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Fish Creek

Adaptive Watershed Management in the 21st Century

A Case Study

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A three-mile long debris torrent swept through Third Creek, a tributary to Fish Creek, and washed out the main road paralleling Fish Creek during the winter of 1995-96.

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Photos by Dave Hohler, Dan Shively and Tom Iraci.

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Introduction and History of Fish Creek

Adaptive management is thoughtful, appropriate actions based on monitoring results.

The Floods

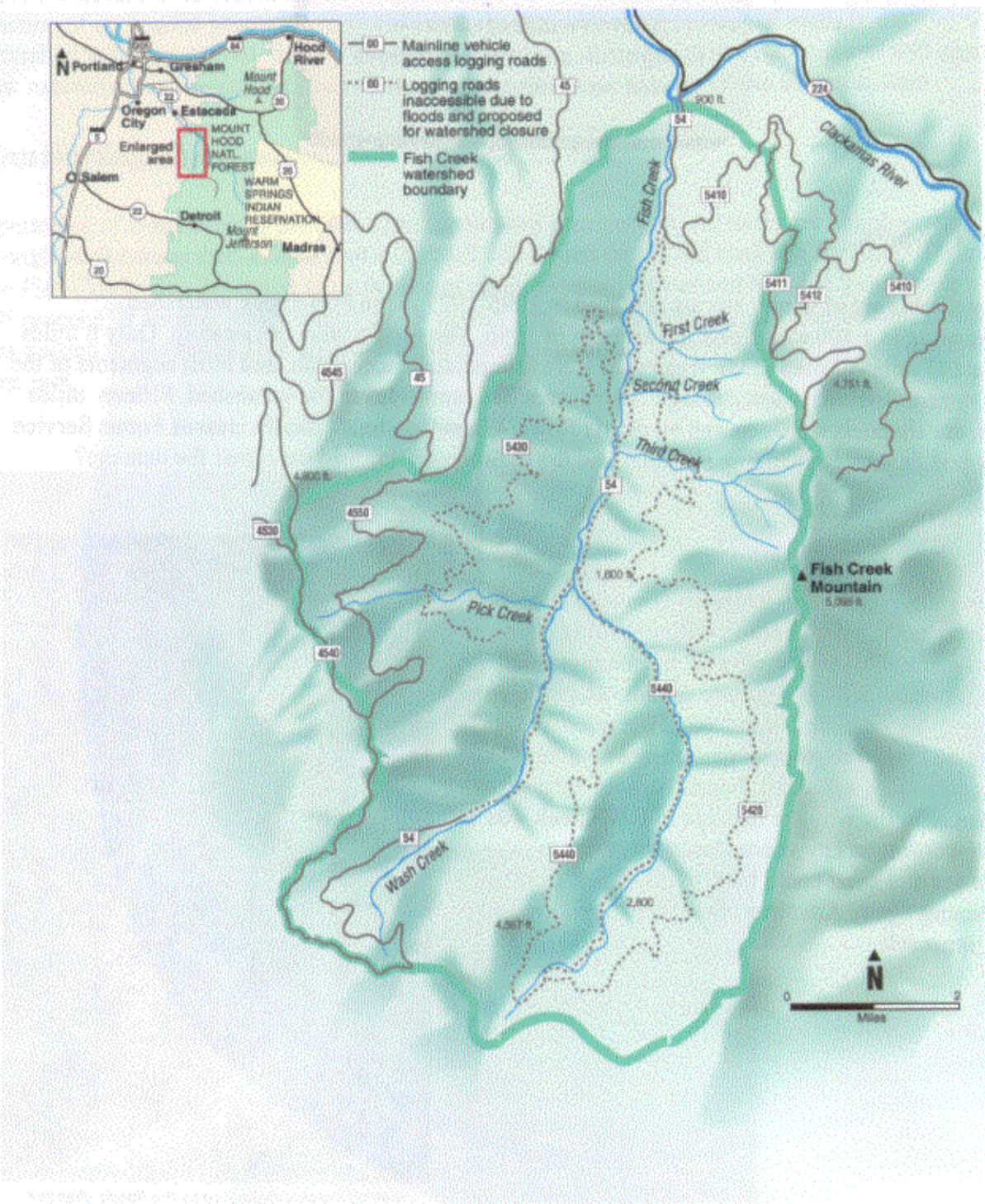
A remarkable set of winter storms occuned in 1995-1997 in the Fish Creek watershed culminating in a 100 year flood in February of 1996. The results were devastating. Only 6 miles of the 143 miles of road in the watershed were immediately accessible, and most segments of the road system suffered major damage. There were 236 landslides in the watershed. Fifteen miles of stream channels were scoured by debris flows. When the clouds finally cleared Forest Service managers faced a challenging situation and the question how do we repair the damage?

The Challenge

Initially it was not known how extensive damage was to the watershed. Road crews began clearing away trees and mud to open roads and, by summertime, , field crews were able to survey streams and hills1opes to determine the scope of damage. The questions of where and why the storm impacts were so great were beginning to be answered. Forest Service managers wanted to know why the damage in Fish Creek was so much worse than anywhere else in the western Cascades and what could be done to keep it from happening again Adaptive management required a new approach.

Wood and gravel deposited by the floods changed fish habitat. Notice in the lower left corner Fish Creek is eroding the mad and reclaiming **the** *natural stream channel.*

Fish Creek Watershed
Location Map Identifying Streams and Roads to be Obliterated



Note: smaller spur roads are not shown

Adaptive Watershed Management

In 1964 a similar flood struck Fish Creek damaging roads and streams, and the Forest Service moved quickly to repair the damage. The response to damage in Fish Creek was different this time around. Adaptive management requires Forest Service managers to learn and ask questions about past activities, then apply the answers to future decisions. This report details the extensive data collection and analysis done in Fish Creek prior to repair work and exemplifies adaptive management. Faced with miles of damaged roads, altered streambeds, and acres of bare land from hundreds of landslides Forest Service managers used the best science available to make decisions. Some questions answered were how, where, why and even if to repair roads, restore stream habitat and begin the long process of restoring the watershed.

Now, in 1999, future management of Fish Creek has been determined. The Forest Service is continuing to repair damage from the winter storms three years earlier and accelerate the return of the watershed to a more natural, more stable condition by completing the following activities:

- Obliteration of 105 miles of road in conjunction with stream crossing restoration (approximately 73% of the roads in Fish Creek);
- Repair and stormproofing 38 miles of road;
- Reforestation of 50 acres of landslides and streamsides, plus thinning thousands of acres to promote accelerated growth of young trees; and
- Restoring fish habitat at key locations.

About the Watershed

The Fish Creek watershed is managed by the U. S. Forest Service and is located on the Mt. Hood National Forest. The 30,000 acre watershed is located about 45 miles southeast of Portland, Oregon, and is characterized by lush vegetation and steep slopes. The history of Fish Creek is similar to that of other watersheds in the Pacific Northwest. Fish Creek's origins were tire and ice, as volcanoes and glaciers created the geology of the watershed. When Europeans first entered the watershed in the 1800's they found towering old-growth Douglas-fir forests and steep, rocky hillsides. Streams were clear and cold and home to salmon and steelhead.

As the United States began the economic boom after World War II the Fish Creek watershed was a source of wood for new home building. It was most economical to reach timber by truck and an extensive road system was built. By 1994 143 miles of road were built in the watershed, and 41% of the old-growth trees had been cut and replaced with young tree plantations.

Stream channels also changed. After the 1964 flood remaining large trees in stream channels were removed. As fish biologists learned the importance of wood in streams in the 1980's an aggressive stream and fish habitat restoration program began and wood was returned to the stream . A partnership with the Pacific Northwest Forest Service Research Station began and Fish Creek was on its way to achieving prominence as one of the first complete watershed monitoring programs.

1994 - The Northwest Forest Plan

A new era in forest management began with the signing of the Northwest Forest Plan in 1994. Initially a recovery plan for the Northern Spotted Owl, the Plan was also geared to the recovery and restoration of rapidly declining salmon populations, A major change was identifying forests and streams by their watershed boundary.

The Northwest Forest Plan also defined broad forest management objectives. Fish Creek was identified as a Tier One key watershed. Tier One watersheds are important watersheds for the recovery of threatened and endangered fish.

A scientific report was written about the Fish Creek watershed analyzing important ecological factors. Called 'watershed analysis" it provided a new way of thinking about how physical processes such as landslide risk and hydrology set the foundation for management of forests and streams. By integrating important ecological factors in Fish Creek it was learned:

- Fish Creek had the greatest potential for landslides on the Mt. Hood National Forest,
- Important winter steelhead and coho salmon live in the streams of Fish Creek,
- Too much road building and timber harvest had occurred next to streams on steep slopes,
- Road removal and road repairs were needed to improve downstream aquatic conditions, and
- Removing roads next to streams and improving road-stream crossings ("stormproofing") would reduce sediment in streams and reduce future landslide potential.

More conclusions are found in the Fish Creek Watershed Analysis. The Clackamas River Ranger District began executing recommendations in the watershed analysis such as thinning young trees to improve tree growth next to streams and removing roads at risk for landslide failure.

The Floods and Monitoring, Planning, and Adaptive Management

Then the winter storms of 1995-97 struck, Storm systems, nicknamed “the pineapple express” brought warm rains from Hawaii to pour on and melt the snowpack on Fish Creek hillsides. The intensity of the floods depended on the number of days of rain and the depth of the snowpack. The storm in February of 1996 was unusually long and intense and the snow was deep on the hillsides. The resulting flood was a record breaker.

Forest Service employees mobilized to action after the flood waters receded Road crews cleared debris and began assessing damage. Field crews spent long days walking streams and climbing hillsides collecting information about origins of landslides and changes in stream habitat. The following winter Forest Service employees assembled into an interdisciplinary team to discuss options for the future of Fish Creek.

Valuable and extensive information was gathered. Geologists were able to tell why and where landslides originated, The long term fish habitat research project provided records for the before and after story of changes in streams and fish habitat from the floods. The U. S. Department of Transportation and U. S. Congress made funds available for repair or restoration the Fish Creek watershed. Initial estimates of costs for repair of roads were in the millions of dollars. Forest Service employees discussed options of repairs in Fish Creek from repairing all roads and replacing stream habitat, to doing nothing, to removing and obliterating all roads in the watershed.

Trees and logs deposited on streambanks show the massive size and force of landslides.

Developing the Fish Creek Restoration Plan

As Fish Creek restoration plans began to take shape (including an option to obliterate all roads) controversy and public discussion swelled. Numerous field trips to view flood effects were taken. Visitors included scientists, media, Forest Service policy makers and members of the public. Local Forest Service officials formed a technical review team composed of scientists and specialists in watershed restoration. This group reviewed large amounts of post-flood data and made the following observations and key findings:

- Steep hillslopes and weak rock formations mean landslides are a natural part of the Fish Creek ecosystem. When coupled with timber harvest and road building landslide rates increase over natural levels. There was a ten-fold increase in landslide occurrence in young, replanted harvest units on weak geologic areas wiht steep slopes.
- Landslides are a natural part of the Fish Creek ecosystem. Roads often act as dams and stop landslides containing large wood from entering stream systems, Over time, this may be leaving streams unnaturally low in large wood which is important for fish habitat.
- Older roads (pre-1968) had twice the incidence of landslides than newer roads (1968-present). Older sidecast built roads were greater sources of sediment.
- The large magnitude winter storms destabilized areas without actually causing them to fail, and future, weaker storms may provoke additional landslides.
- Timber was harvested next to stream channels in earlier decades. The replanted young trees cannot provide needed old-growth conifers for instream fish habitat, Small, deciduous trees such as alder, do not resist floods and stabilize streambanks. Consequently, stream channels widen during high flows.
- Fish habitat surveys showed overall stream habitat conditions were relatively similar pre- and post-1996 flood. However areas nearest the mouth of Fish Creek were most negatively affected by flood flows with a loss of 20% of pool habitat.

Young, replanted harvest units are ten times more likely to be an initiation point for a landslide.

Restoration of a Watershed

Flood damage repair in Fish Creek is bold and based on adaptive management. Problems from past timber management and road construction have been identified, and repairs are appropriate for the natural conditions of Fish Creek

The Problem	The Repair
Young, replanted harvest units have increased the number of landslides.	• Field crews have thinned 3,400 acres of young plantations to accelerate tree growth and reduce landslide potential
Roads block large wood from entering streams.	▸ Over 341 road-stream crossings have been removed and restored to natural conditions so future, naturally occurring landslides will deposit large wood in streams.
Older roads have twice the incidence of landslides and contribute a larger percentage of sediment.	• All older roads will be obliterated, stream crossings restored and replanted in vegetation. A total of 105 miles of road will be obliterated.
Destabilized areas may fail in future winter storms.	▸ Areas identified as destabilized have had rock and debris removed.
Timber harvest next to streams removed old growth needed for fish habitat. Small deciduous trees are not resistant to floods.	▸ Where beneficial, conifers have been planted next to streams. Existing conifers have been encouraged to grow by trimming out competing vegetation. Where all vegetation was stripped, streamside alder has been planted to promote shading while slower growing conifers grow.
Fish habitat at the mouth of Fish Creek was negatively affected by the floods.	• Flood resilient stream reaches of Fish Creek fish habitat have been reproduced at the mouth of Fish Creek. Log jams 4-6 feet high created backwater areas to increase the depth of the streambed.

Monitoring and the Future of Fish Creek

In the history of the Forest Service the scope of the restoration and flood repair in Fish Creek is unprecedented. Never before has such aggressive action been taken to restore the natural function of ecological processes such as hydrology. Seventy three percent of roads in the watershed will be removed. Stream channels intersecting roads and piped into culverts will again flow naturally. Fish habitat will be restored to jump start the recovery of the stream system.

Monitoring the Restoration of Fish Creek

Monitoring of restoration of the Fish Creek watershed is important. As roads are obliterated throughout the watershed a three foot wide path will be left on the old road bed for future access into Fish Creek. The following table describes monitoring objectives and how the monitoring will proceed, If another major winter storm occurs Forest Service personnel have the background data needed to determine how effective these restoration efforts have been and if objectives have been met.

Before . . .

. . . After

Road obliteration sometimes included excavation and recontouring of large volumes of road fill.

Monitoring of a Watershed

Monitoring Objective	Monitoring Task
Project implemented as planned.	Contract implementation and photo points of road obliteration, stream restoration and replanted riparian areas.
Stream temperature change as streamsides revegetate	Continue monitoring at 13 stations throughout the watershed and the U.S. Geological Survey gaging station.
Changes in fish habitat and fish populations.	The Pacific Northwest Research Station will continue to monitor fish habitat, fish populations and large woody debris inventories and trends.
Stream channel change.	Following a 10+ year flow event channel cross sections taken in 1997 will be repeated.
Health and growth of replanted young tree stands.	Inventory and monitor health and growth of tree stands.
Changes in stream flow.	U.S. Geological Survey measure at gaging station.

The Future of Fish Creek

It is expected the combination of aggressive restoration measures will speed the natural recovery of the system, As landslide and erosion rates return to predevelopment levels, large trees return to logged areas and streamsides shade over many changes are expected. Hillsides will stabilize Stream channels will narrow. Summer water temperatures and sediment levels will improve Large pools and side channels will increase and improve the quality of fish habitat. Fish Creek will be much more resilient to major floods like those winter storms during the winters of 1995-1997.

The adaptive management cycle will continue in Fish Creek Forest Service employees will continue to monitor and ask questions about the success of the restoration of the watershed. If needed, projects will be adjusted to better address restoration needs. Nature and time will then have the biggest role in the restoration of Fish Creek as the watershed returns to maximum health.

Fish Creek Publications

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