

of the fish food chain, can be reduced in numbers or completely washed away from their gravel environments. Increased run-off during summer, on the other hand, can benefit fish by increasing stream flows at rearing time.

Some of the most serious problems are associated with increased soil erosion or soil mass movements such as landslides and earth slumps.

Erosion accelerates the transport of sediment into streams, where it can affect fish habitat in several ways. Sediment fills the spaces between the gravel, reducing the flow of oxygen-rich water that is vital to fish egg survival. When it is time to rise from the gravel and begin stream life, the emerging young fish can be trapped and killed by sediment. Heavy sedimentation can also smother insects, thus reducing the food available to fish.

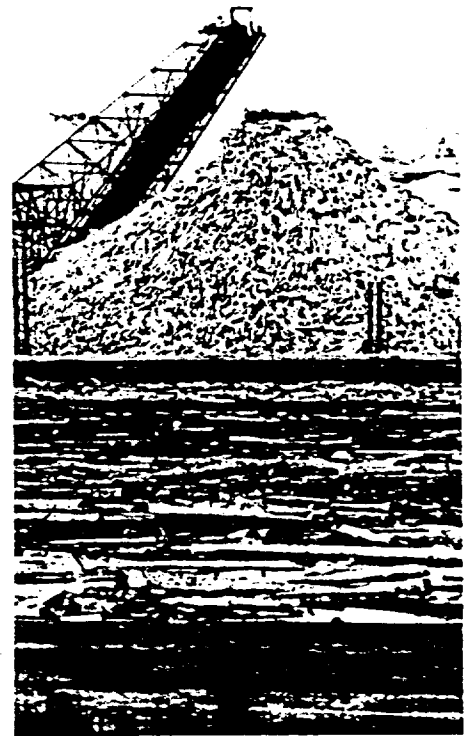
In several disturbed areas, large

amounts of eroded material can overtax a stream's ability to transport sediment. The stream begins to fill up with shifting gravel and debris. Deposits may be so great that some stream sections appear to "dry up". The stream actually goes underground; but nevertheless, surface flows stop, spawning and rearing areas disappear, and fish migration is prevented.

Forest debris accumulations can block migrating fish and produce channel shifts. While removal of debris from streams reduces these threats, overzealous clean-up can do more harm than good.

The removal of streamside vegetation by logging can increase water temperatures to levels unsuitable or even lethal to fish, and can increase the activity of disease-producing organisms. Temperature increases, however, do not always have a negative effect. In streams where temperatures are naturally cool, warmer waters can boost aquatic productivity and even increase fish growth. Streamside vegetation plays a further role in providing an environment for terrestrial insects which fall into streams and contribute substantially to the diet of fish.

Careful planning and better knowledge of fisheries values can avoid or significantly reduce many of the potentially detrimental effects of timber harvesting. Logging methods and patterns designed for local soils and wind conditions and the phased removal of timber can reduce the possibility of erosion and streamflow changes. Leaving green strips along streams can protect banks, reduce debris in channels and maintain normal



stream temperatures. Careful timing of logging operations can mitigate the effects of increased sedimentation on developing eggs and migrating fish.

Forest Roads

In many areas of Canada, forest roads may pose a greater risk to fish habitat than actual logging. Gravel roads can contribute larger quantities of sediment to streams during and after construction, particularly during heavy use by logging trucks. Road construction results in changes in water drainage patterns which can lead to surface erosion and landslides. Attention to site-specific detail in the design and installation of road culverts is essential to habitat protection. Having too few culverts or improperly designed and constructed culverts can cause water velocity barriers or road washouts, preventing upstream migration of fish.

Locating, constructing and maintaining roads to minimize erosion can greatly reduce sedimentation problems. Proper care

