Thomas Fork Watershed Analysis

Montpelier Ranger District,
Caribou-Targhee National Forest

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Proper management of natural resources requires a cooperative spirit of watershed community or we will all suffer the consequences. We could use examples from any of the resource areas in this analysis to support this phrase. Since a Fisheries Biologist is writing this paragraph, let's consider native Bonneville cutthroat trout that inhabit the Thomas Fork Watershed. The Forest Service has a responsibility to maintain the viability of these populations on National Forest Lands. Resident populations spending their entire lives in upper tributary streams may survive over the short term, but may have a high probability of disappearing over the long term without connectivity with the fluvial (river dwelling) cutthroat that exist in the main stem Thomas Fork. It's these river fish that re-found extirpated populations and provide genetic interchange. The Caribou-Targhee and Bridger-Teton National Forests will not likely fulfill their requirements to maintain the long term viability of Bonneville cutthroat trout populations on National Forest Lands without cooperating with willing landowners and other agencies to address the connectivity issue discussed in this document.

This "watershed community" concept is why the team decided to include the entire Thomas Fork Watershed (where data allowed) in this analysis. We followed the Federal Guide to Watershed Analysis (Ecosystem Analysis at the Watershed Scale) when conducting this project. This process generally takes a look at past and current conditions to develop an idea of trends. Recommendations are made to change undesirable trends and maintain desirable trends.

This document and the Thomas Fork State Agricultural Water Quality Project Final Planning Report (Bear Lake Soil and Water Conservation District 1999) will serve agencies and the public as a source for restoration opportunities and an information clearinghouse. As more information is collected, this document can be amended.

Project Area Description

The Thomas Fork Watershed analysis area is 150,100 acres in surface area and includes parts of Idaho and Wyoming. The Thomas Fork is a south aspect watershed located in the Central Bear River Subbasin. This is located on the break between the Middle Rockies and Great Basin provinces. Elevations in the analysis area range from 6075 (the Bear River) to 9313 feet (Sublette Mountain). US Highway 89 bisects the analysis area. Towns in the analysis area include Geneva and Raymond, Idaho.

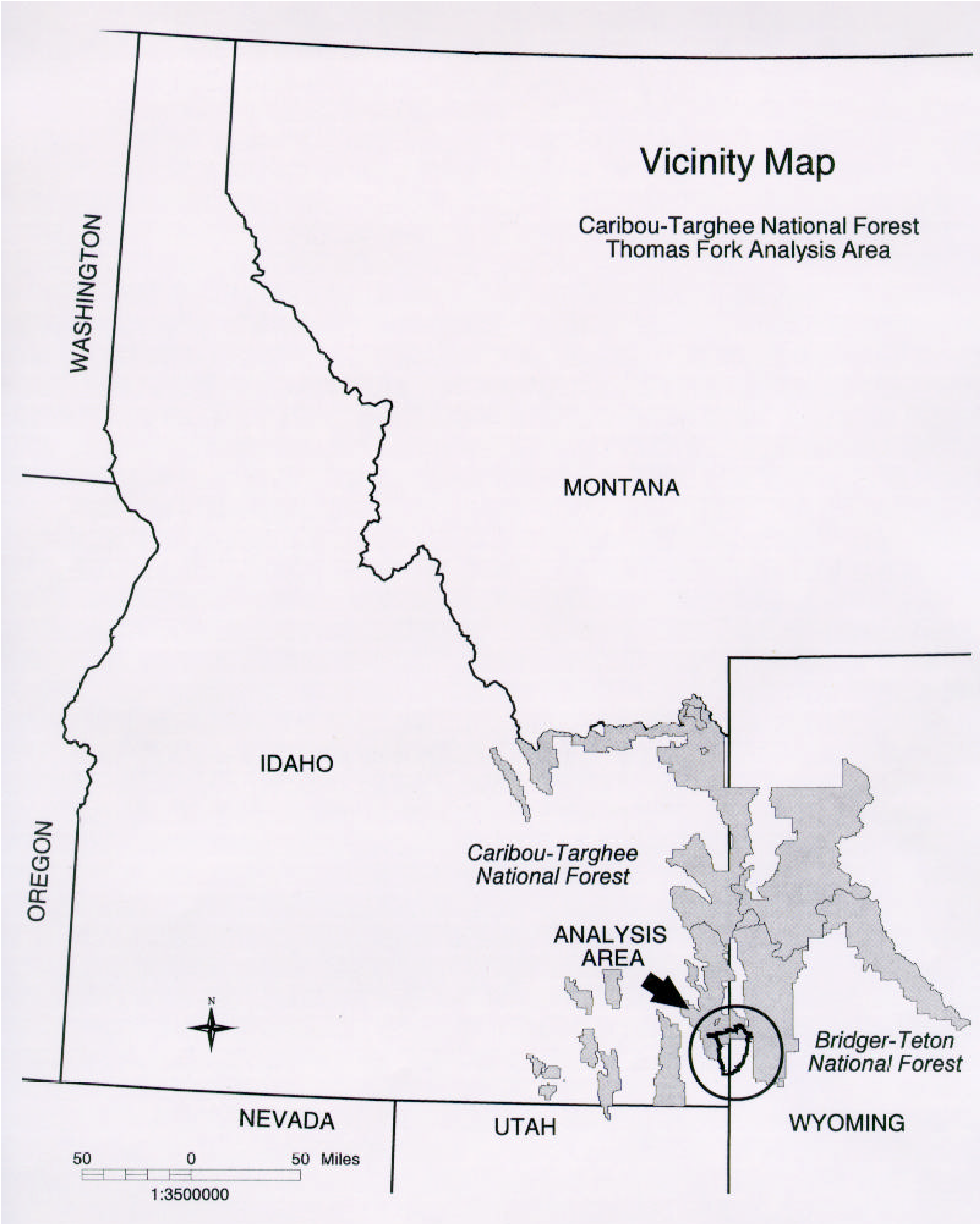

Figure 1. Thomas Fork Watershed Analysis Area Map

Of the total 150,100 acres that make up the watershed, 33% is private land, 63% is federal land, and 4% is state land. Approximately 4% of the watershed is being used for irrigated cropland, 3% for non-irrigated cropland, 5% for irrigated pastureland, 2% for non-irrigated pastureland, 19% for private rangeland and forestland, and 67% for public rangeland and forestland (Bear Lake Soil and Water Conservation District 1999).
The watershed is made up of six primary sub-watersheds: the upper Salt, Giraffe, Coal, Dry-Preuss, Geneva, and Border-Raymond. Upper Salt Creek drains the northeast portion of the watershed through itself and four main tributaries: Little White, Lost, Water Canyon, and Packstring creeks. This drainage is located entirely in Wyoming. Giraffe Creek originates in Idaho before entering Wyoming and being joined by its sole major tributary, Robinson Creek. Giraffe Creek drains the north-central portion of the watershed before joining Salt Creek just above Coal Creek. Coal Creek drains the eastern part of the watershed through itself and three main tributaries (Muddy, Huff, and Stoner creeks). As Salt Creek enters Idaho it becomes the Thomas Fork. Once in Idaho the main tributaries include Preuss, Dry, and Raymond Canyon Creeks. Dry and Preuss Creeks, drain the extreme northwestern part of the watershed. These streams are diverted into the Geneva Ditch before their confluence with the Thomas Fork. The primary tributary in the lower watershed is Raymond Canyon. Again a diversion prevents flows from reaching the main stem of the Thomas Fork except for brief period during spring runoff. For the most part, the Thomas Fork receives its full complement of water before the confluence with Dry Creek. From this point it flows south for 12 miles to its confluence with the Bear River.

Direction for the management of the Caribou-Targhee National Forest portion of the analysis area can be found in the old Caribou Forest Plan as amended by the Inland Native Fish Strategy (INFISH). Specific descriptions and direction for forestland in the analysis area can be found in the Caribou Forest Plan on page IV-52, Management Area 001, Geneva Management Area and the INFISH Environmental Assessment.

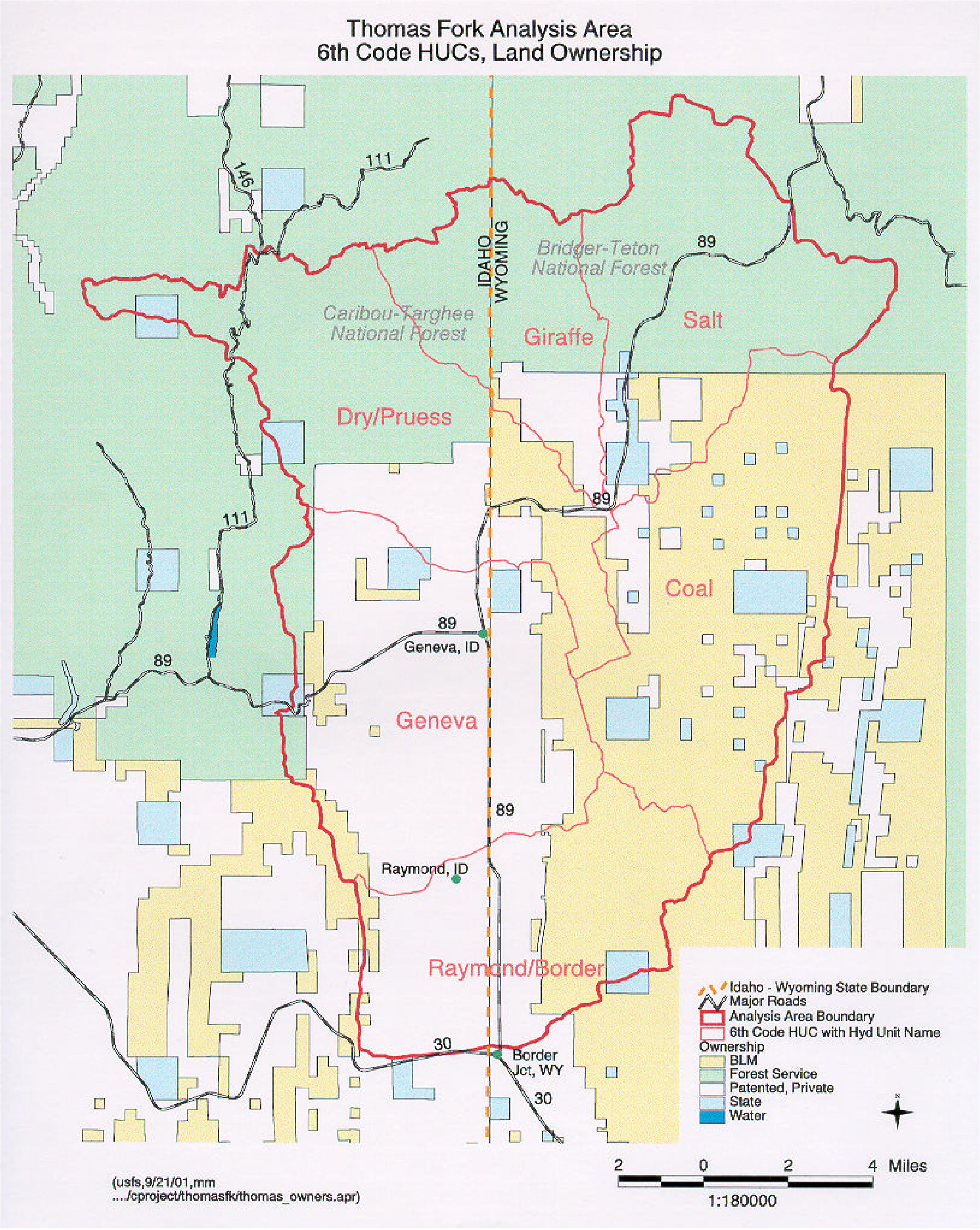

Figure 2. Land Ownership in the Thomas Fork Analysis Area

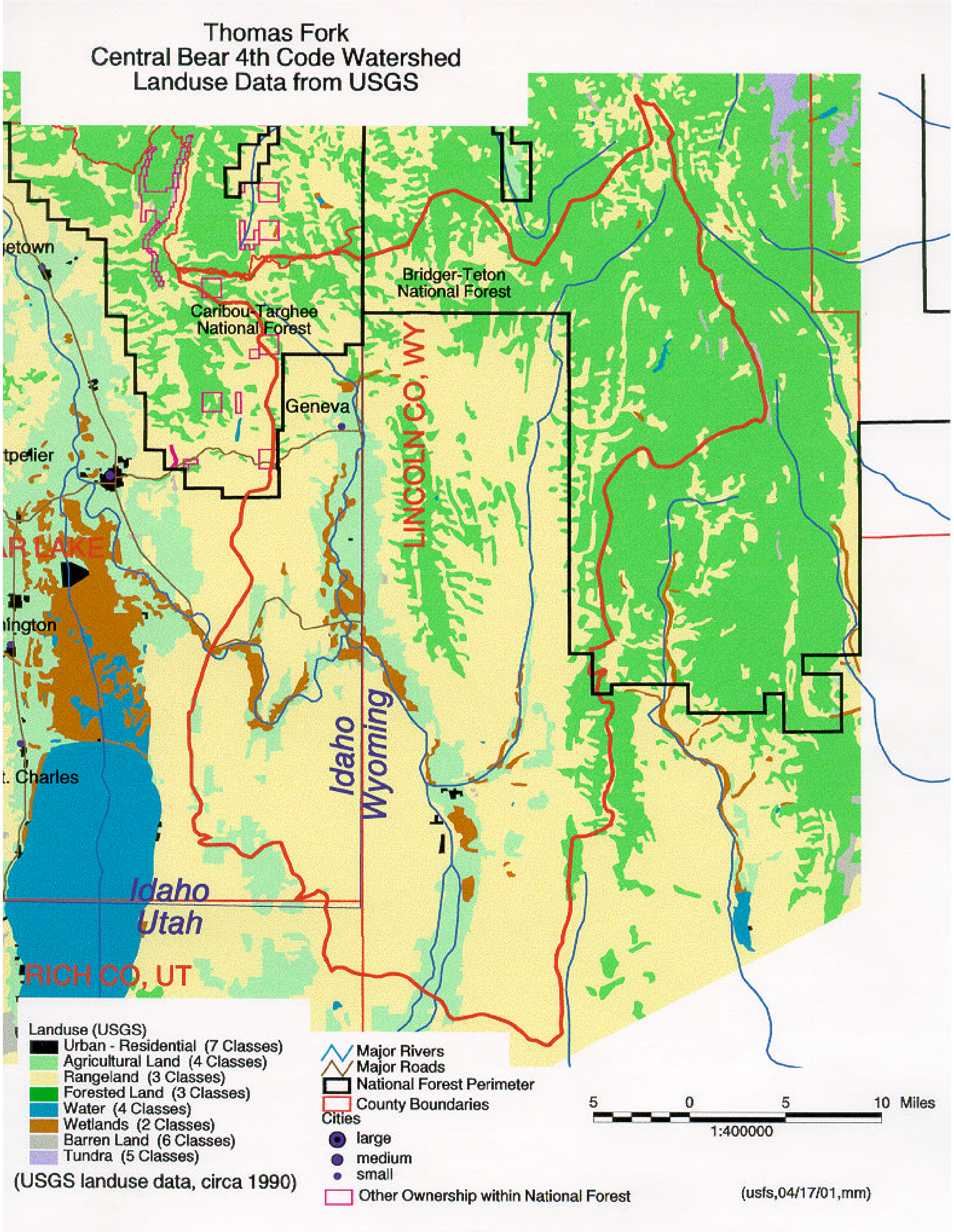

Figure 3. Land Use within the Thomas Fork Analysis Area

Watershed Analysis Process

The purpose of watershed analysis is to develop and document a scientifically based understanding of the processes and interactions occurring within a watershed. This document is our current understanding of the Thomas Fork Watershed of the Bear River.

A watershed analysis is an interdisciplinary process that compares the past and current conditions of an analysis area to develop an understanding of resource trends. The report culminates with several recommendations developed to address the identified trends.

No decisions are made with this document. The findings represent a foundation on which to develop site-specific project proposals and base specific decisions.

The Thomas Fork Watershed Analysis was conducted by a Forest Service interdisciplinary team, with data source assistance from neighboring citizens and agencies. Little new data were collected by those who wrote this document. Rather, they primarily used existing information, including, surveys, documents, maps, photos, and anecdotal information.

Contributors

Interdisciplinary Team

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We thank Dennis Duehren, Russel Boehme, Garth Boehme, Bruce Bowman, and Wendell Johnson for their assistance with this analysis. We thank Dennis Duehren, Carol Lyle, Ric Rine, and Lee Leffert for providing edits.

ISSUES AND KEY QUESTIONS

SOIL

Over 50% of the soils on the Forest within this analysis area are classified as unstable. Approximately 32% of the soils have a high and very high surface erosion hazard. Soil productivity is generally low due to the large acreage of shallow, infertile soils derived from the Preuss Creek shale formation. Any soil disturbing or grazing activity warrants close monitoring to protect these erosive and unstable soils. Timber productivity potential is very low. Range productivity potential is moderate on slopes under 40%.

A variety of soil types occur within the analysis area. Sensitivity of these variations and protection of their integrity will minimize management impacts. Resource management in the analysis area has the potential to increase the amount of soil compaction and erosion in the analysis area.

1. How much and what proportion of the accelerated sediment source in the Thomas Fork watershed occurs on Caribou-Targhee National Forest lands?

2. What is the extent of soils impacted by conversion of native vegetation to irrigated and dry-land cropland. What are the sediment delivery means from these lands?

3. What is the extent and what are the impacts to long-term soil productivity as the result of removal of riparian vegetation and straightening the channel of Thomas Fork?

4. What are the impacts to soils from the “loss of aspen” on National Forest Lands.

5. Where are the major livestock grazing impacts in the Thomas Fork watershed and how has livestock grazing impacted soil?

WATER

The Thomas Fork is an Idaho Department of Environmental Quality 303(d) stream. Factors contributing to the listing include sediment and nutrient loading. Causes of impacts to water resources include overgrazing, flow alterations, sedimentation, mass wasting, lack of adequate riparian vegetation, and lack of proper irrigation water management and nutrient management (Bear Lake Soil and Water Conservation District 1999). Resource management on the Forest has the potential to increase the amount of sedimentation and decrease water infiltration on the Forest.

1. What are the important sediment delivery mechanisms? What are the historic sediment delivery mechanisms?

2. How do the sediment delivery rates compare with natural processes?

3. Where are the high risk areas?

4. How has land management affected water quantity and quality? To what extent have these changes affected stream channel function?

5. What management and restoration measures should be implemented to address impacts to riparian areas and stream channels and what are their priorities?

FIRE

Fire performs many roles within southeastern Idaho ecosystems. Topography, elevation, soils, and climate work in concert with fire to influence these ecosystems. These factors influence plant community composition, drive vegetation succession, regulate fuel accumulations and nutrient cycling, influence the scale of vegetation disturbance, affect wildlife habitat, interact with insects and diseases, and influence ecosystem productivity. The size, severity, and frequency of fires will result in varying degrees of impact on each of these fire effects.

Fire suppression, historic grazing practices, and removal of Native American ignition sources has had an impact on forest and non-forest cover types. The lack of fire has resulted in two primary changes. First, it has resulted in an increased incidence of large fuel accumulations. Secondly, it has caused modification of vegetation structure and composition.

1. What are the historic fire regimes per habitat type in the analysis area?

2. How do current conditions compare with historic fire regimes?

3. If current fire regimes are outside historical ranges what are the management implications?

4. What and where should management actions occur to address the management implications?

FORESTS

The majority of the conifer and aspen stands in the watershed are mature to over mature. Generally, both lodgepole pine and aspen stands are being invaded by shade tolerant species – alpine fir and Douglas-fir. If conditions do not change the shade tolerant species that exist presently in the understory will become the overstory. In these locations human disturbance has and still is minimal. Endemic beetle attacks have and are occurring in these stands.

1. What should be the role of insects and disease within the forest vegetation types?
2. What values should the conifer and aspen stands contribute to the overall health of the watershed?
3. What should the quantities and age distribution be for both conifer and aspen?
4. Silviculturally, what are the conditions of the stands and what needs to be done to maintain or enhance their condition?

RANGELANDS

An ecological approach requires consideration of three elements, biological and physical (biophysical), social and economic needs.

Basic characteristics of ecosystems include structure, composition, processes, and patterns. Our working assumption is that naturally evolving ecosystems (minimally influenced by humans): were diverse and resilient, and that within the framework of competition, evolutionary pressure, and changing climates, these ecosystems were sustainable in a broad sense. Many present ecosystems modified by human influences do not have all these characteristics. Our guiding premise for sustaining ecosystems and protecting biodiversity now and into the future is to manage ecosystems such that structure, composition and function of all elements: including their frequency, distribution, and natural extinction, are conserved. Conservation focuses on maintaining and restoring suitable amounts of representative habitats over the landscape and through time.

Ecosystems vary in time and space. Changes may be rapid or gradual but change occurs. The term "historic range of variation" refers to ecosystem structures, compositions, processes and patterns for a specified time and for a specific area. The potential for survival of native species is reduced if their environment is pushed outside the range of natural variation. Ecosystems have the capacity to change drastically over short or long periods of time and from place to place. As a result, ecosystem components and processes are adapted to a range of conditions. It is believed that native species adapted to and, in part evolved with the disturbance events of the preceding several thousand years. This provided patterns of landscape over time, under natural conditions. This definition is relatively narrow, and reflects those processes, which were more cyclical and occurred with a more or less predictable frequency. Examples of such processes would include cycles of drought, fire incidence and population fluctuations in biota. Additionally, thresholds are developed using the concept of the historical range of variation. Threshold areas are identified to establish acceptable ranges that provide for ecosystem sustainability and resiliency.

1. Structure is a means to express the balance of age and size classes for the cover types. *Does structure reflect a balance not exceeding the sustainable biological and physical capabilities of the rangeland cover types?*

2. Composition is an expression of dominant species present in the covertypes. In rangeland covertypes this requires a smaller coverage of mature plants to allow development of ground cover species such as grass, forbs, and shrubs to limit the amount of bare soil. *Do the species present provide for recruitment and sustainability of early seral species while still maintaining the diversity of all successional species?*

3. Disturbance regime is used to characterize processes and includes all known historical disturbances that have affected the ecosystems. These include past grazing, foraging by

wildlife ungulates, flood, insects, diseases, and fire. Each ecosystem has some distinction concerning which disturbance factors are or have been active. *Are disturbance regimes within the range of natural variability to provide diverse, resilient, and sustainable rangeland ecosystems?*

4. Patterns are an indication of how ecosystems function among and between themselves. Pattern addresses the size, shape, age class, distribution, and juxtaposition of structures in and adjacent to each covertype. *Are the patterns among and between cover types consistent with historical ranges for ecological units?*

FISHERIES

Bonneville cutthroat trout, a Regional Foresters Sensitive Species, occur in the analysis area. The Bear River East Metapopulation is rated at a high risk of extinction due to impacts from land management on and off the Forest. A restoration program that incorporates concerned residents and public agencies will be needed in order to restore Thomas Fork Bonneville cutthroat trout populations.

1. How and to what extent has the historic migration of Bonneville cutthroat trout been affected by land management activities, particularly irrigation diversions and grazing?
2. What are the dominant sediment delivery mechanisms in the analysis area and how did they compare with natural processes? Where are the high risk areas?
3. How and to what extent has the historic habitat quality and quantity of Bonneville cutthroat trout and other native species been affected by land management activities? What actions are required to address these factors?
4. How and to what extent has native fish in the Thomas Fork been affected by the introduction of non-native fish? What actions are required to address these factors?
5. What survey and monitoring should be conducted or continued to gain a better understanding of the quality and quantity of aquatic species habitat and populations?

WILDLIFE

Wildlife is dependent on a variety of vegetation with different structure and composition types. Wildlife can impact social values. Wildlife can be impacted by human presence.

1. Is conifer and aspen forest composition and structure (snags, age/old growth, canopy closure, and stem density) meeting the needs for wildlife (owls, woodpeckers, raptors, and cavity dependent species)?
2. Is mountain brush (bitterbrush) composition and structure (age class, availability, and species) meeting the needs for wildlife (wintering big-game and migratory birds)?
3. Is sagebrush composition and structure (canopy cover and understory) meeting the needs for wildlife (sage grouse)?
4. Are riparian areas (willows and ground vegetation) meeting needs of wildlife?
5. Is the riparian and upland composition and structure (willows and aspen) along streams meeting the needs of beaver to maintain dams?
6. Is there a potential for wolf and livestock interactions causing mortality to either?
7. Do we have suitable quantity and quality of lynx denning and snowshoe hare foraging habitat?
8. Is cross-country snowmobiling impacting wildlife populations (lynx or wolverine)?
9. Is off road/trail travel of ATVs causing harm to rare plants?

RECREATION

The Thomas Fork Watershed is a popular area for recreation. Recreation uses are seasonal, but occur all year. Forest visitors seeking a recreation opportunity rely on motorized access. All terrain vehicle use is increasing throughout the watershed. As the population increases so has the demand for recreation increased particularly on federal lands.

1. Are existing dispersed campsites in appropriate locations? Are we getting unacceptable resource impacts from them?
2. Is the level of cross-country motorized travel adequate for recreation users? What are the impacts and do we need to constrain it?
3. Are current recreation facilities adequate for the watershed?
4. Are the quality and quantity of roads and trails adequate for recreation use?

TRANSPORTATION

Forest roads and trails are used to access and manage resources on National Forest Lands.

1. Is the transportation system appropriate for the uses of Forest.
2. Are there maintenance needs on the existing roads?
3. Are there restoration opportunities associated with the existing road system?

CHARACTERIZATION

SOIL

Much of the following information is summarized from the Thomas Fork Water Quality Project Final Planning Report/Environmental Assessment prepared by the Bear Lake Soil and Water Conservation District in cooperation with the USDA Natural Resources Conservation Service and Forest Service, USDI Bureau of Land Management, Idaho Department of Agriculture, Idaho Department of Fish and Game, Idaho Department of Environmental Quality, Wyoming Game and Fish Department and others dated April 1999.

Geology

The Thomas Fork of the Bear River occupies a narrow, north-south trending valley bound on the east side by the Sublette Range, the Gannet Hills to the north and the Preuss Range and Sheep Creek Hills to the west. The Thomas Fork 5^{th} code watershed analysis area is located in a transition zone between the Middle Rocky Mountains and Basin and Range Geomorphic Provinces. The Thomas Fork valley may be a down-thrown block typical of the Basin and Range. The bordering mountains are typical of the folded and faulted over-thrust belt.

Bedrock of the Preuss Range and Gannet Hills consists of Jurassic Age sedimentary rocks including limestone, siltstone, claystone and salts with a thin smear of Tertiary age deposits on top. The Sublette Range is formed in Upper Paleozoic and Mesozoic Age sedimentary rocks including limestone, sandstone, siltstone, shale and mudstone. The Sublette Range also has a thin smear of Tertiary age siltstone, sandstone, conglomerate and gravels. The parent rocks of the Preuss Range, Gannet Hills and Sublette Range are unstable and subject to slumps and slides. The valley material through which the Thomas Fork flows is Quaternary sediments. Phosphate was mined north and east of Border Junction in Layland Canyon, Rose Canyon and Raymond Creek. Reports prepared by the Wyoming Department of Environmental Quality indicate that runoff from these old mines is thought to influence the waters of the Thomas Fork.

Soils

A variety of ages, intensities and purposes are found in existing soils information for the analysis area. The authors of the Thomas Fork Water Quality Project Final Planning Report/Environmental Assessment have done an admirable job of leveling the reports. Their approach will be used in presenting the following summary.

Flood Plain Soils: The soils on the flood plain consist mainly of the Bear Lake series with surface textures of silty clay loam and silt loam. They are very deep, poorly drained and have moderately slow permeability. A high water table is present from about 0 to 18 inches in winter and spring. Included with these soils are small areas of very poorly drained soils that support cattails and rushes in standing water.

Terrace Soils: The remaining soils in the valley bottom are on low to high terraces. The soils on the low terraces are mainly the Raynal, Thomasfork, Lago and Picabo series. They have silty clay loam and silt loam surface textures. They are very deep and generally poorly drained. These soils have high water tables at about 18 to 24 inches in the winter and spring.

The soils on the high terraces are mainly Bern, Buist, Georgecanyon and Thatcher series. Surface textures are mainly silt loam on the Bern and Thatcher series and gravelly silt loam on the Buist and Georgecanyon series. They are very deep and well drained except for the Bern series, which is moderately well drained. Bern soils have a high water table between 48 and 60 inches.

Hillside Soils: The soils on hillsides are mainly in rangeland and consist of two main groups of soils: the Sprollow, Mumford and Lonjon group and the Vipont, Prucree and Dipcreek group. Slopes range from about 10 to 50 percent. The first group is located on the west side of the valley, is moderately deep to shallow and generally has surface textures ranging from gravelly silt loam to very channery loam. These soils are very high in carbonates, which limits soil fertility. They are well drained and have moderate permeability.

The soils in the second group are located on the northwest end of the valley and generally have surface textures ranging from sandy loam to very stony loam. Soils are very deep to moderately deep to shallow. These soils are well drained and have moderately slow to moderately rapid permeability.

Mountain Soils: The soils in the mountains occur on both BLM and USFS administered lands. They are mainly in rangeland and timber and have slopes ranging from 0 to 75 percent. These soils are placed in three groups: the Beaverdam, Piskun, and Farlow group; the Youman, Wesdy and Amsden group and the Taylor Creek, Reck and Mayflower group.

The first group of soils is found on side slopes and in narrow valley bottoms. They typically have surfaces textures ranging from loam to gravelly loam to extremely gravelly sandy clay loam. These soils are moderately deep to deep, well drained and have moderate to slow permeability.

The second group of soils is found in valley bottoms and on side slopes. They generally have surface textures ranging from loam to silty clay loam to gravelly loam. The soils are very deep, well drained and have moderately slow permeability. Areas of high soluble salt concentrations are common.

The third group of mountain soils is on side slopes. They generally have surface textures ranging from clay to cobbly loam to fine sandy loam. The soils are very deep, well drained and have moderately slow permeability.

WATER

Introduction to the Hydrologic Analysis

For any given location there are four primary components that regulate landscape development or expression. These four components frame the fundamental signature of a landscape and must be described to properly evaluate a watershed's function. These components/characteristics are parent geology, topography, geography, and climate. The long-term interaction of these components creates three dominant landscape features: soils, hydrography, and vegetation (McCammon 1999). This hydrologic analysis describes the first three components and the landscape features under the heading "Drainage Basin Description" and the fourth component under "Climate". These primary landscape components and features are then subject to a variety of natural and human-related disturbances that occur at varied frequencies and magnitudes across the landscape. These interactions and the resulting conditions are described in Chapter 3 under the headings "Watershed Conditions" and "Riparian Conditions". Finally, watershed and riparian conditions can affect the balance between the multiple processes acting to form and maintain the physical channel and water quality. These processes and conditions are discussed in Chapter 3 in the sections titled "Stream Conditions" and “Water Quality.”

Drainage Basin Description

The Thomas Fork is a south aspect watershed located in the “Central Bear River Subbasin.” This is located on the break between the Middle Rockies and Great Basin provinces. The Thomas Fork watershed is an area of steep to moderately steep (30-60%) mountains that rise from semi-arid sagebrush plains and wide alluvial valleys. Elevations range from 6075 (the Bear River) to 9313 feet (Sublette Mountain). The geology is almost exclusively sedimentary rocks with siltstone, mudstone, limestone, and sandstone being the primary types. These parent materials are considered unstable as they experience periodic mass wasting (scattered debris flows, fan complexes and slumps) and have moderate to high erosion rates. In many parts of the drainage, slumps and slides have been large enough to move the stream channels. The result is that sections of these streams flow past or through large areas of unconsolidated flow and slump material and transport these sediments downstream (1998 Wyoming 305(b) Water Quality Assessment). When subject to erosive forces these rock types break down into silt and clay sized particles (this mineralogy is important in determining sediment delivery, sediment routing, and water quality effects). Once eroded these soil particles are readily transported down these steep slopes to the valley bottoms. These processes of extensive folding, faulting, mass failures, and erosion formed the general topography seen today.

This 149,164 acres (233 sq.miles) watershed is made up of six primary sub-watersheds: the upper Salt, Giraffe, Coal, Dry-Preuss, Geneva, and Border-Raymond. Upper Salt Creek drains the north-east portion of the watershed through itself and four main tributaries: Little White, Lost, Water Canyon, and Packstring creeks. This drainage is located entirely in Wyoming. Giraffe Creek originates in Idaho before entering Wyoming and being joined by its sole major tributary, Robinson Creek. Giraffe Creek drains the north-central portion of the watershed before joining Salt Creek just above Coal Creek. Coal Creek drains the eastern part of the watershed through itself and three main tributaries (Muddy, Huff, and Stoner creeks). As Salt Creek enters Idaho it becomes the Thomas Fork. Once in Idaho the main tributaries include Preuss, Dry, and Raymond Canyon creeks. Dry and Preuss creeks, drain the extreme northwestern part of the watershed. These streams are diverted into the Geneva Ditch before their confluence with the Thomas Fork. Only in high water years does any flow find its way into the Thomas Fork and then only from overflow from the Geneva Ditch. The primary tributary in the lower watershed is Raymond Canyon. Again a diversion prevents flows from reaching the main stem of the Thomas Fork except for brief period during spring runoff. For the most part, the Thomas Fork receives its full complement of water before the junction with Dry Creek. From this point it flows south for 12 miles to its confluence with the Bear River.

For the most part these streams flow through broad, low gradient, alluvial valley bottoms that have cross sections that can be described as either “flat” or “U” shaped. When well vegetated, these valley bottoms are effective in filtering sediments produced on the adjacent slopes. Therefore, natural in-stream sediment levels are dominated by instream sources. In addition to the streams, the basin also includes Huff Lake and many small ponds.

Climate-Precipitation

Expressions of Climate, such as precipitation, play a vital role in determining the character of the physical landscape. In fact, precipitation is the dominant driver of hillslope and hydrologic processes and disturbances in mountainous watersheds. While precipitation is the dominant driver, it is difficult to predict exact conditions and the consequences of various events due to the highly stochastic nature of this element.

Data Sources:

- Data was obtained from the National Weather Service Cooperative Network Station "Border 3 N. Wyoming" (480915).
- Data was also obtained from the Natural Resource Conservation Service’s Giveout (Idaho) and Salt River Summit (Wyoming) Snotel Sites.

Assumptions:

- The Border Climate Station was assumed to represent average conditions in the lower Thomas Fork Watershed (6171 feet).
- The Giveout Snotel site was assumed to represent average conditions in the mid-elevations of this watershed (6840 feet).
- The Salt River Summit Snotel was assumed to represent average conditions in the upper elevations of this watershed (7600 feet).

Analysis Results

Border WY Climatic Summary

Annual precipitation averages 14.2 inches, which is evenly distributed throughout the year. This precipitation is primarily snow between mid-November and March; a rain-snow mix between March and April and in early November; and rain between May and November. Snow accumulation begins in late November reaching a maximum in February. At this point, the average maximum temperature exceeds freezing and melt begins. This lower portion of the watershed is generally snow free by mid-April. This pattern of snow accumulation and melt is typical of a snowmelt-dominated system. Table 1 summarizes the climate data for this station.

Table 1: Climatic Data from Border Wyoming

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave Max Temp (F)	**24.8**	**29.9**	**38.8**	**51.5**	**63.5**	**72.9**	**82.4**	**80.7**	**71.6**	**59.6**	**40.7**	**27.0**	**53.6**
Ave PCP (in)	**1.24**	**1.01**	**.94**	**1.15**	**1.49**	**1.37**	**1.03**	**.99**	**1.51**	**1.12**	**1.23**	**1.13**	**14.21**
Ave Total Snowfall (in)	**14.5**	**12.4**	**9.8**	**6.0**	**1.5**	**0**	**0**	**0**	**.5**	**2.5**	**8.1**	**11.7**	**67.1**
Ave Snow Depth (in)	**12**	**14**	**10**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**6**	**--**

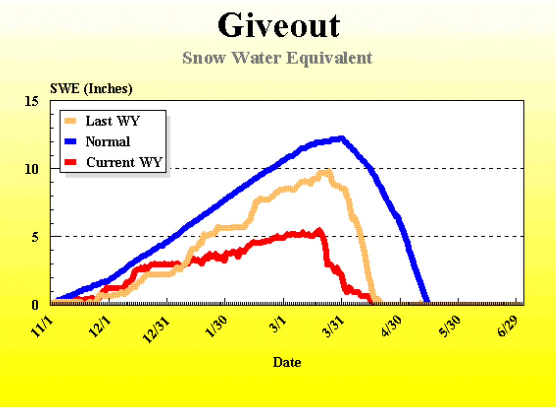
Giveout ID Climatic Summary

Annual precipitation averages 23.4 inches, with 52% occurring between Nov 1-Feb 28 in the form of snow. Precipitation then tapers off reaching a low in July and August where thunderstorms may be common. The maximum snow water accumulation generally occurs about April 1st with the area being snow free by mid-May. The period of maximum melt is between April 15th and May 15th.This pattern of snow accumulation and melt is typical of a mid elevation snowmelt dominated system. Table 2 and Figure 1 summarize the climate data for this station.

Table 2: Climatic Data from Giveout Idaho

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave PCP (in)	**3.30**	**2.60**	**2.30**	**2.10**	**1.90**	**0.90**	**0.70**	**0.70**	**1.20**	**1.40**	**3.00**	**3.30**	**23.40**
SWE – mid month (in)	**6.2**	**9.3**	**11.8**	**10.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.9**	**3.2**	**--**

Figure 4: Normal Snow Water Content and Patterns for Giveout Idaho



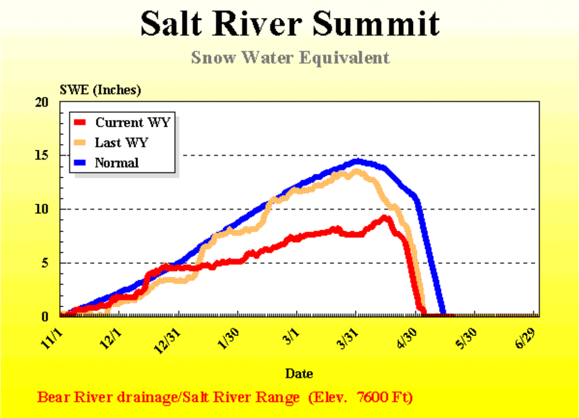
Salt River Summit WY Climatic Summary

Annual precipitation averages 27.4 inches, with 49% occurring between Nov 1-Feb 28 in the form of snow. Precipitation then tapers off reaching a low in July and August when thunderstorms may occur. The maximum snow water accumulation occur generally occurs about April 1st with the area being snow free snow free by mid-May. The period of maximum melt is between May 1st and May 15th. This pattern of snow accumulation and melt is typical of a high elevation snowmelt dominated system. Table 3 and figure 2 summarize the data for this station.

Table 3: Climatic Data from Salt River Summit Wyoming

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave PCP (in)	**3.84**	**2.75**	**2.19**	**1.92**	**2.20**	**1.64**	**1.37**	**1.37**	**1.65**	**1.65**	**3.29**	**3.56**	**27.43**
SWE – mid month (in)	**7.0**	**10.6**	**13.3**	**13.8**	**0.0 (5/1=10.8)**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**3.4**	**--**

Figure 5: Normal Snow Water Content and Patterns for Salt River Summit, Wyoming



Watershed Summary

This Thomas Fork is typical of a snowmelt-dominated watershed. As with many mountainous watersheds, winter precipitation increases with elevation forming deep snow packs. As a result water is stored until being released by snowmelt. This melt may be very rapid as much of the watershed lies at similar elevations. Once released the snow moisture provides the primary source of ground, soil, and surface water. It also provides water for large spring floods, as available water is high, soils approach saturation, and evapotranspiration rates (losses) are low.

A finding specific to this basin is that there is more summer precipitation in the lower portion of the basin than the mid-elevations (see precipitation at the Border and Giveout stations during July and August). Above the mid-elevation level, precipitation again increases with elevation. This is likely the result of high intensity convective thunderstorms storms at this warmer low elevation site.

FIRE

Lightning is one of the oldest natural phenomena known. Today it is estimated that approximately 1800 thunderstorms per hour are active across the globe, and the lighting strikes they generate are responsible for over 10 percent of the total number of fires per year in the United States alone (Pyne 1982). Evidence of past fires is found in charcoal layers in lakes and the fire scared cross-sections of trees. Periodic forest and shrubland fires are as vital to the natural environment as rain, smoke, snow, and wind (Heinsalman 1978). Of all biotic and abiotic influences on vegetation, fires were the most prevalent disturbance on the landscape. Fire's influence varied with topography, fuels and weather patterns. Generally, moist community types burned very infrequently while drier types burn at a much high frequency.

Fire has cultural significance. Native Americans caused many fires in major travel zones in the Northern Rockies, both inadvertently and by design (Barrett and Arno 1982), and early-day journals document a number of such instances in the valleys of eastern Idaho and adjacent areas (Gruell 1985). Early settlers also may have caused fires, but this influence may have been partially offset by overgrazing practices that reduced fine fuels and limited fire spread. Elimination of historic Native American ignition sources and present day fire suppression are the primary reasons for change in frequency and size of fires.

Climate and geography influence fire behavior immensely. Climate dictates when fires will occur in the analysis area and influences pattern, intensity, and severity. The climate is inland maritime, with an average annual precipitation of about 13 inches at the confluence with the Bear River to 45 inches near the headwaters of Preuss Creek. Elevation ranges from approximately 6100 feet at the confluence with the Bear River to slightly over 9700 feet in upper Preuss Creek. Major topographic features including the major mountain ranges in the vicinity influence climate in the analysis area. The mountain ranges trend north and south and are at right angles to the prevailing eastward airflow. This affects wind, precipitation, and temperature patterns. In the analysis area, the spring season is the wettest and windiest with cool nights and hot days occurring in the summer months. Precipitation in the summer is limited to localized showers. The diurnal temperature range for the area is about 40 degrees during the summer months. Winds are influenced by the local topography but prevail from the west. Weather generally comes from the west and is forced upward to clear the Preuss Range. This orographic lifting produces highly unstable air masses, setting the stage for lighting discharges.

The high mountain ridges and narrow, north and south trending valleys of the analysis area tend to make fires terrain driven. Diurnal winds created by solar heating of slopes generally make fire spread upslope and upcanyon. The prevailing winds are channeled through the narrow valleys providing stronger winds to affect fire behavior.

Fire has been a frequent visitor in the Thomas Fork area, either as localized spot fires or as large, expansive conflagrations. Barrett (1994) documented several major fire years throughout the Caribou National Forest in 1745, 1781, 1844, and 1934. Since the 1960's, 14 fires have been suppressed in the analysis area, which equates to 3 wildfires per year. The results of fire suppression and historic grazing practices have had an impact on forested and non-forested community types. The lack of fire has resulted in two primary changes. First, it has resulted in an increased incidence of large fuel accumulations. Secondly, it has caused modification of vegetation structure and composition.

Forest and non-forest structure can be divided into four aspects; age structure, species composition, mosaic pattern and vertical structure or fuel ladders (Kilgore 1981). Each of these aspects can, and in most cases, has been modified by fire exclusion. The effects fire suppression and historic grazing has on structure directly impacts wildlife, hydrologic function, insects, pathogens, and aquatic organisms.

Historic fire regimes are generally based on the habitat type (Daubenmire and Daubenmire, 1968) or potential natural vegetation. Historic fire regimes are assigned to fire groups, based on the response of the dominant species to fire, the potential frequency of fire, and the similarity of post-fire succession (Bradley, et al, 1992). A fire regime is intended to characterize the features of historic, natural fires that have been typical for a particular ecosystem (Pyne et al. 1996). In general terms, fire regimes give us a description of the fire frequency, or expected fire free interval between fire events. This information also tells us what type of fire effects can be expected for different layers of forest and non-forest vegetation. Each fire regime entails three descriptors, fire type and severity (i.e. lethal, non-lethal, mixed-severity), frequency or return interval (frequent, non-frequent), and burn pattern (mosaic, uniform). Descriptions of fire regimes are general and broad because of the enormous variability of fire over time and space, so each of the major regimes is addressed briefly in the following discussion.

Rangeland Habitat Types

Those rangeland habitat types that occupy the drier portions of the watershed generally have similar basic characteristics. They include the basin big sagebrush, mountain big sagebrush, and low sagebrush. Because of these similarities they are categorized as a dry shrub group. This group can be characterized by a lethal fire regime with a 10 to 40 year fire return interval (Winward 1991). It is important to note that given the wide range of fuel situations and our understanding of yearly climatic variation in the sagebrush ecosystem, a naturally wide variation in fire frequency in this system should be expected. Fire return intervals in basin big sagebrush are intermediate between mountain big sagebrush (5 to 15 years) and Wyoming big sagebrush (10 to 70 years) (Sapsis, 1990).

Other rangeland types that occupy more mesic positions include subalpine big sagebrush, spiked big sagebrush, threetip sagebrush, snowbrush, bigtooth maple, and chokecherry-serviceberry-rose. Because these species have similar basic characteristics they are categorized as a cool shrub group. This group can be characterized by a lethal fire regime with a fire interval ranging from 25 to 75 years.

Historic fires naturally burned spotty, leaving islands and stringers unburned during any one fire. Those areas that did burn received various intensities of fire. The overall result was an ever-changing mosaic of different densities and ages of crowns. In any specific geographic area, a mosaic of ecological settings existed ranging from open temporary prairie types where fires were most recent, to relatively dense stands where considerable time had elapsed since the last fire (Winward 1991).

Woodland Habitat Types

This group is composed of curlleaf mountain-mahogany. This community type typically forms the transition zone between shrubland communities at lower elevations and closed forest communities at higher elevations. Mountain mahogany can form open stands by itself, or in combination with limber pine or Douglas-fir. The majority of mountain-mahogany communities generally avoid fire by inhabiting rocky sites or sites on shallow soils with sparse undergrowth that normally will not sustain fire. Mountain-mahogany that has developed on sites with deeper soils with an understory that can sustain fire is easily killed by fire. The woodland habitat type is characterized by a mixed severity, patchy burn, with a 50-70 year fire return interval (USDA 1997).

Xeric Douglas-Fir Habitat Types

This group is composed of cool, dry, relatively unproductive Douglas-fir habitat types. Douglas-fir is often the climax species, and lodgepole pine is occasionally present on some noncalcerous soils. These sites do not develop dense overstories, but support a scattered to open forest. Because of severe microsite drought and light flashy fuels, these communities likely had the most frequent fires of any forest type in the analysis area. The cool, dry Douglas-fir fire regime is characterized by a low intensity, non-lethal underburning fire pattern which favors mature open canopy stands. Barrett's fire history research on the Caribou National Forest indicated the mean fire interval was 19 years, ranging from 7 to 39 years.

Mesic Douglas-Fir Habitat Types

This group consists of relatively moist Douglas-fir habitat types where lodgepole pine, aspen, or Douglas-fir are the major seral species. These habitat types occur on cooler or moist exposures between 5,700 and 8,500 feet in elevation. Limber pine may occur in small amounts on drier microsites within these habitat types.

Fire regimes of Douglas-fir and lodgepole pine are variable over their distribution (Kilgore 1981). Topography, weather, stand structure, and fuel loading all contribute to different patterns of fire intensity and frequency. A complete range of fire behavior is represented in this type, from light surface fires to stand-replacement fires. A mosaic of fire effects probably occurred across the historic landscape, with much variability also existing within a single fire (Arno 1980). Stands are thinned or replaced, and the potential dominance of one species over another is altered. Thinning fires favor Douglas-fir because mature trees are relatively fire resistant. Stand-replacement fires favor seral lodgepole pine or aspen on sites where seeds or suckering roots are available. The success of aspen regeneration depends partly on the severity of the fire.

Fire interval variability in this habitat type was relatively high, ranging from as little as 5 years to as long as 100 years. However, the average range for this type was 26 to 71 years, and comparatively long fire intervals (e.g. 100-125 yr) are uncommon (Barrett 1994).

Quaking Aspen-Dominated Community Types

This fire group is composed of community types where aspen appears to be the long-term seral dominant. Aspen is able to tolerate a wide range of environmental conditions and is associated with a diverse number of understory shrub and herbaceous species. Stands bordering forest are the most successionally perplexing. The aspen here are often quite vigorous and will quickly invade adjacent sites when the conifers are removed. These stands often contain an occasional conifer that is usually healthy but shows little sign of increasing in the stand. Within the zone of coniferous forest, aspen stands tend to become more clearly seral. Here aspen occupies sites where fire or logging has removed the conifers or where landslides have provided a fresh substrate. Conifers may reclaim these sites fairly rapidly but in some areas conifer establishment appears retarded by a lush development of seral forbs and graminoids.

Aspen has a paradoxical relationship with fire. Individual aspen stems (suckers) have very thin bark that contains a green photosynthetic layer, and thus are very heat sensitive and easily killed by fire. Conversely, aspen clones are very fire resistant in that the clones are very long-lived, periodically sending up suckers after fires. Since quaking aspen is fire-sensitive, the fires burned in a mosaic pattern with varying severities, from high intensity stand replacement (aspen-conifer) to low severity fires (aspen). Barrett (1994) reported a mean fire interval of 69 years in aspen-conifer sites, and much longer fire interval in aspen with a dense forb understory lacking a conifer component on the Caribou National Forest.

Xeric Subalpine fir and Engelmann Spruce Habitat Types

This fire group contains the bulk of subalpine fir and Engelmann spruce habitat types found in the analysis area. Lodgepole pine is the dominant seral species in these forests. Douglas-fir is important in warmer exposures. Engelmann spruce may be a long-lived seral species, or a climax/co-climax dominant with subalpine fir. Aspen often persists on the periphery of older stands, or it may exist with conifer species in the early to mid stages of succession. While aspen is retained on a site, it has the potential to become seral dominant after fire (Steele, et al, 1983). The understory makeup is variable. Some habitat types may be dominated by shrub growth; in others shrubs may contribute only minor amounts of cover.

Barrett (1994) characterized these habitat types as having a mixed-severity fire regime with a moderately long fire return interval. He reported a mean fire interval range of 25 to 113 years (weighted mean of 97 years) in southeastern Idaho. In general, sites with aspen or Douglas-fir are represented by the short end of reported fire return intervals for xeric subalpine forests (Barrett 1994), while sites with lodgepole pine typically report longer fire return intervals (Romme 1982).

FORESTS

Major topographic features including the major mountain ranges in the vicinity influence climate in the Thomas Fork Watershed. The mountain ranges trend north and south and are at right angles to the prevailing westward airflows. Maritime air masses produce snow in the winter months. Subtropical high pressure dominates the weather pattern in the summer months. Most summer precipitation is associated with thunderstorms. Elevation is also a major influence on climate and consequently on vegetative patterns. Generally precipitation increases with elevation while temperatures decrease.

Aspect influences types of vegetation found in the watershed. The south facing slopes are the driest followed by west facing slopes. North facing slopes are the coolest and retain the most moisture. East facing slopes are not as dry as the south and west facing slopes.

The productivity potentials for timber growth generally are not limited by soils, rather it is believed that climate and timing of usable moisture are more limiting factors. Within the analysis area, forested vegetation occurs on several landtype groups. On several of the landtype groups slope stability is poor, slumping potential is high, and the erosion potential is high. A more detailed description of soils properties can be found under the Soils Characterization section.

Disturbance Types

Wildfire has played the primary disturbance role in the past on forested vegetation. The range of wildfires from stand replacement to mixed severity to non-lethal, to the exclusion of wildfires, are the major influences upon what now occupies this landscape.

Biological disturbances prevalent to lodgepole pine cover type include mountain pine beetle and dwarf mistletoe. Endemic attacks of mountain pine beetle have occurred in the majority of the lodgepole pine stands in the analysis area. The majority of the lodgepole pine stands in the area are infected to some degree by dwarf mistletoe. The result of these combined factors are stands of mainly mature to over mature Lodgepole pine with decreasing vigor, decreased viable seeding potentials, ever increasing down fuel loadings in stands that have ever decreasing densities of overstory, mature Lodgepole pines. These stands are typified as having an understory dominated by sub-alpine fir and pine grass sod with concentrations of, heavy to moderate down fuels. Douglas-fir stands have been attacked in varying degrees by bark beetles as well, while the mistletoe levels in this timber type are at a lower level of infestation when compared to Lodgepole pine. Sub-alpine fir also shows the onslaught of the sub-alpine fir bark beetle complex, which is the combination of root rots and lethal bark beetle attacks that tend to produce circular patches of multiple dead trees.

Big game winter foraging has impacted mountain mahogany stands to a level of producing a very defined browse line, which in multiple, and consecutive, drought years has caused some mortality. This mortality has been more than offset by the expansion of mountain mahogany from its typical sites by the exclusion of fire.

Big game and livestock has had a limited, negative impact upon the regeneration of aspen. The young sprouts and suckers of aspen are highly sought after as forage by ungulates. This heavy utilization, of specific clones, has had negative impacts upon an aspen stands' ability to propagate itself in the absence of fire. This level of negative impact is not evident across this watershed as a whole, but is rather a reflection of specific, localized factors. Such as the aspen stands proximity to summer water sources, which are heavily utilized by livestock as bedding areas. In the case of big game, aspen clones located close to, or within, winter ranges and migration corridors receive much heavier use, thus decreasing the young aspen numbers to such levels as to allow individual clones to disappear.

Past beaver populations have also influenced aspen numbers in limited areas. In very specific locations, former beaver populations and their heavy use of aspen, combined with the exclusion of fire have lead to deteriorating aspen clones. This has progressed to a point where local residents remark about the current lack of beaver, aspen and willow in and adjacent to riparian areas.

Human activities have had a direct effect upon the timbered vegetation within this watershed. The most notable and widespread of effects has been the fostering of conifer establishment and succession as a result of past grazing practices and their resultant effects upon the historical range of fires.

Logging has not had a significant role in influencing the timber types found throughout this watershed. Mainly because the amount of logging that has occurred is very limited. Selective logging with horses was relegated to specific and limited areas. Modern logging practices with heavy equipment have also been very limited on an acreage basis. Most effects from logging have been localized to small specific areas. The predominant effect of logging has been to accelerate conifer succession by favoring climax species.

Commercial timber sales, commercial firewood, personal use firewood, and post/pole harvesting have directly affected a total area of less than 1% of the watershed. Access, slope, soils, and other resource values are the main factors influencing this limited amount of timber harvesting. Personal use firewood and post/pole cutting remain an important activity to the local populace. This harvest has been limited to predominantly Lodgepole pine stands adjacent to roads. This cutting has furthered the succession of timbered stands to climax species, but on a small-scale basis.

Forested vegetation is grouped into dominant tree cover types. They are lodgepole pine, aspen, Douglas fir, sub-alpine fir/Engelmann spruce, limber pine and juniper.

Lodgepole Pine

This is the dominant, mid-seral, conifer, timber cover type that is mainly disturbance dependent, for its regeneration. It generally occurs upon the moister and gentler of north to east facing slopes, from adjacent to riparian areas to just below the ridge tops and drainage headwaters. It is classified as being even-aged, mainly non-serotinous, and mature to over-mature in age, with an established understory of sub-alpine fir. Due to the lack of fire and intensive timber management, there is a definite lack of younger age and structure classes represented within this timber type, there are accumulating levels of dead and down fuels as well. Radial growth is characterized as being static to declining as a function of age, densities, competition, and disease. This species is of local importance for fuelwood gathering and post/pole cutting. There are local small businesses and ranches, which are dependent upon this species' availability for firewood and especially for post/pole cutting. The lack of roads in the area has limited the removal of these products.

Insects and disease are at endemic levels, with some localized pockets of advanced disease and insect infestations. The most commonly occurring diseases are mistletoe and stem diseases. The mountain pine beetle is by far the most prevalent insect and disturbance agent within these stands. The majority of this type is at or near the age/diameter class, which puts this timber at moderate to high risk from epidemic mountain pine beetle attack (Cole,W.E. 1980).

Aspen

This tree species occurs across a wide array of soils, slopes, aspects, and elevations. Aspen is one of the few plants able to grow in most mountain vegetational zones, which illustrates its broad environmental adaptability. It grows in stringers, small islands and large continuous stands in the semi-arid sagebrush-grass steppes; to vast pure and mixed stands interspersed among a variety of conifer species at upper elevations. The upper elevational limits of aspen appear to be determined primarily by the length of the growing season, and lower elevational limits by evapotranspiration.

"Aspen functions both as a seral species in habitat types where conifer trees are climax, and as a climax dominant in aspen forest habitat types. The environmental conditions determining aspen's role as a seral or as a climax tree species remain ill defined. This flexibility in successional status, especially the ability to function as a major seral tree in a wide variety of coniferous forest series, contributes greatly to the diversity of overstory and undergrowth composition. Composition of these seral aspen stands changes with time as the stand progresses in the course of succession toward dominance by conifers" (Mueggler 1988). The most valid general indicator of seral aspen is the presence of conifers either in the overstory or as reproduction.

The abundance of aspen throughout much of the interior West is believed to result from the historic prevalence of wildfires. Aspen reproduces vigorously by root suckers following fire." (Mueggler 1988) This vegetative reproduction results in clones within which individual trees are genetically identical. Genetic differences do exist between clones, which account for differences in physical appearances, resistance to diseases, and probably responses to human disturbances (Mueggler 1988). Young aspen sprouts are highly palatable by many species, and are thus highly sought as forage by ungulates. This utilization by ungulates can have an effect upon an aspen stand's ability to regenerate itself successfully. Past grazing practices ('pre 1970's) have had a negative impact upon aspen regeneration survival within this watershed, but at present this negative impact is very limited in scale.

Aspen may dominate the forest community on conifer climax sites for many decades, even centuries, but will gradually decline as the more shade-tolerant conifers become established (Mueggler 1988). However, the role of wildfires in maintaining aspen communities in the West has changed. DeByle and others (1987) have determined that it would take approximately 12,000 years to complete a fire cycle under the present regimen of wildfires. Thus many stands once dominated by aspen are well along in the process of replacement by conifers (Mueggler 1988). Conifer encroachment of aspen stands within this watershed is apparent. The potential loss of aspen stands/clones is a well-founded concern of forest managers of today.

The observed mean stand age at which most aspen begin to deteriorate is approximately eighty (80) years of age. Aspen is attacked by a multitude of rots, diseases and leaf blights, which increases a stands likelihood of being lost over time if management does not specifically address aspen regeneration. It has been observed, that aspen stands over eighty (80) years of age, are in a general state of decline with advanced stages of rot, mainly heart rot, conifer invasion and are in danger of being lost. Many stands of aspen cannot successfully perpetuate themselves on their current sites without some sort of disturbance. Protection of aspen regeneration from extended utilization by ungulates must be a part of the management decision.

Aspen types use and transpire much less water volume than do conifer on an annual basis. Therefore, stream and soil water recharge is much greater adjacent to aspen types. This does have a significant impact on available water when viewed at a large scale.

Interior Douglas-fir

Douglas-fir occurs as a seral dominant and a climax dominant on a wide range of sites in association with a variety of other species. It occurs as a seral dominant on sites where sub-alpine fir and Engelmann spruce are climax dominants, most often on northerly and moister sites. It occupies sites as a climax dominant where lodgepole pine and aspen are seral dominants. It also occurs in scattered, open stands on the drier and harsher sites that are usually associated with mountain mahogany or sagebrush. It often borders types formed by climax aspen, limber pine, and species of juniper or non-forest communities. Regeneration periods are long and stand development slow on nearly all sites. In ecological terms, Douglas-fir is a seral species on moister sites and a climax on drier sites

(Ryker 1975). Douglas-fir tends to be a fairly long-lived tree with examples of veterans exceeding 200 hundred years not uncommon. Its longevity can be attributed to its ability to withstand periods of drought, recurring low intensity ground fires and its resistance to disease. It is not uncommon for a Douglas-fir stand to exhibit a two or even three storied stand as a result of a long period of regeneration and stand development. A pronounced lack of wildfire has lead to many of these Douglas-fir stands fostering an understory of sub-alpine fir instead of Douglas-fir.

Regeneration can be sporadic and on drier sites successful regeneration is thought to be a result of a chance combination of a good seed crop and favorable weather during the next growing seasons. Partial site protection benefits the establishment and growth of young Douglas-fir by moderating temperatures and increasing retained soil moisture.

A fair proportion of the current Douglas-fir stands have originated from aspen stands where the fir established in the understory, and, in the absence of fire, has succeeded to the point of replacing the aspen.

Extended periods of drought in conjunction with bark beetles, in the absence of intense wildfires, are the highest mortality factors of Douglas fir.

Spruce – Fir

The spruce-fir type is a climax dominant, which grows in a moist climate with long, cold winters and short, cool summers. These sites typically receive and retain the highest amounts of snow well into the run-off period and as such is important water yielding areas. It typically occupies the coldest and wettest sites usually associated with high elevation north to northeast facing slopes, and is dominated by Engelmann spruce and sub-alpine fir. Douglas-fir, lodgepole pine, and aspen also occur within these stands but usually as seral dominants remaining from an earlier seral stage or some small scale, site disturbance that favored their establishment. These stands are typified by their multiple stories, multiple age classes, with large to very large diameter down woody material, which aids in the protection of seedlings and are a representative of naturally occurring, un-even aged stands.

Trees that grow within this alpine zone are well adapted to the short growing season, cold, moist conditions and generally produce seed crops at regular intervals. Engelmann spruce is considered a somewhat shade tolerant species, while sub-alpine fir is an extremely shade tolerant species, that seems to be able to establish itself prolifically on any but the harshest and driest of sites. Deep snow often causes problems for seedlings and saplings, which tend to be very slow growing. These conditions are somewhat offset by fewer insect and disease problems so common in lower elevation areas. Engelmann spruce's biggest killer is the spruce bark beetle; especially when it is preceded by a wind throw or avalanche event which places many large diameter trees on the ground in one event. These large diameter trees are the perfect food base, and site for epidemic beetle populations to brood in, emerge and infest the adjoining stands. Sub-alpine fir is susceptible to a myriad of rots, but its biggest mortality factor is a complex formed by drought, root rots and bark beetles, which can be identified by rough, circular groupings of dead trees.

Natural wildfires in this type are less frequent than at the lower elevations and their intervals are far less well documented. When fires do occur, they are generally conflagrations in which all the trees in the stand are killed.

RANGELANDS

The occupancy by vegetation other than trees, rangelands, constitutes the preponderant share of vegetation types in the Thomas Fork watershed. Of these vegetation types, sagebrush (*Artemisia*) occupies a major portion of this acreage. At least 6 taxa are represented in the watershed and are included in this report. Several other tree/shrub-dominated types occur within the area. These types that may or may not have mixed compositions of several tree/shrub species include: Rocky Mountain juniper (*Juniperus scopulorum*), snowbrush (*Ceanothus velutinus*), bigtooth maple (*Acer grandidentatum*), and a combination chokecherry (*Prunus virginiana*)-serviceberry (*Amalanchier alnifolia*)-rose (*Rosa* spp.)-snowberry (*Symporicarpos* spp.) type. One rather distinct type is curlleaf mountain-mahogany (*Cercocarpus ledifolius* var. *ledifolius*). Sites, where shrubs are mostly absent and are characterized by an array of luxuriant, rather tall mesic forbs, are referred to as the tall forb types. The presence of free or unbound water, at least seasonally, in the upper soil profile results in the establishment of moisture loving or moisture tolerant plant species. These tree, shrub, grass, and forb genera, either singly or in various combinations serve as indicators of this riparian type.

Most often soil and temperature moisture regimes determine the juxtaposition of these various rangeland types and their associated understories. The sagebrush types range from the driest areas to the moistest areas at the highest elevations in the watershed. The basin big sagebrush (*A. tridentata* subsp. *tridentata*) type occurs in areas generally below 7000 ft elevation where mean annual precipitation is low but on deep permeable soils. On more gentle terrain in drier areas this type frequently borders riparian areas. On its mesic side, the type often borders the mountain big sagebrush (*A. tridentata* subsp. *vaseyana* var. *pauciflora*) type, which generally occurs more often on stonier soils and rougher topography. The subalpine big sagebrush (*A. tridentata* subsp. *vaseyana* var. *vaseyana*) type occupies an intermediate position between mountain big sagebrush and the spiked big sagebrush (*A. tridentata* subsp. *spiciformis*) types. This latter type is the most mesic of the big sagebrush types. It usually constitutes the upper elevation sagebrush zone, occurring in association with tall forb and forest communities. The climatic range of the low sagebrush (*A. arbuscula*) type generally overlaps that of the big sagebrush types and it occurs as an edaphic climax throughout this range. It often occurs in mosaics with the big sagebrush types, with the two communities sharply separated. Likewise, the occurrence of the threetip sagebrush (*A. tripartita*) type appears to be edaphically controlled although the factors that separate its habitat from that of the other sagebrushes are not well understood. Mountain silver sagebrush (*A. cana* subsp. *viscidula*) is present in the watershed but in limited acreage. It occurs in more poorly drained settings than other *Artemisia* taxa and is often considered in riparian settings as a distinct community type.

Generally, the mountain brush types share a similar sensitivity to temperature and moisture regimes. The chokecherry-serviceberry-rose type is found in ecological settings slightly moister than pure sagebrush types and slightly drier than quaking aspen types. At lower elevations it often occurs on protected northerly exposures or in depressions where snow accumulates within the more widely scattered sagebrush types. At upper elevations it occurs on southerly aspects or rocky ridges within quaking aspen and coniferous forest types. The snowbrush (*Ceanothus velutinous*) type commonly occurs in the watershed in small dense patches often associated with locations where snow drifts. It can be found associated with subalpine and spiked big sagebrush, aspen, and coniferous forest types. The bigtooth maple (*Acer grandidenatum*) type usually occurs in canyon bottoms and on portions of side slopes with deep well developed soils and in a mosaic with other rangeland cover types. The curlleaf mountain-mahogany (*Cercocarpus ledifolius* var. *ledifolius*) type is commonly associated with sagebrush, other mountain brush, and some conifer types but on more shallow, rockier soils. Within the watershed, Rocky Mountain juniper (*Juniperus scopulorum*) type forms open woodland commonly associated with the big sagebrush, mountain brush, and curlleaf mountain-mahogany types.

The tall forb type is found where soils are deep and soil moisture is adequate for nearly season-long plant growth. The type occurs primarily in small openings in forest, and in larger open parklands within the spruce-fir (*Picea engelmannii-Abies lasiocarpa*) forest zones.

Riparian areas occur scattered throughout the watershed. In steep terrain they are mainly confined to the bottoms of canyons or drainages, while on more gentle terrain such as the Thomas Fork valley they may encompass a large portion of the valley bottom.

Certain prominent graminoid and forb species serve as indicator species for more than one rangeland cover type. Their presence, again, is largely determined by moisture and temperature regimes. In drier areas, rubber and green rabbitbrush (*Chrysomthamnus nauseosus* and *C. viscidiflorus*), antelope bitterbrush (*Purshia tridentata*), and gray horsebrush (*Tetradymia canescens*) are common shrubs. Major grasses are bluebunch or broad-glumed wheatgrass (*Pseudorogeneria spicata* also known as *Agropyron spicatum*), Sandberg's bluegrass (*Poa secunda* which includes *Poa sandbergii*), and in moister areas Idaho fescue (*Festuca idahoensis*). Other perennial grasses that commonly occur include bottlebrush squirreltail (*Elymus elymoides* also known as *Sitanion hystrix*), needle-and-thread (*Stipa comata*), rhizomatic wheatgrasses (*A. dasystachyum*) and related species. The most common forbs include longleaf phlox (*Phlox longifolia*), pussytoes (*Antennaria dimorpha*), hawksbeard (*Crepis acuminata* and spp.), fleabane (*Erigeron pumilis*), tapertip onion (*Allium accuminatum*), and milkvetch (*Astragalus* spp.). These species are commonly associated with the basin big sagebrush and mountain big sagebrush type as well as mountain brush types such as the curlleaf mountain- mahogany and Rocky Mountain juniper types. These species also extend into adjacent low sagebrush and threetip sagebrush types.

In more mesic environments the shrub cover is typical of the individual moister mountain brush types. Mountain snowberry (*Symphoricarpos oreophilus*) becomes a major shrub component in the subalpine and spiked big sagebrush types. Dominant grasses are mountain brome (*Bromus carinatus*), slender wheatgrass (*Elymus trachycaulus* also known as *Agropyron trachycaulum*), onion grass (*Melica* spp.), western needlegrass (*Stipa occidentalis*), and sedges (*Carex geyeri* and spp.). Ground cover is more complete and the forb component is richer than in drier types. Prominent forbs often found on these moister sites are nettleleaf (*Agastache urticifolia*), larkspur (*Delphinium occidentale*), geranium (*Geranium viscosissimum*), and valerian (*Valeriana edulis*). These species often comprise a majority of the tall forb type. This herbaceous understory is also associated with the chokecherry-serviceberry-rose and the bigtooth maple mountain brush types. The dense growth form that characterizes the snowbrush type inhibits the establishment of very many associated forbs and grasses.

Natural processes have evolved to develop a balance between the soil, water, and vegetation resources in riparian settings. In the higher gradient areas, rocks, boulders, and/or large trees most often serve to buffer effects of moving water. In moderate gradient systems a combination of large shrubs or trees along with a group of robust deep-rooted understory species buffer the effects of moving water. Typical tree genera include: *Populus, Alnus*, and *Betula*. Common shrub genera are *Salix* and *Cornus*. The herbaceous species include: *Carex nebtrascensis*, *C. rostrata*, *C. aquatilis*, and *Juncus balticus*. On more shallow gradients, these deep-rooted herbaceous species are able to buffer the hydrologic forces of water.

These rangeland covertypes with their associated species evolved as a result of a complex of processes. Mean annual precipitation ranges from 13 inches at the confluence of the Thomas Fork with the Bear River to 45 inches at the highest elevations near the headwaters of Preuss Creek. Less than half of the precipitation occurs from April through September. Much of the precipitation falls as snow, the proportion increasing with altitude and far exceeding 50 percent in the higher mountains. Similarly, mean annual temperatures range from 40 to 26 degrees Fahrenheit. The average freeze-free period is approximately 75 days at lower elevations and 35 days at the highest elevations. Relative humidity, temperature and wind influence evapotranspiration rates. Potential evapotranspiration is the water loss that would occur if there were never deficiencies of water in the soil for use by vegetation or for evaporation from the soil surface. Because of the deficiency of water at times, actual evapotranspiration for most vegetation in the study area is considerably less than potential evapotranspiration would be. At higher elevations average potential evapotranspiration exceeds average precipitation during summer months. At lower elevations a few inches of excess moisture are available in winter to recharge soil moisture. The soil moisture is soon exhausted in early spring by evapotranspiration.

Thunderstorms are common and usually occur several days each month from June through August. Fires from lightning periodically burned across the landscape and as such have resulted in these fire-adapted ecosystems. Many species sprout back readily following fire. Others that are dependent on seed to reestablish have evolved under specific fire regimes.

FISHERIES

The Thomas Fork Watershed of the Bear River provides habitat for a diverse community of native and non-native fish. Native fish include Bonneville cutthroat trout, mountain whitefish, mottled sculpin, longnose dace, mountain sucker, Utah sucker, Utah chub, leatherside chub, and redside shiner. Non-native fish include brown trout, rainbow trout, and European carp. Crayfish also occur in the watershed. Key fish species and habitat characteristics are discussed below.

Bonneville cutthroat trout are a Regional Forester Sensitive Species and listed as a Species of Concern in the State of Idaho. U.S. Fish and Wildlife Service received a petition to list Bonneville cutthroat trout as Threatened in February 1998. The agency responded the petition presented substantial information indicating that listing this species may be warranted. They initiated a status review of the subspecies. According to the agency guidelines, a finding was due February 1999, but the status review is ongoing.

Two life history patterns of Bonneville cutthroat trout occur in the Thomas Fork Watershed; resident and fluvial. While resident fish spend the majority of their lives in a relatively short segment of stream, fluvial fish migrate into tributaries to spawn, returning to the Thomas Fork or Bear River for the remainder of the year. The offspring of fluvial fish spend a year or two in the nursery streams and eventually migrate downstream to larger water. In recent telemetry studies, fluvial Bonneville cutthroat trout have been documented migrating from the Bear River to tributaries of the Thomas Fork to spawn (Colyer 2001). In the same study, Thomas Fork cutthroat average home ranges are as large as 4 kilometers, indicating frequent movement of these fish up and down the river.

Disconnectivity between fish populations is a common theme in the Bear River and Thomas Fork Drainages, affecting the ability of fluvial fish to migrate and interact with other populations. These barriers to migration are associated with irrigation diversion structures and dewatering. The Bonneville cutthroat trout in the Thomas Fork Drainage are part of the overall Bear River East Metapopulation, as described in the Caribou Forest Plan Revision DEIS (Caribou-Targhee National Forest 2001). All metapopulations of Bonneville cutthroat trout in Idaho are considered by the Caribou-Targhee National Forest as being at a high risk of extinction.


Photo 1: Thomas Fork of the Bear River (Colyer 2000).

The Bear River East Metapopulation of Bonneville cutthroat trout are genetically isolated from other Bonneville cutthroat trout metapopulations in Idaho by the dam at Alexander Reservoir. Irrigation diversion structures within the metapopulation area, including within the Thomas Fork Watershed, are barriers to upstream and downstream migrating fish for at least part of the year. The connectivity between populations in the Thomas Fork and elsewhere in the metapopulation area may be limited due to a full spanning irrigation diversion structure in the lower Thomas Fork that blocks upstream migration for most of the spring and all of the summer. However, there is still potential interchange between some populations in tributaries of the Thomas Fork.

Leatherside chub is a State Species of Concern. It has been observed in the Smith Fork of the Bear (next drainage to the south), but has not been surveyed for or documented in the Thomas Fork. It is likely they occur in the Thomas Fork in low densities. Leatherside chub occur in the lower reaches of streams, in low gradient habitat. They prefer pools and slow, off-channel habitat with complexity provided by vegetation and bank overhang and large instream wood. The species appears to be quite rare on the Forest, currently documented in only 2 streams.

Rainbow trout have been introduced to the Bear River and Thomas Fork systems periodically. Some hybridization between rainbow and cutthroat trout has been documented. Rainbow trout also compete with Bonneville cutthroat trout for habitat and food.

Brown trout were introduced into the Bear River System, including the Thomas Fork, in the 1940's. Although they don't interbreed with native cutthroat trout, they are voracious predators that likely prey upon their young.

European carp were introduced to the Bear River System is the 1880-90's. Now they are common throughout the lower elevations of the system. They occur in lower reaches of the Thomas Fork, affecting water and habitat quality. The common carp is regarded as a pest fish because of its widespread abundance and because of its tendency to destroy vegetation and increase water turbidity by dislodging plants and rooting around in the substrate, causing a deterioration of habitat for species requiring vegetation and clean water (Cole 1905; Cahoon 1953; Bellrichard 1996; Laird and Page 1996). In their review of the literature, Richardson et al. (1995) concluded that common carp has had noted adverse effects on biological systems including destruction of vegetated breeding habitat used by both fish and birds, and an increase in turbidity. It stirs up the bottom during feeding, resulting in increased siltation and turbidity (Lee et al. 1980 et seq.). This feeding behavior also destroys rooted aquatic plants that provide habitat for native fish species and food for waterfowl (Dentler 1993). There is also evidence that common carp prey on the eggs of other fish species.

In addition to the effects of full spanning irrigation weirs upon upstream fish migration, other human impacts upon fish habitat in the Thomas Fork Watershed include irrigation withdrawals diverting fish from the river and streams into fields, stream desiccation from irrigation withdrawal, impacts to riparian and aquatic habitat from livestock use, roads constructed in and near floodplains, and sediment delivery from agricultural practices and grazing.

Table 4: Native Fish in the Analysis Area

Common Name	Scientific Name	Status
Bonneville cutthroat trout	(*Oncorhynchus clarki utah)*	S, SC-A
Mountain whitefish	(*Prosopium williamsoni*)	
Leatherside chub	(*Gila copei*)	SC-C
Utah chub	(*Gila atraria*)	
Mottled sculpin	(*Cottus bairdi*)	
Longnose dace	(*Rhinichthys cataractae*)	
Redside shiner	(*Richardsonius balteatus*)	
Utah sucker	(*Catostomus ardens*)	
Mountain sucker	(*Catostomus platyrhynchus*)	

Table 5: Introduced Non-Native Fish in the Analysis Area

Common Name	Scientific Name
Rainbow trout	(*Oncorhynchus mykiss*)
Brown trout	(*Salmo trutta*)
European Carp	(*Cyprinus carpio*)

Status Codes

S: USDA Forest Service Regional Forester Sensitive species designation (Forest Service Manual 2670.5). Those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by:

A. Significant current or predicted downward trends in population numbers or density.
B. Significant current or predicted downward trends in habitat capability that would reduce a species existing distribution.

SC: Idaho Fish & Game Species of special concern: native species that are either low in number, limited in distribution, or have suffered significant population reductions due to habitat losses, but is not likely to become threatened in the near future. There are 3 categories:

A. SC-A: Species, which meet one or more of the criteria listed above and for which Idaho presently contains, or formerly constituted, a significant portion of their range (i.e. priority species).
B. SC-B: Species which meet one or more of the criteria above but whose populations in Idaho are on the edge of a range that falls largely outside the state (i.e. peripheral species)
C. SC-C: Species that may be rare in the state but for which there is little information on their population status, distribution, and/or habitat requirements (i.e. undetermined status species).

In this document, the fisheries resources in the analysis area are described in Characterization (this chapter), Reference Conditions, Current Conditions, Trends, and Recommendations. Generally, the time frame 1900-1989 is considered reference conditions and 1990-present is considered current conditions in the Fisheries write-ups. This is primarily due to the data that was available for this analysis and changes in resource management that occurred in the 1990's. The Fisheries sections in each chapter are organized by stream, beginning with a part on the mainstem Thomas Fork River (which often includes an overall watershed perspective), continuing with the tributaries that occur on the Caribou-Targhee National Forest, and then covering other tributaries off Forest.

Although the fisheries resource write-up focuses more intensely on habitat within National Forest Lands, there has been an effort to cover all aquatic habitat within the Thomas Fork Watershed where data existed. The need for this holistic watershed perspective hinged upon the migratory nature of some of the fish species within the watershed and the need to consider the well being of all populations in the watershed to maintain long term population viability.

Data sources include scientific publications, interagency planning reports, interviews with individuals who live and work in the watershed, past internal and interagency letters and memos, meeting notes, and stream, fish, and riparian surveys by USDA Forest Service, Bureau of Land Management, Idaho Department of Fish & Game, and Idaho Department of Environmental Quality.

WILDLIFE

Threatened and endangered species

Threatened and endangered species that may occur in the Thomas Fork watershed are wolves and lynx; and grizzly bears due to the proximity to the population in the Greater Yellowstone area.

Gray wolf (*Canis lupus*) (USDI 1994a, 1994b) – The Thomas Fork watershed is within the Yellowstone nonessential experimental population area that currently has 13 breeding pairs (exceeding the 6 pair minimum). Thirty breeding pairs of wolves, with an equitable and uniform distribution throughout the three states for three successive years would constitute a viable and recovered wolf population (USDI and others 2001).

Canada lynx (*Lynx canadensis*) (USDI 2000) (Ruediger and others 2000). – The project is in LAU (Lynx Analysis Unit) #41*, a 147,562-acre unit containing 43,934 acres (30%) of suitable primary and secondary lynx habitat. Less than 15 percent of suitable habitat can be impacted in a 10-year period. Of the lynx habitat, ten percent needs to provide denning habitat in patches generally larger than 5 acres. Shrub-steppe, riparian and aspen habitats provide for the needs of alternate prey species. *LAU 41 contains Salt River tributaries (Pole Canyon, Sage Creek, Crow Creek, Spring Creek and Sprague Creek), Thomas Fork tributaries (Preuss Creek, Dry Creek, and Giraffe Creek) and Montpelier Creek and tributaries including Home Canyon.

Grizzly Bear (*Ursus arctos*) habitat is mostly arctic or alpine tundra and subalpine mountain forests. In Idaho, grizzly bears occupy lodgepole pine/Douglas-fir forest near Yellowstone. Vegetal matter dominates their diet, and they also eat carrion, mammals, fish, insects, and garbage. Yellowstone area study found ungulate remains composed major part of early season diet, graminoids dominate May-June, and whitebark pine seeds were important in late season; berries composed minor portion of scats in all seasons. (Groves and others 1997, 342).

Sensitive Species

The Thomas Fork watershed may provide habitat for several Forest Service sensitive species (Groves and others 1997) and (Spahr and others 1991). Forest stands are small and fragmented by large sagebrush openings. Aspen stands are in large patches or part of the conifer forest.

Townsend's (Western) big-eared bat (*Corynorhinus townsendii*) – Maternity and hibernation colonies occur exclusively in caves and mine tunnels. Occasionally uses buildings, bridges, and tree cavities for night roosts. They are extremely sensitive to human disturbance. They feed primarily on moths and forages near foliage of trees and shrubs (Groves and others 1997, Spahr and others 1991).

Wolverine (G*ulo gulo*) - Alpine cirque and talus slopes are important for den sites. Travel corridors are usually located in spruce/subalpine fir forested areas near natural openings with limited human activity and an adequate prey base (prefers carrion). Human disturbance of occupied den sites is detrimental. Wolverine home range is 148 $mile^2$ (females) and 610 $mile^2$ (males). Dispersal distance is 115 miles. Wolverines are known to travel through non-typical habitat as part of their large territories when traveling between forested areas (Copeland, per. Comm., Ruggiero and others 1994, Groves and others 1997, Spahr and others 1991).

Boreal owl (*Aegolius funereus*) - nest in tree cavities in mature subalpine fir, Engelmann spruce or western hemlock forests with a high density of large trees; forage on small mammals, birds and insects. Summer home range is 3,585-2,847 acres (Hayward 1994, Groves and others 1997, Spahr and others 1991).

Flammulated owl (*Otus flammeolus*) - are obligate cavity nesters (18" dbh snag) usually in mature ponderosa pine & Douglas-fir forests with open canopies (30-60%) forage on insects in edge habitat. Home range is 35 acres (Hayward 1994, Groves and others 1997, Spahr and others 1991).

Great gray owl (*Strix nebulosa*) - use nests abandoned by hawks or on the tops of snags in mature lodgepole pine or subalpine fir forests bordering small openings or meadows (Hayward 1994). They prey on voles, mice etc. along edges of clearings. Home range is 640 acres. Dispersal distance is 1.8-27 miles. (Groves and others 1997 & Spahr and others 1991).

Northern goshawk (*Accipiter gentilis*) nest in a 30 acre mature & old-growth forest stand with closed tree canopies, high density of large trees on slopes <30% & northerly exposures. They prey on birds & mammals within forest canopy. Nests are 1.2 miles apart. (Reynolds et al 1991, Groves and others 1997, and Spahr and others 1991).

Three-toed woodpecker (*Picoides tridactylus*) - nests in 12" dbh snag. They feed on bark beetle larvae usually in wet sites or subalpine fir habitat types (spruce-fir and lodgepole pine in a variety of successional stages). Home range is 130-740 acres. (Groves and others 1997 & Spahr and others 1991).

Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) - use undisturbed native shrub-grassland, with high structural diversity (Paige and Ritter 1999). Sharp-tailed grouse dancing grounds, nest sites, and brood sites are found in areas containing big sage, arrowleaf balsamroot, bluebunch wheat grass, mountain shrub, and riparian cover types. Grass and forbs are needed for cover. Home range is 462 acres. (Groves and others 1997 & Spahr and others 1991).

Starveling milkvetch *(Astragalus jejunus var. jejunus)* - is found on barren, eroding shale substrata of the Twin Creek Limestone formation which is chalky white, with little established vegetation. In general, astragalus plants have a low palatability. Little is known about possible threats to the widespread *var. jejunus* (NatureServe 2001).

Migratory Birds

The objectives in the Idaho Bird Conservation Plan (Ritter 2000) will be used to meet Executive Order #13186 for migratory birds. Riparian, Non-riverine wetlands, and sagebrush shrublands are the highest priority habitats for birds found in the Thomas Fork watershed.

Riparian with dense grasses/shrubs (60-80% crown cover, 6' tall, 20 acres with scattered openings), open tree canopy with balanced age classes (snags), and abundant flowers are important habitat features.

A net increase in the number of acres of wetlands in Idaho, focusing on the same types and amounts that historically occurred here is important to migratory birds.

Sage grouse was chosen as the umbrella species for sagebrush shrublands. Grass height and cover affect sage grouse nest site selection and success. The Idaho Bird Conservation Plan guidelines recommend that each sage grouse area should be provided with at least 25 percent of each major sagebrush community (especially big sagebrush) in an early-seral stage, 25 percent in a mid-seral stage, and 25 percent in a late-seral stage. (For example use <15 %, 15-25%, & >25% canopy cover.) Connelly and others (2000) recommends that, within 5 miles from a lek area, a maximum of 20 percent mountain big sagebrush breeding habitat be treated in a 20-year period. The sagebrush understory should contain a healthy bunchgrass community (bluebunch wheatgrass, Idaho fescue, & S*tipa)*. Adequate ground cover of non-senescent grasses/forbs as cover/forage should be maintained from May 1 to July 15 to provide cover and forage for nesting birds. More than 50 percent of the annual vegetative growth of perennial bunchgrasses should be allowed to persist through next nesting season. The proper use of rest-rotation or deferred-grazing systems will meet these conditions. Springs/seeps in suitable condition will provide for sage grouse water/insect use during chick rearing.

Other Wildlife Species

Mule deer – are found in coniferous forests, shrub steppe, chaparral, and grasslands with shrubs. Often associated with successional vegetation, especially near agricultural lands. In Idaho, prefers rocky brushy areas, open meadows, open pine forests, and burns. Home range may be 89-600 acres. In Pacific Northwest, deep winter snows are major factor limiting population size (Groves and others 1997, 358).

Elk – use a variety of habitats. In Idaho, herds move to lower elevations in winter to feed. Recent Idaho study points to hunter access and intensity, not habitat parameters, as major factor in population control (Groves and others 1997, 357).

Moose – prefers mosaic of second-growth forests, openings, lakes, and wetlands. In Idaho, prefers shrubby, mixed coniferous and deciduous forests with nearby lakes, marshes and bogs. Requires water bodies for foraging, and hardwood-conifer forests for winter cover. Avoids hot summer conditions by utilizing dense shade or bodies of water. In summer, moose browse on new growth of trees and shrubs, and on vegetation associated with water (attracted to high-sodium aquatic plants). In winter, moose feed on conifer and hardwood twigs. (Groves and others 1997, 360).

Beaver – are dependent on slow-flowing brooks, streams, and rivers for dam construction. Adjacent stands of successional growth are preferred over mature forests (Groves and others 1997, 319).

Western boreal toad (*Bufo boreas*) – are found in ponds, lakes, reservoirs, and slow-moving rivers and streams (Groves and others 1997, 6). Breeding and egg laying occur mainly in shallow areas of ponds and lakes that are less than 15 cm deep, often with emergent vegetation. In cold waters, toads have bred in shallow water along the north shoreline of small lakes where exposure to the sun warms the water. Breeding can take place in temporary ponds, but successful larval development through metamorphosis often requires permanent or semi-permanent water. (Keinath and Bennett, 2000, 5)

Northern leopard frog (*Rana pipiens*) – are usually found in permanent water containing rooted aquatic vegetation. Commonly inhabits wet meadows and fields, but may also be found in springs, slow streams, marshes, bogs, ponds, canals, reservoirs, and lakes (Groves and others 1997, 11).

Photo 2: Maintained beaver dam below Crow Creek Road.


Photo 3: Salt Basin Upper Beaver Dam. Grass covered dam.

RECREATION

The Thomas Fork Watershed is made accessible by a variety of different types of roads. Therefore, most recreation activities within the watershed rely on truck/sedan for access.

U.S. Highway 89 and 30 access the area. Constructed graveled roads are found on federal lands and on county roads running through private lands. Some roads are constructed but the running surface is composed of native material. Pioneered two track roads exist mostly on federal lands and are not maintained and during wet weather can be difficult to drive over. Roads composed of native material become rutted when driven on during wet weather. These roads contribute to soil movement.

Motorized travel is restricted to designated routes on most of the federal lands. Private landowners determine access to private lands.

Big game hunting (mule deer and elk) is the most popular recreation activity in the area. Different methods of hunting are allowed to harvest these animals. Hunting season usually begins in September and ends in December. The area is popular to both resident hunter and non-resident hunters. During this period camping is also popular. Most of the camping associated with hunting occurs at dispersed camping sites. The most popular area for these dispersed sites are riparian area. These sites have evolved as campers have founds sites of brush to pitch tents or park recreational vehicles. The majority of these sites do not contain any improvements such a toilets, picnic tables or fire grills.

Historically, the watershed was a popular fishery. Fishing still remains a recreation activity. However, interest has waned as trout populations have declined. Within the last decade all tributaries in the watershed were closed to fishing for several years. In 1999 the tributaries were open to catch and release fishing only. Due to low water conditions in the lower reaches of the watershed, the decline in fish populations, and the catch and release policy, most anglers do not find it desirable location to fish.

Snow machining remains the most popular form of winter recreation. One groomed snow machine trail exists along the Crow Creek Road from U.S. Highway 89 to the Bear Lake – Caribou County line. Most snow machine riders enjoy cross country riding and use the existing road access to launch their riding experience. A limited amount of cross-country skiing and snowshoeing exists.

Waterfowl hunting is popular in the Thomas Fork Valley during the fall months. Waterfowl hunting occurs on both private and federal lands in this area. Upland game hunting for forest grouse and sage grouse occurs in the watershed. Since sage grouse populations have declined and daily bag limits have be reduce, the numbers of hunters have declined.

Trapping of beaver and muskrat occurs in the watershed during the open trapping season. The trapping of other fur bearing animals occurs on a limited basis. While some trappers do this for a livelihood, others enjoy this as an outdoors experience similar to hunting.

There are numerous trails in the area. Historically these trails were built to accommodate foot travel and horse travel. Presently the use has been expanded to include motorized travel such as motorbikes and all terrain vehicles on some of these trails. Most of the trails activity occurs during the hunting season.

Other recreation activities that occur in the watershed are hiking, backpacking, rock climbing, and horseback riding. While there are few forest visitors that participate in these activities, it is an indication of the increased recreational interest in the watershed.

These recreation activities are similar to those found in the subbasin and river basin.

REFERENCE CONDITIONS

SOIL

"Man is dependent on soils—and to a certain extent good soils are dependent upon man and the use he makes of them. Man's standard of living is often determined by the quality of soils and the kinds and quality of plants and animals grown on them." (Brady 1974).

Soil quality and long term soil productivity are the focus of historic and current condition discussion. Many of the stories told below, we already knew.

Flood Plain Soils

Data Sources:

-Thomas Fork Water Quality Project (BLSWDC 1999)
-Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
-Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
-Hydrology and Vegetation Sections in this Report

Most of these soils would have supported sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrushes (*Scirpus* spp.), reedgrass (*Calamagrostis* spp.), mannagrass (*Glyceria* spp.), bluegrasses (*Poa* spp.), inland saltgrass (*Distichilis stricta*), willows (*Salix* spp.), dogwood (*Cornus* spp.), greasewood (*Sarcobatus vermiculatus*), alder (*Alnus* spp.), boxelder (*Acer* spp.), cottonwood (*Populus* spp.) and other riparian vegetation. Ground cover would have been dominated by living and dead vegetative material with very little bare ground. Detrimental soil compaction and soil displacement was uncommon. Soil surfaces would be dark and thick from the high yearly inputs of soil organic matter from roots and leaves. Water tables would have been near the surface or shallow for most of the year. Areas of standing water supporting cattails and rushes would have been common. Minor flooding of these soils would be common in the spring leaving fine sediment on the soil adding to its depth.

Terrace Soils

Data Sources:

-Thomas Fork Water Quality Project (BLSWDC 1999)
-Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
-Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
-Hydrology and Vegetation Sections in this Report

Most of the soils on the lower terraces would have supported Shrubby cinquefoil (*Potentilla fruticosa*), Rose (*Rosa* spp.), Currents (*Ribes* spp.), Greasewood, (*Sarcobatus vermiculatus*) Sedges (*Carex* spp.) and Inland Saltgrass (*Distichilis stricta*), Rushes

(*Juncus* spp.) and Bluegrasses (*Poa* spp.). Similar to the flood plains, ground cover would be mostly live and dead vegetative material with little bare soil. Soil compaction and soil displacement would be limited to a few trails. Soil surfaces would be thick and dark from the large amounts of organic matter incorporated into the soils each year. Maybe 30 to 50 percent of the soils would have shallow water tables for most of the year. Minor flooding of the lower terraces would not be uncommon in the spring leaving fine silt on the soil surfaces.

Most of the soils on the upper terraces would have supported Basin big sagebrush (*Artemisia tridentata* subsp. *tridentata*), scattered Threetip Sagebrush (*Artemisia tripartita*), scattered Mountain silver sagebrush (*Artemisia cana* subsp. *viscidula*) and their associated understories of perennial grasses and forbs. Ground cover would be shifted more toward litter and gravels with less live vegetation than the lower terraces, but bare soil would still be a small component. Soils surfaces would be thick and dark from yearly organic matter inputs from both above ground and below ground plant parts. Flooding would be uncommon. Fire would begin to play more of a role on the upper terraces in the mix of shrub species; the proportion of shrubs to grasses and forbs; and soil nutrient cycling.

Hillside Soils

Data Sources:

- -Thomas Fork Water Quality Project (BLSWDC 1999)
- -Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
- -Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
- -Fire, Hydrology and Vegetation Sections in this Report

Data Gaps:

- -Mapping and extent (acres) of current vegetation communities

Hillside soils dominantly supported shrubland vegetation. On the west side of the valley the deep hillside soils supported primarily Mountain big sagebrush (*Artemisia tridentata* var. *vaseyana* and var. *pauciflora*), perennial grasses such as Bluebunch wheatgrass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), junegrass (*Koeleria pyramidata*), and slender wheatgrass (*Agropyron trachycaulum*) and a variety of perennial forbs. On shallow soils Low sagebrush (*Artemisia arbuscula*) or Threetip sagebrush (*Artemisia tripartita*) were the dominant shrubs. Ground cover was dominantly litter with some live vegetation and gravel and normally small amounts of bare soil unless recently disturbed. Soils were moderately deep to shallow with surface textures ranging from gravelly silt loam to very channery loam. Soil surfaces were mostly dark. Nutrient inputs and losses were approximately at equilibrium and soils overall slowly increased in depth and progressed in development. Detrimental soil compaction, displacement and erosion were uncommon and localized. Fire was an important disturbance. It influenced the mix of shrubs according to their response to burning and also the relative proportions of shrubs to grasses and forbs, for at least 20+ years. Burning released nutrients to the soils and after fires the amounts of organic matter inputs generally increased as grasses and forbs increased (Knight 1994, Blaisdell et al 1982).

Hillside soils on the northwest end of the valley supported similar vegetation but greater production. The hillside soils on the west side of the valley are strongly influenced by carbonates from the parent material which reduces the availability of nutrients and water to most native grasses and especially deep rooted shrubs (National Soil Survey Handbook 1996). Ground cover on the northwest hillside soils was dominated by thicker litter layers, more grasses and forbs and less bare soil compared to the west hillside soils. Soils were very deep to moderately deep to shallow with surface textures ranging from sandy loam to very stony loam. Soil surfaces were dark and thicker than the west hillside soils. Nutrient losses and inputs were in equilibrium and detrimental soil impacts were uncommon. Fire influences on vegetation and soils were similar to those described above.

Mountain Soils

Data Sources:

- -Thomas Fork Water Quality Project (BLSWDC 1999)
- -Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
- -Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
- -1998 Wyoming 305(b) Water Quality Assessment
- -Fire, Hydrology and Vegetation Sections in this Report

Data Gaps:

- -Mapping and extent (acres) of current vegetation communities.

The great majority of the deeper, well drained mountain soils supported Mountain big sagebrush communities with associated perennial grasses and forbs. At higher elevations or lower elevations with moister aspects the shrub dominated communities included chokecherry (*Prunus virginiana*), serviceberry (*Amalanchier alnifolia*), wild rose (*Rosa* spp), bitterbrush (*Purshia tridentata*) and snowberry (*Symphoricarpos* spp.) as well as mountain big sage on deep soils with thick dark surfaces and horizons of clay accumulation below the surfaces. On shallow, rocky soils with less water holding capacity, Threetip sage mixed with mountain big sage. Snowbrush (*Ceanothus velutinus*) could be found at higher elevations associated with mountain sagebrush, quaking aspen and conifers in areas where snow drifts. These soils would also have thick, dark surfaces from the high level of organic matter added annually in leaf fall and the nitrogen fixing capabilities of snowbrush. Aspen groves and stands of conifers, primarily Douglas fir (*Pseudotsuga menziesii*), Subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus* *contorta*), were found mainly at the higher elevations on north and east facing slopes and in pockets at lower elevations. Soils that supported aspen were similar to the soils supporting mountain sagebrush, but with more moisture. Organic matter inputs from aspen leaf fall and from the lush understory of grasses and forbs built very thick dark surfaces. Soils that supported conifers, especially closed canopy conifers, had horizons of leaching below the thin light surfaces. Horizons of clay accumulation below the leached layer were common (Amacher et al 2001).

Two natural disturbances were common and of large extent on mountain soils. The first, slope failures and landslides, were most common on the east and north sides of the watershed in parent rocks of the Preuss Range, Gannet Hills and Sublett Range. Soils with high shrink-swell clay contents associated with parent materials dominated by shales, siltstones and mudstones were prone to failures. These exposed faces were highly erodible and sediment often reached small drainages. The second common natural disturbance was fire. Natural fire intervals vary according to vegetation communities. (Historic fires in this area also likely included those ignited by Native Americans). Fires in the mountain big sagebrush communities varied the mix of shrubs based on their response to burning and shifted the relative abundance of woody plants to grasses and forbs. Nutrients were released with burning and bare ground and erosion increased for a short time. Fires that started or were carried up into aspen could kill succeeding conifers and stimulate regeneration of the aspen clones if conditions were right. Soil impacts were generally short lived. Fires that burned in the higher, cooler and wetter Douglas fir, subalpine fire and lodgepole pine forests were not as common. Fires in hot, dry years could burn intensely enough to be stand replacing. Soil impacts could be long lasting and include severe burning, erosion and loss of the most important biological layers for tree growth. Fires that were ignited in more normal years were typically of small extent and low intensity. Soil impacts from these events were generally short lived. Fires that burned in the drier Douglas fir communities were often of lower intensity and frequent with minimal impacts to soils. Hot, stand-replacing fires in the drier Douglas fir would impact soils similarly to stand replacing fires in higher, cooler conifer stands.

WATER

Watershed Conditions

In its simplest form, a watershed's condition can be viewed as the status of its components as a result of natural and anthropogenic disturbances. To get a clear understanding of a watershed's condition, both the spatial and temporal variability must be considered. To address the spatial variability, six sub-watersheds were identified: Salt, Giraffe, Coal, Dry-Preuss, Geneva, and Border-Raymond. The temporal variability was address by evaluating both historic and current conditions. The Thomas Fork Water Quality Project was used in many of the following sections (Bear Lake Soil and Water Conservation District 1999). This reference will be abbreviated as "BLSWCD 1999" for the remainder of the document.

The Inland West Watershed Initiative Ratings (IWWI) was developed to evaluate all federally managed subwatersheds in the Great Basin and Rocky Mountain areas using common criteria. This analysis focused on three IWWI factors:

- Watershed vulnerability evaluates the inherent risk of instability based upon the presence of sensitive lands. Sensitive lands are defined as having highly-dissected slopes, highly erosive soils, landslide deposits, or landslide prone areas.
- Geomorphic integrity evaluates the function of the sub-watersheds, streams, and riparian areas within the basin.
- Water quality integrity evaluates whether water-related resource values (beneficial uses) are being protected.

Since watershed vulnerability reflects the inherent risk of instability within a basin, the historic and current conditions would be the same. Therefore the ratings for Coal, Salt, and Dry-Preuss would have been high; while those for Giraffe and Bishop would have been moderate. The "Geomorphic Integrity" and "Water Quality" of all basins would have been high meaning that most stream segments were functioning properly with only short-term or minor impairments. These ratings would have produced a high composite rating with no damaged segments.

Watershed Conditions Resulting from Disturbance

Data Sources:

- Thomas Fork Water Quality Project (BLSWCD 1999)
- Water in Environmental Planning (Dunn and Leopold 1978)

Assumptions:

- Natural disturbances were adequately addressed in the section on Drainage Basin Description and in the IWWI rating for watershed vulnerability.
- Land use is the dominant factor influencing watershed conditions.

- Curve numbers can accurately evaluate changes in watershed conditions.

Vegetative and soil characteristics influence how water moves through the system with the primary mechanisms being infiltration and evapotranspiration. The affects of land use on watershed conditions are well summarized in the Thomas Fork Water Quality Project Report and are not repeated here. To evaluate changes in watershed condition, the US Soil Conservation Service's "curve number method" was used. This method estimates runoff from agricultural catchments with various types of soils, cover, and land use.

Most of this watershed would have fallen into three vegetative cover classes: Meadow/ Wetlands, Native range/pasture, and forestlands. All of these types would have been in good hydrologic condition. This means that rangelands would have been lightly grazed by ungulates and woodlands would have had almost complete ground cover by both litter and vegetation. The majority of the soil fell into class B, which has a moderate infiltration rate when thoroughly wetted. They are moderately-deep to deep loamy soils, which are moderately to well drained. Given these conditions, the historic curve number would have been 61 for rangelands, 58 for meadows, and 55 for woodlands.

Riparian Conditions

Properly functioning riparian areas are critical in maintaining healthy and diverse aquatic systems. They influence water quality and fish habitat by providing: (1) shade to regulate water temperatures, (2) strength to stream banks (3) large woody debris, (4) fine organic material and invertebrates as a food source, (5) sediment and water filtration, and (6) cover for fish.

Flood Plain and Wetland Conditions

Data Source:

- Data was obtained from the National Wetland Inventory (US Fish and Wildlife Service).

Data Gap:

- Riverine wetlands are not fully shown.

The Thomas Fork and its principle tributaries were un-confined streams flowing through fairly wide valley bottoms/flood plains. Frequent over-bank flows (every one-two years) were important in providing sediments, nutrients, and vegetative diversity to these areas. The Thomas Fork and lower Preuss Creek valleys also supported vast wetlands. With the exception of the Bear Lake area, this was the largest expanse of wetlands in the subbasin (figure 3). These wetlands would have maintained high water quality and high base flows. The structure and function of these wetlands were maintained by high water tables and periodic flooding.

Riparian Vegetation / Conditions

Data Sources:
- Properly Functioning Condition assessments (BLM – 1994 and 1995 in Coal Creek and Raymond Canyon).
- Smiths Fork Allotment Evaluation (BLM, 2000)
- Stream Stability Surveys (Forest Service – Dry/Preuss in 1979, 1987, and 2001).
- Stream Surveys (BTNF - Salt Creek in 1993, 1999 and 2000).
- Riparian Surveys (CNF – Dry/Preuss in 1987).
- Personal Observations (Philbin, 2001).

Data Gaps:
- Riparian conditions along minor tributaries.

The dominant community type for these areas would have been Salix boothii / Carex rostrata (Padgett et.al. 1989). This vegetation would have filled the floodplain producing a moderately wide moist area surrounded by dry hillslopes. Very little bare ground would have been present with this cover type. These species would have provided a dense root mat capable of maintaining bank stability at greater than 90%. The only areas of instability would have been where the stream flew against the toe of adjacent slopes. In these areas the riparian vegetation zone would have been narrow, with less wetland species. Air photos from 1940 and 1955 indicate that riparian areas had extensive willow growth in the lower drainages and aspen in the upper reaches. Beaver ponds were also abundant (USDI 2000).

Steam Conditions

Now that the drainage basin, climate, watershed conditions, and riparian conditions have been evaluated we can move on to stream condition/function. In all stream systems there exist unique balances between many interrelated variables including: stream flow, sediment quantity and size, geomorphic controls, bank vegetation, and floodplain accessibility. A major shift in any of these variables may initiate a series of adjustments leading to a new channel form. This section begins with an assessment of the stream flow and sediment regimes and ends with a discussion of stream conditions.

Overall, fire and floods are the primary natural disturbances in the Thomas Fork watershed. These events, individually or together, have produced large sediment and water yield increases that have effected channel conditions. Following a disturbance, material accumulated in both headwater streams and localized areas of the primary channels. This material was then routed downstream delivering nutrients, sediment, and structure. While this pulse created a short-term impairment, it was important in maintaining the long term physical and biological functioning of the system. Following the disturbance was a period of recovery during which time the channel stabilizes and provides morphological features that provide habitat for a variety of aquatic species. This recovery period continued until the next infrequent disturbance "reloaded" or "reset" the system.

Stream Flow Regime

Data Sources/Data Gaps:

- U.S. Geological Survey (USGS) stations used included: Bear River @ Border, Wyoming (10039500); Thomas Fork near Raymond, Id (10042500); Thomas Fork (really Coal Creek) near Geneva (10040000); Salt Creek near Geneva (10040500).
- 1995 Beneficial Use Reconnaissance Project Stream Flow Data for Giraffe Creek, Dry Creek, Preuss Creek, and Thomas Fork River.
- A data gap is that the Thomas Fork, Coal, and Salt creek gages were discontinued in 1952.

Assumptions (additional assumptions are found under the historic section):

- The period of record is assumed to be adequate to determine bankfull flows.
- Base flow data from gages (Coal, Salt, and Thomas Fork) and direct measurements (Dry, Giraffe, Preuss, and Thomas Fork) are comparable. This was tested by comparing the calculated flow at the lower Thomas Fork site (37.3 cfs) with one measured flow (36.8 cfs). This implies that the two data sets may be comparable.

The stream flow regime refers to the quantity and timing of runoff. Both of these variables are critical factors in determining the health of aquatic systems. Climate, watershed condition, and riparian condition all influence the streams runoff patterns.

Due to long-term irrigation, it is difficult to determine historic discharge levels. However, we can evaluate timing. From 1940-51 there is an overlapping period of record between the Thomas Fork, Georgetown Creek (for comparisons), and the Bear River. During this time 90% of the Thomas Fork's peaks occurred in April and May; 85% of Georgetown Creeks came in May and June; and 90% of the Bear River's came in May and June. This earlier peak is likely the result of aspect, whereby the south aspect Thomas Fork melts off earlier than the other basins. In a typical snowmelt model, once snow begins to melt at the low elevations the hydrograph begins to rise. As temperatures continue to increase, more of the basin melts out and the hydrograph rapidly rises. The hydrograph peaks when most of the basin is contributing. This appears to be how this basin operates. While we cannot determine the return period for historical discharges, it does appear that the annual peak flow can vary by an order of magnitude (100-1000 cfs (figure 4)).

Sediment Regime

Data Sources:

- Thomas Fork Water Quality Project (BLSWCD 1999).
- Smiths Fork Allotment Evaluation (BLM 2000).
- 1998 Wyoming 305(b) Water Quality Assessment.

The sediment regime refers to the size, quantity and timing of soil and rock movement through the watershed. All three of these variables are critical factors in determining the health of aquatic systems. Climate, drainage basin characteristics, watershed condition, and riparian condition all influence the streams sediment regime.

Sediment Sources

Most sediment would have entered the stream system through episodic mass wasting events or chronic bank erosion. The mass wasting would have been infrequent events triggered by extreme weather. While less common than bank erosion, these pulses were much larger. Mass wasting also input large rocks and large woody debris, which were important in creating aquatic habitat complexity. The bank erosion would have been associated with natural channel migration as the streams moved across their valley bottoms. This erosion would have been most severe as the streams approached the edge of their valley bottoms or eroded into terraces. Sediment from surface erosion would have been uncommon, occurring only after natural disturbances such as fire. However, the well vegetated and relatively flat valley bottoms would have minimized sediment delivery. A final and relatively minor sediment source would have been associated with wildlife impacts to stream banks and game trails.

Sediment Transport

While upslope erosion displaces soil particles, this material must be delivered to a stream to effect water quality. This delivery generally occurs where disturbances are either close to or cross a stream. Where disturbances are not close to streams, sediment is efficiently trapped on the hillslopes with fine gravels (2-8 mm) and sands (.05-2mm) being filtered out first and silts and finer particles being delivered further down slope. Since this delivery would occur during high flows (storm events or snow melt) the fine material would then likely remain in suspension and move rapidly through the system.

Sediment that reaches small creeks must be transported into larger streams before it influences aquatic biota or other beneficial uses. Therefore, understanding the factors that influence sediment transport to and through these small streams is required. Duncan, et.al (1987) found that sediment transport from an introduced source to the mouths of two experimental streams (95 and 120m) did not exceed 45% of the material added. Silts and clays were moved efficiently through the system, at all but the lowest flows, while sizes between fine sand and course sand were retained at progressively higher rates. In fact, only 10% of course sand was delivered to the mouth. Megahan (1982) estimated that on average fifteen times more sediment was stored behind obstructions than was delivered to the mouths of his experimental streams. This equates to 6% being routed through the basin which is consistent with the 10% found by Duncan. These studies illustrate the importance of channel storage in sediment transport. The three dominant types of channel storage are: (1) short term storage in channel bedforms as a function of flow conditions and sediment particle size; (2) moderate duration storage caused by obstructions; and (3) long-term storage in floodplain deposits.

Channel morphology is important in four major ways: accessibility of the floodplain, system structure (step-pool vs riffle-pool etc..), channel geometry [high width to depth ratio (W/D ratio) vs low], and frequency of obstructions. A stream that can access its floodplain (B, C, and E stream types) has the ability to deposit sediment in long-term storage effectively removing material from the system. Streams with step-pool systems (A stream types) can store sediment behind woody debris which provides moderate duration storage, while riffle-pool systems (B and C stream types) store sediment in relatively short-term bed features (bars). Streams with low W/D ratios (A, E, and G stream types) are more efficient at processing sediment than those with higher ratios (C and F streams types) at similar flows. Finally, woody debris (the most frequent obstruction) is extremely effective in retaining sediment.

During storms and catastrophic events, it's believed that sediment moved through the system in pulses as opposed to a continuous even flow. Most first order (unbranched) tributaries had moderate to steep gradients and were primarily source and transport reaches (A stream types). These streams were characterized by a high rate of sediment delivery to lower gradient streams. Within these A stream types, moderate duration woody debris storage was the primary storage component.

The Thomas Fork, Coal, Salt, Giraffe, Dry, and Preuss creeks begin as B stream types and transition into C and E types. While B stream types are generally able to access their flood plains, most sediment storage would have occurred in moderate duration debris storage and short-term bed storage. In the C and E channel types, fine sediments would have been delivered out onto the floodplain while coarser material would be stored as bed features. This provided a natural sorting of particle sizes with silts and clays enriching riparian areas (trapped by riparian vegetation) and sand appearing as dunes. Extensive beaver pond complexes, which were common in these low gradient areas, also stored large quantities of sediment. This sediment would either go into long-term storage where ponds filled and a new channel was formed; or moderate duration storage if the dam failed and sediment was released in a large pulse. In general, storage was an extremely important factor in regulating sediment movement through the system and into the main Thomas Fork and Bear River.

Stream Channel Morphology/Stability

Data Sources:

- Properly Functioning Condition assessments (Kemmerer BLM – 1994 and 1995 in Coal Creek and Raymond Canyon).
- Smiths Fork Allotment Evaluation (BLM, 2000)
- Stream Stability Surveys (Caribou-Targhee National Forest – Dry/Preuss in 1979, 1987, and 2001).
- Stream Surveys (Bridger-Teton National Forest - Salt Creek in 1993, 1999 and 2000).
- Riparian Surveys (CNF – Dry/Preuss in 1987).
- Personal Observations (Philbin, 2001).
- Professional interpretation of maps and aerial photos.
- Thomas Fork Water Quality Project (BLSWCD, 1999).

Data Gap:

- Information on many tributary streams is a data gap.

Assumptions:

- It is assumed that the ground truthed segments truly represented overall stream conditions.

Historically Thomas Fork area streams would have been in a state of "dynamic equilibrium." This means that the channel would be in balance - not aggrading or degrading. Following the geomorphic theory that channels form to accommodate the watershed products (water, sediment, and woody debris) that they normally process, we would not expect a stable stream to show more than isolated channel erosion. Widespread erosion would imply that the current conditions were outside of the range that formed the existing channel. Stream types (based on geomorphic characteristics) play a large role in stability as the inherent stability of the various stream types vary considerably. This section takes merges the stream flow and sediment regimes with the riparian vegetation, and geomorphic controls to evaluate the stream channel itself.

Determining historical conditions was accomplished by evaluating the drainage basin's characteristics and the forces acting upon them and then reconstructing the historic stream system from the existing conditions. The valley bottoms within this watershed would have supported "E" and “C” stream types (Rosgen 1994). “E” channels are low gradient, meandering, riffle-pool streams that are very narrow and deep. They frequently have undercut banks which provide excellent fish cover. These streams would have naturally had gravel substrates. The “C” channels are also low gradient, meandering, riffle-pool streams with cobble to gravel substrates. However, they are wide streams with well-defined bed features such as point-bars. These streams are found in broad valleys with alluvial floodplains and terraces. Both of these channel types are highly dependant upon riparian vegetation for their stability. This vegetation also supported large beaver populations that maintained bank moisture, and healthy riparian communities. Based upon this analysis the average stream(s) would be similar to the following description:

- The Thomas Fork consisted of a series of channels each carrying a portion of the total flow.
- Banks were well vegetated and stable - 90% for "E" channels and 80% for "C" types. The difference was due to the inherent differences in stream types. C types had greater width: depth ratios, less cohesive bank materials, and deposition on the inside bends that resulted in cutting on outside bends. Most of the instability of the "E" types occurred where the stream reached the edge of its valley bottom and was eroding into the adjacent hillslope.
- Streams were connected to their floodplains. As such the energy of peak flows was dissipated on the floodplain and channel impacts were minimized.
- Stream connectivity allowed the passage of fish, sediment, and woody debris.
- Sediment was primarily from in-stream sources.
- Woody debris played a role in channels through forested, canyon reaches.
- Beavers played an active role throughout the watershed. Old photos showed large beaver complexes on the main and overflow channels. These facilities served as grade control structures keeping the channels relatively stable. These features also slowed water velocities, stored sediment, and added to stream structure. Good riparian conditions supported a large enough population to maintain the facilities and prevent stream impacts when older dams failed. This vegetation also protected the stream banks from erosive forces minimizing instream sediment production. In silted in pond areas, wetlands formed.
- Channels moved as beaver ponds silted in and the dams were breached. As the channel shifted the beaver dammed the new section repeating this process. This process was common as evidenced by the many old channels and "high and dry" beaver dams on the floodplains.
- The substrate was dominated by cobble and gravel particles. Silts dominated in beaver ponds and where the channel was cutting through old ponds.

Water Quality

Data Sources /Data Gaps:

- Bear River Resource Conservation and Development http://www.bearriverrcd.org/bearriver/field/UB3a.html
- Idaho and Wyoming 303(d) list and 305 (b) Reports
- Thomas Fork Water Quality Project (BLSWCD, 1999)

Water Quality refers to the ability of a water body to support its beneficial uses. This can relate to changes in the physical channel or the water column. For this report changes to the physical channel were discussed under "STREAM CONDITIONS" while water column impacts are emphasized here. Stream bank erosion and mass wasting, irrigated and non-irrigated agriculture, stream channelization, pasture and riparian grazing, and animal holding/feeding areas are all, to various degrees affecting water quality in the Thomas Fork and its tributaries. Beneficial uses for these streams include:

Water quality was likely excellent historically. The only sources of pollution would have been native wildlife and nutrient releases following large wildfires. Functioning riparian areas would have provided ample vegetation to filter animal waste and sediment.

FIRE

Fire, insects, and disease have been the primary agents of ecological disturbance within the analysis area for centuries. Fire has been a frequent visitor in the area either as localized spot fires or as large, expansive conflagrations. Smoke associated with the fires has also been a part of the environment. The smoke could linger throughout the summer, and well into the fall in dry years. Barrett (1994) documented several major fire years throughout the Caribou National Forest in 1745, 1781, 1844, and 1934. Since the 1960, 14 fires have been suppressed in the analysis area, which equates to 3 wildfires per year (Montpelier Ranger District). To better understand the legacy of vegetation fire has left across the landscape, we must understand the plant communities and how they have adapted to and with fire.

Rangeland Habitat Types

Big sagebrush is not fire-resistant and is easily killed by fire. Big sagebrush generally stores seeds in the soil, which germinate as a result of fire-induced heating. Threetip sagebrush and spiked big sagebrush are exceptions, in that they will sprout after fire. Depending upon climatic conditions and grazing patterns, big sagebrush usually requires twelve to forty years before returning to pre-fire levels (Winward 1991). Antelope bitterbrush, as well as grasses and forbs, are scattered within this community. Antelope bitterbrush in the analysis area is generally a strong sprouter, and grasses and forbs sprout readily and dramatically increase their abundance following a fire. Approximately fifteen percent of the sagebrush communities avoid fire. They generally do not develop sufficient biomass in either the canopy or understory to adequately carry fire and normally do not compete with the herbaceous understory (Winward, pers. comm.). Mountain brush shrub (chokecherry-serviceberry-rose) species typically sprout following a fire.

Woodland Habitat Types

Curlleaf mountain-mahogany may depend on fire to reduce conifer competition and produce favorable soil conditions for seedling establishment. However, individual curlleaf mountain-mahogany is severely damaged by fire (Bradley, et al, 1991). Because many dead branches persist in the crown and leaves are slightly resinous, curlleaf mountain-mahogany is probably very flammable. The majority of mountain-mahogany communities generally avoid fire by inhabiting rocky sites on thin soils with sparse undergrowth that normally will not sustain fire. Mountain-mahogany that has developed on sites with deeper soils with an understory that can sustain fire is easily killed by fire. Mountain-mahogany adjacent to sagebrush sites typically has been affected by fire spreading from the shrubland into the woodland wherever sufficient surface fuel was available.

Xeric/Mesic Douglas-Fir Habitat Types

Douglas-fir: Mature Rocky Mountain Douglas-fir is generally more fire resistant than spruces and true firs, equally or slightly less fire resistant than ponderosa pine, and less fire resistant than western larch. Mature trees can survive moderately severe ground fires because the lower bole is covered by thick, corky bark that insulates the cambium from heat damage. It takes about 40 years for trees to develop fire-resistant bark on moist sites in the northern Rockies. Low growing branches and flammable foliage that makes trees susceptible to crowning often offset protection offered by thick bark. Chance of survival generally increases with tree size. Because they have thicker bark and larger crowns, large trees can withstand proportionally greater bole and crown damage than small trees (FEIS).

Douglas-fir relies on wind-dispersed seeds to colonize burned areas where trees have been killed. Mineral soil exposed by burning provides a good seedbed. Germination of artificially sown seed was about 60 percent on burned seedbeds but only 10 percent on unburned duff. Seedling establishment begins a few years after fire and is restricted to within a few hundred yards of seed trees (FEIS).

Lodgepole Pine: Lodgepole pine is more damaged by ground fires than thicker barked species such as ponderosa pine or Douglas-fir. Because its thin bark has poor insulating properties, many trees are killed from ground fires as a result of cambial heating. However, some trees survive, and in general, low-intensity ground fires thin lodgepole pine stands. In northwestern Wyoming, Loope and Gruell observed numerous individual trees in open lodgepole pine stands with two or three fire scars (FEIS).

The percentage of lodgepole pine trees bearing serotinous cones varies considerably throughout the Rocky Mountains, but in most stands both closed- and open-coned trees occur. This allows lodgepole pine to regenerate following both low- and high-intensity fires. Serotinous cones are advantageous for regeneration following high-intensity fires because the heat opens the cones and releases the seeds. These cones store huge amounts of seeds. Sometimes, 10 years of annual seed production are stored in serotinous lodgepole pine cones, which equal millions of seeds per acre. This huge seed reserve blankets the exposed forest floor within 3 years after fire. Even in areas where the nonserotinous habit is prevalent, such as in Yellowstone National Park, seed released from serotinous cones can be substantial. Following the wildfires of 1988 in Yellowstone, estimates of seed on the ground in burned-over lodgepole forests in the fall ranged from 50,000 to 970,000 per acre (123,000-2,400,000/ha). Conversely, ground fires generate insufficient heat to open serotinous cones. Following this type of fire, seed for regeneration must come from surviving, nonserotinous coned trees. Lodgepole pine produces seed at an early age. Cones on young trees are nonserotinous. Thus, postfire seedlings contribute to seedfall within about 10 years, and additional seedling establishment can occur if seedbed conditions are favorable (FEIS).

Quaking Aspen-Dominated Community Types

Small-diameter quaking aspen is usually top-killed by low-severity surface fire. Brown and DeByle (1987) found that as dbh increases beyond 6 inches (15 cm), quaking aspen becomes increasingly resistant to fire mortality. Large quaking aspen may survive low-severity surface fire, but usually shows fire damage. Moderate-severity surface fire top-kills most quaking aspen, although large-stemmed trees may survive. Some charred stems that survived low or moderate-severity fire initially have been observed to die within 3 or 4 postfire years. Severe fire top kills quaking aspen of all size classes. Moderate-severity fire does not damage quaking aspen roots insulated by soil. Severe fire may kill roots near the soil surface or damage meristematic tissue on shallow roots so that they cannot sprout. Deeper roots are not damaged by severe fire and retain the ability to sucker (FEIS).

Mortality does not always occur immediately after fire. Sometimes buds in the crown will survive and leaf out prior to the death of the tree. Brown and DeByle (1987) reported that quaking aspen trees died over 4-year period following fires in Wyoming and Idaho, although most individuals succumbed by the second postfire year. Even when quaking aspen is not killed outright by fire, the bole may be sufficiently damaged to permit the entrance of wood-rotting fungi.

Quaking aspen generally sprouts vigorously after fire. Long-term growth and survival of quaking aspen sprouts depend on a variety of factors including prefire carbohydrate levels in roots, sprouting ability of the clone(s), fire severity, and season of fire. Moderate-severity fire generally results in dense sprouting, however with a high severity fire fewer sprouts may be produced. A low-severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand (FEIS).

Xeric Subalpine and Engelmann Spruce Habitat Types

Historically, fire led to dominance by one or more seral species created by openings in dense stands, and created a mosaic of different ages and species compositions in spruce-fir forests. Where aspen is seral, encroachment of conifers make sites increasingly susceptible to fire as woody fuel and litter succeed succulent forbs. Generally moist conditions and slower rates of fuel accumulation make large fires unlikely except during periods of drought and high wind. Most fires that consume significant acreage in subalpine fir and spruce habitats are high-intensity crown fires during dry, windy conditions that accompany cold fronts (Crane, 1982). Lighting starts fewer fires in subalpine habitat types than it does in drier, warmer forests types.

Subalpine Fir: Subalpine fir is very fire sensitive and generally suffers high mortality even from low intensity fires. It relies on wind-dispersed seeds, which readily germinate on fire-prepared seedbeds to colonize burned areas. The occasional mature tree, which survives fire in small, unburned pockets, and trees adjacent to burned areas provide seeds to colonize burned sites. In subalpine habitats, scattered subalpine fir trees often escape fire because of discontinuous fuels, broken and rocky terrain, and the moist and cool environment (FEIS).

Xeric subalpine fir habitat types have more frequent and less intense fires than mesic subalpine fir habitat types. Fires at this frequency kill subalpine fir and keep these forests dominated by seral conifers such as lodgepole pine or Douglas-fir (FEIS).

Engelmann Spruce: Engelmann spruce is easily killed by fire. It is very susceptible to fire because it has (1) thin bark that provides little insulation for the cambium, (2) a moderate amount of resin in the bark which ignites readily, (3) shallow roots which are susceptible to soil heating, (4) low-growing branches, (5) a tendency to grow in dense stands, (6) moderately flammable foliage, and (7) heavy lichen growth (FEIS).

Crown fires typically kill Engelmann spruce trees. Engelmann spruce is also very susceptible to surface fires because fine fuels, which are often concentrated under mature trees, burn slowly and girdle the thin-barked bole or char the shallow roots. Some large Engelmann spruce may survive light, surface fires, but these often die later due to infection by wood-rotting fungi that enter through fire scars.

Following fire, Engelmann spruce reestablishes via seeds dispersed by wind from trees surviving in protected pockets or from trees adjacent to burned areas. The rate of reestablishment is variable and depends on the proximity of surviving cone-producing trees and seed production during the year of the fire and immediate postfire years. In general, Engelmann spruce seedling establishment is very slow in areas burned by large, continuous crown fires because much of the seed source is destroyed. However, on small burns or near pockets of surviving trees within a large burn, Engelmann spruce usually establishes numerous seedlings within 5 to 10 years (FEIS).

In areas where Engelmann spruce is abundant and lodgepole pine scarce before burning, Engelmann spruce establishes rapidly after fire if sufficient numbers of seed trees survive or are near the burn. If lodgepole pine is present in the preburn community, it usually seeds in aggressively, assuming a dominant role as it overtops any spruce seedlings establishing on the site. However, Engelmann spruce seedlings usually survive under the developing pine canopy because of its shade tolerance.

Above 9,850 feet, lodgepole pine does not regenerate, and burned areas remain open for several decades or longer. Postfire succession in this harsh, high-elevation zone (9,850 to 10,850 feet precedes very slowly. Spruce slowly becomes established as scattered seedlings. It may take 100 to 200 years before young spruce-fir forest covers the area. However, conditions in the upper parts of this zone sometimes make it difficult for tree seedlings to establish and survive at all. Regeneration is also poor where shrub and herbaceous cover is dense, where exposed mineral soil is subject to excessive evaporation, and where fire has only charred the duff. Postfire Engelmann spruce seedling establishment is best on moist surfaces where fire has consumed most or the entire duff leaving bare mineral soil. Seedlings do require some shade to survive; thus regeneration after fire is best on sites where standing dead trees, logs, or developing vegetation is present (FEIS).

FORESTS

Lodgepole pine

This early seral, conifer cover type has always been well represented within this watershed throughout time due to the natural range of fire intervals and intensities which have occurred. The structure and composition of lodgepole pine stands in the past differed somewhat from the current stand structures. There were probably a greater percentage of stands within the younger age classes, which directly reflects the historical, recurring fire intervals and intensities that occurred. Before European settlement, it is believed that there were fairly equal amounts of seedling/sapling, young or immature sawtimber, mature and old stands of lodgepole pine across the landscape. As a stand matures, bark beetles, disease, windthrow, snow, drought and other biological factors contributed to the down, and standing dead fuel loadings within these stands. Succession to shade tolerant species continued, until conditions were right for a fire to burn through these stands. Not all fires within a lodgepole pine stand were huge, lethal stand replacing fires as can be witnessed today by the presence of smaller, younger age classes of lodgepole intermixed within larger lodgepole stands, or by the presence of a different age and size class of lodgepole pine on a slope that is otherwise dominated by Douglas-fir, sub-alpine fir or spruce. One can also interpolate the presence of lodgepole pine on sites that were traditionally a sage-grass type but are succeeding to lodgepole in the absence of fire. This is evidenced by the presence of lodgepole occurring on slopes other than north to east facing slopes at elevations, which have sufficient moisture to support tree establishment and growth. Some of the present timbered stands currently dominated by sub-alpine fir, were at one time, most likely dominated by lodgepole pine, but due to the absence of fire have succeeded to more shade tolerant timber species.

Historical logging in Lodgepole pine types was mainly for post/pole, firewood and very limited cutting for sawlogs, all of which was associated with access along roadways. Horse logging and conventional ground based logging with mechanical equipment has had insignificant effects upon this timber type. Local residents have stated that the majority of cutting, which has been mainly on privately held lands, has targeted Douglas-fir. It is estimated that a very small percentage of the total acreage within this type has ever been commercially harvested. The amount harvested from this type is not sufficient to affect the overall age/size class distribution within this watershed. Historically wildfire has been the major disturbance factor for this type.

Aspen

Due to the evidence of many deteriorated aspen clones, aspen types once occupied a greater percentage of land area than at present. Historical aspen range can been evidenced by the presence of old aspen “carcasses” on the ground within many stands of conifer today. It is estimated that aspen occupied over 50% of what is now forested. (PFC).

Non-lethal fires at lower elevations and stand replacement fires at higher elevations, historically regenerated this species and kept the patterns and composition in a balance. Research noted fire frequencies from 31-202 years in aspen types on the Caribou National Forest, the (weighted mean) average fire interval was 69 years. There appears to be a trend toward declining fire occurrence since the late 1800's. The apparent result has been succession to dominance by conifer species.

Insects and diseases have always been present and active to one extent or another dependent upon stand vigor, age, local climate, and/or fire interval. These natural occurring controls were endemic until conditions permitted outbreaks, that lead to heavy down fuels, that eventually lead to wildfires, which lead to the regeneration of most aspen clones effected. Undoubtedly some aspen clones have been lost to these natural agents before fire could rejuvenate them.

Fuelwood cutting has been insignificant within this type over time. Logging of this species has been at or below fuelwood gathering levels.

Interior Douglas-fir

Historically stand structures were primarily even-aged and single- storied or two-storied, with two distinct age classes with very few trees reaching 300 + years of age. Douglas-fir is associated with a variety of insects and diseases including Douglas-fir bark beetle, spruce budworm and dwarf mistletoe (PFC). Fire regimes were usually non-lethal at fairly frequent intervals, which served to restrict the encroachment of more shade tolerant species and to consume the down fuels in cool surface fires. This frequent fire interval also served to prepare a favorable seed bed for germination of Douglas-fir and lodgepole pine with a corresponding effect upon aspen regeneration when a source for sprouting or seeding was available. Historical fire intervals maintained this species upon drier sites and in mostly pure stands.

Douglas-fir was sought after for sawlogs as building material for the railroads, pioneers, as well as their descendants. The practice of winter horse logging was conducted until recently. Evidence of this light selective harvesting practice can be found scattered in many stands of Douglas-fir within the analysis area. This type of logging was usually very small scale and typically involved removing only a few select trees.

Spruce – Fir

This timber type occurred from pure Engelmann spruce to pure sub-alpine fir forests, but in moist cases it occurred as a mixed species type. The proportion of Engelmann spruce typically increases with elevation and corresponding moisture. Aspen, Douglas-fir, and lodgepole pine can be represented, but are minor occasional components within this type. Equal amounts of seedlings, saplings, immature sawtimber, and mature sawtimber size and age classes were represented. An occasional old, larger diameter veteran or group of veterans, which had been spared from fires, could be found. These forest types were characterized as being mostly uneven-aged and multi-storied with varying amounts of dead standing and down fuels.

Insects and diseases were evident in most stands of this type. They would remain at endemic levels for extended periods of time until such environmental conditions combined to foster epidemic outbreaks of insects. Mortality rates associated with such epidemics could reach as high as 80%.

During the early days of unregulated livestock grazing, this forest type was usually the most sought after for forage during the summer months as all of the lower elevation timber types had been heavily grazed in the spring (B.Baughman). This timber type also tended to hold the most moisture for a longer period of time due to the heavy snowpack associated at this elevation.

Horse logging of the past never had much of an impact upon this type as it was buried in heavy snowpack for a good portion of the year, with bitterly cold temperatures, and spruce or sub-alpine fir were never a highly sought after tree.

RANGELANDS

Those rangeland cover types that occupy the drier portions of the watershed generally have similar basic characteristics. They include the basin and mountain big sagebrush, and low sagebrush as well as Rocky Mountain juniper. Because of these similarities they are categorized as dry shrub potential vegetation group. Historically, grasses and forbs covered 10 to 60 percent of these dry shrublands with sagebrush crown cover ranging from 0-5 percent on 10 percent of the area and 5-15 percent on 50 percent of the area. Shrubs covered the remaining 40 to 90 percent with sagebrush crown cover generally exceeding 15 percent. Bare ground ranged from 20 to over 50 percent. In the absence of fire for long periods, trees, such as juniper sometimes invaded dry shrublands. Generally, sagebrush species maintained dominance on all but 0-5 percent of the historical habitat with an associated understory component of perennial grasses and forbs. Secondary shrubs such as rabbitbrush and horsebrush, which are more fire tolerant increased for a period of time until sagebrush gained dominance. The perennial forbs and grasses responded quickly to nonlethal fires by sprouting from bunchgrass root crowns, seeds, or runners. The majority of fires in this vegetation group were lethal to the dominant shrub overstory. The fire return interval was approximately 20 years. Drier sites may have had a return cycle approaching 40 years. The native grazing regime appears to have varied between relatively high intensity, short duration grazing by herds of wild ungulates, to low intensity grazing by scattered wild ungulates, to seasonal moderate levels of grazing by groups of wild ungulates. Grazing was strongly influenced by seasonal weather. The patchy pattern of mixed grass and shrub areas tended to exist in rocky areas and rough terrain. Areas of gentle terrain and deeper soils tended to have more continuous patterns. The mixed pattern of trees, shrubs, grasses and forbs provided a variety of food and cover for animals.

Historically, the curlleaf mountain-mahogany type was represented by relic specimens (older individuals). Greater than 35 percent of the annual leader growth was retained each year to assure flowering and seed set. Raw marked habitat (severely disturbed sites) provided conditions favorable for seedlings to become established. Stands of the species characteristically had sparse understories with considerable bare soil. In contrast to associated cover types, indications are that this type rarely burned. Rare climatic events such as intense thunderstorms and severe wind-driven fire most likely created conditions favorable for establishment of new stands. Curlleaf mountain-mahogany is a highly palatable, preferred winter browse for big-game species. On dry southern exposures at lower to moderate elevations where the type is found, it is heavily browsed. The area occupied by the curlleaf mountain-mahogany covertype was generally small and often restricted to rock outcrops.

Other rangeland covertypes that occupy more mesic positions in the watershed and include subalpine and spiked big sagebrush, threetip sagebrush, snowbrush, bigtooth maple, and chokecherry-serviceberry-rose have similar basic characteristics and are categorized as a cool shrub potential vegetation group. Most of the species that characterize these types have the ability to resprout after fire. Snowbrush is well adapted to recover after burning, since the germination of the long-lived seeds is stimulated by heat and resprouts profusely after fire. Historically, these cool shrublands had fairly short cycles of dominance by either grasses and forbs or other shrub species. Grasses and forbs covered from 10 to 40 percent of these rangeland covertypes and shrubs covered the remaining 60 to 80 percent. Conifers occupied from about 3 to 10 percent of the area. These types naturally supported high amounts of grasses and forbs with a high level of species diversity. Most fires in this type were lethal occurring at intervals ranging between 25 and 75 years over most of the group. The native grazing regime appears to have varied between relatively high intensity, short duration grazing by herds of wild ungulates, to low intensity grazing by scattered wild ungulates, to seasonal moderate levels of grazing by groups of wild ungulates. Grazing was strongly influenced by seasonal weather.

The tall forb covertype was historically dominated by many tall forb species without any species dominating, although sites varies in number of species present and in those that were visually dominant. Shrubs were mostly absent and graminoids were mostly inconspicuous and seldom comprised more than 10 percent of the composition. Species in these colder environments are perennial, surviving years in which flowering and fruiting cycles are disrupted by the early arrival of killing frosts. Fire free intervals range from 50 to 100 years. The type occurs in relatively moist opening in the spruce-fir zone.

The riparian covertype played a role in many physical processes. Riparian vegetation shaded streams and moderated water temperatures by helping keep waters cool in summer and providing an insulating effect in winter. Densely vegetated riparian areas buffered the input of sediment from runoff generated on adjacent uplands. Riparian vegetation promoted bank stability and contributed organic matter and large woody debris to some stream systems. Almost all of the dominant natural species that occurred in the riparian covertype were extremely strong, deep-rooted species. Under natural conditions, riparian plant communities exhibited a high degree of structural and compositional diversity. Historically, floods and fires dominated disturbance regimes along riparian areas, with some grazing by native ungulates. Within riparian woodlands, fires were normally infrequent but severe, occurring at 65 to 150 year recurrence intervals. In the riparian shrub communities, fire was typically more frequent, occurring every 25 to 50 years. Riparian areas were mainly confined to the bottoms of canyons or drainages in steep terrain, while on more gentle terrain they encompassed larger areas of valley bottoms.

FISHERIES

Thomas Fork

In prehistoric times, the Bear River was tributary to the Snake River, but lava movement during the late Pleistocene (25,000-35,000 years ago) diverted it into the Bonneville Basin. Fish from the Snake River system accessed the Bonneville Basin this way. At its largest, Lake Bonneville covered 51,152 square kilometers, which helped distribute cutthroat trout within the basin. However, even at its peak, Lake Bonneville did not inundate the Thomas Fork. The cutthroat trout in the Thomas Fork continued to be oriented to fluvial and resident life histories (Binns 1981).

Before the Caribou National Forest was established in 1907, the area was heavily grazed by both cattle and sheep, resulting in very poor range and riparian conditions. The 63,000 acre Montpelier Elk Valley Allotment was established around 1907. The original allotment boundaries were approximately the same as the present boundaries, although some adjustments have since been made (Hanson 1980). The excessive livestock grazing may have resulted in impacts to riparian and aquatic habitat.

Russell Boehme, a lifetime resident of the Dry/Preuss Creek drainage, recalls heavy livestock grazing in the first half of the 1900's. Large herds of 2-3,000 sheep grazed the hillsides and valleys. The heavy grazing converted the 3 feet tall grass in some areas to sagebrush (Boehme 2001).

Bruce Bowman, a resident of the Thomas Fork Valley for over 60 years, agreed. However, he noted that overall perspective of land ownership and stewardship has evolved since those days. He believes land is more valued today and there has been significant improvements in rangeland management. Today, he said, there are no options to move somewhere else when resources are depleted (Bowman 2001).

Binns (1981) reported the water quality in the Thomas Fork Drainage to be generally good, but silt and thermal pollution was severe in some tributaries. Active stream bank erosion contributed much silt to some streams. In addition, the riparian vegetation was much reduced decreasing stream shading.

Local Residents have observed a noticeable decline in the fisheries of the Thomas Fork in the period between 1970 and 1980. Bruce Bowman believes the decline in fisheries is due to the increased frequency of desiccation of the river (Bowman 2001). Bowman owns the private land at the mouth of Giraffe Creek. He noted the river was dry 5 times since 1980. Water right claims have not significantly changed over the last 3 decades.

Russell Boehme attributes the noticeable decline in the fisheries to stream channel alterations. His family settled at the mouth of Preuss and Dry Creeks in 1893. In the 1950's, the Thomas Fork downstream of their ranch was straightened for approximately ¼ mile to remove a river meander from a farmer's field. Downcutting, bank erosion, sedimentation, and a decrease in the elevation of the water table resulted. Boehme also noted an active willow eradication program as a potential effect to stream bank stability. When he cleared willows along Preuss Creek, he maintained a rod distance from the stream bank, recognizing the value of willows to stream bank stability. However, spring floods caused the channel of Preuss Creek to shift away from the willows in sections, resulting in bank erosion and downcutting (Boehme 2001). Others cleared, and still clear, willows to the edge of the stream. Many ranchers and farmers clear willows from the stream and riverbanks in an attempt to gain more surface area for agricultural practices and more livestock access to the stream. It may be one of those actions that were handed down from generation to generation. Perhaps the thought that "My grandfather did it and my father did it, so it must be the right thing to do for the ranch" is the catalyst for those actions. Those families that settled the valley 100 years ago likely had to carve their ranches out of the willow flats. They had to clear willows or they wouldn't have been able to produce enough agricultural products to be viable. It could be that the "war on willows" just continued from generation to generation in some places on the Thomas Fork and its tributaries. It may have developed into a kind of instinct.

The Thomas Fork of the Bear River has been stocked by IDFG since the 1940's. Cutthroat trout, rainbow trout, and brook trout were planted. Other undocumented plantings have likely occurred, including the planting of carp by the US Fish Commission. Most of the source hatcheries and sources of fish eggs were not documented in the stocking records. However, likely sources for eggs included Henry's Lake, Jackson National, and Auburn Hatcheries. All of these hatcheries were sources for Yellowstone cutthroat trout. The planting of Yellowstone cutthroat trout upon native Bonneville cutthroat trout had the potential to affect the genetic integrity of the Bonneville cutthroat trout populations.

Table 6: Documented hatchery plants in the Thomas Fork Drainage
(Data courtesy of IDFG)

DATE	SPECIES	POUNDS	NUMBER	SIZE (inch)	HATCHERY
9/24/1946	CT	unknown	40128	FRY	WHISKEY CREEK
10/18/1949	CT	32	38400	FRY	WHISKEY CREEK
7/18/1950	CT	311	6220	PARR	AMERICAN FALLS
7/6/1950	CT	312	5616	PARR	AMERICAN FALLS
9/17/1953	CT	50	31800	FRY	GRACE
9/6/1957	CT	40	41600	FRY	GRACE
8/3/1964	CT	8	16000	FRY	GRACE
08/08/1969	CT	8	21760	FRY	UNKNOWN
07/20/1970	CT	20	20600	FRY	UNKNOWN
07/31/1971	BRK	80	16000	FRY	UNKNOWN
08/05/1971	BRK	6	1200	FRY	UNKNOWN
08/05/1971	CT	10	16000	FRY	UNKNOWN
08/17/1971	BRK	20	4000	FRY	UNKNOWN
11/12/1971	BRK	10	2830	FRY	UNKNOWN

07/27/1972	BRK	215	20210	FRY	UNKNOWN
07/18/1973	RB	300	1080	CATCHABLE	UNKNOWN
08/11/1973	CT	13.4	20100	FRY	UNKNOWN
07/17/1974	RB	140	504	CATCHABLE	UNKNOWN
07/24/1975	RB	300	1020	CATCHABLE	UNKNOWN
07/15/1976	RB	300	1050	CATCHABLE	UNKNOWN
07/21/1977	RB	420	1008	CATCHABLE	UNKNOWN
07/26/1978	CT	5	5000	FRY	UNKNOWN
07/26/1978	RB	200	1080	CATCHABLE	UNKNOWN
08/08/1979	CT	400	2600	FRY	UNKNOWN
08/09/1979	CT	400	2600	FRY	UNKNOWN
08/23/1979	RB	350	1225	CATCHABLE	UNKNOWN
07/14/1980	RB	300	1020	CATCHABLE	UNKNOWN
07/15/1981	RB	400	1520	CATCHABLE	UNKNOWN
06/23/1982	RB	400	1120	CATCHABLE	UNKNOWN
06/29/1983	RB	225	1035	CATCHABLE	UNKNOWN
06/21/1984	RB	275	1045	CATCHABLE	UNKNOWN
06/24/1985	RB	305	1007	CATCHABLE	UNKNOWN
06/19/1986	RB	245	1005	CATCHABLE	UNKNOWN
06/10/1987	RB	300	1020	CATCHABLE	UNKNOWN

Brook trout were observed by Wyoming Game and Fish in population surveys in 1976, 1977, and 1987 (Remmick et al. 1994).

Genetic Purity of Bonneville Cutthroat Trout in Thomas Fork

Dr. Robert Behnke, from Colorado State University, studied the genetics of Bonneville cutthroat trout in the Thomas Fork and their tributaries in the late 1970's. Raymond, Upper Giraffe (in Wyoming), and upper Coal Creeks tested as genetically pure. Middle Giraffe, Salt, and Huff Creeks tested essentially pure. Upper Giraffe (in Idaho) and Middle and Lower Coal Creek tested as good representatives of Bonneville cutthroat trout with some hybridization evident. Although samples were not taken from all streams in the Thomas Fork Drainage, sufficient data were obtained to indicate that Bonneville cutthroat trout were the dominant trout and well dispersed throughout the drainage. The basic physical appearance has persisted through numerous plantings of non-native hatchery trout, including rainbow trout. Some contamination from past hybridization was evident through a tendency toward a finer spotting pattern. However, such contamination is faint and Bonneville cutthroat trout in the Thomas Fork are reasonably high in genetic purity.


Photo 4: Adult Bonneville cutthroat trout from lower Thomas Fork (Colyer 2000).

1975-76, BLM Kemmerer Resource Area surveyed stream habitat on 80% of the stream miles on BLM land within the eastern half of the Thomas Fork Watershed (50% of the total stream miles). Within those streams, the average channel stability was rated low/fair to poor, with excessive bank erosion. While resident habitat (pool quality and quantity) was primarily in fair condition, suitable spawning habitat was limited to small, scattered reaches throughout to drainage. Lack of overhead riparian cover, high summer water temperatures and extensive stream sedimentation were primary limiting factors for cutthroat trout production in these streams.

In a correspondence with Earl Thomas, the Director of Wyoming Department of Game and Fish, BLM Wyoming State Director Daniel Baker (1977) expressed concern for the "precarious status of Bonneville cutthroat trout in the upper reaches of the Thomas Fork drainage." Baker was seeking concurrence to recognize the subspecies as Sensitive in the State of Wyoming.

In 1979, the Kemmerer Resource Area prepared a habitat management plan for the Thomas Fork (USDI BLM 1979). The habitat management plan used the data collected in 1975-76 to document 73% of the fisheries habitat in the eastern half of the Thomas Fork watershed as in an apparent declining trend. The plan reported extensive willow and aspen riparian habitat impacts from brush spray projects that occurred decades earlier. Since that time, commulative effects of intensive utilization of riparian vegetation by livestock grazing had sustained the trend to reduced channel stability, stream bank erosion, downcutting, lowered water tables, and hydric to xeric streamside vegetation conversion. The plan listed several conservation actions to be taken to restore Bonneville cutthroat trout populations in the planning area, including establishing survival areas, adjusting grazing use, determining instream flow requirements, and road improvements.

A 1981 Thomas Fork Cooperative Aquatic Habitat Management Plan Progress Report described accomplishments in the construction of livestock exclosures, and instream improvements in Coal Creek. Channel deepening and narrowing were reported in Huff Creek, where the area was rested from grazing for more than 4 years. Fish community response was favorable to these improvements. In the study reach, there was a 52% increase in total fish biomass and an increase in native fish community diversity.

Preuss Creek

Several aquatic surveys have been conducted on Preuss Creek since 1979. The stream was originally surveyed by Dave Hanson, Caribou Forest Zone Fisheries Biologist (1979). He reported the stream gradient as 3-4%, downstream of the Crow Creek Road crossing and 5-10%, upstream of the crossing. The low gradient reaches flowed through an open valley while the high gradient reaches flowed through a V-shaped valley. Douglas fir and lodgepole pine dominated the north slope vegetation while sage and aspen dominated the south. Moderate to heavy beaver activity was observed and evidence of stream impacts was noted where dams failed. While the substrate in the upper stream reaches primarily consisted of gravels, the low gradient reaches primarily consisted of silt and sand. During the survey, very few fish were observed. The only fry observed occurred in the upper reaches.

Dean Grover surveyed Preuss Creek in August 1980 and September 1981. Using the Forest Service GAWS stream survey methodology, he rated pools, substrate, and stream bank vegetation. The stream reaches with the worst ratings were near the mouth of Beaver Creek and near the Forest boundary.

The habitat surveys conducted in 1981 included a reach within and a reach downstream of a cattle exclosure. The reaches were resurveyed in 1985 to find the percentage of eroding banks inside the exclosure had decreased from 24% to 4%, percent trampled banks had decreased from 20% to 0%,

Preuss Creek was stocked by IDFG with Yellowstone cutthroat trout 1969-1976. In 1968, IDFG stocked Preuss Creek with cutthroat/rainbow hybrids.

David Hanson visited Preuss Creek in September 1980. He commented the previous 2 seasons of rest in the stream bottoms had resulted in obvious improvement in riparian vegetation. He recommended increasing the intensity of riding the allotment to help move cattle from the stream bottoms (Hanson 1980).

Al Winward, Forest Service Regional Ecologist rode Dry and Preuss Drainages in October 1987. The riparian area of Dry Creek had very little remnant native vegetation. Instead, Kentucky bluegrass and red top were the primary species present, providing limited ability to hold together stream banks. In addition to grazing, Winward attributed riparian and stream channel impacts to an unusually high abandonment of beaver dams. The beaver have utilized the quaking aspen as far upslope as practical and then abandoned the area. The deteriorated dams broke, scouring the downstream channel. The scouring would have been less severe if the streamside vegetation was in better condition. Winward noted the unstable nature of the soil and geology of the area as an additional reason for these fragile riparian areas. He believed livestock distribution was the major problem in the allotment. Similar problems were noted in Preuss Creek, but he did note areas experiencing slow recovery there (Winward 1987).

Winward (1987) recommended a change to the grazing system built around a 2-year's rest in 5 approach to accelerate recovery. He also recommended the initiation of a major prescribed fire effort in the allotment. Strategically located fires could draw cattle away from riparian areas to new forage upslope. He also suggested more fencing to improve cattle distribution in the allotment.

Burton et al (1987) conducted a level II riparian inventory in Preuss Creek. The stream segments inventoried represented riparian area complexes mapped according to stream and valley geomorphology, dominant soil families, and dominant riparian vegetation types. The inventory covered the lower 5 miles of stream on the Forest. They documented Preuss Creek downstream of the mouth of Beaver Creek as generally in poor condition. There were short stretches of what appeared to be improving riparian conditions, but the majority of the stream was in a declining trend due to intensive livestock use. Bank stability and cover were poor for much of the study area. Instream sediment was severe. The bank stability ranged from 7 to 53%. The GAWS Habitat Condition Index was rated primarily as poor. The GAWS Habitat Vulnerability Index was rated as severely and critically vulnerable. Beaver habitat condition was rated as poor and riparian condition was rated as poor and fair. The Forest interdisciplinary team that performed the survey recommended the amount and season of cattle use be adjusted to allow willows and sedges to regenerate. The assessment of soils supported the recommendation for livestock management changes to minimize and reduce soil compaction. The team recommended a fence around the lower half of Red Mountain Unit (below Beaver Creek) and the unit being used as a separate riparian pasture. They recommended controlling the cattle use of riparian vegetation with a permanent rider or a corridor fence along Preuss Creek from the Forest boundary to the Narrows and upstream of the Narrows around riparian complexes.

In 1987, Caribou Forest Fisheries Biologist Tim Burton prepared a document reviewing stream habitat conditions in Preuss and Giraffe Creeks. He found that bank cover, riparian vegetation, and bank stability all improved in the Preuss Creek exclosure between 1985 and 1987, despite livestock encroachment on the stream through an opening in the exclosure fence in 1986. Slight habitat improvements were noted outside of the exclosure (Burton 1987).

Burton (1987) reported that since 1979, the upper portions of Preuss Creek (above exclosure) had improved in channel condition slightly. Those reaches downstream of the exclosure have all declined in channel condition probably due to the historic loss of riparian vegetation that contributed to the loss of bank stability. He reported that some segments of Preuss Creek have improved and thought those improvements reflected improvements in grazing management. He used the stream segment from Crow Creek Road to the exclosure as an example.

Burton (1987) discussed the interrelationships between riparian vegetation health and the stability of beaver dams. Where riparian vegetation was lacking on stream banks downstream of failed beaver dams, the stream had suffered considerable destabilization for distances of up to several hundred yards. If additional dams were located immediately downstream, they too would wash out, and the backwater areas of these dams would downcut significantly. In some instances, dams located downstream of failed dams did not wash out because the failure occurred slowly and the downstream dam was extremely stable with heavily vegetated riparian areas. In areas lacking downstream riparian vegetation, upstream dam failures usually resulted in the loss of all dams below. In well vegetated areas, what few dams failed have usually been replaced. Burton recommended stream improvements be limited to bank stabilization and sediment reduction and new grazing strategies be employed in Preuss and Dry Creeks.

In 1987, an interagency team consisting of IDFG, USFWS, and USDA Forest Service employees reviewed stream and riparian conditions on Preuss Creek (Spillett 1987). At the time, fisheries managers believed Preuss, Dry, and Giraffe Creeks to be the only streams in Idaho to support Bonneville cutthroat trout. The discussion, spirited at times, centered on livestock use of the riparian area, the resulting impacts, and potential management solutions. In hindsight, it appears the cooperative spirit captured in the current conservation agreement took a while to develop. Early efforts at aquatic habitat protection and restoration in these streams apparently included finger-pointing and frustration. These discussions were elevated to a correspondence between Idaho Department of Fish & Game Director Jerry Conley and Regional Forester Stan Tixier (Burton 1988). Conley (1987) expressed discouragement with the condition of Preuss Creek fish habitat. Cutbanks, high embeddedness, and poor riparian cover were reported as common and he identified past grazing practices as the cause. Conley recommended adjustments to the grazing system and corridor fencing. He suggested a four year rotation schedule with double rest and two years of deferred grazing. Conley also expressed concern regarding riparian conditions in Dry Creek (denuded and trampled stream banks) and Giraffe Creek (increased access).

In a letter to the Forest, US Fish and Wildlife State Supervisor Robert Ruesink (1987) also expressed a need for an increase in riparian fencing.

A letter in response to IDFG drafted by Burton (1987) for the Regional Forester's signature, reiterates the agency's commitment to the protection of Sensitive Bonneville cutthroat trout and cooperation with Idaho Department of Fish & Game. After several revisions, this letter was later apparently sent from the Forest. However, public concern over the condition of the range within these watersheds did not subside.

A letter from Steve Huffaker, Idaho Department of Fish and Game Bureau Chief of Fisheries (Huffaker 1991) to Paul Nordwall, Caribou National Forest Supervisor, expressed deep concern over the status of Bonneville cutthroat trout on the Forest and requested immediate attention due to precipitous population declines. He suggested the need for a policy level discussion in light of ongoing concerns. In a response letter, Forest Supervisor Paul Nordwall (1991) also expressed concern regarding the status of Bonneville cutthroat trout. However, he disagreed a policy level meeting was required. He cited the development of new grazing strategies, more comprehensive vegetation utilization standards, and fences. He also assured that fences and other improvements already in place would be fully maintained.

In a letter responding to concerns expressed by the Idaho Chapter of the American Fisheries Society, Montpelier District Ranger Mark Johnson (1990) identified Montpelier Elk Valley Allotment as the district's highest priority allotment and pledged to continue to invest the bulk of their time and resources into managing it. Johnson pointed out the effectiveness of the coordinated resource management approach. This management strategy emphasizes coordination between the Forest Service and other agencies/organizations. Based upon the group's recommendations, the 1991 Annual Operating Plan for the allotment would include:

1. As much rest from grazing as possible (with strict enforcement),
2. Improvements on guidelines for proper grazing utilization for riparian and uplands,
3. Detailed instruction to permitees on maintenance of improvements,
4. Requirements for removal in case of draught,
5. and the creation and improvement of exclosures in Preuss Creek.

Johnson (1990) highlighted improvements made:

1. An increase of information exchanges between managers and permitees,
2. Better fence maintenance on existing improvements,
3. Restriction/elimination of sheep trailing through the allotment,
4. Giraffe Creek road closure and rehabilitation,
5. and extensive inventory and monitoring of aquatic and riparian resources.

Dry Creek

Based on drainage surface area, Dry Creek is considered a tributary to Preuss Creek. Geneva Ditch was excavated from the Thomas Fork to Preuss Creek in 1895 (Boehme 2001). When operating, the ditch rewatered lower Dry and Preuss Creeks. They were traditionally dewatered by irrigation practices upstream. Garth Boehme (2001) believes the water from the ditch maintained a watered connection between Dry/Preuss Creeks and the Thomas Fork for a longer period of the year. Although this is desirable for maintaining wetted habitat in the lower watershed, there would still be concerns about connectivity between the river and the upper watershed. Full spanning irrigation weirs are set in the streams traditionally in early May, negating upstream migration of fluvial cutthroat trout spawners and likely intercepting most downstream movement of juveniles in Dry and Preuss Creeks.

When the Geneva Ditch was excavated, it was connected to Dry Creek. Between where the ditch connected with Dry Creek and Dry Creek's confluence with Preuss Creek, Dry Creek was converted to a ditch through channel straightening (Boehme 2001). This was done to maximize continuous farmland surface area and, it was believed, efficiency of water delivery.

A pioneering motorized vehicle user initiated the Boulevard Road in the upper watershed in 1948 (Boehme 2001). Since then, the Forest has surfaced the road and relocated road segments. Although reduced, it continues to be a source of sediment to Dry Creek. A culvert located under the Boulevard Road with beaver fencing attached is a barrier to upstream migrating fish. This road segment is maintained by the Bear Lake County.

Dry Creek was stocked by IDFG with Yellowstone cutthroat trout. Stocking occurred once every summer from 1969 to 1972, and 1975 and 1976. In 1969, an additional stocking of Dry Creek occurred in September. At the time, there were no concerns about impacts upon native Bonneville cutthroat trout genetics.

Dr. Richard Wallace (1980) tested Bonneville cutthroat trout for genetic purity. He reported the fish sampled in Dry and Preuss Creeks had meristic characteristics very similar to pure populations of Bonneville cutthroat trout, with no apparent effects of hybridization with rainbow trout. Some physical characteristics (high scale and tooth counts) may indicate slight hybridization with Yellowstone cutthroat trout. Based on meristic characteristics, Wallace concluded the stocking of non-native fish in Dry and Preuss Creeks have apparently not significantly affected the genetic integrity of these Bonneville cutthroat trout populations.

Burton (1987) reported Dry Creek showed an improving channel condition on the reaches nearest the Forest boundary. The upper reaches were decreasing in channel condition. Burton explained this was due to the quality of the riparian vegetation at these sites. The degraded channels upstream had lost the stabilizing influences of healthy riparian vegetation. The loss of healthy riparian vegetation was due to overuse by livestock.

Beaver Creek

Beaver Creek is a tributary to Preuss Creek. It was stocked once every summer from 1969 to 1972 with Yellowstone cutthroat trout.

David Hanson, Zone Fisheries Biologist for the Caribou National Forest, visited Beaver Creek in September 1980. He noted a blown out beaver dam in the upper reach of the stream was contributing tons of sediment downstream. The vegetation that remained in the vicinity of the dam site was not conducive to the construction of sturdy dams (Hanson 1980).

Giraffe Creek

Dr. Richard Wallace (1978) tested Bonneville cutthroat trout from Giraffe Creek for genetic purity and concluded they are nearly pure (assigned a “B” rating per Binns’ genetic purity sliding scale). Phenotypically (judging from the spotting pattern and coloration) these fish appeared to be pure Bonneville cutthroat trout. Meristically (based on the lateral line scale counts and basibranchial teeth) these fish may have been slightly hybridized. Past stocking had occurred in the drainage. At the time of Wallace's study, this was the only known population of Bonneville cutthroat trout in Idaho. Wallace concluded the Giraffe Creek population was essentially pure and good representatives of Bonneville cutthroat trout. He recommended the discontinuation of all stocking of non-native salmonids and recommended the reduction or elimination of grazing in the Giraffe Creek watershed.

Bruce Bowman (2001) recalled more and deeper beaver complexes in Giraffe Creek in the 1950's. He fished the stream regularly and would use spinning tackle in the beaver ponds. He believes the beaver dams in Giraffe Creek were composed of larger material in the 1950's than today. They were likely constructed of aspen stems and branches, when aspen were more frequent and occurred closer to the stream.

During the last 2 decades, range use in Giraffe Creek has been further regulated. Two sheep allotments were discontinued in Giraffe and Dry Creek. In 1976, cattle grazing was discontinued in lower Giraffe Creek (Johnson 2001).

David Hanson, Caribou National Forest Zone Fisheries Biologist, visited Giraffe Creek in September 1980. He noted the riparian area had markedly improved with rest from grazing. He expressed concern about placing salt near the North Fork of Giraffe Creek and the past intensity of grazing this area. He was not concerned about potential impacts from a proposed timber sale in that drainage but conveyed concerns of increased access to the watershed expressed by Idaho Department of Fish & Game. IDFG thought they would have to close the stream to fishing if access was increased (Hanson 1980).

Idaho Department of Fish & Game expressed further concerns regarding a proposed increase of access into Giraffe Creek during the scoping for the 1984 Giraffe Firewood Sales Environmental Assessment (Burton 1988). These concerns were apparently met with mitigations that included routing the road away from the stream, controlling the period of public access, and monitoring angler use. Road use was controlled so that no access was possible during the cutthroat trout spawning period.

Robinson Creek

Robinson Creek is a tributary to Giraffe Creek. It was stocked by IDFG in 1969 and 1970 with Yellowstone cutthroat trout.

Salt Creek

No historic information was found for Salt Creek. It is the primary headwater tributary to the Thomas Fork River. Its major tributaries include Packstring, Little White, Lost, Water Canyon, and Dipper Creeks.

Coal Creek

Coal Creek watershed was sprayed to eliminate sagebrush in the uplands and the spraying continued across streams, killing willows. Bank erosion, sedimentation, and downcutting occurred (Johnson 2001).

The following aerial photos depict the decline of riparian vegetation and beaver activity along Coal Creek from 1940 to 1977. The aerial photos are courtesy of BLM Kemmerer Resource Area Office and are included in Binns (1981).

Photo 5: Coal Creek, just upstream of its confluence With Huff Creek on August 29, 1940. Note Dense shrub growth along stream. Arrow Is reference point included in following Aerial photos.

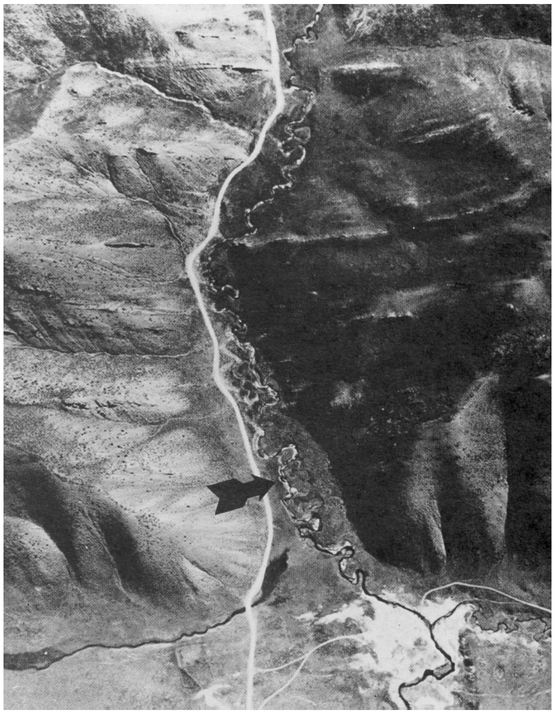


Photo 6: Coal Creek, same location, on August 12 1955. Note less riparian shrubs.

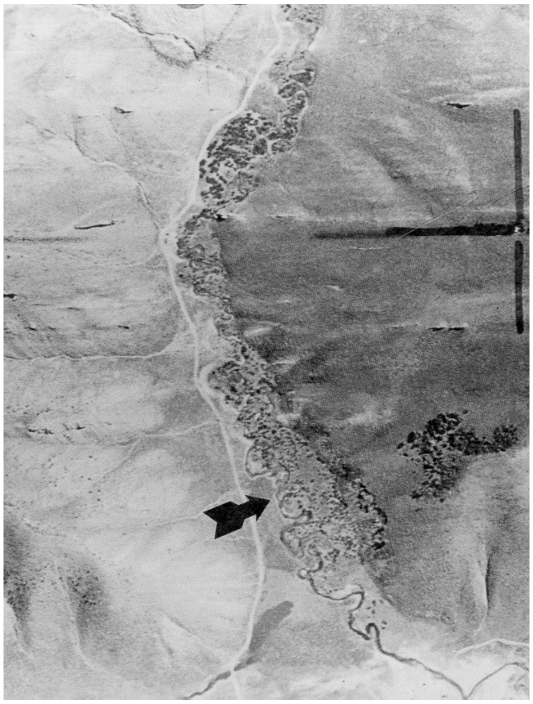


Photo 7: Coal Creek, same location, on September 9, 1977. Large shrubs, such as willow, have disappeared. Sagebrush is now common in riparian area. Less beaver activity is evident.

The herbicide 2,4-D was applied from planes and helicopters to kill sagebrush in 1968, 1969, and 1970. The program was initiated to increase forage for livestock. The precise application of the spray was not a concern at the time and much of the riparian vegetation was sprayed, including willows. Streamside willows were killed in all the areas sprayed. The areas that were sprayed were no longer as productive as they were prior to spraying (USDI BLM 2000).

Application of Tordon in Coal Creek was documented in 1978, 1979, and 1980. Although those applications certainly killed riparian vegetation, adding to bank instability, much of the vegetation adjacent to the stream was already xeric upland vegetation. The Coal Creek drainage has been heavily grazed for many years, mostly by sheep. In the 1980's, sheep use was decreased and cattle use was increased. The deterioration of riparian vegetation has resulted from aerial application of herbicides and overgrazing (Binns 1981).

The Thomas Fork Aquatic Habitat Management Plan was developed by BLM Kemmerer Resource Area in 1979 in an effort to conserve Bonneville cutthroat trout and their habitat.

Huff Creek

Huff Creek originates in the Sublette Range near the Wyoming-Idaho state line and flows north to join Coal Creek, a major tributary of the Thomas Fork. Upper Huff Creek flows within a grass and sagebrush basin bounded by alluvial fans and steep slopes. Downstream of this basin, Huff Creek flows through a steep-sided, U-shaped canyon. The drainage contains easily eroded sedimentary formations, adding to stream turbidity after a summer thunderstorm.

Aerial photos taken in 1940 show Huff Creek as a stable stream. Beaver had constructed numerous dams and there were frequent patches of willow. The use of herbicides and excessive livestock grazing in riparian areas degraded habitat. By 1978, habitat impacts included excessively grazed riparian vegetation, severe bank erosion, siltation, and high summer water temperatures. Willow patches and beaver ponds were infrequent and the stream width:depth ratio was high (Binns and Remmick 1994). BLM took management actions in 1978 to restore Bonneville cutthroat trout in Huff Creek. The agency placed 68 instream structures and 3,760 feet of rock riprap and livestock was controlled with exclosures and herding. Binns and Remmick (1994) monitored the effectiveness of these efforts and published their findings in the North American Journal of Fisheries Management. They reported mean cutthroat trout numbers in 1989 (170 trout/mile) were significantly higher than in 1978 (pre-project estimate of 35 trout/mile). Post-project drainage-wide cutthroat trout abundance peaked in 1984 at 456 trout/mile. The largest population occurred in a reach containing instream structures within an exclosure.

WILDLIFE

Bison (Urness 1989), grizzly bear (USDI 1993, 9), wolf (USDI 1994b), and lynx (Ruggiero and others 1999, 227) are some of the wildlife species that have been extirpated from the area, primarily due to man.

Bison skulls have been pulled out of the banks of Salt Creek and are on display at the store at the Idaho/Wyoming border (Transtrum per. Com.). The bison that roamed the Northwest until the 1800's has become extinct. The buffalo west of the Continental Divide were called mountain buffalo (*Bison bison athabasca*). These were smaller, more active, more timid, and lighter and silkier hair than the bison of the plains (*Bison bison bison*). The plains buffalo were more numerous and have a much wider range. There are few reports of mountain buffalo in the Northwest after the 1840's and 50's. It is believed that severe winters or disease (or both) and hunting pressure by Indians and early trappers caused their decline and disappearance. (Thomas 1991)

In North America, the grizzly bear's historic range extended from the mid-plains westward to the California coast and south into Texas and Mexico. As the mountainous areas were settled, logging and recreational development contributed to the increase in human-induced mortality of grizzly bears. In most cases, bears that threatened or appeared to threatened man's early tenuous existence were eliminated. Livestock depredation control, habitat deterioration, commercial trapping, unregulated hunting, and protection of human life were leading cause of decline. Conflicts between bears and livestock were common during the settling of the West. The attitude of the early American stockman was expressed by Bailey (1931): "The destruction of these grizzlies is absolutely necessary before the stock business . . . could be maintained on a profitable basis." The Thomas Fork watershed was on the edge of the known distribution of grizzly bears of the Yellowstone region in 1922. (USDI 1993, 9) The southern limit of whitebark pine is found on the Salt River Range near the east side of the Thomas Fork watershed (Little 1971, Map 43-W) but does not extend further into southeast Idaho.

The gray wolf occurred historically in the northern Rocky Mountains, including mountainous portions of Wyoming, Montana, and Idaho. The drastic reduction in the distribution and abundance of this species in North America was directly related to human activities, such as the elimination of native ungulates, conversion of wildland into agricultural lands, and extensive predator control efforts by private, State, and Federal agencies. The natural history of wolves and their ecological role was poorly understood during the period of their eradication in the conterminous United States. As with other large predators, wolves were considered a nuisance and threat to humans. (USDI 1994b).

Five verified records of lynx taken in Caribou County in 1947 and two from Bonneville County in 1955. Verified records of lynx in Wyoming after 1920 are rare. A lynx was collected in 1940 at Hoback Rim in northwestern Sublett County and another in 1949 near Afton, Lincoln County. A lynx was trapped in Cache County, Utah in 1991.

(Ruggiero and others 1999, 226, 230-231). These five counties surround the Thomas Fork watershed.

Roads and motorized travel have increased in the watershed. Off road motorized (ATV and snowmobile) travel has become a common and popular form of off-road transportation. This use has increased the presence of human activity into unroaded parts of the watershed. Their use has increased in the watershed area as performance and capabilities of these machines have developed. Humans may exert potentially negative influences on lynx by building houses and roads in and through lynx habitat, by altering and modifying and existing habitats, and by direct disturbance through recreation or travel in areas inhabited by lynx. Our anecdotal experiences suggest that lynx will tolerate moderate levels of snowmobile traffic through their home ranges. (Ruggiero and others 1999, 281). Human modifications to the environment increase access by coyotes to deep snow areas. Snowmobile trails provide hard or shallow snow conditions that allow coyotes to access areas with deep, soft snow previously limited to lynx and snowshoe hare (Ruggiero and others 1999, 94-95). The effects of outdoor recreation on lynx population have not been studied. Ruggiero and others (1999, 461) do not know if snow compaction increases predation rates or competition from generalist predators.

Logging, wildfires and prescribed burning provides disturbances to vegetation. A lack of these disturbances in conifer and aspen forest habitat in the last 100 years has resulted in most of these stands being in an over mature or climax condition.

Migratory birds that use riparian habitat, especially willow habitats would have been higher due to the large expanse of willows that occupied the valley bottom. Riparian habitat has been reduced through pasture development and the elimination of willows, straightening of Thomas Fork and Salt Creek, settlement, livestock grazing, water diversions, and noxious weed introductions (Ritter 2001, 26).

Sage grouse populations have observed to decrease as the red fox population increased (Leon Jaurequi per. Comm. 5-11-01).

Elk and deer populations were low approximately 40-50 years ago (C.Anderson per. Comm.).

Moose populations were lower 20 years ago (J.Mende per. Comm.).

Beaver – Early exploration of western North America was largely due to the search for beavers by trappers. Size estimates of pre-European beaver population in North America were 60-400 million animals or the equivalent of 10-60 animals per mile of stream and river. Trapping nearly eliminated the beaver population and the subsequent quantity and quality of riparian habitat declined. Today, population size estimates are 6-12 million animals, a fraction of the original numbers. (Olson and Hubert 1994, 2). Beaver dam building in the Thomas fork watershed is widespread. There has been a decline in dam building (water holding) activities in recent years allowing water to flow through the dams (photo 2, 4 & 5).

Amphibians were relatively abundant in the western U.S.

RECREATION

Dispersed Camping

Native Americans used the tributaries in Thomas Fork drainage as camping sites mainly during the summer months. Camping probably occupied these sites for an extended period of time. These campsites along these tributaries were important since they provided forage for livestock, water for culinary and hygiene purposes, and areas to harvest game and fish.

With the arrival of settlers, homesteads and even communities were located near these same tributaries particularly in Thomas Fork Valley. These homes and communities were more permanent and the tributaries provided the same benefits as for the Native Americans.

Settlers seeking a recreational experience sought streams usually higher in the mountains. Camping in the early settlement days was limited. However, as settlers had more time to recreate, dispersed camping increased.

Following settlement times, tributaries within the watershed became more popular areas for camping particularly with the increase of mule deer and elk populations.

Most of the dispersed camping has occurred during the big game hunting season. Fishermen and other types of users also camped on these tributaries in pursuit of a recreation/camping experience. Traditionally dispersed camping has not been popular for tourists using U.S. Highway 89 or 30.

The traditional method of tent camping still exists however, recreational vehicles have become more popular. As roads have been improved in the watershed, recreational vehicles have accessed and still use the traditional dispersed sites adjacent to these tributaries.

Cross Country Motorized Travel

Cross - country motorized travel became popular with the 4x4 military jeep type vehicles within the last 50 years. Some of the routes traveled by these vehicles have turned into primitive roads (two tracks). Historically, most if not all of the public lands did not restrict these vehicles to designated routes. As 4x4 pickup trucks came on the scene, they followed these same routes and pioneered more of these primitive roads.

Motor bikes have been used as a vehicle for cross country travel, but most motor bike riders prefer to ride trails that were originally developed for horse and foot travel.

All terrain vehicles (ATV) have become popular in the last 15 years and have had an impact on cross-country travel. These vehicles are very much adapted for cross-country use. These vehicles not only use primitive roads, but also in some cases have made there own trails. Generally, ATV use does not impact resources as much as 4x4 pickup trucks. However, continual repeated use over an area combined with the increase of ATV users can create noticeable trails and roads.

The popularity of snow machines have come on the scene within the past 30 years. Cross-country travel with snow machines is both popular and challenging. Cross-country snow machine travel is not restricted in most of the watershed.

As all of these methods of cross-country motorized travel have become popular and as their numbers have increased, conflicts have arisen. Federal agencies and private landowners have seen the need to restrict and//or prohibit their use. Presently most of the federal agencies restrict cross-country motorized travel in one form or another particularly to wheeled vehicles.

Historically, there has been a demand by this group of users to modify the current plans to allow for cross-country travel. The advent of ATV has made it difficult for Federal agencies to enforce travel plans.

Recreation Facilities

In the past, recreational facilities such as toilets, fire rings, potable water sources, trailheads, hitching/tethering areas, corrals, and loading ramps have been limited. The majority of these facilities existed as makeshift facilities, located by the public. In general impacts on other resources were not considered in their location and use. Federal agencies have constructed very few facilities to accommodate forest users.

At least one developed site, Allred Flat Campground, has existed for some time.

Many roads and trails have been constructed and reconstructed. Some of these roads have changed from primitive roads to asphalt roads. Many roads are graveled. Some have been reconstructed but the running surface remains native material. It should be noted that all roads and trails were not developed to accommodate recreation use only.

CURRENT CONDITIONS

SOIL

Flood Plain Soils

Data Sources:

-Thomas Fork Water Quality Project (BLSWDC, 1999)
-Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
-Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
-Hydrology and Vegetation Sections in this Report

Much of the current floodplains are now being managed as irrigated pasture and non-irrigated cropland and pasture. Much of the woody riparian vegetation has been removed and the species composition of grasses and grass-like plants has shifted to those that can withstand more intense grazing pressure. Crop species have replaced native vegetation in portions of this landform. The amounts of organic matter provided to the soils yearly by roots and above ground plant parts have been reduced through removal of biomass by grazing and cropping. In some areas the thick, dark soil surfaces of the Bear Lake soils are not as dark or as thick. Nutrient cycling has been altered. Bare ground has increased, soil erosion by wind and water has increased, soil compaction has increased from farming, roads and trails, and livestock trampling and trailing. The cropped soils have been mixed, moved, tilled, fertilized and sprayed with herbicides. Portions of the Thomas Fork channel have been straightened and vertical control of the channel is now unstable. These areas now have a deeper water table or a water table that is shallow for a shorter period of the year. The extent of standing water has been reduced and/or is present for a shorter period of the year. Flooding of these soils in the spring would be not as common compared to historic frequencies. The character of flooding now is scouring and erosion rather than deposition of fine soil.

Terrace Soils

Data Sources:

-Thomas Fork Water Quality Project (BLSWDC 1999)
-Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
-Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
-Hydrology and Vegetation Sections in this Report

Most of the terraces are now being managed as irrigated cropland and non-irrigated cropland and pasture. Current soils and some of their characteristics are summarized below in Table 7.

Table 7: Soils of Terraces

Lower Terrace Soils	Taxonomic Classification	Depth to Seasonal Watertable	Common Surface Texture
Lago	Aquic Calcixerolls, fi-sil, mixed, frigid	18-42 inches	Silt loam
Picabo	Oxyaquic Calcixerolls, co-sil, carb, frigid	24-48 inches	Silt loam
Raynal	Cumulic Haploxerolls, fi-sil, mixed, frigid	24-40 inches	Silty clay loam
Thomasfork	Vertic Haploxerolls, fine, smectitic	16 to 36 inches	Silty clay loam
Upper Terrace Soils			
Bern	Typic Calcixerolls, fi-sil, mixed, frigid	48-60 inches	Silt loam
Buist	Calcic Haploxerolls, lsk, mixed, frigid	> 60 inches	Gravelly silt loam
Georgecanyon	Typic Calxerolls, lsk, mixed, frigid	>60 inches	Gravelly silt loam
Thatcher	Calcic Argixerolls, fi-sil, mixed, frigid	>60 inches	Silt loam

Cropping and pasturing the lower terrace has removed most of the native species found historically. In their place are hay and small grains or species that tolerate higher levels of grazing. Cropped soils with silt loam surfaces have higher amounts of bare ground and erosion. These soils have greater amounts of soil compaction from farming practices and roads. Soil structure and function is lost with the mixing and moving of soils as part of cropping. These soils are also fertilized and sprayed with herbicides. As with floodplain soils, the lower terrace soils do not receive as much organic matter yearly due to removal of biomass in crops and through grazing. Nutrient cycling has been altered. Flooding of these soils is now less common and flooding processes now are dominated by erosion and scouring. Water tables have dropped compared to historic conditions as discussed in floodplain soils. The result of cropping, pasturing, lowered water tables and flooding dominated by erosion and scouring is soils that have reduced productivity over historic conditions.

Removal of the native shrub, grass and forb species on the upper terrace with cropping and pasturing practices has impacted these soils. Bare ground and erosion of the silt loam surfaces has increased, detrimental compaction and displacement has increased, noxious weeds have increased and nutrient cycling has been altered. The reduction of fire compared to historic conditions has not had as much impact on this landform as the removal of native vegetation.

Hillside Soils

Data Sources:

-Thomas Fork Water Quality Project (BLSWDC 1999)
-Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
-Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
-Fire, Hydrology and Vegetation Sections in this Report

Data Gaps:

-Mapping and extent (acres) of current vegetation communities

Most of the hillside soils are now being managed as private, federal and state rangelands with some small areas of dryland cropland. Current soils and some of their characteristics are summarized below in Table 8.

Table 8: Hillside Soils.

West Side Soils	**Taxonomic Classification**	**Common Surface Texture**	**Soil Depth**	**Hydrological Group**
Sprollow	Typic Calcixerepts, lsk, carbonatic, frigid	Gravelly loam	20-40 inches	C
Mumford	Lithic Calcixerepts, lsk, carbonatic	Very gravelly silt loam	10-19 inches	D
Lonjon	Typic Calcixerolls, lsk, carbonatic, frigid	Silt loam	20-40 inches	D
Northwest Soils				
Vipont	Pachic Argixerolls, lsk, mixed, frigid	Very Stony loam	20-40 inches	C
Prucree	Pachic Haploxerolls, co-ly, mixed, frigid	Sandy loam	20-40 inches	B
Dipcreek	Lithic Haploxerolls, lsk, mixed, frigid	Gravelly loam	10-19 inches	B

The relatively small area of hillside soils that have been dryland cropped have been impacted the most. The native vegetation has been removed, the soils have been compacted, displaced, mixed and moved. Soil structure and function has been altered. Wind and water erosion has increased. Nutrient cycling has been altered and more nutrients are taken from the site in crops than input as organic matter. The productivity of these soils has likely declined.

The remaining hillside soils have been impacted with a transportation system, grazing by livestock and an interrupted fire regime. The transportation system removes soils under roads and trails from the productive soils base. Soils are detrimentally compacted, displaced, and surfaced with gravel or asphalt. Erosion increases are found on cut and fill slopes, especially with construction, reconstruction and maintenance (Ketcheson and Megahan 1996). Roads on midslope positions interrupt and concentrate the flow of water moving down slope. Grazing these soils by livestock has increased bare ground and erosion, soil compaction and displacement in localized areas where animals trail and congregate. Livestock grazing has altered nutrient cycling in areas where vegetation composition has been changed due to intensity of grazing and/or spread of noxious weeds. The removal of nutrients and biomass by grazing of livestock has also impacted nutrient cycling (Blaisdell et al 1982). Effective fire suppression over the last 50 to 80 years coupled with heavy livestock grazing and the removal of fine fuels has interrupted fire regimes on hillside vegetation and impacted soils. Nutrient cycling has been altered with less frequent inputs from burning and an interruption of the shift to vegetation dominated by grasses and forbs following burning (Clark and Starkey 1990, Knight 1994, Blaisdell et al 1982).

Mountain Soils

Data Sources:

- -Thomas Fork Water Quality Project (BLSWDC 1999)
- -Official Soil Series Descriptions (online @ http://statlab.iastate.edu/cgi-bin/osd/osdname.cgi)
- -Provisional soils mapping and reports for Bear Lake County, Natural Resources Conservation Service, Soda Springs, ID.
- -1998 Wyoming 305(b) Water Quality Assessment
- -Fire, Hydrology and Vegetation Sections in this Report

Data Gaps:

- -Mapping and extent (acres) of current vegetation communities.

Much of the mountain soils are currently being managed for livestock grazing. One extensive area grazed by livestock saw broad treatment with herbicides about 35 years ago. Extensive transportation systems have been built; isolated areas have been impacted by mining, primarily for phosphate; and additional areas have been impacted by timber harvest and recreation activities. Landslides and slumps continue to occur. Relatively small areas high in soluble salts are common. Fire frequencies have been altered in some communities. Current mountain soils are summarized in Table 9.

Table 9: Mountain Soils.

Dominant Soils Throughout the Watershed	Taxonomic Classification	Common Surface Texture	Soil Depth
Beaverdam	Vertic Argicryolls, fine, smetitic	Loam	>60 inches
Piskun	Typic Cryorthents, lsk, mixed, calcareous	Extremely gravelly sandy clay loam	40-60 inches
Farlow	Calcic Haplocryolls, lsk, mixed	Loam	20-40 inches
Failure Prone Eastside Soils, Side Slopes and Valley Bottoms, Moist Aspects			
Youman	Vertic Argicryolls, fine, smectitic	Loam	>60 inches
Wesdy	Typic Argicryolls, cl-sk, smectitic	Silty clay loam	>60 inches
Amsden	Ustic Argicryolls, fi-ly, mixed	Gravelly loam	>60 inches
Failure Prone Eastside Soils, Side Slopes, Dry Aspects			
Mayflower	Argic Pachic Cryoborolls, fine, smectitic	Fine sandy loam	20-40 inches
Reck	Vertic Haplocryalfs, cl-sk, smectitic	Cobbly loam	>60 inches
Taylor Creek	Argic Cryoborolls, very-fine, smectitic	Clay	>60 inches

Grazing

Grazing these soils by livestock have had similar impacts as those found with hillside soils. Bare ground and erosion have increased in localized areas and detrimental compaction and displacement can be found where cattle are trailed or congregate. Nutrient cycling is altered where vegetation species composition has been changed due to intensity of grazing; where noxious weeds have spread and increased; and where heavy grazing has yearly removed much of the biomass (Blaisdell et al, 1982). Grazing by cattle on riparian zone soils increases bare ground; increases erosion by water, ice and wind; decreases the litter layer; increases compaction; decreases infiltration; and decreases fertility (Belsky, et al, 1999).

Herbicide Treatment

Through a combination of herbicide spray projects, beaver activity and repeated season long livestock use in the mid-to-late 60's much of the riparian willow and aspen stands on BLM mountain soils on the east side of the Thomas Fork Drainage have been lost (Thomas Fork Habitat Management Plan, 1979). The result has been extensive channel down cutting and accelerated stream bank erosion. The water table has been lowered and with it a loss of riparian vegetation structure and productivity. Soil loss through erosion and a reduction of soil productivity from a lowered water table and loss of the soil surface has followed.

Transportation System

The building and reconstruction of roads and trails requires vegetation removal, soil disturbance and slope re-contouring. These actions and maintenance of roads and trails loosen soils and can lead to large contributions of sediment to stream systems (Ketcheson and Megahan, 1996). Roads built across landscapes and soils with a high risk for mass movement are especially problematical. Moll (1996) summarizes some slope stability investigations: "Road fills increase steepness and place added burdens on slopes, creating stability problems, or elevating moderate risks to higher risks. 'Risk' in the context used here is a function of probability and consequence. Road cuts undermine upper slopes, increasing the probability of soil movement and mass failure." Soils under roads and trails are effectively removed from the productive base. Soils are detrimentally compacted, displaced and surfaced with gravel or asphalt. Roads on midslope positions interrupt and concentrate the flow of water moving down slope. Roads in valley bottoms contribute sediment to flowing streams at stream crossings and cross channel drains.

Mining

Layland Canyon, Rose Canyon and Raymond Creek, east and north of Border Junction, have been impacted by phosphate mining. Very little reclamation has taken place on these sites. Unstable spoils have been placed on topsoil, excavations are still open, erosion is extensive and sediment is reaching nearby wetlands and possibly the Bear River. Soils have been contaminated, diluted, displaced, eroded and detrimentally impacted biologically. Soil productivity at these sites is severely reduced.

Timber Harvest

Relatively small areas of timber harvest have occurred on BLM (White Canyon) and National Forest lands. Most of the recent activity on the Caribou National Forest occurred in the Dry creek/Giraffe Creek area in 1983 (approximately 100 acres of clear cuts and salvage). Soils have been detrimentally compacted, displaced, eroded and severely burned in association with yarding, slash treatment and construction and use of skid trails, temporary roads and landings. Detrimental impacts occurred on 10 to 20 percent of the harvest units.

Recreation

Developed recreation sites have been improved and expanded, but the biggest changes have been seen beyond these sites. Dispersed camping impacts have increased in many areas. User created ATV, motorcycle and full size 4X4 roads and trails and the numbers of users of these vehicles have shown the biggest growth.

Soil impacts from developed recreation sites are mostly permanent. Vegetation is removed; soils are exposed, shaped and leveled, compacted; and surfaced with gravel, concrete or asphalt. Areas that are not surfaced, such as footpaths, tenting and picnicking areas, have exposed, compacted, puddled and eroded soils (National Soil Survey Handbook 1996, Cole 1999). Streams adjacent to or within campgrounds often show trampled and shearing banks; bank erosion from stream rerouting; and heavily used terraces with damaged vegetation, soil compaction and erosion.

Dispersed camping areas show vegetation removal or trampling and compacted, displaced, puddled and eroding soils. These sites that are adjacent to streams often channel water and sediment toward streams in tire ruts.

User created road and trail impacts to soils are not limited to the appearance of a tire mark, but include compaction, decreased permeability to air and water, increased runoff, increased erosion, reduction in soil depth and organic matter and a decrease in vegetation density and productivity (Payne, et al, 1983, Snyder, et al, 1976, Weaver, et al, 1978, Cole, 1999). Soil impacts tend to be more severe at high elevations; on steeper slopes; and on wetter, poorly drained soils (Leung and Marion, 1996, Weaver and Dale, 1978). Increased erosion will also reduce the productivity of the remaining soil. Belnap (1995) reported a reduction in soil nutrients as a result of off-road vehicle impacts in several ecosystems including mountain meadow and lodgepole pine. Soil disturbance from off-road vehicles also provides sites for establishment of non-native species and noxious weeds (Cole 1999).

Landslides

Slope failures and landslides are still occurring on mountain soils of the Preuss Range, Gannet Hills and Sublett Range. The unstable geology and soils with high shrink-swell clay contents are still present. Over-steepened slopes are still found adjacent to drainages and the slopes fail, especially when the soils become saturated. Small areas high in soluble salts are common. These areas support little vegetation and are highly erodible.

Fire

Effective fire suppression over the last 50 to 80 years has interrupted fire regimes on portions of the mountain soils. The associated soils of shrublands, dry Douglas fir, and aspen communities are the most affected. Periodic fires on shrublands varies the mix of shrubs according to their ability to rootsprout and shrubs versus grasses and forbs. Effective fire suppression alters nutrient cycling with less frequent nutrient inputs from burning and the interruption of the shift of vegetation favoring root sprouting shrubs, grasses and forbs (Knight 1994, Clark and Starkey 1990). The increase in erosion from natural wildfire in shrub communities is generally short-lived. Prescribed burning of shrubs on mountain soils has been of limited extent, and generally of little negative impact to soils.

Effective fire suppression in dry Douglas fir is potentially allowing fuel buildups that would support high intensity and high severity fires when these areas do burn with wildfire. Soils are not being greatly impacted yet, but would be negatively impacted with a severe fire. Prescribed fire in these communities has been limited.

Aspen in the Thomas Fork other than that eliminated on BLM lands on the east portion of the watershed is approaching an important time for the continued recent expression of the plant (Knight 1994). Succession of conifers in aspen is slowly impacting the amounts of organic matter added yearly to these soils as leaf fall and from the lush understory of grasses and forbs. Nutrient cycling of these soils is being impacted but changes in the depth of the very deep dark surfaces, or lightening of the surfaces and lowering of surface pHs, or loss of the surfaces through erosion appears to be a number of years away if current conditions continue (Amacher et al 2001). Continued fire exclusion on aspen soils has the potential to reduce the productivity of these soils.

WATER

Watershed Conditions

In its simplest form, a watershed's condition can be viewed as the status of its components as a result of natural and anthropogenic disturbances. To get a clear understanding of a watershed's condition, both the spatial and temporal variability must be considered. To address the spatial variability, six sub-watersheds were identified: Salt, Giraffe, Coal, Dry-Preuss, Geneva, and Border-Raymond. The temporal variability was address by evaluating both historic and current conditions. The Thomas Fork Water Quality Project was used in many of the following sections (Bear Lake Soil and Water Conservation District 1999). This reference will be abbreviated as "BLSWCD 1999" for the remainder of the document.

The Inland West Watershed Initiative Ratings (IWWI) was developed to evaluate all federally managed subwatersheds in the Great Basin and Rocky Mountain areas using common criteria. This analysis focused on three IWWI factors:

- Watershed vulnerability evaluates the inherent risk of instability based upon the presence of sensitive lands. Sensitive lands are defined as having highly-dissected slopes, highly erosive soils, landslide deposits, or landslide prone areas.
- Geomorphic integrity evaluates the function of the sub-watersheds, streams, and riparian areas within the basin.
- Water quality integrity evaluates whether water-related resource values (beneficial uses) are being protected.

Table 10:

	Coal	Salt	Giraffe	Dry-Preuss	Bishop
Watershed Vulnerability	High >50% Sensitive	High >50% Sensitive	Moderate 20-50% Sensitive	High >50% Sensitive	Moderate 20-50% Sensitive
Geomorphic Integrity	Moderate <20% Not fully Functioning	Moderate <20% Not fully Functioning	Moderate <20% Not fully Functioning	Moderate <20% Not fully Functioning	Moderate <20% Not fully Functioning
Water Quality	Moderate <20% Impaired	Moderate <20% Impaired	Moderate <20% Impaired	Moderate <20% Impaired	High Damage >20% Impaired
Composite	Moderate	Moderate	Moderate	Moderate	Moderate
Damaged Streams	None	Little White Cr, Salt Cr	Robinson Cr	None	Bishop Canyon
Crucial Streams	Coal Creek	Salt, Lost, Little White, and Pack-string	Giraffe Cr	None	None

Watershed Conditions Resulting from Disturbance

Vegetative and soil characteristics influence how water moves through the system with the primary mechanisms being infiltration and evapotranspiration. The affects of land use on watershed conditions are well summarized in the Thomas Fork Water Quality Project Report and are not repeated here. To evaluate changes in watershed condition, the US Soil Conservation Service's "curve number method" was used. This method estimates runoff from agricultural catchments with various types of soils, cover, and land use.

Data Sources:
- Thomas Fork Water Quality Project (BLSWCD, 1999)
- Water in Environmental Planning (Dunn and Leopold, 1978)

Assumptions:
- Natural disturbances were adequately addressed in the section on Drainage Basin Description and in the IWWI rating for watershed vulnerability.
- Land use is the dominant factor influencing watershed conditions.
- Curve numbers can accurately evaluate changes in watershed conditions.

Most of the meadow areas have been converted to crop and pasturelands increasing the curve number from 58 to 74 (28%). This is a conservative estimate since 74 assumes the lands are in good condition. Grazing has degraded rangeland conditions to fair-poor condition increasing the curve number from 61-75 (23%). Woodlands would be in fair condition due to the presence of grazing. This would have increased the curve number from 55 to 60 (9%). This assessment makes no attempt to calculate runoff. Its sole purpose is to identify which land use practices could have the greatest affect on an areas runoff response. The abundance of these practices within a sub-watershed can then be used to raise "red flags."

Riparian Conditions

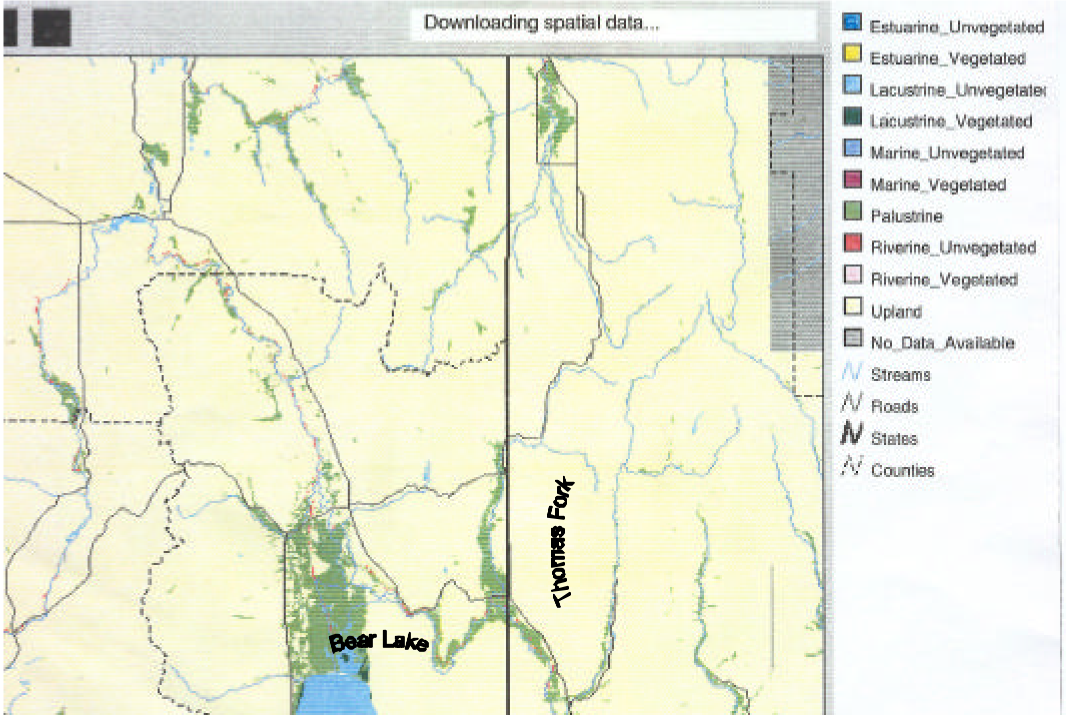
Properly functioning riparian areas are critical in maintaining healthy and diverse aquatic systems. They influence water quality and fish habitat by providing: (1) shade to regulate water temperatures, (2) strength to stream banks (3) large woody debris, (4) fine organic material and invertebrates as a food source, (5) sediment and water filtration, and (6) cover for fish.

Flood Plain and Wetland Conditions

Data Source:
- Data was obtained from the National Wetland Inventory (US Fish and Wildlife Service).

Data Gap:
- Riverine wetlands are not fully shown.

Figure 6: Wetlands in the Central and Bear lake Subbasins.



Very little of the original wetlands remain with the exception of riverine or riparian wetlands. Of these, those associated with Beaver complexes are the most functional. There are also some seasonal wetlands in depressions such as the old pond site near Geneva. Channelizing the creeks also resulted in rapid downcutting eliminating connectivity with the floodplain in several areas.

Riparian Vegetation / Conditions

Data Sources :
- Properly Functioning Condition assessments (BLM – 1994 and 1995 in Coal Creek and Raymond Canyon).
- Smiths Fork Allotment Evaluation (BLM 2000)
- Stream Stability Surveys (Forest Service – Dry/Preuss in 1979, 1987, and 2001).
- Stream Surveys (BTNF - Salt Creek in 1993, 1999 and 2000).
- Riparian Surveys (CNF – Dry/Preuss in 1987).
- Personal Observations (Philbin 2001).

Data Gaps:
- Riparian conditions along minor tributaries.

The combined effects of herbicide spraying, willow grubbing, agricultural conversion, high levels of cattle utilization, and stream channelization has led to reduced channel stability, channel downcutting, a lowering of the water table, and an alteration in riparian communities. Subsequently, deteriorated riparian habitats exist throughout much of the watershed (USDI 2000). Beaver activity is now limited to the upper reaches of analysis area streams.

Salt Creek

Canadian thistle is abundant between the forest boundary and Little White Creek. This indicates that riparian conditions are substantially impacted in this area. Another factor affecting this area is Highway 89, which encroaches upon the channel. To mitigate for these affects, several structures were added to improve stream stability. However even with these structures, riparian vegetation is still limited. Above Water Canyon the riparian area is mostly comprised of willows and sedges. This represents the historical vegetation types for this drainage. Tributaries such as Dipper, Lost, and Packsaddle creeks appear to have functional riparian areas with regard to both age and species diversity. However, the vigor of some species is marginal. The vegetative communities in these areas are comprised of willow, sage, riparian grasses, and timber. This represents the historical vegetation types for these drainages.

Giraffe Creek

There are two dominant riparian communities in this drainage: (1) willow and sedge or (2) grass and forbs. While these are the dominant community types, thistle is the dominant plant type. This degraded condition is the result of heavy sheep grazing in the Bridger-Teton National Forest.

Coal Creek

A sagebrush-spraying program in the late sixties and early seventies greatly reduced willow abundance (BLM 2000). However, where seed sources exist willows are beginning to reappear. These areas include the upper reaches of Coal Creek, the Coal Creek/East Fork confluence, and Huff Creek. The re-establishment of these sprouts is occurring very slowly as the willows are sparsely spaced and low growing (susceptible to grazing). Most of these areas are functioning at risk due to decreased vigor and a minor willow component. However, there are fully functioning sections in exclosures. With the exception of agricultural impacts along the main Thomas Fork, the lack of willow adjacent to Coal Creek is the most obvious riparian impact in the watershed. The riparian areas for Huff Creek, the Middle Fork Huff Creek, the West Fork Huff Creek, and Cliff Creek all appear to be functional with both age and species diversity. However, upper Cliff Creek is low in willow abundance and appears over grazed. Overall the Huff Creek area is benefiting from cattle exclosures

Dry/Preuss Creek

Above Beaver Creek, Philbin found that Preuss Creek's riparian area was in good condition with a great deal of willow and abundant beaver use (Philbin 2001). There is also a significant timber component along the south bank that provides shade and large woody debris. This woody debris is very important, as it provides high quality building materials necessary to produce stable beaver dams. These stable dams then form the foundation of an extensive beaver complex that is maintaining riparian and wetland vegetation as well as high riparian soil moisture. This beaver complex also extends up the bottom of Beaver Creek. Below Beaver Creek, riparian conditions appear to change. The willow becomes lower in abundance and its distribution is spotty. A survey by Burton (1987) found that the riparian area was comprised mostly of poa and some carex rostrata (13-48%) and bare ground (25-70%) with fewer shrubs (15-36%) and almost no forbs and litter While some areas contained trees, they were spotty and didn't dominate the community type. Overall riparian conditions in this lower reach were poor-fair with better conditions occurring where beaver created small marshes and wetlands. Below National Forest Lands agricultural uses, channelization, and diversions have resulted in poor riparian conditions.

Dry Creek supports a narrow grass-willow riparian area ranging from 25-50 feet wide. The willow is fairly abundant and its distribution is good. The grasses are a mix of poa types and some carex rostrata. A 1987 stream stability survey found that overall vegetation density was about 70% with low vigor and species that provide a somewhat shallow and discontinuous root mass. Three situations appear to be occurring in this area. In many locations there is a terrace on one bank and a lower floodplain on the other. In this case, the lower bank is covered by wetland/ riparian vegetation while only a narrow strip exists on the higher terrace. Where this strip is disturbed, bank erosion is severe. Another example of this situation occurs where the stream flows against the toe of the adjacent hill slopes. The second situation occurs where the stream has downcut or has minimal access to its floodplain. In this case, the narrow riparian stringer is present on both banks. This provides little protection and the banks are very sensitive to disturbance. Finally, the third situation occurs where the stream is fully connected to its floodplain and the riparian vegetation is wide on both banks. This is a stable situation. Below National Forest Lands agricultural uses, channelization, and diversions have degraded riparian conditions along Dry Creek. Here the riparian buffer is insufficient to protect water quality.

Raymond Canyon

The riparian areas for the Main Fork, Middle Fork, and South Fork are all non-functional. Both riparian species and age diversity are lacking with Poa being the primary grass. Plants that do exist are young and unable to protect the stream banks from direct trample or bank erosion. However, slight improvements may be occurring as willows are becoming established in some locations. Conditions are also a little better in the North Fork. However while there is more species and age class diversity, usage is still high. This area is functioning at risk.

Stream Conditions

Now that the drainage basin, climate, watershed conditions, and riparian conditions have been evaluated we can move on to stream condition/function. In all stream systems there exist unique balances between many interrelated variables including: stream flow, sediment quantity and size, geomorphic controls, bank vegetation, and floodplain accessibility. A major shift in any of these variables may initiate a series of adjustments leading to a new channel form. This section begins with an assessment of the stream flow and sediment regimes and ends with a discussion of stream conditions.

Stream Flow Regime

The stream flow regime refers to the quantity and timing of runoff. Both of these variables are critical factors in determining the health of aquatic systems. Climate, watershed condition, and riparian condition all influence the streams runoff patterns.

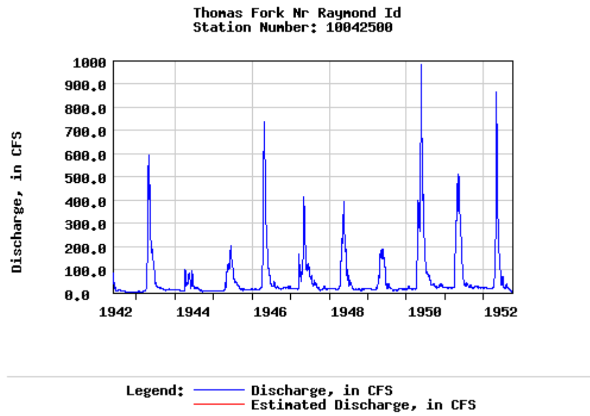
Data Sources/Data Gaps:

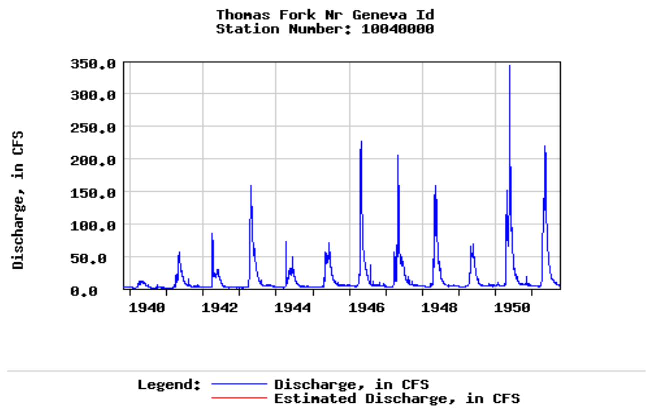
- U.S. Geological Survey (USGS) stations used included: Bear River @ Border, Wyoming (10039500); Thomas Fork near Raymond, Id (10042500); Thomas Fork (really Coal Creek) near Geneva (10040000); Salt Creek near Geneva (10040500).
- 1995 Beneficial Use Reconnaissance Project Stream Flow Data for Giraffe Creek, Dry Creek, Preuss Creek, and Thomas Fork River.
- A data gap is that the Thomas Fork, Coal, and Salt creek gages were discontinued in 1952.

Assumptions (additional assumptions are found under the historic section):

- The period of record is assumed to be adequate to determine bankfull flows.
- Base flow data from gages (Coal, Salt, and Thomas Fork) and direct measurements (Dry, Giraffe, Preuss, and Thomas Fork) are comparable. This was tested by comparing the calculated flow at the lower Thomas Fork site (37.3 cfs) with one measured flow (36.8 cfs). This implies that the two data sets may be comparable.

Figure 7: Thomas Fork Hydrographs (the near Geneva station is really Coal Creek)





At its mouth, the Thomas Fork makes up 7.5 percent of the Bear River's drainage yet it produces 15% of its bankfull discharge. The Thomas Fork also produces twice the water as the Bear River per unit area (table 11). Given these volume characteristics and the earlier runoff, the Thomas Fork is likely an important source of water to the Bear River.

From June to September flows gradually decrease until base flows are reached. Flows than stay about 8 cfs until the onset of spring rain and low elevation snow melt. It appears that the ratio between bankfull and base flows is approximately 37-41 times (table 12). This indicates a strong irrigation influence and also that the system is snowmelt and not rainfall or spring dominated. The influence of irrigation is also shown by the discharge per unit area. Diversions on Preuss, Dry, and Raymond creeks prevent these drainages from adding water to the Thomas Fork's discharge. However they add considerable drainage area, which causes the unit discharge to drop dramatically (table 11). Water is also likely diverted from the main Thomas Fork, as it's clear that flows decrease in a downstream direction.

Within the watershed, the upper basin is the main area for water production. For example, figure 4 shows that Coal Creek's annual peak ranges between 27-50% of those found in the Thomas Fork. In addition, in 56% of years with overlapping flow records, the combined flows from Coal and Salt creeks exceed those at found at Raymond. This water loss is likely the result of irrigation. This data also suggest that when flows at Raymond approach bankfull water can be contributed from Dry, Preuss, and Raymond creeks. It also suggests that when peaks are lower than bankfull, these streams do not contribute flow and almost all the water in the Thomas Fork originates in the upper basin.

There are also differences between upper basin subwatersheds. Table 11 shows that in the high elevation, south aspect subwatershed (Salt Creek), bankfull flows are 50% higher than in the north aspect drainages (per unit area). This is likely due to the increased snowmelt associated with aspect. Aspect may also control the range of flows. The south aspect drainages (Thomas Fork and Salt Creek) show a ten-fold range, while the north aspect Coal Creek has a much wider range 18-fold. In addition to aspect, elevation appears to play a major role during bankfull flows. At this time, the amount of water on the hillside drops 2 inches at the lower elevations, 10 inches at mid elevations, and 13.8 inches at higher elevations (tables 1, 2, and 3). Given these findings, it is clear that elevation and aspect are important drivers of bankfull flows.

Table 11: Comparisons of Bankfull Flows and Contributions per Unit Area

Basin	Area	Bankfull	Ratio	Range of Annual Peaks
Coal Creek	45	92	2.0	23-418 cfs
Salt Creek	38	111	2.9	37-382 cfs
Thomas Fork (Raymond)	202	325	1.6	104-1070 cfs
Bear River (Border)	2486	1884	.76	

Table 12: Comparisons of Bankfull Flows and Baseflows

Basin	Bankfull	Baseflow	Ratio
Coal Creek	92	2.5	36.8
Thomas Fork (Raymond)	325	8	40.6

Table 13: Comparisons of July Flows and Contributions per Unit Area

Basin	Area	Q_{july}	Ratio	Ratio
Coal Creek	45	11.5*	.27	\
Dry Creek	09	5.6	.62	} .45
Preuss Creek	21	10.3	.49	/
Giraffe Creek	08	3.3	.41	
Thomas Fork River	233.0	37.3*	.16	.16

* calculated from flow records

Sediment Regime

The sediment regime refers to the size, quantity and timing of soil and rock movement through the watershed. All three of these variables are critical factors in determining the health of aquatic systems. Climate, drainage basin characteristics, watershed condition, and riparian condition all influence the streams sediment regime.

Data Sources:

- Thomas Fork Water Quality Project (BLSWCD 1999).
- Smiths Fork Allotment Evaluation (BLM 2000).
- 1998 Wyoming 305(b) Water Quality Assessment.

Sources:

The primary sediment sources can be placed into three categories: (1) channel disturbances/ erosion; (2) mass wasting; and (3) surface erosion. Of these, channel erosion and mass wasting are the key sediment producers since they deliver large pulses of material in all size classes.

Channel Disturbances/Erosion: Channel erosion is estimated to produce 21% of the sediment delivered to the Thomas Fork (BLSWCD 1999). However, this percentage is likely low since it does not include the Coal Creek subwatershed. Channel erosion is an important source since it produces both suspended and bedload sized particles. The coarser material such as sands and fine gravels are transported as bedload that can have negative effects on channel morphology. These sediments are also input directly to the stream system as opposed to sediment generated outside of the channel. In the Thomas Fork, the main causes for channel disturbances are high levels of riparian utilization, vegetative alterations, bank trampling, vertical instability, and riparian roads (in that order). Once disturbed, high flows can erode long sections of bank producing large sediment inputs. High banks and terraces (where the stream is incised) can also fail as they dry out and the soils lose cohesion. In these cases, riparian soil moisture is low and the altered vegetation is less effective at maintaining bank stability. The presence of livestock on these banks has greatly increased the rate of failure. Sediment from the channel is most prevalent in the Thomas Fork, Coal, East Fork Coal, Stoner, Dipper, Dry, and Raymond creeks.

Mass Wasting: Mass wasting produces large pulses of both coarse and fine sediments. These episodic events can have a major effect on stream conditions and are what drive the natural range of variation. The main causes of mass wasting are natural landslides, avalanches, slumps, and debris flows. The risk of mass wasting is highest in the Coal, Salt, and Dry-Preuss creek sub-watersheds.

Surface Erosion: Rangeland and forestland erosion is estimated to produce 34% of the total sediment load for the Thomas Fork. Cropland erosion produces similar levels as 32% of the load is produced here. Pasturelands produce 13% of the total (BLSWCD, 1999). Roads that either cross streams or are located within riparian areas are an additional concern. This is primarily a concern along Coal and Salt creeks.

Turbidity: Turbidity is influenced by suspended silt, clay, finely divided organic matter, plankton, and microorganisms (MacDonald, et.al 1991). As reported under "drainage basin description", the dominant parent material in this basin decomposes into silt and clay sized particles. Therefore, turbidity could be an issue in the Thomas Fork.

The Thomas Fork Water Quality Project (BLSWCD 1999) provides more detailed information of sediment sources.

Sediment Transport

While upslope erosion displaces soil particles, this material must be delivered to a stream to effect water quality. This delivery generally occurs where disturbances are either close to or cross a stream. Where disturbances are not close to streams, sediment is efficiently trapped on the hillslopes with fine gravels (2-8 mm) and sands (.05-2mm) being filtered out first and silts and finer particles being delivered further down slope. Since this delivery would occur during high flows (storm events or snow melt) the fine material would then likely remain in suspension and move rapidly through the system.

Sediment that reaches small creeks must be transported into larger streams before it influences aquatic biota or other beneficial uses. Therefore, understanding the factors that influence sediment transport to and through these small streams is required. Duncan, et.al (1987) found that sediment transport from an introduced source to the mouths of two experimental streams (95 and 120m) did not exceed 45% of the material added. Silts and clays were moved efficiently through the system, at all but the lowest flows, while sizes between fine sand and course sand were retained at progressively higher rates. In fact, only 10% of course sand was delivered to the mouth. Megahan (1982) estimated that on average fifteen times more sediment was stored behind obstructions than was delivered to the mouths of his experimental streams. This equates to 6% being routed through the basin which is consistent with the 10% found by Duncan. These studies illustrate the importance of channel storage in sediment transport. The three dominant types of channel storage are: (1) short term storage in channel bedforms as a function of flow conditions and sediment particle size; (2) moderate duration storage caused by obstructions; and (3) long-term storage in floodplain deposits.

Channel morphology is important in four major ways: accessibility of the floodplain, system structure (step-pool vs riffle-pool etc..), channel geometry [high width to depth ratio (W/D ratio) vs low], and frequency of obstructions. A stream that can access its floodplain (B, C, and E stream types) has the ability to deposit sediment in long-term storage effectively removing material from the system. Streams with step-pool systems (A stream types) can store sediment behind woody debris which provides moderate duration storage, while riffle-pool systems (B and C stream types) store sediment in relatively short-term bed features (bars). Streams with low W/D ratios (A, E, and G stream types) are more efficient at processing sediment than those with higher ratios (C and F streams types) at similar flows. Finally, woody debris (the most frequent obstruction) is extremely effective in retaining sediment.

The main changes from the historic transport system are the rate at which bank sediments are delivered to the system, changes in the stream flow regime, the lack of storage in beaver ponds, a change storage duration (including less time in beaver ponds as poor quality building materials have changed the life of these ponds), and the fact that the Thomas Fork's floodplain is now a sediment source as opposed to a sediment storage area. As with historical conditions, the ability of a stream to store or transport sediment is dependent upon channel morphology. Since bank erosion has cause many reaches to become shallower and wider, they are now less efficient at transporting sediment. Therefore, material is now going into short-term bed features. As a result when a large runoff event does occur, it produces a larger sediment pulse than would have occurred naturally. The BLM confirmed this finding when they found erosional and depositional features that suggest large amounts of sediment are moving during high flows. Overall, since sediment supply has increased along with a decrease in routing efficiency, instream sediment levels are greater than natural and recovery time has been slowed. Another important change is that reduced flows in the lower basin have made sediment transport flows less frequent. This adds to sediment deposition and a fining of the streambed.

Stream Channel Morphology/Stability

Historically Thomas Fork area streams would have been in a state of "dynamic equilibrium." This means that the channel would be in balance - not aggrading or degrading. Following the geomorphic theory that channels form to accommodate the watershed products (water, sediment, and woody debris) that they normally process, we would not expect a stable stream to show more than isolated channel erosion. Widespread erosion would imply that the current conditions were outside of the range that formed the existing channel. Stream types (based on geomorphic characteristics) play a large role in stability as the inherent stability of the various stream types vary considerably. This section takes merges the stream flow and sediment regimes with the riparian vegetation, and geomorphic controls to evaluate the stream channel itself.

Data Sources:

- Properly Functioning Condition assessments (Kemmerer BLM – 1994 and 1995 in Coal Creek and Raymond Canyon).
- Smiths Fork Allotment Evaluation (BLM, 2000)
- Stream Stability Surveys (Caribou-Targhee National Forest – Dry/Preuss in 1979, 1987, and 2001).
- Stream Surveys (Bridger-Teton National Forest - Salt Creek in 1993, 1999 and 2000).
- Riparian Surveys (CNF – Dry/Preuss in 1987).
- Personal Observations (Philbin, 2001).
- Professional interpretation of maps and aerial photos.
- Thomas Fork Water Quality Project (BLSWCD, 1999).

Data Gap:

- Information on many tributary streams is a data gap.

Assumptions:

- It is assumed that the ground truthed segments truly represented overall stream conditions.

The Thomas Fork begins at the State line above Dry Creek. This stream is entirely on private lands. It is comprised of C, E, F, and G channel types, which are low gradient fine textured reaches. As agricultural lands were developed, many of the tributary and overflow channels were eliminated creating a single thread channel. This produced flooding problems in the spring as total channel capacity was greatly reduced. Local straightening also occurred to facilitate agricultural operations. These activities eliminated lateral migration and resulted in substantial channel downcutting. As the channel downcut, it lost its connection with its floodplain and high stream flows were contained within the channel. This increased energy, along with degraded riparian conditions and bank trampling, caused excessive bank erosion and sediment production. These problems are continuing today and are shown by headcuts, which are still moving upstream. The most extensive bank erosion likely occurred during the spring of 1982 and 1984 when very large floods moved through the system. The most impacted reach is located between the Taylor Canal Diversion and ½ mile below the state line this reach is experiencing extreme bank erosion (estimated at 15 feet in 3 years) and sediment production. This is due to unlimited cattle access to the stream and riparian areas.

Beaver pond complexes, once common throughout the watershed, are now almost exclusively confined to the uppermost headwater reaches. The loss of riparian willow and aspen, along with a drastic reduction in beaver activity, has added to the extensive channel downcutting and associated stream bank erosion. This problem is compounded by extensive cattle utilization. As riparian communities are converted to drier species, they are more susceptible to sloughing and less resistant to direct impacts.

Subwatershed Scale

Salt Creek:
Salt Creek is a relatively stable stream with very high sediment levels. However two stream segments appear to be very sensitive: (1) from Shale Hollow to Coal Creek and (2) from the Forest Service boundary to Little White Creek. These areas are experiencing low bank stability with cracking and sloughing banks being common. This bank instability is likely a major source of the sediment found lower in the drainage.

From Coal Creek to the Forest Service boundary extensive revetments have improved bank stability and these banks are rated as good. However, sediment levels are high in this reach. Much of this sediment is likely from riparian and watershed disturbances as well as bank sloughing and erosion in the reach between the Forest Service boundary and Little White Creek. The presence of thistle supports the presence of riparian disturbances. These lower segments are “C” channel types. Above Little White Creek the channel becomes a “B” type. This area still has a high level of fine sediment (38%), which is a concern as this is not a depositional reach. Since bank stability in and above this reach is good (93+%), this sediment is likely coming from riparian and watershed disturbances. Another concern is the high width:depth ratio in the B reach (26:1). While overall bank stability is good, there are areas of local instability in the reach below Packsaddle Creek. Numerous log weirs and deflectors were constructed in this lower reach and they appear to be controlling bank erosion. Above Water Canyon beaver play a major role with many small and some large pond complexes. While bank erosion is associated with beaver activity and sheep watering, overall bank stability is good in this area.

Beaver also play a major role in tributaries. In Lost Creek there are many beaver dams in the lower reach. Overall, this is a stable stream with a cobble bed, cobble/boulder banks, and well-vegetated riparian area. Packsaddle is also occupied by beaver. This is predominately a stable B4/3 stream type with a steep section 1.6 miles above the mouth. While stable, sediment is still a problem (45% fines in the lower reach) with sheep watering and stock trails being two of the main sources. A lack of beaver in Dipper Creek has likely led to head cutting (vertical instability) and a high sensitivity to high flows.

Giraffe Creek:
The Idaho (Caribou-Targhee National Forest) portion of Giraffe Creek is in fair condition from the forks down to the state line. This is a “B” stream type with an “E” inclusion through a relatively large meadow. Banks are stable but sediment levels are still high. This entire area has recently been fenced off to exclude cattle. As the stream flows through the Bridger-Teton National Forest it is primarily a “B” channel type (83%) with a co-dominant type of “C”. Thirty-five percent of this stream length is made up of Beaver ponds. These ponds are rapidly filling with sediment. This high sediment load appears to

be coming from both upland grazing and instream sources. The upland sources appear to originate in both the Giraffe and Robinson Creek drainages. The instream sources are likely associated with degraded riparian conditions and bank erosion. This is shown by very low bank stability, which ranges from 8-20% through the Bridger-Teton National Forest. Below National Forest lands, bank stability is good with only isolated disturbed areas. These are located where cattle access the stream. The lower reach is a meandering channel with undercut banks. Sediment levels appear to be high as a result of an abundant supply and limited transport flows.

Coal Creek:
Ocular estimates of the stream and most of its tributaries show that these areas are in fair to poor condition from its headwaters to Salt Creek. These conditions have resulted from historic overgrazing, severe bank erosion, and high sediment levels (BLSWCD, 1999). BLM "Properly Functioning Condition" assessments (1994 and 1995) found that at the subwatershed scale 23% of the stream length are at PFC, 23% are functioning at risk with an upward trend, 34% are functioning at risk with no apparent trend, and 20% are functioning at risk with a downward trend. The reaches at PFC or improving trends are associated with cattle exclosures (primarily on Huff Creek).

At a finer scale, stream ratings show that 20% of Coal Creek is at PFC, 16% is functioning at risk with an upward trend, 33% is functioning at risk with no apparent trend, and 31% is functioning at risk with a downward trend. A review by Philbin (2001) found improving trends in the vicinity of Huff Creek. While old high banks are present, a new lower bankfull level is being formed and banks are fairly stable at this level. However without willow to protect the banks and the new terrace banks, erosion is still possible. Sixty-one percent of Huff Creek is at PFC while 39% is functioning at risk with an upward trend. Twenty-one percent of Stoner Creek is functioning at risk with no apparent trend and 79% is functioning at risk with a downward trend. Finally for Little Muddy Creek, 36% is functioning at risk with an upward trend, 59% is functioning at risk with no apparent trend, and 5% is functioning at risk with a downward trend. Frequent headcuts (vertical instability) were noted on Coal, the East Fork, and Stoner creeks.

Dry-Preuss Creeks:
Just below the forest boundary Dry Creek has a very unstable section of stream extending approximately ½ mile. Another unstable section is located below county road. Beavers appear to be playing a key role in maintaining stability in the rest of this lower section. However, due to a lack of quality building materials these dams may not withstand large flow events. Above the forest boundary the stream is in fair condition (table 7). This reach is somewhat incised with moderately unstable banks. Sediment levels are also high. Small side channels are abundant throughout the flood plain, some of which contain old beaver dams. In general, the steeper canyon reaches are in good shape while alluvial reaches have moderate levels of instability.

For ½ mile above the forest boundary Preuss Creek has been severely impacted by cattle. This area was originally established as an exclosure but cattle got in side the fence and effectively turned it into an enclosure. The impact from the cattle was severe as the majority of the woody vegetation along the stream was denuded. Banks were severely overhanging with heights approaching 8 feet. Immediately below the forest boundary, bank stability remains poor with 10 foot high eroding and sloughing banks. Upper Preuss Creek (from Beaver Creek to the Crow Creek) is a stable section of stream in good condition (table 14). Banks are generally stable and the stream is connected to its floodplain. This area is a long beaver complex connected by “E” channel types.” Lower Beaver Creek is also a large beaver complex with tall dams (up to 10 feet high) and valley spanning ponds. In both Preuss and Beaver Creek, incised areas that are fully inundated and will silt in potentially reconnecting them to their original floodplain.

Table 14: Channel Ratings

	1979			1987			2001 Rating/Comments	
Preuss 1	85	Fair		63	Good		74	Good
Preuss 2	101	Fair-Poor		111	Fair-Poor		The upper end is improving. This area and lower Beaver Creek are a continuous series of beaver ponds.	
Preuss 3	73	Fair		85	Fair		Not Evaluated	
Preuss 4	105	Fair-Poor		116	Poor		Not Evaluated	
Dry 1	97	Fair		128	Poor		Not Evaluated	
Dry 2	96	Fair		83	Fair		Not Evaluated	
Dry 3	103	Fair-Poor		124	Poor		Not Evaluated	
Dry 4	88	Fair		74	Good		72	Good
Dry 5	76	Fair-Good		65	Good		107	Fair

Raymond Canyon:
The main stream has a straight channel with numerous headcuts (vertically unstable). This is resulting in excessive bank erosion and sediment production. This is tied to channelization and poor riparian conditions. The Middle Fork is experiencing excessive lateral bank erosion and stream bank trampling. As a result sediment production is high. BLM "Properly Functioning Condition" assessments found that at the subwatershed scale 5% of the streams in this drainage were at PFC, 19% were functioning at risk with no apparent trend, 28% were functioning at risk with a downward trend, and 48% were not properly functioning.

Water Quality

Water Quality refers to the ability of a water body to support its beneficial uses. This can relate to changes in the physical channel or the water column. For this report changes to the physical channel were discussed under "STREAM CONDITIONS" while water column impacts are emphasized here. Stream bank erosion and mass wasting, irrigated and non-irrigated agriculture, stream channelization, pasture and riparian grazing, and animal holding/feeding areas are all, to various degrees affecting water quality in the Thomas Fork and its tributaries. Beneficial uses for these streams include:

Table 15: Beneficial Uses

Stream	Reach	Beneficial Uses
Thomas Fork (ID)	Mouth to State Line	Cold Water Biota, Salmonid Spawning, Primary Contact Recreation
Dry Creek (ID)	Source to Mouth	Cold Water Biota, Salmonid Spawning, Secondary Contact Recreation
Preuss Creek (ID)	Source to Mouth	Cold Water Biota, Salmonid Spawning, Secondary Contact Recreation
Salt Creek (WY)	Source to Mouth	2A. Coldwater game fisheries
Coal Creek (WY)	Source to Mouth	None Designated. Existing = Coldwater game fisheries

Water Quality – General

Data Sources /Data Gaps:

- Bear River Resource Conservation and Development http://www.bearriverrcd.org/bearriver/field/UB3a.html
- Idaho and Wyoming 303(d) list and 305 (b) Reports
- Thomas Fork Water Quality Project (BLSWCD 1999)

During spring run-off, seasonal surges carry significant amounts of bacteria, nutrients and dissolved solids introduced from dairy farms and cattle feeding operations located on or near stream banks. In addition, the Thomas Fork flows through a relatively flat valley that is highly susceptible to flooding during spring run-off. Manure deposited from winter-feeding cattle on the watershed's valley floor is then picked up by the floodwaters and carried to Thomas Fork River, Bear River and eventually deposited into nearby Bear Lake. Water quality investigations conducted in the watershed determined that 10 to 30% of the nitrogen, phosphorous and total suspended solids found in the Bear River was introduced from Thomas Fork. See the Thomas Fork Water Quality Project Report for more information (BLSWCD 1999).

Water Quality - Temperature

Data Sources:

- Thermographs were used in Dry and Preuss (1992) and Dry and Giraffe creeks (1995).
- Spot temperatures were collected in Salt Creek in 1999.

Assumptions:

- 1995 was a cool, wet year in much of the middle Rockies. It’s assumed that this was the case in the Thomas Fork watershed.

The following table presents data from 1992 for Dry Creek and upper Preuss Creek. The Preuss temperatures are somewhat misleading in that they were taken in a timbered reach and not in the reach most likely to experience high temperatures.

Table 16: 1992 Temperature Monitoring

1992	Maximum	Max Daily Average	7-Day Running Max
Dry Creek	23.5 (8/10 4pm)	17.7 (8/9)	22.6
Upper Preuss Creek	17.5 (8/10 2 pm)	12.9 (8/8-10)	16.5

The 1995 monitoring found daily low temperatures between 10-15.5 degrees and daily highs between 15.5-21.1 degrees. The patterns of highs and lows were similar for both streams but Dry Creek appears to be slightly (1 degree) warmer than Giraffe Creek. The wide and shallow nature of many of the streams and the open riparian areas may make water temperature a concern. The maximum water temperature for Salt Creek was 24 degrees C on July 21 1999 at noon.

Table 17: Water Quality – Water Quality Limited Segments (303(d))

	Segment	Pollutants	Miles
Thomas Fork (ID)	Wyoming – Bear River	Nutrients & Sediment	27.54 Miles
Preuss Creek (ID)	FS Boundary – Thomas Fork	Sediment & Habitat Alt.	3.67 Miles
Dry Creek (ID)	Headwaters- Thomas Fork	Nutrients & Sediment	8.68 Miles

Salt and Coal creeks were listed on Wyoming's 303(d) list for siltation and other pollutants (1996). However, USEPA 1998 305(b) guidelines state that water bodies not meeting their designated beneficial uses due to naturally occurring conditions or catastrophic conditions are not to be listed. While the relative influence of natural and man caused activities has not been determined, natural conditions appear to have had the most influence on water quality. The 60 miles of perennial streams are now reported as supporting all designated beneficial uses (1998 Wyoming 305(b) Water Quality Assessment) and these streams are no longer listed.

FIRE

Fire is a natural and vital ecosystem process (White and Pickett, 1985), and is necessary for sustaining forest ecosystems, which can all, in some way, be characterized as fire dependent (Atkins et al, 1999). Fire serves many roles in the ecosystem including reducing biomass, recycling nutrients, regenerating vegetation, and maintaining diverse landscapes (Kozlowski and Ahlgren, 1974). Fire has played a central role in the Forest's ecosystems. The origin of Engelmann spruce/subalpine fir, lodgepole pine, Douglas-fir, and most quaking aspen stands in the analysis area can be traced to some form of disturbance. Historically, that disturbance was usually fire. Fire suppression in these communities can affect their susceptibility to insects and diseases and lead to changes in species composition, structure, and diversity (Atkins et al, 199).

Over the years numerous people have pointed out the undesirable effects of fire suppression including Hoixe (1910), Weaver (1943), Gruell (1976), Arno (1980), Pyne (1982), General Accounting Office (1999), and the Secretaries of Agriculture and Interior (2000). The consensus is that fire suppression leads to the accumulation of fuels that, when eventually ignited can lead to uncharacteristically large or intense fires. The evidence of the unintended consequences and undesirable effects associated with fire suppression is overwhelming. Having acknowledged that it can have adverse effects, overall, fire suppression has caused moderate departure from the historic range of variability in the analysis area.

The consequence of fire suppression and historic grazing has been an apparent increase in the amount of woody biomass (e.g., standing dead fuels, down woody fuels, ladder fuels). Despite a moderate departure in conditions generally, four trends have emerged as a result of fire exclusion that are worthy of discussion: the area of sagebrush with dense canopy cover has increased in some parts of the analysis area; an expansion of woodland species; the removal of low severity fires from mixed severity regimes; and a decline of quaking aspen.

Rangeland Habitat Types

Alterations in the natural fire regimes have greatly influenced the location, composition, and structure of the rangeland cover types. In the analysis area, the frequency of fire has decreased because of fire suppression, cultivation, irrigation, and removal of carrier fuels by livestock grazing. Changes resulting from decrease fire frequency include: encroachment of conifers and woodland vegetation into non-forested vegetation, for example Douglas-fir and mountain-mahogany; increased density of big sagebrush and other shrubs, with an accompanying loss of herbaceous vegetation.

The current fire regime for the dry shrub group has not changed much from the historical regime. Significant acreages have been treated with herbicides, and prescribed burns in the past to reduce shrub overstory competition to allow for increased forage production. Also, several wildfires have occurred in the past that have contributed to the treated acres.

The cool shrub group has a high degree of overall departure from historical succession and disturbance. The fire regime is beyond or near the upper limits of the interval range (25-76 years). This is evident from the succession of conifer and woodland species into this group. Also the chokecherry-serviceberry-rose species are in an old age class and many stands are becoming decadent.

Woodlands Habitat Types

Because of fire exclusion, curlleaf mountain-mahogany has expanded outside its natural range and has invaded into the cool shrub group. Fire regime is greater than 50 to 70 year interval.

Xeric Douglas-fir Habitat Types

Fire frequency in this group is four times longer than presettlement average interval, likely from long-term overgrazing and fire suppression (Barrett 1994). Increased fuels and stand decadence is evident even on these dry, unproductive sites. Therefore fire exclusion has altered the previous fire regime pattern from one of frequent light surface fires, to one of moderately long to long interval fires that produce mixed severity burning or total stand replacement during wind driven events.

Mesic Douglas-fir Habitat Types

Fire regimes in this group are approximately twice the length of the presettlement average fire interval. Forest succession in the absence of fire has allowed growth of subalpine firs into areas that historically were dominated by Douglas-fir. Fire return in this group is beyond 100 years with increasing susceptibility to stand replacement fires.

Quaking Aspen-Dominated Community Types

The fire return interval is less frequent today compared to historical averages. Barrett's research noted fire frequencies from 31-202 years in aspen types on the Caribou, the (weighted mean) average fire interval was 69 years. The data suggest a general trend toward declining fire occurrence since the late 1800's. The fire regime for this group is outside historical ranges, fire has not had a significant role in influencing distribution of structural classes and patterns within the analysis area.

Xeric Subalpine fir and Engelmann Spruce Habitat Types

Changes in structure and composition have typically resulted in higher surface fuel loads and greater crowning potential. The predominant fire regime is now lethal stand replacing fires, most of which burn at very infrequent intervals. The mixed severity fire regime is still present on some sites, but nonlethal underburns have essentially been eliminated from the present fire regime.

FORESTS

Lodgepole pine

The majority of this type is mature to over-mature sawtimber size, which are rated as at a moderate risk to mountain pine beetle epidemic attack (Cole,W.E. 1980). This condition will not change until the stand age and average diameter are drastically reduced. These lodgepole pine stands are well on their way of succession to a climax stage where sub-alpine fir will be the dominant species. Sub-alpine fir is very well established in the understories of these stands. The combination of these conditions points to the potential for large scale, lethal stand replacement fires. Field observations noted the active pioneering of lodgepole pine into sagebrush steeps due to the lack of fire.

Diseases, mainly dwarf mistletoe, are increasing incrementally with stand age and densities. On-going mortality from pine beetles can be seen in nearly every drainage within this watershed) (3410 Aerial Pest Detection Surveys. Tree mortality and volume loss to these factors will continue and increase as the age of the stands increases. Standing dead and down fuels are present and increasing.

Currently there is little balance of structural stage and age classes. A very small percentage of this timber type can be classified as young aged seedling/sapling. The lodgepole pine stands within this watershed approximate the stand age and structure classes found in the Draft Properly Functioning Condition (PFC) report for the Caribou National Forest.

Aspen

Aspen cover types are presently estimated to occupy approximately 30% of the land base on the Caribou National Forest (PFC). A field observation of the remaining land base within this analysis area suggests this percentage to be even lower. Many aspen stands and clones are well along the way of succession to conifers, mainly Douglas-fir and sub-alpine fir. Numerous stands have an established understory dominated by these conifers. Field observations noted many areas having conifer in their main canopies as well.

Insects, and disease in combination with advancing age of the aspen have begun to accelerate the lose of aspen clones throughout this analysis area. The majority of the aspen stands visited are over 80 years in age, with many stands well past this age.

Aspen regeneration is evident today in clones, which display a ring of younger seedling/sapling, or pole sized stems about the perimeter of the stand, or by the presence of numerous sprouts within the understory. The case today of an aspen clones' remnant presence in an otherwise conifer dominated stand is evident by the presence of a few saplings, post size or small sawtimber sized trees scattered randomly about the stand. In some cases, aspen regeneration has not been successful because of heavy grazing by wild and domesticated ungulates. The fire return interval of today, probably is having the largest impact upon the lack of regeneration of quaking aspen, the succession of aspen to conifers, and the main reason for aspen's deviation from its natural range of variability.

Interior Douglas-fir

Current structures are typified by mature, even aged and size classes, with few occasional scattered over-mature veterans in small groups or fingers. Relatively few acres are in the seedling and sapling structural/age class. Forest succession in the absence of fire has allowed growth of true firs into areas that historically were dominated by Douglas-fir, and resulted in denser stands of Douglas-fir on drier sites. Patterns across the landscape are outside their historic range of variability as areas of aspen, mountain brush, sagebrush, limber pine and mountain mahogany have been encroached upon and occupied by Douglas-fir, increasing its range.

Douglas-fir bark beetles are at endemic levels after peaking in the early 1990's to near epidemic levels (3410 Aerial Pest Detection Surveys). The latest drought conditions over the last few years has shown an increase in the amount of Douglas-fir trees attacked and killed, but this recent rush of beetle activity is within endemic levels as well. The threat of wide spread bark beetle attack to these Douglas-fir stands will increase as the age of these stands increases. The early to mid 1980's saw a peak in the spruce budworm activity but current aerial surveys show this insect's activity levels to be at endemic levels (3410 Aerial Pest Detection Surveys). This activity indicates the succession towards true firs in otherwise Douglas-fir habitat. Dwarf mistletoe is a localized problem causing volume loss and will remain a constant companion in our Douglas-fir stands, as eradication is nearly impossible to attain.

Spruce – Fir

The majority of these stands are occupied by mature to old age classes. Sub-alpine fir usually makes up 50% or more of the species composition here with its position in the canopy dependent on the successional stage. Where Engelmann spruce is co-dominant with sub-alpine fir, the Engelmann spruce can make up to half or more of the species composition. Natural regeneration in unharvested or otherwise undisturbed stands usually favors sub-alpine fir. Stands of older-aged, large diameter spruce which are highly susceptible to attack from spruce bark beetle, do exist within the analysis area, however this insect is currently at endemic levels (3410 Aerial Pest Detection Surveys). Douglas-fir bark beetle and sub-alpine fir mortality complex both peaked in the early 1990's and have now dropped back to endemic levels (3410 Aerial Pest Detection Surveys). Because of increased stand density, increasing dead and down fuels, and more ladder fuels, the potential for stand replacing fires has increased, particularly on the drier, lower elevations (under 7800 feet) where sub-alpine fir is dominant. The isolation of some high elevation stringer Engelmann spruce stands, and others located in riparian areas, lessens the likelihood of spruce beetle attacks. Patterns of occurrence are stable and self-perpetuating, due to the lack of any recent large-scale catastrophic events.

RANGELANDS

Generally, the age and size class distribution in the dry shrub potential vegetation group has probably not changed significantly from that expressed for reference conditions. More specifically, the low sagebrush covertype reflects a more single age and size class. Increases in bare ground for the vegetation group may be significant. The invasion by trees such as Rocky Mountain juniper into this potential vegetation group appears to be within the range of natural variability for the watershed. Compositionally, the dominance of sagebrush has decreased. In association with this decrease in sagebrush dominance, a significant reduction of the perennial grasses and forbs has taken place as well as a more minor reduction in associated shrubs. These native species have been replaced by exotic species such as crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), alfalfa (*Medicago sativa*), and annual cereal grains. Disturbance regimes that more commonly affect this vegetation group currently are cultivation and an addition to the grazing regime by domestic livestock, both cattle and sheep. Large areas, particularly associated with the basin big sagebrush type, where the deep soils have the greatest agricultural potential, have been taken over for crop production. Over the remainder of the dry shrub group, domestic livestock are wintered on harvested forages at lower elevations on privately owned lands. Spring grazing occurs on the surrounding foothills and summer grazing is provided at higher elevations. Livestock forage on crop aftermath during the fall months. Significant acreages have been treated with herbicides in the past to reduce shrub overstory competition to allow for increased forage production. More recently, small parcels are being excluded from domestic livestock grazing.

A range of age and size classes is currently reflected in the curlleaf mountain-mahogany covertype. Greater than 35 percent of the annual leader growth is being retained each year to assure flowering and seed set. In many areas, Douglas fir grows intermixed with curlleaf mountain-mahogany on deeper soils. In these settings, the curlleaf mountain-mahogany is seral and the conifer species will dominate. The most prominent disturbance regime in the watershed still occurs in the presence of the wild ungulate grazing regime, where areas are still heavily browsed during winter. Stands are relatively large and continuous with all age classes represented. In the absence of fire the species has invaded into other covertypes.

At the watershed scale, the age and size class distribution for the cool shrub potential vegetation group is within the historical range of natural variability and with respect to structure reflects what one might expect in reference conditions. A change in species composition as a result of disturbances can be noted. A shift in understory indicator species to other plant species such as Kentucky bluegrass (*Poa pratensis*), needle grasses (*Stipa columbiana* and *S. lettermanni*), dandelion (*Taraxacum officianale*), and western coneflower (*Rudbeckia occidentalis*) are indications of disturbance. Disturbances commonly associated with the tall forb type have been seasonal heavy and prolonged grazing by domestic livestock in addition to the native grazing regime. As with other associated vegetation types, fire was a significant disturbance factor. In the recent past, both prescribed fire and wildfire have helped restore natural fires within this vegetation group. Over the remainder of the type, increases in disease such as blackknot in chokecherry adversely affect the potential value of the type. Patterns are within historical ranges.

Significant changes associated with rangeland covertypes are expressed in the tall forb type. Most present day stands are in an early seral stage and are dominated by a few species of seral forbs and grasses. Bare soil typically exceeds 10 percent and it appears that soil loss from these sites has been significant. The array of luxuriant mesic forbs has been reduced to nearly a monoculture. Small patches of conifer have established a foothold on historic tall forb sites. Most tall forb sites within the Thomas Fork watershed are composed primarily of northern mule-ears (*Wyethia amplexicaulis*). Disturbances commonly associated with the tall forb type have been seasonal heavy and prolonged grazing by domestic livestock in addition to the native grazing regime. The association of this type with moist or wet spruce-fir forest types indicates that fire, although its occurrence was less frequent, was a important disturbance in the tall forb type. Fire return intervals ranged from 50 years to over 300 years. Although fire as a disturbance may still remain within the range of natural variability, the prolonged absence of fire has resulted in the established of conifer patches within the type. Otherwise, patterns remain similar to what historically occurred.

The balance between the vegetation, soil and water resources in the riparian type has been altered. The most significant alterations occur in the Thomas Fork valley. In this broad valley setting this balance is well outside the historic range of natural variability. The amount and type of vegetation community types needed to maintain riparian dependent resources and provide a high rate of recovery following disturbance have been removed. In many instances, diverse age-class distribution of riparian vegetation is lacking. Likewise, a diverse composition of riparian wetland species is lacking. Many species present are associated with disturbed settings. Widening and down cutting of stream channels has lowered the water table. Plant species present indicate the loss of riparian-wetland soil moisture characteristics. This situation extends up some of the larger drainages. These areas would be considered nonfunctional for the most part. In the foothill areas of the watershed alteration overall appears less severe. Better diversity in age-class distribution and composition of riparian-wetland vegetation is present. Riparian-wetland soil moisture characteristics are presently being maintained. In many instances plants and community types are present that have root masses capable of withstanding high stream flow events. However, in many instances this vegetation is not found in adequate amounts to protect banks and dissipate energy during these events. Shrub genera, specifically *Salix*, appropriate for stream size and ecological setting is noticeably lacking. These streams remain functional but at risk. At higher elevations, stream functionality appears to be proper overall. Adequate amounts of the right plants and community types associated with these riparian-wetland settings are most often adequate to protect banks and dissipate energy. In these settings, where coarse and/or large woody debris is required to capture bedload, aid floodplain development, and dissipate energy, adequate amounts are generally exist.

FISHERIES

Thomas Fork

The 1990's brought an increased interest in the management and use of resources in the Thomas Fork and greater interest in Bonneville cutthroat trout. These resulted in management changes that were often reflected on the ground.

The Montpelier Elk Valley Cattle and Horse Grazing Allotment Management Plan was revised in 1993. The grazing system changed to a rest-rotation where each unit is rested one out of every three to five years. Some low gradient sections of Preuss, Dry, and Giraffe Creeks were corridor fenced for a total of 5 corridors. Approximately 60 water developments were installed to better distribute livestock. Utilization standards for riparian vegetation were set at 45% utilization or 4-6" stubble height (Fallau 1992).

Kershner (1993) identified several causes for the decline of Bonneville cutthroat trout. They include the introduction of non-native fish species, habitat loss and degradation, and angling. Non-native fish compete with Bonneville cutthroat trout for habitat and rainbow trout and other cutthroat trout subspecies interbreed with Bonneville cutthroat trout, resulting in hybrids. Some non-native fish, such as brown trout and carp, prey upon Bonneville cutthroat trout. IDFG and WDGF no longer stock fish in the Thomas Fork and their tributaries. However, naturally reproducing populations of non-native fish remain. Kershner identified potential primary causes of habitat loss and degradation as water diversion and degradation of riparian areas from grazing, road building, mining, and timber harvest. Cutthroat trout may be more susceptible to angling pressure than other salmonids and this could cause a decline in populations that are heavily fished.


Photo 8: Juvenile Bonneville cutthroat trout from lower Thomas Fork (Colyer 2000).

In 1993, Wyoming Game and Fish, USDA Forest Service (Bridge-Teton National Forest), and Bureau of Land Management (Rock Springs District) entered into the Bonneville Cutthroat Inter-Agency Five Year Management Plan (Remmick et al 1994). Its purpose was to coordinate conservation measures between agencies and to further encourage actions that would prevent the need to list Bonneville cutthroat trout under the Endangered Species Act (USDI BLM 2000). The plan focused on 4 general areas;

population and habitat monitoring/inventories, increasing the species' range, improving watershed condition, and a public awareness program. Remmick (2001) and Nelson (2001) reported most of the action items on the plan completed and an accomplishment report is being prepared.

In 1993, Kurt Nelson, Fisheries Biologist for the Bridger-Teton National Forest, estimated Bonneville cutthroat trout populations for several Wyoming streams tributary to the Thomas Fork. These estimates were summarized in the draft Bonneville cutthroat trout habitat conservation assessment (Kershner 1993).

BLM Kemmerer Resource Area completed a draft evaluation of the Smith Fork Allotment in November 2000 (USDI BLM 2000). The Smith Fork Allotment spans into the eastern side of the Thomas Fork drainage. Concern was expressed in the document that BLM direction relating to maintaining an upward trend in watershed properly functioning condition and maintaining ecological processes in riparian areas was not being met. PFC data collected in 1994 and 1995 show only 17% of the stream miles in proper functioning condition (minimum standards). The reassessment done in 2000 showed no or very little change in the PFC rating, indicating little recovery is occurring.

The evaluation described grazing use as heavy, preventing the recovery of willows in places. Periodic observations of the willows on all streams from 1993 to 2000 documented some willow establishment, but not enough to meet greenline survey objectives (USDI BLM 2000).

In 1994, the Caribou National Forest entered into a conservation agreement in the Thomas Fork of the Bear River on the Montpelier-Elk Valley Allotment to benefit Bonneville cutthroat trout through the protection of habitat in Dry, Preuss, and Giraffe Creeks (Caribou-Targhee National Forest et al. 2000). Since 1994, the Forest has spent approximately $20,000 for 14 new or reconstructed water developments, built 10.25 miles of new fence at a cost of $35,000, constructed 5 livestock exclosure fences at a cost of $12,000. March 2000, the conservation agreement was updated. Among other measures, the update established a data repository and required a watershed analysis to determine drainage-wide recovery needs for Bonneville cutthroat trout and their habitat. This is a primary reason for this watershed analysis.

Bear Lake Soil and Water Conservation District (1999), in cooperation with USDA Natural Resources Conservation Service, Idaho Department of Fish & Game, Idaho Department of Environmental Quality, USDA Forest Service, and other agencies, prepared the Thomas Fork State Agricultural Water Quality Project Report. The document stated water quality degradation of the Bear River and Thomas Fork is due in part to current land management practices within the Thomas Fork Watershed. These land management practices have contributed to sediment, nutrient, and bacteria loading. These pollutants are having an adverse impact on riparian and aquatic habitat and are impairing beneficial uses such as salmonid spawning and cold water biota. The document also identified stream and river dewatering as impacts to fisheries. The objectives of the water quality project included reducing sediment loading and excessive erosion, restoring the riparian area of the Thomas Fork and its tributaries, and protecting/enhancing fish habitat. The project restoration plan, primarily focusing on agricultural land, included the application of best management practices that will reduce erosion and overland nutrient/bacteria flow. The document also recommended fish screening.

Photo 9: Thomas Fork (Colyer 2000).

In support of the Thomas Fork Water Quality Project, Idaho Department of Environmental Quality collected and analyzed aquatic macroinvertebrates in the Thomas Fork (Bear Lake Soil and Water Conservation District 1999). Pollution tolerant species were greatest and species diversity was lowest on the reach of the Thomas Fork just above its confluence with the Bear River. Macroinvertebrates were sampled in the lower and upper Thomas Fork and upper and lower Salt Creek. Overall scores indicated the reaches sampled were impacted by introduced sediment. The samples consisted of taxa tolerant of pollutants. There was a virtual absence of intolerant taxa (indicators of high habitat complexity and integrity). No cold water taxa were collected at any site.

The water quality project also identified dewatering as a challenge to Bonneville cutthroat trout populations in the Thomas Fork. The Thomas Fork has periodically become completely dewatered due to diversion of flows to honor existing water rights. Most of the dewatering occurs in the reach from Geneva to Raymond. Major diversions along the mainstem are Taylor Canal, Hall’s Ditch, and Raymond Canal.

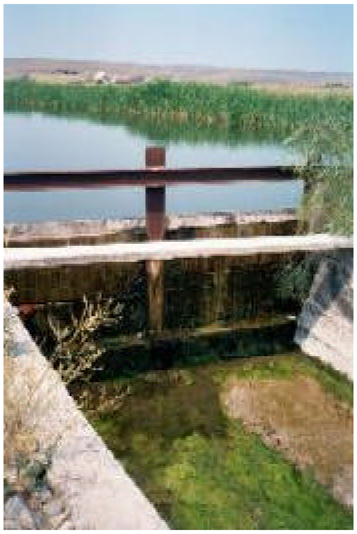


Photo 10: Full spanning diversion Dam on the Thomas Fork stops all downstream flows (Colyer 2000).

Photo 11: Same diversion. Passes some water downstream, but still barrier to upstream-migrating fish (Colyer 2000).

The report described a ¼ mile long reach of river that was straightened immediately upstream of the Geneva Bridge. The channel straightening, described by Russell Boehme in the Past Conditions section, has resulted in severe headcutting upstream to the Taylor Canal diversion structure. The headcutting has eliminated all overhanging banks and elevated water temperatures due to lack of shading. The Taylor Canal diversion structure is now at least a partial, if not full, upstream migration barrier for fish (Bear Lake Soil and Water Conservation District 1999). It also captures Bonneville cutthroat trout from the river. Many die in the associated irrigation and power operations.

The Natural Resources Conservation Service has worked with some landowners on the Thomas Fork to improve habitat by planting riparian vegetation and constructing/maintaining livestock exclosures in sensitive riparian areas. In cooperation with the Bear Lake Regional Commission, nearly 5000 feet of eroding stream banks have been stabilized through bio-engineering (Thomas 2001).

The U.S. Fish and Wildlife Service purchased 1,015 acres at the mouth of the Thomas Fork in 1995. This land includes 3.75 miles of the lower Thomas Fork and 926 acres of wetlands. Livestock grazing of the riparian area was stopped and riparian area condition improvements are being observed (Sjostrom 2001). Riparian areas downstream of the Esche Diversion are recovering slower than those upstream. Recovery may be hindered by the manipulation of water levels by irrigation. Riparian areas upstream of the diversion appear to have more woody cover and stable banks than downstream. Willow regeneration is limited throughout the U.S. Fish and Wildlife Service reach of the river. This is likely due to flow manipulations (Colyer et al. 2001).

From 1999 to 2001, U.S. Fish and Wildlife Service helped fund a study conducted by Utah State University assessing Bonneville cutthroat trout populations in the Thomas Fork. This study concentrated on the large (>400 mm) fluvial cutthroat trout that utilize the river within the recently purchased U.S. Fish and Wildlife refuge land. Riparian vegetation was surveyed, stream cross sections were established, electrofishing surveys were conducted, radio transmitters were placed in 55 cutthroat trout, and pit tags were implanted in 100 cutthroat trout. The overall intent was to describe seasonal movements of these fish, determine their spawning areas, and describe aquatic and riparian habitat conditions. The study identified the lower Thomas Fork as valuable winter habitat and an important migration corridor for fluvial Bonneville cutthroat trout. Adult Bonneville cutthroat trout in the lower river prey upon juvenile carp, suckers, and whitefish (Colyer et al. 2001).

Fifty-five cutthroat trout with radio transmitters were planted upstream and downstream of the large water diversion structure near the mouth of the Thomas Fork. The study suggested the diversion may be excluding some fish from preferred winter locations in both upstream and downstream populations (Colyer and Kershner 2001). Colyer had documented a concrete diversion weir (Esche Diversion) that blocks the flow of the Thomas Fork most years by May 1 to 15, prior to most fluvial Bonneville cutthroat trout upstream spawning migration. In addition to affecting fish migration, the Esche Diversion impacts river hydrology, contributes to bank instability, and alters riparian community composition (Colyer et al. 2001).

Photo 12: Diversion structure (Esche Diversion) in lower Thomas Fork is barrier to upstream-migrating fluvial Bonneville cutthroat trout (Colyer 2000).

Rahel and Schrank (2001) studied the migratory behavior of Bonneville cutthroat trout in the Thomas Fork from 1999 to 2001. Large spawners were collected in Huff, Coal, and Water Canyon Creeks, in the headwaters of the Thomas Fork Drainage, and implanted with radio transmitters. Of the 42 cutthroat trout with transmitters, 24 (57%) migrated to the Thomas Fork. The other fish remained in the tributaries or died after spawning. Some fish died after being diverted into agricultural fields. Of the 24 fish from Huff and Coal Creeks implanted with transmitters in 2000 that migrated downstream to the Thomas Fork, 9 were diverted by the Taylor Ditch and died (Schrank 2001). Several of the fish that migrated downstream to the Thomas Fork, continued downstream to the Bear River, a distance of 75 km. These fish spend most of their lives in the Bear River and migrate upstream to tributaries of the Thomas Fork to spawn. Schrank intends to implant additional fish with transmitters in 2001, including fish believed to exhibit a resident life history pattern.

Nelson (2001) has recently identified 3 Highway 89 crossings of tributaries of Salt Creek that are at least partial barriers to upstream migrating fish.

In January 2000, a range-wide conservation agreement and strategy was prepared for the conservation of Bonneville cutthroat trout (Lentsch et al. 2000). The document included range-wide conservation goals, objectives, and actions. The document was signed by agency directors, including the Forest Service Regional Forester and the BLM State Directors, indicating their concurrence.

Preuss Creek

In Preuss, Dry, and Giraffe Creeks, habitat features in grazed sections were compared with those in ungrazed sections. Bank stability, percent undercut bank, width:depth ratio, and amount of fine sediment indicated poor habitat quality compared with the ranges of values found in ungrazed stream segments (Fallau 1995).

Multiple dispersed camping sites occur near the Crow Creek Road crossing. This is one of the few documented camping-related sediment sources to streams in the study area. The dispersed sites appear to be a minor sediment source.

Photo 13: Upper Preuss Creek grazing exclosure in 1994. Previously eroding stream banks like lower right in photo are now covered with sedge and willow (Johnson 1994).

Photo 14: Lower Preuss Creek (1994). Although some bank stabilization efforts (exclosures, planting, and tree revetments) have been successful, some eroding banks remain (Johnson 1994).

Photo 15: Lower Preuss Creek looking downstream into Wyoming (Johnson 1994)


Photo 16: Excellent riparian vegetation recovery inside lower Preuss Creek exclosure (Johnson 1994).

Mangum (1995) sampled the macroinvertebrate community in Preuss Creek. The community was dominated by sediment tolerant taxa and there were indications of organic enrichment. The observed number of shredders in the community is generally found where the riparian habitat is in fair to good condition. He expressed the exclosure in Preuss Creek may be too small to effectively reduce sedimentation from grazing impacts.

Forest Fisheries Biologist Capurso visited Preuss Creek in September 2001 as part of the conservation agreement monitoring field trip and documented impacts to the stream and its riparian area. Conservation agreement partners from Idaho Department of Fish & Game and Idaho Department of Environmental Quality expressed their discouragement and disappointment with the extent of grazing that had occurred there. This is the same concern expressed in previous years. 2001 was an extreme drought year, but does not justify the overuse of the range within the conservation agreement area. Riparian greenline average stubble height was estimated at 3-4 inches, exceeding the 6 inch stubble height standard (in the floodplain) agreed upon in the Montpelier/Elk Valley Allotment Bonneville Cutthroat Trout Conservation Agreement (2000).


Photo 17. Conservation agreement partners discussing riparian impacts from cattle grazing along Preuss Creek. Note bank trampling and 3-4 inch average height of greenline vegetation (9/01).


Photo 18. Cattle driveway crossing on Preuss Creek downstream of the Crow Creek Road Crossing (9/01). This is a sediment source to Preuss Creek.

Dry Creek

Several channel diversions occur in Dry and Preuss Creeks that act as barriers to upstream migrating fish. Boards are placed in the full-spanning structures to divert flows for agricultural purposes in the beginning of May (depending on the water year, the date ranges from May 1 to 15). Typically, Bonneville cutthroat trout migrate upstream to spawn in late May to early June. The current diversion structures are excluding the fluvial fish from migrating upstream to spawn in Dry and Preuss Creeks.

Montpelier Ranger District surveyed segments of Dry Creek in 1992 using the R1/R4 Aquatic Habitat Survey Methodology. Beaver ponds made up 31% of the length of the surveyed stream. The average width:depth ratio was 26:1. The percent of stream banks that were stable was 59%. There were no undercut banks. The substrate was dominated by gravel (USDA Forest Service 1992).

Montpelier Ranger District surveyed segments of Dry Creek in 1995 using the R1/R4 Aquatic Habitat Survey Methodology. Beaver ponds made up 26% of the length of the surveyed stream. The average width:depth ratio was 27:1. The percent of stream banks that were stable was 65%. There were 7% of the stream banks that were undercut. Fines and small gravel dominated the substrate (USDA Forest Service 1995).

Photo 19: Stream bank revegetation occurring in Dry Creek (1994).

Mangum (1995) surveyed Dry Creek for macroinvertebrates. There were indications of sedimentation and organic enrichment in the stream reach sampled.
Cleanwater taxa indicated fairly good water quality and some good instream substrate. The observed number of shredders in the community is generally found where the riparian habitat is considered good to excellent.

Rob Gregoire (1998), President of the Pocatello Chapter of Trout Unlimited, visited Dry Creek three times in late summer 1998 to monitor the effectiveness of the conservation agreement. He expressed concern about the condition of lower Dry Creek. The riparian vegetation condition within the lower Dry Creek exclosure was similar to outside the exclosure due to an electric fence that was not energized and an opening in the exclosure fence that allowed cattle entry. However, he was pleased with the condition of Dip Creek, a tributary of Dry Creek within the exclosure. Its willow growth protected the integrity of the stream. He was also pleased with the condition of the middle section of Dry Creek where most of the riparian area was covered with willows and small areas of forage were not utilized extensively. In this area, small Bonneville cutthroat trout were common. Gregoire observed some overgrazed riparian vegetation and stream bank sloughing in upper Dry Creek but the exclosure (one year old at the time) was functioning properly.

Forest Fisheries Biologist Capurso visited Dry Creek in September 2001 as part of the conservation agreement monitoring field trip and documented impacts to the stream and its riparian area. Conservation agreement partners from Idaho Department of Fish & Game and Idaho Department of Environmental Quality expressed their discouragement and disappointment with the extensive grazing that is frequently observed during fall monitoring trips. 2001 was an extreme drought year, but does not justify the overuse of the range within the conservation agreement area. Riparian greenline average stubble height was estimated at 3-4 inches, exceeding the 6 inch stubble height standard (in the floodplain) agreed upon in the Montpelier/Elk Valley Allotment Bonneville Cutthroat Trout Conservation Agreement.

Photo 20. Lower Dry Creek cattle impacts documented during the Conservation Agreement monitoring field trip (9/01). Note 2” average height of floodplain vegetation and extensive trampling.

Giraffe Creek

Bridger-Teton National Forest fisheries personnel surveyed Giraffe Creek between private land and Caribou National Forest land for approximately 3.4 miles in August 1992 (Cannon and Rowan 1992).

Old, inactive signs of beaver were noted in downstream portions of the survey. New beaver activity was observed in the middle reach of the survey. Old signs of beaver were again noted in the upper stream reach. Beaver ponds made up 35 percent of the entire stream by length and provided 47 percent (by length) of the pool habitat. Heavy siltation was common in all of the beaver ponds and pools.

Photo 21: Old beaver dam showing severe impacts along the edges from frequent sheep use. Willows are infrequent (Cannon and Rowan 1992).

Giraffe Creek had been extensively impacted by cattle and sheep grazing throughout the length of the survey (on Bridger-Teton National Forest). While some impacts were within the stream channel and riparian area (trampling, overgrazing, and trailing affecting vegetation and inputting sediment), surveyors believed the most drastic impacts to the stream were from the extensive grazing in the uplands, where extensive grazing had reduced vegetation cover and had caused large amounts of sediment to enter Giraffe Creek. Intensive sheep grazing was noted within the riparian area and uplands through about 90 percent of the stream during the survey. Thistle was the dominant riparian vegetation for most of the survey stream length.

Photo 22: Extensive sheep grazing Resulted in bare hillsides that contributed To stream sedimentation (Cannon and Rowan 1992).

Photo 23: Large hillside adjacent to Giraffe Creek that receives intense sheep grazing and contributed to the stream sediment load (Cannon and Rowan 1992).

Cutthroat trout of all age classes were observed throughout the entire length of stream.

Photo 24: Less impacted segment of Giraffe Creek, but still had high levels of sediment (Cannon and Rowan 1992).

Cowley (1995) sampled a tributary of Giraffe Creek with electroshocking gear to determine distribution, estimate population density, and collect genetic samples. Only cutthroat trout were observed in the stream. There was an average of 8 fish per 100 meters collected. They were primarily age 2 fish and older. Based upon his observations, Cowley recommended relocating a shepherd camp away from the stream bank to minimize sedimentation and riparian trampling.

Mangum (1995) sampled the macroinvertebrate community in Giraffe Creek. Below the exclosure, there were indications of sedimentation and organic enrichment in the stream. The observed number of shredders in the community is generally found where the riparian habitat is in at least fair condition. Upstream of the exclosure, the macroinvertebrate community was dominated by sediment tolerant taxa and organic enrichment tolerant taxa. The observed number of shredders in the community is generally found where the riparian habitat is in poor condition.

Rob Gregoire (1998), President of the Pocatello Chapter of Trout Unlimited, visited Giraffe Creek in late summer 1998 to monitor the effectiveness of the conservation agreement. He noted a natural mineral area on the stream banks of the Left Fork of Giraffe Creek that was extensively used by cattle. There was a high width to depth ratio and trampled stream banks there and a lack of riparian vegetation. The small exclosure in Giraffe Creek was inoperable and 15 cattle were inside.


Photo 25: Giraffe Creek Exclosure 1993


Photo 26: Cattle using natural salt lick along Left Fork of Giraffe Creek (Gregoire 1998)

Photo 27: Upstream end of exclosure on Left Fork Giraffe Creek. Right side of fence is inside exclosure. Note cow pies on both side of fence. This salt lick area is pictured in the photo above prior to exc losure fence construction (9/01).

In 2000, the Montpelier Ranger District constructed an exclosure from the forks to the Forest boundary. The exclosure terminates at the Left Fork salt licks observed by Gregoire. Some of the salt licks were included in the exclosure and some were excluded in an attempt to determine the degree of wildlife use. Monitoring in September 2001 documented slight improvements within the exclosure and none outside. Improvements would have likely been greater inside the exclosure, but cattle were grazing in there throughout the summer.

Capurso and Janowsky (Forest Service Fish Bios), Rushane (Forest Service Range Management Specialist), and Dickerson (USFWS Biologist) visited Giraffe Creek in September 2001. They prepared a report documenting their observations (Capurso et al. 2001). A 3-4" riparian greenline stubble height was documented along the Lefthand and Right Hand (Upper) Giraffe Creek. A 6-7" riparian greeneline stubble height was documented in the Giraffe Creek exclosure. Cattle were documented in the exclosure and a later monitoring trip (October 1, 2001) documented even more use in the exclosure (estimated average 5-6 inch stubble height). The conservation agreement requires a 6 inch stubble height in the floodplain. This standard was not met in the Left Hand and Right Hand Forks of Giraffe Creek.

Photo 28. Looking downstream at 110 meters downstream of Trail 418 crossing of Giraffe Creek. Note trampled banks and bare soil (9/01).

Photo 29. Willow browse. Note leaves stripped off top of willow branches. This was common along Right Fork of Giraffe Creek (9/01).


Photo 30. Pond in headwaters of the Lefthand Fork of Giraffe Creek (9/01).


Photo 31. The headwaters of Lefthand Fork Giraffe Creek (9/01).

Robinson Creek

Robinson Creek was surveyed by the Bridger-Teton National Forest (Cannon and Rowan 1992) using an R1/R4 aquatic habitat survey. The stream is approximately 2.8 miles long, draining about 1,900 acres. Robinson Creek is a tributary of Giraffe Creek. Moderate to steep sideslopes are common throughout the drainage and erosion rates for much of the area are high. The entire length of the stream was determined to be Rosgen channel type B3.

Beaver dams made up approximately 21% of the stream length and most were old and had breached, but still backing up water. Very few new beaver ponds were observed. All of the ponds and most of the pools in the stream were heavily silted in. Active bank erosion was measured at 18%. In addition to that sediment source, a jeep trail parallels the stream for approximately 0.8 mile, providing sediment to the stream. The majority of the riparian vegetation (80%) was composed of grass and forb.

Width to depth ratios varied from 7 to 1 on stream channels with naturally stable stream banks to 40 to 1 on highly impacted sections. Excessive impacts from cattle were observed in areas of high width to depth ratios. According to Rosgen's stream classification, a B3 stream channel should have a width to depth ratio of between 8 and 20 to 1.

Cattle trampling of depositional areas had a major effect upon the natural stream stabilization process. Because of this habitat alteration and the concentration of cattle within the riparian area, black flies were prevalent. Black flies are very tolerant to organic enrichment and elevated sediment loads and their numbers increase as pollution increases. They indicate degraded habitat. Thistles in the riparian area were documented as a concern in places.

Photo 32: Excessive cattle use in Robinson Creek. Note trampling (Cannon and Rowan 1992).

Salt Creek

Stinson (2000) and Stinson and Fredricksen (1999) performed an R1/R4 physical habitat survey on Salt Creek for the Bridger-Teton National Forest. Fine sediment (less than 2 mm in size) dominated this stream, consisting of an average of 37% of the stream substrate composition. Sediment is transported from the headwaters where past and present grazing has adversely affected riparian vegetation. Highway 89 encroaches upon the lower reaches of Salt Creek. The highway occupies approximately 50% of the historic floodplain and limits channel migration. Canadian thistle is common throughout the lower reaches in areas previously disturbed by grazing. This plant does not provide the stability that native willows and sedges do for stream banks.

Photo 33: Vertical stream bank on lower Salt Creek in close proximity to Highway 89 (Stinson 2000).

The riparian vegetation in the lower reach of Salt Creek primarily consisted of upland grasses, forbs, and willows. There were numerous pools formed by log weir and deflector structures. Wyoming Game & Fish constructed these in-channel structures with the assistance of the Forest Service in the 1980's. Fine sediment has affected the quality of aquatic habitat in this reach. Average bank stability was low and steep vertical soil banks were common.

Photo 34: Typical habitat in lower reach of Salt Creek (Stinson 2000).

Large instream wood was more frequent in the middle reaches. Wood was the formative feature of more pools than the lower reach. Bank stability increased. Further upstream, riparian vegetation was dominated by trees, willows, and some grasses and forbs. Surface fines were still frequent and were deposited in slow water habitat units.

In the upper most reaches, the stream channel confinement and gradient increase. The effects of beaver dominate these reaches.


Photo 35: Beaver activity in Upper Salt Creek (Stinson and Fredricksen 1999).

Packstring Creek

Pakcstring Creek was sampled by Cowley (1995) to determine fish distribution, estimate populations, and collect genetic samples. Only cutthroat trout were observed. Population density was not estimated because the complexity of the habitat made sampling difficult. Based on his observations, Cowley recommended aspen regeneration projects to restore beaver forage, hopefully encouraging the return of beaver to the stream.

Packstring Creek is a tributary to Salt Creek. It was surveyed by Stinson and Fredricksen (1999) using the R1/R4 physical habitat survey. Lower Packstring Creek is moderately confined. It has a dominant substrate of gravel to small cobble, with a large percentage of fines within the bedload. Most pools were created by meanders or beaver dams. Beaver activity was frequent in the lower portions of the reach. Stream banks were well vegetated with willow armor and undercut and eroding at the outcurves. Stock damage is evident from trail erosion.

The middle reach of Packstring Creek is more confined. Dominant substrate throughout the reach was cobble with a gravel dominated section near the middle of the reach with numerous beaver dams. Substrate fines remained near 30%. Instream wood played more a role in the stream and the floodplain was relatively narrow. Most pools were created from plunges or beaver dams. There was little to no sinuosity. Most sinuosity was associated with beaver activity. Sediment sources in this reach included the pack trail, excessive sheep grazing, and stock watering points.

Photo 36: Confined middle reach of Packstring Creek (Stinson and Fredricksen 1999)

The upper reach of Packstring Creek was confined to moderately confined. The dominant substrate was small boulders, but was gravel further upstream. Most pools were plunge and step pools. Stream banks were stable and well vegetated with natural erosion at outcurves. Riparian damage from excessive sheep use was documented in the middle of this reach.

Overall, the survey identified several opportunities to address sedimentation from the trail and sheep grazing.

Photo 37: Direct delivery of sediment to Packstring Creek
From trail (Stinson and Fredricksen 1999).

Little White Creek

Little White Creek is a tributary to Salt Creek. Cowley (1995) electrofished this stream to determine fish distribution. Only cutthroat trout were observed (primarily age 3 fish).

Lost Creek

Lost Creek is a tributary of Salt Creek. It is confined with a dominant substrate of cobble. Its stream banks had a cobble/boulder component. Near the mouth of the stream, the channel was slightly more sinuous and several beaver dams occurred there. Most stream banks had moderately thick vegetation. Some water access points for sheep were observed, but no heavy grazing was found within the riparian area.

Photo 38: Lost Creek looking downstream to its confluence with Salt Creek (Stinson and Fredrickson 1999).

Water Canyon Creek

Water Canyon Creek is a tributary of Salt Creek. Cattle grazing and recreational activities such as hunting and fishing occur in the drainage. Beavers are present in the drainage with dams currently being maintained. Cowley (1995) sampled this stream using electroshocking and found 100% cutthroat trout. The fish captured in the stream consisted primarily of young-of-the-year and age 2 fish. Based upon his observations, Cowley recommended controlling sediment input to the stream. Water Canyon is used by Wyoming Game and Fish as a broodstock source stream for their hatchery stock of Bonneville cutthroat trout (Remmick 2001). The high frequency of Bonneville cutthroat trout in Water Canyon can be attributed to beaver activity providing quality habitat (Remmick et al. 1994).

Coal Creek

Rahel and Schrank (2001) monitored summer water temperatures throughout the Thomas Fork during 1999 and 2000. Stream temperatures generally remained suitable for cutthroat trout throughout the drainage except for the upper reaches of Coal Creek, where daily high water temperatures in July and August often reached 25-27C. However, no mortality or emigration of Bonneville cutthroat trout were observed through radio telemetry or with fish collection weirs. Population densities at the 2 warmest sites remained the same. This stream experiences high daily temperature fluctuations. Daily high temperatures reached 25-27C and night temperatures cooled to 13-15C.

Segments of the riparian areas of Coal Creek and Huff Creek were aerial sprayed with 2,4-D and Tordon in the 1960's-1980's. These applications affected riparian willow health. At present, there is a general lack of riparian willows. Willows are beginning to show up in the areas where there is a seed source. The upper reaches of Coal Creek, the reach of Coal Creek at the confluence with East Fork Coal Creek, lower Coal Creek, and Huff Creek have willows in the riparian community, but they are sparsely spaced and low growing so they are susceptible to grazing (USDI BLM 2000). The following table illustrates recent PFC assessments by BLM of Coal Creek and tributaries:

Table 18: PFC Assessments of Coal Creek and tributaries.

Stream/Reach	Date Surveyed	Rating	Trend
Coal Creek Exclosure	8/95	Proper Functioning	
Tributary	8/95	Functional-At Risk	Downward
Dipper Creek	8/95	Functional-At Risk	Not Apparent
Omega Fork	8/95	Functional-At Risk	Downward
Mainstem Coal Creek	8/95	Functional-At Risk	Upward
Banoose Fork	8/95	Functional-At Risk	Downward
Anna Marie (trib to upper Coal Creek)	8/95	Functional-At Risk	Not Apparent
Upper Coal Creek	8/95	Functional-At Risk	Not Apparent
Upper East Fork Coal	8/95	Functional-At Risk	Downward

In 1995, BLM determined the mainstem of Coal Creek and most of its tributaries to be Functional at Risk. Coal Creek had an upward trend while most tributaries assessed had downward trends.

Huff Creek

The following table illustrates recent PFC assessments of Huff Creek and tributaries:

Table 19: PFC Assessments of Huff Creek and tributaries

Stream/Reach	Date Surveyed	Rating	Trend
Lower Huff (private)	6/94	Proper Functioning	
Middle Huff (private)	6/94	Functional at Risk	Upward
Upper Huff	6/94	Functional at Risk	Upward
West Trib	6/94	Proper Functioning	
Upper Cliff Creek	6/94	Proper Functioning	
Lower Cliff Creek	6/94	Functional at Risk	Not apparent
Lower Cliff Creek	7/00	Functional at Risk	Upward

BLM (2000) performed PFC assessments on Huff Creek and its tributaries in 1994 and 2000. All assessed reaches were Properly Functioning or Functioning at Risk. Trends identified were upward.

Raymond Creek

The following table illustrates recent PFC assessments of Raymond Creek and tributaries:

Table 20: PFC assessments of Raymond Creek and tributaries.

Stream/Reach	Date Surveyed	Rating	Trend
Main stem	6/94	Nonfunctional	Downward
North Fork	6/94	Functional at Risk	Not apparent
North Fork	6/00	Functional at Risk	Not apparent
Middle Fork	6/94	Functional at Risk	Downward
South Fork	6/94	Nonfunctional	
South Fork	6/00	Nonfunctional	

The PFC findings at Raymond Creek were not as favorable as Coal and Huff Creeks. BLM (2000) performed PFC assessments on Raymond Creek and its tributaries. Assessed stream reaches were Nonfunctional or Functional at Risk and trends were downward or not apparent.

WILDLIFE

The grizzly bear is listed as a threatened species under Endangered Species Act. The Thomas Fork watershed is outside the Yellowstone Grizzly Bear Recovery Zone (USDI 1993, 41). Other areas throughout the historic range of the grizzly bear are being considered to determine their suitability for grizzly bear recovery. Areas to be considered must have the potential to provide adequate amounts of quality habitat, space, and isolation necessary to sustain a viable population of grizzly bears (USDI 1993, 13). Today grizzlies remain only in large tracts of relatively undisturbed land (USDI 1993, 21). Grizzlies have not been seen in the Thomas Fork watershed recently but the potential for grizzlies to use the watershed is possible due to the proximity to known sightings. The area is suitable for grizzly bears but probably lacks survival and recovery values. There is currently no management direction for this area for the recovery of grizzly bears. The opportunities for human-grizzly conflict potential are higher than preferred due the roading, logging, human settlement, grazing, and recreation. A lack of whitebark pine may also contribute to a lack of suitability.

Gray wolf (*Canis lupus*) –Wildlife Services took a wolf on private land 9 miles northwest of Soda Springs on November 21, 2000. The 65 miles between the Thomas Fork watershed and the Gros Ventre pack near Jackson, WY is within dispersal distance of wolves (Smith and others 2000). There is a likelihood of livestock and wolf interactions that may cause the removal or mortality of problem wolves. Restrictions of human disturbances are not required around known denning or rendezvous areas. Human disturbance is possible to wolves in the Thomas Fork watershed.

Canada lynx (*Lynx canadensis*) (USDI 2000) (Ruediger and others 2000). – The project is in LAU (Lynx Analysis Unit) #41 (USDA 2000), a 147,562-acre unit containing 43,934 acres (30%) of suitable primary and secondary lynx habitat. In the last 10 years activities (timber sales and wildfires) have converted 1,096 acres (2.5%) to an unsuitable condition. There are no other proposed activities that would decrease suitable habitat. Of all known treatments 2,831 acres (7%) has been impacted. The remaining lynx habitat (41,103 acres, 93%) is forested stands in their most mature, over mature or climax successional condition. Tree mortality from wind damage, insect or disease has created snags that contribute to down woody debris. Historical logging practices and 100 years of fire suppression have allowed thick understories to form. Denning habitat (10% minimum) is found within these stands that have the highest density of subalpine fir regeneration. This is typically at higher elevations and on north facing slopes.

Townsend's (Western) big-eared bat (*Corynorhinus townsendii*) – There are no know caves or mines in the area but roosting sites may occur in the Thomas Fork watershed. The Thomas Fork watershed provides habitat for moths (Groves and others 1997, 285).

Wolverine (G*ulo gulo*) – The Thomas Fork watershed is within home range of wolverines that may use suitable denning habitat found on Snowdrift Mountain and along the Salt River Range (Ruggiero et. al 1994). Southeast Idaho is within suitable habitat

(Spahr and others 1991) (Fertig and Beauvais 1999) but occurrence is unknown (Groves and others 1997, 349).

Boreal owl (*Aegolius funereus*) - Suitable nesting and foraging habitat is found in forests stands in the Thomas Fork watershed (Groves and others 1997, 134).

Flammulated owl (*Otus flammeolus*) - Suitable nesting and foraging habitat occurs in forested stands in the Thomas Fork watershed (Groves and others 1997, 125).

Great gray owl (*Strix nebulosa*) - Suitable nesting and foraging habitat is found in the Thomas Fork watershed (Groves and others 1997, 131).

Northern goshawk (*Accipiter gentilis*) - Suitable nesting and foraging habitat is found in the Thomas Fork watershed (Groves and others 1997, 80).

Three-toed woodpecker (*Picoides tridactylus*) - Suitable nesting and foraging habitat is located in the Thomas Fork watershed but the occurrence is not known (Groves and others 1997, 152). Population levels are probably low at this time due to a lack of large amounts of dead trees containing beetle larvae.

Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) – Suitable habitat is found in the Thomas Fork watershed (Groves and others 1997) but birds have not been seen in the Geneva area (Leon Jaurequi per. Comm. 5-11-01).

Starveling milkvetch *(Astragalus jejunus var. jejunus)* – Plants are found on the Twin Creek limestone within the Montpelier Creek drainage to the southwest. This geologic formation is located in the Thomas Fork watershed (IBMG 1979) and plants are expected to grow there. Plants are and can be impacted by ATV use on Twincreek limestone. However, ATV use on suitable habitat is limited to localized areas and plants are growing adjacent to compacted trails.

Migratory Birds

Riparian with dense grasses/shrubs (60-80% crown cover, 6' tall, 20 acres with scattered openings), open tree canopy with balanced age classes (snags), and abundant flowers are near these levels. However mature aspen along live water is lacking.

Acres of wetlands in the project area are probably higher due to the construction of livestock water developments (ponds and water troughs). Seeps and springs could have more impacts from livestock grazing of the riparian vegetation and trampling.

Sage grouse are reproducing in the area. Surveys found five leks northwest of Geneva (D.Meints per. comm. 2001). Past and proposed (Red Mountain) prescribed burns are expected to impact 20 percent of the mountain big sagebrush-breeding habitat 5 miles from these leks in a 20-year period (USDA 2001).

Ground cover of non-senescent grasses/forbs as cover/forage are available in rested or deferred grazing pastures. Tall willows are providing bird habitat. Willow habitat is not occupying its potential habitat.

Springs/seeps (and livestock developments) in suitable condition provide for sage grouse water/insect use during chick rearing. Livestock trampling and heavy grazing has reduced the surrounding vegetation.

Other Wildlife Species

Mule deer – population levels are meeting state objectives. Deer from the Geneva area winter on the Bear Lake plateau; it is possible to see deer north of US-89 in the Geneva area in the winter. The population of this herd was 2,428 in 1994 and 4,334 in 2001. The population of deer in Southeast Idaho fluctuated from 3,600 to 7,400 in the past eight years. (C.Anderson per. com.).

Elk – population levels are meeting state objectives. Elk winter in the Geneva area. A few may winter on the Bear Lake plateau. There was a large increase in elk number in the 1980s in most places. The numbers have been stable in the last few years. (C.Anderson per. com.).

Moose – populations are strong and stable with a good age structure and meeting State of Idaho objectives (T.Maeder per. Comm.).

Beaver – activity has increased in the watershed during 2001 (photo 8). However, most of the dams in the watershed are old (photos 2, 5 & 6). Some have filled in with sediment and contain large willow patches (photo 9). A few of the dams have "blown out" following high rain events and lack of beaver dam repair. The closest mature aspen from beaver dams is 100 to 300 feet away (photo 4). Regenerating aspen is growing within the harvested area but has not reached or pre-harvesting size and quantity. Most aspen, for beaver to utilize for dam construction and forage, is probably beyond the suitable foraging distance of beaver due to increased chance of predation and ability to skid the material to water. Aspen within the retrieval distance for beaver would provide material for beaver to improve and maintain the existing beaver dams in the Thomas Fork watershed. Sagebrush is also used as construction material for beaver dams, but has limited success (photo 3). Trapping is occurring in the watershed.

Western boreal toad (*Bufo boreas*) – Appear to be declining in Greater Yellowstone Ecosystem and in other parts of western United States (Groves and others 1997, 6).

Nothern leopard frog (*Rana pipiens*) – Anecdotal information exists for their decline in Idaho (Groves and others 1997, 11).

Photo 39: Giraffe Creek Beaver Dam
Sagebrush and fence posts used for construction material.

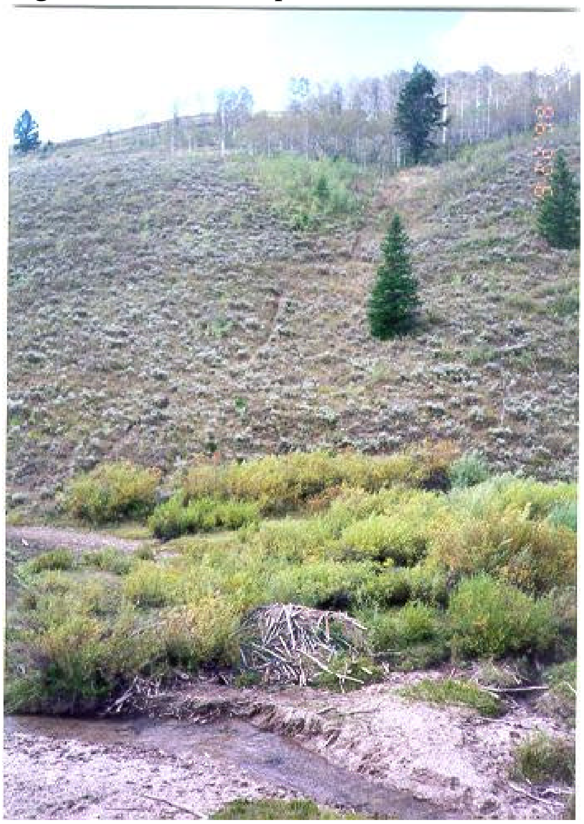


Photo 40: Preuss Creek Beaver Skid Trail and Lodge
Old aspen growing above young aspen resprouting
after old aspen were used for dam construction.
Beaver dam is not being maintained.
Located near big/upper exclosure.

RECREATION

Dispersed Camping

Dispersed camping remains popular in the watershed. Riparian areas still remain the most popular locations for camping. The majority of these dispersed sites are located along streams in areas large enough to provide a campsite and contain no planned improvements. In general, federal agencies do not restrict camping along tributaries in the Thomas Fork Watershed. The majority of the dispersed camping occurs during the big game hunting season from September through November. In less amounts dispersed camping also occurs during the late spring and summer months.

Cross Country Motorized Travel

Cross country travel on all federal lands within the water shed is restricted to designated routes, snow machines being the exception. Some federal agencies allow motorized cross-country travel to retrieve big game animals. All terrain vehicles are becoming more popular each year and there is an interest in this group to provide as much freedom as possible in regard to cross-country travel.

Recreation Facilities

The Allred Flat Campground is only developed campground in the analysis area. No developed dispersed sites exist. Facilities such as toilets, fire rings, potable water sources, trailheads, corrals, loading ramps, and hitching/tethering areas have not been constructed in these popular dispersed sites. Trails have been improved and maintained. Some trails have been modified to accommodate ATV use. Roads are continually being improved/reconstructed. There is a wide range of different road classifications ranging from paved two lane highways to primitive two track roads.

TRANSPORTATION

The first phase of the road inventory was to indentify non-system and system roads. Currently the Forest is working on a GIS layer of Forest roads that consists of all system roads. Additionally, the roads layer contains many, but not all non-system roads. To identify roads not show on the GIS layer, the 1991 Caribou Forest air photo set (1:12,000 scale) was used. A non-system road was defined as any road not part of the Forest Transportation System. Non-system roads can include "temp" roads, abandoned roads, and jeep trails. Most are not maintained, incressing their associated erosion hazard.

Using the Forest Service roads layer and the identified non-system roads, a project map of the road system was constructed and served as the base map for showing location of sites with potential futrue erosion and sediment delivery to streams.

Within the Thomas Fork Watershed Analysis area the following roads on the Caribou-Targhee and Bridger-Teton Nation Forest were identified: Two major highways go through the analysis area. U.S. Highway 89, and State highway 89, which makes up a total of 32.2 miles of paved highway with apprximately 7 miles of those being on the Bridger-Teton, Forest. There are 59.9 miles of improved road with an approximated 7 miles on the Caribou-Targhee and none showed up on that portion of the Bridger-Teton Forest in the analysis area. 163.9 miles of road were classified as unimproved roads, with 14.2 miles of those roads showing up as jeep trails. 23 miles show up on the Caribou-Targhee and 4.0 miles are located on the Bridger-Teton Forest. GIS generated an estimated 132.3 miles of trails on the map, with 39.0 miles of those trails on the Caribou-Targhee and 38.0 miles on the Bridger-Teton National Forest. The remaining miles of road and trail generated are located on private, State or BLM lands.

Only the roads and trails that are on National Forest land will be analyzed in the Thomas Fork Analysis.

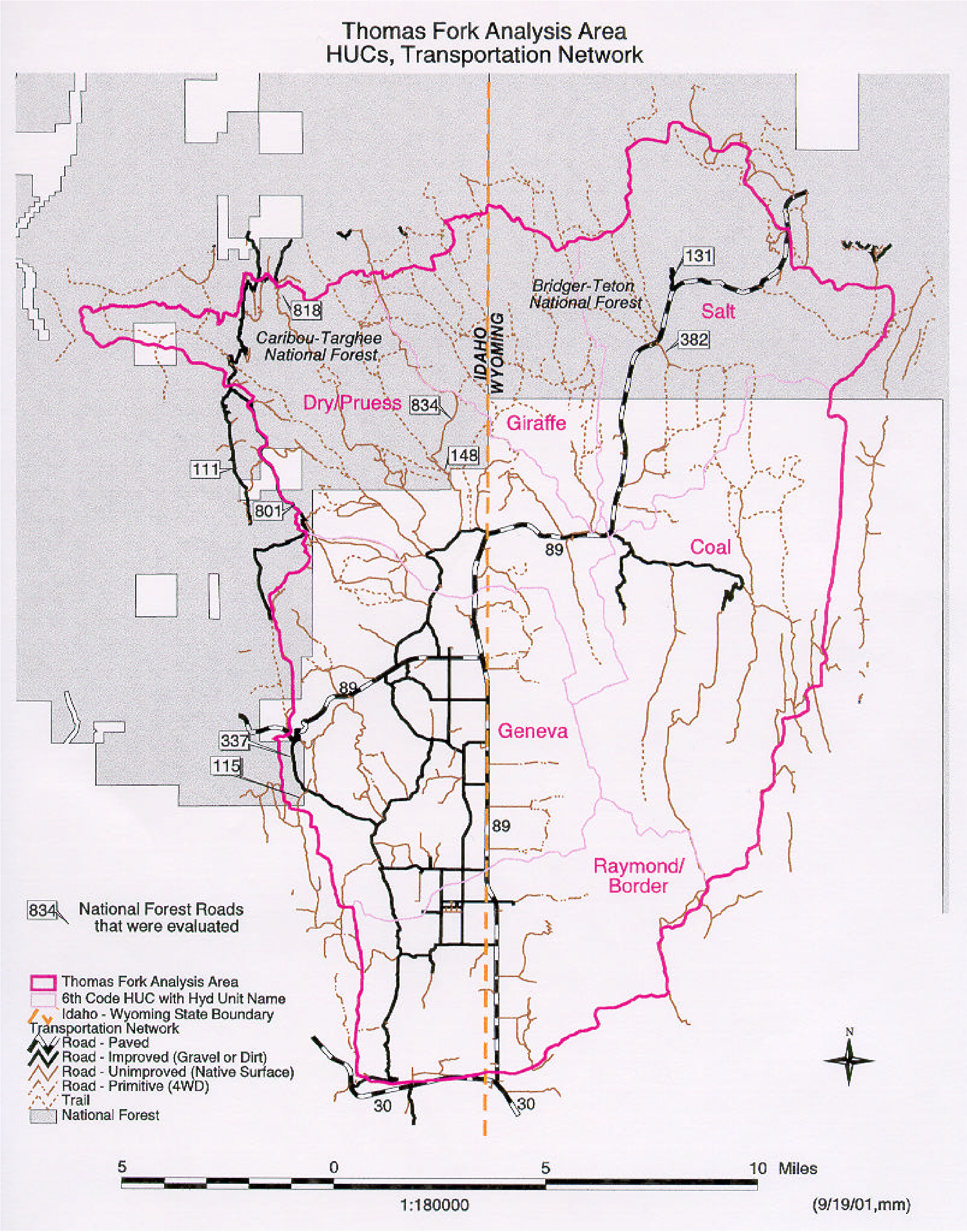


Figure 8. Transportation network in the Thomas Fork Watershed Analysis Area

TRENDS

SOIL

Flood Plain Soils

Much of the native vegetation has been removed with crop and pastureland species planted in their place. Soils have been detrimentally eroded, compacted, displaced and mixed. Productivity of these soils has been reduced with removal of biomass by cropping and intensive grazing.

Portions of the Thomas Fork channel have been straightened and vertical control of the channel has become unstable. Water tables have dropped and soil profiles have dried. Flooding frequency has been reduced and the character of the flooding has become one of more erosion and scouring.

Terrace Soils

Much of the native vegetation on lower and upper terrace soils has been replaced with species valuable for hay, small grains and pastureland. Noxious weeds have increased. Roads and trails are common on these soils as well. Terrace soils have been detrimentally eroded, compacted, displaced and mixed. The productivity of these soils has also been reduced by biomass removal.

Water tables have dropped, especially on the lower terrace soils, and soil profiles have dried. The silt loam and silty clay loam surfaces are easily eroded and scoured by less frequent flooding.

Hillside Soils

A relatively small area of hillside soils are being used for production of dryland crops. The impacts and trends of these soils are similar to upper terrace soils that are cropped.

The west side of the watershed is dominated by shallow to moderately deep soils high in calcium carbonate content with less productivity potential than soils found farther north.

The majority of the hillside soils have mountain big sagebrush and associated perennial grasses and forb vegetation. These soils are largely managed for livestock grazing. An extensive transportation system of roads and trails have been built on them. Effective fire suppression in the last 50 –80 years has interrupted fire regimes on these soils.

Soil impacts are localized and include detrimental compaction, displacement, mixing, and erosion. Soil productivity losses from nutrient cycling alteration as a result of long term livestock grazing are also found. Soils under the transportation system have essentially been lost from the productive base. Shrub communities that have had interrupted fire regimes have also had soil productivity losses due to altered nutrient cycling.

Mountain Soils

Mountain soils make up the greatest area of the Thomas Fork Watershed.

Dominant vegetation communities on deep, well drained soils are mountain big sagebrush with associated perennial grasses and forbs.

Moister sites and those at higher elevation include mountain shrub communities. Snow drift areas include snowbrush. Soils had thicker, dark surfaces.

Aspen communities found on sites with more moisture than shrub communities at slightly higher elevations or in pockets at lower elevations. The thickest, very dark surfaces found on soils under aspen.

Shallow rocky soils at moderate elevations support Threetip sage or mountain mahogany stands.

Conifer stands found at the highest elevations or on coldest and wettest aspects at lower elevations. Old, closed canopy stands on soils with shallow surfaces and leached subsurface horizons.

Natural disturbances of greatest extent historically were fire and landslides. Native American ignitions were also important historically. Landslides and slope failures continue to occur on parent rocks of the Preuss and Sublett Ranges and Gannett Hills. Small areas high in soluble salts are common. These areas support little vegetation and are highly erodible.

Overall

Current disturbances are widespread, complex, not easily separated and additive. Livestock grazing is the dominant current use. Detrimental levels of bare ground, erosion, compaction and displacement are found in localized areas. Noxious weeds, modified species composition and long-term removal of biomass have altered nutrient cycling of soils as well. Cattle grazing on riparian soils have negative impacts.

BLM past herbicide treatment of upland and riparian shrubs on east side of watershed in combination with beaver activity and heavy livestock grazing has resulted in channel down cutting and accelerated bank erosion. There has been loss of soil productivity from drying soil profiles and erosion of surface.

Extensive transportation system of roads and trails has resulted in detrimental soil compaction, displacement, erosion, loss of productivity and loss of soils from productive base. Construction of roads and trails on unstable geology and soils has caused additional slope failures and erosion.

Phosphate mining north and east of Border Junction has contaminated, diluted, displaced, and eroded soils. Soil productivity at these sites is severely reduced. The extent of impacts is not clear. The recovery of these areas is in doubt.

Timber harvest in the watershed has been limited. Soils have been detrimentally compacted, displaced, eroded and severely burned on 10-20 percent of the harvested areas.

Recreation impacts have grown and show little sign of slowing. Developed recreation areas have mostly permanent soil impacts of compaction, mixing, displacement, erosion and surfacing. Soil impacts from dispersed recreation are of greater but unknown extent. Dispersed camping sites have vegetation removed and soils showing detrimental compaction, displacement, puddling, rutting and erosion.

The extent of user created trails and 2-tracks are unknown. Soils show detrimental compaction, decreased permeability to air and water, increased runoff and erosion and reduced soil depth and productivity. Sites for establishment of non-native plants and noxious weeds have been provided by off-road travel of ATVs, motorcycles and 4X4 vehicles.

Effective fire suppression for the last 50 to 80 years has unsettled the fire regimes of shrublands, dry Douglas fir and aspen communities. Soils associated with shrublands have altered nutrient cycling due to less frequent inputs of nutrients from fire and an interruption in the shift of shrubs, grasses and forbs. Soils under dry Douglas fir may be burned severely by wildfire due to fuel buildups. Aspen soils may be impacted by the lack of fire disturbance as conifers succeed. Closed conifer stands would reduce organic inputs from aspen leaf fall and from the once lush understory of grasses and forbs.

WATER

Climate-Precipitation

- The entire watershed falls within the snowmelt-dominated zone. Therefore, activities that alter snow accumulation or melt rates could increase the magnitude of the associated runoff response.

- Summer thunderstorms in the lower watershed can increase sediment delivery where soils are exposed. Vegetative cover and high infiltration rates should be maintained at this time.

- Snowmelt systems can produce saturated springtime soils. This can then affect stream bank stability, as wet soils with high silt contents are more susceptible to deformation than dry soils. Therefore, springtime cattle grazing can affect these stream banks.

- The summer thunderstorms may add some moisture to soils, but during the summer soils are dry and evapotranspiration rates are high. Therefore, these storms do not create the soil moisture conditions found during snowmelt and the risk of bank deformation is low.

Overall Watershed Ratings (IWWI)

- All subwatersheds are moderately impaired with regard to their geomorphic integrity and water quality. The assumption behind these ratings is that watersheds of moderate integrity can see short-term recovery either naturally or through revised management with minimal capital investment. Since water quality is primarily tied to sediment, and bank erosion is a primary sediment source, the same premise applies to water quality.

- Since Dry and Preuss Creeks are both on Idaho's 303(d) list, the water quality rating for this subwatershed should be changed to "High Damage." However, the above premise would not change since the main sediment source is still the stream banks.

- It appears the identification of crucial and damaged segments was not carried out consistently across administrative boundaries. For example, the Bridger-Teton National Forest identified many more segments (in the Salt and Giraffe creek subwatersheds) than the other federal units. Based upon a field review by Philbin (2001) this appears to be more a function of how streams were identified rather than condition.

Watershed Conditions Resulting from Disturbance

- Based on changed curve numbers we can assume that there has been:

    1. an increase in runoff associated with croplands, pasturelands, and rangelands;
    2. an increase in sediment production associated with this increased runoff;
    3. little affect from woodland areas; and
    4. little watershed scale affects from roads.

- Since the Border/Raymond and Geneva subwatersheds contain the majority of crop and pasturelands, water movement in these areas may be altered. However, these areas have gentle slopes that reduce the likelihood that runoff would be affected. A far greater risk is that exposed soils may be washed (during floods) or blown into a stream due to narrow buffer widths.

- Rangelands in poor condition may produce altered runoff. These areas include steep slopes where runoff is possible. This runoff could displace soil and move it downslope affecting water quality. Rutting and gullies are also possible in these areas. See the range section for the location of these areas.

- Other problem areas are described in detail in the Thomas Fork Water Quality Project report (Bear Lake SW Conservation District, 1999)

Flood Plain and Wetland Conditions

- Agricultural activities have greatly reduced the amount and function of wetlands in this watershed. These activities included converting wetland vegetation to crops and farmsteads, channalizing the Thomas Fork, and diverting water from tributaries. This altering/dewatering of the natural hydrologic system has eliminated most perennial wetlands. Seasonal wetlands occur in depressions such as the old pond site near Geneva. The hydrologic implications of wetland loses are discussed throughout the section on “Stream Conditions.”

- The same activities that affected wetlands also affected floodplain function (primarily the floodplain along the Thomas Fork). These actions, along with the removal of a concrete structure in the Thomas Fork, resulted in rapid downcutting that eliminated stream-floodplain connectivity in several areas. The implications of this lost connectivity are discussed throughout the section on “Stream Conditions.”

Riparian Vegetation / Conditions

- The density and type of vegetation has been altered from historic conditions. For the most part this represents a reduction in willow and carex. These species are very important in maintaining water temperatures (willow) and channel stability (carex and willow). As a stream's stability declines and the channel downcuts, the vegetation can move further away from historic conditions. This is a common situation in this watershed.

- The vigor and age classes are also altered along most reaches. In many areas there is not enough large willow or other woody vegetation to maintain stable beaver dams. This has lead to channel downcutting, soil moisture reductions and a change in riparian conditions.

- The hydrologic implications of altered riparian areas are discussed throughout the section on "Stream Conditions."

- Streams with impacted riparian areas include:
    1. The Thomas Fork;
    2. Salt Creek below Water Canyon;
    3. Giraffe Creek;
    4. Coal Creek between Salt Creek and the East Fork;
    5. Stoner Creek;
    6. Preuss Creek between the Geneva Ditch and Beaver Creek;
    7. Dry Creek above the Pasture fence (section 20);
    8. Dry Creek between the Geneva Ditch and the Forest Service/Private boundary;
    9. The main, middle, and south forks of Raymond Creek.

Stream Flow Regime

- Since there are no reservoirs on the Thomas Fork the timing of runoff is likely close to historic conditions. However, agricultural practices may be having minor affects on timing. By forcing flow into a single and straightened channel, velocities increased and water now moves quickly through the system. The reduction in wetlands and beaver ponds adds to this problem by reducing storage and increasing water velocities.

- The main affect on water quantity is that irrigation has reduced the amount of water flowing in tributaries and the main river. This affect is more pronounced during low flows than high flows as shown by a greater reduction in unit discharge between the upper and lower basins.

- The reduction in wetland and beaver pond storage could affect soil and ground water recharge/storage and baseflows.

- Aspect appears to be very important in this watershed. At the watershed scale, it drives the timing of peak flows. While the Thomas Fork peaks in April and May, the Bear River and other area drainages peak in May and June. This influence is also present at the subwatershed scale. It seams odd that the north aspect Coal Creek has a greater range of flows than the south aspect Salt Creek. However, the range of peaks found in Coal Creek may be a function of an unusual event and not truly controlled by aspect. Therefore, it may be better to use aspect in evaluating bankfull flows rather than the range of flows. This being the case, the south aspect Salt Creek (and not Coal Creek) is likely the subwatershed where peak flow alterations may be of greatest concern.

- The wide range of peak flows would make it difficult if not impossible to detect changes in peak flows. However, changes in the frequency of the largest events may be important as the recovery time between extreme discharges would be reduced. If the frequency of these events were to occur, it would likely accelerate bank erosion. Based on a limited data set it appears these large events occur every 3 years (figure 4).

Sediment Sources

Channel Erosion:

- Channel erosion has been substantially increased in the Thomas Fork and all its subwatersheds.

- The reduction in wetlands adjacent to and the channelization of the Thomas Fork have significantly increased channel erosion and sediment production.

- The floods of 1982 and 1984 resulted in significant channel erosion. These floods also “blew out” beaver dams releasing large quantities of stored sediment.

- Since sediment from surface erosion is limited to the Thomas Fork and the lower reach of its tributaries, channel erosion is the most widespread sediment source in the watershed.

- Since sediment from Coal Creek was not included in the BLSWCD project and visual observations by several individuals suggest that Coal Creek runs very turbid, it is likely that channel erosion produces more than the estimated 21% of the basins total volume.

Mass Wasting:

- Mass wasting appears to be occurring at natural rates..

Surface Erosion:

- Surface erosion is likely the largest sediment source at the watershed scale. The vast majority of this sediment comes from the Raymond-Border and Geneva sub-watersheds.

- The estimated sediment produced by surface erosion supports the findings in the "watershed conditions resulting from disturbances" section. In these sections, rangelands and croplands were found to be problem areas. While the BLSWVD (1999) identified rangelands and forestlands together, rangelands appear to be the true source of sediment.

- A significant change from historic conditions is that the floodplains adjacent to the Thomas Fork and lower Coal, Preuss, and Dry Creeks were once sediment storage areas during flood events; however, they are now sediment source areas as overbank flows and wind can deliver sediments from disturbed surface locations.

Turbidity:

- More information is needed to evaluate trends or alterations in physical processes. Coal Creek is thought to be a major source of turbidity.

Sediment Transport

- The current sediment pulses are quite a bit larger than what was found historically. This is because a majority of the basin's sediment is now being stored in short-term bed features. In addition, the sediment transport efficiency of many project area streams has been reduced. This combination creates an abundant supply of sediment that is not being held back (stored) in beaver dams, behind woody debris, or on the floodplain. These conditions were caused by: (1) a substantial reduction in beaver dam storage, and (2) bank erosion that created wider streams which are less efficient at transporting sediment. The first cause is more prevalent in the main Thomas Fork and the lower reaches of principle tributaries while the second is a watershed wide problem.

- Another concern is that the quality and quantity of building materials for beaver dams declines in a downstream direction. This is important because when a dam fails, a large pulse of water and sediment may be released. This risk is elevated since water velocity has been increased in the lower watershed. The combination of higher velocities and lower quality building materials make it unlikely that a beaver dam would last long in the Thomas Fork. If many dams fail at once, as they did following the 1982 and 1984 floods, this could cause a significant impact.

- Irrigation has reduced flows making sediment transport flows less common. This has led to sediment deposition and a fining of the streambed.

Stream Channel Morphology/Stability

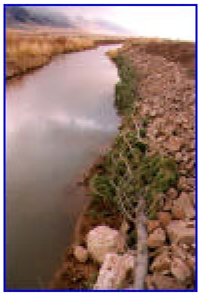
The amount of data available differs considerably between streams. Therefore, the length and amount of detail in the write-up may be more a function of available information than condition or trend. The first section evaluates the differences between the historic and current conditions. The second section evaluates how sensitive the various streams are to future disturbances.

Stream Evaluations and Trends

Thomas Fork:
The Thomas Fork is the most altered stream in the watershed. Several factors led to this condition including: stream channelization, side channel obliteration, the removal of a concrete grade control structure, channel dewatering, wetland losses, bank trampling, a reduction in bank stabilizing vegetation, an increase in water velocities, sediment from land management activities, cumulative upstream effects, the removal of beaver, and flooding (1982 and 1984). The floods are thought to have been the "final straw" as they eroded sensitive banks and washed out beaver dams throughout the watershed. While the effects of reduced beaver activity are only discussed in detail under Dry Creek, the same chain of events may have occurred watershed wide.

Although several factors reduced channel stability, a stream restoration project on private lands greatly improved the stability of the treated reach. This project entailed pulling back the banks, placing over 100 trees along the banks to serve as flow deflectors, placing large rocks in the stream as riprap and flow deflectors, placing willow clumps and willow cuttings to enhance stability, and seeding the excavated stream banks. While the project stabilized this section of the stream, this project treated the "wound" and not the cause. To enssure long-term success the factors mentioned above must be addressed. Figure 5 shows a section of the treated reach.

Photo 41: A Treated section of bank on the Thomas Fork



Salt Creek:

The revetments have successfully stabilized many sections of once eroding banks. However, vegetation is not becoming established in these areas. As a result, improving trends are expected until the revetments either break down or get displaced. At that time erosion may increase and trends may reverse. To ensure long-term stability riparian conditions must be improved. This would be an excellent time to plant willows since the revetment would protect the planting sites until the willow can become established. This is important in this relatively flashy drainage. Where extensive beaver complexes exist, stream conditions are generally good. Stability is good is Salt, Packstring, and Lost creeks and fair in Dipper Creek.

Giraffe Creek:
Grazing appears to be having the greatest impact on this drainage with impacts originating along the main channel and in Robinson Creek. Rapidly improving trends are expected on the Caribou-Targhee portion as a new cattle exclosure is now protecting a long reach between the forks and the state line. The section through the Bridger-Teton National Forest appears to be either a beaver pond or a reach with unstable banks. This could be a function of access where animals concentrate between ponds. The overall stability of this stream is fair.

Coal Creek:
Twenty-percent of the total stream length was found to be in declining condition. These areas are primarily along the main Coal and Stoner creeks where long reaches are not properly functioning. Another problem area is the East Fork where frequent headcuts were also noted. The main factors affecting these streams are watershed disturbances (grazing impacts), riparian impacts (a lack of root strength resulting from the loss of willow), and high but uncommon flows. The cumulative effects of these factors are excessive bank erosion, a wide and shallow channel, and a very high sediment load. While these effects have caused substantial damage, Philbin found improving trends in the area around Huff Creek. Here new banks are being formed at a new (lower) base level. This is a typical recovery pathway where an “E” channel forms within an “F” channel. While the stream is recovering, the lack of willows elevates the risk of bank and terrace erosion. This in turn can set back recovery. Exclosures appear to be working well in this drainage as shown by conditions in Huff Creek and at other locations where streams are either properly functioning or improving. Stability is good in Huff Creek, fair in Coal and Little Muddy creeks, and poor in Stoner Creek and the East Fork.

Dry-Preuss:
Dry Creek: A reduction in beaver activity appears to be the greatest factor influencing stream stability. On national forest lands, the floodplain and terraces contain several old features that appear to be historic overflow channels. These features formed as water over-flowed beaver ponds and scoured new channels. So long as the pond stayed full, water would flow into these channels reducing the amount of flow in the main channels.

However, over time the dam would fail and the side channels would dry up. This process was accelerated during the floods of 1982 and 1984 when many dams likely failed. Occasionally, one of these side channels would capture the main channel leaving a remnant channel on the floodplain. This explains why there are several old channels and small dams of similar age up and down the floodplain. Following this theory two factors may have affected how this stream operates; (1) the floods washed out many dams causing a large release of water and (2) the construction and maintenance of beaver dams decreased causing Dry Creek to lose its connection with its overflow channels. Both of these factors would have forced more water down the main channel resulting in channel downcutting. As more water flowed down the main channel, it became incised and stream and riparian conditions were impacted. This problem was compounded by the presence of cattle. Since the channel downcut, the riparian soils became very dry and they lost their cohesiveness. This also led to vegetation that is not as capable of maintaining bank stability. As cattle add their weight to these banks, they easily slough off. A specific problem area is located right above the pasture fence where cattle concentrate. This extremely high use area has both severely impacted riparian conditions and poor stream bank stability. These conditions are continuing to decline.

Trends are difficult to determine, as there's been a long time between samples. While the rating for reach 5 went from 76 -> 65 -> 107, it is impossible to tell if the reach is declining or if the reach actually is improving. It's possible that once the floods in the mid-1980's washed out the beaver dams that the streams began downcutting. This could have created a period of instability in the early 1990's that was not detected since the stream was not sampled at this time. If this did occur, there may have been a large decline in the early 1990's with some improvement after that. All we can really say is that the stream is now in worse condition than it was in the 1980's and that its overall rating is fair-poor. The reach above this shows no change from 1987.

A final problem area is below the forest boundary where agricultural practices and grazing are adversely affecting stream conditions. These impacts appear to decline as the stream approaches the Geneva ditch.

Preuss Creek: Trends in the upper reach and lower Beaver Creek are rapidly improving. This can be attributed to the presence of Beaver, which have converted this area into a long beaver complex. These dams/ponds are very stable as quality building materials are available in this reach. Not only is the willow mature, but timber is also available along this entire reach. This area likely represents the site potential for many streams in this watershed. In the lower reach, riparian and stream conditions decline. This decline has also affected the type and quality of building materials, which in turn affects the quality of beaver habitat. It is possible that this reach is experiencing the same problems as noted in Dry Creek with regard to reduced beaver activity. Just above the forest boundary cattle have severely affected channel conditions after getting into an exclosure. While agricultural impacts have affected stream conditions below the forest boundary, conditions are improving down to the county road. This area is in better condition than the lowest forest reach.

Raymond Canyon:
Seventy-six percent of the evaluated stream mileage is either not properly functioning or in declining condition. This is attributed to high natural instability and cattle grazing in this sensitive drainage. This damage is so wide spread recovery would be difficult.

Sensitivity to Future Disturbances

Watershed, riparian, and stream alterations have reduced stream resiliency in all subwatersheds. As a result, the sensitivity to peak flows alterations and sediment delivery has been increased in the Thomas Fork, as well as almost all of its tributaries. The relative condition of these basins can be rated from best to worst as Salt, Preuss, Giraffe, Dry, Coal, and Raymond. Table 9 summarizes current stream stability, sensitivities to future disturbances, and the priority for restoration. These variables were developed based upon the inherent sensitivity of the stream, existing conditions, and changes in the stream flow and sediment regimes. The extent of the change from historic conditions defines the magnitude of the sensitivity. The following bullets provide the interpretation for table 9. Where sensitivities are different for sediment and flows, the interpretation applies to the variable being evaluated.

- Streams with good physical stability and low sensitivities are stable with little threat of instability. These streams are functioning as would be expected under minimally disturbed conditions.

- Streams with good physical stability and moderate sensitivities are stable streams that may become slightly impaired if a large disturbance or alteration were to occur.

- Streams with fair physical stability and low sensitivities are streams that show impacts but are still functioning. While somewhat impacted, the inherent characteristics of these streams would protect them from further impacts to the variable being evaluated.

- Streams with fair physical stability and moderate sensitivities are streams that show impacts but are still functioning. These streams would become impaired if a large disturbance or alteration were to occur.

- Streams with fair physical stability and high sensitivities are streams that show impacts but are still functioning. These streams cannot handle any additional impacts.

- Streams with poor physical stability and moderate sensitivities are unstable streams that can have multiple problems if a large alteration were to occur. This rating is rare as most streams with poor physical stability have high sensitivities.

- Streams with poor physical stability and high sensitivities are unstable streams that can not handle the level of disturbance or alterations they are currently receiving. Impacts should be reduced in these areas or the stream will continue declining in condition.

Table 21: Stream Summary

	Key Stream	Physical	Sensitivity to Changes in		Restoration
	Types	Stability	Stream Flow	Sediment	Priority
Thomas Fork	C, E, F	Poor	High	High	Moderate-Low
Salt Creek	B4 and C3	Good	Moderate	Moderate	High
Dipper Creek	-	Fair	High	Moderate	High
Packstring Creek	B3/4	Good	Moderate	Moderate	Low
Lost Creek	B3	Good	Low	Low	Low
Coal Creek	C3	Fair-Poor	High	High	High
Huff Creek	-	Good	Moderate	Moderate	Low
Stoner Creek	-	Poor	High	Moderate	High
East Fork Coal	-	Poor	High	High	High
Little Muddy	-	Fair	Moderate	Moderate	Moderate
Giraffe Creek	B	Fair	Low	High	Moderate
Dry Creek	C	Fair	High	High	Moderate
Preuss Creek	C3/4	Good	Moderate	Moderate	Moderate
Beaver Creek	B	Good	Low	Moderate	Moderate
Raymond	-	Poor	High	High	Low
Middle Fork	-	Poor	High	High	Low
South Fork	-	Poor	High	High	Low
North Fork	-	Fair	High	High	Low
East Fork	-	Fair-Poor	Moderate	Moderate	Low

Poor = Not Functioning or Functioning at Risk – declining trend

Fair=Functioning at Risk

Good= Functioning

Restoration

Improving watershed conditions along the main Thomas Fork is a high priority since this is where a great deal of the sediment originates. These efforts should concentrate on riparian restoration, expanding beaver populations, wetland enhancement, and sediment reductions through improved land management practices. Many of these opportunities have been identified and discussed in the Thomas Fork Water Quality Project (BLSWCD, 1999). With the exception of rehabilitating specific and severe bank problems, instream work should be deferred until problem areas in the upper watershed are corrected. Treating the Thomas Fork may not address the true problems caused by altered watershed processes. These alterations include a loss of wetlands, degraded riparian conditions, a reduction in the size and spatial extent of beaver complexes, upstream bank erosion, poor rangeland conditions, and cropland and pastureland erosion.

Treating these true problems is the only way to ensure long-term success. The priority for treatment can be summarized as Salt, Coal, Preuss, Giraffe, Dry, and Raymond.

- Salt Creek has the highest priority because it would take the least amount of work to improve conditions, its recovery potential is high, its position with regard to other subwatersheds is good, and its connectivity to the Thomas Fork is good. The restoration should center on improving riparian conditions to (enhance beaver habitat) below Little White Creek.

- Coal Creek is the second highest priority because its recovery potential is moderate-high, its position with regard to other subwatersheds is good, and its connectivity to the Thomas Fork is good. The restoration should center on improving riparian conditions through improved grazing management, actively stabilizing stream and terrace banks, and vegetative management. The main Coal Creek, Stoner Creek, and the East Fork are the priority areas.

- Preuss Creek is third because it is in better condition than Giraffe or Dry creeks and the beaver complex in the upper reach suggest that the streams recovery potential is good. Restoration should center on the reach just above and below the forest boundary. Techniques include re-establishing the exclosure on Forest Service lands and improving riparian conditions below Beaver Creek (improve beaver habitat). The tie-breaker between this stream and Giraffe is that Preuss Creek is a 303(d) listed stream.

- Giraffe is fourth because of its position in the watershed and it connectivity to the main Thomas Fork. Restoration should center on improving grazing management and improving riparian conditions along both Giraffe and Robinson creeks. The target riparian community is willow and sedge with a reduction in grass, forbs, and thistle.

- Dry Creek is fifth because of its position in the watershed, and the fact that its recovery potential and condition is better than Raymond Canyon. Restoration should center on improving watershed and riparian conditions (improve beaver habitat). The lower portion of the stream (from ½ mile below the forest boundary to the canyon above the pasture fence) is the priority area for this drainage. This stream is also listed as a 303(d) listed stream.

- Raymond is the lowest priority due to its poor condition, its position in the drainage, and lack of connectivity with the Thomas Fork. Restoration should center on improved riparian and grazing management.

- Once problems in the contributing streams are corrected, the emphasis can shift to the Thomas Fork's channel.

Water Quality – General

- Since most water quality information is being analyzed as part of the Bear River Subbasin Assessment and TMDL, we will defer to the Idaho Department of Environmental Quality for this section. Additional information is also available in the Thomas Fork Water Quality Project Report (BLSWCD, 1999) and not repeated here.

Water Quality – Temperature

- Water temperature may be a concern in this watershed. Limited monitoring found that standards were exceeded in both Salt and Dry creeks. It's likely that Coal Creek and the Thomas Fork would also exceed standards. This can be attributed to a lack of willow cover, wider and shallower streams, and little topographical shading.

- More information is likely available in the upcoming Bear River Subbasin Assessment and TMDL being produced by the Idaho Department of Environmental Quality.

Water Quality – Water Quality Limited Segments (303(d))

- While Coal Creel was delisted in 1998, it appears this stream is impaired by human related activities. It seams appropriate that this stream be relisted for siltation and maybe temperature.

- Temperatures may be exceeding state water quality standards in Dry and Salt Creek. Therefore, it may be appropriate to list Salt Creek for temperature and to add temperature as a pollutant to Dry Creek.

FIRE

Rangeland Habitat Types

There has been a moderate departure from the historic range of variability for sagebrush at the watershed scale. Many sites have an abundance of late seral sagebrush (greater than fifteen percent canopy cover), and a shortage of early and mid-seral sagebrush (less than or equal to fifteen percent canopy cover). The dry and cool shrub ecosystems along with xeric Douglas-fir have the shortest fire interval of any vegetation type in the analysis area, and are therefore considered to be the most fire-dependent. When sagebrush canopy cover exceeds fifteen percent, it begins to aggressively compete for resources with the herbaceous species in the understory, putting these ecosystems at risk of losing diversity. Most mountain shrubs are in an old age class and many stands are becoming decadent, especially in the serviceberry type. Mountain brush (chokecherry-serviceberry-rose species) types show signs of aging because of abundant dead material found in the canopy. These dense and decadent habitat types are at risk from uncharacteristically large wildfires.

Woodland Habitat Types

Because of fire suppression and long term overgrazing, curlleaf mountain-mahogany has expanded outside its natural range and has invaded into sagebrush, mountain brush, and Douglas-fir cover types. Historically, fire controlled the expansion of mountain-mahogany into these shrubland sites. The increase of woodland vegetation has increased the risk of fires of higher intensity than those that traditionally occurred on these sites. Now, the potential fires are more resistant to fire control efforts.

Xeric Douglas-fir Habitat Types

Increased fuels and stand decadence are evident even on these dry unproductive sites. Therefore fire exclusion has altered the previous fire regimes pattern from one of frequent light surface fires, to one of moderately long to long interval fires that produce mixed severity burning or total stand replacement during wind driven events.

Mixed Severity Regimes

The majority of fire regimes within the analysis area are mixed severity regimes. Mixed severity regimes refer to fires that can produce the full range of severities, from non-lethal to total stand replacement, both during a single fire event and between consecutive events. These sites typically experienced low intensity thinning fire periodically (thirty to sixty years) between less frequent, high intensity stand replacement fires. Fire suppression and long term over grazing has interrupted the low severity portion of the fire cycle, especially in the mesic Douglas-fir, quaking aspen, lodgepole pine, and xeric subalpine fir fire groups. These patches served many important roles, for example, they maintained habitat and vegetation diversity across the landscape, provided fuel breaks during large fire events, and helped to prevent widespread insect and disease activity. The interruption of low severity thinning fires has resulted in increased density, inadequate regeneration of certain species that rely on frequent disturbance, and a shift towards dominance by shade tolerant species with increased standing dead fuels, down woody fuels, and ladder fuels. This has caused a more homogeneous and less diverse stand, and the increases in density and woody biomass have increased the risk of insect epidemics and uncharacteristically large fires with in the analysis area.

Summary

As a result of fire exclusion, there has been an increase in the amount of woody biomass, both live vegetation and dead plant material. The analysis area has become more homogeneous and less diverse. There has been a moderate increase in the risk of uncharacteristically large wildfires. If this trend of withholding fire, or some other form of disturbance, continues the risk of large wildfires is expected to continue to rise.

FORESTS

Lodgepole pine

Overall there appears to be a moderate departure from PFC indicators in lodgepole pine (PFC). Lodgepole is currently in a static situation of pine beetle attacks (3410 Aerial Pest Detection Surveys). Beetle attacks are likely to increase in the very near future due to the increasing stress from prolonged drought conditions and the ever-increasing ages of our mature to old lodgepole pine stands. The primary risk is related to structural changes in the mature age classes. Succession will continue to favor shade tolerant species invading and eventually taking over these mature and old lodgepole stands. This mature age class is susceptible to large-scale mortality from mountain pine beetle infestations. Such widespread mortality results in conditions favorable for stand replacing wildfires or succession to late seral vegetation. Long-term risks are related to large swings from mature aged forests to grass/seedling classes as a result of wildfire and its associated impacts to the landscape.

Aspen

There is a high risk that significant acreage of this type will continue on the path of succession to other vegetation types, mainly conifer. The presence of more old-age (greater than 80 years of age) stands of aspen and the steady loss of aspen to conifers may be leading to a significant loss of habitat and the species which depend on the historical patterns found in properly functioning aspen stands. The effect of conifer presence for longer periods of time than is historically evident, may limit the sites potential to regenerate aspen if the surface layer becomes too acidic to allow suckering following a disturbance, which would otherwise lead to aspen regeneration. Most treatments of aspen in the past have had only a very limited effect upon aspen regeneration when compared to the analysis area. These treatments, which were mainly from fuelwood gathering, did successfully regenerate aspen by suckering and sprouting from the existing root systems. Insects and disease are occurring at endemic levels but should be monitored as successive years of defoliation can have lethal effects upon a clone, especially if it is in a poor condition to begin with (PFC).

Inland Douglas-fir

The most significant risk and departure from the reference conditions is associated with fire in the disturbance regime. This absence of fire has lead to the establishment and development of layers of shade tolerant species, specifically sub-alpine fir. This condition can foster a drastic increase in the likelihood of large, stand replacement fires.

Insect populations are now at endemic levels following a peak during the 1990's, however recent drought conditions have brought about a marked incidence of recent beetle attacks within many stands. Stands of Douglas-fir become more susceptible to attacks from spruce budworm defoliation as stand densities remain high and a corresponding understory of sub-alpine fir becomes established through time. Disturbances caused by defoliation or windthrow and extended periods of drought also increase tree susceptibility to bark beetles in older, dense stands of Douglas fir. Less than 10% of this type is affected by dwarf mistletoe; however, this is slowly increasing and is causing additional volume losses.

Additional expansion by Douglas fir beyond historic ranges will continue in the face of fire suppression. This type has shown the greatest expansion of its range beyond historic variability due almost entirely to fire suppression. The current status of patterns and structures will be compromised by large stand-replacing fires, or continued exclusion of frequent non-lethal fires. This could lead to more intense disturbances, which could foster drastic, unforeseeable changes in the vegetation patterns and structures (PFC).

Spruce – Fir

This type is at risk due to the departures from PFC indicators when considering structure, disturbance regime, and patterns. Patterns of sub-alpine fir have expanded greatly in the analysis area, encroaching on aspen, Douglas-fir, lodgepole pine, and mountain brush. Insect and disease levels are going to increase as the stand age increases, as this type progress farther away from its natural range of variability, and by the continued exclusion of fire. The combination of insects and disease combined with extended drought will lead to increased mortality of sub-alpine fir. The risk for large-scale fires will increase as this type occupies the more productive sites and is capable of higher fuel loadings than any other type. Changes will eventually occur as a result of large, stand replacing fires, insect epidemics, avalanches, or a combination of all three throughout much of the spruce – fir range.

RANGELANDS

Differences between reference and current conditions for the basic elements of rangeland covertypes are a result of plant succession and disturbances both natural and human caused. The temporal and spatial changes that have had the most significant effect on sustaining many of these vegetation types have been a result of human influences. Agricultural values associated with the various types have been the primary reasons for these changes. Practices such as cultivation and domestic livestock grazing have affected structure, composition, and function of these types, including their frequency and distribution. This area was settled during the late 1800's. These early settlers recognized the agricultural potential of the basin big sagebrush covertype and most of the area was taken over for crop production both dryland and irrigated. An eye turned next to the riparian covertype. Much of the willow was removed to make room for and harvest cultivated crops. The value of their area to produce forage was likewise recognized and grazing on most rangeland and forest covertypes was extreme. Other practices to increase forage for domestic livestock included herbicidal treatment. These treatments were most often conducted on large continuous blocks of land and affected primarily forbs and shrubs including willow. These practices continued for many years.

Programs have been established more recently that provide incentives to cease cultivation on much of the basin big sagebrush type. On these old fields, basin big sagebrush is once more becoming dominant. Much of the area within the watershed is public land administered by various government agencies. Decreases in intensity of grazing combined with more compatible cultural treatments such as prescribed fire has improved the basic characteristics of most rangeland ecosystems. Additionally, people who have no interest in livestock grazing are purchasing land within the watershed. These areas are being excluded from use by livestock.

Generally, few types have been pushed beyond the historic range of variability. Those types that have been or will be the slowest to respond appear to have exceeded this threshold. They include a portion of the riparian type associated with lower gradient streams in the Thomas Fork Valley and the tall forb type where apparently a considerable amount of soil loss is inhibiting recovery. Other rangeland covertypes currently appear to be within the range of natural variability. Currently, the invasion of aggressive exotic plants is a threat to the diversity of many rangeland cover types.

FISHERIES

Thomas Fork

An overview of the trends associated with the Thomas Fork fisheries resources features improving trends in some areas and no changes in others.

The signing of the interagency Range-wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout (Lentsch et al 2000) was a significant recent development that has the potential of producing improving trends beneficial to fish in this watershed.

The Montpelier/Elk Valley Allotment Conservation Agreement, established in 1994 and updated in 2000 has improved Bonneville cutthroat trout habitat conditions in Preuss, Dry, and Giraffe Creeks through improvements in livestock management and increased exclosures and off channel cattle watering. It has also helped as a forum for agencies and organizations to discuss issues and opportunities relating to Bonneville cutthroat trout conservation.

The Bonneville Cutthroat Trout Interagency Five Year Management Plan, established in 1993 as a partnership between WGF, Bridger-Teton National Forest, and Rock Springs BLM District, has benefited the fisheries resources in the analysis area through an increase in inventories, increasing dialogue between management entities and improving public outreach.

The USFWS purchase of land along lower Thomas Fork is another recent activity considered in this analysis to be a benefit to the fisheries resource. Livestock grazing in the riparian area on that ranch was discontinued with the purchase and the condition of the riverside vegetation is improving.

The preparation of the Thomas Fork Water Quality Project Report also benefited the fisheries resources in the analysis area by documenting agricultural issues in the watershed and identifying solutions. Stream bank stability projects, like the recent one implemented by the Boehme's in cooperation with the Bear Lake Soil and Water Conservation District and others, is an example of on-the- ground restoration occurring within the drainage.

Intensive cattle and sheep grazing have occurred in the Thomas Fork Watershed since the early nineteen hundreds. Some restrictions and reduction in numbers have occurred throughout the 20th century primarily due to the recognition of the value of other resources, including clean water and healthy fish populations. Silt and thermal pollution in the Thomas Fork and its tributaries are still considered a problem. The recently completed Smith Fork Allotment Evaluation (USDI BLM 2000) expressed concern that direction for maintaining ecological processes in riparian areas is still not being met. Comparing data from 1994/1995 to 2000 showed no or very little change in PFC rating.

Fallau (1995) compared habitat features in grazed and ungrazed stream segments in Preuss, Dry, and Giraffe Creeks. She found better conditions in bank stability, percent undercut bank, width:depth ratio, and amount of fine sediment within ungrazed stream segments than grazed segments.

In association with the Thomas Fork Water Quality Project, Idaho DEQ recently sampled aquatic macroinvertebrates in the Thomas Fork. Overall scores indicated the sampled reaches were impacted. The samples consisted of taxa tolerant of pollutants. There was an absence of intolerant taxa (indicators of high habitat complexity and integrity).

A common theme throughout several streams in the analysis area is the sudden, sharp decline in recent beaver activities. In streams where this trend was documented, available forage (aspen) receded further and further from the stream, making beaver use of those trees infeasible. Aspen regeneration is lacking. I suspect this is due to 2 reasons, fire suppression and overgrazing. A discussion of the decline of aspen stands in the analysis area can be found in the Vegetation section.

The problems associated with river desiccation for agricultural needs have not been addressed, but harmful modifications to the Thomas Fork River channel have been reduced primarily through regulatory agencies such as the U.S. Army Corps of Engineers (dredge and fill permits) and Idaho Department of Water Resources.

Although the stocking of non-native fish by IDFG and WGF has been discontinued, naturally reproducing non-native fish still inhabit the system. Naturally reproducing populations of carp, brook trout, brown trout, and rainbow trout still occur in the analysis area. Carp affect habitat quality by rooting the riverbed while foraging, decreasing water quality. They also feed upon native fish. Brook trout out-compete native cutthroat trout, particularly when their habitat has been impacted. We have documented cases of complete native fish population replacement with brook trout in other tributaries of the Bear River. Brown trout primarily affect native fish through predation. Rainbow trout have the potential of interbreeding with cutthroat trout, affecting their genetic integrity, and compete with native fish for habitat.

Migration barriers have not been addressed in the Thomas Fork. These include impassable drainage structures and diversion weirs. These migration barriers decrease the interaction between individual fish and populations and increase the extinction vulnerability of fish populations upstream.

Agricultural water diversion structures have been shown to divert fish away from habitat and into fields and power generation structures within the analysis area. In 2000, of the 24 adult cutthroat trout tagged and released in Huff and Coal Creeks by Schrank and returning to the Thomas Fork (2001), 9 were diverted into the Taylor Ditch to die. Entrainment of fish into diversions is a problem in the Thomas Fork that has not yet been addressed.

Although some risks and threats to the fisheries resources are beginning to be addressed in the Thomas Fork River and the overall watershed, some of the most significant issues remain to be addressed. These significant issues, such as migration barriers and entrainment at diversions, river desiccation, sedimentation, and non-native fish need to be addressed prior to recovery of the fish resources in the analysis area.

Preuss Creek

Idaho Department of Fish & Game has monitored the densities of Bonneville cutthroat trout periodically in Preuss Creek since 1981. Their population fluctuations are graphed in the chart below. The map below depicts the location of the reaches.

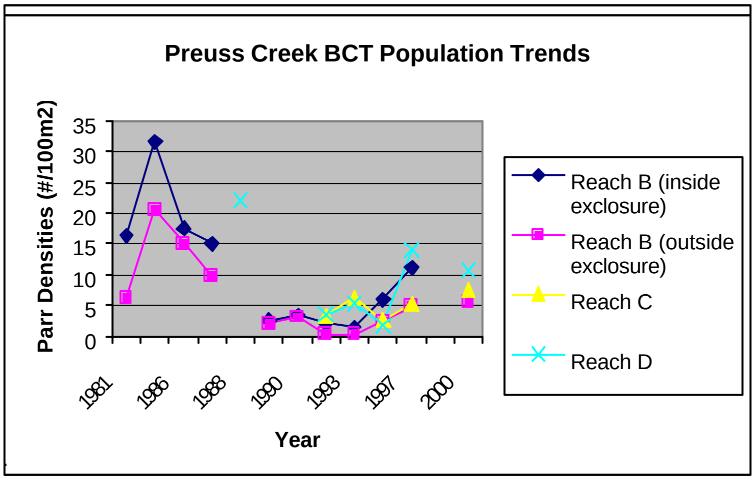


Figure 9: Preuss Creek BCT Population Trends. (Idaho Dept of Fish & Game 2001)

Cutthroat trout populations naturally fluctuate through time. In addition, a drought is likely one of the factors causing the downward population trend in the late 1980's and early 1990's. However, populations within the exclosures regularly produce more fish than outside. Based on this limited population data, there appears to be an upward trend in the Preuss Creek cutthroat trout population since the drought in the early 1990's. In addition, conservation measures from the 1993 allotment revision and the 1994 conservation agreement were implemented in the same time period, providing additional reasons for the population increases.

Generally, the data indicated a recovery tend for the riparian habitat in reaches of Preuss Creek (upper and Beaver Creek). Recovery has been accelerated in exclosures. Any improvements likely reflect structural changes in the allotment (fencing and off-channel watering areas) and improvements in livestock management. It is believed that restoration would be further accelerated by cattle number reduction/exclusion, additional fencing, particularly around and remaining unfenced low gradient stream reaches. Fine sediment levels in the stream substrate were still elevated in Preuss Creek, indicating the need for additional improvements prior to significant realization of the benefits to the fisheries resources. Lower Preuss Creek is apparently not experiencing this improving trend. Recent beaver activity in lower Preuss Creek is limited. Overall, the trend in Preuss Creek is slightly upward.

Although stream channel and riparian vegetation improvements are likely in Preuss Creek when comparing the first and second halves of the 20th century, the stream has not achieved its potential. Overgrazing is still apparent in Preuss Creek. This has been documented in conservation agreement monitoring trips.

Any improvements to the fisheries resources in Preuss Creek are limited by the diversions in lower Dry and Preuss Creeks that intercept upstream-migrating fish, isolating resident fish upstream. Until those barriers are addressed, all improvements to the fisheries resources will not fully be realized.

Dry Creek

Marked improvements in riparian and channel conditions of Dry Creek were likely with the reduction of grazing use that occurred between the first half of the 20th century and the second half. However, the potential of Dry Creek is far from being realized. This is apparent when comparing the habitat condition in the lower Dry Creek exclosure with outside the exclosure. There are opportunities for improvements in riparian vegetation and stream channel conditions.

Montpelier Ranger District surveyed segments of Dry Creek in 1992 and 1995 using the R1/R4 Aquatic Habitat Survey Methodology. When comparing data from these 2 surveys, there were slight differences in the quantity of beaver ponds, average width:depth ratio, the percent of stable stream banks, and the frequency of undercut banks. However, these differences were slight and, due to the lack of time between surveys, trends were not apparent. The lack of earlier data makes trend determination uncertain.

Any habitat improvements likely reflect structural changes in the allotment (fencing and off-channel watering areas) and improvements in livestock management. It is believed that restoration would be further accelerated by exclusion of cattle from riparian areas. This could be in the form of cattle reductions/removal and additional fencing, particularly around low gradient stream reaches.

Any improvements to the fisheries resources in Dry Creek is limited because of the diversions in lower Dry and Preuss Creeks which block upstream-migrating fish, isolating resident fish upstream. Until those barriers are addressed, all improvements to the fisheries resources will be limited at best.

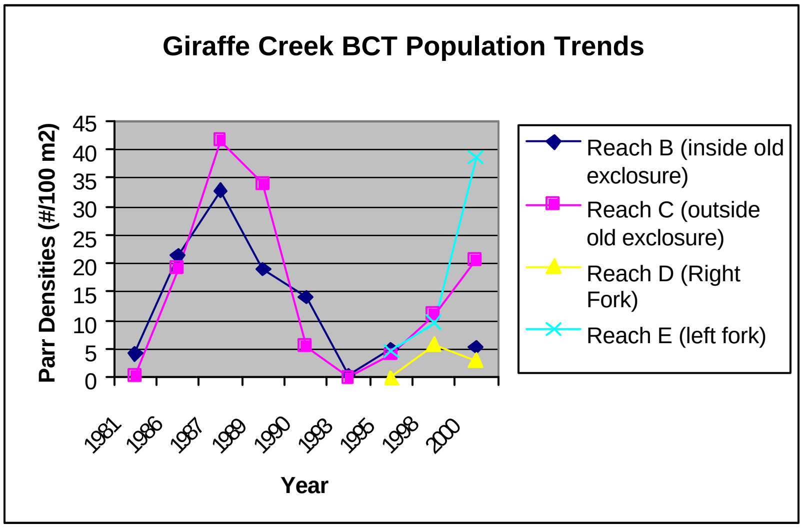
Giraffe Creek

The following graph depicts IDFG fish sampling in Giraffe Creek for nearly the last 20 years. The reaches are depicted on the map that follows.

Cutthroat trout populations naturally fluctuate. In addition, a drought is likely one of the factors causing the downward population trend in the late 1980's and early 1990's. Based on this limited population data, there appears to currently be an upward trend in the Giraffe Creek cutthroat trout population since the drought in the early 1990's. In addition, conservation measures from the 1993 allotment revision and the 1994 conservation agreement were implemented in the same time period, providing additional reasons for the population increases.

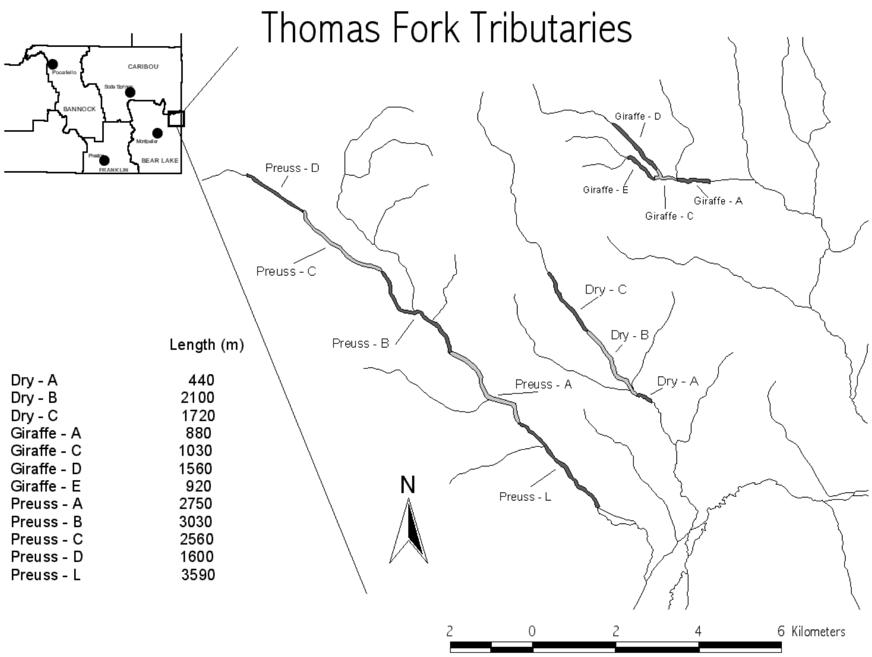
Fine sediment levels in the stream substrate were elevated in Giraffe Creek, indicating the need for additional improvements prior to significant realization of the benefits to the fisheries resources. Any improvements likely reflect structural changes in the allotment (fencing and off-channel watering areas) and improvements in livestock management. It is believed that restoration would be further accelerated by additional fencing, particularly around remaining low gradient stream reaches.

Figure 10:



(Idaho Department of Fish and Game 2001)

Figure 11: Sample Location Map



(Idaho Department of Fish and Game 2001)

Improving trends have been documented in Giraffe Creek in the past (Hanson 1980). However, concern has been documented regarding the decline in beaver activity in the drainage. The recent construction of an exclosure from the forks to the Forest boundary has the potential to accelerate this improving trend and increase beaver habitat quality.

Marked improvements in riparian and channel conditions of Giraffe Creek were likely with the reduction of grazing use that occurred between the first half of the 20th century and the second half. However, the potential of Giraffe Creek is far from being realized. This is apparent when comparing riparian vegetation and channel width inside the exclosure with outside. Average stream channel width is narrower, sedge are generally taller, and willow are generally more frequent inside the exclosure than outside.

Salt Creek

No historic Salt Creek data were found. A recent survey of Salt Creek (Stinson 2000) indicated riparian and aquatic impacts from livestock grazing and Highway 89. Fine sediment dominated the stream substrate at 37% of the substrate composition and Highway 89 encroached upon the stream. Since no historic data are available for Salt Creek, it is difficult to determine a trend. However, considering the highway encroachment and documented past grazing impacts to riparian habitat, the trend may be stable or downward.

Major tributaries of Salt Creek include Packstring, Little White, Lost, and Water Canyon Creeks. Generally, habitat in these streams are in good condition. Although we have no historic data for these streams, it is likely they are experiencing upward trends for the fisheries resource due to improved range management practices.

Coal Creek

Properly Functioning Condition assessments by Kemmerer Resource Area personnel documented a general Functional-at-Risk with an upward trend status for Coal Creek. However, most of its tributaries had downward trends. The stream was affected by herbicide spraying in the 1960-80's and has still not recovered. The problems associated with the loss of riparian vegetation were exacerbated by intensive livestock use. Some young willows are beginning to show up in the riparian area. The construction of more exclosures may accelerate the upward trend.

Huff Creek

Huff Creek, a tributary to Coal Creek, is in generally better condition than Coal Creek and appears to be on an upward trend for fisheries (USDI BLM 2000).

Raymond Canyon

According to BLM PFC data, Raymond Canyon appears to be in poor condition due to grazing and natural instability. The mainstem and its major tributaries were all rated as Nonfunctional or Functional at Risk with a downward or unapparent trend.

WILDLIFE

Management Plans are in place to provide for the recovery of lynx and wolves. Surveys for lynx are needed to determine if lynx are still in the area. Increasing snowshoe hare habitat on 3760 acres (within the entire LAU) is within the 15 percent guidelines. These acres will change on a yearly basis as acres are added to or removed from this total due to changes in seral structure. There are adequate amounts of lynx denning habitat. Wolves could easily move into the watershed from the Gros Ventre Pack near Jackson, Wyoming. Systems are in place to monitor and deal with problem wolves. Any sighting of wolves needs to be reported to ensure the true population of wolves and number of breeding pairs is well known. This will allow these species to become delisted.

Disturbance from off-road motorized travel has increased but the road density is low in the area. Due to a lack of suitable wolverine denning habitat in the watershed snowmobiles are probably not causing a disturbance. Snowmobile tracks may be providing access to deep snow areas by coyotes. This may reduce lynx prey in deep snow areas. Restrictions are probably not needed at this time.

The large amount of mature forest stands has created an abundance of habitat for old growth dependent wildlife (photo 1). There is a lack of young stands to provide the diversity needed to maintain the composition needed in the long term for wildlife. There is a need for disturbances in forested stands.

Large quantities of dead trees from bark beetle outbreaks, wildlife or prescribed burning would provide a short-term supply of suitable foraging habitat for three-toed woodpeckers.

Sagebrush in early seral condition near the Geneva sage grouse leks will be met for the next 20 years if proposed prescribed burning is successful. Any additional burning of mature sagebrush in this sage grouse area would begin to impact breeding success of sage grouse. Mature sagebrush should be protected from fire over the next 20 years while these early seral stands are reaching maturity.

Mountain brush is at mature condition and meeting wildlife needs. Disturbance would provide early seral stands and improve the diversity of these stands. Early seral mountain brush is or would be created through ongoing or planned disturbance to forested or sagebrush habitats where mountain brush is a large component.

Riparian vegetation is providing suitable habitat for migratory birds. Riparian habitat is not at its potential vegetative condition.

Water sources and associated vegetation and insect populations are available for wildlife use but some water sites are not at their potential due to heavy ungulate grazing (specifically: livestock use at stock ponds have left banks denuded of vegetation).

Elk and Deer. Populations are high. Brush species are available as winter forage.

Moose – healthy reproducing willow stands would contribute to moose foraging needs.

Beaver – Many beaver dams are not maintained and water (and fish) is flowing through deposited sediment and through the dam structure (photo 2 & 5). It is generally believed that beaver dams are barriers to trout movement (photo 8). However, some studies indicate that trout not only can pass over dams during high water but also can cross upstream and downstream through most beaver dams during all seasons (Olson and Hubert 1994, 818). Willows are available as building material but large mature stands of aspen along creeks are lacking. Approximately 90 percent of all cutting of woody material is within 100 feet of the water's edge, but cutting can extend to 600 feet from the water. Suitable food should be within 100 feet of the water (Olson and Hubert 1994, 8-9). There is a balance needed between the current population of beaver in the system currently controlled by trapping and the recruitment of aspen and willows in areas harvested by beaver. Reducing the current level of trapping could increase beaver numbers that could increase harvesting of aspen and willow beyond their regrowth ability leading to a decline in aspen and willow health.

Photo 42: Preuss Creek Conifer Stands. Mature conifer stands.
No young conifer regeneration. Conifer encroachment into aspen and sagebrush stands.

Photo 43: Preuss Creek Beaver Dam not being maintained. Located inside the older small exclosure within the Big or Upper Exclosure.

Photo 44: Giraffe Creek Right Hand Fork.
Old beaver dam filled in with sediment.
Conifers are invading aspen. No willows.

RECREATION

Dispersed Camping

Dispersed camping remains popular as it has been in the past. The majority of this dispersed camping is still associated with big game hunting. Tributaries of Thomas Fork remain popular camping areas. As in the past, camping is not restricted on most of these sites along these tributaries. Dispersed camping provides an opportunity to get away from the other forest users in a more primitive type setting. Camping adjacent to these streams provides the campers with much the same amenities that it has in the past.

Cross Country Motorized Travel

Presently most federal lands motorized travel with the exception of the snowmobiles is prohibited yearlong. This change was precipitated by the introduction of the 4x4 jeep type vehicles, followed by 4x4 PU. As motorbikes and all terrain vehicles have become more popular, federal agencies have maintained restrictions on cross-country travel. All terrain vehicles have added a new dimension to cross country travel. The tread lightly idea that prevails with ATV riders, the ability to retrieve big game animals, has made this vehicle popular. There is a concern among some ATV owners that cross country travel should be allowed in these restricted areas to retrieve big game animals. There is also a concern that due to the lack of law enforcement that motorized travel is impacting big game populations and impacting the quality of the hunt. Whereas cross country travel was at one time allowed mostly with 4x4 PU, it is now restricted to all wheeled motorized vehicles.

Recreational Facilities

Constructed recreational facilities such as toilets, fire grills, potable water sources trailheads, hitching/tethering areas for pack stock, corrals and loading remain almost non-existent except for the Allred Flat Campground. Forest users continue to make do with what is available and the sites that are available. In some area forest users are constructing facilities. Impacts to other resources for the most part have not been analyzed. In general roads throughout the area have steadily improved. However there is still a good cross section of road types in the water shed.

TRANSPORTATION

The areas with the highest erosion potential are usually found at stream crossings. The most common problem at a stream crossing is the potential for stream diversions. Since most stream crossings will eventually fail, it is impative to eliminate diversion pontential at all existing crossings, a principal component of any erosion prevention plan within the watershed.

The road system, although relatively stable, suffers from a lack of routine maintenance. Many of the spur and feeder roads are rutted, with steep grades, and difficult to access without a 4x4 vehicle. With poor access to many of these sites, they are likely to continue being unmaintained and eventually fail, delivering sediment into streams. Although the potential of a stream crossing failing is always a factor, it didn't appear that there was any immediate threat of a failure on any of the road systems that were surveyed. (See Road Analysis Table)

Several roads show up on the Forest Visitor Map and also on the Forest Travel Map with route numbers indicating they are Forest roads. All of the roads were found to be on private land and access was prohibited to the general public. The roads are North-West of Geneva and the numbers are, #185, #186, and #226, there are also several other roads shown without numbers and some trails shown. These roads and trails looked to have accessed the National Forest at one time.

Also on the East side of the Valley just Sourt of Raymond there is a large Borrow site. It was a mining operation around 1975-1978 but has been reclaimed and abandoned.

RECOMMENDATIONS

SOIL

Through the comparison of past and current conditions, we developed trends. These recommendations address the trends that were identified. They are presented from a soils perspective and are in a general order of priority. The recommendations that can be implemented on the Caribou-Targhee National Forest within the analysis area are preceded with an "*".

1) Less than 15 percent of the watershed is made up of Caribou-Targhee National Forest. Less than 10 percent of the accelerated sediment reaching the Thomas Fork comes from C-T lands. Following the recommendations of the Thomas Fork Water Quality Project Final Planning Report/Environmental Analysis will make the greatest difference in reducing sediment reaching the Bear River and improving current soil conditions in the watershed.
2) *Better manage livestock grazing, especially in riparian areas. Remove cattle and sheep from riparian areas before soils are detrimentally compacted, before filtering vegetation is removed, before undesirable vegetation dominates, before excessive stream bank damage occurs and before water tables are lowered to the degree that the riparian zone is reduced in extent. Opportunities exist for additional riparian exclosures. Opportunities exist for reintroducing beaver. Include more rest on upland pastures grazing systems. (Applies to C-T)
3) *Complete Roads Analysis Process. Close and obliterate roads and trials that have not been adequately designed and maintained, especially those on unstable landforms, and as a result are concerns for water quality. Limit off road travel and user created trails and roads. (Applies to C-T)
4) *Reduce impacts of dispersed camping by limiting the number and extent of sites, providing alternate sites that would have less impact on soils and providing limited improvements at popular sites. (Applies to C-T)
5) *Increase the extent of prescribed burning in communities dominated by Mountain big sagebrush and dry Douglas fir following adequate site specific analysis. (Applies to C-T)
6) *Remove conifer succession from aspen stands shown to be at risk (Bartos and Campbell, 1998) and stimulate sprouting with a variety of methods appropriate to the site including fire and mechanical disturbance. (Applies to C-T)

WATER

Through the comparison of past and current conditions, we developed trends. These recommendations address the trends that were identified. They are presented from a water resource perspective and are in a general order of priority. The recommendations that can be implemented on the Caribou-Targhee National Forest within the analysis area are preceded with an “*”.

Risk of no action: A rating is a best fit and does not need to meet all criteria.
High: Impacts are and will continue degrading conditions. Impacts are at the watershed or key subwatershed scale.
Moderate: Impacts may continue but some action has been taken to slow effects. Impacts are at the subwatersheds scale.
Low: While impacts may continue, they are not expected to affect conditions at the subwatershed scale. These projects primarily deal with localized problems and not watershed or subwatersheds conditions.

Risk/Benefit to Resource: A rating is a best fit and does not need to meet all criteria.
High: The action would reduce impacts at the watershed or key sub-watershed scale.
Moderate: The action would reduce impacts at the subwatershed scale.
Low: The action would improve conditions at the local scale.

Table 22:

Priority	Wshd	Project	Risk of No Action	Risk/Benefit to Resources
1	**ALL**	Implement projects identified in the Thomas Fork Water Quality Project.	High. Existing management has led to degraded riparian and stream conditions. Not taking action will allow these declining conditions to continue.	High. These actions directly affect the primary sediment sources in the watershed. Expanding the proposed treatments would further improve watershed and stream conditions.
2*	**ALL**	Improve riparian/grazing management. Specifics need to be developed at the project level.	High. Rangeland impacts are causing both surface and channel erosion. Maintaining existing trends would adversely affect key reaches in all subwatersheds.	High. All subwatersheds would benefit from improved riparian conditions and reduced sediment inputs.
3	**Border-Raymond and Geneva**	Recreate side/off channel habitat	High. Bank instability would continue degrading channel conditions. All other treatments are “band aids” that will not provide long-term stability. Reach by reach treatments that do not address issues at the proper scale can lead to problems elsewhere in the system.	High: This addresses the cause of the problem not just the end result. This would provide long-term benefits. Stream stability would increase, sediment production would decrease, and additional habitat would be provided.
4	**Border-Raymond**	Recreate wetlands on the	High. Impacts to the stream flow (increased water velocities and	Moderate-High: Improving wetland/ riparian condition

	and Geneva	Thomas Fork's floodplain.	reduced base flows) and sediment (less long-term storage) regimes will continue.	would increase stream stability and reduce sediment inputs.
5*	All	Improve and expand beaver habitat through vegetative treatments. This includes improving willow and aspen condition and abundance.	Moderate. Recovery will continue but at a slower rate then with an active approach. High flow events may continue channel downcutting.	High. Restoring the role of beaver throughout this watershed would reestablish many processes affecting stream function/conditions. This would improve sediment storage, vertical stability, and connectivity with the floodplain. It would also reduce channel erosion, and create aquatic habitat.
6	Salt	Re-establish willow below Water Canyon. This can be accomplished by planting live stakes in the revetments and willow fascines along the channel.	Moderate. Recovery will continue but at a slower rate then with an active approach. If revetments break down before vegetation becomes established, the banks will once again erode.	High. This stream provides the best habitat in the watershed. This action provides the best chance for main-taining long-term bank stability and minimizing erosion in this stream.
7	Coal	Mechanically alter the banks to prevent bank and terrace erosion. By laying back the banks and using the exiting "sod mat" to resist stream flows, erosion can be greatly reduced. Logs or rocks may be needed to protect the toe of the new, vegetated stream bank.	High. Bank and terrace erosion will continue at high rates. Coal Creek would remain a principle area for sediment production.	High. This stream is a major sediment source to the lower watershed. This action could substantially reduce onsite and downstream sediment levels.
8	Coal	Reestablish willows below the East Fork. This would provide long-term stability.	Moderate. Recovery will continue but at a slower rate then with an active approach. The new stream banks (from priority 5) would have less stability during this period of delayed recovery.	Moderate-High. This stream is a major sediment source to the lower watershed. This action could reduce onsite and downstream sediment levels. By itself the improvements would produce a moderate benefit, along with priority 5 it would produce a high

				benefit.
9*	Dry/ Preuss	Reestablish the exclosure above the Preuss Creek property line.	Moderate. This reach is highly unstable. Further impacts can substantially affect water quality in this drainage.	Moderate. Exclosures have been shown to be highly effective in this watershed. This would substantially accelerate recovery.
10*	Dry/ Preuss	Move the pasture fence into the timber above the current location and exclude the existing fence line area from grazing. This would require moving the fence approximately 500 feet and constructing a 1000-foot exclosure.	Moderate. This reach will continue unraveling with very high bank erosion and sediment production.	Moderate. The new location would be at a location where the stream type can better handle concentrated grazing impacts. The old location would rapidly recover as it's still connected with its floodplain.
11	Coal	Relocate the valley bottom road. The road should be at least 100 feet from the channel.	Low. The road would continue encroaching on the channel in isolated locations. These areas would be a continued source of sediment.	Low. This action would eliminate a minor source of sediment to Coal Creek.

FIRE

The following recommendations have been developed through the analysis of the past and current vegetation condition of the watershed analysis area and the apparent trends occurring there. A variety of management tools in a multitude of combinations would be used in order to accomplish the objectives stated below. These actions can all occur on Caribou-Targhee National Forest Land.

Vegetation Management Tools

Underburning **-** Reduce stand densities, overall fuel loading and competition from shade tolerant species while increasing the representation of fire resistant seral species. This would be done in areas where historical fire regime included frequent underburning events.

Stand-replacement Fire – Reset the successional clock while creating fuel discontinuity on the landscape. This treatment would create concentrations of standing dead trees valuable as wildlife habitat.

Mixed-severity Fire – This tool would produce a mosaic of stand conditions that historically occurred over much of the watershed analysis area. The effects would be similar to both lethal fire and underburning and some case produce similar conditions as those created by thinning, improvement cutting, and regeneration harvest.

Broadcast Burning – Used in conjunction with timber harvest to reduce fuel loading, and prepare the site for tree planting.

Prescribed Natural Fire – Not an option within the watershed analysis area under our current Forest Plan. However, a prescribed natural fire plan would allow naturally occurring fire within the watershed analysis area to burn in areas where it has been deemed desirable at achieving some or all of the objectives listed below.

The following objectives for vegetation treatment within the watershed analysis would be accomplished using the tools listed above. The exact amount, location, and particular treatment tool utilized would be evaluated in an Environmental Analysis that would be guided by the requirements of the National Environmental Policy Act.

Objectives

1. Promote the historical successional stage pattern and distribution within the watershed analysis area.
2. Replicate historical mosaic fire patterns across the landscape
3. Reduce the representation of shade tolerant species while favoring greater representation of seral./shade intolerant species.
4. Enhance stand structure to provide late successional habitat in the future.

5. Create habitat for early colonizer species.
6. Maintain historical vegetation composition and patterns within riparian areas.
7. Reduce fuel loading and create landscape mosaics to prevent expensive, large-scale wildfire.

FORESTS

Through the comparison of past and current conditions, we developed trends. These recommendations address the trends that were identified. They are presented from a forest resource perspective. The measures can be implemented on the Caribou-Targhee National Forest.

Lodgepole pine

There are large acreages of this type that current compartment/stand data is either totally lacking or is so dated its value is suspect. A concerted effort must be made to obtain new compartment/stand data before a site-specific analysis for forest management is undertaken.

Management emphasis should be to bring this type back to a Desired Future Condition (DFC) distribution of age and structure classes of: 40% in the mature to old ages, 30% in the immature class and 30% in the seedling/sapling age class. A rough estimate is to treat approximately 20% of this type by commercial harvest and/or burning within the next two decades.

Insects and diseases should be allowed a continued presence, but at manageable, endemic levels. Annual aerial surveys of insect activities and the subsequent tree mortality should be conducted.

Design timber management projects to simulate natural patch sizes, patch shapes, connectivity, species composition and age class structures that more closely emulates the historical range of variability, while still providing for multiple uses.

Commercial timber harvest, where lands are suitable, should be given priority as a means to attain management goals.

Post and pole cutting along with firewood gathering are important local activities that should be permitted where it is compatible with land suitability and access.

All silvicultural practices along with fire are tools that should remain available to the resource managers. These tools should allow for the control of insects, diseases and vegetation competition to promote regeneration and tree growth at optimum levels, but yet allow for a degree of variability.

Aspen

A high priority for this type is to obtain accurate and current stand data before any site-specific management proposals are analyzed or proposed. A rough estimate is to intensively manage 30% of this type within the next two decades. The emphasis should be the higher elevation mixed stands where conifer succession has severely limited aspen regeneration and dominance. Lower elevation pure aspen stands, which are not showing evidence of successful regeneration, should be the next priority.

This type is an emphasis priority for land managers as some of the ecological functions and processes are well beyond their traditional range of variability. There is a high risk that significant acreage of this type will continue on the path to succession to other vegetative types without specific management aimed at aspen regeneration. Management treatments with the goal of aspen regeneration should consider the effects grazing by domestic and wild ungulates before implementation begins.

PFC suggests that the proper structure for aspen is no more than 30% of this type being in the mature to old age classes at one time. Conifer encroachment should not exceed 15% of the canopy cover as well.

Management should target improving the aspen availability as specific food sources for improving the beaver populations. Site-specific analysis will indicate exactly which streams/drainages require this management approach.

Insects and diseases should be allowed a continued presence, but at manageable, endemic levels. This will require frequent monitoring to remain aware of current activity levels of these factors.

Fire should be used along with mechanical harvesting for fuelwood or commercial products, to influence the disturbance patterns that more closely mimic the historically patterns that were once prevalent.

Interior Douglas-fir

There are large acreages of this type that current compartment/stand data is either totally lacking or is so dated its value is suspect. A concerted effort must be made to obtain new compartment/stand data before a site-specific analysis for forest management is undertaken.

Management emphasis should be to bring this type back to more equitable distribution of age and structure classes, 40% in the mature to old ages, the remaining acreages distributed between the seedling/sapling and immature age/structure classes. A rough estimate of 20% of this type should receive treatment, either by commercial harvest and/or burning, within the next two decades.

Insects and disease levels of mortality should be annually monitored to allow for active management to retain them at manageable, endemic levels.

Design timber management projects to simulate natural patch sizes, patch shapes, connectivity, species composition and age class structures that more closely emulates the historical range of variability, while still providing for multiple uses.

Commercial timber harvest, where suitable, should be given priority as a means to attain management goals.

All silvicultural practices along with fire are tools that should remain available to the resource managers. These tools should allow for the control of insects, diseases and vegetation competition to promote regeneration and tree growth at optimum levels, but yet allow for a degree of variability.

Spruce – Fir

There are acreages of this type that current compartment/stand data is either totally lacking or is so dated its value is suspect. A concerted effort must be made to obtain new compartment/stand data before a site-specific analysis for forest management is undertaken.

This type is at risk primarily due to the dominance of mature and old age structure and changes in the historic lethal and non-lethal fire regimes. A range of structures should exist where 30 to 40 percent of the acres are in mature to old age classes.

Early successional stages of spruce-fir should be maintained and disturbance processes restored through vegetative management, endemic insect and disease disturbances, and fire. Design timber management projects to simulate natural patch sizes, patch shapes, connectivity, species composition and age class structures that more closely emulates the historical range of variability, while still providing for multiple uses. An estimate of 20% of this type should receive intensive management within the next twenty years.

Commercial timber harvest, where the sites are suitable, should be given priority as a means to attain management goals.

RANGELANDS

The following actions are recommended to rangeland ecosystem sustainability.

1. Support the continuation of the Conservation Reserve Program with its associated practices.
2. Encourage participation in the continuous signup portion of the Conservation Reserve Program for the benefit of riparian-wetland resources.
3. Promote cooperation and coordination between private, local, state, and federal land management agencies in developing effective noxious weed control strategies.
4. Develop grazing prescriptions, monitor, and adjust to obtain the intensity of use compatible with diverse and resilient ecosystems.

FISHERIES

Through the comparison of past and current conditions, we developed trends. These recommendations address the trends that were identified. They are presented from a fisheries perspective and are in a general order of priority. The recommendations that can be implemented on the Caribou-Targhee National Forest within the analysis area are preceded with an "*".

1. A full spanning diversion (Esche) in the Thomas Fork blocks most upstream migration of Bear River Bonneville cutthroat trout. If fluvial fish are excluded from the upper Thomas Fork, long-term population viability is in question. Work cooperatively with private landowner, irrigation company, IDFG, and others to provide full time fish passage over the full spanning concrete weir in lower Thomas Fork. In the short term, help operators of the diversion structure divert water while minimizing impacts to upstream and downstream migrants. In the long term, work with irrigators to replace structure with one that would allow passage. Also, explore opportunities to buy water rights at site.

2. Fish mortalities have been documented in the major diversions along the main stem Thomas Fork. These major diversions include the Taylor Canal, Hall's Ditch, and Raymond Canal. These diversions should be screened to stop fish mortalities.

3. Encourage IDFG to use WGF's hatchery stock of fluvial Bonneville cutthroat trout in order to discontinue the stocking of non-native rainbow trout in the Bear River System. WGF has developed their fluvial cutthroat trout stock from Water Canyon, a headwater stream in the Thomas Fork drainage. These fish do well in an adfluvial and fluvial environment and are regularly infused with wild fish genetics. IDFG could establish their own stock at their own hatcheries with WGF's eggs or could use WGF's surplus fish for stocking.

   IDFG currently stocks rainbow trout in high fisheries use areas in the Southeast Idaho Region. There has been an effort to sterilize these fish to protect against interbreeding with native cutthroat trout. It is estimated 10% of these fish are still capable of reproducing. In addition, the stocked non-native fish compete with native fish for habitat and food. The hatchery resources currently dedicated to maintaining the rainbow trout stocking program should be invested in the development of a fluvial Bonneville cutthroat trout stock to be used in the Bear River and its tributaries.

4. Full spanning irrigation diversions occur on Dry and Preuss Creeks. They completely block the upstream migration of fluvial Bonneville cutthroat trout and likely entrain downstream-migrating juveniles. If the private landowners are willing, work with them to install fish friendly irrigation weirs in Preuss Creek to

allow upstream migration of fluvial Bonneville cutthroat trout and downstream migration of juvenile Bonneville cutthroat trout.

5. *Reduce cattle numbers and/or grazing duration in Dry, Preuss, and Giraffe Creek. Monitoring of riparian and stream channel conditions have indicated signs of overgrazing which include high width:depth ratios, frequent trampled banks, and low stubble height.

6. *Stream and riparian habitat recovery has been documented to be accelerated with the construction of riparian exclosures. Exclude cattle from the remaining low gradient habitat in Preuss, Dry, and Giraffe Creeks (including Left Hand Fork salt lick area) where needed. Allow water gaps as necessary. Increase off-channel watering areas.

7. *Al Winward visited Preuss and Dry Creeks and prepared suggestions for range betterment in 1987. He suggested a grazing system built around a 2-year's rest in 5 approach to accelerate stream and riparian recovery. The 1993 revision of the allotment management plan apparently did not consider such an adjustment. During the next allotment management plan revision, more thoroughly consider using Winward's suggestion.

8. *Problems have occurred in the Montpelier Elk Valley Allotment where cattle have entered exclosures and not promptly removed. Monitoring should be increased in the allotment to ensure compliance with existing regulations.

9. *The decline of beaver activity in the analysis area (particularly Dry, Giraffe, and Preuss Creeks) and grazing impacts are underlying concerns in this analysis. A prescribed major fire effort may help to address these concerns by stimulating aspen regeneration. In addition, strategically located fires could draw cattle away from riparian areas to new forage upslope.

10. *Decrease impacts associated with the cattle driveway crossing of Preuss Creek downstream of the Crow Creek Road Crossing by fencing and hardening crossing.

11. *A culvert under the Boulevard Road has been retrofitted to prevent beaver impacts to the drainage structure. This culvert has been reported as a barrier to upstream migrating fish. Work with Bear Lake County to inspect the culvert under the Boulevard Road and replace it if it is an impassable barrier.

12. At least one segment of the Thomas Fork has been channelized, decreasing impacting riparian and aquatic habitat quality. Work with willing landowners where there are opportunities to re-establish the meander of the Thomas Fork.

13. Lower Dry Creek was straightened to create a segment of the Geneva Ditch. If the private landowner is willing, work with him to re-establish meanders in lower Dry Creek where the channel was straightened with the excavation of the Geneva

Ditch. This will increase the quality of aquatic and riparian habitat in lower Dry Creek.

14. Inventory culverts in the watershed. In partnership with WYDOT, restore full fish passage to the 3 culverts under Highway 89 identified by Kurt Nelson as barriers.

15. Brook trout compete against native Bonneville cutthroat trout for habitat and have replaced cutthroat trout populations in some tributaries of the Bear River. Brook trout have been documented by Wyoming Game & Fish in the Thomas Fork, but it is uncertain where they were observed. Survey for brook trout in areas where they have been planted in the past and assess populations. Control populations if needed.

16. *Establish monitoring transects on Preuss, Dry, and Giraffe Creeks to monitor and document changes to the riparian and aquatic habitat over the last decade. Include riparian greenline, woody species regeneration, width:depth measurements, bank stability, and pebble counts. If monitoring transects have already been established, try to work them into this monitoring effort. Recommend similar monitoring on other lands in the watershed, including Bridger-Teton National Forest, Bureau of Land Management, and private grounds.

17. Leatherside chub occur in the Smith River Drainage, so they likely occur in the Thomas Fork. However, they have never been observed. Survey the Thomas Fork and lower reaches of its major tributaries for leatherside chub. Identify opportunities to restore habitat.

WILDLIFE

1. The mature sagebrush providing breeding habitat for the Geneva sage grouse leks should be protected from fire over the next 20 years after Red Mount prescribed burn project is completed.

2. Wildlife habitat would increase if the potential vegetative condition of riparian habitat were met. There is an opportunity to increase riparian vegetation by fencing the north half of livestock ponds or natural seeps or springs heavily grazed by livestock.

3. Aspen regeneration along (within 100 to 300 feet of) live water would provide additional building material for beaver dam construction. The balance of beaver use and aspen and willow recruitment should be monitored.

4. There is a need for disturbances in forested stands to increase diversity and this in turn would provide foraging habitat for three-toed woodpeckers.

5. Lynx guidelines need to be followed for vegetation treatment of primary and secondary lynx habitat (forested stands) within the allowed 3760 acres within the entire LAU. Any sighting of wolves needs to be reported.

6. Off road motorized travel restrictions are probably not needed at this time. Enforcement of existing regulations would help alleviate impacts of ATVs and snowmobiles.

7. Specific disturbance in mountain brush is not required at this time.

RECREATION

Here are the prioritized recommendations for recreation. The recommendations preceeded by a "*" can be done on the Caribou-Targhee National Forest.

1. *Develop dispersed campsites in the locations that will protect all resources. The location of these sites should be determined by the applicable agency. These sites should be located in areas that are the most heavily used. Seasonal use should be considered in installing sites.
2. *Provide recreational facilities such as toilets, corrals, and picnic tables at these dispersed sites. Toilets could also be located near existing sites.
3. Construct a campground near Highway 89 that would accommodate visitors traveling through the area. Look for opportunities with BLM, State of Idaho, Forest Service and even private landowners.

With the increase in visitors to the watershed, resources in the area need to be protected from visitor impacts. Designating and developing these facilities would help mitigate the impacts of visitors.

TRANSPORTATION

Table 23: Transportation recommendations, Road Analysis Table

This table identifies systems roads on Caribou-Targhee National Forest Land with the potential of stream crossing failures or road conditions that may cause consern, in the Analysis Area. Road treatment recommendations are also addressed in this section.

FS Road Number	Segment Length (mi)	Stream Type	No. Of high Immediacy Stream xings	Existing Condition	Recommended Treatment
20834	5.2	Perennial	0	From where the road leaves the trailhead it is a native surface, steep grade w/20%-30%, but has been waterbared and seems to be effective of diverting runoff water from the road surface. The remainder of the road is located mainly on the ridge tops. However a section of this road parrallels a portion of the upper Giraffe Creek drainage, which doesn't seem to be effected.	Maintain waterbars, to prevent erosion from entering Dry Creek. The road is norrow and steep in places and is being used by ATV users. Possibley convert road to ATV trail.
20148	1.0	Perennial	1	Good gravel road to trail-head. Some sluffing around CMP just before Forest Boundary.	Routine Maintenance

				Believe this portion or the road is county maintained.	
20801	4.0	Spring	1	The beginning of the road going up Snowslide Canyon has very deep ruts in it from water running down road. Some steep grades and native surface. About a mile and a half from its beginning it makes a steep clime to the ridge top, then traverses along the ridge through a section of State Land and along an old jeep trail, which crosses the headwaters of several drainages. It terminates when it entersects road No. 111, Crow Creek Road.	Needs drainage improvement, maintenance or possible relocation, out of the bottom for the first mile and a half and may also want to improve a small road off to the North of the canyon that access a spring.
20337	1.2	Intermettent	0	Road parallels a stream or cannel, road looked well maintained.	Routine Maintenance
20115	0.3	None	0	Very little of this road on Forest Service land.	Routine Maintenance
20818	0.8	Intermettent	2	Low standard	Routine

				road which accesses dispersed camp sites.	Maintenance
20111*	4.5	Perennial	1	Road in good shape with adequate stream crossing.	Routine Maintenance
10131	0.3	Perennial	0	Good road access Allred Flat Campground	Of Highway 89 on B-T
10382	0.5	Perennial	1	Road good to corrals	Of Highway 89 on B-T

- When the roads were surveyed, snow conditions on the road prevented access to the stream crossing at Preuss Creek.

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