire history by decade (BDNF GIS data).

	1950's	1960's	1970's	1980's	1990's
Post harvest burn/broadcast burn	-	94	1354	1867	863
Site preparation burning	3	193	-	270	129
Ecosystem burn – range improvement	-	-	-	-	395
Understory burn	-	-	-	-	136
Wildfire	2	1	-	-	-
Totals	*5*	*288*	*1354*	*2137*	*1523*

Fire Regime Condition Class

Fire regime condition classes measure the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components, such as vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought. Possible causes of this departure include (but are not limited to) fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, and introduced insects and disease. Assessing FRCC can help managers gain a landscape perspective of conditions, evaluate risk to ecosystem sustainability, and develop a long term strategy to improve condition class and assess management implications.

Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural fire regime, such as those found in FRCC 1 (low departure). Uncharacteristic conditions are considered to be those that did not occur within the natural regime, such as are often found in FRCC 2 and 3 (moderate to high departure). These include (but are not limited to): invasive species (weeds and insects), diseases, “high graded” forest composition and structure (in which, for example, large fire-tolerant trees have been removed and small fire-intolerant trees have been left within a frequent surface fire regime), or repeated annual grazing that reduces grassy fuels across relatively large areas to levels that will not carry a surface fire.

Table IIC-7: Stand-level FRCC for BDNF lands.

FRCC	Acres	% of Total
1	17,567	52%
2	8,019	24%
3	8,238	24%
Total	33,825	

Figure IIC-6 in appendix 1 presents stand-level FRCC from USFS R1 for all forested lands within the landscape. Table IIC-7 presents stand-level FRCC acres for the BDNF within the landscape. The stand-level FRCC is based on departure of current vegetation conditions from reference vegetation conditions only, and does not include departure of current fire regimes from those of the reference period as described in Hann et al. (2004). Table IIC-8 describes the various FRCC rankings.

Table IIC-8: FRCC rankings.

Class	Description	Potential Management
FRCC 1	Low departure. Fire regimes are within their historical range and the risk of losing key ecosystem components is low.	These areas can be maintained within the historical fire regime by such treatments as fire use.
FRCC 2	Moderate departure. At least one fire interval has been missed, or exotic species have altered native species composition (e.g. cheat grass and blister rust). There is a moderate risk of losing key ecosystem components should a fire occur.	These areas may need moderate levels of restoration treatments, such as fire use, hand or mechanical treatments to be restored to historical regime.
FRCC 3	High departure. Several fire intervals have been missed, or exotic species have substantially altered native species composition (e.g. cheat grass and blister rust). There is a high risk of losing key ecosystem components should a fire occur.	These areas may need high levels of restoration treatments, such as hand or mechanical before fire is used to restore to historical fire regimes.

The stand-level succession class FRCC looks at departure of a stand or small-scale project within the context of the FRCC patterns at the landscape scale. Stand-level FRCC assigns a condition class based on the membership of stands within a current seral stage. All stands within the same current seral stage will get the same condition class. The primary purpose of the stand-level

FRCC is to facilitate FRCC reporting for projects that target individual stand under the National Fire Plan Operations & Reporting System (NFPORS) an interagency system designed to assist field personnel in managing and reporting accomplishments for work conducted under the National Fire Plan. Placed into a landscape context, the stand-level FRCC provides insights as to which seral classes are contributing to a departure in the condition class of vegetation at the landscape scale. Specific areas can then be targeted for treatment to address large scale condition class departure.

At the stand-level we see a spatially heterogeneous condition class with areas of FRCC I adjacent to areas of FRCC III. The areas of higher FRCC do not appear to be coincident with a singular forest type such as the mid elevation Douglas fir that borders the sage-brush grasslands or high elevation lodgepole pine. Instead, areas of higher condition class departure are spread through a wide range of aspect and elevation. Table IIC-9 presents the stand-level FRCC data intersected spatially with the SILC3 cover type data by vegetation diversity matrix group for BDNF lands in the landscape (table IIC-2). The FRCC data does indicate a large percent of the landscape where forest structure is likely uncharacteristic of natural conditions. This is supported in field observations and SILC3 data (see Figure IIC-12, table IIC-2, and discussion under range of natural variability in section IIC-2 below) showing existing Douglas fir stands consisting of a disproportionally high amount of pole size trees wherein the RNV for these forest types would support a higher component of open stands with mature trees. Similar is true of lodgepole pine existing condition where the pole size class dominates (Figure IIC-13) forest stands which would typically have a higher component of seedling/sapling under the RNV.

Fire Protection

The Healthy Forests Restoration Act of 2003 (HFRA) provides for coordinated fire protection efforts between USFS and BLM and communities or watersheds that develop a Community Wildfire Protection Plan (CWPP). CWPPs were completed by Powell and Deer Lodge Counties with cooperation from local government and fire departments, Montana Department of Resources and Conservation (DNRC) and with technical support and resource management input from the USFS and BLM (Fox Logic, 2005a,b). The CWPPs establish the wildland-urban interface (WUI) for both counties which includes the standard national HFRA WUI with an additional 4-mile buffer of decreasing

Table IIC-9: Stand-level FRCC by forest type (BDNF lands).

Forest Type[1]	FRCC	Acres	% of Total
Douglas Fir	I	2,932	52%
	II	1,344	24%
	III	1,324	24%
	Total	*5,601*	
Lodgepole Pine	I	13,486	53%
	II	5,541	22%
	III	6,434	25%
	Total	*25,460*	
Subalpine fir	I	445	51%
	II	388	44%
	III	43	5%
	Total	*875*	
Upland Hardwood	I	87	48%
	II	41	23%
	III	52	29%
	Total	*181*	

1- Forest type grouped according to the BDNF vegetation diversity matrix. See table IIC-2 for grouping.

protection priority that was derived to meet local fire protection needs.

In each CWPP, a fire risk/WUI impact model was used to develop a fire mitigation priority rating across the landscape (figure IIC-7 provided in appendix 1). The fire mitigation priority rating used is a function of a risk analysis which combines four sources: 1) a fire behavior fuels model, 2) an ignition probability model, 3) FRCC data, and 4) WUI priority protection zone. This priority rating is used to determine the implementation schedule for mitigation actions. Each CWPP describes general mitigation actions to be implemented; in each CWPP fuels reduction receives the highest priority. According to the mitigation timeline provided in each CWPP, very high and high fire mitigation priority areas (figure IIC-7) will be addressed first starting in 2005. Medium priority areas will be addressed starting in 2008. Local county governments, through the Powell County and Anaconda-Deer Lodge County Fire Councils are responsible for selection and implementation of fire mitigation actions. USFS, BLM, and DNRC are the primary government agencies responsible for implementing mitigation activities.

Air Quality and Prescribed Fire

The air quality within the landscape is typically good. Air quality may also be impacted by particulates generated by local nonpoint sources of air pollution including prescribed fire and wildfire, wood burning stoves, road construction, vehicle traffic on unpaved roads, and agricultural activities.

All open burning on the BDNF is regulated by the restrictions in the Air Quality Major Open Burning Permit issued to the USFS R1 pursuant to the Administrative Rules of Montana (ARM) 17.8.601, et seq. Major prescribed burners such as the USFS have joined in the Montana/Idaho State Airshed Group which includes a Smoke Monitoring Unit that provides daily air quality predictions and restrictions to its members. Restrictions may be by airshed, elevation or by special impact zones around populated areas and are based on current and predicted smoke dispersion. The major goal of the group is to minimize or prevent the accumulation of smoke in Montana when prescribed burning is necessary by using Best Available Control Technology. The BDNF is permitted to burn based on compliance with burning restrictions set by the Airshed Group.

The Prevention of Significant Deterioration portions of the 1977 Clean Air Act Amendments (P.L. 95-95) classified areas of the country as Class I, II, or III. Class I areas area are all international parks, all national wilderness, memorial parks greater than 5,000 acres, and all national parks greater than 6,000 acres that existed on August 7, 1977. (P.L. 95-95, Part C, Sec. 162(a)).

The EDLV landscape is designated as Class II. Each class allows a specific maximum increase of sulfur dioxide and particulate matter above base line concentration per section 163 of the Clean Air Act. Class I areas within 50 miles of the landscape include the Anaconda Pintlar Wilderness approximately 23 miles to the southwest, the Welcome Creek Wilderness approximately 45 miles northwest, the Gates of the Mountains Wilderness approximately 41 miles northeast, and the Scapegoat Wilderness approximately 45 miles north. The most stringent Federal and State air quality regulations apply to these and other Class I areas. An area around Butte is a designated PM-10 Nonattainment Area under 40 CFR 81.327 which will limit the timing of and impacts to air quality by prescribed burning in the landscape. Example burn plans for addressing air resource impacts from prescribed fire smoke are available from DEQ.

Sensitive Species

Some plant species are rare because their habitat needs are very exacting and those habitats are and have been in short supply. Other plant species are rare because human activities have either reduced plant numbers or reduced habitat necessary for those species. Plants that are rare to the point of becoming extinct are protected by the Endangered Species Act (ESA) and are listed as threatened or endangered. None of those species are known to exist on this landscape.

Sensitive plant species are designated by the USFS R1 office and are species for which population viability is a concern. Sensitive plant species and their habitats are protected and managed to perpetuate their continued presence and to prevent them from becoming threatened or endangered in the future.

Historical records of plant species determined to be sensitive by the USFS within the landscape include Idaho sedge *(Carex idahoa)* which was last observed in 1897 at the Grant-Kohrs Ranch which is administered by the National Park Service.

Invasive Weeds

Extensive weed mapping is available from the USFS for national forest lands and quarter-section based weed mapping is available from Powell County for lands off of the forest. Weed mapping is not available in Deer Lodge County other than on national forest lands and national forest road easements. County weed mapping is quarter-section based and national forest mapping provides delineation of specific patches.

Spotted knapweed *(Centaurea maculosa)* and leafy spurge *(Euphorbia esula)* are the dominant noxious weeds in the landscape (figures IIC-8 and IIC-9 in appendix 1). Yellow toadflax *(Linaria vulgaris)*, Canada thistle *(Cirsium arvense)*, houndstongue *(Cynoglossum officinale)*, whitetop *(Lepidium draba)*, Russian knapweed *(Acroptilon repens)*, and common tansy *(Tanacetum vulgare)* are also present in the landscape and in need of control.

Range grasslands on the large benches of the EDLV are in various states of infestation by knapweed and spurge. Low elevation, arid areas of private lands that are over grazed and do not benefit from routine weed control contain some of the largest weed patches in the landscape. Generally, weed infestations are less extensive on national forest lands and often follow transportation routes.

BDNF resource reports for the Dry Cottonwood Allotment (figure IIC-10 in appendix 1) indicate the Girard gulch area has extensive areas of leafy spurge infestation. Other infestations of leafy spurge can be found in Dry Cottonwood, near Cottonwood Mountain, and in the Orofino area. Chemical control efforts for the infestations are ongoing annually. Biological control methods have been initiated on leafy spurge in several locations on the allotment including Girard Gulch, Sand Hollow, and Cottonwood Mountain. BDNF grazing allotment records also show the Dry Cottonwood Allotment has several significant spotted knapweed patches. Chemical control efforts for the infestations are annual. Spotted knapweed and leafy spurge infestation data for the other allotments in the landscape are limited to that shown in figures IIC-8 and IIC-9.

Photo: Leafy spurge on private lands along road and riparian area of lower Perkins Gulch.

Riparian areas are among the most impacted by noxious weeds owing to heavy use of these areas by livestock as well as past placer mining and flood events which have left large areas of disturbed ground. Because weed communities do not provide the bank stability nor do they provide the habitat or forage of native grass, sedge, and shrub communities, loss of these native riparian communities is one of the most significant resource concerns in the landscape. Weed infestation of the riparian areas is further described in this landscape assessment under section IIB-1 Existing Condition – Riparian Health.

Grazing

History

The history of grazing use throughout the landscape area is typical of most grazing areas in Southwest Montana. Domestic livestock began using the area prior to the creation of the National Forest Reserves. The first use was in the mid 1800's by pack and saddle stock belonging to trappers, prospectors, and miners, followed by livestock associated with the many homesteads. Grazing continued by cattle, sheep, and horses after the Deerlodge National Forest was established in 1908. However, the sheep industry began to decline, and sheep grazing was mostly eliminated by the 1920's. In these early years of the forest, the landscape also supported large numbers of horses, both permitted and unauthorized.

Historically, livestock grazing within the national forest lands of the landscape was organized into the Dry Cottonwood and Emery livestock divisions. Present allotments included in the historic Dry Cottonwood division are Dry Cottonwood and Peterson Creek. Current allotments are shown in figure IIC-10. The Emery Livestock division included present Burnt Hollow, Cliff Mountain and South Cottonwood allotments. These five allotments are now managed by the

Pintler Ranger District. Additionally, the Indian Creek allotment which straddles the divide inbetween Peterson Creek and the Boulder River drainage is managed by the Jefferson Ranger District.

Livestock grazing on the Dry Cottonwood division likely began in the late 1870's. From the date of the creation of the Helena Forest reserve in 1906, up to and including the season of 1920, both sheep and cattle were grazed in the area. The demand for grazing on the Dry Cottonwood division peaked in 1912 when approximately 17,128 animal unit months (AUMs) were authorized. Records indicate that from 1910 to 1920 there was an average of 6,800 sheep and 1,451 cattle grazing the Dry Cottonwood area annually. Grazing seasons varied from a 5-1/2 month season to a year long season during this period. From 1921 to 1963, the area was grazed by 538-1,303 head of cattle with a season long grazing system. In 1963, a 2 herd rest rotation grazing system was implemented for 538 head and a June 16-September 30 season. In 1967, an allotment management plan (AMP), implementing this 2 herd, 6 pasture rest rotation system was approved. In 1979, the Dry Cottonwood AMP was revised into a 1 herd, 4 pasture rest rotation system.

Livestock grazing in the Emery division began about 1875. The demand for grazing on the Emery Division peaked in 1918 when 10,338 AUMs were authorized. In 1922, sheep use of the Emery Division ceased. Allotment notes from 1926-1927 indicate that a management objective was to use as much available forage as possible. Distribution was attained by riding and salting practices. During the 1940's and 1950's livestock numbers were progressively reduced to 468 head and season of use were reduced to June 16-September 15 for 1853 AUMs, several drift fences and water developments were constructed. In 1960, the first AMP for the Cliff Mountain allotment noted that portions of the Airplane Park area were in poor condition and indicated that a 20% reduction in season or numbers would be required if extensive management was continued. In 1968, the AMP was revised to implement a six pasture rotation grazing system and it was felt that the more intensive system would allow for recovery of these areas without a reduction in livestock numbers. In 1978 the AMP was amended to adjust the rotation schedule because the high elevation pastures were not ready to graze at turn-on and it was felt that two consecutive years early use was detrimental to plant vigor. Since 1989, the Cliff Mountain Allotment has been managed so that the Airplane Park and Cliff Mountain areas have been receiving rest at least every other year. The two lower elevation pastures receive alternate use, either late or early season and the remaining pastures are deferred until mid season.

Resource impacts from the early livestock grazing were severe in many areas, especially along riparian zones. Mining activities have also impacted some of the same areas currently classified as suitable livestock range.

Range Vegetation

<u>Grasslands:</u>

All of the grasslands in the landscape are in various seral stages; most have been altered to some degree by past management activities. The steeper sites, those over 35%, are usually nearer their potential than those on more gentle ground. Grasslands in later seral stages or near their potential produce more forage per acre. Another factor used in determining seral stages of grasslands is the presence or absence of spotted knapweed. Where knapweed is present in high densities, the native grasses and forbs are being out competed at the site. The level of noxious weed infestation generally coincides with the levels of previous management activities, such as timber harvest, proximity to roads, grazing, and/or infested adjacent private land.

The native grasslands vary in size from a few acres to over a couple of hundred acres. Depending on their past history of use and accessibility to livestock grazing, current composition of the grasslands range from an early seral stage to the potential natural community. Vegetative trend for grasslands on national forest lands can generally be described as upward or static. Most allotments have experienced a reduction in livestock numbers or season of use and more intensive management systems over the last several decades.

Shrublands:

The landscape contains a few scattered stands of rubber rabbitbrush *(Chrysothamnus spp.)* and antelope bitterbrush. Trend within the antelope bitterbrush communities was degrading in the mid-1990's, with most plants being dead or dying and with very few new sprouts (USFS, 1995b). In conjunction with FWP, attempts to rejuvenate a portion of the bitterbrush population using prescribed fire were conducted in the 1990's. No information on the effectiveness of these prescribed burns to restore bitterbrush is available. The grazing lands within the landscape contain larger areas of the big sagebrush.

Forest Lands with Bunchgrasses:

With the absence of wildfires during the past 80-100 years, conifers have been able to severely encroach on the native bunchgrass habitat types leading to a reduction in the area of bunchgrass within these habitat types. The existing seral stage of these habitats is dependent on the history of fire suppression and conifer encroachment for a specific location.

Riparian Areas

Riparian conditions in the landscape were adversely impacted by past livestock grazing and placer mining activities in the late 1800's and early 1900's. In the mid 1900's, grazing reforms and better management were implemented. The improved management resulted in measurable recovery of the uplands. The previous downward trend of riparian areas was slowed or even stopped. However, the improved management did not provide the conditions necessary for the riparian areas to significantly improve. Because of stock preference for the lush vegetation, available water, and shade, riparian communities remain the heaviest used and most impacted of the vegetative communities in the landscape. In light of this, by the 1980's riparian conditions remained generally static or only slightly better from what they were when modern grazing systems were employed in the 1960's.

The shrub communities within riparian areas in this landscape are generally in mid to late seral stages. The steeper gradient streams are in the best shape due to their lack of appeal to domestic livestock. Riparian areas that have a conifer overstory produce less forage for livestock than willow and sedge dominated sites. With the implementation of formal riparian mitigation measures in the late 1990's and improved management along riparian zones, a gradual improvement of both vegetation and stream functioning was expected. However, riparian assessments have not been completed at multiple intervals since the implementation of the 1997 Interim Riparian Mitigation Measures to determine trends in riparian health.

According to BDNF range specialists, riparian condition on Cottonwood and Baggs Creeks has improved in areas where riparian exclosure fences have been constructed since 1996.

Allotment Status and General Range Conditions

Figure IIC-10 shows a map of the current grazing allotments in the landscape. Table IIC-10 lists the acres and grazing system for each allotment.

Currently, all allotments are evaluated using the standards outlined in the FP (1987), the applicable allotment Environmental Assessment (EA), or the 1997 Interim Riparian Mitigation Measures. The 1997 Interim Riparian Mitigation Measures were designed to assist the BDNF in maintaining or moving toward the standards outlined in the Inland Native Fish Strategy (INFISH - USDA, 1995). These desired conditions are to restore and maintain the historical extent and function of riparian areas where possible, considering their inherent characteristics (physical and biological) and their existing conditions and functionality. The 1997 Interim Riparian Mitigation Measures utilize four parameters to determine the appropriate level of livestock grazing in the riparian areas: stream bank disturbance, woody browse utilization, stubble height, and riparian herbaceous utilization. Allowable disturbance and utilization levels are tailored to each stream reach depending on the inherent stability of its vegetative community and its resiliency and resistance. The site specific Riparian Mitigation Measures are now being incorporated into AMPs as they are revised.

Table IIC-10: Grazing allotments.

Allotment	Livestock number	AUMs	Suitable grazing acres[1]	% suitable	Season	Grazing system
Cliff Mountain	460	1822[2]	5,381[2]	36%	7/1-9/15	Deferred rotation
South Cottonwood	51	206	500	20%	7/1-8/15 or 8/16-9/30	Alternating season
Burnt Hollow	Variable	270	1,686	36%	Variable	Rest-rotation
Indian Creek[3]	175	616	2,461	35%	6/16-10/10	Rest-rotation
Peterson Creek	-	-	143	100%	-	Not currently permitted
Dry Cottonwood	556	2,568	6,874	41%	6/16-9/30	Rest-rotation

1- For definitions of suitable grazing acres see R1 Directive FSH 2209.21.
2- Information from allotment management plan EA.
3- Indian Creek totals include rangelands outside of the landscape on Jefferson RD.

Between 1989 and 1993, vegetative conditions of the Cliff Mountain allotment were evaluated using ECODATA techniques (Jensen et al., 1992). ECODATA provides detailed, multilevel intensity sampling methodologies for collecting topographic, vegetation, soil, wildlife, hydrologic, riparian, and other information at the plot level. ECODATA sampling showed that in the early 1990's grasslands within the allotment were 22% late seral, 74% mid seral, and 4% early seral. In the shrub/grassland communities, 31% were late seral, 41% mid seral and 28% early seral. Observations in the bitterbrush communities along the north hillside of Baggs Creek indicate that 85-90% of the plants had some live growth, generally 20-40% of the plant; 10-15% of the plants were dead; and 5-10% of the plants were young and vigorous. All the older plants showed evidence of heavy browsing pressure. The branches on older plants were severely clubbed and most new sprouting was close to the stem. All the bitterbrush was in a mid seral condition. Canopy coverage of big sagebrush on the allotment varied from 3-38%.

Revised allotment management plans with EAs were prepared for the Cliff Mountain and Dry Cottonwood allotments in 1995 to bring the allotment management in line with the goals and objectives of the FP (1987). At the time of these EAs, it was found that some conditions on the Cliff Mountain allotment were exceeding FP (1987) standards. Specifically, riparian areas in the upper reaches of Cottonwood Creek and Baggs Creek were in unsatisfactory condition. The combined effects of heavy grazing and the flood of 1981 had left many of the stream banks bare and highly susceptible to soil loss. Forage utilization in these areas had consistently exceeded allowable use standards, preventing these areas from recovering. Analysis had also indicated that the seral status of the vegetation in many areas was not consistent with the desired condition of the allotment. Lack of fire, vegetative succession, the flood of 1981, and grazing had contributed to the sub-standard vegetative conditions on the Cliff Mountain allotment and loss of native bunchgrass through succession to coniferous tree overstory. Vegetation condition analyses for the Dry Cottonwood allotment, other than permit compliance monitoring, has not been undertaken in the last three decades.

The 1999 Forest Monitoring and Evaluation Report (BDNF, 1999b) is focused on riparian health. That report presents 1998 compliance monitoring of the 1997 Interim Riparian Mitigation Measures indicating that on the Deerlodge zone 37% of allotments had not met those standards. In 1998 and 1999 the forest conducted a more formal, integrated review of implementation of grazing decisions on seven allotments including the Dry Cottonwood allotment. Results from that integrated review indicated that the Dry Cottonwood allotment was not meeting riparian browse utilization standards at 2 of 4 monitored sites and was not meeting bank disturbance standards at 2 of 3 sites. Results of the integrated review for 7 allotments forest-wide indicated that bank disturbance standards were only met at 23% of monitored sites. This reporting shows the challenge of implementing the new standards and indicates major compliance issues in the initial years under the new standards.

Recent permit compliance monitoring reports were consulted for the most up to date information on allotment management compliance. In all cases compliance with riparian standards was evaluated by the Range Management Specialist using ocular estimates or personal judgment if the site was not visited. 2006 annual reporting for the Dry Cottonwood allotments showed that available forage utilization and maintenance of upland grassland condition for ground-nesting birds was satisfied as were the 1997 Riparian Mitigation Measures except in the North Fork of Dry Cottonwood Creek where standards were not met. Perkins Gulch on the Dry Cottonwood allotment was noted as having quite a few raw banks but was reported as complying with riparian standards. The 2006 report suggests that the riparian standards are not being consistently met on the Dry Cottonwood allotment. 2006 annual reporting for those pastures inventoried on the Cliff Mountain and Burnt Hollow allotment showed that all standards were met. On the Indian Creek allotment, the only pasture located within the landscape is Blizzard Hill. Blizzard Hill was rested in 2003 and 2006 the years of recent compliance monitoring and no data is available on recent trends. Recent compliance monitoring reports were not available for the South Cottonwood allotment and the Peterson Creek allotment is not currently permitted.

2. Range of Natural Variability

Wildfire

Natural processes affecting vegetation within the landscape are led by fire. Wildfire is an important ecosystem process influencing spatial and temporal variation in plant community composition and structure. The frequency, intensity, and extent of wildfire is closely tied to climatic conditions and site physiography. Climate patterns occurring on the scale of centuries to millennia are a dominant control on vegetation composition and fire regimes. In the last century organized fire suppression has had the greatest short term effect on vegetation. The natural fire ecology of forest vegetation in the landscape described here is adapted from the summary of fire ecology of Western Montana forest habitat types by Fischer and Bradley (1987). Various habitat types can be classified into fire groups based on the relationship of each species to fire and forest succession. The fire ecology of grasslands differs from the forest habitat fire groups.

Using satellite derived land cover from the Gap Analysis Project (GAP) (Redmond et al, 1998), the largest portion of the EDLV landscape, approximately 42%, is low/moderate cover grassland while 7% is sagebrush community adjacent or intermingled with the grassland at higher elevations. In the grassland community, the dominant grasses include Idaho fescue which is a fire adapted grass species which recolonizes a burned area by residual plant survival and seed germination. Co-dominant rough fescue has a similar recolonization strategy. The fire ecology of grasslands varies greatly. Within the landscape grassland fires likely had a considerably higher return frequency under presettlement conditions. With fire suppression, and the reduction in fine dried grass fuels caused by livestock grazing, fires are less frequent and this likely has caused species composition to shift away from more fire adapted types. Due to fire suppression, sagebrush may be present at a higher proportion than under natural conditions. Additionally, conifer encroachment has reduced the size of some grasslands.

According to the GAP analysis, mixed subalpine and lodgepole forest comprise the next two largest portions of the landscape, approximately 13% each. Douglas fir and mixed Douglas fir/lodgepole forest types comprise 8% and 4% of the landscape respectively. Spatial intersection of the GAP data with the BDNF stand classification for the national forest lands shown in figure IIC-1 indicates that the mixed subalpine forest type community is approximately 60% lodgepole pine stands, while Douglas fir stands are the next most common stand class at only 15% of this GAP class. This indicates that lodgepole is the dominant species in approximately 63% of forested lands within the landscape.

The interaction of mountain pine beetle and fire is a fundamental feature of lodgepole ecology and is in part dependent on whether or not lodgepole is the climax species at a site. In the absence of fire, beetle outbreaks may in time eliminate lodgepole in stands where it is a seral species as the pines succumb to beetle mortality and are succeeded by subalpine and Douglas fir which are not affected by pine bark beetle and which can grow in the shade of lodgepole overstory. With continued fire in these seral lodgepole stands, the beetle kill will in fact perpetuate the lodgepole as the buildup of high fuel loads from periodic beetle kill leads to intense fires which favor lodgepole regeneration. In higher elevation lodgepole stands in the EDLV much of the undergrowth is sparse lodgepole, and in these stands, lodgepole will regenerate in the absence of fire.

In some stands where lodgepole is a climax species, fire may have a lower intensity, non-stand replacing effect. In these forests, beetle activity is typically chronic, but lower intensity. Beetle mortality causes openings in the lodgepole-climax stands in which lodgepole is capable of reseeding resulting in two or three-storied stands of differing age and size classes. The result for the beetle is a more continuous source of food and less fluctuation in beetle population than is realized under conditions conducive to stand replacing fires. Additionally, mixed severity fire may result in multi-storied lodgepole pine stands when some of the mature trees survive fire.

Much of the higher elevations in the mixed subalpine and lodgepole forest types likely fall under the fire group ‘cool habitat types usually dominated by lodgepole pine’ (Fischer and Bradley, 1987). In seral lodgepole stands at 7,500 ft and below, fire acts almost exclusively to perpetuate lodgepole and in the absence of fire, shade tolerant species replace lodgepole. The natural reoccurrence interval of severe fire in lodgepole stands may have ranged from less than 100 years to 500 years (Hendrickson, 1970; Brown, 1975). Although, small, cool fires may help rejuvenate lodgepole, large scale, stand replacing fires play the major role in this species fire ecology. In stands older than 60 to 80 years, fuels build up from natural mortality, bark beetle outbreaks and other disease, and snags from previous fires. The ignition of older, thickly stocked lodgepole stands under conditions of extreme fire behavior causes stand replacement fires on the order of thousands of acres. Large, homogenous stands of lodgepole may recolonize the burned area as the heat of the fire causes the serotinous cones of the lodgepole to open.

Above 7,500 ft elevation, a combination of factors including a shorter fire season, less bark beetle activity, and a shorter growing season (less biomass/fuel production) often limits the extent to which stand replacing fires can grow. Romne (1980, 1982) estimated a 300-400 year mean reoccurrence interval for stand replacing fires in Yellowstone’s subalpine forest. This higher elevation fire regime leads to lodgepole stands naturally occurring in a mosaic of age classes as small, higher frequency fires affect several acres before burning out.

A reference for this type of structurally diverse lodgepole pine ecosystem is the Tenderfoot Creek Experimental Forest (TCEF) on the Lewis and Clark National Forest in the Little Belt Mountains of Montana. A detailed fire history for a lodgepole forest at 7,150 – 7,500 ft elevation in the TCEF shows a stand replacement fire interval of 100 – 300 years with low and mixed severity burns occurring within this interval (Barrett, 1993). This fire regime in the TCEF results in a mixed forest with single-aged and two aged lodgepole stands covering approximately equal areas.

Some of the lower elevation as well as warm aspect higher elevation stands where lodgepole is intermixed with spruce, Douglas fir and subalpine fir likely fall under the fire group ‘dry, lower subalpine habitat types’. In these stands periodic low to moderate intensity fires allow Douglas fir and lodgepole pine to persist by setting back succession of subalpine fir and spruce. The major difference between this fire group and ‘cool habitat types usually dominated by lodgepole pine’ is that subalpine fir or spruce are typically the climax species. Moderate intensity fires would favor fire resistant Douglas fir stands, while hotter fires or stand replacing fires within this habitat type would favor lodgepole. Either Douglas fir or lodgepole may become dominant in this fire group if past conditions have favored these species. Natural fire reoccurrence intervals in these stands likely were shorter than for ‘cool habitat types usually dominated by lodgepole pine’ and were in the range 50 – 130 years.

At mid-elevations along the bottoms and sides of the draws which contain the landscape’s numerous streams where Douglas fir is dominant the applicable fire group is ‘cool, dry Douglas fir habitat’. These sites are apparently too dry to support many lodgepole pine and likewise too cold to favor ponderosa pine. Relatively light natural fuel loads, sparse undergrowth, and generally open nature of these Douglas fir stands provide a fire reoccurrence interval on the order of 35 – 45 years. Fire intensity varies naturally with fuel buildup, understory density, and the climate cycle. Ground fire is responsible for maintaining open, park-like stands and in some areas naturally favors open grasslands with Douglas firs limited to rocky microsites. With modern fire suppression these areas are experiencing conifer encroachment. Periodic hotter fires may return a forested area in this fire group to a grassland state which is gradually recolonized by conifers.

Fire Return Interval

Fire return interval was analyzed for forest and range vegetation in the landscape area using data provided by the Landfire project. Landfire was created to support the goals of the National Fire Plan, Federal Wildland Fire Management Policy, and the Healthy Forests Restoration Act. The Simulated Historical Fire Regime Groups data layer presented in figure IIC-11 categorizes simulated mean fire return intervals and fire severities into five fire regimes defined in the Interagency Fire Regime Condition Class Guidebook (Hann et al. 2004). This figure also shows prescribed burn units delineated by the Pintler RD. Burn units are described further in appendix 6. The fire regime group data layer is derived from vegetation and disturbance dynamics simulations using LANDSUM (Keane et al. 2002, Keane et al. 2003, Keane et al. 2005, Pratt et al. 2005). LANDSUM simulates fire dynamics as a function of vegetation dynamics, topography, and spatial context in addition to variability introduced by dynamic wind direction and speed, frequency of extremely dry years, and landscape-level fire size characteristics. The simulations used to produce this layer were 10,000 years in duration to observe the most complete representation of the fire regime characteristics within spatially complex landscapes, given computational limitations.

The Landfire fire group acreages are summarized for BDNF land in the landscape along with prescribed burn targets in table IIC-10B. The prescribed burn targets represent the estimated range of acres within each fire group that would burn under natural conditions each decade. The burn targets are presented by decade because it is not possible to accomplish significant prescribed burning in every year due to budget and climate factors. The prescribed burn targets are intended to maintain fire adapted vegetation types within the RNV.

Within the landscape, 13,170 acres have been delineated as prescribed burn units by the Pintler RD. These burn units provide an opportunity to work towards the burn targets in table IIC-10B. The modeled fire regime groupings for each burn unit are presented in appendix 6. Past activities have affected the vegetation in these burn units as described in appendix 6. However, only burn unit # 9 has seen prescribed fire applied to the majority of the unit. The fire groups in this table are modeled using the broad-scale landscape model LANDSUM. The use of a broad-scale model raises the question of whether the scale of the model is appropriate to use for interpretation at the scale of the burn unit. However, the metadata provided by Landfire for this dataset indicates that it is locally applicable. The Landfire fire regime group data for each burn unit is the best available estimate of prescribed fire management needs by burn unit, in the absence of specific field data. Prescribed fire may additionally be applied outside of the delineated burn units to meet wildlife habitat improvement projects, forest health improvement, WUI goals, and in conjunction with silvicultural treatments.

Table IIC-10B: Landfire fire regime group and burn targets (BDNF only).

Fire Regime Group	Acres	% of Total	Decadal Prescribed Burn Target (acres)
I <= 35 yr MFI, low + mixed severity	699	2%	200+
II <= 35 MFI, replacement severity	680	2%	200+
III 35-200 MFI, low + mixed severity	28,764	72%	1,400 - 8,200
IV 35-200 MFI, replacement severity	7,664	19%	400 - 2,200
V > 200 MFI, any severity	1,929	5%	<100
Total acres:	39,735		

Forest Insect Infestation

Historically, forest insect infestation is a reoccurring disturbance responsible for providing stand diversity as well as a mechanism of initiating stand replacement in forests of the landscape. Mountain pine beetle generally causes mortality on a stand-scale. Lodgepole pine ecosystems are in part adapted to the mortality induced by beetle outbreaks and subsequent stand replacing fires of standing dead timber is one mechanism for renewal of this species. As such, mountain pine beetle epidemic is a potential source of additional fuel loads to mature forests which may complicate severe wildfire conditions already present due to drought. Douglas fir beetles tend to kill trees in patches, which helps to thin the forest, allowing sunlight to filter down to other species of trees and brush. Douglas fir beetle population outbreaks normally run their course in three to four years. Western Spruce budworm is a defoliator which during outbreaks may cause a competitive disadvantage to host species and which plays a critical role in forest nutrient recycling and regulating stand composition and structure. The bio-ecology of these forest insects and their effects on forest vegetation are described in further detail here.

Mountain Pine Beetle (adapted from Furniss and Carolin (1977) and Logan and Powell (2005))
The mountain pine beetle, *(Dendroctonus ponderosae)* ranks first in destructiveness among the bark beetles of the West. It ranges throughout the pine forest of British Columbia, Alberta, and the Western States into northern Mexico. Lodgepole, ponderosa and whitebark pine *(Pinus albicaulis)* are its principal hosts in the Rocky Mountain States. In lodgepole pine, the mountain pine beetle infests mature forests, often decimating them over extensive areas. In ponderosa, group killing, often on a large scale, occurs both in mature forests and in young overstocked stands. Mostly, this beetle is a primary killer, but at times it occurs as a secondary, for example in association with the western pine beetle *(D. brevicomis).*

An outbreak of the mountain pine beetle from 1925 to 1935 in Idaho and Montana killed more than 7 billion fbm of lodgepole pine and vast numbers of whitebark pine. Trees from 10 to 12.5 cm (4 to 5 in) in diameter up to those of the largest size may be attacked by the mountain pine beetle. Under typical conditions pine trees in the 8-inch and up diameter are most prone to beetle infestation. Attacks are usually heaviest along the main trunk of a tree from within a meter or so off the ground up to the middle branches but may extend from the root collar very nearly to the top and into the larger limbs. During endemic infestations there is a tendency for the beetles to select the weaker, less vigorous trees for attack, but no such selection is evident during epidemic conditions. Infested trees are recognized first by pitch tubes on their trunk and red boring dust in bark crevices and on the ground at the roots; later, by discoloration of the foliage, as it changes from normal green to light greenish yellow, and then to reddish brown. The wood of successfully attacked trees soon becomes heavily blue-stained by *Ceratocystis montia*, a fungus symbiotic with the beetle. Attacking beetles carry with them the spores of blue-staining fungi on their bodies and in a special structure on their heads (Amman et al., 1990). As the fungi develop and spread throughout the sapwood, they interrupt the flow of water to the crown. The fungi also reduce the tree's flow of pitch, thus aiding the beetles in overcoming the tree. The combined action of both beetles and fungi causes the tree to die and the needles to discolor.

The life cycle of the mountain pine beetle varies considerably over its wide and diverse range. Historically, the geographic range of this beetle has been limited to areas with enough thermal energy to complete the life cycle in one year, otherwise referred to as univoltinism (Logan and Powell, 2005). Larvae and adults are the overwintering stages. However, recent climate change has lead to changes in beetle habitat and marginal habitat has in cases become ideal. Areas that were previously fractionally voltine, meaning that the beetle could not mature within one year's growing season have become univoltine and large outbreaks have ensued (Logan and Powell, 2005). Additionally these authors show that warming temperature can trigger more synchronous emergence of mountain pine beetles in formally marginal habitat leading to an increase in the beetle's effectiveness.

Several natural factors affect the abundance of the mountain pine beetle, including sub-zero winter temperatures; nematodes; woodpeckers; predacous insects such *as Enoclerus sphegeus, Temnochila chlorodia*, and *Medetera aldrichii*; and the insect parasite *Coelodies dendroctoni*. Recent analysis by Logan and Powell (2005) presents evidence that colder average summer temperatures can provide as much a limitation on pine beetle outbreak as do cold winter temperature.

As stand susceptibility to the beetle increases, the effectiveness of natural control decreases and outbreaks develop. High-risk lodgepole pine stands have an average age of more than 80 years, an average diameter at breast height of more than 8 inches (20 cm), and a suitable climate for beetle development based on elevation and latitude (Amman et al., 1990). As described under the description of wildfire natural variability above, it is currently understood that beetle mortality provides one mechanism to initiate stand renewal in lodgepole pine forest suffering from overcrowding or wildfire suppression.

Douglas Fir Beetle (adapted from Furniss and Carolin (1977))
The Douglas fir beetle, *(Dendroctonus pseudotsugae)* is the most important bark beetle enemy of Douglas fir throughout the range of this tree in western North America. It also attacks western larch but produces brood only in down trees. Normally it breeds in felled, injured, or diseased trees. The resulting endemic mortality is large in amount but widely scattered. At times, Douglas fir beetle becomes epidemic and kills apparently healthy trees on extensive areas. In Rocky Mountain forests, outbreaks usually are of longer duration and commonly develop in trees felled by wind, broken by snow, or affected by drought.

Reddish or yellowish boring dust caught in bark crevices or around the base of trees is the usual evidence of attack by the Douglas fir beetle. No pitch tube is formed but resin may exude from the upper attacks. The foliage of attacked trees turns yellow, then sorrel, and finally reddish brown in late summer, in fall, or in early spring, depending upon the region, time of attack, and weather. Viewed from the air these “redtops” provide a means for assessing an outbreak.

The Douglas fir beetle has one generation annually. Adults and large larvae overwinter, with the adults predominating. Depending upon area and weather, the overwintering adults emerge and attack from April to June. Some of these adults reemerge and attack additional trees, establishing a second brood. Adults from overwintering larvae emerge and attack in July and August.

In Rocky Mountain forests tree resistance is a key factor in control, but trees are subject to greater stress and the effectiveness of natural control varies more than in coastal forests. Among the insects rated as important in natural control of the Douglas fir beetle are *Enoclerus sphegeus, Thanasimus undatulus, Temnochila chlorodia, Coeloides brunneri*, and *Medetera aldrichii*.

Western Spruce Budworm (adapted from Fellin and Dewey, 1982; Bulaon and Sturdevant, 2006; Campbell et al., 2006)
The western spruce budworm *(Choristoneura occidentalis)* is the most widely distributed and destructive defoliator of coniferous forests in Western North America. The most common host-tree species which are present in the landscape are Douglas fir, subalpine fir, and Engelmann spruce. Larvae are also known to occasionally feed on the pine species present in the landscape. Although destructive to foliation, budworm typically causes less mortality relative to bark beetles.

Throughout most of its range, the western spruce budworm completes one cycle of development from egg to adult within 12 months. Moths emerge from pupal cases usually in late July or early

August. After mating, each female deposits approximately 150 eggs, usually on the underside of conifer needles. Larvae hatch within two weeks and overwinter in silken tents called hibernacula. In early May to late June, larvae leave the hibernacula to eat. The larvae first mine or tunnel into year-old needles, closed buds, or newly developing vegetative or reproductive buds and usually leave traces of silken webbing and bits of excrement at the feeding site or entrance hole. Larvae become full grown usually in early July about 30 to 40 days after leaving the hibernacula. Larvae pupate in webs of silk they have spun either at the last feeding site or elsewhere on the tree completing the life cycle.

New foliage, which is normally the preferred food, is usually entirely consumed or destroyed before larvae will feed on older needles. In addition to foliage, budworm larvae feed heavily on staminate flowers and developing cones of host trees. In some Douglas fir stands, nearly all cones may be damaged or destroyed by feeding larvae, especially when larval population densities are high and cone crops are light. Top-killing of some host trees, as a result of persistent heavy defoliation, often precludes cone production for many years, even when budworm populations subside. The greatest impact from budworm defoliation in mature stands is reduced growth, although repeated defoliation sometimes results in top-killing and mortality. Studies in Montana and Northern Idaho show that budworm caused impacts are often short-term and mature trees can recover quickly after populations subside (Bulaon and Sturdevant, 2006). In some mature stands, trees severely defoliated by the western spruce budworm may be predisposed to one or more species of tree killing bark beetles, mainly the Douglas fir beetle.

There is considerable variation in the timing and duration of these western spruce budworm events at the stand level. Research in southern British Columbia indicates that synchronous outbreaks have occurred in approximately 30- to 43-year cycles and climatic variation appears to have been important to budworm outbreaks in the 20th century (Campbell et al., 2006). Notable outbreaks in this area of British Columbia tend to occur during years with average spring air temperatures following winters with less than average precipitation. These authors propose that with higher over-winter survival rates and a longer growing season associated with climate change, the duration of outbreaks may increase in the future. In Colorado, a tree ring study confirmed outbreak periodicities at about 25, 37, and 83 years (Ryerson et al., 2003). Comparison with an independent drought reconstruction for the Colorado site indicated that outbreaks typically corresponded to increased moisture; while relatively little budworm activity occurred during dry periods. Brookes et al. (1987) suggest that epidemics will continue indefinitely in forests of advanced successional stage but may fluctuate periodically based on abnormal weather patterns.

Budworm populations are usually regulated by combinations of several natural factors such as insect parasites, vertebrate and invertebrate predators, and adverse weather conditions. During prolonged outbreaks when stands become heavily defoliated, starvation can be an important mortality factor in regulating populations. Cool summer weather retards feeding and development, increasing the time larvae are vulnerable to parasites and predators. However, larvae established in hibernacula are not affected by extremely low temperatures. A 7-day cold wave, -43 ° F to -53° F in Montana between November 11 and 17, 1959, had little to no effect on overwintering larvae (Fellin and Dewey, 1982). Unseasonably low temperatures in the late spring or early summer can kill larvae directly by freezing or indirectly by starvation when buds and foliage are destroyed.

Forest Stand Size Class Distribution

The species composition and size class of vegetation in the landscape is a function of the vegetation type, the forces of disturbance affecting the vegetation community, and successional processes which cause vegetation composition to change through various seral stages. The resulting patterns of vegetative composition and size vary from one decade to the next within the range of natural variability. Describing the RNV for the vegetative communities in the landscape is complicated by the random nature of climate and the disturbance processes affecting vegetation. Studies of historical vegetation in Western Montana help to identify points of reference for vegetative RNV; but typically these studies quantify composition and size class for a snapshot in time. Another way of describing vegetative RNV is to use a computer modeling program which simulates random disturbance processes, vegetative succession, and the resulting patterns of species composition and size. One such modeling system is SIMPLLE (Chew et al., 2007), developed by the USFS Rocky Mountain Research Station (RMRS) to help land managers to define and evaluate future conditions at landscape scales, to identify areas that are more prone to disturbances over a given time frame, to identify the options for influencing these disturbance processes, and to help design and evaluate different strategies for achieving desired future conditions. To refine the RNV for forest vegetation in the landscape, SIMPLLE modeling results are compared with studies of historic vegetation.

Historic Vegetation Studies

Two studies performed by previous USFS Forest Ecologist Jack Losensky analyze data from the first round of systematic nationwide USFS forest inventory data from the 1932-1937 period. In both of these studies, Losensky has attempted to backdate the 1930's era survey data to 1900 to provide a picture of the forest prior to Euro-American settlement. Losensky (1993) provides a description of historical vegetation for the Beaverhead-Jefferson climatic section of Southwest Montana which includes the EDLV landscape. Losensky (1995) provides additional description of potential historical forest communities in the following two sections of the interior Columbia River Basin:

- Section M332B: represents the transition zone between the moist Pacific Maritime zone of northern Idaho and the cold, dry continental climatic zone east of the divide including the Clark Fork Valley. This will be referred to as section M332B (Clark Fork) for comparison in the following discussion and is not meant to infer that only the Clark Fork is represented in the historical data.
- Section M332E: represents the southwest corner of Montana including the Beaverhead and Big Hole Valleys and the upper Salmon and Lemhi drainages in Idaho. This will be referred to as section M332E (Big Hole) for comparison in the following discussion and is not meant to infer that only the Big Hole is represented in the historical data.

The location of the EDLV at high elevation on the continental divide puts the landscape in the transitional zone between maritime and continental climate of section M332B. However, M332B includes much of the warmer and more humid habitat types of the Clark Fork and Bitterroot drainages. Additionally, the historical cover type records analyzed by Losensky (1995) in the Butte and Anaconda areas include the areas harvested to feed the huge need for smelter wood. As such, these records may show the affects of widespread clear-cutting in the vegetative size class distribution.

In many ways, the vegetation and climate of the EDLV is also similar to that in the Big Hole Valley of Montana. The Big Hole area is more removed from the mining center of Butte-Anaconda and this section is not noted in Losensky (1995) as being widely affected by early logging. As such, section M332E of Losensky (1995) also provides a good reference for historical vegetation in the landscape.

SIMPLLE Modeling

As part of the Beaverhead-Deerlodge Forest Plan revision process currently underway, BDNF undertook a modeling effort using SIMPLLE to develop RNV for 11 landscapes on the Forest. In the modeling effort the entire Clark Fork-Flints landscape which includes the area in the Upper Clark Fork River Basin from Harvey Creek below the town of Drummond to Warm Springs Creek near Anaconda. With the exception of fire logic, the BDNF used the default system logic in SIMPLLE in their modeling.

During public comment on the draft Forest Plan, the Beaverhead-Deerlodge Partnership, a consortium of conservation groups and companies from the wood products industry, contracted the environmental consulting firm Ecosystem Research Group (ERG) to provide technical analysis of the draft plan. As part of this undertaking, ERG modeled RNV for the same 11 landscapes using a more sophisticated ecological system logic than did the BDNF. As described in ERG (2005), fire occurrence frequency, aspen regeneration logic, and fire logic were altered based on information specific to the landscapes modeled. The fire logic was calibrated in part by comparison of modeled RNV with the study of historic fire regimes in the Big Hole area by Barrett (1997).

Although the modeled Clark Fork-Flints landscape area completely contains the EDLV, the Clark Fork-Flints area contains a wider array of habitat types and potential vegetation communities as does the EDLV. Because of this, the modeled RNV for acres of specific vegetation types is different from the EDLV landscape and cannot be used to infer from the SIMPLLE modeling what percentage of the landscape would typically hold a specific plant community. Size class distribution within the modeled forest communities can be compared between the larger Clark Fork-Flints and EDLV landscapes if one makes the assumption that specific forest types within these overlapping landscapes would naturally have similar age class distributions owing to similar disturbance regimes.

RNV Discussion

In order to make a comparison between the existing condition data available from the SILC3 dataset with the SIMPLLE modeling results and with the historical vegetation studies, all datasets had to be converted into the same species and size class groupings. It was decided for practical purposes that the vegetation groupings used in the SIMPLLE modeling results provided by BDNF would be used for all data sources. The BDNF provided the vegetation diversity matrix file which delineates the species crosswalk between SIMPLLE output and the vegetation groups used by BDNF. Table IIC-11 presents the BDNF vegetation grouping from this diversity matrix file. The existing condition data derived from SILC3 also had to be classified into these same groups. To accomplish this, BDNF provided the species conversion table used to attribute the initial conditions in their SIMPLLE model using SILC3. Table IIC-2 shows how the SILC3 vegetation cover types were classified into the BDNF vegetation groups.

Table IIC-11: BDNF vegetation diversity matrix species grouping.

Vegetation Group	SIMPLLE Species[1]
Douglas Fir	DF, DF-AF, DF-AF-ES, DF-LP, DF-LP-AF, DF-LP-ES, DF-ES
Lodgepole Pine	LP, LP-AF
Subalpine Fir	AF, ES-AF, WB, WB-AF
Upland Hardwood	QA, QA-MC
1- See SIMPLLE user manual for species designation.	

The same diversity matrix input file provided by BDNF was used to classify the ERG SIMPLLE output. ERG indicated that the diversity matrix provided by BDNF did not make sense ecologically, and specifically some of the forest types lumped into the Douglas fir category could be predominantly lodgepole pine. We agree that the vegetation grouping in the BDNF diversity matrix does arbitrarily lump mixed forest types into a limited number of categories and points to the need to for more careful consideration of the uncertainty in species composition in the all data sources when modeling vegetation RNV and comparing the results with land cover datasets derived by remote sensing or extrapolated field inventories. However, given the data sources available it was necessary to use the existing BDNF diversity matrix grouping and the analysis derived from the data is sufficient to show the predominant trends in forest condition.

The historical data presented in Losensky's 1993 and 1995 studies is grouped into compatible forest classes and did not require reclassification. Size classes from all datasets were also grouped as shown in table IIC-12 according to the BDNF vegetation diversity matrix file.

Table IIC-12: BDNF vegetation diversity matrix size class grouping.

Size Class Group	SILC3 Size Class	SIMPLLE Size Class[1]	Losensky (1993, 1995) Size Class
Seedling/sapling	Sapling 1" - 4.9"	SS	Non stocked, seedlings saplings 1-40 years.
Pole	Pole 5" - 8.9"	POLE, PTS, PMU	Poles 41-60 years, poles 41-100 yrs, immature 61-100 yrs.
9"+	Medium 9" - 14.9", Large 15" - 20.9", Very Large 21"+	MEDIUM, MTS, MMU, LARGE, LTS, LMU, VERY-LARGE, VLTS, VLMU	Mature 101-variable years, potential old growth 121+ yrs.
1- See SIMPLLE user manual for size class designation.			

In the table and figures presented below, RNV modeled using SIMPLLE is expressed as percent size class by species (e.g.: 30% of lodgepole pine was in seedling/sapling). The RNV was derived by taking the minimum and maximum percent size class by species the table of species composition at the end of every time step of the SIMPLLE RNV runs. As such, the modeled RNV captures the entire range of values simulated in the model runs.

Table IIC-13 presents both BDNF and ERG SIMPLLE modeled percent size class distribution RNV by species for the Clark Fork-Flints landscape. The data in this table is compared to the existing condition and historic vegetation studies in the following discussion and figures. RNV is not discussed for ponderosa pine because it is an insignificant part of the forested landscape on the BDNF (tables IIC-1 and IIC-2).

Table IIC-13: SIMPLLE modeled size class RNV by species for the Clark Fork-Flints landscape.

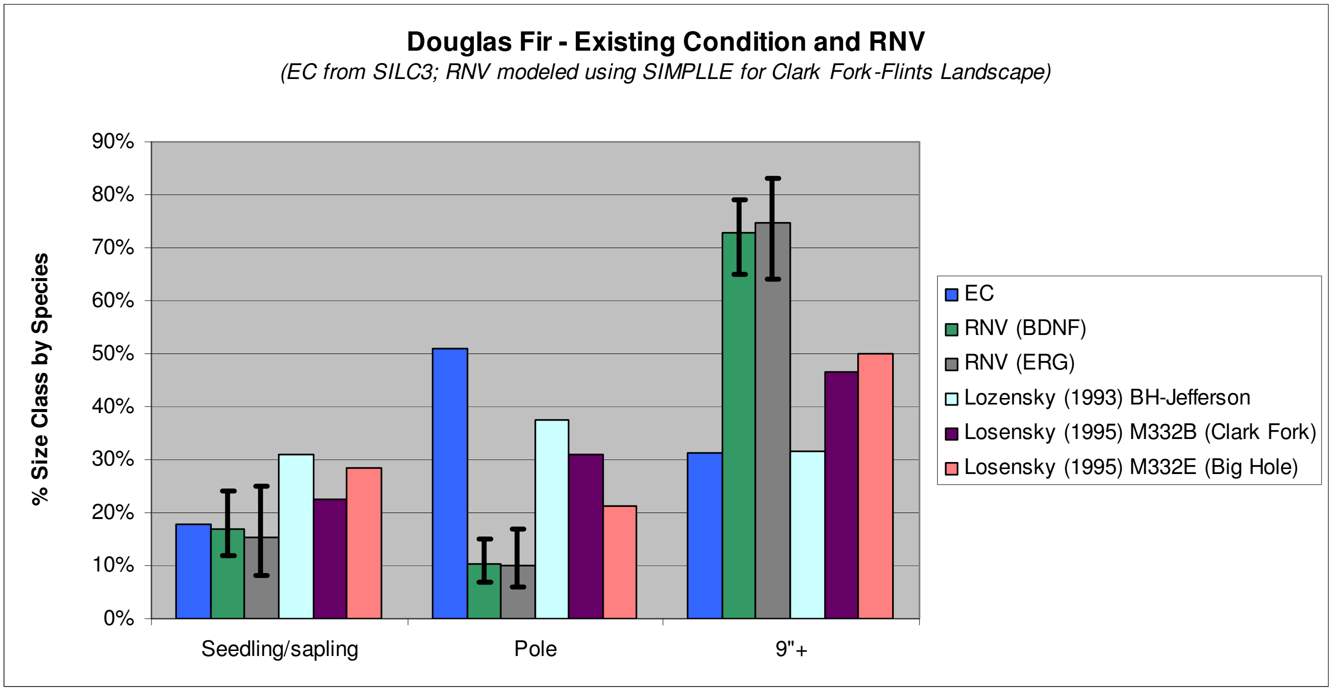
Vegetation Group	Size Class	% Size Class by Species						
		BDNF Model				ERG Model		
		Average	Min	Max		Average	Min	Max
Douglas Fir	Seedling/sapling	17%	12%	24%		15%	8%	25%
	Pole	10%	7%	15%		10%	6%	17%
	9"+	73%	65%	79%		75%	64%	83%
Lodgepole Pine	Seedling/sapling	30%	21%	41%		27%	16%	38%
	Pole	29%	21%	41%		27%	16%	39%
	9"+	41%	33%	48%		46%	35%	57%
Subalpine Fir	Seedling/sapling	26%	19%	34%		14%	4%	24%
	Pole	22%	16%	30%		6%	2%	11%
	9"+	52%	45%	59%		80%	71%	89%
Upland Hardwood	Seedling/sapling	41%	22%	63%		62%	23%	94%
	Pole	33%	13%	53%		25%	4%	67%
	9"+	26%	13%	49%		13%	1%	37%

Douglas Fir

Figure IIC-12 presents the existing condition, modeled RNV, and historical vegetation age class distribution for Douglas fir forest type. In Figure IIC-12 it is apparent that compared to modeled RNV, Douglas fir pole size class is currently overrepresented while the 9"+ size class is underrepresented. It is also apparent that the historical vegetation size class indices provided by Losensky's two studies also deviate from the modeled RNV. Specifically, the pole size class in a larger component of the age class distribution in both the Beaverhead-Jefferson climatic zone and section M332B (Clark Fork) whereas, the section M332E (Big Hole) is closer to the modeled RNV.

Losensky's description of the Douglas fir forest type in the Beaverhead-Jefferson climatic area and in section M332E (Big Hole) is one in which open grown or savanna like large, old fir stands were found on south and west slopes. Stands on north and east slopes tended to be younger and denser. Age structure was more uniform than present. As described previously, Losensky's analysis is derived from 1930's era forest inventory data that in the Butte-Anaconda area is influenced by widespread clear cutting beginning in the late 19th century. The fact that the historical data for section M332E (Big Hole) is closer to the modeled RNV supports the hypothesis that the historical data for the Upper Clark Fork data is showing the result of regrowth following early timber harvest.

Figure IIC-12: Douglas fir forest type existing condition for BDNF lands and RNV.



Lodgepole Pine

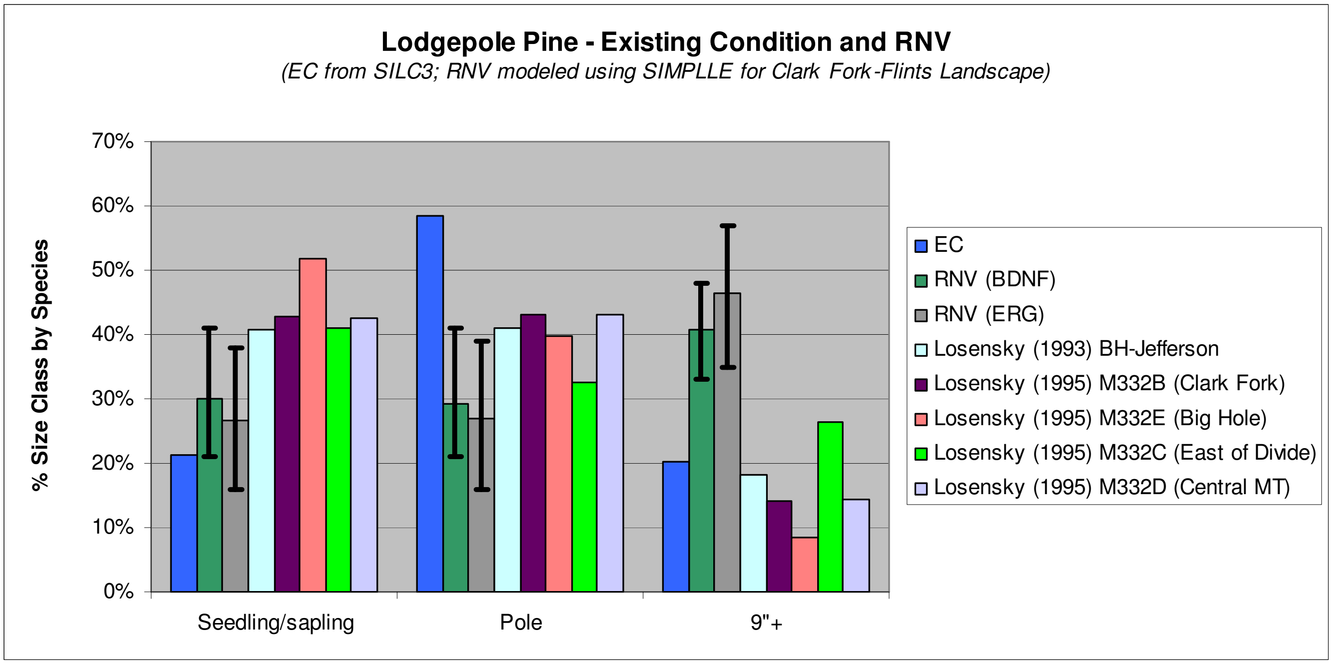
Figure IIC-13 presents the existing condition, modeled RNV, and historical vegetation age class distribution for lodgepole pine. Both section M332C and M332D of Losensky (1995) have been added to Figure IIC-13 as discussed below.

Both seedling/sapling and pole size classes in both sets of SIMPLLE modeling compare well with Losensky's historic vegetation studies. Figure IIC-13 indicates that the pole size class is overrepresented in the existing condition while the seedling/sapling class is near the lower end of the RNV. This again, likely suggests lingering affects in the size class distribution from widespread clear-cutting at the turn of the 20th century. The 9"+ size class for lodgepole existing condition compares fairly well with the historical vegetation studies. However, the SIMPLLE modeling RNV appears to be overstating the portion of the lodgepole forest type in this large size class. In this instance, the historical data for the Big Hole area shows the lowest percentage of lodgepole in the 9"+ size class suggesting that this discrepancy between the modeled RNV and the historical data is not a function of early clear-cutting affecting the historical size class distribution.

Losensky's description of circa 1900 forest in section M332E (Big Hole) is one where both Douglas fir and lodgepole pine show the influence of partial and stand replacement fires at relatively frequent intervals. The description of lodgepole forest in section M332B (Clark Fork) is similar wherein frequent fires have resulted in the seedling/sapling making up the bulk of the size class distribution and where mature sizes are almost absent. In either case, the historic studies suggest that the present occurrence of the 9"+ size class is within the RNV.

Added to Figure IIC-13 are section M332C which represents the area east of the Continental Divide from the Canadian border to the Missouri River and section M332D which represent the island mountain ranges of Central Montana. It is apparent from Figure IIC-13 that section M332C (East of Divide) compares most favorably with the modeled RNV.

Figure IIC-13: Lodgepole pine forest type existing condition for BDNF lands and RNV.

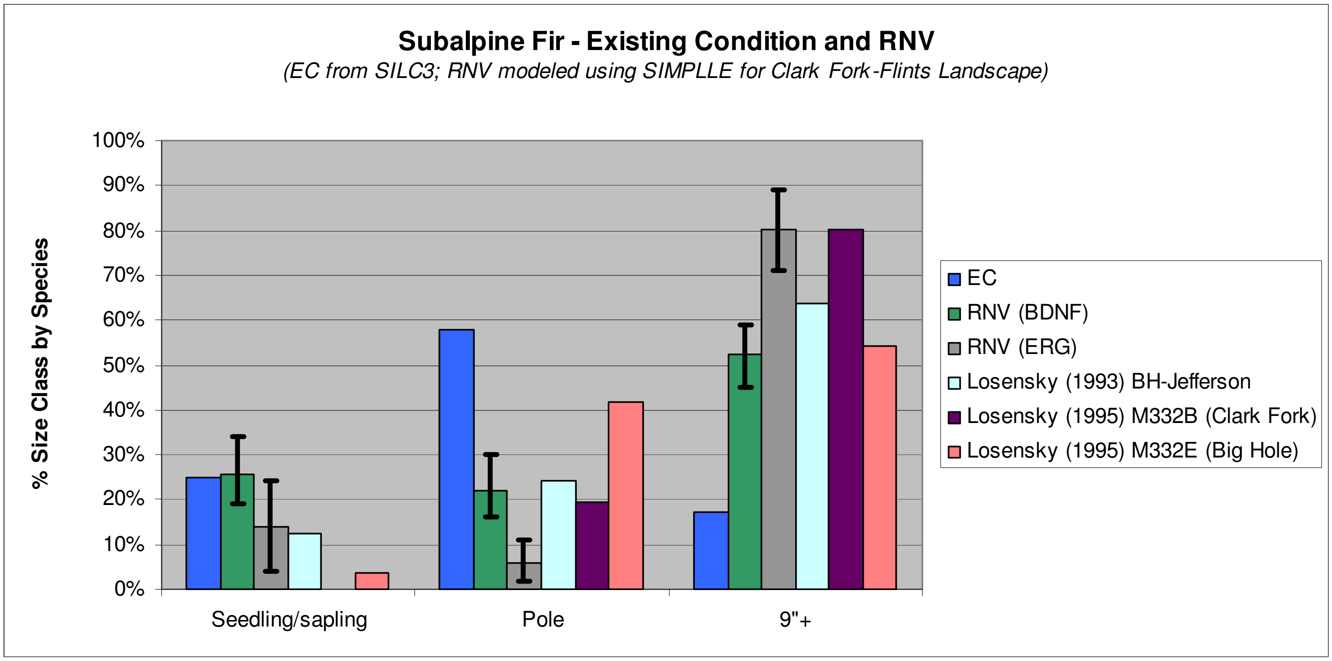


Subalpine Fir

Figure IIC-14 presents the existing condition, modeled RNV, and historical vegetation age class distribution for subalpine fir forest type. Figure IIC-14 shows some disparity between the RNV modeled by the BDNF versus that modeled by ERG. However, the historical vegetation studies compare fairly well when the extent of RNV from both models is considered.

When we compare the existing condition with both sets of modeled RNV in Figure IIC-14 the results suggest that the pole size class is overrepresented in the subalpine fir forest type at the expense of the 9"+ size class. This would again suggest remnant affects of wide-spread clear cutting around the turn of the 20th century. However, in this case, the subalpine fir forest type in the landscape makes up a very small (less than 1%) part of the vegetation present. Therefore, the existing condition of the subalpine fir forest type which is derived from satellite data should be considered to have high uncertainty. Therefore, the comparison between EC and RNV should be treated with caution in this case.

Figure IIC-14: Subalpine fir forest type existing condition for BDNF lands and RNV.



Upland Hardwood

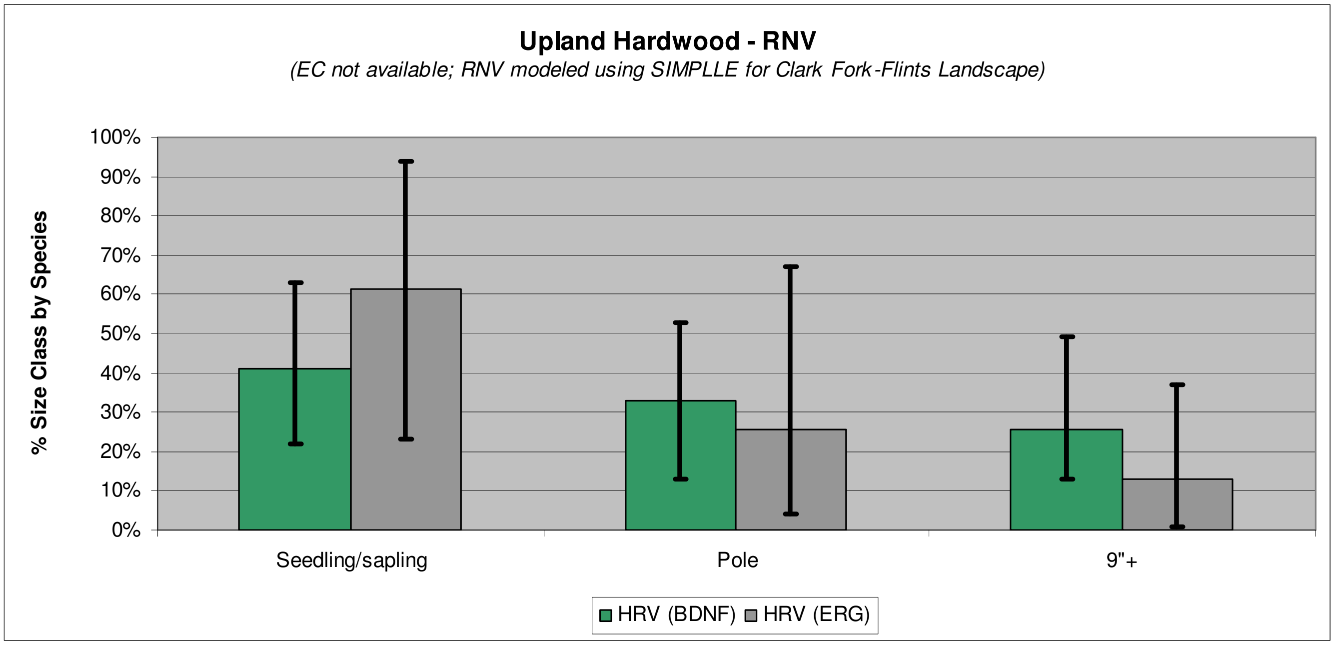
Figure IIC-15 presents the modeled RNV for the upland hardwood forest type. In the EDLV, this forest type is entirely aspen. Existing condition for aspen age class is not available in the SILC3 dataset. BDNF has indicated that it does not presently have a reliable estimate of aspen age class distribution. Additionally, historic conditions are not recorded in the early forest inventories analyzed by Losensky because of the lack of commercial value for aspen.

Generally, the two sets of modeled RNV in Figure IIC-15 compare well and support a high percentage of aspen in seedling/sapling size class and pole size classes and a limited amount of mature aspen.

Lesica and Cooper (1997) provide a study of the presettlement vegetation of the southern portion of Beaverhead County which compares records of the 19th Century explorers and fir trappers as well as early photographs with present vegetation. Lesica and Cooper document the replacement of former aspen stands by conifer encroachment and the maturation of young aspen stands to a decadent state when comparing early photographs to existing condition. In light of this study and other evidence which suggests that aspen stands are over mature and decadent across the west, we can infer that the present age class distribution is overly mature.

No formal mapping of the reduction in acres occupied by aspen over time has been accomplished by the BDNF. In the draft EIS for the revised BDNF Forest Plan (USDA, 2005), BDNF presents modeled historic vegetation using SIMPLLE indicating a reduction in aspen from approximately 74,000 to less than 2,000 acres in the Clark Fork-Flints landscape. As part of comments on the DEIS prepared for the Beaverhead-Deerlodge Partnership, ERG has indicated that they believe the BDNF estimates of the RNV acres for aspen are overinflated due to incorrect logic in the SIMPLLE model used. This is supported by studies such as Bartos (2001) which report that while aspen is declining across the west, the magnitude of the reduction in acres is closer to 64% in Montana

Figure IIC-15: Upland hardwood forest type RNV.



3. Desired Future Conditions

FP (1987) and INFISH amendment

By the end of the first decade, land management activities will have affected the appearance of 33,000 acres of the Forest to some degree. The significance of these effects will vary. The landscape seen from major highways, towns, and recreation sites will not be noticeably changed. In other areas, especially where timber management is practiced, effects will be obvious (pp II-10). By the end of the fifth decade, land management activities will have affected the appearance of 139,000 acres of the Forest. The appearance of areas seen from major roads, towns and recreation sites will be changed little by human actions (pp II-11).

By the end of the first decade, timber over 120 years old found in the suitable timberlands will have increased by 26,000 acres [Deerlodge NF-wide], due to the fact that this age class is increasing faster than the harvest rate (pp II-10). By the end of the first decade, timber will have been harvested on 24,400 acres. In support of this activity, an additional 46 miles of arterial/collector roads and 209 miles of local roads will have been constructed. About 3,600 acres will have been planted with the remaining 20,800 acres regenerating naturally. At least 3,000 acres will have been precommercially thinned (pp II-11). By the end of the fifth decade, there will be 14,500 acres more of 120-year-od timber in the suitable land base than at present. This is a decrease from the end of the first decade. The decrease results from bringing harvest more in line with ingrowth to this age class (pp II-12). By the end of the fifth decade, timber will have been harvested on 122,000 acres, 17,600 acres of trees will have been planted, and 15,800 acres of trees will have been thinned. Three hundred and ninety-three miles of arterial/collector and 997 miles of local roads will have been constructed (pp II-12).

By the end of the first decade, range vegetative conditions will have improved through prescribed fire, noxious weed control, installation of range improvements, and implementation of grazing systems such as rest-rotation (pp II-11). By the end of the first decade, 8,700 acres in the Douglas-fir and sagebrush/grassland zones will have been burned for wildlife habitat and livestock forage improvement. This will recreate the natural openings that existed before conifer encroachment and sagebrush invasion (pp II-10). By the end of the fifth decade, 17,400 acres in the Douglas-fir and sagebrush/grassland zones will have been burned – some of it for the third time – to improve wildlife habitat and livestock forage. This burning, which will be done on a twenty-year cycle, will have created a mosaic of age classes in these vegetative zones (pp II-11). By the end of the fifth decade, almost all range will be in good-to-excellent vegetative condition (pp II-12).

One hundred miles of low-to-moderately damaged riparian habitat and 7 ½ miles of heavily damaged riparian habitat will have been rehabilitated by the end of the first decade. The result will be a higher water table in some meadows. The higher water table will increase the forage production on these areas (pp II-11). By the end of the fifth decade, the Forest's riparian habitat rehabilitation program, involving the riparian zones along 115 miles of streams, will have been completed (this program will actually have been completed by the end of the second decade (pp II-12).

<u>Goals</u>

- To restore damaged riparian zones. (pp II-1)
- Maintain or restore: (INFISH)
    - a) Diversity and productivity of native and desired non-native plant communities in riparian zones.
    - b) Riparian vegetation to:
        - a. Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems.
        - b. Provide adequate summer and winter thermal regulation within the riparian and aquatic zones.
        - c. Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.
    - c) Habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian dependent communities.
- To achieve a higher level of forage production on rangelands through the use of prescribed fire and improved management systems. (pp II-1)
- To bring all allotments into satisfactory condition with a stable or upward trend. (pp II-1)
- To emphasize cost efficiency in all timber management and engineering activities. (pp II-1)

- To protect resource values through the practice of integrated pest management. (pp II-1)

Objectives

- Visual Resource - Landscape management will be practiced throughout the Forest and will have special emphasis in visually sensitive areas (as determined by the visual management system (VMS). A mix of visual quality objectives will be emphasized in project design (based on ROS class and visual sensitivity – see Forestwide Standards and Management Area writeups). (pp II-2)
- Range - Livestock grazing may temporarily decrease slightly as priority allotments are brought under proper use. Permitted use may then increase because of range improvements, prescribed burning, and more intensive allotment grazing management. (pp II-3)
- Range - Grazing management will protect soil and water resources, and riparian areas. Noxious weed control will be emphasized. Soil and water conservation practices will be applied to ensure that State water quality standards will be met. (pp II-3)
- Timber - Timber management activities will be concentrated on 40 percent and flatter slopes. Cultural treatments and harvest methods will concentrate on lodgepole pine to help reduce the risk of mountain pine beetle infestation. Stocking control and basal areas thinning will be used to beetle-proof lodgepole pine stands. Integrated pest management will be used to control western spruce budworm and dwarf mistletoe. At least 13-15 percent of young lodgepole pine stands will be thinned to prevent stagnation. Refer to Appendices A-F for timber related items. (pp II-4)
- Timber - Additional sale opportunities exist on 12,319 acres of lands presently classed as unsuitable with the E1, E2, and E3 Management Areas. Very high timber prices could make these lands more economical. An amendment to the Forest Plan would be needed to class these lands as suitable if a substantial change in timber prices occurs. (pp II-4)
- Riparian - The quality of water coming from degraded watersheds will be improved through restoration projects and changed management practices. Riparian areas which are presently damaged will be restored by the year 2000. (pp II-4)
- Achieve interim RMOs delineated in INFISH (USDA, 1995) or site specific RMOs determined by watershed analysis. (INFISH)
- Protection - The objective of the fire management organization will be to keep the area burned by wildfire to an average of 224 acres or less annually [Deerlodge NF-wide]. (pp II-5)
- Protection - Fire management will be guided by land and resource management objectives and be coordinated with other Federal and State agencies to provide economical aerial detection, fire dispatch, and initial attack. (pp II-5)
- Protection - Effort will be made to harvest ahead of mortality from mountain pine beetle outbreaks by scheduling harvest in moderate and high risk stands. Over 70 percent of the timber harvest will be scheduled in the lodgepole pine type. Control of western spruce budworm and dwarf mistletoe will be through integrated pest management. (pp II-5)

- Air - Fire management activities will prevent significant air quality deterioration in Class I areas and meet requirements of the Management Area goals. (pp II-5)

FSP

The FSP desired condition of vegetation in the landscape is one in which national forest lands support a full range of healthy plant communities with appropriate levels of successional stages representing either the effects of natural processes or management designed to provide a similar outcome to natural processes. The RNV describes disturbance influences and the resulting patterns and abundance of various successional stages of vegetation across the landscape.

Goals

- Restore vegetative composition, structure, and function to reflect natural effects of plant succession, climate, fire, insects and disease landscape-wide.
- Eliminate expansion and reduce current extent of invasive weed species.
- Restore age class diversity to aspen clones. Prevent aspen component of forested landscape from being reduced below RNV acres.
- Reduce fire risk associated with vegetation condition due to departure from historic fire regimes.
- Restore and maintain the natural extent and function of riparian areas where possible.
- Maintain and enhance the health of sensitive plants and unique habitats such as aspen and whitebark pine.
- Continue to provide for sustainable livestock grazing on suitable lands.

Objectives

- Treat noxious weed infestations promptly to control spread. Utilize treatment techniques to fully contain and control these infestations.
- Coordinate with Powell and Deer Lodge counties and other agencies to gain efficiency and effectiveness in noxious weed treatment programs.
- Achieve a mix of species, age, and stand structure classes through timber harvest or prescribed fire in lodgepole forest types.
- Restore open stands of Douglas fir where appropriate.
- Prevent conifer encroachment of both upland and riparian aspen areas and of native grasslands through a combination of mechanical treatment and/or prescribed burning.
- Implement fire hazard reduction through appropriate vegetation treatment. Follow guidelines in Anaconda-Deer Lodge Country and Powell County CWPP for prioritizing treatment.
- Introduce fire back into grasslands to reduce conifer encroachment and improve range/grassland ecosystems. Mitigate post-fire spreading of noxious weeds.
- Where management plans call for full suppression, mechanical treatments (timber sales, thinning, fuel reduction) should be used to best mimic natural disturbances.
- Implement riparian restoration that restores natural diversity of vegetation species and sizes.