United States Department of Agriculture

Forest Service

Beaverhead-Deerlodge National Forest

Dillon Ranger District

BIRCH CREEK
WILLOW CREEK
LOST CREEK

WATERSHED ASSESSMENT

May 2008

Cover Photo: Baldy Mountain, Dillon District Files

TABLE OF CONTENTS

.

. BIRCH, WILLOW, and LOST CREEK
. WATERSHED ASSESSMENT

Dillon Ranger District
Beaverhead-Deerlodge National Forest
2008

I. INTRODUCTION

This watershed assessment consists of four sub-watersheds situated on the east side of the Pioneer Mountains on the Dillon Ranger District. See Map 1, Vicinity. These sub-watersheds are referred to as 6th code Hydrologic Code Units (HUCs). See Map 2 for a perspective of sub-watersheds compared to watersheds or sub-basins. The sub-watersheds are BIRCH, WILLOWUP, WILLOWLOW, and LOST-PIONEER. The LOST-PIONEER is part of the Big Hole at Melrose watershed while BIRCH, WILLOWUP, and WILLOWLOW are part of the Lower Big Hole watershed. All are part of the Big Hole Sub-basin. The four sub-watersheds identified above shall be referred to as the Birch, Willow, Lost Creek Watersheds, or the watersheds for this assessment, when not being addressed separately.

A. BACKGROUND AND DOCUMENT OVERVIEW

1. Purpose

This group of watersheds was identified in the 2008 Revised Forest Plan amongst a group of 15 key restoration watersheds with high priority for assessment and subsequent action. Key restoration watersheds are designed to focus time and attention to areas across the forest where multiple issues can be addressed through an integrated restoration planning effort. The Beaverhead-Deerlodge Integrated Restoration Strategy, which feeds into the Northern Region Integrated Restoration Strategy, identifies Birch, Willow, and Lost Creeks as a priority area for restoration for 2009.

The Northern Region Integrated Restoration Strategy was developed, starting in 2006, to accomplish regional ecosystem restoration and protection of social values at risk (http://www.fs.fed.us/r1/projects/int-restoration/overview.shtml). Parts of the Region are experiencing dramatic population growth, especially in the rural WUI environment. Many of these areas adjacent to WUI historically had high frequency, low intensity fire regimes. Because of successful fire suppression, these areas may now be subject to large-scale landscape disturbances that may exceed historic natural processes. This scenario places both ecological and social values at risk.

The Region identified the following agents which affect resource conditions:

- Drought
- Forest insects and pathogens
- Invasive plant and animal species
- Forest colonization into grasslands
- Uncharacteristically (from the natural conditions) dense vegetation that create

hazardous fuel conditions
• Erosion, sedimentation, and toxic chemicals

The Birch/Willow/Lost Creek subwatersheds have a high potential for addressing the concerns of the Northern Region Integrated Restoration Strategy as well a high potential for meeting desired conditions, goals and objectives of the 2008 Revised Forest Plan.

2. Watershed Analysis as a Planning Tool

Watershed analysis is a process used to describe the human, biological and physical conditions, processes, and interactions within a watershed. The analysis focuses on specific issues, values and uses identified within the landscape that are essential for making sound management decisions. For each resource of concern, the analysis describes past trends, existing conditions and desired conditions in both biophysical and social terms. The intention of this document then, is to present our current understanding of the processes and interactions of concern within the Birch, Willow and Lost Creek watersheds based on information developed by a 12 person interdisciplinary team.

Watershed analysis is an intermediate step between land management planning (Forest Plans) and project planning. It is a stage-setting process which enhances our ability to guide the general type, location, and sequence of appropriate management activities within a watershed. The results establish One product of the watershed analysis is a description of management opportunities that will help to bring resources towards desired conditions. Opportunities are derived from the gap between existing and desired conditions. From a list of general opportunities, potential projects are identified for consideration by forest managers.

The type of information collected varies for each landscape but always includes descriptions of the following conditions within the landscape:

- basic geology, landform and soils
- watershed condition
- distribution of fish species
- vegetation conditions and changes
- key wildlife habitats
- recreation use and travel patterns
- resource uses
- cultural or historic uses

A watershed assessment makes no decisions, nor does it initiate or result in land management allocations. It does not select projects for implementations. Rather, the Dillon Ranger District will use this analysis to determine which specific projects would move the watersheds toward the desired condition described in the Beaverhead-Deerlodge National Forest Land and Resource Management Plan. Proposed projects will then be analyzed individually by a separate interdisciplinary team. Project analysis will include involvement by the public and result in a site-specific decision as required by the national Environmental Policy Act (NEPA).

3. Methods

The watershed analysis was developed by a 12-member interdisciplinary team under the guidance of the Dillon District Ranger, using the Federal Guide for Watershed Analysis – Ecosystem Analysis at the Watershed Scale (Version 2.2, August 1995) as a guideline. The purpose is to identify projects and priorities for restoring watershed and other resource conditions. The watershed analysis process includes the following steps:

Step 1 – Characterization of the watershed – a summary of the dominant conditions and interactions within the watershed.

Step 2 – Identification of issues and key questions

Step 3 – Description of current conditions

Step 4 - Description of reference conditions – Generally, this is the historical condition, prior to the influence of European settlement. Since historical conditions are not available for hydrologic parameters and not necessarily the reference condition for human uses on the landscape, these sections will focus on desired conditions described in management direction of the 2008 Revised Forest Plan.

Step 5 – Synthesis and interpretation of information – a comparison of current and reference conditions including discussion of similarities, differences, causes and trends. Identify the capability of the system to achieve Forest Plan objectives or desired conditions.

The interdisciplinary team identified the key issues in the watershed based on a previous landscape analysis for the Pioneer Mountains (1996), the East Face Ecosystem Assessment and Environmental Assessment (1998), resource data developed for revising the Forest Plan (2002-2007), and District and Forest specialists field experience in the area. These issues and questions around the issues focused the analysis

Desired conditions are based on the 2008 Revised Beaverhead-Deerlodge Forest Plan. Until the Record of Decision is signed for the Revised Plan, all restoration work will comply with the 1986 Beaverhead Forest Plan as amended.

B. LANDSCAPE SETTING

The Birch Creek, Willow Creek and Lost Creek watersheds adjoin each other within the East Pioneer Mountain range approximately 14 miles northeast of Dillon Montana and comprise an area of approximately 58,000 acres. Streams in these watersheds flow east from the East Pioneer Mountain crest for approximately 15 miles to their confluence with the Big Hole River, about 30 miles north of Dillon, Montana. The Big Hole joins the Beaverhead and Ruby Rivers to form the Jefferson River. The Jefferson is one of the 3 forks of the Missouri River flowing to the Mississippi River and thus to the Gulf of Mexico.

The combined watersheds contain approximately 64 miles of perennial streams and 66 miles of intermittent streams along with their accompanying riparian habitats. Streams and lakes contain Yellowstone cutthroat trout, rainbow trout, eastern brook trout, and highly hybridized cutthroat trout. Amphibians like boreal toad and spotted frog are found in and near mountain lakes.

This landscape evolved from high cirque basins of granitic materials. Multiple high mountain lakes feed the stream systems of the three drainages. Elevations range from 10,500 feet along the hydrologic divide of the East Pioneer Mountains down to 7,000 feet at the forest boundary. Land type tends to be open valleys with rolling to moderately steep side slopes.

This watershed contains several distinct vegetative types including mountain big sagebrush/bluebunch wheatgrass/Idaho fescue steppe, mountain mahogany stands on calcareous and metamorphosed limestone, riparian willow, alder, and cottonwood communities, Douglas-fir, lodgepole pine, and white bark pine stands. Aspen clones exist in draws, along riparian zones, and on some talus slopes. The watershed also contains three Region One sensitive plant species under special management and protection, Lemhi penstemon, beautiful bladderpod, and Sapphire rockcress.

The diverse vegetation types in the watersheds support a comparable diversity of wildlife species including elk, mule deer, moose, black bear, wolverine, pine martin, coyotes, wolves, raptors, forest birds and birds of shrubland/grasslands, small mammals, and rodents.

Human activity in this landscape dates back 12,000 years. The area wasn't settled by notable numbers of people until the turn of the 20th century when minerals were discovered and mining communities sprang up. Because of the area's accessibility, the Birch Creek and Willow Creek drainages have been important to those small communities and the larger towns that have grown up around the east side of the Pioneer Mountains, Dillon in particular, for livelihoods (mining, logging, ranching) and recreation. The area fills an important niche for these and visitors who enjoy camping, fishing, outdoor education, firewood gathering, elk hunting, and winter activities.

II. RESOURCE AREAS

A. SOILS AND GEOLOGY

1. Characterization

The geologic structure of the Pioneer Mountains is complex. The Pioneer Landscape Analysis (1996) describes this watershed area as follows. Alpine and mid-elevations on the east face of the Pioneers are primarily granite. The land has been formed at these elevations by glacial and weathering processes. The lower foothills near the valley tend to be mixed sedimentary, formed by a number of processes, colluvial (soil loosened from steep cliffs and slopes), alluvial (soil deposited by flowing water), pluvial (soil eroded by rainfall), glacial, and structural breaklands. Soils are a reflection of this geology and land forming process.

Soils on the Beaverhead-Deerlodge National Forest were mapped over a 10-year period, ending in 2003. The data resides in a database retained by the Natural Resource Conservation Service as the Web Soil Survey (WSS) 2.0, http://websoilsurvey.nrcs.usda.gov/app/ , National Cooperative Soil Survey. Management implications for soils in this watershed assessment are rated in terms of susceptibility to damage by fire, erosion hazard (on-road, on-trail), and erosion hazard (off-road, off-trail).

Acres reported are approximate acres within these 6th code HUCs on the NF. Some HUC boundaries contain non-NF acres which are not counted in this report. Unrated soils in this discussion are primarily rock outcrops leading up to the peaks of the Pioneer Mountains that make up the western boundaries of this watershed assessment area.

Susceptibility to Damage by Fire

NRCS ratings for Potential Fire Damage rank the potential hazard of damage to soil nutrient, physical, and biotic characteristics from fire. Ratings are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

A rating of “Low” indicates that the soil has features that reduce its potential for fire damage. Good performance can be expected, and little or no maintenance is needed. “Moderate” indicates that the soil has features that result in a moderate potential for fire damage. One or more soil properties are less than desirable, and fair performance can be expected.

Erosion Hazard (On-Road, On-Trail)

NRCS ratings indicate the hazard of soil loss from unsurfaced roads and trails. Ratings are based on soil erosion factor K, slope, and content of rock fragments. The soils are described as having slight, moderate, or severe erosion hazard.

A rating of “slight” indicates that little or no erosion is likely; “moderate” indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and “severe” indicates that significant

erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Erosion Hazard (Off-Road, Off-Trail)

NRCS ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. Ratings are based on slope and soil erosion factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by some kind of disturbance. The hazard is described as slight, moderate, severe, or very severe.

A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions; "moderate" indicates that some erosion is likely and that erosion-control measures may be needed; "severe" indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and "very severe" indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Land Management Direction Relevant to Soils

2008 Revised Forest Plan
Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition - Resources adversely affected by past management activities have been rehabilitated.

Goal – Soil Productivity is maintained or restored.

2. Current Condition

The NRCS Websoil Survey provides the following hazard rating data for the BWL watersheds.

Table 1. Acres in sub-watersheds by Hazard Rating

Watershed	Birch	Lower Willow	Upper Willow	Lost	TOTAL	TOTAL %
Unrated	1,689		2,692		4,381	8%
Susceptible to Damage by Fire Low	14,445	5,099	15,754	3,272	38,570	67%
Mod	8,054	1,672	3,193	1,663	14,582	25%
High	0	0	0	0	0	
Erosion Hazard (On Road/Trail) Slight	2			0	2	<1%
Mod	6,849	246	6,241	574	13,910	24%
Severe	15,668	6,525	12,791	4,362	39,346	68%

Erosion Hazard (Off Road/Trail	Slight	5,817	152	5,459	574	12,002	21%
	Mod	5,561	3,607	5,609	2,136	16,913	28%
	Severe	1,303	73	0	132	1,508	3%
	Very Severe	9,838	2,939	7,964	2,094	22,835	40%
Total Acres in drainage		24,208	6,771	21,724	4,936	57,639	100%

*Acres in the soil survey do not exactly match acres in other data bases used for the assessment because hydrologic divides are in slightly different locations. It is less by 800 acres.

Overall, the soils in these four 6th code HUCs have a “Low” to “Moderate” susceptibility to damage by fire (93%), “Severe” erosion hazard on roads and trails (68%) and “Very Severe” erosion hazard off roads and off trails (40%). A Map of Hazard ratings for the BWL watershed is available at the Dillon District Office.

Because of their granitic nature, soils across the watershed generally are erodible, making slope the driving factor in the ratings. Slope was the dominant component for potential for damage by fire among surface depth, soil texture, and rock fragments. Compared to the “very severe” ratings for Off-Road/Off-Trail, ratings for On-Road/On-Trail include content of rock fragments in the ratings which generally lowers the severity from “very severe” to “severe”. Lower elevations with less slope, such as valley bottoms, tend to have a lower erosion hazard.

Prescribed fire and wildfire pose some risk to soil conditions, however greater immediate threats to soil stability are unmaintained travel routes including off road and off trail travel that causes disturbance of the soil surface.

3. Reference Conditions

Reference conditions for soils are tightly tied to vegetative reference conditions when looking at potential for damage by fire. See vegetation and fire sections.

Reference conditions for erosion hazard related to potential for damage by fire is established by natural fire processes and patterns, when fire occurred naturally and man caused soil disturbance was negligible. The “Fire and Fuels” resource section describes those reference conditions.

4. Synthesis and Interpretation

The difference between reference conditions and existing conditions for vegetation reflects a change in the way fire and other natural processes are operating on this landscape. After an absence of fire, resulting from effective fire suppression, a change in other major forest management actions such as logging, coupled with a warmer, drier climate in recent years, there is a dramatically increased potential for impacts by wildfire. Increased potential for wildfire and prescribed fire increases the Potential for Damage by Fire, however risk is primarily low based on the soils present.

Increased recreational use, specifically OHV use, on existing roads and trails has contributed to on-road and on-trail disturbance, and caused off-road and off-trail disturbance. This increased use and soil disturbance, both on and off roads and trails increases erosion hazard, especially on steeper slopes. Impact to soils from road and trail use is currently high and the risk of future impacts is high.

Land management plan direction supports maintaining or restoring soil productivity: restoring fire as a disturbance process, and rehabilitating resources adversely affected by past management activities. The recommendations below describe how that direction could be met.

5. Recommendations

Manage and use fire, to the extent possible, to encourage reestablishment of native species well suited to hold the soil surface intact.

Maintain existing roads and trails including installing effective erosion control measures to decrease soil loss

Manage or prohibit off road and off trail travel to minimize soil surface disturbance, especially on steeper slopes.

B. WATERSHEDS, STREAMS AND AQUATIC HABITAT

1. Characterization

The BWL watersheds cover 99,362 acres. Ownership is comprised of Forest Service, 58398 acres (59%), BLM, 16220 acres (16%), State of Montana, 3787 acres (4%), and private, 20957 acres (21%).

According to the GIS derived data there are 13 perennial streams within the watersheds The total perennial stream miles for the watersheds within Forest ownership is 64 miles. In addition, there is 66.5 miles of intermittent stream miles within the Forest ownership of this watershed.

Table 2. Total Length (both Forest and non-Forest ownership) of Perennial Streams and Sub-Watershed location within the watersheds

Stream Name	Length(Miles)	Sub-Watershed
Lost Creek	7.3	LOST-PIONEER
Willow Creek	18	WILLOWUP, WILLOWLOW
Bond Creek	5.7	WILLOWUP
Dubois Creek	6.6	WILLOWUP
Buckhorn Creek	2.1	WILLOWUP
Gorge Creek	4	WILLOWUP
Uphill Creek	0.7	WILLOWUP
Birch Creek	16.3	BIRCH
Sheep Creek	2.5	BIRCH
Armstrong Gulch	2.3	BIRCH
Thief Creek	3.7	BIRCH
Thief Creek, SFK	2.7	BIRCH
Mule Creek	2.2	BIRCH

All water within the BWL watersheds eventually drains into the Big Hole River. Some streams are dewatered for irrigation. Dewatering locations depend on topographical considerations, and can occur either on or off the National Forest.

Main channels, above the Forest Boundary, within the BWL watersheds are primarily 'B' stream types, referencing to the Rosgen stream classification system (citation).

Tributary streams tend to be steeper, and 'A' stream types are prevalent in the headwaters. 'C' and 'E' stream types occur as inclusion on all sizes of steams, in a variety of topographical locations from cirque basins to the Forest Boundary. Elevations within the Forest Service ownership range from 5600 to 11100 feet.

The predominant bedrock within the watersheds is granite, and natural erosion rates are high. Consequently, the percentage of fines found within stream channels is higher than for other bedrock types.

There are currently two 303(d) listed streams within the watersheds, Birch Creek and Willow Creek. Birch Creek has been broken into two segments with one segment starting at the Forest Boundary and ending at its headwaters and the other segment starting at its confluence with the Big Hole River and ending at the Forest Boundary. The Willow Creek segment is from its confluence with the Big Hole River to its headwaters. Table 3 shows the status of these 303(d) listed streams.

Table 3 - 303(d) Status of Birch and Willow Creeks

Year	Stream Segment	Probable Impaired Uses	Use-Support Status	Probable Causes of Impairment	Probable Sources of Impairment
1996	Birch Creek headwaters to the National Forest Boundary	Aquatic life, Cold water fishery	Not supported	Flow alteration, Metals, Other habitat alterations, Siltation	Agriculture, Flow regulation/modification, Irrigated crop production, Resource extraction, Streambank modification/destabilization, Upstream impoundment
		Drinking water	Threatened		
2006	Birch Creek headwaters to the National Forest Boundary	Aquatic life, Cold water fishery	Partial support	Alteration in streamside or littoral vegetative cover, Low flow alterations, Physical substrate habitat alterations, Sedimentation/Siltation	Grazing in riparian or shoreline zones, Streambank modifications/destabilization, Impacts from hydro structure flow regulation/modification, Agriculture, Irrigated crop production
1996	Birch Creek National Forest Boundary to mouth (Big Hole River)	Aquatic life, Cold water fishery	Not supported	Flow alterations, Metals, Other habitat alterations, Siltation	Agriculture, Flow regulation/modification, Irrigated crop production, Resource extraction, Streambank modification/destabilization, Upstream impoundment
		Drinking water, Recreation, Industry	Partial support		
2006	Birch Creek National Forest	Aquatic life, Cold water	Not supported	Alteration in streamside or littoral	Channelization, Dam or

	Boundary to mouth (Big Hole River)	fishery, Recreation		vegetative cover, Low flow alterations, Other anthropogenic substrate alterations, Physical substrate habitat alterations	impoundment, Impacts from hydro structure flow regulation/modification, Irrigated crop production
1996	Willow Creek from headwaters to mouth (Big Hole River)	Aquatic life, Cold water fishery, Recreation	Partial support	Flow alterations, Other habitat alterations, Siltation	Agriculture, Irrigated crop production, Rangeland, Silviculture
2006	Willow Creek from headwaters to mouth (Big Hole River)	Recreation	Partial support	Low flow alterations	Irrigated crop production, Agriculture

Currently a TMDL is being developed for these streams by Montana DEQ but this process has not been completed.

Aquatic species can be found throughout the BWL watersheds. Based on information provided by Montana Department of Fish, Wildlife and Parks and electrofishing surveys conducted by the Beaverhead-Deerlodge National Forest, Table 4 shows water bodies and known fish species present within the watersheds.

Table 4. Known Fish Species Present by Water Body

Water Body Name	Fish Species Present
Willow Creek	Rainbow Trout, Eastern Brook Trout, Hybridized Cutthroat Trout, Mottled Sculpin
Bond Creek	Brook Trout
Dubois Creek	Brook Trout
Gorge Creek	Hybridized Cutthroat Trout
Uphill Creek	Hybridized Cutthroat Trout
Birch Creek	Rainbow Trout, Eastern Brook Trout, Brown Trout, Mottled Sculpin
Tendoy Lake*	Yellowstone Cutthroat Trout, Westslope Cutthroat Trout*
North Gorge Lake	Yellowstone Cutthroat Trout
South Gorge Lake	Yellowstone Cutthroat Trout
Barb Lake	Yellowstone Cutthroat Trout
Bond Lake	Brook Trout
Deerhead Lake*	Yellowstone Cutthroat Trout
Tub Lake*	Yellowstone Cutthroat Trout

May Lake	Cutthroat Trout
Pear Lake	Cutthroat Trout
Boot Lake	Cutthroat Trout, Rainbow Trout

*Historically stocking of lakes have been with Yellowstone Cutthroat Trout. Montana Department of Fish, Wildlife, and Parks have recently changed the stocking of these lakes to Westslope Cutthroat Trout.

Electrofishing Surveys within the watershed are somewhat limited, but based on the above information it appears that non-native salmonid species dominate the analysis area.

Habitat conditions for aquatic species are generally acceptable within the BWL watersheds, specifically in the upper reaches. Downstream habitats are affected by increased sedimentation, bank alteration, and bank in-stability from roads and other management activities. Streams within the watershed are all generally well shaded with riparian vegetation or conifers. Within the lower reaches of these streams conifer colonization is occurring within the riparian vegetation and could potentially affect and limit this riparian vegetation if the colonization is allowed to continue.

Amphibians are also found within the watersheds. Boreal Toads and Columbian Spotted frogs have been documented within the Birch and WillowUp sub-watersheds. Deerhead Lake, in the upper headwaters of Bond Creek is one of the largest know breeding sites of Boreal Toads on the Forest. The majority of amphibian data shows that they are present within the upper half of the watershed.

Land Management Direction relevant to Aquatic Resources

2008 Revised Forest Plan
Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Conditions for self-sustaining or viable populations of native and desired non-native plant and animal species are supported within the natural capability of the ecosystem.

Goal – Restoration Key Watershed: Fish habitat, riparian habitat, and water quality are recovered to desired conditions developed through watershed assessments.

Goal – Watershed Restoration Projects: projects are designed and implemented to promote long term ecological integrity of ecosystems, conserve the genetic integrity of native species, and contribute to attainment of desired stream function.

Goal – Total maximum Daily Loads (TMDLS): Management actions are consistent with TMDLs. Where waters are listed as impaired and TMDLs and Water Quality Restoration

Plans are not yet established, management actions do not further degrade waters. Water quality restoration supports beneficial uses.

Goal – Stream Channels: Stream channel attributes and processes are maintained and restored to sustain natural desired riparian, wetland, and aquatic habitats and keep sediment regimes as close as possible to those with which riparian and aquatic ecosystems developed.

Goal – Riparian Areas: Riparian habitat, species composition, and structural diversity of native and desired non-native riparian plant communities are maintained or restored to provide: woody debris characteristic of functioning systems, thermal regulation for streams, band stability, trapped and stored sediment.

Goal - Riparian Habitat: Maintain and restore habitat for viable well distributed populations of native and desired non-native aquatic and riparian dependent species.

Goal – Channel Integrity: Stream channel function and water quality are maintained or restored to support designated beneficial uses on all reaches through management decisions, restoration projects or Best Management Practices as outlined in the Soil and Water Conservation Practices handbook.

Goal - Roads: Roads are designed, constructed, and maintained to meet desired stream function and avoid adverse effects to native fish and sensitive aquatic species.

2. Current Conditions

Hydrology

Hydrological stream surveys were completed for past projects on several streams, beginning in 1994. Individual reaches within Birch, Thief, Thief SF, Mule, Willow, and Bond Creek have all been surveyed. The stream surveys are specific to reaches (small stretches of stream with similar characteristics), and are designed to classify that reach as to stream type (Rosgen, 1996), as well as describe additional reach attributes, including function. Each component of the stream type designation (entrenchment, w/d ratio, sinuosity, gradient, substrate size) is quantitatively measured at a site that is representative of that reach. Entrenchment and width to depth ratios are measured along an established cross-section, gradient of the water-surface, slope and particle size distribution are measured along approximately 100 ft. of stream in the vicinity of the cross-section, and sinuosity is measured over 500 ft. of the stream. Additional measurements included a cumulative distribution of stream width, Riffle Stability Index (Kappesser, 1993), Bank Erosion Hazard Index (Rosgen, 1996), and the Channel Stability Evaluation.

This stream survey data was analyzed with the idea of comparing the measured reach with a reference reach from a watershed that is similar in area, geology, valley bottom width, and valley bottom gradient. By comparing reference and "project" reaches, an assessment of stream function can be made (Beaverhead NF, 1997).

No additional hydrological surveys have been completed within the analysis area for the watersheds. By using information provided by analysis completed for other projects, an accurate description of existing condition can be determined. If it is desired to view the past analysis for the individual streams within the BWL watersheds please see East Face Ecosystem Management Project File. The following narrative is a summary of that information to reflect the current condition for surveyed streams within the watersheds.

Major hydrological events that have significantly affected streams within the analysis area include a dam failure at Boot Lake prior to 1910 that gutted the Birch Creek channel. Currently, Birch Creek has re-established its channel within the deposition and channel stability is considered good. The Birch Creek road is a significant sediment source at a number of locations. In 1995, the construction of a bridge across Birch Creek near Bridge Gulch was the source of accelerated fine sediment into the channel. The end result of these sediment sources has been localized deposition and the creation of a substrate that is generally finer than its reference reach. The increased deposition however, has not been sufficient to affect channel stability as the existing stream types along Birch Creek (B2/B3) are stable. The present channel is likely near the end of the process of establishing a new equilibrium after the flood.

It appears that the easily accessed portions of the riparian area of Thief Creek were logged historically, and that activity probably increased sediment loads significantly. Multiple channels exist in places, and old skid trails are evident across the bottom. Although once heavily disturbed, the channels are presently stable.

Road maintenance operations have caused large sediment increases to Willow Creek on a segment of road in the vicinity of Dubois Creek, and a culvert washout on Uphill Creek has also added excess fines to the main channel of Willow Creek. Most of the main stem of Willow Creek probably exhibits the morphologic features that should be present, but increased fines from various sources are shifting the stream towards a B4 instead of maintaining a B3. The various land uses within Willow Creek may well have increased its sediment load, but to pin down sources and relative amounts would take more investigation.

Bond Creel is heavily dewatered when it leaves Bond Lake, and the water is deposited in Birch Creek through a system of ditches. Severe gullying and increased sediment introduction exists immediately below the dam. Above the lake, Bond Creek is well functioning for the remainder of its length.

Lost Creek is a small drainage to the north of Willow Creek. It has an old road paralleling it for its entire length. The road often encroaches on the channel and is a continuous source of sediment. Livestock use has been heavy throughout the drainage. The combination of road location and stream bank trampling has caused a shift in stream type in Lost Creek. At the surveyed reach, Lost Creek is non-functional. This reach was fenced in 1998. Elimination of the effects of livestock along this reach will allow it to stabilize and begin to reform an E stream type.

Additional information for streams was provided by Department of Environmental Quality. The following narrative was provided by DEQ to display information obtained by their analysis for water quality status. Currently, the TMDL has not been completed for these 303(d) listed streams.

"Upper Birch Creek Water Quality Status Summary

Metals: There were no exceedances of Montana water quality standards in 2000, 2005 or 2006 in the upper segment of Birch Creek. However, supplemental criteria for arsenic, copper and zinc concentrations in streambed sediments were exceeded in 2000, and criteria for arsenic and copper were exceeded again during sediment sampling in 2005. There are abandoned mine sites within the watershed, including the Indian Queen priority abandoned mine site. Development of a TMDL is not recommended for metals in the upper segment of Birch Creek at this time; however monitoring plans will be developed to determine the effects of arsenic, copper and zinc associated with the stream bottom sediments.

Sediment: The percent surface fines in pool tail-outs exceeded the target in both monitoring sections, while the width/depth ratio failed to meet the target in the upper monitoring section. Increases in the width/depth ratio and the percent surface fines suggest a decrease in sediment transport capacity and possibly an increased sediment supply. The BEHI score failed to meet supplemental indicator criteria in both monitoring sections, suggesting an increased sediment load from streambank sources. Macro invertebrate and periphyton supplemental indicator criteria were met in one sample from 2000. The primary anthropogenic source of sediment within the upper watershed is rangeland grazing, though roads are an additional source. In addition, a historic dam failure in the upper watershed was a source of sediment at one time.

Lower Birch Creek Water Quality Status Summary

Metals: No excess of metals concentrations in the water column occurred in samples collected in 2000, 2005 or 2006. Concentrations of arsenic in sediment were exceeded in 2000 and 2005, and concentrations of copper in stream bed sediment were exceeded in 2000. The likely source for sediment contamination is the abandoned Indian Queen Mine, which is a priority abandoned mine site. The development of metals TMDL is not recommended for lower Birch Creek at this time; however monitoring plans will be developed to determine the effects of arsenic and copper associated with the stream bottom sediments.

Sediment: The composite pebble count percent fine sediment and the entrenchment ratio failed to meet the target criteria. Increases in percent surface fines suggest a decrease in sediment transport capacity and possibly an increased sediment supply. The BEHI score failed to meet supplemental indicator criteria, suggesting an increased sediment load from streambank sources. The Low Valley MMI supplemental indicator criteria was not met in one macro invertebrate sample from 2000. Periphyton metrics were meeting supplemental indicator criteria. The primary anthropogenic sources of sediment within the lower watershed are rangeland grazing and irrigated cropland, though roads are an additional source.

Willow Creek Water Quality Status Summary

Sediment: The percent surface fines in pool tail-outs and width/depth ratio exceeded the target, while the entrenchment ratio failed to meet the target. Increases in the width/depth ratio and the percent surface fines suggest a decrease in sediment transport capacity and possibly an increased sediment supply. The BEHI score failed to meet supplemental indicator criteria, suggesting an increased sediment load from streambank

sources. In addition, macro invertebrate data failed to meet supplemental indicator criteria, suggesting impairment. Out of 14 periphyton samples in 2004 and 2005, 4 failed to meet supplement indicator criteria. The primary anthropogenic source of sediment within the watershed is rangeland grazing and irrigated agriculture, though roads and timber harvest are additional sources." (DEQ, 2008)

Stream Function

A wide range of existing conditions can be found on the streams, on Forest, within the analysis area. For the most part, streams are functioning for the majority of their lengths, although some streams have appreciable reaches that are functioning-at-risk or non-functioning. These properly functioning stream reaches are generally within the headwaters and upper elevations of the watershed where management activities have been minimal. Those stream reaches that are not functioning properly generally occur in mid to low elevations where past livestock grazing, timber harvest, mining, water diversions, and roads and trails have all been damaging to these stream reaches in the past.

Riparian Management Objectives (RMO's) established by the Revised Forest Plan are shown in table 5. These RMO's are designed to maintain proper stream functioning condition.

Table 5. Riparian Management Objectives East of the Continental Divide

Riparian Management Objectives	
1. Entrenchment Ratio (all systems)	Rosgen Channel A-<1.4 Rosgen Channel B-1.6-1.8 Rosgen Channel C->11.6 Rosgen Channel E->10.7
2. Width/Depth Ratio (all systems)	Rosgen Channel A-<10.3 Rosgen Channel B-<18.8 Rosgen Channel C-<23.2 Rosgen Channel E-<6.5
3. Sediment Particle Size, %<6.25mm (all systems)	Stream Type B3->13 Stream Type B4-<27 Stream Type C3->15 Stream Type C4-<25 Stream Type E3-<19 Stream Type E4-<35
4. Bank Stability (non-forested systems)	>80% Stable
5. Large Woody Debris (forested systems)	>20 pieces per mile, >6 inch diameter, >12 feet long

Stream survey work in the analysis area collected information that can be used to see if RMO's 1 through 3 are in compliance or not. Table 6 shows the streams, stream reaches and the attributes measured in surveys to compare RMO's to new Revised Forest Plan objectives. Bond and South Fork Thief Creeks are both reference reaches.

Reference Reaches are identified to represent streams functioning properly for those channel types and drainage characteristics. They are used to compare other stream reaches with similar channel type and drainage characteristics to determine functioning condition.

Table 6. Stream Name, Reach ID, Measured attributes, and RMO number not met

Stream Name	Reach ID	Potential Rosgen Channel Type	Existing Rosgen Channel Type	1. Width to Depth Ratio	2. Sediment Particle Size, %<6.25mm	3. Entrenchment Ratio	RMO's Not Met	Stream Function
Bond Creek	Bond Up	E4b	B4	16.63	52%	2.14	1,2,3	NF
	Bond	E5b	E4b/E5b	3.59	65%	3.89	1,3	F
Birch Creek	Birch1		B2c/B3c	27.54	11%	1.14	1,2,3	F
	Birch2		B3	13.83	6%	1.89	1,3	F
Mule Creek	Mule	E4b	E4b	5.0	36%	5	1,3	F
Thief Creek	Thief	E4b	E4b	4.6	37%	1.6	1,3	F
	Thief Mid	E3b	F4b	15.8	43%	1.88	1,2,3	NF
	Thief Up		B4a	11.3	38%	1.98	3	FaR
Thief Creek, SFK	SFThief	E4a	E4a	2.8	28%	7.87	1	F
Willow Creek	Willow Down	B3	B3	9.7	37%	3.28	1	F
	Willow Mid	B3	B3	5.99	25%	5.88		F
	Willow Up	E5	E5	7.6	78%	3.76	1,2	FaR
Lost Creek	Lost Up	A3	B4a	18.6	41%	1.78	3	NF

F=Functioning NF= Not Functioning FaR= Functioning at Risk

In theory, Riparian Management Objectives that are not being met indicate that some type of impairment is affecting stream function for these reaches. This information does not imply that the entire stream is not within compliance it shows that at the location of those reaches, and for a representative length, there are factors that are negatively affecting stream function. In assessing the Forest RMO's East of the Continental Divide, as they apply to Birch Creek, it is apparent that there may be a problem, particularly the entrenchment ratio objective. In theory, the established objectives are based on a range of reference reaches. However, neither reference reach in the BWL watershed meets the new entrenchment ratio objectives and none of the functioning reaches meet entrenchment ratio objectives. The ratio displayed in Table 5 is not appropriate for this watershed. Currently, the analysis that was used to develop these RMO's is being reviewed by specialists to determine if values are in error and truly reflect desired stream and channel conditions east of the divide on the Beaverhead-Deerlodge National Forest. After this analysis is complete, these stream reaches will be revisited to determine if they meet RMO's or not. If RMO's are still not met this information would not imply that the

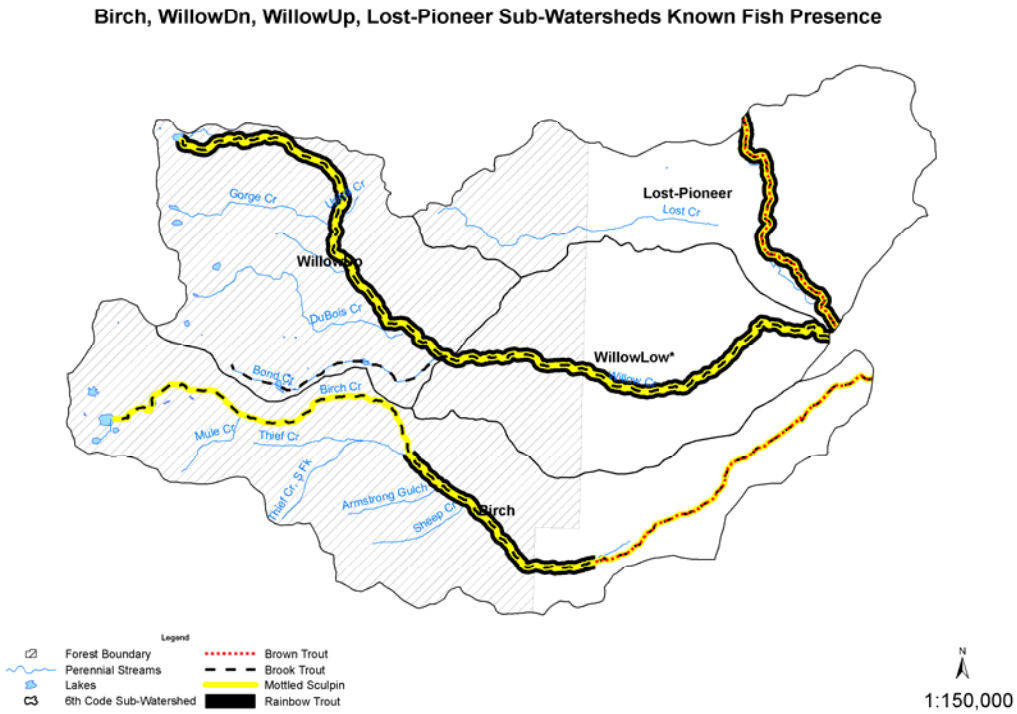
entire stream is not within compliance it would show that at the location of those reaches, and for a representative length, there are factors that are negatively affecting stream function.

Factors negatively affecting both stream function and soil stability include increased levels of sediment by management activities such as logging, mining, grazing, and roads and trails. This is a significant issue that is currently affecting the ability of most streams within the analysis area to move toward proper functioning condition. In addition, bank in-stability and channel over-widening caused by past grazing practices, roads and trails, and other management activities are also reasons that stream reaches are functioning poorly. Additional analysis is needed to ensure that all streams will comply with Riparian Management Objectives.

Aquatic Species and Habitat

Limited survey work has been conducted to determine which aquatic species are present. The survey work that has been done shows that non-native salmonid species dominate (Figure 1).

Figure 1

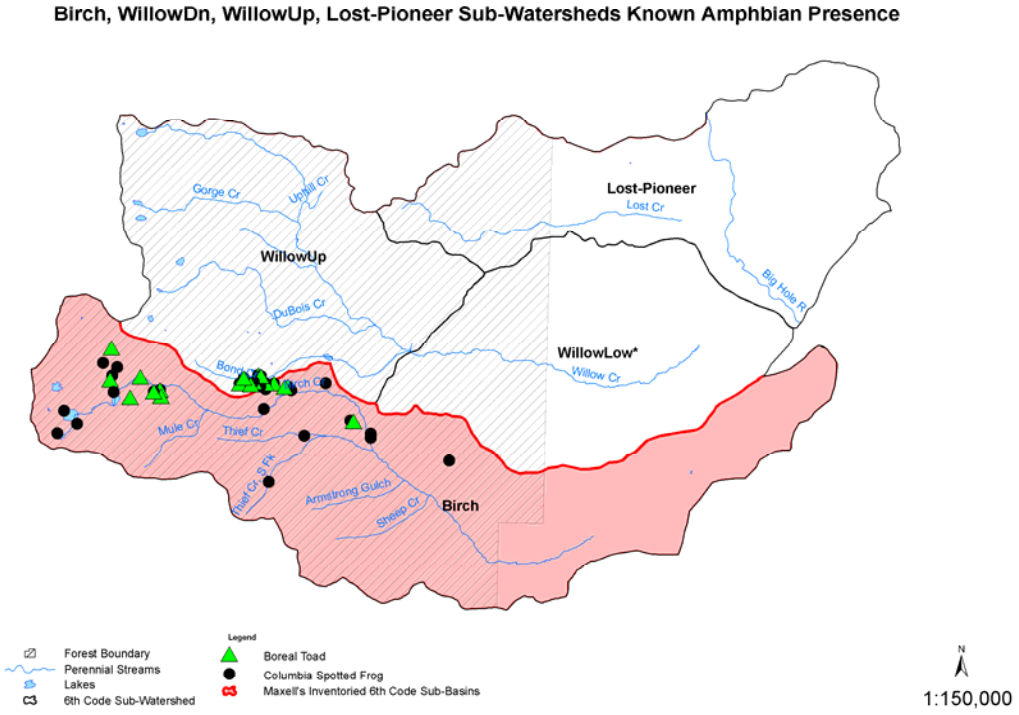


Though not all streams have been sampled, the presence of genetically pure native salmonid species (Westslope Cutthroat Trout) in the watershed is unlikely. Historic stocking of Yellowstone Cutthroat and Rainbow Trout in headwater lakes here has provided the genetic source to “pollute” the native species. In addition, competition by Eastern Brook trout has helped to displace Westslope Cutthroat Trout. Genetic information that has been collected on Birch, Dubois, and Gorge Creeks showed highly hybridized cutthroat trout. New management direction by Montana Department of Fish,

Wildlife, and Parks has changed the stocking of lakes within the watershed to Westslope Cutthroat Trout. This is a recent decision, and to date, stocking policy changes have only affected Tendoy Lake. Other lakes, within the watershed, will be planted with Westslope Cutthroat Trout as their rotation in the stocking program comes around.

The long-term persistence and presence of non-natives within the watershed have exceeded the ability to successfully reintroduce native species. To bring native species back, all non-natives would need to be removed. The probability of successfully removing all of the non-natives is low. It is important, however, to maintain satisfactory habitat conditions for these non-natives to persist.

Figure 2



Amphibians are also present within the BWL watersheds (Figure 3). An intensive survey for amphibian presence was conducted by Bryce Maxell across the Beaverhead-Deerlodge National Forest starting in 2001 with a final report submitted in 2004. The Birch sub-watershed was one of Bryce Maxell's randomly selected sub-watersheds for this inventory. In addition there is Heritage and Fauna information for all sub-watersheds within the watersheds. There are many Boreal Toad detections around Deerhead Lake and the upper end of the Birch sub-watershed. These populations appear to be breeding populations of boreal toads. In addition to these Boreal Toad detections there have been Columbia Spotted Frogs noted throughout the watersheds. These populations of amphibians appear to be reproducing successfully, however it is

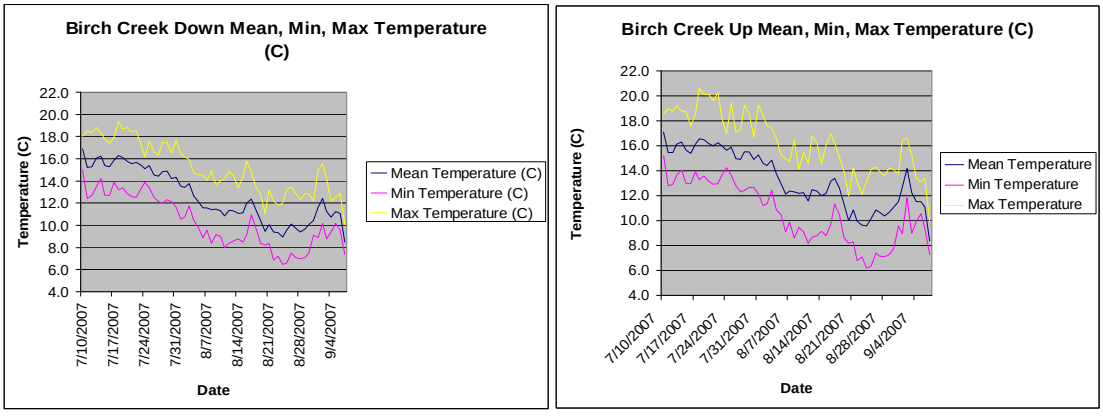
important to note that there is no 'baseline' data available to note declines from existing numbers due to population limiting activities.

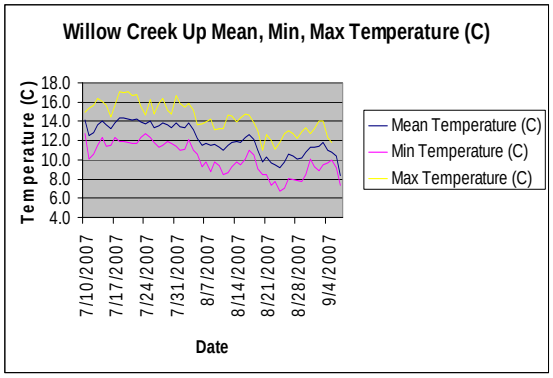
Habitat conditions for aquatic species are generally acceptable to support aquatic species though improvements in habitat are possible. Sediment levels in streams could be affecting suitable spawning locations and spawning success. Decreasing sediment introduction will have a positive affect on aquatic species. Bank stability and riparian vegetation are generally acceptable. Currently most systems have a significant component of riparian shrubs that help hold banks and provide shade for streams. If continued conifer colonization is allowed, this riparian shrub component could be compromised and have a negative effect on bank stability and stream temperature.

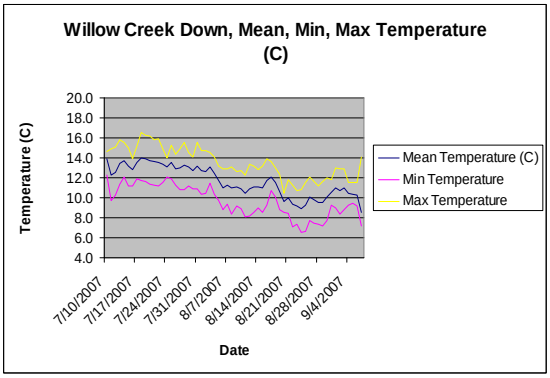
Large woody debris can be found in most of the streams. Simple walkthrough surveys on Birch and Willow Creeks completed in 2007 indicate large woody debris occurs in quantities within these stream systems to satisfy Riparian Management Objectives (RMO's). RMO's are fish habitat objectives established by the Revised Forest Plan for a number of habitat attributes which contribute to properly functioning condition in streams. . The large woody debris RMO for forested stream systems east of the Continental Divide is >20 pieces per mile, these pieces need to be >6 inches in diameter and >12 feet in length. Two walk through surveys completed on Willow Creek showed 76 pieces per mile and 182 pieces per mile and one survey on Birch Creek showed 76 pieces per mile. These are providing structure for pools, shading, and hiding cover, in addition to stabilizing banks. The current condition of beetle killed lodgepole pine should allow the continuance of large woody debris recruitment within systems. It appears that most systems should be in compliance for RMO guidelines for large woody debris identified within the Beaverhead-Deerlodge's Forest Plan however additional habitat work should be completed on other stream systems to ensure that the large woody debris RMO is being met across the analysis area.

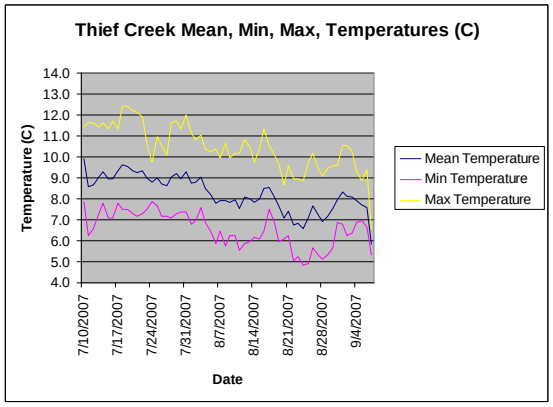
No long term temperature data is available for this watershed. Temperature data was gathered during 2007 and data shows that the temperature range appears appropriate for the persistence of aquatic species. Fish species present within the watershed require 14-18° C for growth and have an upper thermal tolerance of 22-24° C (Eaton et al. 1995). Summary temperature data collected in 2007 is displayed in figure 3 below.

Figure 3. Stream Temperature Summary Information









None of the streams surveyed ever exceeded the upper thermal tolerance throughout the summer of 2007. All surveyed streams mean daily temperatures were generally within the 14 to 18° C for the summer months. Continued monitoring of temperature is needed to see if changes or increases in temperatures are occurring and affecting aquatic species.

Total road and trail miles, roads and trails within 300 feet of a stream, and road and trail stream crossings have been calculated for Forest ownership using GIS analysis. Table 7 below shows these values for each sub-watershed and a total for watersheds.

Table 7. Road/Trail Miles, Road/Trail Stream Crossings, and Miles of Roads/Trails within 300 feet of a stream. All within Forest Ownership

Sub-Watershed	Road Miles	Trail Miles	Road Stream Crossings	Trail Stream Crossings	Road Miles Within 300 Feet of a Stream	Trail Miles Within 300 Feet of a Stream
Birch	64.2	15.8	15	5	15.5	4.5
WillowLow	22.8	0.7	1	0	2.6	0
WillowUp	27.4	7.6	12	1	8.2	1.2
Lost-Pioneer	22.6	0.5	3	0	2.9	0
Totals	137	24.6	31	6	29.2	5.7

These numbers represent the known routes within the watersheds. Current routes that exist on the ground are likely higher than what is displayed by the GIS analysis however

these numbers are appropriate to help understand the current condition of the watershed.

Mining activity has occurred since the late 1800's. There are currently 44 abandoned mines mapped on Forest ownership. This past mining activity has affected streams with elevated levels of metals found within the substrate and increased sedimentation and bank in-stability. Currently the Indian Queen mine, located on Birch Creek, is identified by Montana's DEQ as an abandoned mine that is affecting environmental quality (Montana DEQ website). This mine is number 54 (Personal communication with Mike Browne 02/26/2008) on this priority list.

3. Reference Conditions

Reference conditions for the watersheds are those conditions that occurred over a range of time prior to the presence of mining activity, timber harvest, domestic livestock grazing, developed road and trail systems, irrigation diversions, dams, exclusions of fire, or the presence of non-native aquatic species.

Historically, streams would all be functioning under natural climatic cycles and natural disturbances, such as fire or significant runoff events. Beaver activity would have most likely been more prevalent throughout the watershed. This activity would have helped control increased sediment introduction from the naturally unstable soil types. There would be no elevated levels of metals within streams without the presence of mining activity. Sediment levels would be significantly lower within stream systems than what occurs today, however, because of the somewhat unstable soil types within the watershed increased sediment levels could have affected stream function somewhat. Reference reaches have been identified in Bond and South Fork Thief Creeks. These are reaches that show little or no effects of management activity and are considered a good basis for establishing reference conditions for comparison with other streams.

Historically, salmonid presence within any of the streams or lakes of the watershed would have been Westslope Cutthroat Trout. These populations would have been migratory within the watershed because no dams or irrigation diversions to stop access to tributary streams or the Big Hole River would have existed. Habitats were probably appropriate to support these aquatic species. Amphibian species were probably more broadly distributed throughout the watershed and most likely in higher numbers. This historic population would be a reflection of no introduced diseases that are currently affecting amphibian populations and not necessarily a reflection of past management activities.

Riparian vegetation was located throughout the stream bottoms. Natural fire had keep conifer colonization from the riparian bottoms which allowed willows, cottonwoods, and aspen to remain healthy and vigorous.

4. Synthesis and Interpretation

Past and current management activities have had negative effects on streams, stream function, bank stability, riparian vegetation and native aquatic species.
Sedimentation due to naturally unstable soil types was potentially an issue historically but management activities have significantly increased this problem. Roads and trials, past timber harvest, livestock, water diversions and past mining activities have all

significantly increased sediment levels within streams. These same activities have also affected stream function. Bank stability, width to depth ratios, and other stream function parameters have been negatively affected by these management activities. Increased metals can be directly linked to past mining activities.

The streams within the headwater portion of this watershed are generally stable and functioning properly. Management activities have generally not affected this portion of the watershed, as most management activity has occurred in the mid to lower elevations of the analysis area. Increased sedimentation from roads and trials is the most significant effect to the upper portions of the watershed. While the RMO for entrenchment ratio is only met on two of the surveyed streams, this appears to be a problem with the forest-wide ratio, not condition of the streams.

The presence and persistence of non-native salmonid species is likely to remain at current conditions. Technologies do not exist to completely eradicate past management effects or to remove these non-native species. This is not to imply that non-native species are not important. They have significant value as recreational opportunities for fishermen and can help display that a healthy aquatic community exists. It is important to maintain healthy habitat conditions for these non-native species.

The BDNF 2008 Revised Land Management Plan directs us, in general, to restore functioning condition of stream channels, aquatic habitat, riparian zones, and watersheds. The Plan uses reference conditions to establish management objectives for streams. The Plan also allocates restoration watersheds with the purpose of focusing funding and personnel on accelerating improvements in water quality and watershed conditions. Birch, Willow and Lost Creek watersheds were identified in the Plan as key restoration watersheds. This watershed assessment is the first application of the Forest Goal of directing projects to key watersheds to promote long term ecological integrity of ecosystems, conserve the genetic integrity of species, and contribute to attainment of desired stream function

The recommendations below specify actions which will help achieve proper functioning streams, healthy riparian vegetation, and viable aquatic species population. These recommendations will help address the 303(d) stream concerns and should improve conditions that could allow those streams to be recovered and taken off the 303(d) list, and meet goals of the Forest Plan.

5. Recommendations

Recommendations include efforts to reverse some of the past management's negative effects to the watershed. This includes continued monitoring of past mining sites to ensure that no additional environmental effects will affect streams, reclamation of historic mining sites, improving road and trail crossings to decrease the amount of sediment reaching streams, ensuring that existing roads and trails are functioning properly with adequate drainage features to keep sediment out of streams, repairing/replacing culverts that are known to not be functioning properly, and maintaining healthy and vigorous riparian vegetation which will continue to stabilize banks and provide shade.

The Indian Queen mine is currently on Montana DEQ's list for mines that are impacting environmental quality. It is number 54 (Personal communication with Mike Browne 02/26/2008) on this priority list. Currently there is no reclamation plan in effect to deal

with this resource issue, one needs to be prepared and implemented to address negative effects on water quality. This would certainly contribute to moving the watersheds to healthier watershed conditions. A restoration effort would eliminate or reduce increased metal presence within the substrate of Birch Creek. In addition, any other stream function that is affected by the presence of this mine could be addressed at this time.

Roads and trails are contributing to increases in sedimentation for several streams. Specific examples include:

-A stream crossing of Birch Creek on road 98, below Boot Lake. This crossing is a ford with multiple approaches to the stream, the stream has become over-widened, stream bank in-stability has increased, and the crossing location is within a spring source into Birch Creek. Correct impacts by stabilizing banks, installating a culvert to address the spring source, redesigning the trail prism approaching the stream so that only one crossing site would be utilized, and hardening of the crossing itself. On the same road, there are multiple crossings of small spring sources carrying sediment to Birch Creek. Install culverts to remove these water sources from the trail prism.

-A culvert on Uphill Creek, a tributary to Willow Creek, has failed. This culvert needs to be properly designed and replaced to address increased sedimentation issues.

-A segment of road in the vicinity of Dubois Creek where past activity has not remediated an erosion problem.

-The main Birch Creek road, just upstream of the Forest Boundary is contributing sediment into Birch Creek. Drainage features within the road prism should be constructed with filters on and below the fill slope to prevent sediment from entering the stream. Revegetation of the fill slope would be beneficial to help trap sediment.

In addition to those specific examples above, all roads and trails within the watersheds need proper functioning drainage features and stable crossings to decrease levels of sediment affecting streams. There are 29.2 miles of roads and 5.7 miles of trails within 300 feet of streams within this watershed. A significant portion of these routes are preventing streams from achieving properly functioning condition. A combination of surfacing, additional drainage features within the road prism, reclamation, and/or prism re-routes should be completed to effectively promote stream function.

Maintaining healthy riparian vegetation is important for proper stream function. Currently healthy riparian vegetation exists throughout the watersheds. However, riparian willow and aspen stands are being threatened by conifer colonization. This colonization is relatively recent and could be treated to reduce the impacts of colonization and ensure that the willows and aspen communities maintain vigor. Individual tree removal, girdling conifers to act as future large woody debris recruitment, and cutting trees and leaving within the riparian are all possible management activities. By maintaining a healthy willow and aspen community, stable stream banks, appropriate stream temperatures, and healthy insect communities can be maintained. In addition the presence of these riparian species could protect stream corridors from high intensity fire more effectively than a conifer over story (Dwire, Kauffman 2003).

Very active fire wood gathering is taking place in response to the increased beetle killed lodge pole pine. Monitoring this activity is important to ensure that fire wood gatherers are not taking dead trees out of the riparian corridors that are providing bank stabilization or would act as future large woody debris recruitment. This activity could increase bank instability or sedimentation in streams of the analysis area.

Grazing has been shown to have had negative impacts within the BWL watersheds in the past. Proper implementation of grazing standards and monitoring of allotments are critical to ensure that stream systems are allowed to move toward proper functioning condition and that no increased resource damage will occur.

Amphibian monitoring around Deerhead Lake is an opportunity to understand whether management activities and environmental changes are impacting this amphibian population. If monitoring detects any changes to population viability due to management actions should be implemented to protect this population. Informational and educational signs could be used to educate users on the uniqueness of this area.

C. VEGETATION

1. Characterization

Vegetation Shaping Natural Processes

Composition and configuration of vegetation in the watersheds prior to European settlement was shaped by natural disturbances and processes and, to a lesser extent, Native American land management. Natural disturbances and processes that influenced and will likely continue to influence vegetation in this area include climate variability, watershed processes (i.e. flooding, mass wasting, debris flows, avalanches), fire events, and insect population dynamics. Native American land management was characterized by fire ignitions for travel corridors, forage improvement, game habitat improvement, and maintenance of native plant food sources. Although scientific research specific to the watershed analysis area is currently lacking, results of studies completed in ecosystems and landscapes of the western United States and northern Rocky Mountains can be used to assess the historic conditions and processes that operated in these watersheds.

Geological Processes

Geological processes operate on a temporal scale of thousands to millions of years. These processes are commonly slow and influence areas larger than most other processes influencing the analysis area. The large and long temporal and spatial scales of geologic processes shaped the current topography, rock formations, and parent material that exist within the BWL watersheds. Geological changes since the last ice age (18,000 to 12,000 years ago) in these watersheds include erosion and deposition, vegetation migration, and tectonic movement. Natural leveling processes of geological erosion include surface erosion and mass wasting (i.e. landslides, debris avalanches, slumps and earth flows, creep, and debris torrents) (Brooks et. al 2003).

Climate

Variations in monthly normal (30 year average) temperature, precipitation, humidity, and wind define climate for any given area at any given time (Robinson and Henderson-Sellers 1999). However static climate may seem for an area, spatial and temporal climate variability has influenced vegetation in the western US for centuries (Whitlock et. al 2003). Periods of warming and cooling and/or high and low precipitation, such as the cool-moist conditions associated with the last phase of the little ice age (1800-1850), were driven by ocean-atmosphere interactions prior to onset of modern industrialization effects to global climate. Tree ring reconstructions of climate shape our current understanding of historical climate variability in the western US, a source of information limited by the longevity of the tree species used to compile past climate information.

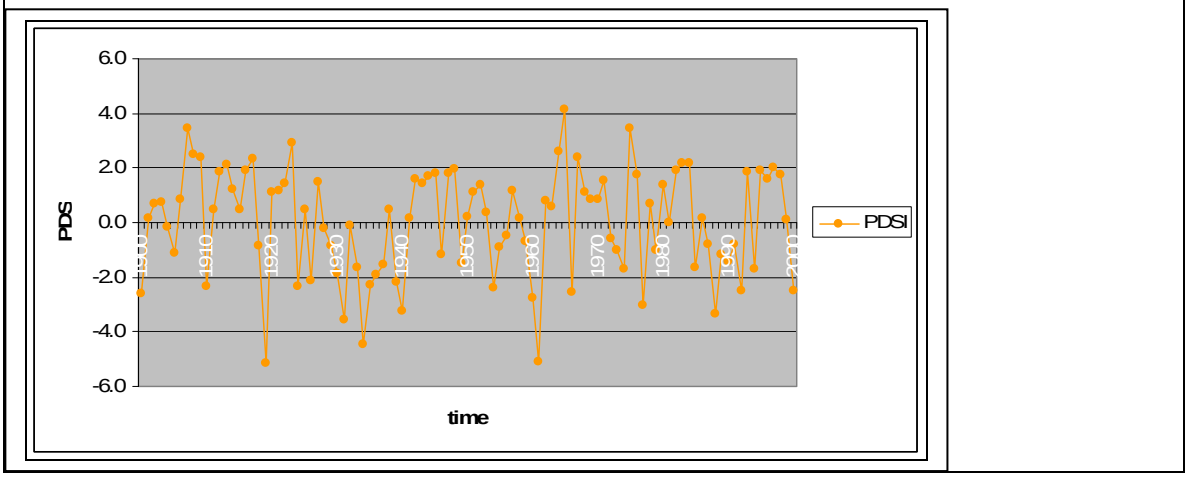
Fluctuations in temperature and precipitation that characterized historic climate likely influenced vegetation distribution and patch size in the watersheds by affecting other processes such as germination and establishment of native species, fire regimes, insect activity, erosion, and stream morphology.

A 20-year period of dry summers beginning in 1855 facilitated *Pseudotsuga menziesii* (Douglas-fir) expansion from small ecotone patches to sagebrush (*Artemesia tridentata vaseyana*) and grassland ecosystems on Fleecer Mountain, north of the watersheds

(Heyerdahl et. al 2006). Dry summers in this community type negatively effect shallow rooted grass and herbaceous species and encouraged establishment of deeper rooted mountain big sagebrush that are nurse plants for *P. menziesii*. These climate conditions of the late 1800s combined with livestock grazing facilitated the succession of *Juniper* species in the western United States into sagebrush and grass dominated communities. This variation in climate, in combination with European settlement in the region, facilitated changes in the sagebrush and grassland communities in the BWL assessment area.

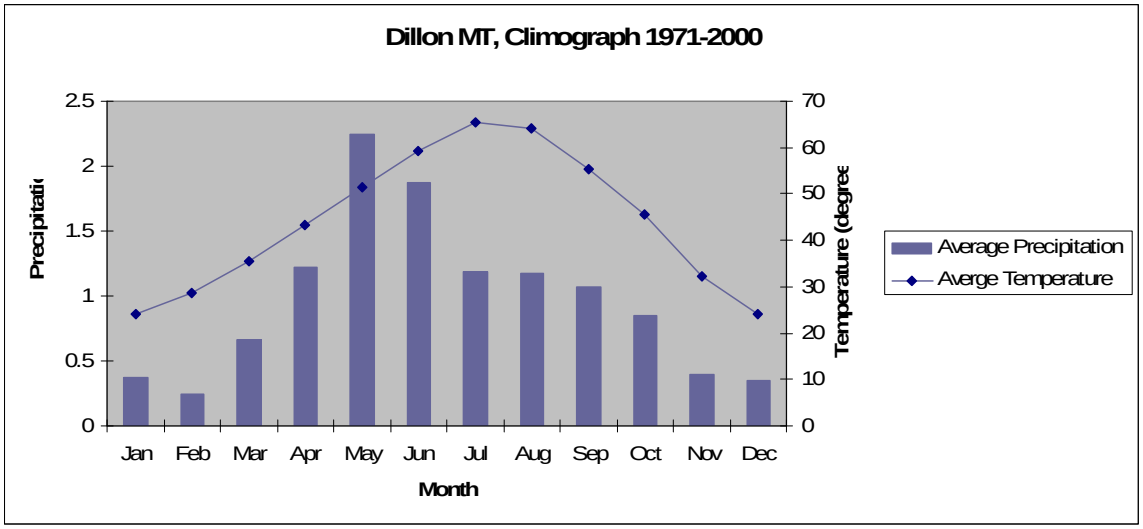
Since the little ice age subsided (1850), global average temperatures have increased due to natural climate variability and human induced climate change. During the 20th century, periods of drought and abundant moisture occurred in the southwest Montana (Figure 4). Recent variation in regional climate formed the human perception of seasonal temperature and precipitation variation. The climate of Dillon, Montana, the closest meteorological station to these watersheds, is used to describe the climate of the assessment area (Figure 5). Winter and summer jet stream position influence annual climate variability that result in these normals. Average precipitation is highest in late spring (μ = 2.25 inches May) and lowest in winter months (μ = 0.25 inches February); while average temperature is highest in summer months (μ = 65.5°F July) and lowest in winter (μ = 24°F January). Precipitation and temperature normals reflect the watersheds cool and moist springs, often hot and dry summers, cool and dry falls, and cold and dry winters. These normals are characteristic of continental climates influenced by continental polar, maritime polar, and, to a lesser extent, continental tropical air masses that shift according to summer and winter jet stream position.

Figure 4. Palmer Drought Severity Index of southwest Montana from 1900 – 2000 (NOAA, Paleo).



As climate is anticipated to become warmer and drier in the future (IPCC 2007), precipitation and temperature trends in the analysis area are anticipated to change in response. Warmer springs may lead to earlier snow pack ripening and runoff, influencing riparian and upland vegetation. Longer fire seasons are likely to result from a change in these two climate elements and increased fire behavior may contribute to changes in erosion that influence stream morphology and habitat (Mote et al 2005, Wondzell and King 2003).

Figure 5. Monthly precipitation and temperature normals for Dillon Montana from 1971-2000 (NOAA 2005)



Insects

Mountain pine beetle (MPB) populations have been cyclic in conifer stands of the BWL watersheds. This species is known to affect lodgepole pine and whitebark pine. 20 to 40 year cycles of population booms lasting up to 11 years initially kill larger individual trees before successively killing smaller individuals (Cole and Amman 1980). Up to 60% of trees greater than 8 inches dbh were killed when MPB populations were epidemic.

Lodgepole pine stands can sustain several episodes of MPB infestation, each episode killing many of the larger trees in a stand and creating conditions for seedling growth. Persistent lodgepole stands resulted in landscape patch heterogeneity. Whitebark pine of these watersheds was less continuous than lodgepole pine and largely represented mid-successional stands characteristic of subalpine fir-Engemlann spruce climax communities. MPB mortality of whitebark pine individuals resulted in succession to later successional stands.

Low elevation stands were most impacted by MPB, reducing the presence of lodgepole pine as a significant stand component. Mid elevation stands comprised of mostly lodgepole pine were most affected by MPB, allowing for shade tolerant subalpine fir and Engelmann spruce to increase. At high elevations where lodgepole pine and whitebark pine are a lesser component of coniferous vegetation, extensive mortality did not occur but did contribute to higher ground fuels.

Western spruce budworm (WSB) occurrence has been most evident at lower elevations where Douglas-fir was abundant. WSB population booms last up to 30 years and cause mortality in small and defoliation of large Douglas-fir trees. Increasingly dense, later successional stands of Douglas-fir are susceptible to WSB because these stands are often stressed by competition. As a consequence of recent drought condition coupled

with interspecific competition and WSB population increases, mortality of large Douglas-fir individuals and stands has occurred in the BWL watersheds.

Rusts, fungi, and microbes

Rusts, fungi and microbes occur throughout the BWL watersheds. The majority of these species occur at natural levels, are native to the greater ecosystem, regulate natural intra- and inter-specific competition, and are important ecosystem elements for decomposition and soil nutrient cycling. In aspen stands fungi and other microbial species kill individual trees, disrupting the stand hormone ratio that results in suckering and stand sustainability. Following conifer mortality from insect activity fungi weakens the boles of trees, resulting in an increase in downed wood that is cycled through the soil ecosystem by fungal and microbial activity.

The bulk of rust, fungi and microbes occurring in the assessment area are important components of ecosystem function and structure. Alternatively, white pine blister rust is a non-native species that has negatively affected five-needle pines in the western US during a portion of its life cycle (McDonald & Hoff 2001). Limber and white bark pines are the only five needle pines on the Beaverhead-Deerlodge National Forest (BDNF) and whitebark pine is the only five needle pine occurring in large numbers in the assessment area. This rust affects vigor and cone crops of whitebark pines, which occur at upper elevations of the watershed. In portions of the BDNF white pine blister rust has resulted in widespread mortality of white bark pine, however in this watershed assessment area white bark pines are comparatively healthy. Future climate conditions (IPCC 2007) are likely to favor whitepine blister rust and have deleterious effects to five needle pines in the assessment area.

Fire

Fire was historically the predominant natural disturbance in the area. Lightning ignitions largely determined where and when fires started (Agee 1993, Baker 2002, Pyne 1982), while indigenous burning is presumed to have occurred at lower elevations within the assessment area (Kimmer & Lake 2001). Fire regimes are differentiated by the frequency, extent, severity, and timing of fire events associated with vegetation. High frequency, low severity fire regimes were historically typical of low elevation dry forests such as Douglas-fir. Senesced grass and herb communities fueled understory fires in these forests, allowing dominant conifer species to survive multiple low intensity fire events that killed seedlings and created low density stands (Heyerdahl et. al 2006). Mixed severity fire regimes historically occurred in several forest types in the region such as early seral subalpine fir forest types dominated by lodgepole pine (Arno 1980, Arno et al. 2000). With less frequent fires than those of lower elevation forests fuel loads increased and when fire spread in these forests low severity surface fire, single or clustered tree torching, and high severity crown fire were typical within a single fire perimeter. High elevation forests such as subalpine fir and whitebark pine experienced low frequency, high severity fire regimes (Agee 1993).

Fire frequency determines vegetation successional stage and fuel conditions. Shape and size of past fires play a role in fuel connectivity and landscape heterogeneity or homogeneity (Arno et al. 2000, Turner et al. 1998). Summer persistent snow pack in high elevation forests historically resulted in high fuel moisture and low potential for fire spread on an annual basis; causing high fuel loading, easy fire spread from surface to

crown, and canopy consumption when fire eventually occurred in these forests (Romme 1982). These trends in fire and the relationship between fire and climate in the northern Rocky Mountains existed in the distant (Heyerdahl et al. 2008) and recent past (Morgan et al. 2008).

Flooding

Flooding was likely the most significant process in riparian areas, ranging from annual floods to large events that significantly altered stream channels. Flood frequency likely varied annually in the assessment area and was highly dependent on annual snow pack properties, storm characteristics during spring (regional storm activity) and summer (localized storm activity) months, and upstream lake holding capacities.

Beaver presence and stream damming historically led to sediment impoundment and changes in channel morphology associated with flooding. This modification of the stream environment resulted in seasonal and annual water persistence in the stream channel and flood plane that facilitated surface to ground water connectivity and maintenance of riparian vegetation.

Land Management Direction Relevant to Vegetation

2008 Revised Forest Plan
Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Conditions for self-sustaining or viable populations of native and desired non-native plant and animal species are supported within the natural capability of the ecosystem.

Desired Condition – Natural disturbance processes are recognized and accepted as essential to the health of ecological communities at various spatial scales. Fire is allowed to play its natural role where appropriate and desired. Life, investments, and valuable resources are protected using the full range of appropriate management responses to fire.

Goal –. Biodiversity: A variety of disturbance processes are managed or allowed to produce a mosaic of species and age classes of native trees, shrubs, grasses, and forbs for animal forage and cover, and perpetuate the diversity of plants and the microbial and insect communities upon which they are dependent.

Goal – Unique Habitats: The trend toward an older forest is altered by increasing the younger age classes providing greater forest diversity in age classes. Stable or upward trends are achieved for declining or unique habitats.

Goal – Sensitive Plants: Sensitive plant populations and their habitat are maintained or restored.

Goal – Old growth: Old growth is managed to retain at least 10 percent of forested acres on a forest wide basis, well distributed, and measured by dominance type for the following: Douglas-fir/ponderosa pine/limber pine, lodgepole pine, whitebark pine, Engelmann spruce/subalpine fir and other.

Objective- Forested Vegetation: Manage for a mosaic of stand structure by species type using 0 to 5 inch diameter breast height (DBH), 5.1 to 9 inch DBH, and greater than 9 inch DBH, which more closely resembles historical range:

Increase acres of Douglas-fir in the 0 to 5 inch DBH class by approximately 20,000 acres across the forest.

Increase the lodgepole pine 0 to 5 inch DBH class by approximately 7,000 acres and increase the aspen component, reducing acres in the larger size classes.

Restore 67,000 acres of aspen within lodgepole pine and other vegetation types by increasing the number of acres in the 0 to 5 inch DBH class.

Increase the number of acres in the 0 to 5 inch DBH class for whitebark pine and sub-alpine fir types by 45,000 acres, largely through the use of fire.

Objective – Grassland/Shrubland/Riparian: Reduce conifer colonization on 74,000 acres of riparian areas, shrublands, and grasslands.

Objective – Noxious Weeds: Prevent, reduce, or liminate infestations of non-native or noxious weed species with emphasis on areas where there is high likelihood of establishment and spread. Manage noxious weeds through Integrated Pest Management.

Objective – Monitor G1 through G3 ranked sensitive plants, perform conservation assessments, and develop conservation strategies for species showing downward trends.

2. Current Condition

Data Sources

Published literature was used to describe reference conditions, identify factors contributing to change and develop desired future conditions for vegetation resources in the assessment area. Local data sources were used to identify existing conditions: Beaverhead-Deerlodge National Forest Land and Resource Management Plan Final EIS (2008); Pioneer Landscape Assessment (1997); East Face of the Pioneers Ecosystem Management (1998); Beaverhead-Deerlodge National Forest (BDNF) Timber Stands Management Record System (TSMRS) spatial data; BDNF fire group spatial data; and modeled vegetation change spatial data generated specifically for the assessment area.

Fire Groups

The BWL watersheds are representative of 5 fire groups (Table 8.); which describe fire regimes in the context of vegetation types (Fischer and Clayton 1983). In the text below, fire group classifications were used to describe historical fire processes that defined succession and resulting vegetation for coniferous habitats of the watersheds. All habitat types associated with miscellaneous, non-coniferous vegetation were described using other sources.

The five fire groups represent areas ranging in size from .25 - 21,000+ acres in the assessment area. Fire groups 5 and 7 dominate (approximately 80% of the total area - Table 8). Also see Map 4. Vegetation of these fire groups is diverse. Understory species are wide ranging and commonly not exclusive to a single dominant coniferous vegetation (Table 9).

Table 8. Vegetation classification and area of each mapped fire group (Fischer and Clayton 1983, Pioneer LA GIS)

Fire Group	Vegetation Classification	Acres (%)
0	aspen, rock, water, wet meadow, willow	6,220 (10)
5	Douglas-fir, sagebrush steppe, mountain mahogany, dry meadow	29,140 (50)
7	lodgepole pine	17,580 (30)
8	subalpine-fir	820 (1)
10	whitebark pine	5,270 (9)

Table 9. Associate plant species of habitat types and fire groups described for the assessment area (Fischer and Claytonb 1983)

Common name (*latin name*)	Habit	Fire Group
beargrass (*Xerophyllum tenax*)	grass-like	8, 10
bluebunch wheatgrass (*Pseudoroegneria spicata*)	grass	5
bluejoint (*Calamagrostis canadensis*)	grass	7
elk sedge (*Carex geyeri)*	grass	5, 7, 8
Idaho fescue (*Festuca idahoensis*)	grass	5, 10
Parry rush (*Juncus parryi*)	grass	10
pinegrass (*Calamagrostis rubescens*)	grass	5, 7, 8
Ross sedge (*Carex rossii*)	grass	10
smooth woodrush (*Luzula hitchcockii*)	grass	10
arrowleaf balsamroot (*Balsamorhiza sagittata*)	forb	5
ballhead sandwort (*Arenaria conjesta*)	forb	10
broadleaf arnica (*Arnica latifolia*)	forb	5, 7, 8, 10
false Solomon's seal (*Smilacema racemosa*)	forb	8
heart-leaf arnica (*Arnica cordifolia*)	forb	7, 8
pussytoes (*Antennaria* spp.)	forb	5
pyrola (*Pyrloa* spp.)	forb	8
slender hawkweed (*Heracleum gracile*)	forb	10
strawberry (*Fragaria virginiana*)	forb	5, 8
sweet cicely (*Ozmorhiza bertori*)	forb	8
timber milkvetch (*Astragalus miser*)	forb	5, 8
valerian (*Valeriana spp*)	forb	8
violet (Viola *spp*.)	forb	8
western meadow rue (*Thalictrum occidentale*)	forb	5, 7, 8
buffaloberry (*Sheperdia canadensis*)	shrub	5, 7, 8
common juniper (*Juniperus communis*)	shrub	5, 7, 8, 10
dwarf huckleberry (*Vaccinium caespitosa*)	shrub	7
grouse whortleberry (*Vaccinium scoparium*)	shrub	7, 8, 10

kinnikinnick (*Arctostaphylos uva-ursi*)	shrub	7
mountain big sagebrush (*Artemesia tridentata vaseyana*)	shrub	5
mountain snowberry (*Symphoricarpos oreophilus*)	shrub	5, 8
mountain gooseberry *(Ribes sp*.)	shrub	
Oregon grape (*Berberis repens*)	shrub	7, 8
red mountain heath (*Phyllodoce sp.*)	shrub	10
smooth menziesia (*Menziesia sp.)*	shrub	10
twinflower (*Linnaea borealis*)	shrub	7, 8
wax currant (*Ribes lacustre*)	shrub	5
yellow mountain heath (*Phyllodoce grandiflora*)	shrub	10

The dominant vegetation in the BWL watersheds was mapped using the Pioneer Landscape Analysis GIS layer based on Timber Stand Management Records System data and polygons. See Map 3. Rare or unique vegetation types like riparian, willows, aspen and mountain mahogany only show up in this data where stands are apparent on aerial photographs and cover at least 5 acres.

Table 10. Existing mapped vegetation of the assessment area.

Vegetation Classification	Acres (%)
aspen	130 (0.2)
Douglas-fir	17,630 (30)
Douglas-fir colonization	920 (1.6)
grassland	3,600 (6.1)
lodgepole pine	17,580 (28)
mountain mahogany	310 (0.5)
rock outcrops & scree	5,730 (9.7)
sagebrush steppe	6,250 (11)
subalpine fir	910 (1.5)
water (lakes)	220 (0.4)
wet meadow	390 (0.7)
whitebark pine	5,270 (9)
willows	100 (0.2)

Source:

The following data was generated by digitizing in Arc GIS 9.2 NAIP Imagery (1 meter accuracy satellite raster layers). Degrees of change were assessed by the Ecologist assigned to the project and were based on visual observations of the raster layer and reading published literature. See Maps 7, 8, and 9.

Table 11. Known or suspected change in dominant vegetation types.

Vegetation	Acres by Degree of Change (# stands < 1 acre)			Total Acres
	1*	2*	3*	
aspen	21 (0)	457 (4)	316 (3)	794
riparian aspen	0 (0)	13 (7)	115 (0)	128
mountain mahogany	253 (1)	449 (0)	999 (1)	1701
sagebrush/grassland	0 (0)	185 (0)	3587 (3)	3772

*Degree of change: 1 reflects little to no detected change or uncertain whether vegetation delineated actually exists on the ground;

2 reflects moderate successional type change;

3 reflects high degree of successional change and conversion of dominant vegetation. Change in mountain mahogany and sagebrush/grassland vegetation is commonly attributed to conifer establishment and associated conversion of dominant vegetation.6iparian Habitats

The timeline of this project was not commensurate with data gathering and research necessary to draft original text regarding historic, current, and desired conditions for riparian vegetation within the assessment area. Please refer to the Pioneer Landscape Assessment (USDA 1996) or the fisheries/hydrology portion of this watershed assessment.

Aspen Habitats

Quaking aspen (*Populus tremuloides*) is the most widespread deciduous tree species in North America. When historical aspen distribution is compared to current aspen distribution in Montana, results suggest this species has declined by over 60 percent (Bartos 2001). In the Gravelly Mountains, aspen declined by ~47 percent from 1947 to 1992 (Wirth et al. 1996). Comparison between historical and current aspen stands in the Pioneer Mountain landscape indicates this species occupied more area in the past than today (Pioneer LA 1996). The reduction in aspen patch size and distribution in the Pioneer and Gravelly Mountains is attributed primarily to conifer expansion and disruption of fire return intervals, as well as domestic and wild ungulate grazing.

Existing vegetation maps indicate aspen occupies 130 acres of the assessment area (Table 10 and Map 3). This is a reflection of limitations associated with photo interpretation and stand delineation criteria in the TSMRS. Aspen stands mapped from 2005 NAIPS satellite imagery occupy approximately 795 acres of the landscape (Table 11 and Map 7). Walk through exams conducted in 2007 document presence of remnant aspen trees, both living and dead, wide spread throughout conifer stands in the Birch, Willow and Lost Creek drainages (2007 surveys on file in the Dillon District Office).

Curlleaf Mountan-Mahogany Habitats

Existing vegetation maps indicate curlleaf mountain mahogany (*Cercocarpus ledifolius*) communities occupy 310 acres of the assessment area (Table 10 and Map 3). However, 2005 satellite imagery indicates that curlleaf mountain mahogany communities occupy approximately 1700 acres of the landscape (Table 11 and Map 8). Dry, steep calcareous soils and rock outcrops of lower Birch Creek and lower Willow Creek support the majority of this vegetation type. Many of these stands are co-dominated by Rocky Mountain juniper (*Juniperous scopulorum*) with moister sites being colonized by Douglas-fir. More than 50% of all curlleaf mountain mahogany stands within the assessment area are believed to be at risk of habitat conversion by Douglas-fir succession, potential for fire spread into these unique communities, and the known negative effects of fire to curlleaf mountain mahogany in the western US.

Big Sagebrush Steppe Communities

Big sagebrush steppe and dry grasslands occupy low elevations in the eastern portions of the assessment area. The three sagebrush steppe community types are not delineated in current vegetation maps maintained by the USFS (see map Dominant

Vegetation); however it is assumed that basin big sagebrush occupied a larger portion of the landscape in the past and that a finer mosaic of grassland to sagebrush steppe occupied upland foothills of these watersheds. Existing vegetation maps indicate dry grasslands occupy 3,600 acres of the assessment area and sagebrush steppe accounts for 6,250 acres (Table 10 and Map 3). Fire exclusion and the introduction of livestock grazing to the assessment area are believed to have resulted in a shift from a large grassland component to nearly 50% more sagebrush dominated lands within the assessment area. Elimination of fire from the landscape similarly increased shrub densities, fuel, and conifer presence in sagebrush steppe communities. Almost 4,000 acres of the assessment area are in severe risk of change due to conifer succession into habitats typically dominated by sagebrush steppe vegetation (Table 11 and Map 9).

Cool, Dry Douglas-fir Habitats

Douglas-fir dominates middle elevations of the BWL assessment area. In contrast to pre-settlement conditions, Douglas-fir stands in these watersheds are continuous, presumed to be mid successional, densely stocked, and encroaching into sagebrush-steppe, grassland, aspen, curlleaf mountain mahogany, and riparian communities. Fire suppression and elimination of indigenous burning, in combination with intense livestock grazing during the first half of the 20th century have resulted in Douglas-fir domination of 30% of this landscape (Table 10 and Map 3). The increase in extent and continuity of this coniferous vegetation type has effectively reduced landscape heterogeneity and biodiversity and put unique habitat types (i.e. aspen and mountain mahogany) at risk of irreversible habitat conversion.

Cool Habitats Dominated by Lodgepole Pine

Cool habitats dominated by lodgepole pine *(Pinus contorta*) are common in the BWL analysis area and account for approximately 30 percent of the assessment area (Table 8). It is assumed these stands are early to mid successional and age class diversity is uncertain within this landscape. These habitats are likely within their historic range of variability, but are likely to succeed into later successional stages in the absence of fire. Fire suppression is believed to have contributed more homogeneous conditions than historically characterized this landscape. Intraspecific competition of maturing stands coupled with drought has resulted in stressed stands that are susceptible to mountain pine beetle activity in the watershed. Although insect activity of these stands is scant in comparison to activity in other locations of the Beaverhead-Deerlodge National Forest (i.e. Butte RD or Pintler RD), this disturbance agent is thinning stands where the absence of fire has created high tree density.

Dry, Lower Subalpine Habitats

Dry, lower subalpine habitats are uncommon within these watersheds and account for between 5 and 10 percent of the assessment area (Table 10). It is assumed these stands are early to mid successional and age class diversity is uncertain within this landscape These habitats are likely within their historic range of variability, but are likely to succeed into later successional stages in the absence of fire.

Cold, Moist Upper Subalpine And Timberline Habitats

Cold, moist upper subalpine and timberline habitats occupy less than 5 percent of these watersheds (Table 10). The structure and function of these habitats are assumed to be within the natural range of variability.

Sensitive Plants

Five populations of *Penstemon lemhiensis* occur in the assessment area. Road cuts on Thief Creek and Birch Creek roads support three of these populations. These roadside populations are currently threatened by noxious weeds (cheatgrass and spotted knapweed) and road maintenance. One population on Sugarloaf Mountain and one population within Armstrong Gulch occur in mature sagebrush steppe communities and are increasingly threatened by community change associated with Douglas-fir succession into these locations and associated uncharacteristically sever fire.

One population of *Arabis fecunda* occupies the slopes of Farlin Gulch off Birch Creek Road. This population of sensitive plants occurs within a mature curlleaf mountain mahogany stand that also supports Rocky Mountain juniper and Douglas-fir. Cheatgrass occurs in some portions of the population and is spreading by seed and through ground disturbance created by browsing native ungulates. This sensitive plant population is threatened by uncharacteristic fire and competition with cheatgrass.

One population of *Lesquerella pulcheslla* occupies the bottom of Farlin Gulch off Birch Creek Road. This population of sensitive plants on the edge of a mature curlleaf mountain mahogany stand that also supports Rocky Mountain juniper and Douglas-fir. Cheatgrass and spotted knapweed occurs in some portions of the population, density of these noxious weeds has increased in recent years. A large, disturbed pull out for vehicles is adjacent to this population and has likely limited the extent of this population. This sensitive plant population is threatened by competition with noxious weeds, unauthorized travel, and herbicide treatment of noxious weeds.

Insects and Disease

Insect and disease conditions are monitored across the Forest by the Forest Health Protection branch of USDA FS State and Private Forestry and Montana Department of Natural Resources Forestry Division (R1 Aerial Detection Flights). Map 5 displays the location insect and disease infestations mapped by these flights between 2000 and 2007 in relation to recreation and administrative sites of concern. The entire Forest is not necessarily flown every year. In 2004 it was, but, in 2006 for example, the Dillon District was not flown.

In the last eight years of survey, 6,600 acres or 11% of the assessment area have been mapped with infestations.

Noxious Weeds

The watersheds included in this analysis contain 39 noxious weed infestations identified, totaling approximately 50 acres, with individual infestation sizes ranging from a few plants up to approximately 11 acres. Infestations occur as a few +/- 5 acre patch infestations combined with intermittent linear infestations along roads and trails. The primary weed species present in these watersheds include spotted knapweed, hounds tongue, and Canadian thistle, with smaller or fewer infestations of black henbane, musk thistle, leafy spurge, St. Johnswort and white top. Most infestations are less than 1 acre.

Noxious weeds have been treated by the Forest Service, Beaverhead County, and other partners through weed days and cooperative agreements. Most infestations are being eradicated or held in check through current efforts. Bio-control is also being examined for larger, denser infestations where they exist.

3. Reference Condition

Aspen Habitats

Quaking aspen (*Populus tremuloides*) is the most widespread deciduous tree species in North America and has declined by 50 to 90 percent in western landscapes (Bartos 2001). Throughout its distribution, aspen exists in a diversity of landscapes and this varied existence has resulted in a similar diversity of ecological roles (Romme et al. 2001). Approximately 75 percent of all historical and current North American aspen occurs in Colorado (50%) and Utah (25%) as large stands; while in the northern Rocky Mountains, aspen historically occurred and currently exists in relatively small patches at the sagebrush steppe and coniferous forest ecotonal band (Romme et al. 2001).

Successful reproduction from seed is infrequent and episodic in western aspen, with estimated seedling establishment intervals of 200-400 years (Jelinski and Cheliak 1992). Regeneration from seed historically occurred during periods of cool climatic conditions (e.g. Little Ice Age; Tuskan et al. 1996), indicating the current rise in global average climate may not be conducive to regeneration from seed in the west. Once aspen is lost from a landscape it generally will not reestablish from seed.

Aspen is a disturbance dependent species; with fire as the primary and disease the secondary disturbance agents. Single aspen trees are typically joined by subterranean root systems, resulting in stands of genetically identical interconnected trees that are commonly referred to as clones. Reproduction is largely accomplished by suckering from underground root systems following disturbance or die back that disrupts the hormonal balance between trees and roots. When trees are killed or stressed the flow of sucker suppressing hormones (auxins) from the crown is disrupted, influencing the hormone ratio in favor of sucker stimulation (via cytokinin). New trees will grow from sprouting suckers in the post-disturbance environment, if they escape browsing pressure of wild and domestic ungulates.

Historically, fire disturbances in the northern Rocky Mountains maintained stand vigor by killing or severely stressing trees and allowing for sucker production from clonal roots. High fire frequency at the steppe-conifer zone prior to European settlement in southwest Montana limited distribution of coniferous and sagebrush-steppe communities, effectively regulating competition between aspen and these adjacent vegetation types. Although aspen clones in southwest Montana were historically smaller and occupied smaller portions of the landscape than clones of Colorado and Utah, aspen clones were most likely more vigorous and larger in the past.

Curlleaf Mountain Mahogany Habitats

Curlleaf mountain-mahogany (*Cercocarpus ledifolius*) habitat types were historically the most widespread of all mountain mahoganies (*Cercocarpus spp*.) and south-central Montana was the northernmost extent of the species (Dayton 1931, Dorn 1984). Pre-settlement stands were small in the context of landscape vegetation types and confined to calcareous derived soils and outcrops in the assessment area. Poor soils and dry characteristics of sites occupied by curlleaf mountain-mahogany supported sparse understory vegetation and resulted in slow regeneration of dominant shrub species following disturbance. These habitats occupied steep, low elevation sites (below 2,000

feet) and were commonly co-dominated by Rocky Mountain juniper (*Juniperus scopulorum*). In the absence of disturbance, late seral open stands were long lived (over 100 years) and provided important forage for moose, mule deer, small mammals, and other wildlife species.

Curlleaf mountain mahogany stands were historically affected by herbivory, drought, and fire. The high palatability of dominant vegetation favored large ungulate utilization of stands, particularly in years when snowpack covered forage of low elevation sites. This pressure likely effected individuals and affected canopy structure. These habitat types occurred on normally dry sites and drought affected seedling survival and speed of regeneration following disturbance more than mature individuals. Dry site characteristics resulted in a sparse understory, low downed wood component and wide canopy spacing that limited fire spread and frequency. Mature stands were historically capable of surviving cool surface fires, while more intense fires killed mature curlleaf mountain-mahogany and destroyed seedbanks. Stand regeneration following fire was dependent upon seedbank survival, but postfire establishment was historically on the scale of decades. The oldest curlleaf mountain-mahogany individuals occupied the harshest sites (USDA 2008).

Big Sagebrush Steppe Communities

Three big sagebrush steppe communities occurred at low, foothill elevations in the assessment area and were associated with deep and well drained soils. Communities dominated by Wyoming big sagebrush (*Artemesia tridentata* ssp. *wyomingensis*) were located on the most xeric sites, accounted a large portion of the sagebrush steppe habitats, and had 10 to 25 percent bare ground. Sagebrush steppe dominated by basin big sagebrush (*Artemesia tridentata* ssp. t*ridentata*) were more mesic than locations occupied by Wyoming big sagebrush and supported more perennial herbs, higher overall plant cover, and were located in valley bottoms between riparian and upland vegetation. Mountain big sagebrush (*Artemesia tridentata* ssp.*vaseyanna*) was the most common sagebrush steppe community type in the assessment area. This dominant sagebrush community type tolerated the most mesic conditions of the three big sagebrush communities, was located at mid to upper foothill locations and in parks within coniferous vegetation, and was associated with a high diversity of bunchgrasses and perennial vegetation. All three of these sagebrush steppe community types historically included a large grass component and fire was the dominant agent of change (USDA, 2008).

Fire frequency and extent historically shaped the mosaic of grass and sagebrush succession that characterized sagebrush steppe landscape of the BWL assessment area prior to European settlement. Frequent fire suppressed big sagebrush and favored grass species domination most locations, while fire exclusion favored late succession sagebrush stand development and conifer expansion into sagebrush communities. Estimated fire frequency for the grassland-sagebrush mosaic was 5 to 60 years (Table 5v) and fire extent was historically limited by fuel continuity and fire weather.

Table 12. Range of fire return intervals for the three sagebrush steppe community types (Arno & Gruell 1983, Cooper et al. 2007, Miller & Rose 1995).

Community	Dominant Species	Fire Return Interval (yrs)

basin big sagebrush	*Artemesia tridentata* ssp. *tridentata*	12-43
mountain big sagebrush	*Artemesia tridentata* ssp. *vaseyanna*	15-40
Wyoming big sagebrush	*Artemesia tridentata* ssp. *wyomingensis*	10-70

Cool, Dry Douglas-Fir Habitats

Cool, dry Douglas-fir (*Pseudotsuga menziezii* var *glauca*) habitat types were historically maintained by fire at mid elevations between the dry foothills and moister upper elevations. Many pre-settlement stands occurred as small, scattered stands in a mosaic of sagebrush-grasslands. Prior to European settlement, fire occurred frequently in Douglas-fir stands and limited the extent of this habitat type in the assessment area. Thick bark insulated the cambium of mature individuals, providing for individual persistence and seeding onto the fire prepared seedbed. Competition between overstory and understory vegetation on droughty sites generally did not support seedling survival and regeneration; however in locations where seedling survival was high, fire likely acted as a thinning agent that allowed for stand longevity in the past (Arno & Gruell 1983; Fischer & Clayton 1983; Heyerdahl & Miller 2006).

Low severity and frequent fire historically maintained open stands with grassland and shrub components (Table 11). Occasional associate conifer species historically occurred in cool-dry Douglas-fir stands and included Rocky Mountain juniper (*Juniperus scopulorum*), lodgepole pine (*Pinus contorta*), Engelman spruce (*Picea engelmannii*), and whitebark pine (*Pinus albicaulis*) in the assessment area. The presence and proportion of associate plant species was historically determined by frequency and severity of fire in Douglas-fir stands of the assessment are and the successional stage of these stands at the time of fire disturbance.

Fire group 5 is associated with the cool-dry Douglas-fir habitat type (Table 8). Frequent fire maintained grasslands and was not favorable to Douglas-fir persistence at any given location within the watersheds, as thin barked seedlings and saplings were unable to survive fire events and facilitate later regeneration. The presence of Douglas-fir suggests this scenario was unlikely and, upon stand initiation, fire likely reduced grass cover and prepared sites for seedling establishment. Adequate seed source, germination conditions, and soil moisture combined to assist seedling establishment and even–age stand development. Fire events during this stage of stand development would have resulted in seedling mortality and regression to grassland. Stands comprised of pole-sized individuals were able to survive cool, low severity surface fires because these events thinned stands; while severe fire at this stage of stand development would have resulted in conifer mortality and regression to grassland. Historically mature Douglas-fir stands had been exposed to these thinning events and cool, low severity surface fires entering these stands reduced fuel loads and temporarily reduced competition by removing understory vegetation. Mature stands developed into climax communities that were maintained by repeated exposure to cool surface fires that maintained low fuel loads. When fire weather was favorable for high severity fire in climax Douglas-fir stands, the stand reverted to grassland and the successional cycle was reset (Fisher & Clayton 1983).

Cool Habitats Dominated By Lodgepole Pine

Cool habitats dominated by lodgepole pine (*Pinus contorta*) were historically common in the analysis area. Two habitat types represented the broader cool habitat types dominated by lodgepole pine: habitats where lodgepole pine was the climax species and occurred as pure stands prior to climax; and mixed conifer habitats where lodgepole pine was dominant in most stands. Fire disturbances historically characterized the mosaic of age classes and stand successional stages of cool habitats dominated by lodgepole pine that characterized mid to upper elevations of the BWL assessment area. Although the thin bark of lodgepole pine as a species made stands susceptible to mortality from fire events, several key characteristics facilitated stand regeneration following fire (Fisher & Clayton 1983).

Cone serotiny historically allowed for seed storage in canopy seedbanks that were released by crown scorching and locations historically exposed to higher fire frequency historically had a higher proportion of serotonous cones than non-serotonous cones (Perry & Lotan 1979). Early and prolific seed production, highly viable seed (up to 80 years), and high seedling survival and rapid growth were historically traits that allowed for rapid regeneration following fire. Habitats characterized as mixed conifer with lodgepole pine as a dominant species were moister and supported Douglas-fir, Engelmann spruce, and subalpine fir at mid to late stages of succession. These associate conifer species lack traits that favor rapid post-fire regeneration and were typically killed during high intensity fire events that historically characterized high elevation forests. The understories of these cool lodgepole pine dominated stands were typified by species common to northern Rocky Mountain landscapes (Table 9; Fisher & Clayton 1983).

Dense stands of the cool lodgepole pine dominated habitats were characterized by fire group seven. Habitat types below 7,500 feet experienced more frequent fire than those above this demarcation. At these lower elevations fire perpetuated lodgepole pine by eliminating shade tolerant species from stands. Fire frequency ranged from 100 to 500 years (Hendrickson 1970), but higher fire frequency did occur. Stands older than 60 years were more dense and susceptible to increased competition, insect activity (most notably mountain pine beetle mortality), dwarf mistletoe, and increased flammability. Historically lower elevation cool dry habitats dominated by lodgepole pine occupied large swathe of the landscape and were single-aged and uniform in structure (Fisher & Clayton 1983).

At elevations higher than 7,500 feet fire season historically had a shorter fire season due to cooler temperatures and snow pack persistence into summer months. Temperatures and productivity was lower at these locations and resulted in slower fuel accumulation, insect activity was limited, and fire potential was lower than lower elevation sites. Stands dominated by lodgepole pine above 7,500 feet elevation had a fire regime similar to subalpine fir, with fire frequency of approximately 150 years and stand replacing fire return intervals of 300 to 400 years (Romme 1980) that resulted in landscapes with a mosaic of age classes (Fisher & Clayton 1983).

Where lodgepole pine was the climax species, succession was dominated by this species regardless of fire frequency. Stand structure reflected fire history. After initial succession of forbs and shrubs, a seedling/sapling stage occupied most stands and any fire during this stage of succession returned the stand to the initial species composition. Stands that were not exposed to fire matured and well stocked pole sized stands exposed to cool fires were thinned, while those exposed to moderate to severe fire

reverted to the herb and shrub successional stage. After a thinning fire stands were open, while stands still lacking fire disturbance were dense with a large downed wood component. In the later fire free scenario, windthrow and insect associated mortality thinned stands. Mature to climax stands exposed to cool fires were thinned and resulted in open, late successional stands. When stand were at or near climax and exposed to fire, fuel loads and canopy spacing frequently resulted in high severity fire, stand mortality, and regeneration (Fisher & Clayton 1983).

Where habitat types were dominated by lodgepole pine but climax species were Douglas-fir, Engelmann spruce or subalpine fir, post-fire forest succession was similar to that described for pure lodgepole pine stands but understory species composition was different. Some climax species were present at the seedling stage and lodgepole dominated canopies of pole sized stands had a greater proportion of shade-tolerant climax species in the understory. Fire absence resulted in continued perpetuation of shade-tolerant climax species until lodgepole canopies were eventually overtopped. Cool fires interrupted successional development in a similar fashion described for the lodgepole climax habitat types, but these events were less frequent and of smaller extent. Moderate fires in pole and mature stands favored lodgepole by killing associate conifer species that were less fire resistant and thinning the stands. Severe fires at any stage of successional development reverted stands to the early forb and shrub state (Fisher & Clayton 1983).

Dry, Lower Subalpine Habitats

Dry, lower subalpine habitats characterized by Engelmann spruce (*Picea engelmanii*) or subalpine fir (*Abies lasiocarpa*) historically occupied portions of the analysis area. These habitat types were characterized by mixed conifer stands for stages of successional development and supported various densities of Douglas-fir, lodgepole pine, and whitebark pine. Fire disturbances historically produced a mosaic of age classes and stand successional stages of these subalpine habitats in the assessment area (Fisher & Clayton 1983).

The dry, lower subalpine habitats of the assessment area had a similar relationship to fire as mixed conifer stands dominated by lodgepole pine described in the previous section but were characterized by fire group eight. Fire frequency was low for these habitats and ranged from 50 to approximately 130 years. Pole sized and mature stands that experienced cool fires were thinned and Douglas-fir was favored over the thinner barked and more flammable associate species; whereas moderate to severe fires favored lodgepole pine. Stands maturing to climax communities, where subalpine fir or Engelmann spruce were the dominant species, required a long fire-free period that was likely associated with cool climates. Climax stands exposed to fire were commonly returned to early successional stages due to large amount of downed fuel, ladder fuel, and the fire weather conditions that were favorable to fire entering a stand and spreading through coniferous canopy.

Cold, Moist Upper Subalpine and Timberline Habitats

Cold, moist upper subalpine and timberline habitats characterized subalpine fir (Abies lasiocarpa) historically occupied portions of the analysis area. These habitat types were characterized by mixed conifer stands for stages of successional development and supported various densities of Engelmann spruce, whitebark pine and lodgepole pine. At timberline, alpine larch may have been present in some stands but lodgepole pine was

likely absent in the past. Understories varied in species composition and percent cover (Table 10.), but was generally sparser than other habitats of the assessment area in the past. Climate and soil conditions were the primary factors that historically influenced these habitats in the assessment area. Windthrow, avalanches, and insect activity likely influenced stands of these habitats more in the past than fire. Despite the susceptibility to lightning, the low productivity and fuel connectivity of these sites resulted in a historically low fire frequency. When conditions facilitated fire entrance to stands of these habitat types, events were historically stand replacing due to heavy fuel loads and fire tolerance of species typical of these locations (Fisher & Clayton 1983, Romme 1980).

Sensitive Plants

Three Region 1 sensitive species occupy portions of the assessment area. *Penstemon lemhiensis* (Lemhi penstemon) was a fire dependent species of sagebrush steppe communities. Historically, this species occurred in post-fire environments of sagebrush steppe ecosystems. *Arabis fecumda* (Sapphire rockcress) historically occurred on open and often eroding slopes of calcareous parent material. *Lesquerella pulchella* (beautiful bladderpod) also occurred on calcareous soils dominated by curlleaf mountain mahogany.

Noxious Weeds

Non-native species are not present under natural conditions not influenced by man's settlement or other development activities. Noxious weeds as well as other more beneficial non-native species appeared only in the last 150 years.

4. Synthesis and Interpretation

Aspen Habitats

When historical aspen distribution is compared to current aspen distribution in Montana, results suggest this species has declined by over 60 percent (Bartos 2001). In the Gravelly Mountains, aspen declined by ~47 percent from 1947 to 1992 (Wirth et al. 1996). Comparisons of historical to current aspen stands in the Pioneer Mountain landscape indicate this species occupied more area in the past than today (Pioneer LA 1996).

The reduction in aspen patch size and distribution in the Pioneer and Gravelly Mountains is attributed to conifer expansion and disruption of fire return intervals, as well as domestic and wild ungulate grazing. Change within aspen stands is associated with lack of age class diversity within and between stands, single age class (mature) stand dominance, poor vigor associated with stand age, and/or conifer establishment .

Extrapolating from existing literature and BDNF data (Pioneer LA & USDA), it is assumed that aspen stands in the assessment area were more vigorous and occupied a from 10% more area than currently observed up to 60% as estimated by Bartos, 2001. Approximately 430 of the 795 acres of aspen dominated vegetation are suspected of being at high risk for change (Table 11 and Map 7). Based on the presence of remnant aspen trees documented in walk through exams of conifer stands, there may be additional opportunities to restore aspen (see Map 16).

The FEIS accompanying the Revised Forest Plan cites a high level of downward departure from modeled historic to current vegetation conditions. The Revised Plan sets an objective to restore 67,000 acres of aspen forestwide over the life of the Plan, citing

upland lodgepole pine and Douglas-fir stands where viable clones remain as the opportunity to meet the objective. This amounts to between 4,500 and 6,700 acres per year (USDA, FEIS, 2008). These watersheds provide a good opportunity to contribute to the Forest objective for aspen.

Curlleaf Mountain Mahogany Habitats

The longevity of curlleaf mountain mahogany habitat is jeopardized by the threat of fire spreading into and within existing stands. A high intensity fire has the likelihood of destroying the older plants and any seed source. The risk of fire puts these stands at high risk of extirpation. Eliminating Douglas-fir within these stands and treating Douglas-fir stands adjacent to curlleaf mountain mahogany stands can reduce potential fire effects to this vegetation type. Rocky Mountain juniper is often associated with mahogany stands. This species is considered highly flammable vegetation and, where present, presents an additional risk of fire spread into these stands.

More than 50% of all curlleaf mountain mahogany stands within the assessment area are believed to be at risk of habitat conversion; which is attributable to Douglas-fir succession into mahogany stands, potential for fire spread from the surrounding landscape into these unique communities, and the known negative effects of fire to the species.

Large areas of mahogany occupy the northern slopes (south facing) of Willow Creek and are at high risk of conversion to Douglas-fir. These stands are large in comparison to others within the assessment area, Douglas-fir surrounding these stands is dense and beginning to overtop curlleaf mountain mahogany, and fire spread from surrounding upland vegetation will likely lead to habitat conversion when fire enters this portion of the landscape. Curlleaf mountain mahogany stands of lower Birch Creek are similarly threatened and the higher road densities and associated potential for human caused fire starts result in high potential for habitat conversion in these locations.

Big Sagebrush Steppe Communities

The natural role of fire has been disrupted in the sagebrush steppe and grassland mosaic of the area. Continued absence of fire will contribute to perpetuation of homogeneous of sagebrush steppe dominated foothills and increased conifer dominance of the landscape. Both of these conditions resulted from over a century of fire suppression in the assessment area, as well as the elimination of indigenous burning in southwest Montana. This scenario will contribute to larger, severe fires with a higher than natural return interval Turner et al. 1998). Returning fire to the sagebrush steppe-conifer ecotone can slow the succession of conifers into the sagebrush steppe and grassland mosaic. Conifer removal from sagebrush steppe and grassland communities can contribute to the persistence of these communities, contribute to landscape heterogeneity and biodiversity, and provide opportunities to allow naturally ignited fires to be confined by vegetation. Treatment to restore the natural heterogeneity of this portion of the assessment area must incorporate the spatial and temporal component of natural fire in order to address ecological concerns and be cost effective.

Specifically, fire exclusion and the introduction of livestock grazing to the assessment area are believed to have resulted in a shift from a large grassland component to nearly 50% more sagebrush dominated lands within the assessment area. Elimination of fire from the landscape similarly increased shrub densities, fuel, and conifer presence in

sagebrush steppe communities. Almost 4,000 acres of the assessment area are in severe risk of change due to conifer succession into habitats typically dominated by sagebrush steppe vegetation (Table 11 and Map 9).

The Revised Forest Plan sets an objective to reduce conifer colonization on 74,000 acres or riparian areas, shrublands, and grasslands forestwide over the life of the Plan. This amounts to between 4,900 and 7,400 acres per year. The BWL watersheds provide a good opportunity to contribute to the Forest objective for grasslands and shrublands.

Douglas-fir Habitats

Forty-two fire starts have been suppressed within the landscape since the 1950s (Table 12). This management action has contributed to the continuity of mid successional Douglas-fir habitat types across these watersheds. Restoring fire in the landscape through a strategic fuels treatment plan would allow for fire starts to be utilized within the assessment area to reduce the extent and continuity of Douglas-fir.

Table 12. Fire starts by cause in the assessment area (BDNF GIS library, Dillon RD hard copy files).

number of fires	fire cause
27	lightning
14	human
1	arson

The increase in extent and continuity of this coniferous vegetation type has effectively reduced landscape vegetation heterogeneity and associated biodiversity and put unique habitat types of the BWL assessment area (i.e. aspen and mountain mahogany) at risk of irreversible habitat conversion.

The Revised Forest Plan sets an objective to increase the number of acres in the 0 to 5 inch DBH class by 20,000 acres (not including Douglas-fir colonization into non-forest habitats. This amounts to between 1,300 and 2,000 acres per year. The watersheds provide a good opportunity to contribute to the Forest objective for reducing mid-successional stands of Douglas-fir.

Lodgepole Pine Habitats

As mentioned previously, 42 fire starts have been suppressed within the BWL landscape since the 1950s (Table 12). This management action has contributed to the continuity of mid-successional cool habitats dominated by lodgepole pine across these watersheds. Restoring fire in the landscape would allow for fire starts to be utilized within the assessment area to reduce the continuity of cool habitats dominated by lodgepole pine. Further assessment of stand composition and configuration of this at a scale finer than Forest Inventory and Analysis (FIA) would support strategic planning for management of fire starts for resource benefits (i.e. to facilitate landscape heterogeneity).

Dry, Lower Subalpine Habitats

Fire suppression activities have contributed to the continuity of mid successional dry, lower subalpine habitats across these watersheds. Restoring fire in the landscape through a strategic fuels treatment plan would allow for fire starts to be utilized within the assessment area to reduce the continuity of dry, lower subalpine habitats. Further

assessment of stand composition and configuration of this at a scale finer than Forest Inventory and Analysis (FIA) would support strategic planning for management of fire starts for resource benefits (i.e. to facilitate landscape heterogeneity).

Cold Moist Upper Subalpine and Timberline Habitats

No departure or gap between current conditions and reference or desired conditions was identified.

Sensitive Plants

Populations of sensitive plants in this watershed occur in locations at risk: roadsides threatened by noxious weeds and road maintenance, mature sagebrush steppe communities threatened by community change associated with Douglas-fir succession and associated uncharacteristically sever fire, and associated with mature curlleaf mountain mahogany stands threatened by uncharacteristic fire and competition with cheatgrass. Protecting these populations should direct future road maintenance, noxious weed treatment, and project work.

Insects and Disease

Drought across the Rocky Mountain west and aging timber stands on the Forest is major contributors to insect outbreaks (USDA, 2005a). A majority of forest types on the BDNF have advanced into mid or late seral conditions and associated size classes which are vulnerable to insects (USDA, 2005b). Size class was not quantitatively described for this assessment because the data sources, TSMRS, SILC and NAIP, all painted a different picture. But the level of infestation confirms that 11% of the assessment area has been affected by insects since 1999. Fuel buildup from insect activity has implications to fire protection and safe public use of facilities. But it adds to large woody debris accumulations in streams, improving fish habitat, and is capitalized on by wood boring insects, birds, and small mammals.

Noxious Weeds

Noxious weed spread potential increases with increased traffic on roads and trails, and increased user created trails. New infestations are being found primarily along routes of soil disturbance such as roads, trails, and other recreation sites.

Vegetation treatment or ground disturbance along major travel routes which support noxious weeds could increase the risk of spread into disturbed natural vegetation.

The watersheds offer an opportunity to meet Forest objectives for preventing, reducing and eliminating infestations of noxious weeds by identifying those routes with a high likelihood of establishment and spread.

5. Recommendations

Recommendations: Aspen

Maintain aspen stands by removing existing conifers, treating coniferous vegetation around existing stands, allowing fire to enter stands, and eliminating or reducing wild and native ungulate grazing pressure until sprouts are identified as stable. Approximately 430 acres of mapped aspen stands show a high degree of change and risk of type conversion (Table 11 and Map 7). Walk through exams indicated sizeable acreage beyond mapped stands where remnant aspen was observed within conifer stands and aspen stands may be restored.

Priority should be given to large stands along Birch Creek and Willow Creek and treatment to stands within drainages should be planned and executed with care to avoid further damage to these stands and/or result in attracting browsing to these locations. Treatments should be implemented where the effects of livestock and/or wild ungulate browsing can be eliminated or reduced to allow for stand recovery.

Recommendation: Mountain Mahogany
Eliminate Douglas-fir in mountain mahogany stands and treat Douglas-fir adjacent to mahogany dominated areas to reduce potential wild fire effects in these stands. A high degree of adverse change was mapped for 1,000 acres of mahogany. See Map 8. Because Rocky Mountain juniper is considered highly flammable, reduce the proportion of Rocky Mountain juniper within curlleaf mountain mahogany stands to further protect stands when fire events occur.

Target large areas dominated by curlleaf mountain mahogany on the south facing slopes above Willow Creek as a first priority. These stands are large in comparison to others within the assessment area, Douglas-fir surrounding these stands is dense and beginning to overtop mahogany, and fire spread from surrounding upland vegetation will likely lead to habitat conversion when fire enters this portion of the landscape. Curlleaf mountain mahogany stands in lower Birch Creek are similarly threatened and the higher road densities and associated potential for human caused fire starts result in high potential for habitat conversion in these locations.

Recommendations: Big Sagebrush Steppe
Restore the mosaic of big sagebrush and grassland communities and reduce the threat of community type conversion associated with conifer succession into sagebrush steppe vegetation through natural fire, prescribed fire, and/or conifer removal. Approximately 3,600 acres of this type show a high degree of change and a risk of conversion to conifer cover type. See Map 6 and Map 17.

The preferred method of treatment is natural fire (management of natural ignitions), with prescribed fire as a secondary treatment option. Consider the natural role of fire when treatments are designed. Incorporate both the spatial and temporal components of natural fire in order to address ecological concerns and be cost effective.

Treatments adjacent to major travel routes are not recommended, as these locations typically support noxious weeds that have a high risk of spread into disturbed natural vegetation (Sheley, et.al. 2002). Restore fire into upland vegetation but at locations at least ½ mile from travel routes (i.e. major & secondary roads, OHV trails, and hiking trails) to avoid deleterious effects of noxious weeds.

Recommendations: Douglas-fir
Develop a strategic fuels treatment plan that will allow for fire starts to be utilized within the assessment area to reduce the extent and continuity of Douglas-fir, especially mid-successional Douglas-fir habitat types.

Recommendations: Lodgepole Pine
Develop a strategic fuels treatment plan that will allow for fire starts to be utilized within the BWL assessment area to reduce the continuity of cool habitats dominated by lodgepole pine. It is also recommended that stand composition and configuration of this

habitat be systematically quantified within this landscape at a scale finer than Forest Inventory and Analysis (FIA) in order to strategically plan for management of fire starts for resource benefits (i.e. to facilitate landscape heterogeneity).

Recommendations: Lower Subalpine Fir Habitats
Develop a strategic fuels treatment plan that will allow for fire starts to be utilized within the BWL assessment area to reduce the continuity of dry, lower subalpine habitats. It is also recommended that stand composition and configuration of this habitat be systematically quantified within this landscape at a scale finer than Forest Inventory and Analysis (FIA) in order to strategically plan for management of fire starts for resource benefits (i.e. to facilitate landscape heterogeneity).

Recommendation: Cold Moist Upper Subalpine and Timberline Habitats
Allow fire to burn and insect activity to persist within cold, moist upper subalpine and timberline habitats when ignitions are natural.

Recommendation: Sensitive Plants
Since sensitive plants are rare elements within the assessment area; care should be a taken to avoid impacts to these populations when planning future road maintenance, noxious weed treatment, and project work, especially in the following locations.

Table 12a. Sensitive plant locations in the Birch, Willow Lost Creeks assessment area (Beaverhead-Deerlodge NF sensitive plant GIS).

Species	Habitat	Location
Arabis fecunda	open rocky slopes of calcareous parent material mountain that support mahogany stand	slopes of Farlin Gulch off Birch Creek Rd
Lesquerella pulchella	gravelly, calcareous foothill soil in mountain mahogany & sub to alpine fellfield slopes in sparse limber pine	bottom of Farlin Gulch off Birch Creek Rd
Penstemon lemhiensis	open sagebrush & woodland slopes in foothill & lower montane zones	Sugarloaf Mountain, Birch Creek Rd road cuts (near Aspen Picnic area, upslope from spring near Forest boundary) and Thief Creek Rd road cuts (unmapped), Armstrong Gulch

Recommendations: Noxious Weeds
Continue existing management of noxious weeds in these watersheds including cooperative agreements and help from other agencies, organizations, and individuals.

Examine new treatments available, including bio control and apply where possible.

D. FIRE AND FUELS

1. Characterization

This resource section discusses two aspects of fire:

FIRE ECOLOGY: fire as a natural part of the ecosystem (fire regimes, fuel models, fire return interval, vegetation conditions like colonization), and

FIRE PROTECTION: fire as a threat to public safety, facilities, and structures (activity fuels, natural barriers, ingress and egress routes, utilities, residences)

The presence and absence of fire plays a key role in the composition and structure of the vegetation that occurs across the landscape. Fire has been an integral part of all four of the Hydrological Unit Codes (HUCs) within the watershed assessment area. The exclusion of fire from these ecosystems has resulted in a different range of vegetation conditions than occurred prior to European settlement. Although other agents of change such as insects, disease, mining and timber harvest have affected vegetation in the past, fire appears to be the most influential.

The discussion in the Vegetation resource section provides information regarding the different plant communities or habitat types that are present in each of the HUCs. These habitat types are associated with the fire groups described in "Fire Ecology of Montana Forest Habitat Types East of the Continental Divide" (Fischer and Clayton, 1983), also discussed in the Vegetation section. Fire frequency determines vegetation successional stage and fuel conditions and past fire shape and size play a role in fuel connectivity and landscape heterogeneity (Arno et al. 2000). As conditions of vegetation and fuel within a fire group change, those are measured using other classifications like fuel model or condition class, discussed under “CURRENT CONDITION”.

A fire group is comprised of several different habitat types and is based on response of tree species to fire and the roles tree species take during successional stages. Both frequency and severity of fires that typically occurred identify each fire group. Habitat types in the analysis area can be grouped into five fire groups, see Table 13.

Table 13 - Fire Group acres for each HUC

Acres Per Hydrological Unit (NF Lands)					
Fire Group	Birch	Lower Willow	Upper Willow	Lost	Total
Zero	2,694	45	3,402	78	6,220
Five	12,333	7,114	4,814	4,886	29,148
Seven	5,617	0	11602	355	17,573
Eight	542	0	280	0	822
Ten	3,242	0	2,032	1	5,274
Total	24,428	7,160	22,130	5,320	59,038

The relative percent of acres of each fire group in the different HUCs are located in the subsequent table. Fire group zero is a collection of miscellaneous and special habitat types that occur at lower, middle and upper elevations, such as rocky areas, wet meadows, aspen groves and willow. Fire group five includes Douglas-fir, sagebrush, grass and mountain mahogany, Fire group seven is dominated by lodgepole, Group eight is mixed conifer and subalpine fir, and group ten is high elevation white bark pine. The fire group designations also closely represent the fuel models as they actually exist on the ground and as seen during walk through examinations conducted in the fall of 2007.

Table 14 - Percentage of Fire Group acres for each HUC

Relative Acreages (%) Per Ecological Landscape Unit (NF Lands)				
Fire Group	Birch	Lower Willow	Upper Willow	Lost
Zero	11	1	15	1
Five	50	99	22	92
Seven	23	0	52	7
Eight	2	0	1	0
Ten	13	0	9	0

Land Management Direction Relevant to Fire, Fuels and Fire Protection

2008 Revised Forest Plan
Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Natural disturbance processes are recognized and accepted as essential to the health of ecological communities at various spatial scales. Fire is allowed to play its natural role where appropriate and desired. Life, investments and valuable resources are protected using the full range of appropriate management responses to fire.

Goal – Safety: Fire fighter and public safety is always recognized as the first priority for fire suppression.

Goal – Appropriate Management Response: The full range of appropriate management responses to wildland fire is available to meet social needs and to achieve ecosystem sustainability.

Goal - Fuels Management: A full range of fuels management activities is available to achieve ecosystem sustainability, including economic, and social components.

Goal – Wildlife Hazard Reduction: Effects of unplanned and unwanted wildfire are reduced by moving areas of condition class 2 and 3 to a condition class 1 for all regimes and by maintaining areas in condition class 1.

Objective – Reduce the risk from wildfire to communities and resources in this priority: areas with a community wildfire protection plan, high risk areas adjacent to communities, areas in condition class 2 and 3 in fire regimes 4 and 5, areas to be maintained in condition class 1.

2. Current Condition

Method of Assessment

Current conditions were described using field survey and fuel modeling. A field survey of all 45 drainages within the watershed area was completed in the summer and fall of 2007. Both fire and fuel related information was gathered during the on the ground assessment using the criteria itemized in the example Inventory Analysis Form below.

Example 1 – Fire and Fuel Watershed Assessment Inventory Analysis Form

Drainage: _____
Name: _____
Direction facing up drainage: N NE E SE S SW W NW

Left Side: Right Side:

Aspect: N NE E SE S SW W NW Aspect: N NE E SE S SW W NW

Fuel Model:	Fuel Model:
Colonization: Yes NO	Colonization: Yes NO
Activity Fuels: Yes NO	Activity Fuels: Yes NO
Ingress/egress Route: Yes NO	Ingress/egress Route: Yes NO
Utilities: Yes NO	Utilities: Yes NO
Residences: Yes No	Residences: Yes No
Fire Return Interval: Recent Not Recent	Fire Return Interval: Recent Not Recent
Natural Barriers: Yes No	Natural Barriers: Yes No

Notes:

0-5 inch class present Y N

MTN. Mahogany Y N

Aspen Y N sizes

Several specific issues were identified during the walk through exams. These are highlighted in the remaining discussions. Topics related to fire ecology are: change in fuel models and subsequent fire behavior and colonization of conifer into surrounding stands. Topics related to fire protection are the condition of natural barriers, activity fuels, ingress and egress, utilities and residences.

Fire Regimes

Fire regimes define how fire burned historically in different vegetation types. Fire regimes are differentiated by the frequency, extent, severity, and timing of fire events associated with vegetation. The recorded history of wild fires on the forest is documented in a GIS database. This data base shows large fires in the general vicinity in 1879, 1889, and 1900. Approximately 42 wild fires occurred since then that were suppressed and therefore very small in nature. Walk through exams confirm a lack of evidence large fires burned in the areas within the last 120 years. See Map11.

Fire regimes were mapped for the BWL watersheds using the "Reference Condition Characteristics for Forested Biophysical Settings, Western US", http://www.frcc.gov/. Fire regimes were defined by vegetation type as follows:

Table 17. Fire Regime Classification as a Reflection of Vegetation Type

BWL Watersheds Vegetation Types	Fire Regime
Dry Meadow	1
Sagebrush Steppe	1
Douglas-fir	1
Wet Meadow	2
Aspen	3
Mahogany	3
Willow	3
Whitebark Pine	3
Lodgepole Pine	4
Subalpine Pine	4

Source for veg layer: (Pioneer LA GIS layer derived from TSMRS)

Fire regime condition class defines the degree of departure from the historic fire return interval and is used to indicate where there is a high risk of wildfire. The higher condition classes 2 and 3 represent vegetation conditions with larger fuel loads than typical. Higher condition classes are more conducive to higher intensity fires which in turn hamper suppression efforts. The risk of a wildfire igniting would be the same regardless of the condition class.

Stands in condition class 1 reflect historic fire return intervals. For the purpose of this exercise, any stand in the watershed that has experienced disturbance within its respective fire regime is mapped as Condition Class 1 or 2, whether that is timber harvest, prescribed burning or wildfire. Condition Class 3 is mapped where stands have not experienced some kind of disturbance within their respective fire regime. For example, a lodgepole stand with a fire regime of 35-200 years that was clearcut 35 years ago or that experienced a wildfire 10 years ago would be in condition class 1. See Table 17. If it has been 250 years since a wildfire modified the stand, it would be in condition

class 3. Condition class 3 represents a high degree of departure from historic fire return interval. See Map 10.

The National Fire Plan and 2008 Revised Forest Plan both set objectives for reducing acres in Fire Regimes Condition Classes 2 and 3. Treating these areas in Fire Regimes 1, 2, and 3 adjacent to communities is prioritized higher than Fire Regimes 4 and 5.

Table 15 – Types of Disturbance Which Affect Fire Regime Condition Class (% Acres disturbed by fire regime)

Historic Fire Regime	Total acres	Acres of Wildfire	Acres of Prescribed Fire	Acres of Harvest	Acres disturbed	% Disturbed *
I (0-35 years, low/mixed severity)	28539	2737	1544	349	4630	16
II (0-35 years, stand replacement)	393	65	1	2	68	17
III (35-200 years, low/mixed severity)	5814	1313	5	41	1359	23
IV (35-200 years, stand replacement)	18487	5807	348	1915	8070	44
No Vegetation (Rock/Water)	5804	451	3	2	456	8
Totals	59038	10,373	1901	2309	14583	25

Source of Disturbance Acres: FACTS database

Fire Behavior

Fire behavior can be predicted using a fuel model: a simulated fuel complex for which all the fuel descriptors required for the solution of the mathematical fire spread model have been specified (Gaylor, 1974). The fuel model is determined by the stratum of the surface fuels most likely to carry the spreading fire; i.e., grass, needle litter, leaves, logging slash etc. Fuel models are broken up into four categories, grass (Models 1-3), Shrub (Models 4-7), Timber Litter (Models 8-10), or logging slash (Models 11-13) (NWCG Fireline Handbook, 1998). The current condition in the study area exhibits presence of fuel models 1, 2, 8, and 10. See Map 10.

Fuel Model 1: (1 foot deep) Fire spread is governed by the fine herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Fuel Model 2: (1 foot deep) Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where herbaceous material, besides litter, and dead-down stem wood from the open shrub or timber overstory, contribute to the fire intensity. Open shrub lands and pine stands or scrub oak stands that cover 1/3 to 2/3 of the area may generally fit this model but may produce firebrands. Some juniper as well as mixed grass and sagebrush may be in this model.

Fuel Model 8: (0.2 foot deep) Slow burning ground fires with low flame heights are generally the case, although an occasional “jackpot” or heavy fuel concentration may cause a flare up. Only under severe weather conditions do these fuels pose fire problems. Closed canopy stands of short needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present in the stand. Representative conifer types are white pine, lodgepole pine, spruce, true firs, and larches.

Fuel Model 10: (1 foot deep) Fires burn in the surface and ground fuels with greater fire intensity than other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger limb wood resulting from over-maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation leading to potential fire control difficulties. Any forest type may be considered when heavy down materials are present; examples are insect or diseased stands, wind-thrown stands, over mature situations with deadfall, and cured light thinning or partial-cut slash.

Table 16 - Fuel Model acres for each HUC

Acres Per Hydrological Unit (NF Lands)					
Fuel Model	Birch	Lower Willow	Upper Willow	Lost	Total
1	185	17	191	0	393
2	3800	3710	1163	2241	10914
8	6174	41	3516	201	9931
9	171	1	55	0	228
10	11681	3364	13922	2801	31768
98	119	0	100	0	220
99	2297	27	3183	78	5585
Total	24428	7160	22131	5320	59038

Table 17 - Percentage of Fuel Model acres for each HUC

Relative Acreages Per Ecological Landscape Unit (NF Lands)					
Fuel Model	Birch	Lower Willow	Upper Willow	Lost	Total (%)
1	1	0	1	0	1
2	16	52	5	42	18
8	25	1	16	4	17
9	1	0	0	0	0
10	48	47	63	53	54
98	0	0	0	0	0
99	9	0	14	1	9

See Map 11.

Colonization

Colonization for the purpose of this assessment refers to succession of Douglas-fir and Rocky Mountain juniper into grasslands and shrublands. The absence of fire has resulted in a marked reduction in the availability and palatability of forage, thus reducing the capability of these lands to support big game species and live stock (Gruell 1983). Invasion of conifers upon grasslands is noticeable across all the grassland area found within the watershed assessment area. Presence of colonization was recorded in 58 sub-drainages within the assessment area. In the absence of fire after the mid- 1800's, sagebrush invaded grasslands and eventually these shrubs provided shaded microsites for establishment of Douglas-fir seedlings. Sagebrush remnants at the base of trees attest to a sagebrush/grass community in the past (Gruell, Brown and Bushey, 1986) By lighting some fires and putting others out, humans have increasingly influenced the way dry montane forests burn and look. Due to the proximity of these forests to human habitation and the relative ease with which low-intensity fires can be controlled, we have directly shaped the fire regime of this forest type to a greater extent than that of any other in the region. Indians, for example, substantially increased the fire frequency in dry montane forests of western Montana by setting fires in heavily used valleys (Barrett 1980, Barrett and Arno 1982). More recently, however, human influence has had the opposite effect (Rollins et al. 2000). Successful fire exclusion efforts of the past century have allowed many of the region's low-elevation dry forests to grow thick with regenerating trees, increasing the likelihood that a given fire will carry through the treetops and leave a slew of dead trees in its wake (Agee, J. K. 1990).

Natural Barriers

Natural barriers, for the sake of this assessment, will be considered any area that naturally slows or alters the spread of a wildfire including but not limited to rocks, wet meadows, riparian areas, lakes and barren ground. These areas provide a barrier of some kind to the spread of fire. This being said, it doesn't mean that any of these features will suppress a fire or cause a substantial change to fire behavior. Fire protection strategies can take advantage of natural barriers, connecting these areas by removing fuel on the forest floor, clearing low branches, or creating shaded fuel breaks on north slopes.

The BDNF currently uses "Appropriate Management Response" as the primary fire suppression strategy. Appropriate Management Response (AMR) is an opportunity to manage wild fires as they occur and utilize natural features and fuels treatment areas. AMR is also a tool that can reduce costs, increase public and fire fighter safety and offer managers multiple management opportunities. Fire group zero is a collection of miscellaneous and special habitat types that occur all elevations (like rocky areas, wet meadows, aspen groves and willow). This fire group comprises 6,220 acres or 28% of the entire watershed assessment area. The arrangement of fire group zero offers many locations to utilize these natural features to identify management areas for future AMR events.

During the fall 2007 walk-through exams in the area, rock outcrops, boulder patches, riparian areas, and other naturally occurring potential fuel breaks were noted. Currently, the areas that would lend themselves to acting as natural barriers have a denser

understory of conifers than they would have historically. While these rockslides and boulder patches provide microsites for conifer to survive frequent fire events due to the lack of vegetation which would carry a fire, these areas are now more heavily inhabited by young conifers, understory, and down dead woody debris than they were historically. This condition is primarily due to fire exclusion.

Activity Fuels

Activity fuels are currently present in six drainages within the BWL watersheds. Most of the activity fuel within the watersheds was produced by logging operations which occurred in the mid 1980's through the mid 1990's. Currently activity fuels are being produced in the area from wood cutting activities as a response to large amounts of timber being killed by mountain pine beetle which offers easy access to large quantities of fire wood. The primary locations of the activity fuels are found in the following drainages: Birch, Bridge, Willow, North, Farlin and the drainage northwest of Farlin for a total of 465 acres. See Map 12.

Ingress and Egress Routes

In case of a watershed scale wildfire emergency, routes in 28 drainages of the watershed area would have to be patrolled for presence of forest visitors or residents. Roads vary in condition from maintenance level two to ATV trails. Daily visitor use is hard to gauge in the BWL watersheds as few designated trail head areas exist requiring forest visitors to park in a specific location and begin their recreational experience. Due to the vastness of the watersheds and the number of points allowing access to this area, locating and informing forest visitors would be a lengthy involved process in the event of a watershed level wildfire. See Map 13.

Utilities

Utilities are present in 7 drainages, providing power to homes or structures in 7 different locations. Utility lines primarily run up the drainage bottoms. In some instances, these utility lines provide power for wells, a backup source of water for fire fighting.

Residences

Five drainages in the watershed have residences. This includes the Bender Center, an educational facility, and one recreational residence through special use permit. Numerous mining claims lie within its boundaries. Many of the claims with structures on site vary in condition and some are historic. The table below lists man-made improvements to consider in the event of a wildland fire.

Table 19: Residences/Structures

Type of Structure	Count
Building	46
USGS Gaging Station	1
Bender Center (Multiple buildings)	1
Campground	2
FS Facility (Recreation Cabin)	1
Mine	20

See Map 14. Structures and Residences.

3. Reference Condition

Fire Regimes

Prior to the fire suppression policy of the mid-1900's, Douglas fir habitat types were open and patchy as periodic ground fires restricted development of Douglas fir forests (Loope and Gruell 1986). Arno and Gruell (1983) stated that with fire suppression, Douglas fir has invaded grass and sagebrush habitats downslope from more rocky areas. Arno and Gruell (1983) found that prior to 1910, mean fire return intervals in the Douglas fir/grassland ecotone of southwestern Montana ranged from 35-40 years, but that no fires had been recorded in their study areas the previous 61 years. Arno and Gruell (1986) recorded a mean fire interval of 26 years in the galena Gulch area outside of Boulder, Montana for the period 1690-1979, but only 1 fire occurred in the 94 years prior to their study. The longest fire intervals prior to 1890 were 72-82 years. Arno (1976) found fire frequencies ranging from 6-19 years in Douglas fir/grassland habitat types on the Bitterroot National Forest of Montana. However, Arno (1976) stated that there has been a marked decrease in fire since 1920, and that in many areas the time elapsed since the fire now exceeds the longest fire free interval from 1735-1900.

Fire Behavior

Prior to the 1860's, lightning caused fires burned freely, and the American Indian used fire extensively. Historically, low elevation fires in drier areas, such as those characterized by Fire Groups Zero and Five occurred more frequently, resulting in low intensity fires that cleared lower ground fuels without affecting the overstory. Fischer and Bradley (1987) estimate mean fire-free intervals (MFI) for Fire Group Five to range between 5 and 45 years. Fire Group Seven which becomes more prevalent at the middle elevations is estimated to have a MFI that ranges from 40 to 100 years. A mix of understory burns and stand replacement fire occurred in this Fire Group. Fire Groups Eight and Ten are generally found at the higher elevations and experienced understory and stand replacement fires at intervals of 100-300 years. Severe fires usually occurred during periods of drought. Fires in these groups left a mosaic a different age classes across the landscape.

The effect of the historical fires burning freely across the landscape would have been periodic thinning of mature timber stands, elimination of encroaching conifers into sagebrush grassland parks and reduction of down dead woody debris in the forested understory. Historically, habitat types would determine the fire behavior, not an uncharacteristically high accumulation of fuel and debris. The reference condition would have been one of low severity frequently occurring wildfire events that would promote vigorous healthy open stands where fire would act as a maintenance treatment rather than a stand replacing event.

Colonization

Prior to the late 1800's, these watersheds likely had much more open grassland expanses with little to no sagebrush or conifer invasion. An example is Antelope Basin in Southwest Montana where photographs from the 1800's show grasslands in contrast to

today's shrubland. Osborn Russell, an early but educated fur trapper saw no sagebrush in the 1840's in southwest Montana, only bunch grass, but did record sagebrush as he neared the Snake River in Idaho. The ability of domestic herbivores to irreversibly change grasslands to shrublands is well known (van de Koppel et al. 2002). In a study conducted by Heyerdahl, Miller and Parson on Fleecer Mountain in southwestern Montana in 2006, reference conditions were described as follows. *"In the past, a mosaic of sagebrush-grasslands with stable islands of Douglas-fir savanna probably dominated the study area much of the time, whereas today it is dominated by Douglas-fir forest. In 1855 less than half the study area sustained trees whereas all but six plots have trees today and average tree density at plots has increased from 45 trees/ha in 1855 to 166 trees/ha today*". These and other studies addressing conifer colonization describe today's stands as having far more trees than the reference condition in the mid 1800's had.

Natural Barriers

Historically, low elevation fires in drier areas, such as those characterized by fire groups zero and five occurred more frequently, resulting in low intensity fires that cleared lower ground fuels without affecting the overstory. These fire groups would act as barriers for less frequent, higher intensity fires.

Concerns about fire protection have developed with increased human use of the landscape. A goal of the 2008 Forest Plan is to use a full range of fuels management activities to achieve ecosystem sustainability including economic and social components. Enhancing natural barriers could be one of those fuel management activities.

Activity Fuels

Activity fuels are related by definition to human activity. Prior to settlement of the area in the 1860s, activity fuels were non-existent. Between the late 1800's and mid-1900s there were still limited amounts of activity fuels. Timber harvest was prevalent throughout the watershed, to assist in various activities relating to the mining industry which was very predominant in the vicinity. Logging activity fuels where primarily used to fuel smelters within the mining camps found scattered throughout the area, while all easily accessible fuel was probably used for heating, and cooking in the many homes and structures associated with the settlements of the mid 1800's to early 1900's.

The related Forest Goal (2008 Revised Forest Plan) is to use a full range of fuels management activities to achieve ecosystem sustainability including economic and social components.

Ingress and Egress Routes

Prior to Anglo colonization and settlers moving into the BWL watersheds, there were not established roads and perhaps only game or hunting trails. There are old road beds which are no longer in use and many roads that are in pictures from the 1930's which are still in use. From conducting walk-through exams in the study area, it appears that many of the roads from the turn of the century up to the 1930's where probably used to access a natural resource, either timber or mineral based. Many of the roads used during the mining era have gradually faded away.

Concerns about fire protection and evacuation of visitors and residents have developed with increased human use of the landscape. A goal of the 2008 Forest Plan is to recognize fire fighter and public safety as the first priority for fire suppression.

Utilities

Prior to Anglo colonization and settlers moving into the BWL watersheds, there were no facilities, homes and obviously, no utility lines. According to the District's archeologist, there were utilities in the lower end of Birch Creek servicing the early settlements of Farlin and the Birch Creek CCC Camp/ These utilities where established in approximately the mid 1930's (Mark Sant, personal communication, December, 2007). Remnants of a phone line were found within the Armstrong Gulch drainage which once provided service to Tower Mountain Lookout (Jim Christensen, retired range conservationist Dillon Ranger District, personal communication, January, 2008).

With the increased development of the landscape there is increased concern for the protection of residents and residences from wildfire. A goal of the 2008 Forest Plan is to recognize fire fighter and public safety as the first priority for fire suppression.

Residences

Prior to Anglo colonization and settlers moving into the watersheds, there were no facilities or homes. The Birch Creek area has historical remnants and evidence of far more residences and structures than today. For example, the location where the mining settlement of Farlin once stood, at one point had 300 residents and the Birch Creek CCC camp housed over 200 residents. Today, there are a hand full of residents in the Birch creek drainage and only one or two of those people are there full time.

With the increased development of the landscape there is increased concern for the protection of residents and residences from wildfire. A goal of the 2008 Forest Plan is to recognize fire fighter and public safety as the first priority for fire suppression

4. Synthesis and Interpretation

Fire Regimes and Fire Behavior

Fire frequency (measured using MFI) has been measureable altered in the watersheds since the end of use of fire by the American Indian, more intense grazing which decreased light ground fuels that carried fires, and effective fire suppression programs. The changes in the composition and structure of plant communities described in the Vegetation Resource section are primarily a result of the events that have excluded fire. The change in vegetation includes denser stands of timber, multistory stands and more areas becoming forested. The effect of this change to a wildland fire is a gradual buildup of available fuel and increased ladder fuels in many stands. The increase in fuel has resulted in a change in the intensity and burn patterns of wildfires.

Fire Regime Condition Class 3, with a high degree of departure from historic frequency and severity, dominates the lower and mid elevation fire regimes, 1, 2, and 3. In the lower elevations of the analysis area where park like stands of Douglas-fir existed (Fire Group Five), a shade tolerant understory has developed. With this increase in the amount of vegetation, dead debris and ladder fuels, a fire start will more likely result in a stand replacement fire rather than the historically occurring underburn.

The lack of fire in the middle and upper elevations (Fire Groups Seven, Eight, and Ten) has resulted in a change from a mosaic of different age classes and tree densities to a more continuous cover of mature trees. A fire start under the current conditions would more likely result in a stand replacement fire rather than a mosaic in the burn area.

The type of fire occurring in Fire Group Zero has also changed. The fuel in these areas have changed from what was mostly riparian bottoms and grass to a mix of grass, seedlings, saplings and intermediate size conifers. As the riparian grasslands become more heavily colonized with conifers, deciduous trees with little shade tolerance are dying out and fires that occur are burning more intensely.

Current fuel models show a gap from reference conditions. The specific differences evident are: increases in down dead woody debris, increases in understory colonization in mature timbered stands and advancement of conifers into sagebrush grassland parks and riparian communities. These changes have altered fuel models 1 and 2 to display fire behavior most consistent with a fuel model 8 while fuel model 8 locations are displaying fire behavior more consistent with that of a fuel model 10. Riparian communities are also showing a change from what would have historically been described as burning similar to a fuel model 2 to burning more consistent with brush fuel model behavior similar to models 5 or 6 depending upon the amount of down dead woody debris and conifer colonization. Overall, departure from historic conditions in aspen, sage, mahogany and mature conifer stands appears to be the primary difference between the current and reference condition.

The 2008 Revised Forest Plan articulates the desire to achieve ecosystem sustainability including economic and social components using a full range of fuels management activities. “Effects of unplanned and unwanted wildfire are reduced by moving areas of condition class 2 and 3 to a condition class 1 for all fire regimes and by maintaining areas in condition class 1.” The BWL watersheds offer opportunities to meet Forest Plan Objectives for reducing acres in condition class 2 and 3.

Colonization

Conifers have invaded into areas once described as open sagebrush-grasslands. Areas once consisting primarily of aspen and mahogany are now heavily invaded with conifers also. See Map 6. These areas would have historically burned frequently from low severity naturally caused wildfires and occasional burning conducted by Native Americans. Fire frequency in areas with heavy conifer colonization has decreased, making the fire exclusion the primary element causing departure from reference condition.

The Revised Forest Plan sets an objective to reduce conifer colonization on 74,000 acres or riparian areas, shrublands, and grasslands forestwide over the life of the Plan. This amounts to between 4,900 and 7,400 acres per year. The BWL watersheds provide a good opportunity to contribute to the Forest objective for grasslands and shrublands.

N*atural Barriers*

A greater amount of conifers, vegetation and down dead woody debris are found in areas where low intensity fires historically cleared lower ground fuels without affecting the overstory. These fire groups (zero and five) would act as barriers for less frequent,

higher intensity fires. Now, insect infestations are contributing to fuel buildup in these areas, see Map 5. The presence of this fuel source allows for fire to ignite within natural barriers and burn readily with a high level of severity rather than with a low severity or pruning fire that maintains the vegetative condition and reduces ground litter and debris. These areas which once slowed and or altered the spread and size of fires now act as additional fuels sources and may even provide areas for spotting to occur and isolated areas of extreme ground heating and stand replacement.

We should expect large scale fires will continue to occur. Stand replacement fires will continue to occur in the landscape until fuel is burned up. However, treatments like shaded fuel breaks can provide an opportunity for fire personnel to take more effective suppression action. Fuel breaks allow fire suppression action to take place well in advance of the fire, some distance from critical structures, to protect some areas like corridors and area access routes.

Activity Fuels

Today's level of activity fuel is not that much different than historically except in areas where firewood cutters are harvesting large amounts of bug killed lodgepole. This is causing activity fuel build ups in various locations. Management of fuel buildup is encouraged by the Forest Plan.

Ingress and Egress Routes

While the number or routes may not have changed a lot over time, use of roads and trails in the watersheds has been steadily increasing. Today their use is primarily for recreation purposes and not to access a product. At any point in the summer, campers, ATV riders, horse riders, hikers, and firewood cutters can be scattered widely across the watersheds. If the desired condition is to provide fire fighter and public safety as the first priority for fire suppression, the challenge when a wild fire breaks out is to find and evacuate these visitors. This is difficult to do at present without an evacuation plan and improved signing of roads and trails. A goal of the 2008 Forest Plan is to recognize fire fighter and public safety as the first priority for fire suppression.

Utilities

We currently have more utilities within the assessment area than we had historically. The primary increase in utilities is seen in service line to private residences within the area that were not there in the past. Fuel is building up around power lines as a result of increased age of stands and growing insect and disease infestations. A goal of the 2008 Forest Plan is to recognize fire fighter and public safety as the first priority for fire suppression. Management of fuel buildup is encouraged by the Forest Plan.

Residences

There are actually far fewer structures today in the area than there were 100 years ago during the heydey of mining. Recreational activity in an near the residences and facilities is high in summer when fires are most likely. A goal of the 2008 Forest Plan is to recognize fire fighter and public safety as the first priority for fire suppression. Increased fuel loading from absence of fire and increased insect activity makes these areas difficult to protect, particularly if conditions around the buildings is unknown.

5. Recommendations

Fire Regimes and Fire Behavior

Reintroduce prescribed and/or wildland fire to the ecosystem, particularly in Fire Regime Condition Class 3. Areas most likely benefited by the reintroduction of fire are identified in Map 6, 9 and 17. Further assessment should identify where fire, in conjunction with thinning or slashing conifer colonization can be most beneficial. Maximize the opportunity to manage natural occurring ignitions for resource benefits by actively managing areas with prescribed treatment as fuel breaks. The overall outcome of management should be to maintain/restore areas to their reference condition fuel model or condition class while providing management opportunities in any fire event, be it management or naturally ignited.

Treat those aspen, sage, mahogany and mature conifer stands with the greatest potential opportunity for restoration to their reference condition. These are identified in Maps 6, 7, 8, and 9. Map 16 expands the potential for aspen restoration to conifer stands with remnants of aspen trees indicating the presence of a clonal root structure. Treatment opportunities would include areas of thinning, both commercial and sub-merchantable material as well as prescribed burning. Concentrate proposals where the greatest number of stands requiring treatment are clustered. Restore these areas to their historic fuel model and fire behavior condition. Consider critical forest plan elements when prioritizing area for treatment. Areas requiring further consideration for fuel model restoration activities based on 2007 walk-through exams include the area south of the Birch creek Road between Bridge Gulch and the Bender Center and the Willow Birch Creek divide.

Colonization

Thin conifer invasion in sagebrush grasslands, aspen and Mountain Mahogany stands. Determinations should be made from the information gathered in the walk-through assessment, to prioritize areas having the greatest potential to reduce large fire growth/fire behavior while benefiting other resource values. See Maps 6, 8, 16 and 17. Recommendations would also include prescribed burning in areas experiencing dense conifer stands in sagebrush-grasslands, aspen and mahogany stands. Where treatments are implemented, they should be at a large enough scale that no one treatment area becomes a target by ungulate grazers. When identifying areas targeted for treatment, locations holding a number of stands or drainages needing conifer reductions should be chosen and implemented within one to two field seasons, to reduce impacts by wildlife grazing. The south side of Birch creek between Bridge Gulch and the Bender center, and the divide between Willow Creek and Birch Creek has high populations of aspen and sagebrush-grasslands which are conducive to restoration treatments.

Natural Barriers

Strengthen the effect of potential barriers to assist in wildfire control and to protect adjacent stands that would be lost to higher intensity fires. See Map 18. Use these barriers to slow or reduce fire behavior. There are many areas within the Birch Creek area that are surrounded on three sides by natural barriers, these areas should be used as starting points to build from and increase the size and function of the barrier to be used as a fire management tool. Identify areas with relatively light fuel loading so

appropriate management response plans can manage naturally occurring ignitions. Design future fuels reduction projects around this management strategy.

Activity Fuels

Continue to reduce activity fuels by piling and burning the fuels created by wood cutters, see Map 12. The mountain pine beetle epidemic will run its course and people will continue to harvest firewood and produce activity fuels, which will require removal by piling and burning. The activity fuels which are still present from timber harvest activities are small enough in size and spread out enough that they have little impact on the and do not need any attention.

Ingress and Egress Routes

Reduce fuels along ingress and egress routes, appropriately sign routes and accurately identify through routes. As a result from this process we would like to develop an emergency evacuation plan which would give firefighters a quick reference depicting items such as where to look for folks and where they could drive fire apparatus.

Utilities

Reduce fuel accumulations adjacent to any utility which may cause harm to the utility in the event of a wildfire. Reducing fuels adjacent to utilities would improve chances that wells used to provide water to a home defense hose lay would have power during wildfire events. This may reduce the need to utilize water sources great distances from the structures and improve opportunities for home wildfire defense systems. Homes that would be easily considered defensible with utilities present would otherwise be considered not defensible if utilities are not adequate. Specific recommendations would be to remove all down dead woody debris and vegetation along utility corridors and potentially remove all down dead woody debris and vegetation immediately adjacent to utility lines. By removing this combustible material, fire fighters would have the option to implement suppression strategies that may provide wildfire suppression options prior to fuel removal. By removing combustible material under and adjacent to utilities, there is an increased probability that the utilities may not catch fire as readily as they would have prior to treatment.

Residences

Conduct a wildland fire structure assessment of each residence and structure within the watershed area and determine what treatment should be recommended. Remove areas of heavy fuel loading from the perimeter or private lands that could act as an ignition source to the private inholding in the event of a wildfire, see Map 19. Recommend actions to private land owners to improve their defensibility against wildland fire. Regardless of what action may be recommended to better fire proof structures or residences, the primary goal would be to identify potential suppression challenges and identify ways to overcome these challenges prior to a wildland fire event.

Summary

Some of the key considerations from the fire/fuels assessment include: Fire Regimes 1 & 2 are lacking the most disturbance which coincidently is where the most residences/structures are located, ingress/egress routes need to be maintained/enhanced, and residences/structures could benefit from some fuels reduction treatments in their proximity.

E. WILDLIFE

1. Characterization

Wildlife is a product of the land (MDFWP 1971), reflected in part, by the habitat available. Habitat is comprised of food, cover, water, and space. Food and cover are both characteristics reflected encompassed by vegetation. Habitat for wildlife is tied integrally to vegetation cover types, structural classes and condition.

The Coarse Filter Analysis assumes that by maintaining a set of ecological communities of sufficient size, composition, structure and distribution, viability for the majority of all species is maintained (USDA 2003). The purpose of a Coarse Filter Analysis is to provide findings that are a basis for the development of management recommendations to maintain or restore ecological communities of sufficient size, composition, structure, and distribution such that the viability for the majority of all species will be maintained (Hunter et al. 1988 in USDA 2003).

These are described in the vegetation and fire resource sections of this report. The wildlife habitat discussion will focus on habitats or vegetation types of concern in this watershed which surface through the coarse filter look at vegetation and habitats.

There are species, however, that because of rareness or elevated human value, warrant individual analysis. This is the “fine filter” approach. The section on wildlife species, using this fine filter approach, will include Threatened, Endangered, Sensitive and management indicator species.

Land Management Direction Relevant to Wildlife

The 1986 Beaverhead Forest Plan identifies the wildlife terrestrial and avian Management Indicator Species (MIS), listed in the table below, that are used to judge effects of land management activities on various habitats.

Table 20. 1986 Management Indicator Species

Species	1986 Status	2008 Status	1986 Representative Habitat	2008 Representative Habitat
Grizzly Bear	ESA Threatened	FS Sensitive – delisted 4/30/07	ESA Threatened Species	Not MIS
Peregrine Falcon	ESA Endangered	FS sensitive – delisted 8/25/99	ESA Endangered Species	Not MIS
Bald Eagle	ESA Endangered	FS Sensitive – delisted 8/08/07	ESA Endangered Species	Not MIS
Gray Wolf	ESA Endangered	FS Sensitive – delisted 3/28/08	ESA Endangered Species	Not MIS
Elk	Commonly hunted big	Commonly hunted big	Habitat generalist – big	Habitat generalist – big

	game	game	game species	game species
Sage Grouse	MIS Only	FS Sensitive	Sagebrush communities	Not MIS
Pine Marten	MIS Only	No special status	Old growth spruce-fir	Not MIS
Goshawk	MIS Only	No special status	Old growth Douglas-fir	Not MIS
Trumpeter Swan	MIS Only	FS Sensitive	Marshland communities	Not MIS

Management indicator species have historically been identified under the premise that population changes can reflect the effects of management activities.

The 2008 Revised Forest Plan Monitoring Plan identifies wolverine and mountain goat as indicators of disturbance in high elevation winter habitat, and elk as an indicator of fall and winter security at mid and lower elevations. Wildlife objectives in the revised plan pertinent to this assessment are security objectives, measured by open road and trail densities for summer and fall.

2008 Revised Forest Plan
Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Conditions for self-sustaining or viable populations of native and desired non-native plant and animal species are supported within the natural capability of the ecosystem.

Goal – Habitat: Cover and forage for animals is provided by a mosaic of species and age classes of native trees, shrubs, grasses and forbs.

Goal – Sensitive Species: Habitat management maintains viable populations of sensitive wildlife species (R1 Sensitive Species List).

Goal – Wildlife Security: Secure areas and connectivity for ungulates and large carnivores are provided, while recognizing the variety of recreational opportunities.

Goal – Wildlife Secure Areas : Manage density of open motorized roads and trails by landscape year-round, except fall rifle big game season, to achieve levels at or below the following (scale – Landscapes).

Pioneer = 1.5 miles/square mile desired density

Goal – Elk Security: Elk security is managed to provide quality elk habitat, provide a variety of recreational hunting opportunities, and provide support for Montana's fair chase emphasis. Manage open motorized road and trail density by MTFWP hunting units as of 2006 – on National Forest lands during the fall rifle big game season, to achieve levels at or below the following: (Scale – Hunting Unit)

HD 131 = 1.5 miles/square mile desired density

2. Current Condition

Wildlife Habitat

There are a myriad of vegetation types that occur in the East Pioneer mountains that range from subalpine "tundra" to sagebrush to sub irrigated alfalfa fields. Each vegetation type contributes various habitat requirements to different species. The vegetation and fire resource sections provide detailed discussion about the habitat groups in the watershed. The following discussions of wildlife habitat below focus on vegetation types which show the greatest change, or are rare or unique.

Quaking aspen –The amount and quality of aspen cover in the West has been declining for many years. The decline is disturbing because aspen is second only to riparian areas in terms of biodiversity (Wooley et al. 2008). Aspen across the Forest (and region wide) is considered a community at risk because it is declining in patch size and vigor. The State comprehensive plan (2005) has identified altered fire regimes in aspen galleries with resulting conifer colonization as a conservation concern. Aspen are of ecological importance to many species of wildlife such as elk, deer, moose, beaver, and blue grouse (Montana FWP 2005).

At the Forest scale, aspen is the single forest type considerably below the historic range of variation, so far below it is a serious concern for wildlife species dependent on aspen for good or cover (BDNF, Revised Forest Land and Resource Management Plan, FEIS, 2008). The Pioneer Landscape Analysis (1996) found that of the 1,600 acres of aspen mapped with aerial photos, mean stand size was 6.5 acre. Of 837 acres inventoried for that analysis, 4% had not been grazed by an ungulates. Fifty-eight percent had been lightly browsed, 24% had been moderately browsed and 15% had been heavily browsed. Aspen evolved with browsing by ungulates, but extreme browsing pressure on aspen stands can affect stand vigor and reduce the amount of time that an aspen stand persists on the landscape.

In the BWL watersheds about 400 acres are at high risk of decline and stand conversion (see Table 11).

Curlleaf mountain mahogany – Mahogany is restricted to the extreme southwestern portion of the State (Montana FWP 2005). Curlleaf mountain-mahogany is good forage for all classes of browsing animals in both summer and winter and is one of the few browse species that meets or exceeds the protein requirements for wintering big game animals (Utah State University).

Mahogany is generally a long-lived tree or shrub that provides important wildlife habitat for a myriad of species. Regeneration occurs from seed, production of which can be variable but heavy at times. Bare mineral soil is the usual seed bed with regeneration very uncommon in established stands. Seed predation by insects in the fall may be nearly complete at times. (Ross, species account undated)

Fire control efforts have altered structure of mahogany stands in the East Pioneers. Although curlleaf mountain mahogany is sometimes referred to as a weak resprouter after fire, this is very uncommon (Ross). In the western Great Basin it is invariably killed

by fire regardless of intensity and never resprouts (Ross). Even very light burns that do no apparent damage to mature trees result in full mortality within one year (Ross).

Currently there are two characterizations of mahogany stands in the assessment area: 1) old-growth, even-aged plants with high crown closure and excessive litter accumulation that prevents seedling establishment, accessible plants showing heavy browsing pressure by big game including moose 2) conifer colonization into mahogany stands is gradually shading out the mahogany plants. Walk through studies conducted in Birch and Willow Creeks in 1996, documented in the Pioneer Landscape Analysis, and again in 2007 for this assessment, indicate seedling establishment in mahogany stands is rare, stands are mature, dying and generally unavailable as forage, and other stands are slowly succumbing to Douglas-fir or limber pine colonization.

Shrubland –grasslands – This habitat ranges from solid stands of grasses to a mixture of sagebrush and grasses to almost solid canopy of shrubs (mostly sagebrush). The lower elevation grasslands are relatively large and continuous, whereas the upper elevation habitats are interspersed with conifers and shrubs. Fire and herbivory were historically important disturbance processes in this habitat. The absence of fire and presence of increased herbivory (including livestock grazing) have influenced the distribution and seral stages of sagebrush and grasslands available for wildlife. At present these habitats show increases in conifer cover and nonnative over presettlement conditions. Sagebrush cover in the watersheds is variable but there is obvious evidence of reduced shrubland/grassland due to conifer colonization, (Hammer, Johnston, 2007 walk through exams).

A variety of small mammals, invertebrates and birds are found in these habitats. Sagebrush stands in particular serve as important forage and cover for a number of wildlife species, including mule deer, elk, sage grouse, and pygmy rabbits at lower elevations (<6500 ft). Winter range for mule deer and moose has been mapped by Montana FWP across public and private lands in the lower foothills of Birch, Willow and Lost Creeks. However, winter range for elk only shows up on the very north edge of this watershed area.

Young seral conifer stands – Douglas-fir and lodgepole pine stands forestwide lack young replacement stands in the 0 to 5 inch size class (USDA FEIS 2008). These young seral stands are important to a number of species including snowshoe hare, the primary prey species for Canada lynx. This is in accord with fire suppression having allowed for more trees to advance into larger size classes. The 5 to 10 inch size class is 13% higher than the upper end of modeled historic range of variation (USDA, FEIS, 2008).

Secure habitat – Security is important for a range of mammals, including elk, bears, andwolverines. Christensen et al (1993), for instance, demonstrates that habitat effectiveness for elk decreases as road densities increase. The State's preferred approach for both elk and grizzly bear habitat is to maintain road densities at < 1.0 mi/sq. mi (MT FWP 2002).

Increasing access and use of an area causes increasing conflicts and risks to wildlife resources that can be displayed in four broad categories: habitat alteration, disturbance, increased vulnerability to mortality, and increased noxious weed establishment.

Under the 2008 Revised Forest Plan, a range of open road densities and secure habitat is provided across the Forest, from 0 miles/mile^2 to 2.0 miles/mile^2. Open roads and trails are scattered throughout much of the watershed. Actual open road density objective in Hunting District 331, which encompasses the assessment area, is 1.5 miles per square mile in both summer and fall. This meets the security objectives for this hunting district and landscape set by the 2008 Revised Forest Plan. Under the revised Plan, much of the assessment area is in the East Face Management Area, managed for a mix of accessible recreation opportunities in semi-primitive motorized and roaded settings. Cross country travel is prohibited everywhere. Only the high elevations within the Torrey Mountain Recommended Wilderness have no motorized routes. The route analysis in Appendix A has not identified any road segments generating specific high risks to wildlife. The risks from motorized roads and trails are associated with their being vectors for noxious weeds, a threat to any wildlife habitat.

Wildlife Species of Interest

The watersheds provides a wide variety of diverse habitats for wildlife, hence a wide variety of species. The following table displays a screen for current sensitive species, and 1986 Management Indicator Species (MIS) that are known or suspected of occurring in the BWL watersheds area. As a result of ESA delistings noted on Table 20, there are no longer any federally listed terrestrial or avian wildlife species for the Beaverhead-Deerlodge NF. The analysis area provides or could provide year-round habitat for a number of 1986 management indicator species and current sensitive species.

Table 21. Sensitive and 1986 management indicator species Wildlife species considered for presence in the watersheds, their status on the Forest, general description of habitat preference, whether the species or its habitat is present in the analysis area.

SPECIES	2008 STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA
Grizzly bear	2008 sensitive	Habitat generalist. Lack of human disturbance.	Yes-habitat No known occupancy or transient use
Peregrine Falcon	2008 sensitive/ 1986 MIS	Prominent cliffs for nesting within 1 mile of water and 10 miles of hunting habitat including riparian areas, parklands, and mountain valleys.	Yes-habitat No known eyries
Gray Wolf	Nonessential Experimental 2008 sensitive	Habitat generalists. Lack of human disturbance (corresponding to low road densities), abundant prey (primarily elk) required.	Yes-habitat No known packs
Bald Eagle	2008 sensitive	Nesting trees/platforms near an open water body (> 80 acres) or major river system; available fish and water bird species prey near nesting habitat; forages on carrion in winter or during spring/fall migration.	No
Elk	1986 & 2008 Commonly	Habitat generalist. Winter range in lower elevation	Yes

SPECIES	2008 STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA
	Hunted MIS	conifer/shrub/grasslands.	
Greater Sage Grouse	2008 sensitive and 1986 sagebrush MIS	Sagebrush obligate. -	Yes-dispersal habitat No known breeding
Pine Marten	No 2008 status. 1986 Old Growth MIS	Lodgepole pine mature and old growth, spruce/ subalpine fir mature and old growth.	Yes
Northern Goshawk	1986 Old Growth MIS 2008 no special status	Mature and old growth Douglas-fir stands for nesting.	Yes
Trumpeter swan	2008 sensitive 1986 MIS	Marshlands	No
Black-backed Woodpecker	2008Sensitive	Burned or insect-killed forest	Yes- habitat Habitat is increasing due to insect caused conifer mortality
Flammulated Owl	2008 Sensitive	Mature (> 9 inches dbh) and old growth ponderosa pine/Douglas-fir with abundant moth species prey.	Yes-habitat marginal. Dry Douglas fir possible
Harlequin Duck	2008 sensitive	Fast moving, low gradient clear mountain streams	No. Only activity in Rock Creek system on Pintler RD
Fisher	2008 Sensitive	Moist coniferous forested types (including mature and old growth spruce/fir), riparian/forest ecotones	No known activity
Great Basin Pocket Mouse	Sensitive	Dry grassland with less than 40% cover.	Yes. Habitat Assessment area at periphery of range
North American Wolverine	Sensitive	Large areas of unroaded security habitat; alpine/subalpine talus slopes for secure denning habitat, ungulate carrion in winter.	Yes
Northern Bog Lemming	2008 Sensitive	Wet riparian sedge meadows, bog fens.	No Nearest activity at Maybee Meadows on Wisdom RD
Pygmy Rabbit	2008 sensitive	Dense clumps of big sagebrush or greasewood forage on grasses (wheat grass, bluegrass) in summer and sage in winter.	Yes. Assessment area at periphery of range. No known activity
Townsend's Big-Eared Bat	2008 sensitive	Roosts in caves, mines, rocks and buildings. Forages over tree canopy, riparian areas or water.	Yes-foraging & roosting No known

SPECIES	2008 STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA
			hibernacula
Spotted Bat	2008 sensitive	Cliffs, Rock faces for roosting. Forest openings, riparian areas, wet meadows for foraging	Yes- activity in 2007

The big game species elk, deer, black bear, and moose occupy portions of the area in all seasons. Elk are especially important in southwest Montana with high public interest and value for hunting. Elk utilize a variety of habitats during different times of the year. The assessment area is encompassed by State hunting district 331identified in the State elk management Plan (FWP 2004). Hunting District 331 includes the entire East half of the Pioneer Mountain Range. The elk population objective for HD 331 is 1400 animals maximum. Montana Fish Wildlife and Parks 2007 estimate is 1085 animals, plus or minus 10%. Winter range for mule deer and moose has been mapped by Mt FWP across public and private lands in the lower foothills of Birch, Willow and Lost Creeks. However, winter range for elk only shows up on the very north edge of this watershed area. No management challenges on Forest Service land are identified in State Elk Plan.

Wolverines occur in several places on the Forest and were detected in the Pioneers during 2001-2005 (Squires et al 2006). Wolverine passed back and forth from the East to West Pioneers, crossing the Scenic Byway. Recreational trapping was the primary mortality factor for instrumented wolverines during this study (Squires et al 2006).

Because of their sensitive status, sage grouse are of interest anywhere on the Forest there is sagebrush habitat. However, there are no known active or inactive leks, breeding or nesting grounds anywhere on the BDNF. Habitat modeling based on Connelly (2000) demonstrates that there is potential summer /fall use habitat within range of a known lek north of Dell between the forest boundary and I-15.

There is the potential for pygmy rabbit use of the area because of the sagebrush habitat. The summer of 2005 and 2006 and the fall of 2005 and 2006 systematic linear grid surveys were conducted in the Birch Creek drainage for pygmy rabbits (USDA 2007). No pygmy rabbits were found on any of those visits. No pellets were found, no sagebrush clippings and no rabbits themselves. The assessment area is on the periphery of the range in Montana.

Northern goshawk, MIS for old growth in the 1986 Forest Plan, have two established nesting territories in the Willow Creek Drainage. The Buckhorn territory had nesting birds moving between four nests during all but two years from 1994 to 2006. The Dubois Creek territory had one next site, occupied in 2000 and 2003. Nests were monitored and habitat surveys conducted by Jack Kirkley “Northern Goshawk Productivity, Movements and habitat Selection in Southwest Montana”, 2005, University of Montana – Western. The Region 1 grid sampling crew for Northern Goshawk and Flammulated owl found goshawk in same vicinity within the watershed area (USDA 2007).

“Pine marten in southwest Montana do not show an affinity for old growth forest, however mesic subalpine fir is used preferentially and xeric subalpine fir types are avoided. Dry lodgepole pine types are important during the winter (Coffin 1994). Marten

prefer characteristics associated with mature mesic timber stands, such as large diameter trees and downed woody material (Coffin 1994). Overhead cover and coarse woody debris associated with mature forests address many of the needs that martens have for physical structure: predation, thermoregulatory needs during winter, and prey abundance and availability (Bissonette et al. 1989, Com and Raphael 1992, Buskirk et. aI1989). Marten are found within the East Pioneer Mountains in mature mesic subalpine fir and lodgepole pine forests." (USDA 2007)

Black-backed woodpecker habitat, as noted in Table 21, has been increasing forest-wide due to insect caused mortality. The analysis area shows increasing mortality in both watersheds. While insect killed trees do not offer the immediate pulse of preferred habitat provided by fire killed trees, this mortality does provide habitat for wood boring beetles that follow mortality caused by the mountain pine beetle.

Preferred flammulated owl habitat is Ponderosa pine which is not found in the assessment area. Marginal nesting habitat can be provided by dry-site Douglas fir which does occur in pockets in the assessment area. Owl surveys done for the Birch Creek fuels project did not detect this species (USDA 2007)

As noted in Table 21, Townsend's big-eared bat foraging habitat is found across the assessment area. Roosting occurs in large hollow trees and caves. The only documented maternity colony in southwest Montana is located at Lewis & Clark Caverns State Park. While the Beaverhead-Deerlodge NF is encompassed by the species' range, it is not yet confirmed on the forest.

Table 21 notes spotted bat habitat is found in the assessment area. The State's range map for the species shows it occurring well east of the forest. In 2007, a reliable electronic detection was recorded from the lower Birch Creek area. While we are awaiting confirmation of the detection, we have added the species to our sensitive list.

3. Reference Condition

Natural vegetation, the cornerstone of wildlife habitat, reflects natural disturbances like fire, insects, disease, weather events, herbivory and natural succession. Prior to settlement in the mid to late 1800's, these disturbances were the primary influence on both the pattern of vegetation covering the foothills and mountains of the BWL watersheds area (patch size, juxtaposition, distribution), and the successional stages of the vegetation cover.

Before settlement, southwestern Montana's valley bottom and mountains were occupied by a great number of wildlife species year round or seasonally. It can be assumed that present animal communities, distribution, assemblages, densities and interactions (predation, competition and parasitism) are somewhat different now than before the 1850s. A shrinking base of native grassland/shrubland and riparian vegetation, historical and recent developments which convert vegetation or land use, market hunting, and the interruption of natural processes like fire contribute to these differences.

Among many factors, the changes in land use in the valleys, introduction of non-native species, and public interest in hunting and game management preclude using historical distribution of wildlife species as a reference point. The desired condition (as expressed in the 2008 Revised Forest Plan) is a diversity of forest, shrub land, grassland, riparian, and aquatic communities which reflect ecological disturbance processes like fire. The

resulting plant communities provide conditions for self-sustaining or viable populations of native and desired non-native species within the natural capability of the ecosystem.

4. Synthesis and Interpretation

Habitats of concern are directly linked to those cover types showing the greatest change: mountain big sagebrush, upland aspen, riparian aspen/alder/willow/cottonwood stands, and mountain mahogany stands. The change is incurred in these types from conifer colonization – competing for water, sunlight and space. The change is precipitated by a combination of climatic change (an increase in droughty years) and lack of fire disturbance.

Road densities in the watershed area are in the mid range for the Forest and they meet wildlife objectives of 1.5 miles per square mile set by the 2008 Revised Forest Plan. The Torrey Mountain Recommended Wilderness which lies at upper elevations of the watershed and across the west face of the East Pioneer Mountains offers a very large block of secure habitat.

5. Recommendations

Improve wildlife habitat by reducing conifer colonization into:

- Mountain Big sagebrush communities and sagebrush grassland parks
- Aspen stands
- Alder/Willow/Cottonwood stands
- Mountain mahogany stands

Concentrate aspen restoration in large treatment areas so wildlife browsing pressure on regenerating sprouts doesn't compromise recovery of the stands.

F. RECREATION RESOURCES

1. Characterization

The east face of the Pioneer Mountains is quintessential of the distinctive role the Beaverhead-Deerlodge Forest plays in the Northern Region. The following description is extracted from the Revised Forest Plan niche (2008) and the BDNF Recreation Niche (2007) which capture the essence of the assessment area well.

Unique for its lakes and streams, large elk populations, and uncrowded backcountry, it contributes to species diversity, public open space, recreation, tourism, environmental education, commodity production, and to local economic opportunities.

Complex geology contributes to the scenery, recreational opportunities, and local economies. Mineral extraction has attracted people since prehistoric times and continues today. The rich cultural history is inextricably tied to the resources. Historic features are common. Historic roads and trails continue to lead people from their homes to the forest to escape and reconnect with nature.

Key multi-season activities include hunting, fishing, hiking, exploring historic sites and areas, viewing natural features/wildlife, participating in regionally significant winter sports, and digging for gems. Campgrounds and camp sites are staging points for other activities. Continuing to tell the stories, the forest is a living classroom that shares the unique geology and history of the area and public lands.

Wilderness & Proposed Wilderness –Includes hiking and stock use. Mostly day trips with some multi-day treks.
Backcountry – Includes hiking, stock use, mtn biking, historic cabin rentals, and winter snowmobiling.
Roaded Backcountry –Driving for pleasure, OHV riding, mtn biking, hiking, dispersed camping, and historic cabin rentals.
Frontcountry – Driving for pleasure, OHV riding, developed camping, resorts, rental cabins, ski areas, non-motorized trail use, daily backyard access, primary place for historic interpretation “.

Land Management Direction Relevant to Recreation

2008 Revised Forest Plan
Desired Condition –Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and non-motorized backcountry opportunities.

Goal – Recreation Allocations are mapped forestwide. Goals are displayed for managing the settings and opportunities within each allocation (see pg 32 of the Plan). Allocations include: road-based, backcountry, summer non-motorized, and recommended wilderness.

Goal – Recreation Opportunities: High quality diverse outdoor recreation opportunities are provided, including but not limited to:

Day use activities within a 30 minute drive of communities for motorized and non-motorized trails, picnicking and interpretive sites,
Winter use areas near communities for ski touring, snowshoeing and snowmobiling,
Trails and routes for autos, 4-wheel drive vehicles, ATVs, motorcycles, mountain bikes, horses and hikers to mountain lakes and other features, and developed and dispersed camping.

Goal – Road and Trail Use: A system of routes and areas designated for motorized use are identified and available for public use. Resources are protected and user conflicts are minimized by allowing motorized wheeled travel only on designated routes and areas. Established routes to dispersed campsites are recognized as part of the forest transportation system. A system of trails designated for non-motorized uses are also identified and available for public use.

Goal - Developed Sites: High quality developed recreation facilities are strategically located to concentrate use, provide access to backcountry settings, and protect natural resources. Sites are clean, well maintained, and designed for universal accessibility.

Objective – Non-motorized winter activity: Increase opportunities for non-motorized winter activities, such as ski touring and snowshoeing, where highway access points and parking are available.

Objective – Dispersed Sites: Identify dispersed campsites causing adverse resource impacts. Develop mitigation or relocate the site to protect the resource. Actions may include but are not limited to installing toilets for public health, bulletin boards, or hardening sites where necessary. Close campsites where unacceptable resource damage cannot be mitigated.

Objective – Trails: Maintain both motorized and non-motorized trails to standard. Reconstruction priorities are 1. safety of users, 2. resource damage, and 3. user levels.

Management Area Direction: the East Face Management Area comprises the majority of the watershed area (75 percent). The Torrey Mountain Recommended Wilderness Management Area includes much of the high elevation acres of the watersheds. Torrey Mountain Recommended Wilderness is entirely non-motorized and prohibits timber harvest or road building. Recreation allocations within the East Face include 3 types of settings: road-based, backcountry motorized and non-motorized

The East Face Management Area emphasizes livestock grazing and a mix of recreation opportunities easily accessed from Interstate 15. Specific direction for the area follows:

"The area provides a mix of semi-primitive and roaded settings. The terrain, vegetation, and types of past uses, including timber harvest, have resulted in some areas of high open motorized road density". The East Face has a long tradition of use by people from Dillon and other area communities for dispersed recreation yearlong, both motorized and non-motorized. A Recreation Residence tract is authorized in the Birch drainage.

The Birch Creek Center (Bender), University of Montana Western, provides a variety of outdoor education programs and classes. The Birch and Willow Creek drainages are areas rich with mining history.

Forage is managed for livestock grazing and for big game winter range on foothill slopes. Vegetation will also continue to be managed using timber harvest and fire.

Winter non-motorized allocations in the BWA provide opportunities for accessible quiet recreation.

There are several reservoirs, which allow popular small lake recreation activities as well as irrigation water for permittees. Active restoration of the Willow Creek, Birch Creek and Lost-Pioneers watersheds takes place in this area.

Visitors may encounter
Vegetation changes from timber harvest or fire
Dispersed campers, motor vehicle and mountain bike riders on roads and trails
Snowmobilers and skiers
Livestock

Objectives in addition to Forestwide Objectives
Develop or improve trailheads and access to motorized and non-motorized recreation opportunities.

Improve the quality of motorized trail opportunities (this is constrained by the 1.5 mile per square mile road density objective for wildlife security).

Recreation Allocation	Birch Creek	Willow Creek	Lost Creek	TOTAL Acres
Road-based	1639	12452	3496	32886
Backcountry	3011	4299	1835	9145
Summer Non-motorized	0	250	0	250
Recommended Wilderness	3931	12145	0	16076
Inholding	561	166	0	727
TOTAL				59084

Land Management Direction Relevant to Roads and Trails

2008 Revised Forest Pan
Desired Condition – People and communities benefit from programs and infrastructure that support livestock grazing and an array of forest products and services. Methods for using resources to benefit people while maintaining functioning ecosystems are employed.

Desired Condition - Resources adversely affected by past management activities have been rehabilitated.

Goal – Transportation System: The minimum transportation system necessary is identified and managed. Roads and trails are identified in the transportation atlas

maintained at the Forest Supervisor's Office. Roads and trails are constructed, managed, and maintained to meet land and resource objectives.

2. Current Condition

Birch Creek, Willow Creek and Lost Creek have been important to local communities (Dillon, Glen, Melrose, Twin Bridges, Sheridan, Wise River and Butte) since mining and ranching brought the first settlers to the area. It has been a source of livelihood for many, a source of irrigation water for ranches, supplemented homes with firewood and harvested meat, and been a place to camp, fish and play for many decades. People in the area feel a sense of connection to the Birch Creek area similar to the connection residents of the Bitterroot Valley feel to the forest near them. The watershed is not only an important place, but the types of use and the resulting impacts have produced diverse and strong community relationships with the watershed and a dependence on the integrity of the area. Maintaining the community's relationship and the meaning it finds in this area will require maintaining the quality of place and range of opportunities throughout the watershed, (Gunderson/Watson).

The Birch, Willow and Lost watersheds primarily falls in the Frontcountry designation although Roaded Backcountry, Backcountry and Recommended Wilderness settings are represented here as well.

Activities

This area has been a regular seasonal camping and recreation area for the Dillon community for many years and the primary access to the east side of the East Pioneers.

The BWL Watershed provides a range of recreational opportunities in a variety of settings.

Spring: Activities start with Memorial Weekend

Heavy OHV and ATV use – takes place throughout the assessment area utilizing system and unauthorized roads and trails. Heavy dispersed camping occurs along the Birch and Willow Creek drainages largely in the riparian zones. Extensive pioneering and inappropriate use occurs in this period of use. Because of early ground conditions heavy impacts to the resource are occurring.

Nature hiking, flower and bird observing. A large number of users and educational groups take advantage of seasonal migrating bird populations and spring green-up of botanical communities. These users are on the increase and are typically non OHV/ATV recreationists.

Education - permitted educational events through the University of Montana Western College start in the spring. Biological, Geological, and Historical presentations and research are common and increasing in presence throughout the watershed.

Summer:

OHV and ATV activities continue with more extended group and Family camping associated with these public users.

Mineral- rock hound exploration - casual non commercial activity by recreationists. Users are typically with motorized transportation. A percentage of the users involved are day hikers exploring non roaded areas.

Cultural Exploration - public users, both motorized and non-motorized exploring for historic sites associated with mining, ranching and Native American activities.

Day use is predominate and tied to dispersed and developed campground sites for extended group stays.

Day and overnight hiking/backpacking - the remote non roaded and non motorized core of this watershed receives high use from the recreationist looking for the opportunity of solitude.

Fishing occurs with all activities - . High mountain lakes are now open and day use is occurring to high elevation sites. Users are both non-motorized and motorized with a larger percentage of overnight activity increasing throughout the summer. Areas of open motorized routes are seeing illegal activity off open routes. Impacts are increasing particularly in the high elevation zones. Commercial day fishing is authorized by a limited number of outfitter special use permits.

Mountain/Rock Climbing - the core high elevation range of this watershed receives high use by climbers. Technical and moderate climbing is available.

Horse back riding- a popular area for day riding on roads, trails and cross country. Proximity to local communities and the road access to this watershed have made the area popular for equestrians.

Mountain bike riding - very popular throughout the watershed. A high desire for this activity does occur in the high mountain areas, especially those with restricted motorized access.

Firewood cutting - because of the forested land type predominant in this watershed, and existing pest infestations in many tree species, wood cutting is a common activity. Much of the illegal off road and trail use and pioneering of motorized trails is a result of wood cutters.

Fall:

Wood cutting is a high use activity. Impacts are increasing due to the sensitivity of the resource in this time period.

Archery season begins the high use hunting period. Archery is increasing due to the availability of new hunting and motorized transport technology. High use continues through out the entire fall ending Dec 1 at the end of the general hunting season. Illegal off road and trail use is on the rise by mechanized users in search of easier hunting techniques. There is a solid core of hunters that look for the non

motorized portions of the watershed looking for the non obtrusive and quieter forms of the hunting experience through hiking and horse use.

Winter:

Snowmobile activity - popular during the winter months. Open road access allows high use through the winter period.

Cross country skiing - developed trails, use of snow covered roads , and cross country travel is popular in the watershed. Because of local community growth and proximity use is increasing.

Winter fishing - low elevation lakes through out the watershed provide ice fishing opportunities. Snowmobile and winter ATV access is the predominant use. Some non motorized ski and snowshoe use also occurs.

Winter ATV activity - technology and climate changes are providing an increase in this recreational use. Illegal off road use and resulting impacts are also increasing.

Access and travel are tied closely to recreational activities. The east and southeast 2/3 of the watershed provides more roaded and trail/jeep-ATV opportunities while the northwestern 1/3 provides more primitive to semi-primitive non-motorized activities. There are four primary travel routes providing access within the watershed. In the eastern portion of the watershed there are a number of old mining, range and logging roads.

In the predominantly motorized portion of this part of the watershed the diversity of recreational use has diminished. Technology, inappropriate vehicle use and the resulting impacts has created a more exclusive ATV/OHV activity. Visual impacts of this motorized activity have affected the diversity of user and overall enjoyment of a large number of forest visitors in all time periods. It is also suggested that overall hunting success and enjoyment has also been diminished.

The following OHV/ATV travel routes are located within the watershed and are used primarily during the summer and fall seasons. Summer and fall motorized recreation currently utilizes approximately 100 miles of open trails and roads within the BWL watersheds. An evaluation of the condition and value of motorized routes was included in the route analysis described in the road section below.

- Deerhead Lk Trail #7470
- Bond Lk Trail #7471
- Lost Willow
- Boy Scout Flat
- Farlan System and Heritage Site
- North and Lost Creek System
- Bridge Gulch
- Thief Creek

These roads are in various states of disrepair with excessive grades and eroded tracks. Sedimentation is an issue, in the vicinity of riparian zones, unacceptable levels are

reaching stream courses. Also of concern is the documented rapid spread of noxious weed species. New pioneered tracks are also occurring at an unacceptable rate.

The core of the East Pioneer Mountains is recommended wilderness. This includes the upper elevations of the study where most of the watersheds high mountain lakes are located.

These areas are generally used in summer and fall. Fishing in lakes and streams, day and overnight hiking/backpacking, rock climbing, geologic exploration and research, mountain and rock climbing, horse back riding and mountain bike riding make up the activities sought by our public recreationists.

Where open motorized road and trail access to lakes is available, critical impacts are developing and increasing yearly. Of particular concern are the areas in upper Birch: Boot, Pear, Anchor and May Lakes area. The associated perimeter Lakes of Minneopa, Boatman, Tent and Twin Lakes need to have motorized restrictions maintained. In upper Willow: the Tendoy Lake, an area open to motorized travel, has resource impacts and user conflicts increasing. The Gorge and Rainbow Lakes will need to maintain their motorized restrictions.

In all cases these sensitive and popular areas have trailhead improvements (if any) that are barely custodial at best. All trailheads need significant improvement for interpretive, compliance and education information.

The entire watershed area provides hunting opportunities for both elk and deer. There is both roaded and unroaded hunting available throughout. The hunting activities defined in the watershed are unique as compared to surrounding landscapes. Roaded access to the BWL watershed, so close to an urban population and a variety of different communities, has established the area as significantly important to hunting recreation. And further exemplifies one of the critical threads identifying community connection and dependence. The watershed also provides critical summer and winter habitat needs. Maintaining hunting opportunity and habitat is a critical foundation block.

Sites and Facilities

Campgrounds: Dinner Station Campground is a small 8 unit campground with a group site located within the watershed. It is located in the Birch drainage and is currently in poor condition. There is an older style wooden toilet with a vault in this campground. Vehicle access for the campground does not accommodate newer RV's. The Aspen Picnic Area has an old vault toilet, 5 units and a capacity for 25 PAOT.

Birch Creek Center: The Birch Creek Center (BCC) was originally constructed for use as a Civilian Conservation Corps (CCC) camp in 1935. This facility is one of the last remaining intact facilities of the New Deal era in the country. With the start of the Second World War, Camp Birch Creek was abandoned. In 1955 the Evangelical Covenant Church of America operated the Birch Creek Bible Camp. In the late 1970's, the site came under the jurisdiction of the United States Forest Service (USFS). An environmental assessment from 1979 recommended that the site be developed as an educational site. Under a Special Use Permit, BCC continues to provide educational

support to the University of Montana - Western and general public. The Birch Creek CCC camp is on the National Historic Register.

Dispersed camping sites: Camping within the watershed takes place primarily in dispersed sites with little to no development. There are a number of dispersed campsites located throughout the watershed. The heaviest use is predominantly in the summer and fall. The majority of the sites are located along the Birch and Willow Cr roads. One has a modern SST to reduce impacts to the riparian area and reduce sanitation issues. These dispersed sites are not hardened and are accessed by user created two track roads. Most of these dispersed sites are adjacent to or in the vicinity of the streams. The watershed is popular for both ATV/4wd OHV recreation and winter snowmobiling. Use is increasing dramatically by ATV recreationists. Specific areas of concern include:

Boy Scout Flat- an approximate 2 mile section along Willow Creek with heavily concentrated and scattered dispersed sites. Multiple ATV routes link this series of sites. Sanitation issues and proximity erosion impacts to stream channels pose the greatest management concerns.

Birch Creek crossing to Dinner Station- an approximate mile section along Birch Creek. This area contains many pioneered routes along the stream corridor. In addition, excessive firewood cutting in the riparian zone, and sanitation issues comprise the major management issues.

Boot/Pear/May Lakes- road access to the lakeshores have significantly impacted these sites by ATV action. Vegetation loss, ground scaring and erosion are at unacceptable levels. Illegal pioneered routes are occurring in this vicinity and illegal use of closed motorized trails to high elevation lakes are major concerns.
Tendoy Lake- motorized access to this high elevation lake in proposed Wilderness is at unacceptable levels. Impacts at the lake through camping and intrusion of ATVs to shorelines are increasing.

Tendoy Lake- motorized access to this high elevation lake in proposed Wilderness is at unacceptable levels. Impacts at the lake through camping and intrusion of ATVs to shorelines are increasing.

Trails: There are a number of summer hiking and OHV trails located throughout the watershed, most within the western ½ of the area. The more popular routes access spectacular high mountain lakes.

Non-motorized recreationists (hikers and horse back riders) currently utilizes approximately 22 miles of trail. These trails are as follows:

- Tendoy Lake Trail #1104: Offers scenic views and fishing opportunities in recommended wilderness. It is currently an open ATV route that would be closed under the Revised Plan.
- Gorge Lakes Trail #1154: Offers scenic views and fishing opportunities in recommended wilderness. Closed to motorized use.
- Boot, Pear Anchor, Tub, and May Lakes: All accessed via the Birch Creek ATV Rd #98. Tub and Anchor Lakes are in recommended wilderness where motorized access would be closed under the Revised plan.

- Minneopa, Tent, and Boatman Lakes: All accessed via Mule Creek Rd #7400. Offers scenic views and fishing opportunities. This area is currently closed to motorized use. (This system is actually just out of the BWA, it is directly associated with Birch Creek and identified in Birch Creek related recreation opportunities).
- Uphill Trailhead: Non motorized access to Rainbow and Agnes Lakes. Offers scenic views and fishing opportunities in recommended wilderness.
- Rainbow Lake: Non motorized access to Rainbow and Agnes Lakes. Offers scenic views and fishing opportunities in recommended wilderness.

Roads: With diminishing funding, Forest road maintenance typically focuses on higher-standard, higher-use roads or those with critical resource protection needs or health and safety issues. (These are often arterials or collectors, or local roads accessing campgrounds or other heavily-used sites.) Consequently, the overall condition of the Forest's road system is deteriorating. Roads in this watershed are no exception. As described above, most of the routes in the area are local low-standard, native-surfaced roads. Only a few of the roads in the drainage receive regular annual maintenance.

Road condition surveys have been performed across the Forest since 1998, and have been conducted for the primary access routes (maintenance level 3 and 4 roads) in this watershed. The surveys identified the annual maintenance, deferred maintenance, and capital improvement needs for these roads. The deferred maintenance work items, in particular, provide insight as to the extent of the road maintenance backlog. Drainage-related maintenance items are an important consideration, of course, when addressing watershed protection concerns. Another identified deferred maintenance work item – surface replacement – may be an equally important watershed protection concern, depending on the likelihood that road-generated sediment from the affected road segments will reach a live stream.

Residences and private structures: There are seven private parcels of land totaling 727 acres within the assessment area. Modern homes have been built on two parcels, one each within the Birch and Willow drainages. Two other parcels have older cabins on site. Historic structures at Farlin Mining District site are located on the National Forest.

There is one recreation residence permitted under a special use permit. Recreation residences are a valid use of National Forest System lands. They are an important component of the overall National Forest System recreation program and have the potential of supporting a large number of recreation person-days. They may provide special recreation experiences that might not otherwise be available. It is Forest Service policy to continue recreation residence use and to work in partnership with holders of these permits to maximize the recreational benefits of these residences. The Birch Creek Lot is on a half acre located on the Birch Creek Road #98 approximately 2 ½ miles west of the Forest boundary. This Special Use Permit will be re-issued January 1, 2009.

Transportation System

Approximately 87 miles of National Forest System Roads (NFSRs or "system" roads) network the drainage, as well as about 60 miles unauthorized (non-system) roads. Nearly half of these roads are in the Birch Creek subwatershed (HUC). Several roads in

the Birch and WillowUp HUCs provide access suitable for passenger car use (maintenance levels 3 and 4); these routes generally parallel Birch, Willow, Mule, and Thief Creeks. The remaining roads in the analysis area are maintained for high-clearance vehicles only (maintenance level 2). Most of the roads are native-surfaced, with some aggregate-surfaced routes (portions of the Birch Creek Road) and some spot-surfaced segments. There are several closed (maintenance level 1) system roads in the area. In addition, some road decommissioning has been accomplished in the past.

Nearly 22 miles of National Forest System Trails (NFSTs or "system" trails) and several miles of unauthorized (non-system) trails currently provide motorized and non-motorized access in the Birch and WillowUp HUCs. There are no inventoried trails in the WillowLow and Lost-Pioneer HUCs.

See Map 20 for the location of inventoried roads and trails. Table #22 below displays the current inventoried miles of existing roads and trails broken down by 6th-code HUC.

Table 22. Existing Open Road Mileage by Subwatershed

	Road miles			Trail miles		
6th-code HUC	System roads (NFSRs)[1]	Unauthorized roads	Totals	System trails (NFSTs)[2]	Unauthorized trails	Totals
Birch	47.9	23.2	71.1	12.2	2.3	14.5
WillowUp	17.1	11.5	28.6	9.5	0.6	10.1
WillowLow	9.3	13.8	23.1	0.0	0.0	0.0
Lost-Pioneer	13.1	11.5	24.6	0.0	0.0	0.0
Totals =>	87.4	60.0	147.4	21.7	2.9	24.6

[1] System road mileages do not include operational maintenance level 1 roads.

[2] System trail mileages do not include "coincident routes" (i.e., where trail segments follow system roads).

Route Analysis -- In 1999, the roads analysis process was introduced as a means of informing Forest Service planners and decision-makers of road system opportunities, needs, and priorities in support of land and resource management plan objectives. Roads analysis may be conducted at several scales, including Forest-scale and watershed- or project-scale.

A Forest-scale roads analysis was completed in 2004 for the Forest's "backbone" road system. The analysis included all arterial and collector roads (regardless of maintenance level) plus selected local roads considered suitable for passenger car use (objective maintenance level 3, 4, & 5). The purpose of the analysis was to assess broad-scale issues related to road management on the Forest, including: environmental, social, and economic issues, right-of-way needs, and interrelationships with other agencies. The roads analysis report includes a display of the Forest road system with risks and opportunities identified for each analyzed road, as well as management priorities.

A project-scale roads analysis was completed in 2007 for the Bond-Deerhead-Estler area. This analysis analyzed the road and trail needs in the project area, using a

process similar to that used in the Forest-scale roads analysis but with more detailed site-specific information.

At the on-set of the Birch-Willow-Lost Creek Watershed Assessment in the fall of 2007, the interdisciplinary team (IDT) decided that it would be valuable to conduct a similar watershed-scale route analysis (including roads *and* trails). Members of the IDT, along with several other Dillon Ranger District employees, formed a "sub-group" to complete the roads analysis.

A map of the existing road and trail inventory was assembled, including known system and unauthorized routes. The team developed a checklist to be used in the field to document desired all route attributes in the field, such as physical characteristics, types of use, resource issues, etc. The team then conducted a field inventory of nearly all the known routes in the watershed.

Along with the field inventory, information from the Forest-scale and Bond-Deerhead-Estler roads analyses were incorporated into this route analysis, and a similar process for "rating" the roads was used. The road-by-road ratings table can be found in Appendix A. For more detailed information about the route analysis, refer to the Birch, Willow, & Lost Creek Route Analysis (separate document).

3. Reference Conditions

See the Cultural Heritage write-up for a discussion of historical reference.

Desired conditions for recreation are defined using the Forest Plan Desired Conditions, Goals and Objectives as well as the Forest Recreation Niche developed for the Beaverhead-Deerlodge NF, Forest Recreation Plan, 2007. See Land Management Direction Relevant to Recreation, above.

The activities/opportunities discussion in the Forest Niche statement developed for the Beaverhead – Deerlodge NF, Forest Recreation Plan in 2007 provides a basis for desired recreation opportunities and activities in this watershed (see below) as does the 2008 Revised Forest Plan direction for the East Face Management Area and the Torrey Mountain Recommended Wilderness (see description under "land management section above".

"Forest-wide Activities/Opportunities/Experiences: Historic roads and trails continue to lead people from their homes to the forest to escape and reconnect with nature. Key multi-season activities include hunting, fishing, hiking, exploring historic sites and areas, viewing natural features/wildlife, participating in regionally significant winter sports, and digging for gems. Campgrounds and camp sites are staging points for other activities. Continuing to tell the stories, the forest is a living classroom that shares the unique geology and history of the area and public lands.

<u>Wilderness & Proposed Wilderness</u> –Includes hiking and stock use. Mostly day trips with some multi-day treks.
<u>Backcountry –</u> Includes hiking, stock use, mtn biking, historic cabin rentals, and winter snowmobiling.
<u>Roaded Backcountry</u> –Driving for pleasure, OHV riding, mtn biking, hiking, dispersed camping, and historic cabin rentals.

Frontcountry – Driving for pleasure, OHV riding, developed camping, resorts, rental cabins, ski areas, non-motorized trail use, daily backyard access, primary place for historic interpretation ".

4. Syntheses and Interpretation

The issues described below were developed by comparing the existing conditions to Forest Plan direction and the Forest Niche.

Facilities: The success and presence of the historic Birch Creek CCC and the Bender Center as an educational resource is connected to the integrity of the Birch Creek watershed. The Birch Creek CCC Camp and the Bender Center facilities lay in a setting of mixed shrub/sage and conifer. This mostly forested setting is important to the educational objectives of the Center, retention of a historic setting for the Camp, and the viewshed for those using the facilities. The science of scenery management indicates that large scale or rapid changes in setting have the strongest affect on visual aesthetics. It is important that vegetation changes in Lower Birch (from the Dinner Station vicinity through the Forest Boundary) are not the sudden or large scale type that a high severity wildfire would have. This concern for visual impacts of wildfire is in addition to facility protection concerns.

Activities and Sites: Recreational use in this watershed is on the increase as are most areas within the western United States. Dispersed camping is concentrating in riparian and lakeshore zones with increased examples of muddy, rutted two tracks accessing them, exacerbating impacts to lake/stream banks and riparian vegetation. Shorelines of lakes in the area are showing disturbance due to the increase in use. Increased areas devoid of vegetation, more fire rings, less firewood, damaged trees and scattered garbage are all obvious signs of increased use. If motorized use continues to increase there will be continued downward trend due to existing trail location and the increased tread disturbance from that motorized use. Trailhead development and signing, and informational kiosks at heavily used dispersed site are tools to educate users and mitigate effects.

Trails and roads: Routes in the watershed are experiencing increased recreational OHV use. With increased use there has been a steady downward trend in trail and road conditions due to the location, design, and the increased tread disturbance from motorized use.

The watershed-scale route analysis for this assessment included ratings of various values and risks for each route. Relevant issues and other pertinent information were documented for each route, and recommendations were made for many of the routes. Specifically, routes the interdisciplinary team felt were not needed as roads were recommended for conversion or addition to the trail system or for decommissioning, as appropriate. Significant resource concerns and other recommendations were made as well. Table 23 below displays a summary of the recommendations made in the route analysis. It is important to note that route analysis is not a decision document. The primary purpose of the process is to identify the values/needs and problems/risks of each route. Though recommendations were made for many routes, site-specific NEPA will be required to identify and analyze appropriate alternatives using, in part, the information contained in the route analysis.

Note: During the route analysis, no changes were recommended for the existing system trails; thus, trails are not included in this table.

Table 23. Route Analysis Recommendation Summary

Recommendation	System Roads		Unauthorized Roads		TOTAL	
	Miles	# of road segments	Miles	# of road segments	Miles	# of road segments
No Change	48.7	25	4.0	7	52.7	32
Convert/add to system	41.3	21	31.2	75	72.5	96
Decommission	3.5	3	30.3	91	33.7	94
Address resource concerns	7.8	3	3.6	4	11.4	7
Other Concerns	1.9	5	1.3	4	3.2	9
Totals	103.2	57	70.4	181	173.5	238

Table 24 displays a more detailed summary of the routes recommended for conversion/addition to the trail system or decommissioning. These mileages are broken down by 6th-code HUC.

As mentioned in the previous section, route-specific ratings and recommendations can be found in Appendix A. See Map 20 for the location of inventoried roads and trails and a visual display of routes recommended for decommissioning and conversion to system trails.

5. Recommendations

Manage vegetation to maintain the viewshed around the BCC/CCC facility for the long term and with the historic setting in mind, while protecting the facility from effects of wildfire.

Improve and develop trailhead infrastructure in the watershed.

Improve existing developed Campground.

Improve existing concentrated dispersed camping areas.

Complete more detailed travel analysis (where necessary) and NEPA to address the problems, opportunities, and recommendations identified in the Birch, Willow, & Lost Creek Route Analysis. This includes: determining which trails within the watershed should be closed to wheeled motorized use; which non-system roads and trails should be added to the system or decommissioned; determining the mode of travel and season of use for new system trails; and, determining which system roads should be decommissioned or converted to system trails.

Address other problems, opportunities, and recommendations identified in the Birch, Willow, & Lost Creek Route Analysis.

Evaluate the opportunity for alternative motorized opportunities in the watershed to offset closures required for watershed protection.

Table 24. Route Recommendations by Subwatershed

6th-code HUC	System road (NFSR) miles		Unauthorized road miles		Total miles	
	Convert/ add to trail system	Decomm-ission	Convert/ add to trail system	Decommi-ssion	Convert/ add totrail system	Decomm -ission
Birch	11.3	1.1	9.6	10.8	20.9	11.9
WillowUp	6.5	0.0	5.3	4.4	11.8	4.4
WillowLow	7.1	2.3	7.2	6.1	14.3	8.4
Lost-Pioneer	13.5	0.0	4.9	6.6	18.4	6.6
Totals =>	**38.4**	**3.4**	**27.0**	**27.9**	**65.4**	**31.3**

Specific Opportunities:

Birch-

Farlan Historic Site (heritage): Develop interpretive and information kiosk. This project would better inform our publics and protect the historic area. Information for compliance and regulation needs would be incorporated.

Bond –

Deerhead Lakes Trailhead: Information board for location and area compliance; resource regulation needs. Associated road maintenance would be incorporated to reduce current system impacts and erosion concerns. Dispersed site improvements would be implemented to concentrate activities and reduce current impact spread.

Boot Lake-

Remodel old campground (ghost) to OHV dispersed site and information display. The area is heavily impacted by ATV/OHV use. Impacts would be concentrated, away from riparian and lake shore edge. The project would provide a destination opportunity. Trail systems would be maintained to prevent stream degradation.

Pear Lake- (same as above)

Associated activity: trailhead development (Minneopa Lk) and trail system maintenance just outside the Watershed Area would occur in association with projects identified for the Birch Creek drainage.

Willow Up-

Bond Lake- Develop interpretive sign (heritage). Focused on mining history, many cultural sites are present in area and at Deerhead Lk. Public information for compliance and regulation needs would be incorporated. Dispersed site improvements would be implemented to concentrate activities and reduce current impact spread.

Deerhead Lake- Develop interpretive sign (aquatics). Focused on sensitive species (toads) identity and preservation. Also tied to Bond Lake. Public information for compliance and regulation needs would be incorporated. Dispersed site

improvements would be implemented to concentrate activities and reduce current impact spread.

North Creek/Lost Creek Trailhead- Major portal for OHV/ATV users into the Willow Low watershed. Incorporate interpretive sign for important mining and ranching history. Informational sign inclusion for public knowledge to reduce illegal motorized use, weed prevention, and watershed resource impacts. Will promote critical OHV recreation opportunities.

Boy Scout Flat- A concentrated dispersed camping area. Improve dispersed camping opportunities and reduce site impacts. Will reduce overall riparian disturbance. Incorporate information board for regulation needs, to improve compliance, and instill responsibility.

Gorge/Wilderness Trailhead- Major portal for Wilderness and backcountry users into the East Pioneer Range. Incorporate interpretive sign for important mining and sawmill history. Informational sign inclusion for public knowledge to reduce illegal motorized use, and watershed resource impacts. Will promote critical primitive recreation opportunities.

Uphill Trailhead- Information board for location and area compliance; resource regulation needs. Associated trail and road maintenance would be incorporated to reduce current system impacts and erosion/sedimentation concerns. Dispersed site improvements would be implemented to concentrate activities and reduce current impact spread.

Tendoy/Wilderness Trailhead- Major portal for Wilderness and backcountry users into the East Pioneer Range. Informational sign inclusion for public knowledge to reduce illegal motorized use, and watershed resource impacts. Will promote critical primitive recreation opportunities.

Associated activity: trailhead development (Rainbow Lk) and trail system maintenance just outside the Watershed Area would occur in association with projects identified for the Willow Creek drainage.

G. Heritage Resources

1. Characterization

Human groups have resided in southwestern Montana for the last 12,000 years. Evidence for this early occupation is based on materials recovered from archaeological sites and ethnographic resources. Throughout prehistory human groups in southwestern Montana pursued a hunting and gathering way of life. The most common type of prehistoric site in the area is the ubiquitous lithic scatter, a site which contains stone tools and/or flakes of stone left during the process of making or repairing a stone tool such as a knife, arrow point, spear point, or hide scraper. Lithic scatters may represent the remnants of prehistoric stone tool manufacturing/maintenance localities, hunting camps, animal butchering sites, or stone quarries. Other prehistoric site types include bison jumps, game traps, tipi ring encampments, vision quest sites, wickiups, and pictograph sites among others.

The Lewis and Clark expedition through the area in 1805-1806 found numerous Indian trails or “roads” through the area. Foot and horseback travel were the primary means of transportation over these trails and roads until the 1860’s, when prospectors and miner arrived. As human activity and industry increased, transportation systems developed for horse-drawn wagons. The railroad reached Dillon in 1880 and a rail stop established at Apex several miles east of the project area.

The Birch-Willow watershed area is essentially co-terminus with what was known historically as the Utopia Mining District (see Anderson and Gray 1992). Although lode discoveries were made in the mid-1860s, and some mineral extraction was conducted in the 1870s and 1880s, little significant mining was done until around the turn of the century. A few placer deposits were found along Birch Creek in the mid-1880s, but were never extensively worked. In the 1890’s that Beaverhead Mining and Smelting Company was formed and started working the Indian Queen and Greenstone Mines. In 1900 interests were turned over to the Birch Creek Copper Mining and Smelting Company, and later the Western Mining Company. The first real production began in 1903 when the Western Mining Company built a 30-ton per day blast furnace which produced 553,220 pounds of copper, 16,000 ounces of silver and 160 ounces of gold from 8,000 tons of ore. During this period, the mine and smelter employed over sixty men and a small town was developed and named Farlin (population 300) after a pair of brothers (O.D. and W.L. Farlin) who originally recorded the Indian Queen mine in 1875. The Golden Treasure, Whale, Los Angeles, and Snowball mines were also developed as extensions of the Indian Queen (Winchell 1914; Sassman 1941; Geach 1972).

Mining efforts in the watershed focused primarily on copper ores, with lesser amounts of gold, silver, and lead, also recovered during the milling and smelting process. The main period of significance for the Utopia Mining District was 1902-1923 when the Indian Queen Mine was developed and operational. The mine was developed to a depth of about 500 feet through an adit tunnel with raises and winzes, plus several shallow shafts. During the major period of operation, the mines produced 23,000 tons of ore which yielded 2 million pounds of copper, 42,000 ounces of silver, and 300 ounces of gold (Winchell 1914; Sassman 1941). At various times iron ore was also mined and shipped to the Glendale Smelter for use as a flux. The diversity of mineral ores in the districted continued to interest the mining industry up through the early 1950s when small amounts of tungsten were recovered from the Greenstone mine.

In 1862, the Homestead Act was passed allowing settlers to acquire 160-acre homesteads after five years occupancy and cultivation. Ranching began in southwestern Montana about ten years before the Bannack Gold Rush of 1862, and ranches continued to establish and grow even as mineral activity declined. Ranchers established water rights and built dams to store irrigation water beginning in the 1890s. Within the analysis area, Bond, Deerhead, Boot, and Pear Lakes were either constructed, or modified, to allow storage and management of water for agricultural uses.

The General Revision Act of 1891 authorized the President to establish Forest Reserves (now called National Forests) on public lands. The Beaverhead Forest was established on July 1, 1908. The Forest Homestead Act of 1906 permitted patenting of homesteads within the Forest Reserves, and several 160 acre homesteads within the analysis area were patented under this authority between 1916 and 1921. From a historical perspective, the east Pioneer Mountains area was more highly populated from the 1880s and 1890s through the 1920s than it is today. There were roads, mines, smelters, sawmills, cabins, dams, ditches, post offices, schools, stores, livestock grazing, and all manner of human endeavor present within the analysis area.

As part of Roosevelt's New Deal Program to combat the depression and unemployment in the 1930's, the Civilian Conservation Corps (CCC) was developed and a permanent camp established near the confluence of Thief Creek and Birch Creek. CCC camp F-60 was established by Company 1501 in the spring of 1935 and housed 200 enrollees plus staff. The camp operated from for 6 years until the outbreak of World War II. While in operation, the CCC participate in the development of much needed infrastructure to support the Beaverhead Forest. They build roads, administrative structures, recreational facilities, and participated in a variety of other resource enhancement/protection projects including fire suppression. Most if not all of the extant forest system roads and recreational facilities within the analysis area were constructed by the CCC. The Birch Creek camp still exists, and is perhaps one of the best surviving examples of a CCC camp in the forest service today. Currently the facility is operated as an outdoor education facility under Special Use Permit with the University of Montana-Western.

Land Management Direction Relevant to Heritage Resources

2008 Revised Forest Plan
Desired Condition – Heritage resources are preserved and managed for the benefit of the American public

Desired Condition - Resources adversely affected by past management activities have been rehabilitated.

Goal – There is no loss of significant heritage resources. Significant means listed in the national Register of Historic Places, eligible for listing, or awaiting formal evaluation for National Register eligibility.

Goal – A heritage program is developed and maintained that includes legal compliance, preservation, interpretation, public education, scientific research, partnerships, and tribal consultation.

Objective – Write historic preservation plans for every heritage property listed in the national Register within one year of listing. Other heritage sites, districts and cultural landscapes will be managed through heritage preservation plans as necessary.

Objective – Complete and assessment of heritage resources with conclusions and priorities for inventory, protection, stabilization, and enhancement.

2. Current Conditions

Existing records on file with the Heritage Program of the B-D Forest provide information on the number and type of known cultural resources and level of previous cultural resource inventory conducted on forest lands within the Birch-Willow-Lost Creek Watershed analysis area. Within the study area, approximately 1600 acres of forest land have been intensively inventoried for cultural resources. This amounts to 3% of the 53,752 acres within the watershed analysis area. All inventories have been primarily project compliance related in advance of a number of proposed federal undertakings including: small range improvements (fences, water developments), road and power line rights-of-way, timber sales, and vegetation treatments. The inventory projects vary from as little as 10 acres, to as much as 530 acres in extent.

As a result of past cultural resources inventory within the Birch-Willow watershed analysis area, 35 cultural properties have been identified and recorded (see Table 25). Of that number, 23% (n=8) are of prehistoric origin, 71% (n=25) are historic, and 6% (n=2) exhibit both prehistoric and historic components. Though little dateable material has been identified at or recovered from the prehistoric site locations, most appear to date to the Middle and Late Prehistoric periods (5500 B.C. to A.D. 1600) and one site is thought to be associated with the early historic Tukudika Shoshone groups and thought to date between 1800 and 1850. Recorded prehistoric site types are primarily lithic scatters (n=5), with one lithic scatter with fire-cracked rock, one rock shelter, and one game trap also identified. Site types associated with the historic period include those associated with historic mining activity (n=12), homesteading/agricultural development (n=5), logging activity (n=3), historic Forest Service administration (n=2) and other (n=3, cabins, trash dumps, etc.). Most importantly however, at least 17 (68%) of the historic sites have cabin remains and an additional five (20%) have wooden structural remains present. Though 35 sites have been formally recorded within the watershed analysis area, only a handful has been formally evaluated for significance in consultation with the Montana State Historic Preservation Office. Interestingly, two of the sites (Lamarche Game Trap and Birch Creek CCC camp) have been formally listed on the National Register of Historic Places.

An examination of the individual site forms indicated that potential adverse impacts had occurred at 29 (83%) of the recorded site locations (see Table 25). These impacts were primarily as a result of natural deterioration or decay (n=18); recreational use (n=5, camping and OHV use); road construction (n=3), modern intrusions/mining activity (n=2); and grazing (n=1). Potential adverse impacts were not noted on six of the site forms. Within the last 10 years, only six (17%) of the recorded sites have been revisited/monitored to assess their current condition and whether or not adverse effects have continue to occur

To date, traditional cultural properties or traditional life-way values of special concern to Native American Groups have not been specifically identified within the Birch Creek-Willow Creek Watershed study area. However, certain site types such as vision quest locations, pictographs, burials, etc. retain particular importance to most Native American Groups. For that reason, should any of these site types be identified in the future, they may be expected to hold religious importance to Native Americans and should be afforded special considerations.

3. Reference Conditions

Human groups have occupied or passed through the Pioneers for 12,000 years. We can learn much about our history and culture as humans, from the evidence left behind by these previous residents. The desired condition for these heritage resources (2008 Revised Forest Plan) is to not lose any significant heritage resources. Significant means listed in the national Register of Historic Places, eligible for listing, or awaiting formal evaluation for National Register eligibility. The Forest also aspires to develop and maintain a heritage program that includes legal compliance, preservation, interpretation, public education, scientific research, partnerships, and tribal consultation.

4. Synthesis and Interpretation

Cultural resource inventories within the analysis area have been strictly “compliance” oriented in support of other forest programs over the past 25 years. Cultural resources that were encountered during these investigations were recorded and avoided. Most of the recorded properties have not been formally evaluated for significance, in consultation with the Montana State Historic Preservation Office.

As noted above, a good share of the known cultural resources are of historic origin and contain wooden cabins, buildings, and/or structures that are in various stages of collapse, decay and neglect. As a result, there is a high probability that much of the original historical integrity of many of these sites may have been lost, resulting in Forest Plan objectives or desired conditions for Heritage Resources not being met. Natural deterioration has been one of the greatest factors in losing the integrity of sites. Vandalism from increased recreational activity near these sites is the 2nd factor. Visual landscape is part of what is considered in maintaining the integrity of sites like the Birch Creek CCC Camp. Changes in vegetation, like shifts in cover type from grasslands or open conifer stands to dense forest are a consideration.

5. Recommendations

Conduct additional site monitoring to determine the rates of natural deterioration and decay at sites with standing structures and to determine if increased recreational activity and motorized access has resulted in increased vandalism and develop proposals for mitigation. Formally evaluate known sites for significance and eligibility to the National Register of Historic Places in consultation with the Montana State Historic Preservation Office.

Prepare Historic Preservation Plans for the two sites that have been formally listed on the National Register of Historic Places: Birch Creek CCC Camp (24BE1194) and the Lamarche Game Trap (24BE1011). Visual landscape is part of what is considered in maintaining the integrity of the site. When a more detailed plan is completed it would have to address that more specifically with the help of a landscape architect.

Provide historical interpretation at several of the recorded historic sites. The comparatively high recreational use of the area, along with the proximity and visibility of the Birch Creek CCC Camp, the historic town site of Farlin, and associated mining sites offer an opportunity to interpret significant episodes in local and regional history. Historical interpretation is an important part of the Beaverhead-Deerlodge “recreation niche” developed in 2007.

Table 25. Birch-Willow Watershed - Heritage Resources Summary

Site Number	Name	Site Type	Impacts
24BE251		Mining Camp – Structures	burned/decay
24BE267		Hist/Prehist - adits/lithics	recreational use
24BE268		Logging – corrals/ramp	recreational/decay
24BE269		Hist/Prehist – logging/lithics	recreational/decay
24BE270		Logging-corrals/ramp	natural decay
24BE271		Logging-corrals/ramp	recreational/decay
24BE492	Lonely Harts Adit	Mining Adit/frame	natural decay
24BE494		Mining-cabin/adits	natural decay
24BE495	Lost Creek Mine	Mining-cabin/adits	natural decay
24BE636		Cabin	natural decay
24BE1011*	Lamarch Game Trap	Prehist. Game trap	natural decay
24BE1194*	Birch Creek CCC	CCC Camp	Bender Center Const.
24BE1202	Farlin Smelter	Mining remnants	dismantled/road const
24BE1212		Hist. Trash dump	none noted
24BE1283	Haggarty Mine	Mining-cabins/adit	modern mining
24BE1349	Buster Lode	Mining-cabin/adit	collapsed/decay
24BE1386	Deerhead Lk cabin	Cabin	collapsed/decay
24BE1390	Boot Lake cabin	Cabin/barn	collapsed/decay
24BE1391	Pear Lake cabins	3 Cabins	natural decay
24BE1393		Lithic Scatter	none noted
24BE1394		Lithic Scatter/FCR	none noted
24BE1533	Birch Cr. Guard	FS Administrative	none noted
24BE1585/ 1606	Farlin Town site	Mining-cabins	natural decay
24BE1588	Lower Plutt Ranch	Homestead/cabins	natural decay
24BE1589	Upper Plutt Ranch	Homestead/cabins	collapse/decay
24BE1604	Humboldt Mine	Mining-cabins/adit	collapse/decay
24BE1605	Indian Squaw Mine	Mining-cabin/adit	collapse/decay
24BE1610	Upper Bridge Gulch	Mining-cabins/adit	collapse/decay
24BE1623	Birch Creek	Lithic Scatter	road const./recreation
24BE1804	Birch Cr. Shelter	Rock shelter/lithic	road construction
24BE1824		Mining	none noted
24BE1906	Barbour Gulch	Lithic Scatter	none noted
24BE1999	Bridge Gulch Mine	Mining-shafts	decayed/fenced
24BE1998	Meyers Gulch Saddle	Lithic Scatter	4 wheeler traffic
24BE2049	Bridge Gulch Lithic	Lithic Scatter	cattle grazing?

* Sites formally listed on the National Register of Historic Places

H. LIVESTOCK GRAZING

1. Characterization

Suitable grazing lands have been delineated on two grazing allotments within the BWL watersheds: the Birch Creek Cattle and Horse Allotment and Lost Willow Cattle and Horse Allotment. These allotments consist primarily of National Forest lands with some some BLM lands and private ownership included. Most of the capacity in both allotments occurs in riparian areas and lower elevation uplands. Forest Service managed pastures in both allotments have not been grazed since 2005. Full numbers have not been run on the either allotment for the last 10 years because of operational needs, drought, and/or ability to comply with Forest Plan allowable utilization standards.

Land Management Direction Relevant to Livestock Grazing

2008 Revised Forest Plan
Desired Condition – People and communities benefit from programs and infrastructure that support livestock grazing and an array of forest products and services. Methods for using resources to benefit people while maintaining functioning ecosystems are employed.

Desired Condition - Resources adversely affected by past management activities have been rehabilitated.

Goal – Sustainable grazing opportunities are provided for domestic livestock from lands suitable for forage production.

Goal – Use of forage by domestic livestock will maintain or enhance the desired structure and diversity of plant communities on grasslands, shrub lands, and forests. Use will be managed to maintain or restore riparian function as defined in the allotment management plan.

2. Current Conditions

Livestock have grazed on the east side of the Pioneer mountains since the early 1900s. The following tables show the current permit and allotment information.

Table 26. Permit Information

Allotment Name	Allotment Number	Permitted Number	Class of Livestock	Season of Use	Number of Permittees
Birch Creek	10260	146	Cow/Calf	6/21-9/30	1
Lost Willow	10261	173 174	Cow/Calf Cow/Calf	6/16-9/30	2

Table 27. Allotment Information

Allotment Name	Acres Primary	Acres Secondary	Acres Unsuitable	Total Acres	Pastures	Pasture admin.

	Livestock Range	Livestock Range	Livestock Range			
Birch Creek	5157	3035	10952	19144	Bridge Gulch Station Thief Creek Limestone Greenstone Barbour Gulch	FS FS FS BLM BLM BLM
Lost Willow	8757	4962	36252	49971	Upper Birch Upper Willow North Creek Sugar Loaf Jaques North Cayuse South Cayuse Tungsten Mill Lower Willow	FS FS FS FS FS FS BLM BLM BLM

Table 28. Structural Improvements, System, & Standards

Allotment Name	Grazing System	Miles of Fence	Number of Water Troughs	Miles of Pipeline	Utilization Standards Riparian	Upland	Winter Range
Birch Creek	Rest Rotation	21.4	12 1 storage tank	8.3	50%	55%	35%
Lost Willow	Rest Rotation	13.7	12 2 storage tanks	4.55	50%	55%	35%

In 1997 the Beaverhead-Deerlodge agreed to settle the lawsuit by National Wildlife Federation by agreeing to an allotment specific NEPA schedule and interim allowable use levels until site specific allotment management could be analyzed. Since 1997, permittees on these allotments have struggled to run full numbers for the full season without being out of compliance with the Forest Plan standards incorporated by the Riparian Amendment following the lawsuit settlement. Additionally, some ranches have changed ownership and not run livestock on some years for convenience, the Forest Service has taken “Resource Protection Non Use” on some drought years, and some permittees have run livestock.

3. Reference Conditions

Vegetation in the Pioneer Mountains developed naturally with herbivory (by wild animals) as one of several disturbance processes (Pioneer LA, 1996). Livestock grazing, however, is directly related to human desires for using resources to their benefit. Livestock grazing did not become a factor in the area until the early 1900’s. We will address the gap between existing conditions and desired condition instead of using historical conditions.

Desired condition for livestock grazing (2008 Revised Forest Plan) is to provide sustainable grazing opportunities on those lands suitable for forage production. Use of

forage by domestic livestock will maintain or enhance the desired structure and diversity of plant communities on grasslands, shrub lands, and forests.

4. Synthesis And Interpretation

Under the current Forest Plan utilization standards (which essentially carry over into the 2008 Revised Forest Plan), it is highly likely that permittees will not be able to run full numbers for the full permitted season.

With increasing recreational use, potential for user conflict with livestock increases, especially at sites favored by both livestock and recreational users such as campsites. In addition, increased OHV use has increased spread and potential for spread of noxious weeds. Along with wildlife, livestock have likely contributed to this spread.

5. Recommendations

Pursue opportunities to not reissue permits or portions of permits waived to the Forest Service when not waived in preference to a new owner of qualifying base property or livestock. This would help avoid non-compliance with Forest Plan utilization standards, avoid user conflicts, and may reduce a contributing factor in weed spread.

I. TIMBER MANAGEMENT

1. Characterization

Even before the Beaverhead National Forest was established, timber was harvested in the BWL watersheds to support mining, homesteading and settlement out in the valley. Timber harvest increased greatly from the 1960;s through the mid-1980's and has declined in recent years. The decline in timber harvest across the west can be attributed to several factors; evolving administrative and judicial interpretation of agency legal requirements, advances in scientific understanding of how ecosystems work, and shifting public attitudes concerning management priorities for national Forest lands (USDA 2008). The Beaverhead-Deerlodge was never one of the higher producing timber forests in the Northern Region, and still is not. However, the low level of timber produced by the Forest over the last 10 years (12 million board feet average) has been important in sustaining local mills like Sun Mountain in Deerlodge and RY Timber in Livingston. The BWL watershed area has not been the focus of any major timber harvest efforts on the Forest, but has contributed through a number of smaller projects.

Land Management Direction Relevant to Timber Management

2008 Revised Forest Plan
Desired Condition – People and communities benefit from programs and infrastructure that support livestock grazing and an array of forest products and services. Methods for using resources to benefit people while maintaining functioning ecosystems are employed.

Goal – Product utilization: Forest products would be used to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met.

.Goal – Lands Where Timber Harvest is Allowed: manage lands where timber harvest is allowed by exception (36 CFR 219.26) to protect other resource values. Resource objectives may include, but are not limited to, protection of wildland urban interface, protection of improvements, aquatic system restoration, fuel reduction, wildlife habitat enhancement, fisheries habitat enhancement, range improvement, and grass and shrub land maintenance. Salvage activities are allowed on these lands. The type, size, and extent of harvest will be determined through site specific analysis.

2. Current Condition

Under the 1986 Beaverhead Forest Plan, a few small areas of suitable timber lands were allocated in the BWL watersheds. The predominant management allocations were for rangelands, custodial, or special management for the recommended wilderness. The actual timber harvest recorded in the drainages since data was collected in the mid 1960's reflects that, see Table 29.

Table 29. Size and Type of Timber Harvest in the BWL watersheds

Type of Harvest	Selection harvest	Clearcut harvest
Acres	1,478	831

Source: (FACTS data base)

Under the 2008 Revised Forest Plan, there are no suitable timber lands allocated for the sole purpose of producing timber. However, there are 27,753 acres identified where timber harvest is allowed to meet other resource objectives. See Map 15. The remaining 31,329 acres is identified as unsuitable for either timber production or timber harvest. Much of this lies in the portion recommended for wilderness.

3. Reference Condition

Timber harvest is a human use of the landscape related to human desires for using resources to their befit. Timber harvest did not become a factor in the areas until the late 1800's or early 1900's. We will address the gap between existing conditions and desired condition instead of using historical conditions as a reference.

4. Synthesis and Interpretation

The 2008 Revised Forest Plan does not direct us to manage timber in this watershed for the sake of timber production. However, we can use timber harvest in the BWL watersheds for the protection of wildland urban interface, protection of improvements, aquatic system restoration, fuel reduction, wildlife habitat enhancement, fisheries habitat enhancement, range improvement, and grass and shrub land maintenance. Timber harvest is a tool available to meet other resource needs and to meet the desired condition of providing benefits to people and communities. These watershed provide a good opportunity to meet that desired condition and goals of utilizing products.

5. Recommendations

Use timber harvest where allowed when it enhances the ability to meet other resource objectives and recommendations. Utilize forest products to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met.

III. INTEGRATED RECOMMENDATIONS

The Interdisciplinary Team identified several common themes that arose from individual resource recommendations. The following concerns and associated recommendations will benefit numerous resources.

Action	Rationale	Sideboards
Reduce conifer colonization in aspen stands.	*Soils*: Some soils in the watershed, Birch Creek especially, have potential to be damaged if wild fires burn uncharacteristically hot. Potential damage is tied to uncharacteristic vegetation patterns and conditions. *Watershed*: Healthy aspen and willow stands contribute to stable stream banks, appropriate stream temperatures and protect stream corridors from high intensity fire more effectively than a conifer over story. *Vegetation*: Aspen levels on the Forest and in the watershed are well below historic levels. Conifer colonization is a major contributor to a decline in size and condition of aspen stands throughout the watershed. *Fire and Fuels*: Site conversion to conifers has changed the historical fire frequency and severity in aspen stands. *Wildlife:* A natural range of diverse habitats is important to retaining diverse wildlife populations. Loss of aspen stands impacts a number of wildlife species, levels of aspen have dropped below viability requirements.	TMDL status and Forest Plan Standards may affect location of treatment in riparian areas. New aspen sprouts are vulnerable to ungulate browsing. Treat large acreages and large stands to avoid browse damage to new sprouts.
Reduce conifer colonization in mountain mahogany stands	*Soils*: Some soils in the watershed, Birch Creek especially, have potential to be damaged if wild fires burn uncharacteristically hot. Potential damage is tied to uncharacteristic vegetation patterns and conditions. *Vegetation*: Mountain mahogany is a unique species on the Forest. Conifer colonization is a major contributor to a decline in condition of mahogany stands throughout the watershed. Conifers around and within the stands increase the potential for fire effects eliminating these stands. *Fire and Fuels*: Site conversion to conifers has changed the historical fire frequency and severity in and around mahogany stands *Wildlife*: Mahogany is an important forage species, especially for wintering big game. It is a difficult species to regenerate so it is important to retain what stands are there.	Mahogany stands are vulnerable to high intensity fires.
Reduce conifer colonization in sagebrush/grasslands.	*Soils:* Some soils in the watershed, Birch Creek especially, have potential to be damaged if wild fires burn uncharacteristically hot. Potential damage is tied to uncharacteristic vegetation patterns and conditions. *Vegetation*: The extent and pattern of big sagebrush and grassland communities in the watershed has changed a lot with the absence of fire. Conifer colonization is a major	Prescribed fire along major travel routes may expand the spread of noxious weeds.

	contributor to that type conversion. Conifer removal can contribute to the persistence of these communities, contribute to landscape heterogeneity and biodiversity and provide opportunities to allow naturally ignited fires to be confined by vegetation. *Fire and Fuels*: Site conversion to conifers has changed the historical fire frequency and severity in sagebrush/grasslands. This scenario contributes to larger, more severe fires with a higher than natural return interval. *Wildlife:* Sagebrush/grasslands are important forage and cover for everything from elk and mule deer, down to small mammals, invertebrates and birds. Loss of fire from this community has affected the distribution and seral stages available for wildlife. Conifer colonization has resulted in an overall loss of coverage by this type.	
Increase acres of Douglas-fir and lodgepole in early seral condition.	*Soils*: Some soils in the watershed have potential to be damaged if wild fires burn uncharacteristically hot. Potential damage is tied to uncharacteristic vegetation patterns and conditions. *Vegetation*: Levels of early seral Douglas-fir d lodgepole on the Forest and in the watershed are well below historic levels. Converting mid-seral stands (currently at higher than historical levels) to a younger age class will restore the natural heterogeneity to the watershed. *Fire*: Douglas-fir stands have become continuous, densely stocked and are expanding into areas previously not occupied by conifer, changing the historic fire frequency and fire severity. *Wildlife:* Young seral stands are important to a number of species including snowshoe hare. Fire suppression has resulted in the development of young seral stands into mid-successional stands with no replacement young conifer habitat.	
Reclaim Indian Queen Mine and other mine sites	*Soils and Watershed*: Reduce sediment in the 303d listed streams and stabilize erosion processes. Improve water quality for fish habitat. *Heritage:* Protect the integrity and historic value of the mine sites. *Recreation*: Enhance educational and recreational experiences by interpreting both the historic value and opportunity to reduce resource impacts.	
Maintain and improve design of selected roads and trails, especially stream crossings and culvert installations.	*Soils and Watershed*: Reduce sediment arising from roads and trails by improving the design. Stabilize soils along routes. *Vegetation*: Reduce noxious weed spread through improved maintenance and controlling use around crossings. . *Fire and Fuels*: Improve ingress and egress for fire protection. Allows for improved signing for evacuation purposes. *Recreation*: Improve the quality of recreation experiences from a safety standpoint and selection of routes that provide the best experiences.	
Decommission and/or	*Soils and Watershed*: Reduce sediment arising road and trails in locations or with	

restore roads and trails identified through route analysis.	designs that cannot be brought up to a desired condition. Stabilize soils by restoring to natural grade and conditions. *Vegetation:* Reduce noxious weed spread along unmanageable routes and by reducing the total miles of roads and trails to be maintained. *Wildlife*: Stay within open motorized road and trail density objectives in the Plan. *Recreation*: Improve the quality of recreation experiences from a safety standpoint by eliminating trails that cannot be maintained to standard and eliminating routes that do not add to the general experience.	
Improve recreation facilities like campgrounds and trailheads.	*Soils and Watershed*: Reduce sediment and stabilize soils by hardening sites, controlling traffic, and improved signing and compliance. *Vegetation*: Reduce spread of noxious weeds by hardening sites, controlling traffic and improved signing and compliance. *Fire and Fuels*: Reduce fuel loading around active sites, enhance fire prevention. *Recreation*: Improve recreation experiences by providing better information, interpreting historical and natural features, and maintaining areas to standard for improved public safety.	

IV. MANAGEMENT OPPORTUNITIES

The following list of projects was developed by the ID Team from integrated and individual resource recommendations. Priorities were established for only the top four projects. Maps are provided for the aspen, sagebrush/grassland and mahogany treatments, fire protection, natural barrier enhancement, and road and trail management. The District Office has a large scale map of specific recreation proposals for trailhead and dispersed site improvement.

Project Description	Resource Objective	Further Analysis Required	Priority
Evacuation Plan	Public safety	None.	1 Should precede NEPA for fuel reduction protection
Facilities/Residences Structure Assessment	Private property protection	None.	2 Should precede NEPA for fuel reduction protection
Indian Queen Mine Reclamation	Reduce sediment contributing to 303d listing, stabilize soils, improve fish habitat, protect historic resources	State DEQ will analyze through CERCLA	3 No NEPA required
Aspen Restoration See Map 7 and 16	Maintain existing stands by removing conifer, increase acres in aspen by treating adjacent conifer stands to stimulate aspen return, restore to reference fuel model and fire behavior condition. .	NEPA	4 Greatest change in condition in Birch/Willow for veg and fire return interval, big viability issue identified in Revised Forest Plan
Facilities/Residences/Utilities/Ingress and Egress Route Protection	Reduce fuel accumulations to facilitate protection	Small NEPA	
Mid –Seral Conifer Reduction	Restore mature Douglas-fir and lodgepole stands to their reference fuel model and fire behavior condition. Increase young age class of conifers for wildlife habitat and to restore an historic range of stand conditions. Incorporate into aspen restoration and fire barrier	NEPA	- Incorporate into aspen proposals and natural fire barrier enhancement.

	proposals		
Sage/grass Restoration See Map 7 and 17	Restore stands of sagebrush and grasslands by removing conifer through slashing or burning. Restore to reference fuel model and fire behavior condition.	NEPA	-
Mountain mahogany restoration See Map 8	Reduce conifer colonization in stands, create buffer around stands for potential regeneration	NEPA	Incorporate stands into other vegetation treatment when possible
Natural Fire Barrier Enhancement See Map 18	Strengthen existing barriers to assist in wildfire control	NEPA	-
Birch Creek Recreation Facility Improvement	Improve camping and trail experiences, improve safety for users through signing.	NO	Facilities in Birch Cr would be first priority, then facilities in Willow, then Lost Creek.
Road and trail analysis See Map 20	Improve recreation system and experiences, reduce sediment and erosion.	NEPA, MVUM	Timing tied to travel analysis and MVUM production
System route maintenance and improvement, specifically, Stream crossing & springs on road 98 Uphill Creek culvert. Main Birch road, streamside See Map 20	Reduce sediment and erosion by improving stream crossings, culvert design and maintenance practices, improve recreation experiences. Priority is the 29.2 miles road & 5.7 miles of trail within 300 ft. of streams.	NO for some, small NEPA for others	Timing tied to travel analysis and MVUM production, unauthorized routes to be retained and those to be closed would be identified as an alternative.
Unauthorized route decommissioning (sign, waterbar, or restore to grade or other level of treatments as approrpiate) See map 20	Reduce sediment and erosion from route, reduce weed spread, improve recreation experiences	NEPA, MVUM	Timing tied to travel analysis and MVUM production
Noxious weed control	Protect soils and native vegetation	No	Annual
Historic Preservation Plans, prepare for Birch Creek CCC Camp and Lamarche Game Trap.	Protect nationally registered historic sites to comply with the law	No	
Historic site Interpretation, particularly Birch Creek CCC Camp, Farlin and the associated mining sites, Indian Queen Mine, Bond lake and Deerhead Lake.	Increase knowledge about local history and culture, protect sites, meet the Forest recreational niche.	No	
Intensify archaeological sampling in high density areas like Birch Creek.	Increase knowledge about local history and culture, protect sites.	No	

Evaluate known sites for potential listing in the national Register of Historic Places	Increase knowledge about local history and culture, protect sites, meet the Forest recreational niche	No	
Mine Site Reclamation	Reduce sediment and improve water quality, stabilize soils, improve fish habitat, protect historic resources	CERCLA	
Snag retention along stream banks	Retain potential for large woody debris in areas being cleaned out by firewood cutters. Retain trees along bank for bank stability	No	
Activity Fuel reduction	Continue to reduce fuels created by wood cutters	No	Ongoing
Improve and develop trailhead facilities. See map in District records. Deerhead Lakes Trailhead Minneopa Lake trailhead North Cr/Lost Cr Trailhead & kiosk Gorge Rec.Wilderness Trailhead Uphill Trailhead and kiosk. Tendoy Rec Wilderness Trailhead and kiosk Rainbow Lake Trailhead work w/ associated work inside the watershed.	Improve recreation experiences, improve compliance, reduce user conflicts, reduce sediment and erosion		
Improve concentrated dispersed campsites See map in District records Deerhead Lakes dispersed site & kiosk Boot Lake OHV dispersed site Pear Lake OHV dispersed site Bond lake dispersed site and kiosk Boyscout Flat Uphill dispersed site	Improve recreation experiences, reduce sediment and erosion. Kiosk provide information for public to reduce illegal use and reduce watershed impacts.		
Improve existing developed Campground.	Improve quality of recreation experiences and safety of campers		
Other interpretive sites: Deerhead Lake -toad population North Cr/Lost Cr –mining, ranching Gorge Trailhead –mining, sawmill			

Monitor: deterioration of historic structures toads in Deer Lake grazing standards in riparian areas.	Develop information to prevent future resource impacts		

V. PARTICIPANTS

District Ranger: Tom Osen

Team Leader: Janet Bean-Dochnahl

Core Team Members:

Steve Kujala, Fisheries Biologist
Reyer Rens, Range Management Specialist
Carly Gibson, Ecologist
Judd Hammer, Fire Management Officer
Michael Johnston, Asst Fire Management Officer
Art Rohrbacher, Wildlife Biologist
Gordon Ash, Recreation Specialist
Craig Simonsen, Transportation Planner
Mark Sant, Archaeologist

VI. REFERENCES

Soils

Web Soil Survey (WSS) 2.0, http://websoilsurvey.nrcs.usda.gov/app/ , National Cooperative Soil Survey, U

Watersheds, Streams and Aquatic habitat

Dwire K.A., Kauffman J.B., Fire and Riparian Ecosystems in Landscapes of Western USA (2003) Forest Ecology and Management, 178 (1-2), pp.61-74.

Eaton, J.G., McCormick, J.H., Goodno, B.E., O'Brien, D.G., Stefany, H.G., Hondzo, M., and Scheller, R.M.. 1995. A field Information-based System for Estimating Fish Temperature Tolerences. Fisheries 20(4):10-18.

Maxell, B. A. 2004. Report on amphibian and aquatic reptile inventories conducted on the Beaverhead-Deerlodge National Forest 2001-2003. Fisheries files, Madison-Dillon Ranger District Aquatic Resource files. Dillon, MT.

Montana Fish, Wildife, and Parks, Montana Fisheries Information System

Montana Department of Environmental Quality;

1. http://www.deq.state.mt.us/abandonedmines/priority.asp
2. http://www.deq.state.mt.us/wqinfo/index.asp
3. Personal communication with Darren Kron.

Rosgen, Dave L. 1996. *Applied River Morphology*. 89pgs.

Shepard, B.B., May, B.E., Urie, W. Status of Westslope Cutthroat Trout (Oncorhynchus clarki lewisi) in the Unitied States: 2002.

USDA. Beaverhead-Deerlodge National Forest's Sub-Watershed Report for the Birch (100200041403) sub-watershed.

USDA. Beaverhead-Deerlodge National Forest's Sub-Watershed Report for the WillowLow (100200041402) sub-watershed.

USDA. Beaverhead-Deerlodge National Forest's Sub-Watershed Report for the WillowUp (100200041401) sub-watershed.

USDA. Beaverhead-Deerlodge National Forest's Sub-Watershed Report for the Lost-Pioneer (100200041309) sub-watershed.

USDA. Beaverhead-Deerlodge National Forest's East Face Ecosystem Management Project File.

USDA. Beaverhead-Deerlodge National Forest's GIS baseline information spreadsheet, 2008.

USDA. Beaverhead-Deerlodge National Forest's Efish Electrofishing Database.

Vegetation

Agee JK. 1993. Fire Ecology of Pacific Northwest Forests. Island Press: Washington, D.C. 493 pp.

Arno, SF. 1980. Forest fire history in the northern Rockies. Journal of Forestry. 78(8): 460-465.

Arno, SF, and GE Gruell. 1983. Fire history at the forest-grassland ecotone in southwestern Montana. Journal of Range Management. 36(3): 332-336.

Arno SF, Parsons DF, RE Keane. 2000. Mixed –severity fire regimes in the northern Rocky Mountains: consequences of fire exclusion and options for the future. *In* 'Wilderness science in a time of change conference – Volume 5:Wilderness ecosystems, threats, and management; 23-27 May 1999; Missoula, MT.' Proceedings RMRS-P-15-VOL-5. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT

Baker WL. 2002. Chapter 2 Indians and Fire in the Rocky Mountains: The wilderness hypothesis renewed *In* Fire, Native Peoples, and the Natural Landscape. Island Press: Washington D.C. Pgs 42 – 76.

Bartos, DL. 2001. Landscape dynamics of aspen and conifer forests. *In* WD Shepperd, D Binkley, DL Bartos, TJ Stholgren, and LG Eskew, compilers. Sustaining Aspen in Western Landscapes: Symposium Proceedings; 2000 June 13-15; Grand Junction, CO. Proceedings RMRS-P-18. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pgs 5-14.

Brooks KN, PF Ffolliott , HM Gregersen, and LF DeBano. 2003. Hydrology and the Management of Watersheds, Third Edition. Iowa State Press: Ames, IA. 574 pp.

Dayton, WA. 1931. Important western browse plants. USDA, Forest Service, Miscellaneous Publications No. 101. Washington, D.C. 214 pp.

Dorn, RD. 1984. Vascular Plants of Montana. Mountain West Publishing: Cheyenne, WY. 276 pp.

Cole WE and GD Amman. 1980. Mountain pine beetle dynamics in lodgepole pine forests Part I: Course of an infestation. USDA, Forest Service, GTR-RM-119. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 283 pp.

Cooper, SV, P Lesica, and GM Kudray. 2005. Big sagebrush shrub-steppe post-fire succession in southwest Montana. Report to the USDI, BLM, Dillon Field Office. Montana Heritage Program, Helena, MT. 58 pp.

Cooper, SV, P Lesica, and GM Kudray. 2007. Post-fire recovery of Wyoming big sagebrush shrub-steppe in central and southeast Montana. Report to the USDI, BLM, State Office. Montana Heritage Program, Helena, MT. 16 pp. plus appendices.

Fisher WC and BD Clayton. 1983 Fire ecology of Montana forest habitat types east of the Continental Divide. USDA Forest Service, Intermountain Forest and Range Experiment Station. GTR-INT-141. Ogden UT. 83 pp.

Hendrickson, WH. 1970. Consideration of natural fire, variance in viewpoint. *In* The role of fire in the Intermountain West; proceedings of the Intermountain Fire Research Council symposium; 27-29 October 1970; Missoula, MT; USDA Forest Service.

Heyerdahl EK, RF Miller, RA Parsons. 2006. History of fire and Douglas-fir establishment in a savanna and sagebrush-grassland mosaic, southwestern Montana, USA. Forest Ecology and Management. 230, 107-118.

Intergovernmental Panel on Climate Change (IPCC). 2007. Summary for Policy Makers. *In* IPCC Fourth Assessment Report; Climate Change 2007: Synthesis Report; An Assessment of the Intergovernmental Panel on Climate Change. 22 pp.

Jelinski, DE and WM Cheliak. 1992. Genetic diversity and spatial subdivision of Populus tremuloides (Salicaceae) in a heterogeneous landscape. American Journal of Botany. 79(7): 728-736.

Kimmerer RW, and FK Lake. 2001. The role of indigenous burning in land management. Journal of Forestry. 99: 36-41.

McDonald, GI, RJ Hoff. 2001. Blister rust: an introduced plague. *In* DF Tomback, SF Arno, RE Keane; Whitebark pine communities. Island Press: Washington D.C.

Millar CI, WB Woolfenden. 1999. The role of climate in interpreting historical variability. Ecological Applications. 9: 1207-1216.

Miller, RF, and JA Rose. 1995. Historic expansion of Juniperus occidentalis (western juniper) in southeastern Oregon. Great Basin Naturalist. 55(1): 37-45.

Morgan P, Heyerdahl EK, Miller C, Gibson CE, Shapiro LB, Riser JP. 2006. Climate drivers of fire in the northern Rocky Mountains: Past, present, and future. In 'Offered paper abstracts of the First Fire Behavior and Fuels Conference, Fuels Management – How to Measure Success, 27-30 March, Portland, OR.' [Available online from: http://www.iawfonline.org/fuels/program.shtml Last accessed April 2006].

NOAA

Perry, DA and JE Lotan. 1979. A model of fire selection for serotiny in lodgepole pine. Evolution. 33(3): 958-968.

Pyne SJ. 1982. Fire in America – a cultural history of wildland and rural fire. Princeton University Press: Princeton, NJ. 654 pp.

Pierce JL, Meyer GA, Jull ATJ. 2004. Fire-induced erosion and millennial-scale climate change in northern ponderosa pine forests. Nature. 432, 87-90.

Ripple, WJ and EJ Larsen. 2001. Aspen stand conditions on elk winter ranges in the northern Yellowstone ecosystem, USA. Natural Areas Journal. 25: 326-338.

Robinson PJ and A Henderson-Sellers. 1999. Contemporary Climatology, Second Edition. Pearson Education Limited: San Francisco, CA. 317 pp.

Romme, WH. 1980. Fire frequency in subalpine forests of Yellowstone National Park. *In* Proceedings of the fire history workshop; 20-24 October 1980; Tucson, AZ. GTR-RM-81. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Range and Experiment Station. Pgs. 27-30.

Romme WH. 1982. Fire and landscape diversity in subalpine forests of Yellowstone National Park. Ecological Monographs. 52, 199-221.

Romme, WH, L Floyd-Hanna, D Hanna, and E Bartlett. 1992. Aspen's ecological role in the West. *In* WD Shepperd, D Binkley, DL Bartos, TJ Stholgren, and LG Eskew, compilers. Sustaining Aspen in Western Landscapes: Symposium Proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings RMRS-P-18. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Research Station. Pgs 243-259.

Sheley, R.; M. Manoukain; G. Marks. 2002. Preventing noxious weed invasion. Montana State University, Extension Service, Bozeman, Montana. MONTGUIDE, MT199517 AG 08/200/. 4 pp.

Turner, MG, WL Baker,CJ Peterson, and RK Peet. 1998 Factors influencing succession: lessons from large, infrequent natural disturbances. Ecosystems. 1: 511-523.

Tuskan, GA, KE Francis, SL Russ, WH Romme, and MG Turner. 1996. RAPD markers reveal diversity within and among clonal and seedling stands of aspen in Yellowstone National Park, U.S.A. Canadian Journal of Forest Research. 26: 2008-2098.

USDA. 1997. Pioneer Landscape Assessment. USDA, Forest Service, Beaverhead-Deerlodge National Forest..

USDA. `1998. East Face Ecosystem Management. USDA, Forest Service, Beaverhead-Deerlodge National Forest, Dillon Ranger District.

USDA. 2005. Forest Monitoring and Evaluation Report, Fiscal Year – 2005, USDA, Forest Service, Beaverhead-Deerlodge National Forest. Pg 45-46.

USDA. 2005. Draft Revised Land and Resource Management Plan, Draftl Environmental Impact Statement, Pgs 73-76.

USDA. 2008. Fire Effects Information System. USDA, Forest Service [Available online from: http://www.fs.fed.us/database/USDA Last accessed 30. January, 2008].

Whitlock, C, SL Shafer, and J Marlon. 2003. The role of climate and vegetation change in shaping past and future fire regimes in the northwestern US and the implications for ecosystem management. Forest Ecosystem Management. 178, 5-21.

Wirth, T, P Maus, J Powell, H Lachowski, K Suzuki, J McNamara, P Riordan, and R Brohman. 1996. Monitoring aspen decline using remote sensing and GIS – Gravelly Mountain Landscape, Southwestern Montana. Report prepared for Remote Sensing Steering Committee, USDA Forest Service. 14 p.

Wondzell, SM, and JG King. 2003. Postfire erosional processes in the Pacific Northwest and Rocky Mountain regions. Forest Ecology and Management. 178: 75-87.

Fire And Fuels

Arno, S. F. 1976. The historical role of fire in the Bitterroot National Forest. USDA Forest Service, Intermountain Forest and Range Experiment Station, Research Paper INT-187.

Arno, S.F. and G.E. Gruell 1983. Fire History at the forest-grassland ecotone Southwestern Montana. J. Range Manage. 39:332-336

Arno, S.F. and G.E. Gruel. 1986. Douglas Fir Colonization into mountain grasslands in Southwestern Montana. J. range Manage. 39:272-275.

Fischer, William C.; Bradley, Anne F. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech. Rep. INT-223. Odgen, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 1-3, 33-35 p.

Gaylor, H.P. 1974. Wildfires Prevention and Control. ISBN 0-87618-131-0 Library of Congress Catalog No. 74-14269, 1974 by the Robert J. Brady Company Aprentice-Hall Company Bowie, Maryland 20715.

Gruell, G.E. Fire and vegetative trends in the Northern Rockies: interoretations from 1871-1982 photographs. General technical report INT-158. Ogden, UT: U.S. Department of Agricutlure, Forest Service, Intermountain Forest Range Experiment Station; 1983. 117 p.

Gruell, G.E., Brown J. K. and Bushey C. L. Prescribed Fire Opportunities in Grasslands Invaded by Douglas-fir: State-of-the-Art-Guidelines. General Technical Report INT-198. United States Department of Agriculture, Forest Service, Intermountain Research Station; 1986 1-8 p.

Heyerdahl, E.K., Miller R.F., Parsons R.A., History of fire and Douglas-fir establishment in a savanna and sagebrush-grassland mosaic, southwestern Montana, USA. USDA Forest Service, Rocky Mountain Research Station, Fire Science Laboratory, Missoula Mt., Oregon State University, Department of Rangeland Resources, Corvallis OR.

Loope, L.L. and G.E. Gruell. 1973. The ecological role of fire in the Jackson Hole area, Northwestern Wyoming. Quaternary Research 3:425-443

NWCG, Fireline Handbook, January 1998, NWCG Handbook 3, PMS 410-1, NFES 0065 P. B-10 to B-19.

Van de Koppel, J., M. Rietkerk, F. van Langevelde, L. Kumar, C. A. Klausmeier, J. M. Fryxell, J. W. Hearne, J. van Andel, N. de Ridder, A. Skidmore, L. Stroosnijder, and H. H. T. Prins. 2002. Spatial Heterogeneity and Irreversible Vegetation Change in Semiarid Grazing Systems. American Naturalist 159: 209-218.

Wildlife

Christensen, A.G., L. Jack Lyon, James W. Unsworth. 1993. Elk Management in the Northern Region: Considerations in Forest Plan Updates or Revisions.

Connelly , J.W.; M.A. Schroeder, A. R. Sands, andC.E. Braun. 2000. Guidelines to Manage Sage Grouse Populations and Their Habitats. Wildlife Society Bulletin 2000, 28(4): 967–985

Hunter, M. L., G. L. Jacobson Jr., and T. Webb III. 1988. Paleoecology and the coarse-filter approach to maintaining biological diversity. Conservation Biology 4:375-384.

Montana Fish, Wildlife, and Parks 2002. GRIZZLY BEAR Management Plan for Southwestern Montana 2002-2012. FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Montana FWP.2004. Montana Statewide Elk Management Plan . Montana Department of Fish, Wildlife, and Parks Wildlife Division, 1420 East Sixth Avenue Helena, Montana 59620

Montana Fish, Wildlife, and Parks 2005. Montana's Comprehensive Fish and Wildlife Conservation Strategy

Ross, Christopher. Natural Resource Specialist, BLM Nevada State Office. Cercocarpus ledifolius NUTT. Species account.

John R. Squires, John R., Daniel H. Pletscher Co-Principal Investigator, Todd J. Ulizio, Leonard F. Ruggiero 2006. The Association Between Landscape Features and Transportation Corridors on Movements and Habitat-Use Patterns of Wolverines. Final Report # FHWA/MT-06-005/8171
prepared for The State of Montana Department of Transportation in cooperation with The U.S. Department of Transportation Federal Highway Administration. June 2006

USDA Forest Service. 2003. Northern Region Consistency in Land and Resource Management Plans

USDA Forest Service 2007. Wildlife Report – Birch Creek Fuel Reduction Project. Dillon Ranger District

USDA Forest Service 2008. FEIS Beaverhead-Deerlodge NF Forest Plan Revision.

USDI Fish and Wildlife Service 2008. Threatened, Endangered,

Utah State University. Range Plants of Utah. Curlleaf mountain mahogany account. http://extension.usu.edu/range/Woody/curlleafmahog.htm

Wooley, Stuart C. ,Scott Walker, Jason Vernon, and Richard L. Lindroth. 2008. Aspen Decline, Aspen Chemistry, and Elk Herbivory: Are They Linked? Society of Range Management. February 2008.

Recreation

USDA Forest Service 2008. FEIS Beaverhead-Deerlodge NF Forest Plan Revision.

USDA, Forest Service, 2007Rock Creek Watershed Assessment.

USDA Forest Service, 1998, East Face Pioneer Ecosystem Management Project
.
Gunderson, K and Watson, A. "Understanding Place Meanings on the Bitterroot NF, Montana", Society and Natural Resources, 20:705-721, 2007.

Heritage

Anderson, Paul and Dale Gray 1992 Survey of Selected Hazardous Mine Openings in the Pioneer Mountains, Beaverhead National Forest, Beaverhead County, Montana. Report of File, Beaverhead-Deerlodge National Forest, Dillon, Montana.

Geach, R. D. 1972 Mines and Mineral Deposits (Except Fuels) Beaverhead County, Montana. Montana Bureau of Mines and Geology Bulletin 85. Montana College of Mineral Science and Technology, Butte.

Montana Department of Environmental Quality, Abandoned Mine Reclamation n.d. Historical Narratives – Utopia Mining District.
http://www.deq.mt.gov/abandonedmines/hist_nar.asp

Sassman, Oren 1941 Metal Mining in Historic Beaverhead. Unpublished thesis, Montana State University, Bozeman. United States Department of Interior n.d. Bureau of Land Management, Mineral Survey Records, Butte, Montana.

Winchell, Alexander N. 1914 Mining Districts of the Dillon Quadrangle, Montana and Adjacent Areas. United States Geological Survey Bulletin 674. U.S. Government Printing Office, Washington, D.C.

http://www.deq.mt.gov/AbandonedMines/Index.asp

VII. MAPS*

Map 1. Vicinity of Project

Map 2. Hydrologic Unit Boundaries

Map 3. Dominant Vegetation

Map 4. Fire Groups

Map 5. Insect and Disease Infestations

Map 6. Vegetation Communities at Risk

Map 7. Change in Aspen

Map 8. Change in Mountain Mahogany

Map 9. Change in Sagebrush Steppe & Grasslands

Map 10. Fire Regime Condition Class

Map 11. Fuel Models

Map 12. Activity Fuels

Map 13. Roads and Trails

Map 14. Structures and Residences

Map 15. Timber Management Allocations

Map 16. Opportunities – Aspen

Map 17. Opportunities - Sagebrush/Grasslands

Map 18. Opportunities – Natural Barriers

Map 19. Opportunities – Protection

Map 20. Opportunities – Road and Trail Management

*NOTE: ALL MAPS ARE ON FILE AT THE DILLON DISTRICT OFFICE AT 32' x 48' PLOTTABLE SCALE OR AT http://www.fs.fed.us/r1/b-d/projects/

. APPENDIX A

. ROAD AND TRAIL ANALYSIS

INSERT CRAIGS PDF FILE HERE)

. APPENDIX B

. INDIAN QUEEN MINE REPORT

. Department of Environmental Quality

Abandoned Mine Report for "Indian Queen" Site

Data last retrieved from DEQ on 1/28/2008 5:59:18 AM

PAD: 01-034 **PAD Name:** Indian Queen **Mine District:** Utopia

County: Beaverhead **Basin:** Big Hole **Landuse:** Recreation

Comment: ?

Feature	Description	Surveyed	Priority	Closure	Comment	T R S	Drainage
CS-1		7/28/1989	2			5S 10W 15	Birch Creek
VO-2	2 = Shaft	7/28/1989				5S 10W 15	Birch Creek
CSL-1		7/28/1989	2			5S 10W 15	Birch Creek
IRW-1		7/28/1989	2			5S 10W 15	Birch Creek
P-1	1 = Adit	7/28/1989	2		UNVEG:4	5S 10W 15	Birch Creek

eld Data

ation	Date	Alkalinity (mg/l)	Flow (cfs)	pH	Conductivity (µS/cm)	Slag Area (sq ft)	Slag Vol (yds)	Tailings Area (sq ft)	Tailings Vol (yds)	Waste Rock Area (sq ft)	Wa Ro Vo (yd
L	6/15/1993	0	119	6.6	0	0	0	0	0	0	
2	6/15/1993	0	119	6.6	0	0	0	0	0	0	
-1	6/15/1993	0	0	0	0	10800	2600	0	0	0	
E	6/15/1993	0	0	0	0	0	0	0	0	0	
1	6/15/1993	0	0	6.4	0	0	0	0	0	0	
1-A	6/15/1993	0	0	5.8	0	0	0	0	0	25200	67
1-B	6/15/1993	0	0	6.2	0	0	0	0	0	0	
1-C	6/15/1993	0	0	6.2	0	0	0	0	0	0	
2	6/15/1993	0	0	7	0	0	0	0	0	5670	17
3-A	6/15/1993	0	0	6.9	0	0	0	0	0	3825	4
3-B	6/15/1993	0	0	7	0	0	0	0	0	1620	1
4	6/15/1993	0	0	5.8	0	0	0	0	0	10800	40
5	6/15/1993	0	0	6.4	0	0	0	0	0	6300	25

ab Data Solids Metals (milligrams per kilogram)

ample	Material	Date	Antimony	Arsenic	Barium	Cadminum	Cobalt	Chromium	Copper	Iron	Mercury	Manganese	Nickel	Lead	Zinc
1-034-G-1	SL	06/15/1993	3	105	42.6	4.6	57.3	40	7130	155000	0.013	14300	19	47	87
1-034-E-1	SU	06/15/1993	5	5	38.9	0.7	2.6	5.7	14	28400	0.019	237	3	9	2
1-034-E-2	SU	06/15/1993	6	448	91.8	7.9	15.4	11.1	4200	51900	0.029	1100	9	176	43
1-034-G-1	T	06/15/1993	0	102.29	14.13	169.93	0	0	3703.28	93206.2	0	11929.9	0	0	582.0
1-034-S-1	T	06/15/1993	4	74.82	521.04	2.2	6.5	5.1	400.43	30547.4	0.085	999.24	3	56	190.1

1-034- /R-1	WR	06/15/1993	4	759	9.1	7.4	20.2	17.1	15900	107000	0.169	2910	10	503	43
1-034- /R1-A	WR	06/15/1993	0	53.16	556.71	128.19	381.4	0	602.77	23655.2	0	634.1	0	0	97
1-034- /R1-B	WR	06/15/1993	0	1198.19	0	191.25	0	0	12750.4	146359	0	5017.96	0	398.82	77
1-034- /R1- :1-)UPA	WR	06/15/1993	0	764.01	400.44	0	0	0	988.12	65523	0	1879.9	0	0	677.9
1-034- /R1- :-DUP	WR	06/15/1993	0	743.52	389.66	0	642.45	0	987.09	65119.6	60.86	1925.16	0	0	698.7
1-034- /R-1- :OMP	WR	06/15/1993	0	1133.4	17.22	0	0	0	11193.8	144340	0	3971.03	0	271.83	545.2
1-034- /R-2	WR	06/15/1993	9	377	253	15.6	9.7	8.1	826	28000	0.822	1800	12	20	64
1-034- /R2-A	WR	06/15/1993	0	1688.9	23.93	230.71	0	0	1940.83	144100	0	4658.58	0	120.5	559.5
1-034- /R-2- :OMP	WR	06/15/1993	0	289.45	497.06	0	0	0	432.78	38154.2	0	1724.49	0	0	675.3
1-034- /R-3	WR	06/15/1993	11	5210	79.1	11.5	74.6	48.2	13500	92100	0.215	1820	25	468	149
1-034- /R3-A	WR	06/15/1993	0	2957.57	116.74	163.72	0	0	13516.8	110156	0	2796.56	0	562.33	1598.2
1-034- /R3-B	WR	06/15/1993	0	1765.51	0	180.25	0	0	928.48	154657	0	5063.59	0	0	335.4
1-034- /R-3- :OMP	WR	06/15/1993	0	3334.95	146.47	0	0	141.44	11880.5	101122	0	2477.05	0	380.74	1175.1
1-034- /R-4	WR	06/15/1993	3	1150	55.1	1.3	12.3	16.4	2070	88400	0.715	2320	7	96	24
1-034- /R4-A	WR	06/15/1993	0	154.09	512.69	0	0	0	209.06	21125	0	773.07	0	31.62	158.7
1-034- /R-4- :OMP	WR	06/15/1993	0	993.59	295.41	0	741.63	0	1053.42	98303.3	0	3195.08	0	49.95	273.2
1-034- /R5-A	WR	06/15/1993	0	3824.48	343.52	0	675.29	0	6434.64	82658.4	0	2248.77	0	100.57	776.8