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AN ABSTRACT OF THE THESIS OF

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presented on April 29, 1994.

Title: Historical Change in Channel Form and Riparian Vegetation of the McKenzie River, Oregon

Abstract approved: Stanley V. Gregory

Stanley V. Gregory

This study examined channel structure and position and riparian vegetation and land use on the upper 70 km of the McKenzie River, Oregon in the 1940s, compared the 1940s conditions to present conditions, and explored the processes driving change in this system and the implications for aquatic habitat. The hydrologic record was analyzed, and field surveys were conducted and compared to historical habitat surveys. Riparian characteristics and channel features were digitized from aerial photographs from 1945/49 and 1986 and imported into ArcInfo GIS for analysis. Types of data digitized from the aerial photos included locations and length or area of wetted channel, active channel, tributaries, side channels, large woody debris, exposed gravel bars, roads, and dominant vegetation or land use within 200 m of the active channel.

Construction of dams on the mainstem McKenzie River and two major tributaries, Blue River and South Fork, in the 1960s has altered the flow regime and sediment supply to the mainstem McKenzie, decreasing the frequency, mean and variation of peak flows, reducing the competence of flows to move existing bedload, and cutting off sediment from over half of the drainage area. Mean peak flows decreased 44% and competence of peak flows with a 2-yr recurrence interval declined approximately 29% after dams were constructed

upriver. Adjustments to reduced sediment supply and flow alteration by dams in this system included 57% decrease in exposed gravel bars, 40% decrease in side channel length, and possible substrate coarsening (as compared to historical estimates).

Channel straightening occurred in each of three instances of channel change during the study period, and sinuosity decreased one half of the amount needed to produce a straight channel in the most susceptible, unconstrained reach. Human actions prior to high flow events played a role in the direction of channel change in each case. Over the entire study area, 7% of the main channel changed position by at 30 m or more and little or no change in channel position was noted in reaches constrained by valley floors. Additional channel constraint has been produced by road construction near the channel and riprapping for roads, bridges, and residences.

Less large woody debris was observed in the 1986 channel than in the 1949 channel, indicating a reduction in pool-forming agents and channel roughness elements. Frequency of large pools (≥2 m depth and >40 m^2 area) decreased 19% over the study area. The greatest loss in pools (73%) was noted in the unconstrained reach that exhibited two areas of channel change and an increase in exposed gravel bars.

Increased human use of the riparian area for roads and residential purposes has led to an increased fragmentation of the riparian landscape. Density of residential or developed patches within the riparian area has increased 215% as more and smaller areas are converted from natural vegetation to human use. Riparian area devoted to roads and residential uses has nearly doubled since the 1940s. Mean vegetation or land-use patch size has decreased from 2.2 ha to 1.6 ha as larger patches have been sub-divided, and patch and edge densities have increased. Agriculture and clearcuts for

timber removal have decreased within the riparian area while continuing upslope. Riparian area in mature conifers has decreased 44% from levels in the 1940s while hardwoods have increased 45% in the riparian area. Future wood loading to the channel is reduced by a decline in mature riparian vegetation, especially mature conifers.

Channel and riparian changes noted in this study have implications for fish populations. Channel straightening, reduction in side channels, and loss of pool-forming agents reduce habitat heterogeneity and off-channel refugia.

Ecosystem management of watersheds requires evaluation of conditions across scales of time and space. The use of GIS in this study made it possible to detect changes in channel form and riparian conditions during four decades, along a 70-m channel and 90-m riparian area and to analyze the large data sets relevant to understanding functions and change in channels and riparian areas.

Historical Change in Channel Form and Riparian Vegetation of the McKenzie River, Oregon

by

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A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Completed April 29, 1994

Commencement June 1995

1622

Bibliography

1. Minear, Paula J. Historical change in channel form and riparian vegetation of the McKenzie River, Oregon. Corvallis, OR: Oregon State University; 1994. 102 p. Note: M.S. thesis.