DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES APPROPRIATIONS FOR 1995

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HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

SECOND SESSION

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PART 6

TESTIMONY OF PUBLIC WITNESSES FOR NATURAL RESOURCES MANAGEMENT PROGRAMS

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INFLUENCES OF ROAD CONSTRUCTION IN NATURAL LANDSCAPES

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Testimony to the United States House of Representatives
Subcommittee on Interior Appropriations

Roads have long been recognized as a source of both accelerated erosion and rapid runoff generation. Although road construction itself typically involves disturbing a relatively small area of a watershed, the resulting changes in runoff generation and sediment production may significantly affect stream channels. Many of the specific, local effects of roads are widely recognized: concentrated runoff from road surfaces may incise gullies or enlarge channels; side-cast material from cut and fill road construction may fail and trigger landslides; and material eroded from cut slopes, road-side ditches, and road beds increases the sediment load of downslope streams (e.g., Furniss et al. 1991). The amount of sediment delivered to streams from roads often exceeds the combined amount resulting from all other land management activities in forested mountain drainage basins of the Pacific Northwest (e.g., Gibbons and Salo 1973). I offer this testimony because I feel that given what we know about impacts associated with road construction in natural landscapes it makes little sense to simultaneously pursue aggressive watershed restoration and road-building programs.

The U.S. Forest Service embarked on the most extensive road building enterprise in history when it accelerated development of logging roads throughout the National Forests in the years following World War II. Accelerated erosion from road-building in forested mountain watersheds was recognized by scientists as early as the post-war housing boom (e.g., Anderson 1954). Extensive road failures and road-related landsliding during the 1950's and 1960's highlighted the association of landsliding with road construction in steep terrain. Many studies in the 1960's through 1980's documented that sediment delivery from landslides associated with road construction varied from several times to several hundred times background rates in undisturbed watersheds [see review in Sidle and others (1985)]. Data compiled in a recent review of studies addressing nonpoint sources of pollution from forest practices in North America (Binkley and Brown 1993) shows that 80% of previous studies of the impacts of logging and road building report an increase in suspended sediment, and thus a decrease in water quality in downslope channels. Half of the studies reported increases in suspended sediment greater than two fold, and 13% of the studies showed increases greater than 10 fold. The great range in the magnitude of observed increases in suspended sediment loads reflects a range of road construction practices, bedrock erodibility, and storm history. New methods of road construction adopted during the 1970's and 1980's are widely thought among road engineers and foresters to have substantially reduced environmental impacts associated with road building. While modified construction practices appear to have reduced rates of landsliding related to new road construction, these techniques typically do not address either channel changes resulting from altered runoff generation (e.g., Hagans et al. 1986) or the effect of drainage concentration on

the delivery to channels of fine sediment eroded from roads, although paving roads dramatically reduces sediment production (Reid and Dunne 1984).

Several new studies reveal additional changes in hydrological and erosional processes in forested mountain landscapes as a result of new road construction. One of my own studies (Montgomery, in press) involved mapping the influence of road drainage concentration on triggering landslides and connecting roads into the channel network in three field areas: the Southern Sierra Nevada; the Oregon Coast Range, and the Olympic Peninsula in Washington. The roads in the Oregon Coast Range and the Olympic Peninsula study areas were ridgetop roads - one of the road design innovations thought to have solved road-related impacts in steep terrain. Drainage concentration along these ridgetop roads was associated with both accelerated landsliding and connecting the road drainage system directly into the channel network. When roads drain directly into channels, a road surface functions like an extension of the channel network. This increases the effective channel length in a landscape and allows sediment produced on roads to be delivered to stream channels. The integration of road and channel networks in these study areas increased the effective channel length by as much as 60%. A just completed Masters Thesis at Oregon State University (Wemple, 1994) reports that 60% of the road network is integrated with the channel network, and that this integration increases the effective channel length by about 40% in Lookout Creek, part of the U.S. Forest Service's H. J. Andrews Experimental Forest in the Oregon Cascades.

While we all recognize that road surfaces and road-side ditches do not function ecologically as stream channels, it is proper to ask what difference an increased effective stream length would make in a landscape. The rain that falls onto and is intercepted by roads is delivered to downstream channels more rapidly than if it had soaked through natural ground. This influences the timing and magnitude of flow in the small stream channels that typically provide habitat for amphibians and some species of trout. Another recent study from researchers at Oregon State University and the U.S.D.A. Pacific Northwest Research Station (Jones and Grant, in review), demonstrates the influence of road construction on peak flows in small mountain channels in the Oregon Cascades. This analysis of more than 30 years of streamflow data suggest that road construction increased peak flows in both small and large watersheds.

Erosion of cut slopes, road surfaces, and drainage ditches also generates fine-grained sediment that contributes to downstream sediment loads if delivered to a stream channel. The connection of up to 60% of the total road length in a watershed with the channel network found in both Wemple's work and my own study implies that much of the fine sediment generated from road surfaces ends up in stream channels. There it contributes to the concentration of fine sediment in the subsurface gravels which salmonids use for incubating their eggs. Fisheries biologists have shown that increased proportions of fine sediment decrease the survival of salmonid eggs buried in the stream gravel (see review in Chapman 1988). Studies from the Clearwater River in Washington found that gravel roads covering only 4% of the basin area increased sediment production by 400% and that erosion from road surfaces was responsible for more than half of the increase in fine sediment (Cederholm et al. 1982). These studies also found that sediment produced from logging and roads increased the fine sediment concentration in stream-bed

gravels (Cederholm et al. 1981; 1982). Preliminary data from another study in several drainage basins in the Washington Cascades and on the Olympic Peninsula (Montgomery, unpublished data) implies that road construction significantly increases the fine sediment concentration in stream-bed gravel. Data collected in this study reveal similar differences in the proportion of fine sediment between channels in roaded and roadless areas within the same drainage basin as that found between adjacent roaded and wilderness watersheds. Together these studies illustrate that we are still learning the full extent of the impact of road construction on watershed processes and hence on the condition of natural resources.

The extent of impacts related to past road construction in the Pacific Northwest are becoming more widely recognized as a result of recent Watershed Analysis efforts implemented on private, state, and federal lands. Watershed Analysis involves examining the physical processes that create and modify habitat and the status of the ecological systems that inhabit a landscape. Many of the Watershed Analyses conducted in Washington State under the new State Forest Practice rules adopted in 1992 have revealed significant problems related to both old and recent road construction, as well as neglected or deferred maintenance. One of the few proposed watershed restoration activities for which I have heard almost universal support is the need to fix road-drainage problems and decommission forest roads. Although roads constructed in the 1950's and 1960's are the greatest problem (e.g., Harr and Nichols 1993), many roads built in the 1970's and 1980's also contributed to the declining condition of streams in the Pacific Northwest.

In my estimation the impacts of road construction should be considered in determining the budget for the Forest Service. I believe that this nation should reconsider whether to spend additional effort and money to build roads that probably will need to be rehabilitated at a later date when funds may or may not be available, and only after potentially significant environmental impacts occur. Speaking only for myself, I do not believe that U.S. government agencies should be involved in building new roads in the western United States unless they can demonstrate that such activity will not have an adverse impact on the already fragmented and degraded condition of aquatic habitat in this region. However, I also believe that it would be unwise to either eliminate or redirect road-maintenance funds from these agencies. Deferred road maintenance is one of the problems that brought us to the current land management crisis in the Northwest. I believe that the Forest Service's road construction budget should be used to decommission, rehabilitate, and maintain roads on our public lands, something that has been neglected for the past forty years. We shouldn't put ourselves in the position of creating future problems while we are paying to undo the results of past road-building efforts.

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