Survey of Effects of Logging Practices on Selected Western Montana Streams

July, 1988

Cooperators and Recipients:

Environmental Quality Council
Montana Department of Health and Environmental Sciences
Montana Department of Fish, Wildlife and Parks
Environmental Protection Agency

DISCLAIMER

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CONTENTS

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LIST OF PHOTOGRAPHS

LIST OF PHOTOGRAPHS - Continued

INTRODUCTION

Effects of road building and logging on forested watersheds has received a great deal of attention in the western United States including Montana. Because of damage that has occurred to streams as a result of logging, many western states have adopted special regulations to manage forest practices to minimize degradation of water quality.

To try and begin to assess the effects of forest practices on Montana streams, we initiated a survey during the summer of 1987. Our objectives were first to identify watersheds that were perceived, either by professionals or members of the lay public as having been impacted by forest practices; secondly, to evaluate the effects of logging activities on the conditions of the streambanks and streambeds in these drainages or on the delivery of sediment to streams; and finally, to suggest practices that could have been employed to prevent problems that were observed. Surveys were conducted by a professional hydrologist.

METHODS

Information on locations that were perceived as problems was obtained through a mail survey or by personal interviews. The form utilized in the mail survey was modeled after survey forms used during the statewide 208 water quality assessments conducted during the late 1970's. Individuals were also asked to identify good examples of forest practices. These were used as a yardstick against which to gauge logging activities that were poorly conducted.

Individuals contacted during the survey included hydrologists, fishery biologists, and other watershed professionals employed by a variety of state and federal agencies involved with resource management. Representatives of the public who were known to have an interest in the watershed-forest practices issues were also included.

The stream reach inventory and channel stability rating developed by the Forest Service was used to gauge conditions of the stream channel (Pfankuch 1978). Parameters used in the scoring included: bank slope and gradient; occurrence and size of debris, vegetation and root mass; relation between stream width and water depth; frequency and age of channel obstructions; evidence of bank cutting, and particle deposition; substrate roughness, brightness, compaction, and stability; and algal colonization. Scoring is such that lower scores represent a higher stability rating. Stability ratings include excellent (0-38), good (39-76), fair (77-114), and poor (115 or greater). Parameters weighed heaviest in the scoring are those dealing with bottom stability, deposition of fines, and bank cutting. Other observations made during the field survey are listed in the field data form which is included as Appendix A.

RESULTS AND DISCUSSION

Most individuals contacted during the survey identified locations that they perceived as having been impacted by logging and roading. Although our primary emphasis was on recent logging operations some individuals brought locations to our attention that had been logged more than five years ago. Locations that were brought to our attention are listed in Table 1. Over the course of the summer, logging operations were reviewed at nineteen locations. Each of these is discussed individually in the report.

CAMAS CREEK

The upper reaches of Big Camas Creek drain portions of the southeast side of the Big Belt Mountains west of White Sulphur Springs. Little Camas and Big Camas Creeks join to form Camas Creek which is a tributary of the Smith River.

We visited the stream reach one-half mile below the confluence of Little and Big Camas Creeks on September 15, 1987. This reach lies on private ranch land just east of the Helena National Forest. The riparian bottomlands consist of willow thickets, alder, Engelmann spruce, and lodgepole pine; uplands are primarily sagebrush and grasses.

Logging has occurred in the bottomlands for the last two years. The road built to access the timber extends for approximately 0.1 mile immediately adjacent to the stream. This portion of the road has not been armored from the stream

Table 1. Areas potentially impacted by forest management practices identified through questionnaire responses or personal interviews.

1. Swift Creek Drainage of Whitefish Lake - Sec. 25, T33N, R23W; Stillwater State Forest.
2. Granger Draw - Secs. 11 and 14, T26N, R24W.
3. Briggs Creek - Secs. 11, 13 and 14, T25N, R25W; west side of Hubbart Reservoir.
4. Redmond Creek - Sec. 13, T24N, R25W.
5. Tamarack Creek - Sec. 25, T26N, R25W.
6. Herrig Creek - Sec. 23, T28N, R25W
7. Fish Creek and Cottonwood Creek - Secs. 15, 16, 21, and 22; T28N, R24W; tributaries to Ashley Lake.
8. Hilburn and Freeland Creeks - tributaries to Lake Mary Ronan.
9. Jim Creek and South Cold Creek.
10. Potomac Creek - Lolo National Forest.
11. No. Fork of Rock Creek - Lolo National Forest.
12. Boles Creek - Secs. 1, 26, 27, 34, and 35, T16N, R16W; tributaries to Placid Lake.
13. East Fork of Lost Creek (good example).
14. Murr Creek and Upper Rock Creek - Thompson River drainage.
15. Lolo Creek, Granite Creek and Lee Creek - Lolo National Forest.
16. Elk Creek and Keno Creek - Garnet Range (Elk Creek County Road)
17. Chamberlain Creek (good example).
18. West Fork of Chamberlain Creek - Garnet Range.
19. South Coal Creek drainage, North Fork of Flathead - Secs. 29, 30 30, and 32 (good example).
20. East Fork of Finley Creek - Swan Range.
21. Gold Creek and Twin Creek - Tributaries to Blackfoot River near Rainbow Bend.

Table 1. Continued

22. Deer Creek, Marshall Creek and Placid Creek - West side of Clearwater River, Swan Range.

23. Nine Mile Creek - West of Missoula near highway I-90, Lolo National Forest.

24. Fish Creek - West of Missoula near highway I-90, Lolo National Forest.

25. Upper Willow Creek, a tributary to Rock Creek - roads follow stream channel (good example).

26. Three Mile Creek, Ambrose Creek and West Fork of Bitterroot River - Bitterroot National Forest.

27. Squaw Creek - tributary of Gallatin River.

28. Mill Creek - tributary of Yellowstone River.

29. South of Thompson Creek Road - Secs. 13, and 23.

30. McClaine Creek Road south of Lolo - land slump.

31. Sally Basin Road.

32. Jack Creek.

33. Meridian Creek, Gazelle Creek and Teepee Creek - tributaries of West Fork Madison River.

34. Sec. 29, east of Hyalite Peak in Paradise Valley.

35. Portal Creek - Gallatin National Forest.

36. Camas Creek - Helena National Forest.

37. Atlanta and Mule Creeks - Helena National Forest.

38. Duck Creek - Sec. 36, stream crossings (Duck Creek Road #139).

39. Ontario Creek - Secs. 29, and 30, R6W, T8N; and Monarch Creek (stream crossings) - Helena National Forest.

40. Copper Creek - tributary of Blackfoot River.

41. Unnamed creek east of Phillipsburg - former public water supply.

42. Upper Ten Mile Creek - Helena public water supply.

Table 1. Continued

43. Crystal and Jackson Creeks - East Helena public water supply.

44. Priest Pass Road - granitic soil resurfaced with gravel (good example).

45. Spotted Dog Creek - Secs. 6, and 7, Helena National Forest.

46. Shields River - upper portions of watershed.

47. Smith River - upper portions of watershed.

48. Hyalite Creek - upper portions of watershed.

49. McClellan Creek and side drainages - Elkhorn Mountains.

50. Spar Lake - Kootenai National Forest near Troy.

51. South and North Fork Callahan Creeks - Kootenai National Forest near Troy.

52. Lake Creek - Kootenai National Forest near Troy.

53. North Fork Keeler Creek - Kootenai National Forest near Troy.

54. Iron Creek - Kootenai National Forest near Troy.

55. Granite Creek - Kootenai National Forest near Libby.

56. Parmenter Creek - Kootenai National Forest near Libby.

57. Flower Creek - Kootenai National Forest near Libby.

58. Fisher River - Pleasant Valley.

59. Fortine Creek - Kootenai National Forest near Eureka.

60. Deep Creek - Kootenai National Forest near Eureka.

61. Swamp Creek - Kootenai National Forest near Eureka.

62. Dodge Creek - Kootenai National Forest near Eureka.

63. Pinkham Creek - Kootenai National Forest near Eureka.

64. Whale Creek - drainage to North Fork Flathead River, Flathead National Forest.

65. Red Meadow Creek - drainage to North Fork Flathead River, Flathead National Forest.

Table 1. Continued

66. Big Creek - drainage to North Fork Flathead River, Flathead National Forest.

67. Hay Creek - drainage to North Fork Flathead River, Flathead National Forest.

68. California Creek - Beaverhead National Forest.

69. American Creek - Beaverhead National Forest.

70. French Creek - Beaverhead National Forest.

71. Upper Willow Creek - Beaverhead National Forest.

72. Game Ridge - SSW of Placid Lake, 300 acre clear-cut.

channel and is vulnerable to erosion during periods of high stream flow (Photo 1). Further riparian logging has reduced streambank stability. Fresh debris was present in the channel during our visit and was causing bank undercutting. Additionally, yarding was conducted on the streambank and some logs had fallen into the stream (Photo 2). Movement of larger size streambed material has caused channel braiding and cobble islands. The stream reach adjacent to the present logging activity received a streambank stability rating of only 109 (fair), compared to 46 (good) and 70 (good), respectively, for reaches above and below the activity.

Best management practices were not employed during the logging. Most problems could have been avoided by locating the road away from the stream, yarding uphill and out of the floodplain, and leaving a buffer strip of trees along the stream to protect the streambank.

DRY CREEK

Dry Creek originates southeast of Fridley Peak in the Paradise Valley and is a tributary to the Yellowstone River. Land ownership in the upper watershed is split between the Gallatin National Forest and a private landowner; the lower watershed is entirely on private land.

We visited the easternmost tributary (unnamed) to the upper Dry Creek watershed on September 18, 1987. Much of the section had been recently logged. Drainage structures along the road were inadequate and overroad runoff and sedimentation

Photo 1. Logging road encroaching on the streambank of Camas Creek.

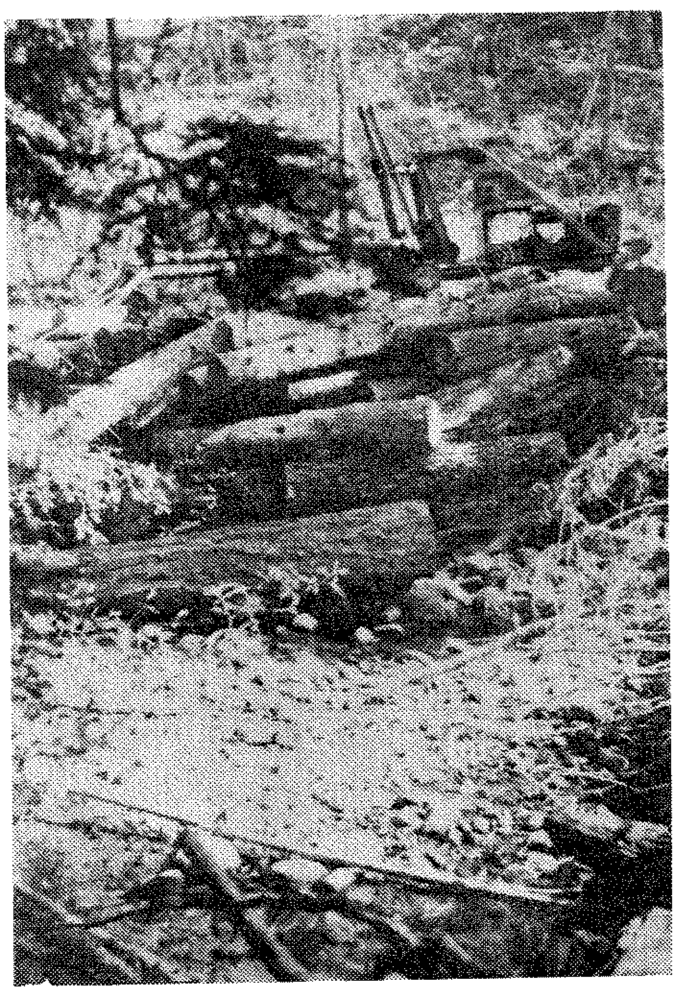


Photo 2. Yarding occurring in the channel and along the banks of Camas Creek.

were common (Photo 3). In some places the roadbed formed the channel bank (Photo 4) and yarding had occurred in a riparian area adjacent to the creek. Large quantities of debris were present in the channel (Photo 5), and most of the channel was heavily silted in. Streamside vegetation had been disturbed, contributing to unstable banks and increased erosion. The stream reach within the timber harvest area received a poor stream stability rating (122).

Downstream of the harvest area, stream stability rating improved (108). While the channel remained heavily silted, channel banks were defined and riparian vegetation was contributing to bank stability.

Problems could have been prevented by locating the road and the yarding area outside of the riparian zone and installation of adequate drainage structure.

FISH CREEK

Fish Creek is a tributary to Ashley Lake on the Flathead National Forest. About half of the Fish Creek watershed is on private land and the other half is owned by the Forest Service. Fish Creek is considered to be the most important spawning tributary to Ashley Lake.

We visited the Fish Creek inlet to Ashley Lake on September 22, 1987. We walked the first 0.1 mile reach of the creek as it flowed through a recent timber harvest area on private land. Most of the lodgepole, larch and Englemann spruce had been cut. On the private land, the riparian buffer strip was only 5-15 feet

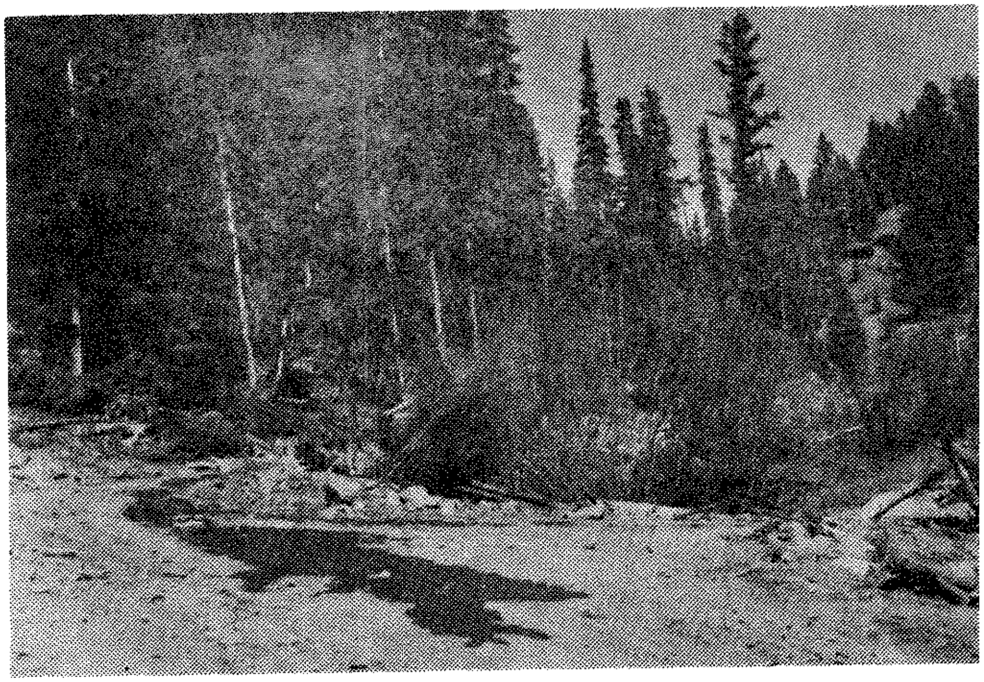


Photo 3. Over road runoff and drainage into an unnamed tributary to Dry Creek.

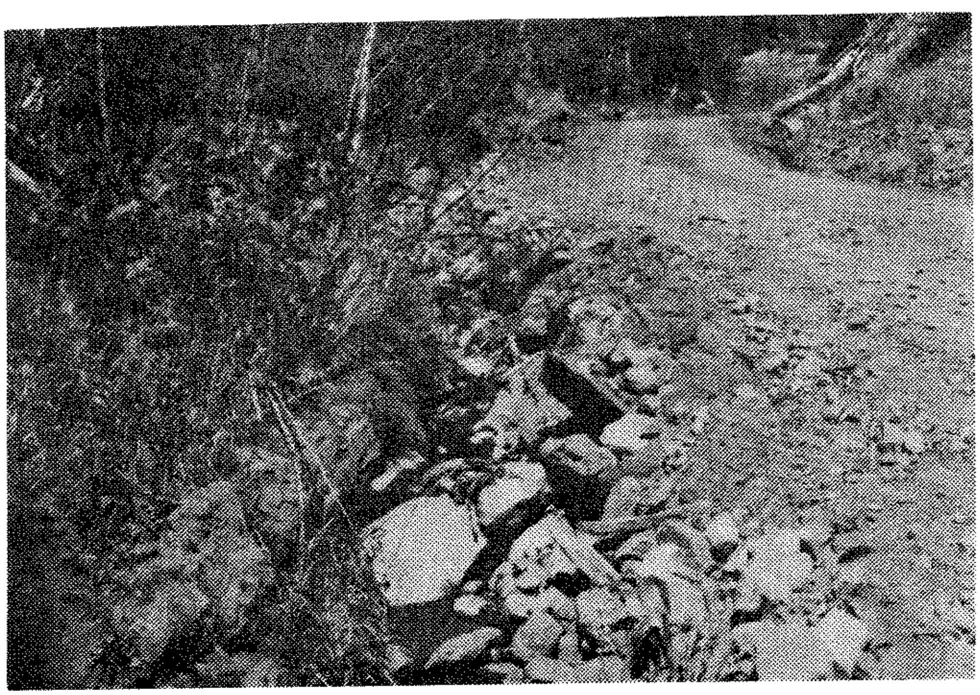


Photo 4. Roadbed, forming the streambank of an unnamed tributary to Dry Creek.

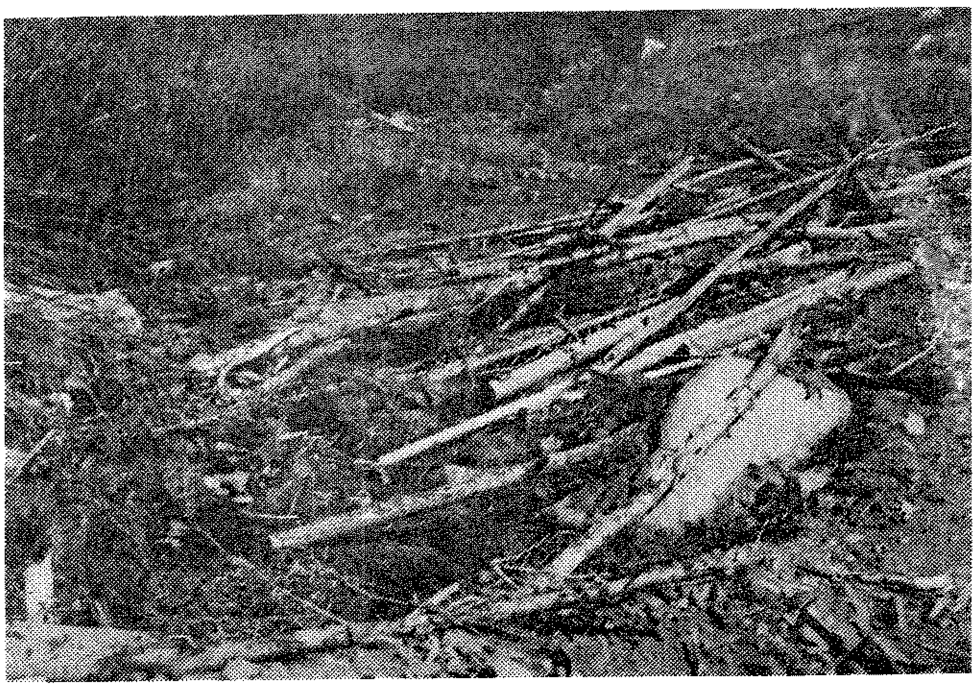


Photo 5. Slash and logging debris in an unnamed tributary to Dry Creek.

wide (Photo 6). Buffer strip width increased markedly as the stream crossed onto Forest Service land.

This reach of Fish Creek received a stream stability rating of 70 (good). Undercut banks (of up to 12 inches) were present on the outside curves and cobble deposition had occurred on the inside curves. Both the volume and size of debris in the stream has increased from blow-down of shallow-rooted trees that no longer have protection from the wind. Some structures built by the local Trout Unlimited Chapter to improve suitability of the stream for spawning were buried by slash.

Debris in the stream could have been minimized by leaving a wider buffer strip along the stream channel. While this was not considered to be a serious problem, minor modifications in the harvest plan could have prevented the problem entirely.

JACK CREEK

Jack Creek originates on the west side of the Madison Range in Madison County and joins the Madison River approximately two miles south of Ennis Lake. The Jack Creek watershed is almost entirely private land. The Gallatin National Forest and the Lee Metcalf Wilderness abut the private land to the north and south and the Big Sky Ski Area is located over the drainage divide to the east.

Timber in the drainage includes lodgepole pine and subalpine fir at higher elevations and lodgepole pine and Douglas-fir at lower elevations; some

Photo 6. Timber harvest along Fish Creek showing the narrow buffer strip that was left to protect the stream.

Engelmann spruce are present along the streams. Logging began in this drainage several decades ago when ownership was shared with the Forest Service.

Between 1975 and 1977, a massive pine beetle outbreak occurred in the drainage. By 1978, between 50 and 60% of the commercial timber had been killed by the beetle. Following the beetle epidemic, the Forest Service traded most of their land in the drainage to a private company. Since then, roughly 40% of the timber in the watershed has been clear-cut (Bengeyfield 1987); harvest is expected to continue.

We examined the upper Jack Creek watershed on July 14, 1987. No serious problems associated with road construction were observed. Timber harvest had occurred near timberline (Photo 7) and some clearcuts approached several hundred acres. Some of the harvest had occurred on southwest-facing slopes where regeneration will be difficult.

An upper reach of the mainstem of Jack Creek appeared to have recently widened; the streambanks had been undercut and there was evidence of movement of large bedload material (Photo 8). Additionally, several small tributaries entering Jack Creek from adjacent clearcuts contained high percentages of fine material. While it is not possible to definitely determine the reason for these changes, they may have been due to increased water yield caused by removing a high percentage of the forest canopy. Better techniques for evaluating and identifying stream channel changes caused by canopy removal are needed. Measures should be initiated to reforest the area as soon as possible.

Photo 7. Large, high elevation clearcuts in the southern portion of the Jack Creek drainage.

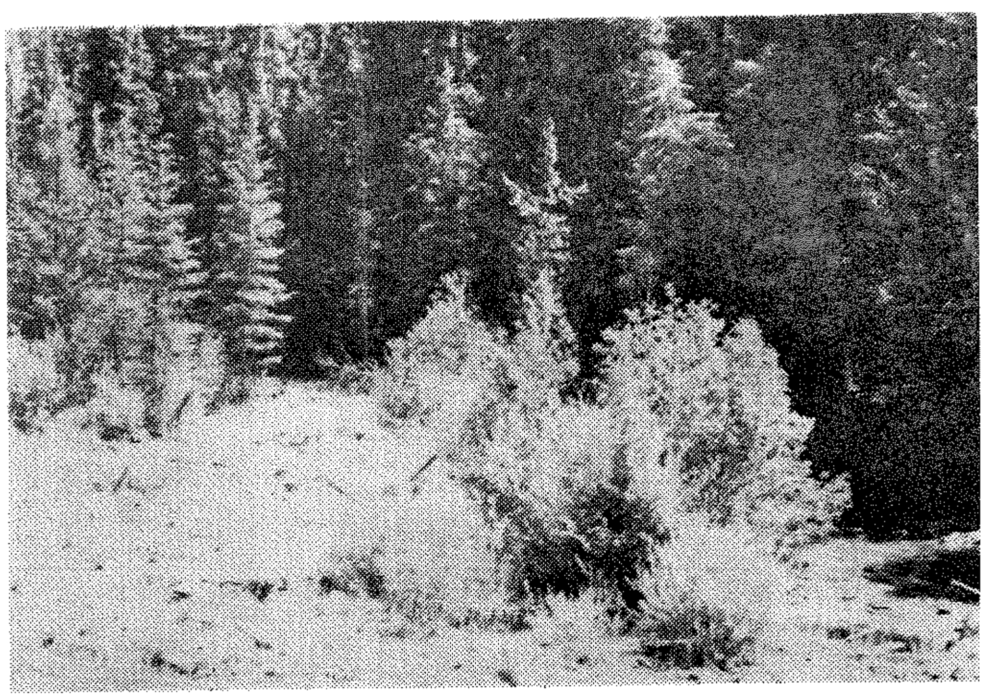


Photo 8. Bank erosion and cobble deposition in the upper reaches of Jack Creek.

JIM LAKE AND INLET

The Jim Lakes Basin is located on the east side of the Mission Range near the Mission Mountain Wilderness on the Flathead National Forest. The upper basin drains into lower Jim Lake which is the source of Jim Creek, a tributary to the Swan River. Both the inlet and Jim Lake are located on private land.

Approximately 200 acres of the upper Jim Lake watershed were clearcut 10-15 years ago, including both sides of the inlet, the areas west and south of the lake, and the steep slopes north of the lake. Regeneration has occurred on the north-facing slopes south of the lake, but has not been successful on the steep, south-facing slopes nor along either side of the inlet (Photo 9).

We visited the Jim Lake area on July 29, 1987. The access road traverses both private and National Forest lands. A road spur located north of the lake lacked proper cross drainage and over road flow was creating gullies (Photo 10).

The lack of a buffer strip along the inlet probably increases water temperature in the creek; however, at this high altitude water temperature is not likely to be a problem. Stream stability was judged to be excellent hence the erosion that we observed did not appear to be affecting the stream. The road erosion that we observed could have been prevented by installation of a water bar.

GAZELLE CREEK

Gazelle Creek is located in Madison County on the Beaverhead National Forest. It joins the West Fork of the Madison just upstream from its confluence with the

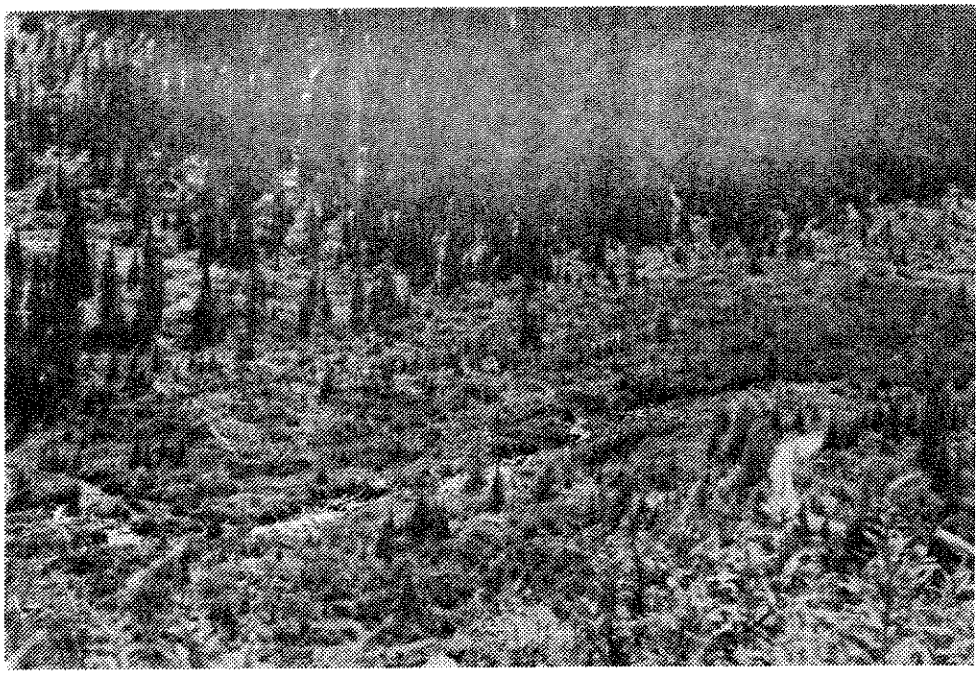


Photo 9. Clearcut near an inlet to Jim Lake. Note that no buffer strip was left.

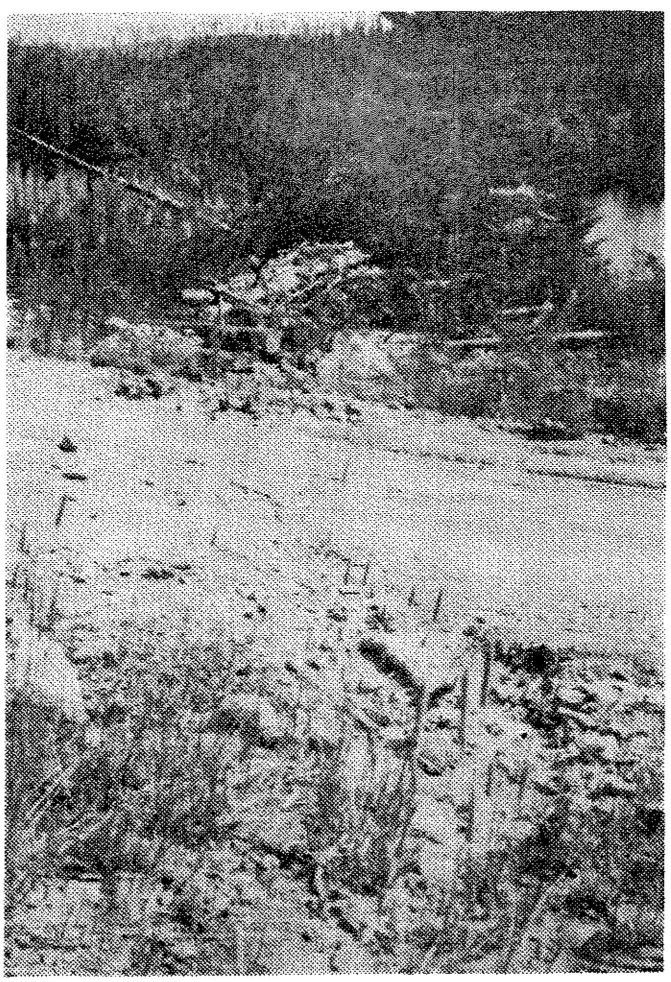


Photo 10. Gullying of road fill material near the inlet to Jim Lake.

Madison River. The Gazelle Creek watershed contains lodgepole pine on the north-facing slopes, aspen groves on the south-facing slopes and Engelmann spruce in the creek bottoms. Timber harvest has occurred periodically over the last twenty years.

We visited the Gazelle Creek watershed on August 12, 1987. We did not observe road related sediment problems. Some harvest units were large but steeper slopes had been avoided and there were large buffer zones along the streams. Lodgepole regeneration had been augmented with seedlings in some areas (Photo 11).

The stream reach inventory and channel stability rating was good to excellent (Photo 12). Small amounts of silt and sand were present due to cattle use of the riparian area channel but boulders and bedrocks comprised 60% of the stream bottom.

TRIBUTARIES TO LAKE MARY RONAN

Lake Mary Ronan lies in Flathead County, ten miles west of Flathead Lake. There are several tributaries to the lake; including Hilburn, Freeland and Donaldson Creeks. The lake drains into Ronan Creek which joins Dayton Creek before emptying into Flathead Lake.

About 20% of Lake Mary Ronan's shoreline is owned by small private landowners. The remaining shoreline is owned by a private company which also owns more than three-quarters of the lake's watershed, including the majority of the watersheds

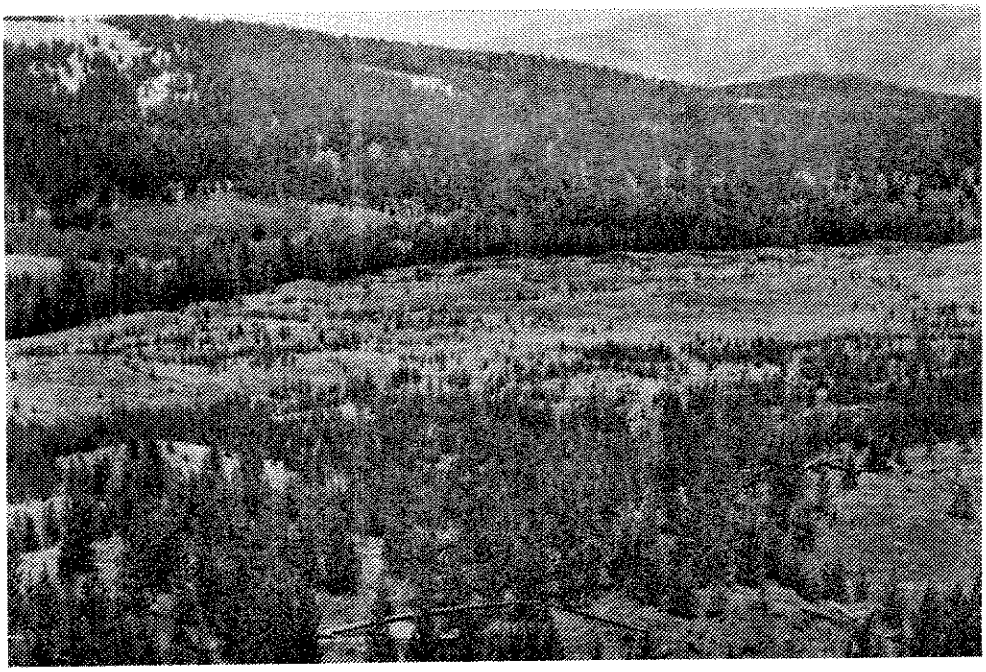


Photo 11. Seedling revegetation in large clearcut units along Gazelle Creek. Most of the trees on the slope leading to the creek have not been harvested.

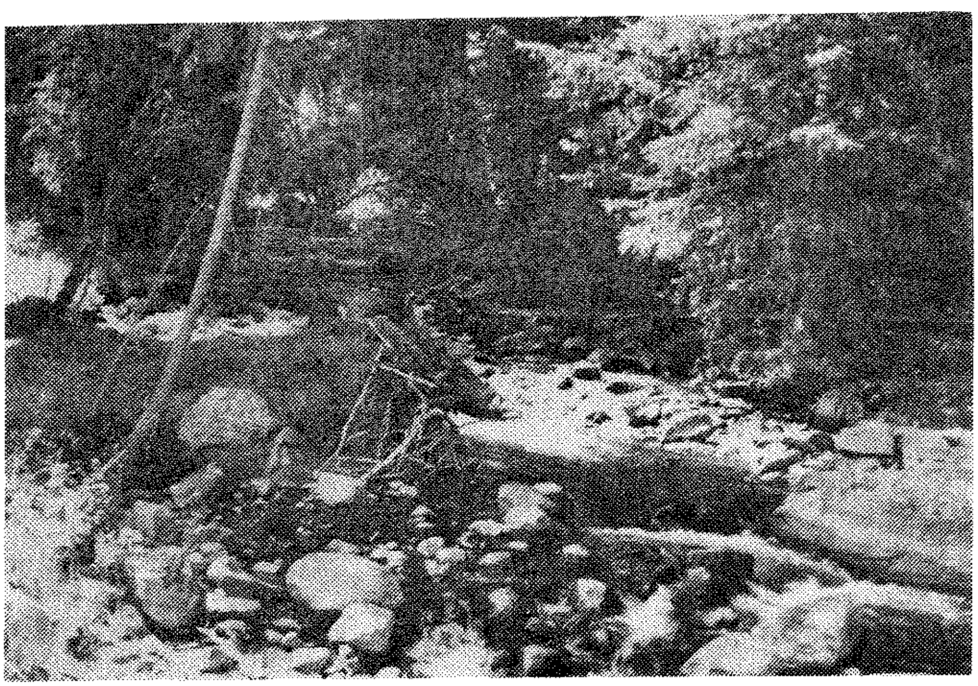


Photo 12. Stream channel of Gazelle Creek received a high stability rating.

of Hilburn, Freeland and Donaldson Creeks; these lands are managed for timber harvest. Lake Mary Ronan supports an excellent kokanee salmon fishery and is the primary source of kokanee salmon eggs used in the Department of Fish, Wildlife and Parks salmon hatchery and planting program. Timber harvest began approximately five years ago and clearcutting is the method of harvest. Approximately 15-20% of the entire watershed has been harvested to date.

We visited Lake Mary Ronan and the Hilburn and Freeland Creek drainages on July 30, 1987. The upper portions of the Freeland Creek drainage were recently winter logged. The roads appeared to be well constructed and there was no evidence of road-related sediment reaching water courses. Most skid trails had been properly placed and water-barred to prevent concentrating runoff on the road (Photo 13).

Stream stability was judged to be good for reaches examined above, and below the harvest area along Freeland Creek. The percentage of sand and silt increased from above the harvest area to below; riparian grazing occurring along the stream probably contributed to the increase (Photo 14). No buffer strip was left along a short reach of either Freeland Creek or on intermittent tributary that flows into Freeland Creek (Photo 15) probably increasing the temperature of the stream. Leaving a buffer strip along the stream would have minimized the chances for adverse impacts.

The Department of Fish, Wildlife and Parks is currently monitoring egg viability on Freeland and Hilburn Creeks which support a spawning run of rainbow

Photo 13. A well designed skid trail in the Freeland Creek drainage. The skid trail has been water-barred and debris piled to prevent runoff from being channeled to the road below.

Photo 14. Timber cutting unit along Freeland Creek where no buffer strip was left.

Photo 15. Fine, silty material in Freeland Creek below a clear-cut reach. This area also receives heavy cattle use.

trout from Lake Mary Ronan. It will be several years before the study is completed.

LOLO CREEK

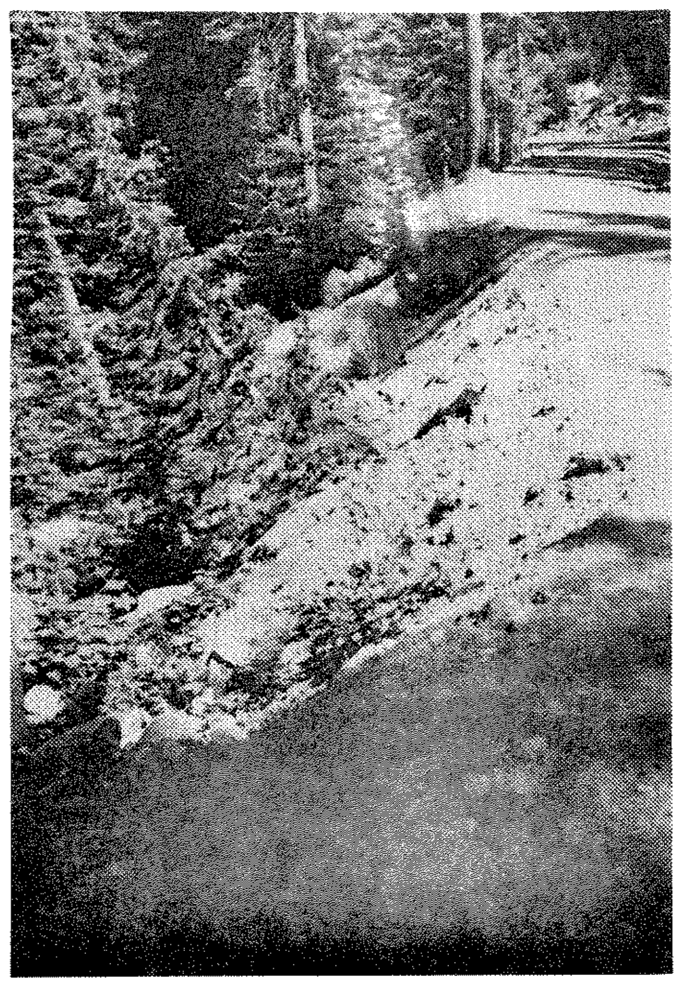
The Upper Lolo Creek watershed drains the area north of Lolo Pass near the Montana-Idaho divide. Major tributaries include the East and West Forks of Lolo Creek, East Fork of Lost Park Creek, Lee Creek, Granite Creek and North Fork of Granite Creek. Land ownership patterns are intermingled; the Lolo National Forest manages 50% of the area (alternate sections) and two private companies manage 40% and 10%, respectively. Timber harvest activities began in the 1950's; lodgepole pine is the primary commercial species.

We visited this area on July 24, 1987. We observed several poorly constructed roads, particularly in the upper reaches of the East Fork of Lolo Creek (Sec. 30) where poor drainage resulted in a significant amount of sediment entering the creek (Photos 16 and 17). Easily erodable granitic material had been used to fill the roadbed which formed the upper banks of the creek. Sedimentation to the stream could have been minimized by judicious use of culverts and water bars, use of less erodable fill material, timely revegetation of cut and fill slopes, and locating the road away from the stream.

Poorly designed skid trails were another source of sediment to Lolo Creek. Skid trails in some locations (Sec. 1 and 7, T11N, R23W) had been placed on 70-80%

Photo 16. Sediment collecting below a culvert in the East Fork of Lolo Creek.

Photo 17. Unvegetated fill slope on a road adjacent to the East Fork of Lolo Creek; the road is about 15 feet from the stream.



slopes resulting in gullying of up to four feet. Additionally, a plugged culvert in Section 1 was routing runoff across the road, causing roadbed erosion and increasing sediment transport to an ephemeral drainage (Photo 16).

In contrast, roads located on Forest Service land were properly drained, were located further from stream channels, and slash filter windrows had been employed to prevent sediment from reaching the creek (Photo 19). Road closures had also been used to reduce sedimentation.

Between 1979 and 1983, bedload and channel bottom sediment increased 2-3 fold in the Lost Park and Lee Creek drainages (Rosquist 1987). These measurable increases in bedload and sediment combined with the overall volume and pace of timber harvest in the area prompted the Lolo National Forest District Supervisor to place a 10 year moratorium on Forest Service logging in the upper watershed effective June 1987. The decision has been controversial.

MERIDIAN CREEK

Meridian Creek is a tributary of the West Fork of the Madison River. It drains approximately 4 mi^2 of the Beaverhead Forest northwest of Hoodoo Pass.

Timber was harvested over approximately 20% of the Meridian Creek watershed during the early to mid-70's. Soils in the drainage are fine-textured and

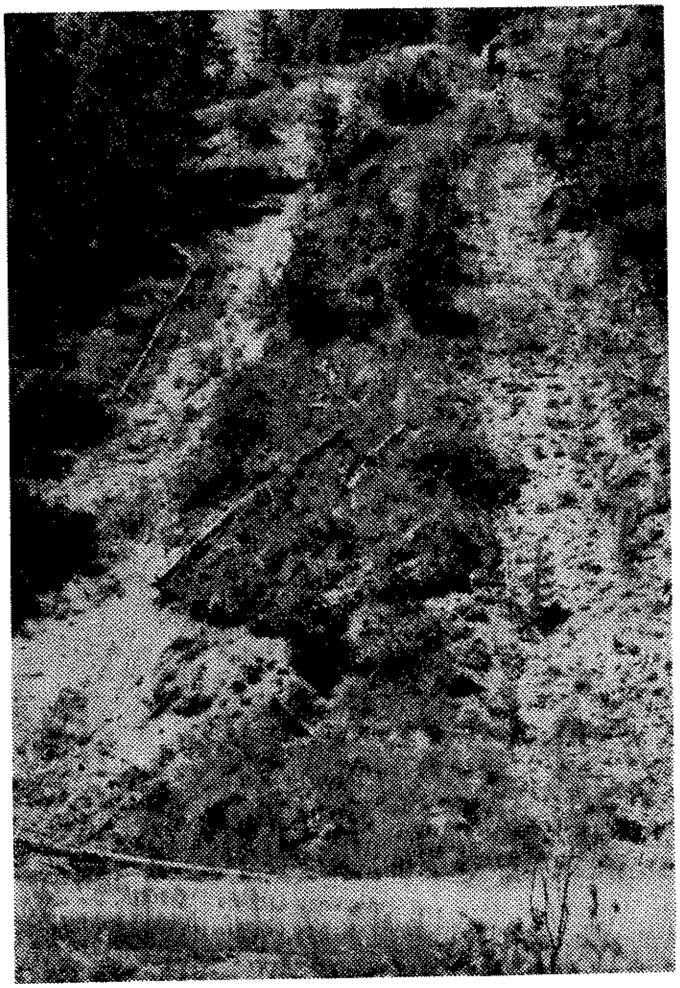


Photo 18. Eroding skid trails in the Grainte Creek drainage.

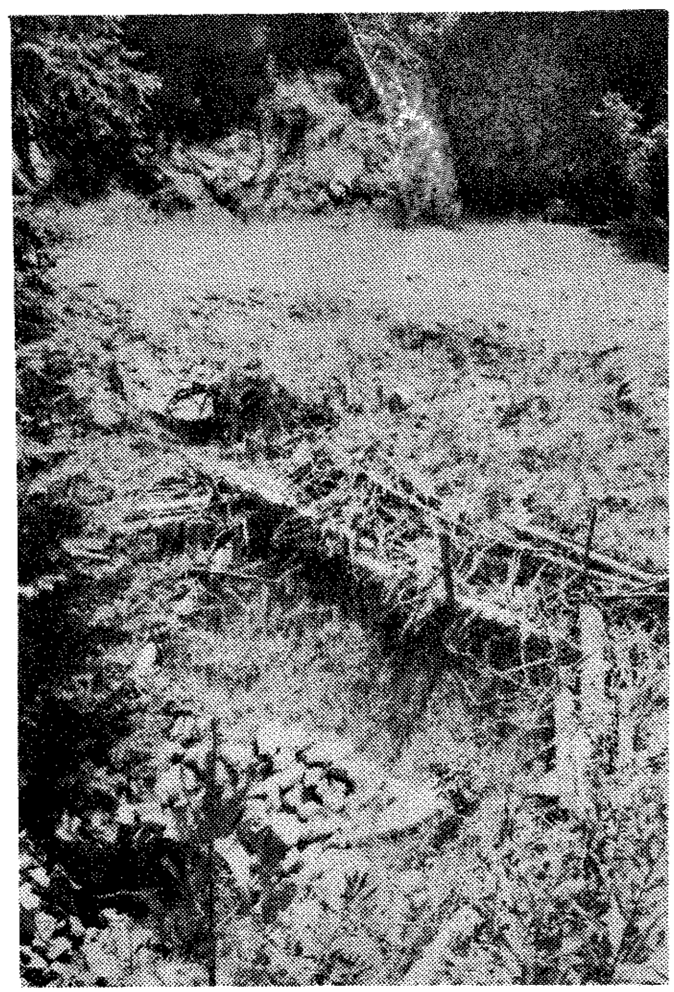


Photo 19. A well constructed road that includes an armored culvert, vegetated fill slopes, and slash filter windrows at the stream crossing.

highly erodible. Several mass failures are present on the West Fork below Meridian Creek (Photo 20).

We visited the Meridian Creek watershed on August 12, 1987. An old logging road accessing the Meridian Creek drainage was gated at Hoodoo Pass. Most of the road was in excellent condition and had been reseeded to decrease erosion, however, some gullying was present about two miles below Hoodoo Pass. A buffer strip approximately 20 feet wide had been left along the stream. Channel stability was rated good rather than excellent because of potential for mass wasting.

The channel bottom was comprised of 30% sand and silt which may have been augmented by cattle usage. Logging and road building did not appear to have contributed to degradation of the stream reach that we evaluated. Cutting units were designed in such a manner as to blend into the landscape giving the harvested area a more natural look (Photo 21).

MONARCH CREEK

Monarch Creek drains the west flank of Bison Mountain on the Helena National Forest. It joins Ontario Creek which eventually joins the Little Blackfoot River. The upper reaches of Monarch Creek are predominently lodgepole pine forest. Some lower reaches flow through wet meadow areas where considerable beaver activity has occurred.

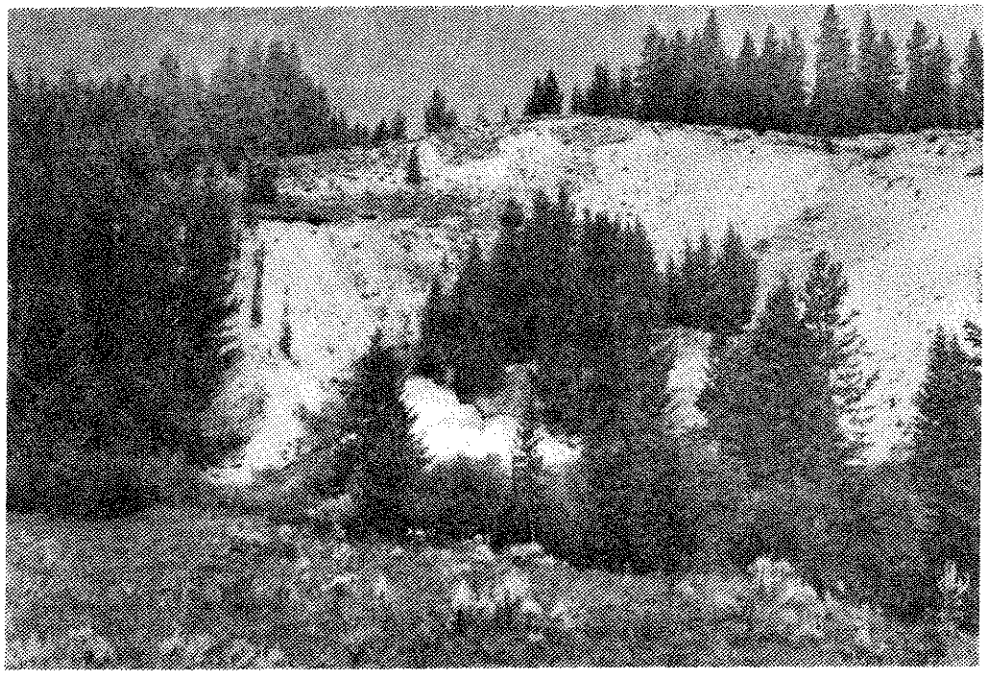


Photo 20. Mass failures adjacent to the West Fork of the Madison River.

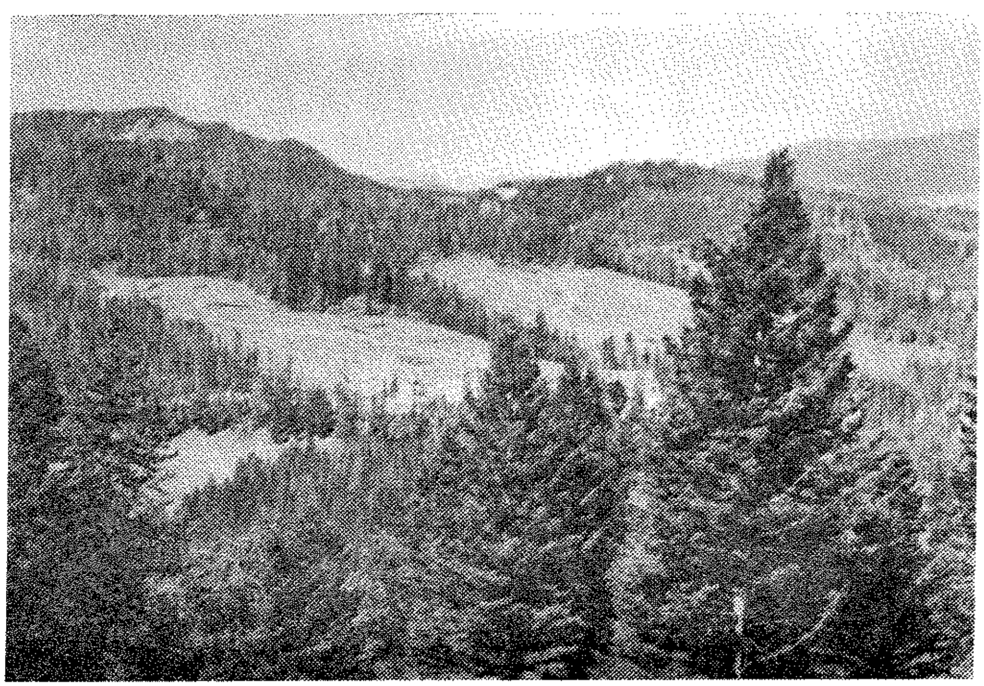


Photo 21. Well landscaped clearcuts in the Meridian Creek drainage.

We examined two reaches of Monarch Creek on September 14, 1987. The reaches lie in the northern and southern portions, respectively, of Section 30 (T8N, R6W). In the upper reach, bottom materials were stable and culverts were well armored and designed to allow fish passage (Photo 22). Stream stability was judged to be good (60).

The second reach examined was located in steep terrain on erodable soils. Some erosion of steep cut (80-90%) and fill (60-70%) slopes was occurring along the access road beside the stream (Photo 23). Additionally, portions of the road lacked proper drainage and some runoff was channeled down the road. The bottom of the stream contained a higher percentage of fine sediments than upstream reaches probably due to erosion from the road. Stream stability was judged to be fair (81).

Sedimentation to the stream caused by road construction could have been minimized by seeding the cut and fill slopes and by use of slash filter windrows.

MULE, PICKFOOT, AND ATLANTA CREEKS

Atlanta, Mule and Pickfoot Creeks lie north of Camas Ridge on the east slope of the Big Belt Mountains on the Helena National Forest. In 1986, 9.2 miles of new road were constructed to access timber stands. The new road begins at the National Forest boundary and runs north-south along the front range. Lodgepole pine is the primary commercial timber species.

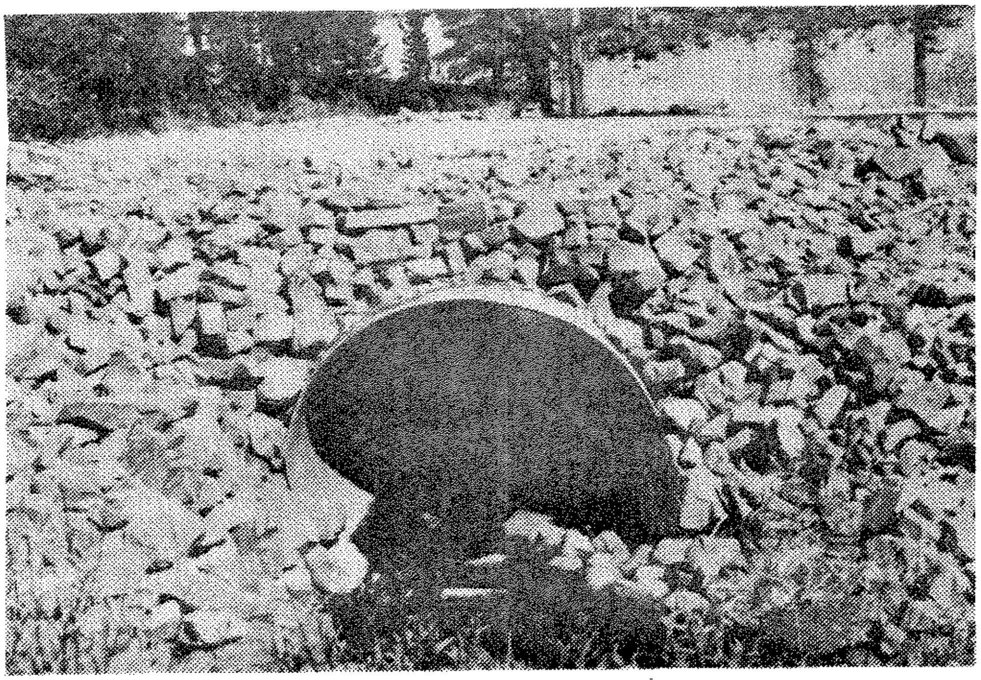


Photo 22. Culvert in Monarch Creek.

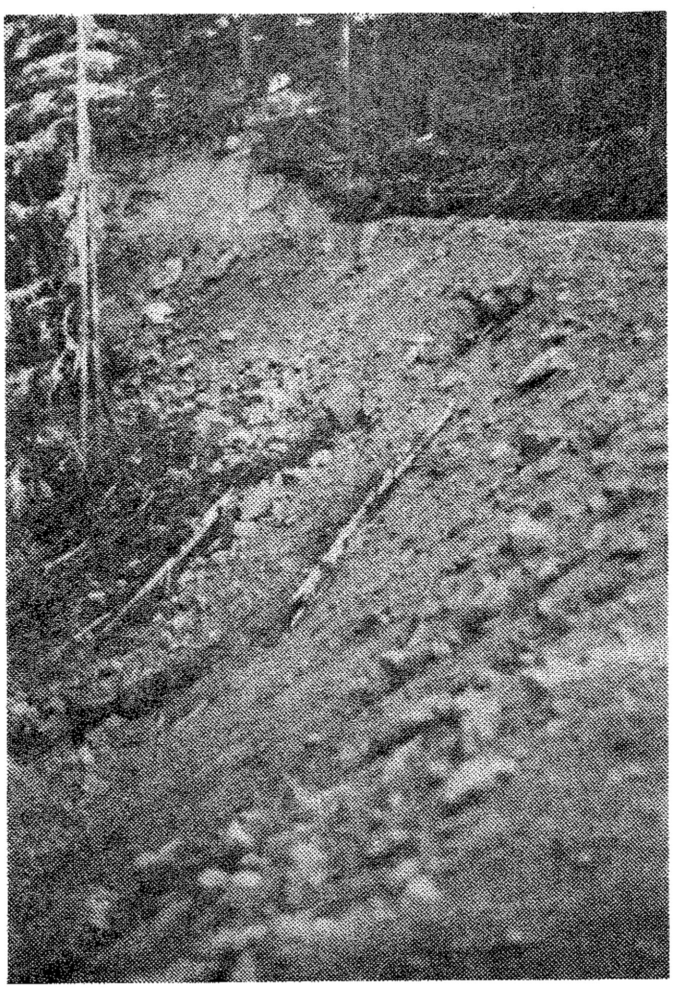


Photo 23. Exposed fill slope adjacent to Monarch Creek.

We visited these watersheds on August 13, 1987 and rated stream stability on reaches of Atlanta, Mule, and Pickfoot Creek both upstream and downstream of road culverts. Portions of the new road have unusually steep cut and fill slopes that appear to have high erosion potential. Seeding had occurred but was unsuccessful in many of the steeper areas. Unstable fill slopes were located above some culverts.

Mule Creek does not appear to have been impacted by the road. Surrounding land slopes and upper bank slopes average 5%; revegetation of cut and fill slopes near the stream has been successful. The road culvert outlet is adequately rip-rapped and the channel has a cobble bottom. Stream stability was rated excellent both above and below the road culvert.

Pickfoot Creek is a high gradient stream with a channel bottom composed primarily of angular, metamorphic sedimentary rock. Steep, unstable fill slopes are present near the creek and appear to have the potential for erosion (Photo 24). However, streambank stability is presently rated good to excellent both above and below the road culvert.

Of the three creeks traversed by the road, Atlanta Creek is judged to be the most likely to suffer impacts. Out-slope drainage off of the road into Atlanta Creek could produce sediment during wet periods (Photo 25). Stream stability was rated slightly poorer below the road than above. Some sediment deposition in pools and in backwater areas had occurred below the culvert outlet. Potential problems could have been minimized by locating the road further from the stream, and by timely reseeding or other slope stabilization methods.

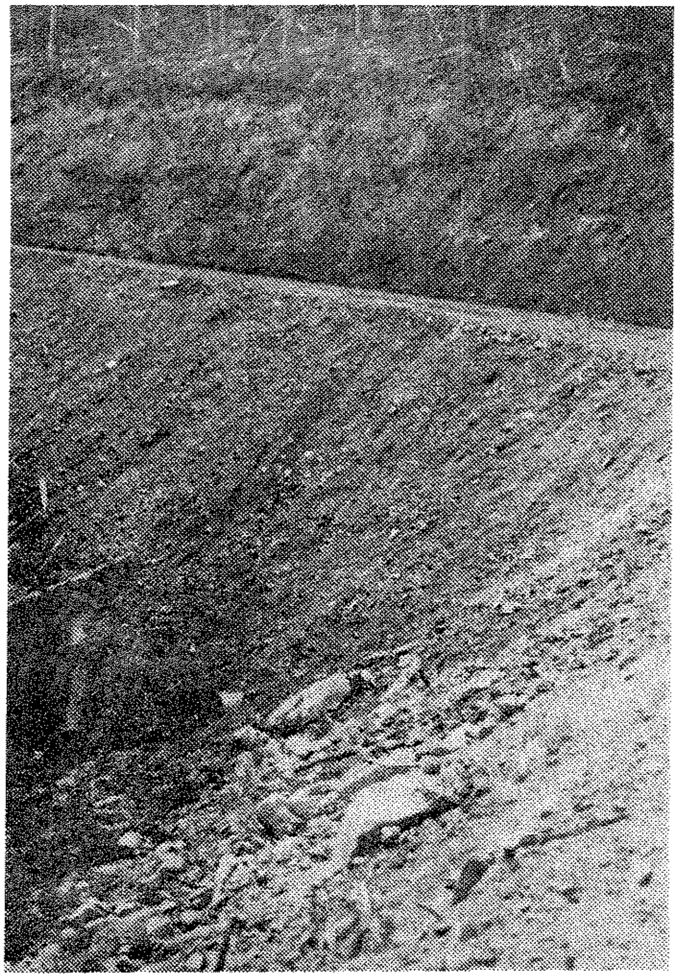


Photo 24. Steep, unvegetated, and unstable cut and fill slopes along Pickfoot Creek.

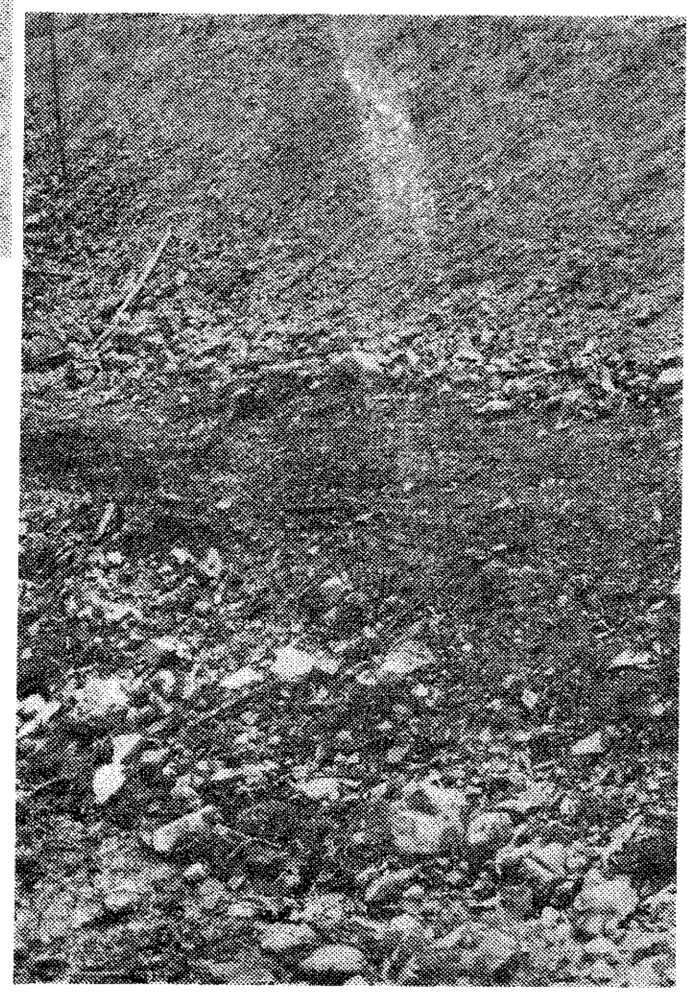


Photo 25. Erosion of roadside material in the Atlanta Creek drainage. Note nearness of the road to the stream.

NORTH FORK OF SPOTTED DOG CREEK

The North Fork of Spotted Dog Creek originates on the Helena National Forest southeast of Avon (T8N, R7W, Section 6 and 7). After several miles, the North Fork leaves the National Forest and flows across private land before joining the Middle, South and West Forks and eventually the Little Blackfoot River at Avon. Lodgepole pine is the primary commercial timber species in the upper watershed. Harvest along the upper reaches of the North Fork occurred in the mid-70's. Subsequent to timber harvest, a fire in the area followed by heavy precipitation (during 1981) resulted in a massive landslide (Photo 26). The slide originated immediately below one of the road cuts.

We visited the upper reaches of the North Fork on August 11, 1987. The roads were in satisfactory condition and some revegetation was occurring. We conducted the stream reach inventory and channel stability evaluation above, at, and below where the landslide entered the stream. Channel stability was rated "good" upstream of the landslide (Photo 27) but deteriorated downstream (Photo 28) due to increased sediment, loose bottom materials, channel widening, and a marked change in distribution of bottom materials. Fine sand, silt and gravels comprised approximately 60% of the bottom materials. Further downstream (about 0.75 miles) channel stability remained deteriorated due to increased sediment, channel widening, and a marked shift in size distribution of bottom materials. Downstream of this reach cattle use had further deteriorated the stream. Timber harvest and roading appeared to have contributed to the landslide. Smaller cutting units, locating harvest roads away from the drainage portion of the hillside, and leaving a buffer strip along the gully may have prevented the problem.

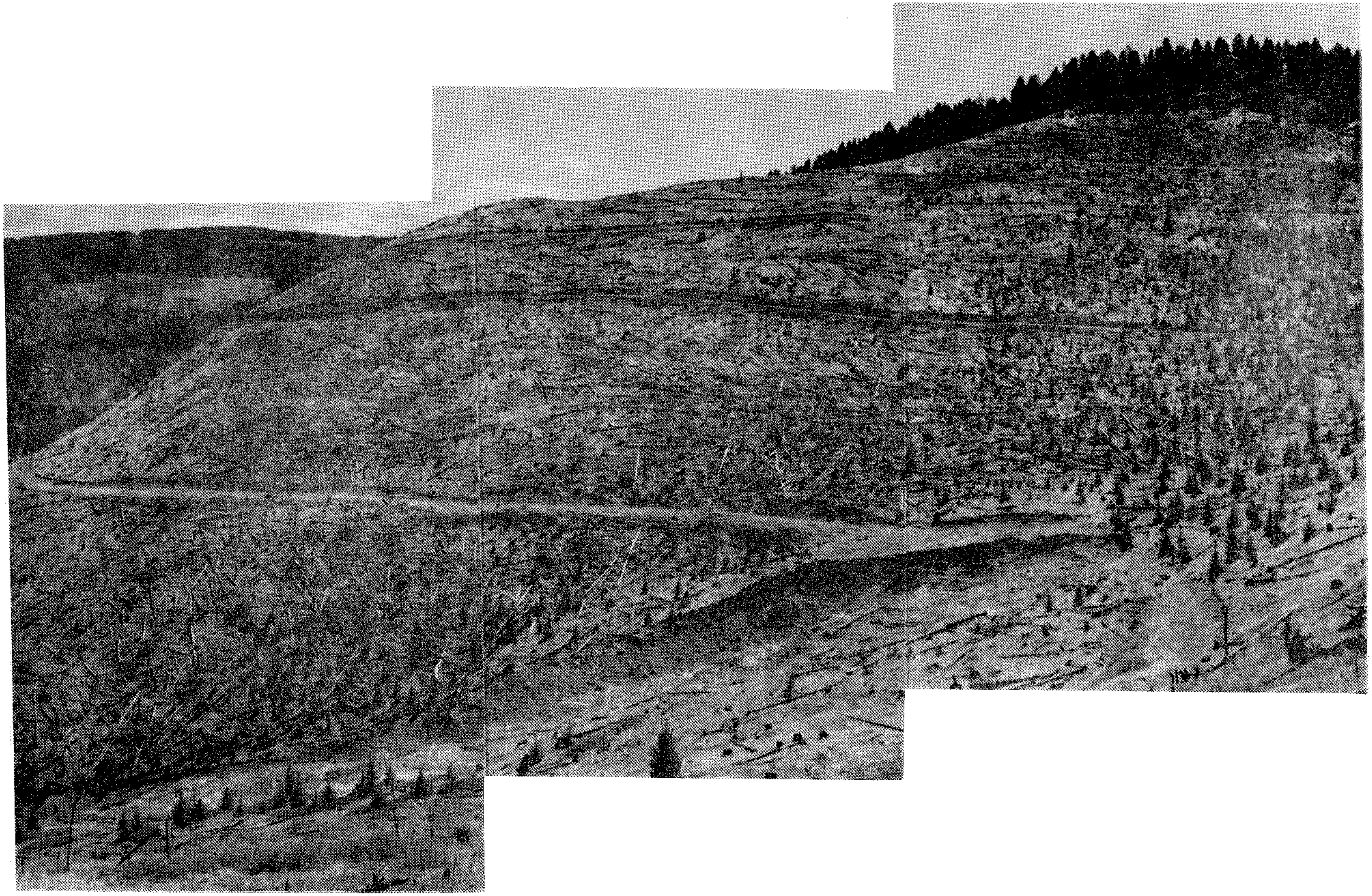


Photo 26. Large landslide in a clearcut in the Spotted Dog Creek drainage. Note that the landslide originated in a draw near a road cut.

Photo 27. Spotted Dog Creek upstream of the landslide. This reach received a good stream stability rating.

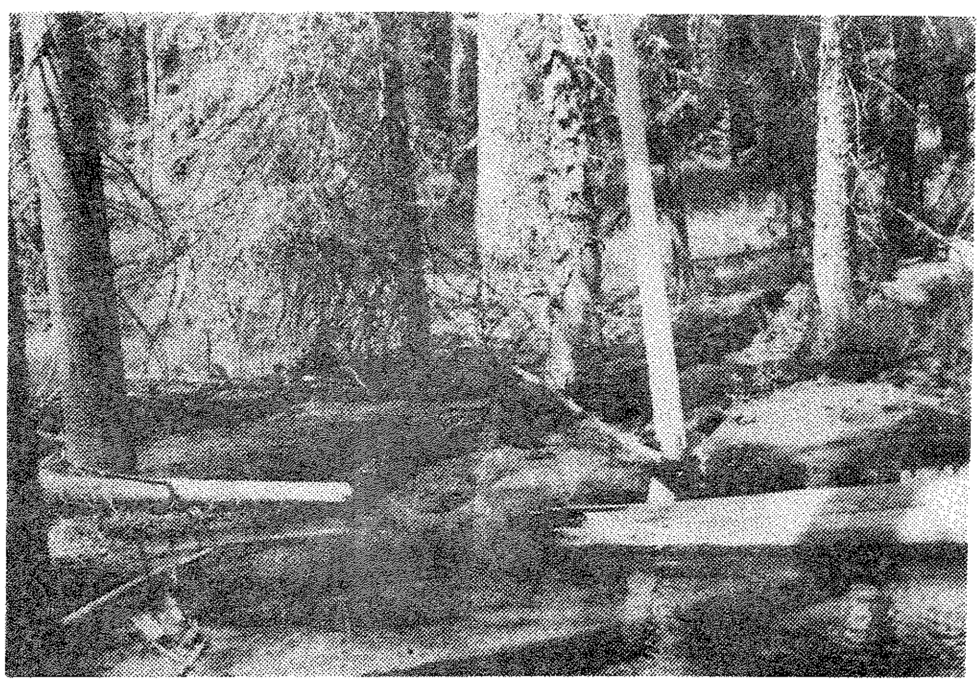


Photo 28. Spotted Dog Creek downstream of the landslide. Note the widening of the channel and the high percentage of fines.

PORTAL CREEK

Portal Creek drains the area west of Windy Pass on the Gallatin Range Divide and is a tributary to the Gallatin River. The entire watershed lies within the Gallatin National Forest. Lodgepole pine, Engelmann spruce, and subalpine fir are the major tree species.

We visited the Portal Creek watershed on September 17, 1987. Timber harvest has occurred periodically over the past thirty years (Photo 29). Harvest has occurred on steep slopes and at high elevations. Some older harvest units extended to the banks of the creek. Regeneration has not begun in some cutting units and significant beetle kill is present on some of the upper slopes. Stream bank stability of Portal Creek was judged to be good (65). We observed a modest amount of debris in the channel, some raw banks, and evidence of sloughing (Photo 30). Considerable bedload movement was evident behind debris jams. The changes in the stream channel that we observed may have been due to a recent flood. It was not apparent that logging activities were responsible for any of the changes in the stream.

SICKLER CREEK

Sickler Creek drains Granger Draw west of Kalispell. Small isolated pockets of Flathead National Forest Service land are interspersed throughout the drainage but the majority of the area is privately owned and managed for timber harvest. Lodgepole pine is the primary timber species with some yellow pine. Soil in the area is very fine-textured and easily eroded.

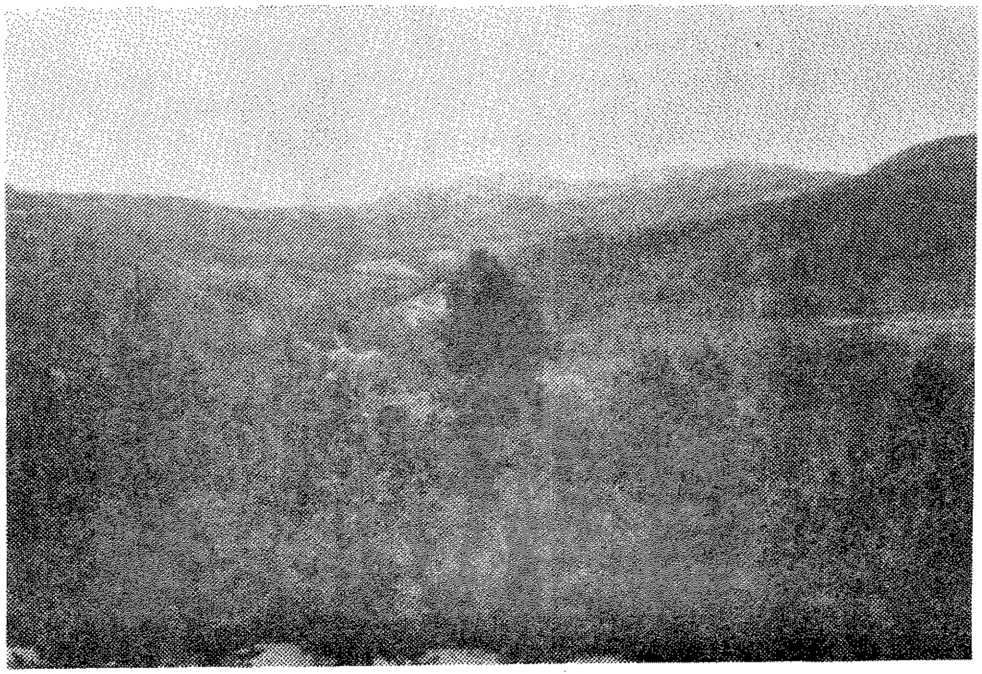


Photo 29. Clearcuts near the head of the Portal Creek drainage.

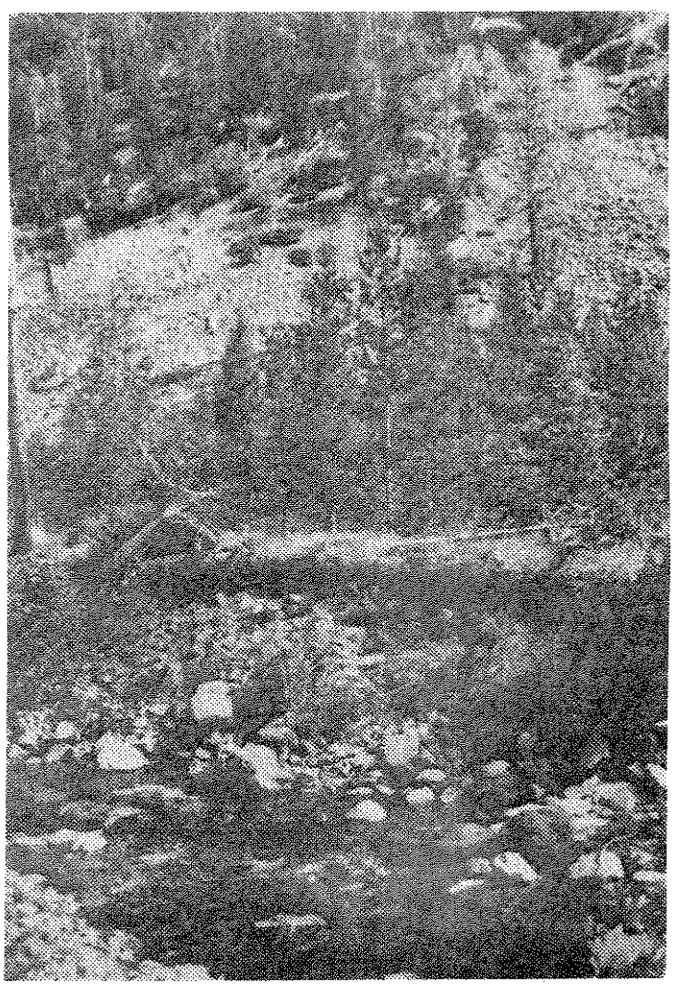


Photo 30. Streambanks of Portal Creek showing evidence of sloughing.

We visited Sickler Creek on September 22, 1987. Timber had been recently harvested to the banks of the stream and some slash was present in the channel (Photo 31). Heavy cattle use in the riparian pastures have resulted in trampled banks, widened stream channel, and heavy deposition of sediment. Some banks have been undercut by as much as 12-24 inches and riparian shrubs have been grazed heavily. Stream stability was rated poor (115) due to the fine-textured bottom materials.

Much of the stream damage could have been prevented by leaving an adequate buffer strip adjacent to the stream and by limiting cattle access to the area. This example illustrates that land management activities that follow (or precede) timber harvest can aggravate problems caused by logging.

SOUTH FORK OF POORMAN'S CREEK

The South Fork of Poorman's Creek drains the area southwest of Granite Butte (Sec. 27, T13N, R7W) on the Helena National Forest. Three first order tributaries converge at the head of the drainage to form the South Fork, which joins Poorman's Creek before it empties into the Blackfoot River. We visited the easternmost headwater tributary on July 22, 1987. The majority of this tributary, about one-half mile, traverses private land; access to the private property is provided by a Helena National Forest road.

The private parcel was recently logged for lodgepole pine and Douglas fir. Harvest methods included clearcut and shelterwood; a narrow buffer strip was

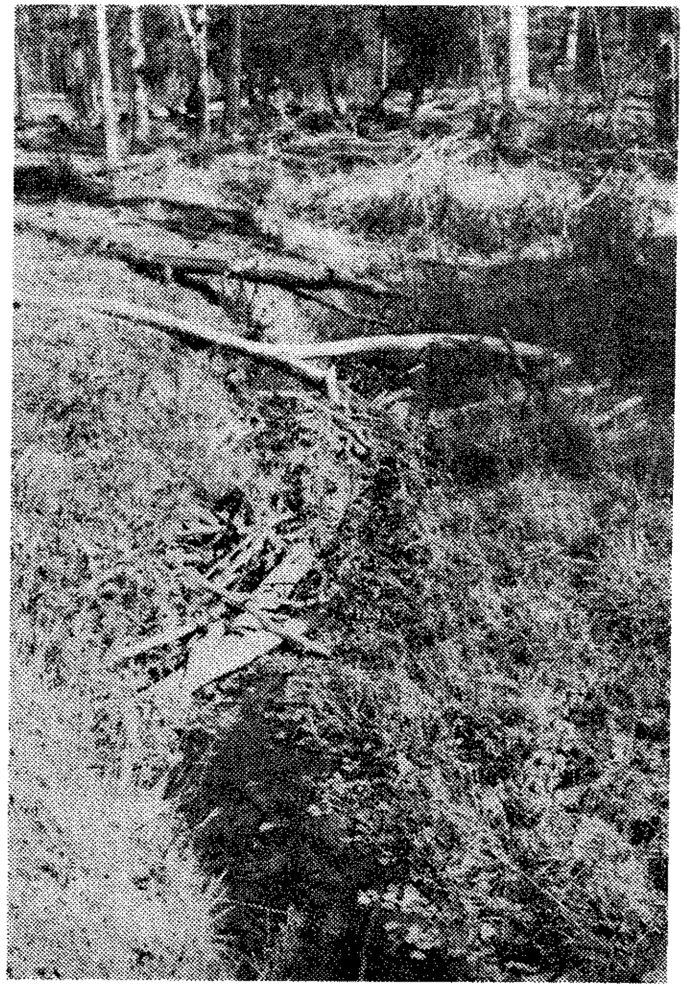


Photo 31. Sediment deposition and slash in Sickler Creek caused by cattle grazing and recent logging.

left along the stream channel. Best management practices were not applied in the selection of skid trails and yarding locations. Skidding and yarding occurred in an intermittent reach of the stream channel which becomes perennial 30 yards below the harvested area (Photos 32 and 33). The channel has been severely damaged where it passes through the private land; cattle grazing in the channel has aggravated the situation and placer tailings downstream of the logged area provide an additional source of sediment.

At the time of our visit, burned slash was found piled at the inlet and the outlet ends of the culvert which extends under the access road (Photo 34) and in the stream (Photo 35). Pooling of sediment below the culvert provides evidence that sediment is entering the drainage.

It is difficult to determine how much of the sediment originates from timber harvest, grazing, or mining; all three sources appear to be contributing sediment. More judicious selection of skid trail and yarding sites, disposal of slash away from the stream channel, and better maintenance of road culverts would have minimized timber harvest-related sedimentation.

SQUAW CREEK

Squaw Creek lies on the west side of the Gallatin Range and joins the Gallatin River near Storm Castle Peak. Land ownership in the upper reaches of the watershed is split between the Gallatin National Forest and a private timber company. The lower half of the watershed is owned entirely by the Forest Service. Lodgepole pine is the dominant timber species, but Englemann spruce

Photo 32. Skid trails located in an intermittent tributary to the South Fork of Poorman's Creek.

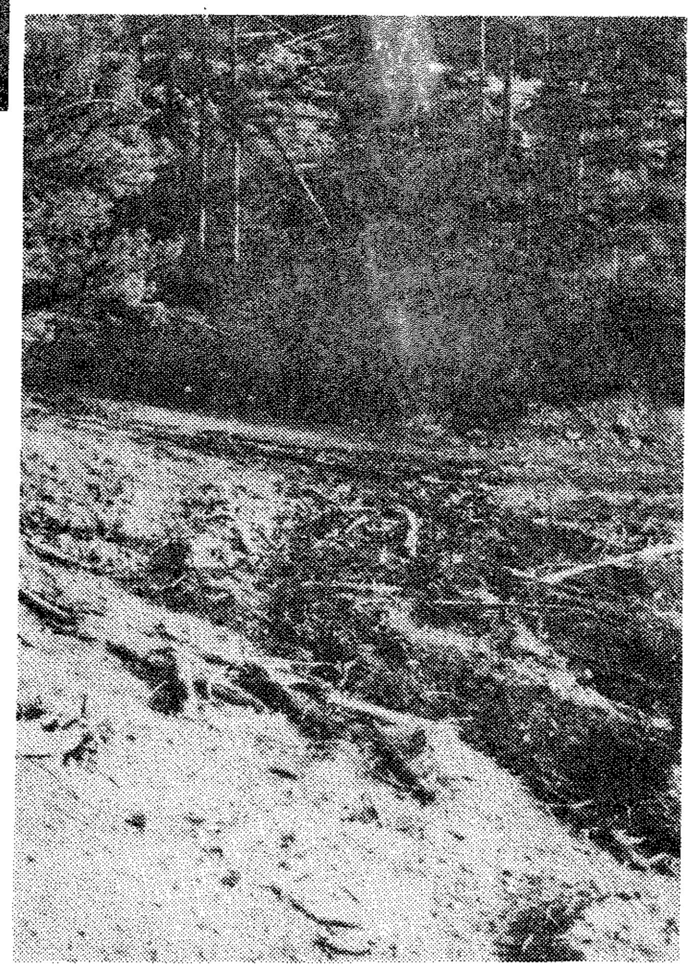


Photo 33. Road crossing an itermittent tributary to the South Fork of Poorman's Creek.

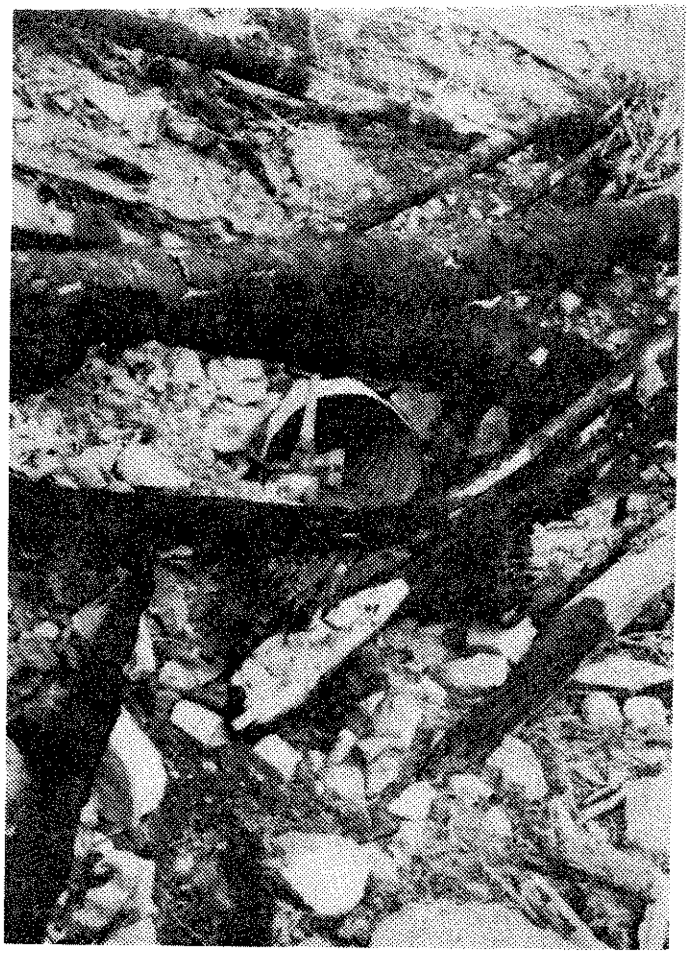


Photo 34. Slash disposal below a culvert in an intermittent tributary to the South Fork of Poorman's Creek.

Photo 35. Slash disposal in the channel of an intermittent tributary to Poorman's Creek.

and subalpine fir are also present. Soils are of both volcanic and sedimentary origins.

We visited the Squaw Creek drainage on September 17, 1987. Portions of the watershed have been periodically clearcut since the 1950's; revegetation has been slow. We conducted stream channel evaluations in three reaches including an area upstream of logging activities at Butte Meadows. Even in the absence of logging, the uppermost reach exhibited signs of excessive stream flows, including evidence of braiding, undercut banks (with root mat overhangs), and a marked shift in the size and stability of bottom materials (Photo 36). Stream stability was judged to be only fair (113).

Reaches downstream of logged areas near the confluences of Orchid Creek and Lime Creek were judged to be more stable, rating 101 and 91, respectively (Photo 37). There appeared to be less bedload movement and banks were in better condition. The road approaches the creek in some places and undoubtedly contributes some sediment. However, neither the road nor logging practices appeared to be important factors in the drainage.

SULLIVAN CREEK

Sullivan Creek originates in the northeast corner of the Anaconda Pintlar Range in Deerlodge County and is a tributary to Deep Creek which flows into the Big Hole River. The upper reaches lie within the Deerlodge National Forest and the lower reaches in the Mt. Haggin Wildlife Management Area. Lodgepole pine is the primary commercial timber species and covers the majority of the watershed.

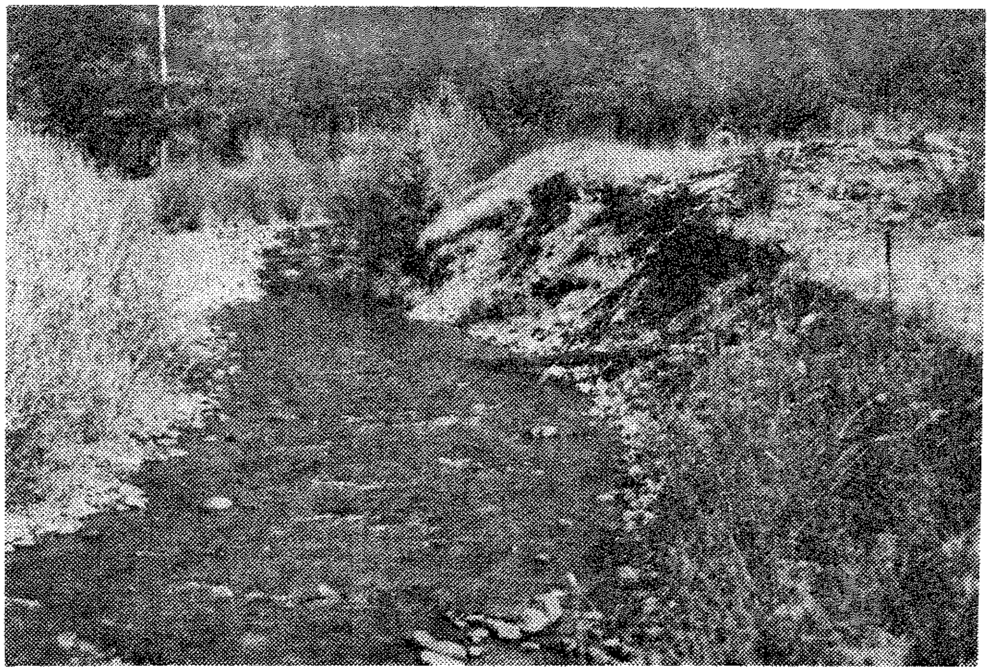


Photo 36. Portions of the Squaw Creek channel upstream of the logged area showed some signs of instability.

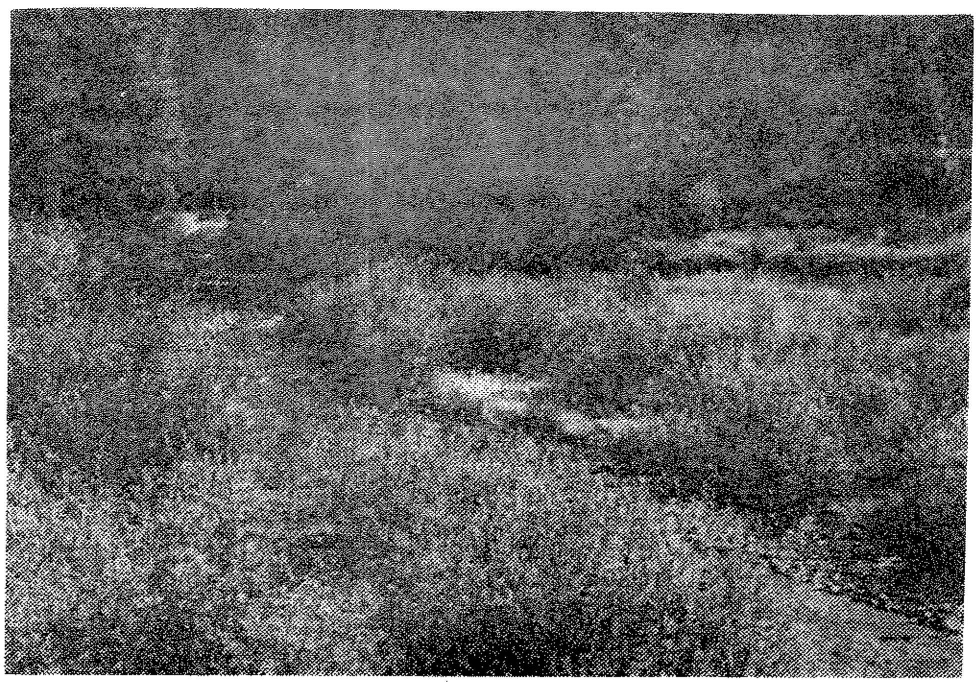


Photo 37. The Squaw Creek channel downstream of the logged area was in good condition.

Timber harvest began in 1968 following donation of the Mule Creek Ranch to the Forest Service and to the Montana Department of Fish, Wildlife and Parks. The donation agreement included a provision whereby a private company is authorized to harvest timber in the area until 1993. Since the agreement was reached, approximately 40% of the watershed has been clearcut.

We visited the Sullivan Creek drainage on July 16, 1987. The majority of logging roads that we observed were in satisfactory condition. Channel stability in an undisturbed reach of Seymour Creek was compared with a disturbed reach of Sullivan Creek. The Seymour Creek reach rated excellent (Photo 38) while channel stability in Sullivan Creek was considerably poorer in its upper reaches and even further deteriorated in the lower reaches. We observed increasing channel width, bedload movement, undercut banks and fresh debris in the stream (Photo 39). These changes are believed to be a result of the increased runoff and water yield caused by large clearcuts in the upper Sullivan Creek watershed (Sec. 13, 14, 19, 23 and 24). The effects of past and ongoing logging practices in this area have recently been summarized by Bengeyfield (1986). Some rehabilitation measures have been taken.

A small ephemeral subdrainage to Seymour Creek has also deteriorated significantly. Topsoil has been lost and the subdrainage has eroded extensively due to increased water yield (Bengeyfield 1986). Reducing the number and size of clearcuts probably would have prevented damage to both of those streams.

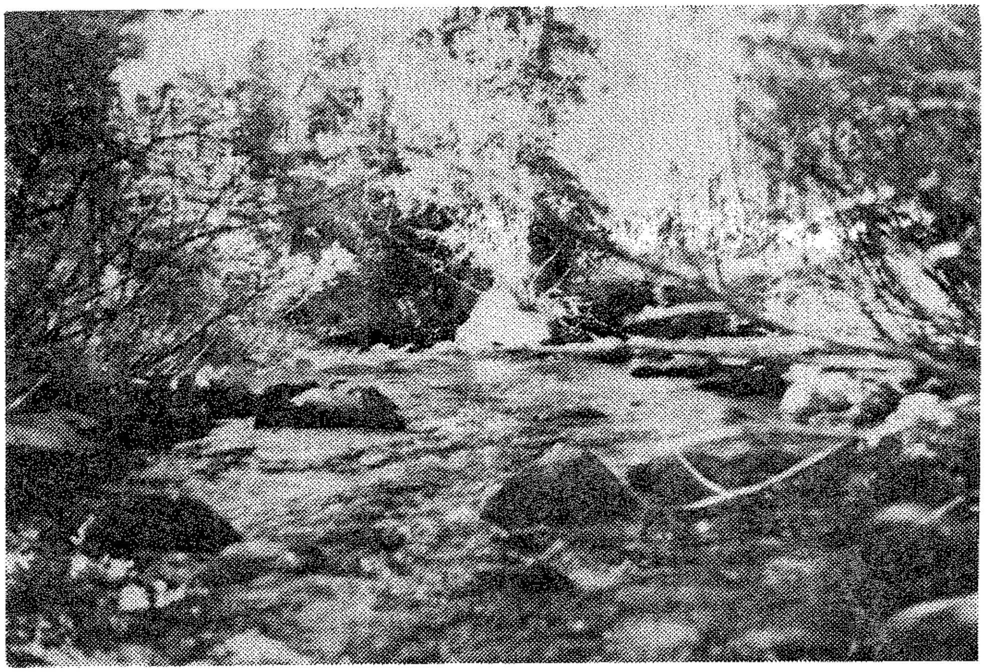


Photo 38. An undisturbed reach of Seymour Creek that is in excellent condition.

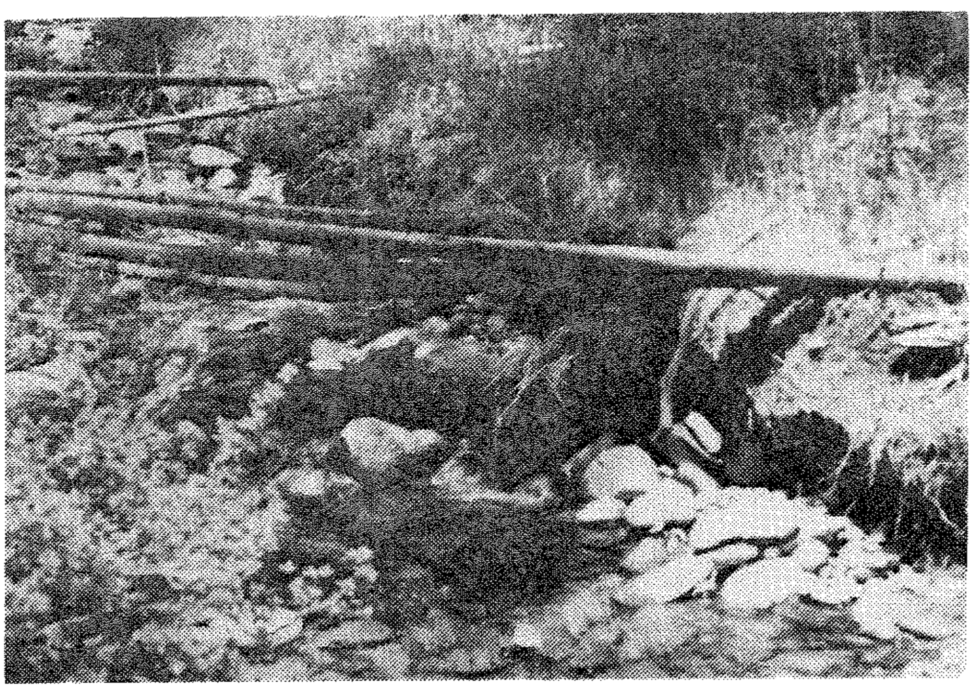


Photo 39. The lower reaches of Sullivan Creek where we observed signs of bedload movement, undercut banks, presence of fresh debris, and a shift in size distribution of bottom materials.

TAMARACK CREEK

Tamarack Creek enters the Bitterroot River about two miles downstream of Hubbart Reservoir. Most of the surrounding lands are privately owned and are managed for timber production. Lodgepole pine is the predominant species, but yellow pine, larch and subalpine fir are also present. Soils are fine textured and easily erodable.

We visited the upper reaches of Tamarack Creek on September 22, 1987; areas adjacent to the creek had been recently clearcut. Skidding and use of heavy equipment had occurred within 20 feet of the creek. Almost no buffer zone had been retained in some locations; slash was present in the channel (Photo 40).

Tamarack Creek received a low stream stability rating (100), primarily due to the fine textured channel bottom materials. Damage to the stream channel had been aggravated due to trampling by livestock. Stream damage could have been minimized by leaving an adequate buffer strip along the stream and by limiting cattle access to the area.

TEN MILE CREEK

Ten Mile Creek originates on the Helena National Forest southwest of Helena. The creek is bordered by a narrow strip of patented mining claims. Granitic rocks of the Boulder Batholith form the parent material for the highly erodable soil in the area. Lodgepole pine is the primary commercial timber species present.

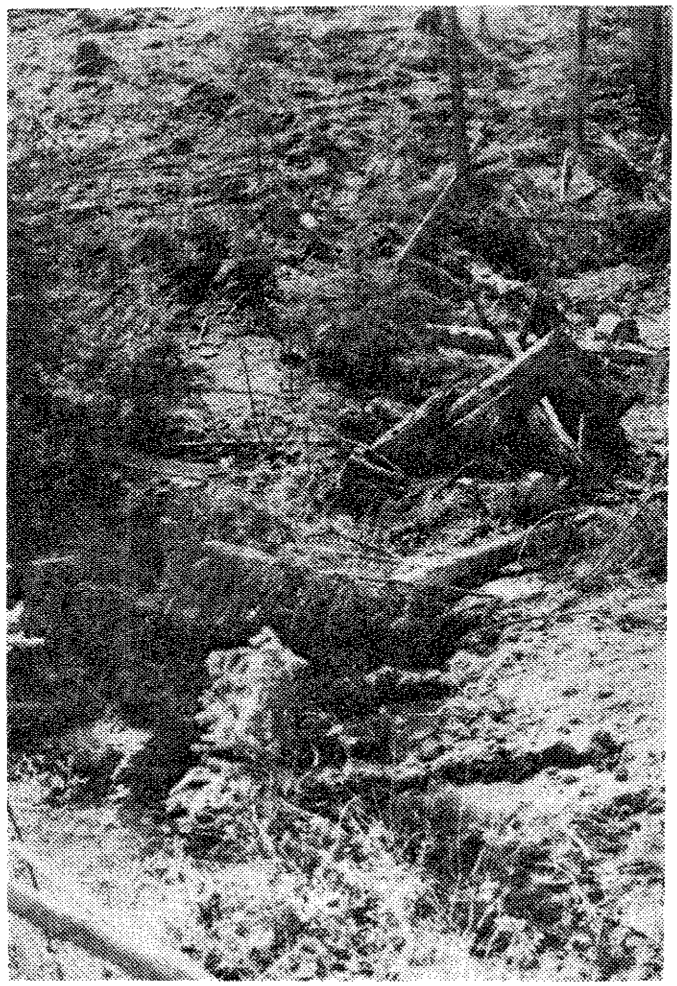


Photo 40. Logging along Tamarack Creek.

We visited the upper reaches of Ten Mile Creek (S½ Sec. 7, T8N, R5W) on July 23, 1987. About 100 acres of an old mining claim had been recently clearcut. Adjacent National Forest lands had not been harvested.

The 1.5 miles of access roads traversing the section lacked effective drainage structures; culverts were too few and sometimes inappropriately placed causing runoff to be channelled down the middle of the road (Photo 41) and eventually into Ten Mile Creek. Erosion of the road was severe and in one location the road had nearly been washed-out (Photo 42). Additionally, cut and fill slopes had not been seeded.

The stream stability rating for upper Ten Mile Creek was poor. The poor rating was partially due to recent flooding and placer mining. The installation and judicious placement of additional culverts and water bars and seeding of the cut and fill slopes would have minimized sedimentation.

Photo 41. Erosion of road material in the Ten Mile Creek drainage.

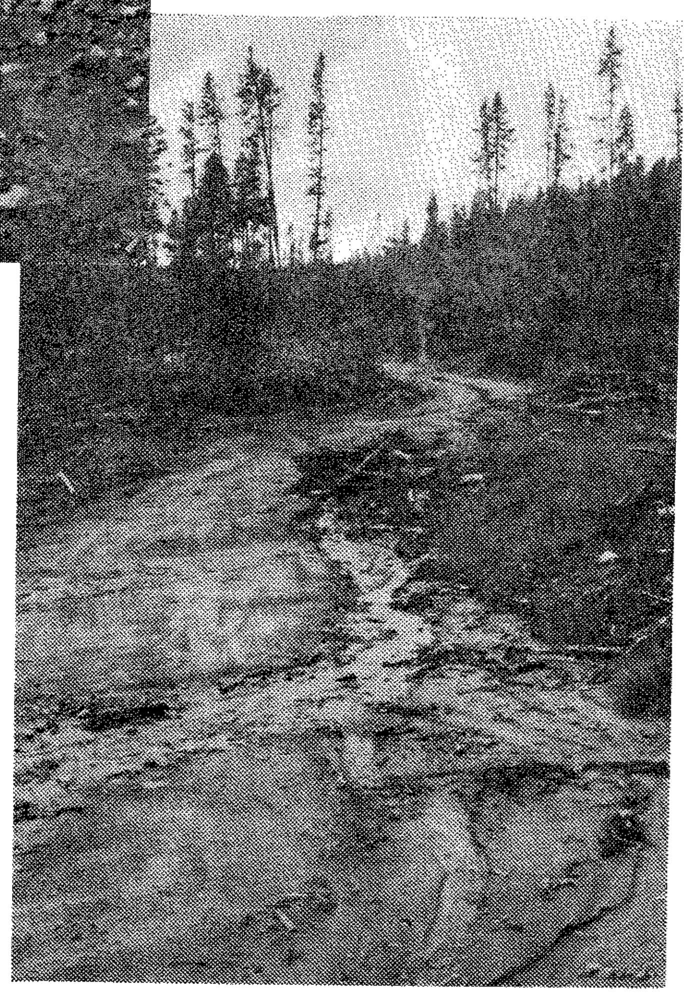


Photo 42. Gullying of road material into the Ten Mile Creek drainage.

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Pfankuch, D.J. 1978. Stream reach inventory and channel stability evaluation, a watershed management procedure. USDA, Forest Service, Northern Region. 26 p.

Rosquist, S. 1987. Personal communication.

GRP/vg-53b

APPENDIX A

Observer ____________________

Date ______________________

FIELD DATA FORM

I. Site Information

County ________________________ Township ________________________

Drainage ______________________ Range ___________________________

Stream Name ___________________ Section _________________________

Ownership: USFS _____________ Private Industrial _____________

State _____________ Small landowner ________________

Adjacent land ownership and present use: __________________________

____

____

Elev. mean/range: ____________________/____________________

Slope mean/range: ____________________/____________________

Aspect: ______________________________

Geologic parent material/soils type: ______________________________

Forest Habitat Type: ____

II. Description of Silvicultural Activities

Stage ( ): Road construction _____________ Harvest _____________

Slash management _____________ Reforestation ________

Harvest (acres per method):

Clearcut ______________________ Seed tree ____________

Individual selection _________ Shelterwood __________

Road Construction and design: _____________________________________

Skidding and Yarding Locations: ___________________________________

Shading (%): Pre-harvest ____________________

Post-harvest ____________________

Site preparation and reforestation (describe): ____________________

____

III. Description of the problem:

Evidence of change in stream morphology caused by excessive flow

____

____

Evidence of activity-caused sedimentation/erosion ____________________

____

____

Evidence of fresh debris in the stream ____________________

____

Evidence of damage to riparian areas/wetlands/aquatic environment

____

____

Length of the affected reach ____________________

____

Description of the probable cause(s) of the problem ____________________

____

____

Have BMP's been effectively applied? ____________________

____

____

Has water quality data been collected for this site before/after logging? ______________________________

Has a beneficial use of water been impaired? ______________

____

____

Other pertinent information ____________________

____

____

____

____

Photos:

(1) Impacted Area (2) Upstream Control

Stream Stability Evaluation

E _______ +G _______ +F _______ +P _______ = _______ Total Reach Score

Size Composition of Bottom Materials (Total to 100%)

1. Exposed bedrock . . . . . . ____%
2. Large boulders, 3'+ Dia. . . ____%
3. Small boulders, 1-3' . . . . ____%
4. Large rubble, 6"-12" . . . . ____%
5. Small rubble, 3"-6" . . . ____%
6. Coarse gravel, 1"-3" . . . ____%
7. Fine gravel, 0.1-1" . . . ____%
8. Sand, silt, clay, muck . . ____%

JS/vg-168a
Attachments