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Appendix - Geographic Analysis

Appendix A. Geographic Analysis

Much of the underlying analysis for the conservation strategies in the HCP was supported by DNR's geographic information system.

A geographic information system (GIS) is a system of integrated processes for the entry, analysis, and query of any data that can be referenced to a specific location. Comprised of computer hardware and software, geographic data, support staff, and applications, the purpose of a GIS is to provide meaningful geographic information in either map or report form.

A GIS query can take either of two general forms. In one form, the user begins with a specific known location (e.g., a timber stand, ownership parcel, or stream segment) and queries the GIS for all characteristics of that location (e.g., age of timber, owner of parcel, or name of stream). For the other form of query, the user enters a list of desired characteristics, without knowledge of where they exist, and queries the GIS for the locations having those characteristics (e.g., stands with timber more than 60 years old, owned by the county, or within 1 mile of the Rushing River).

DNR has been developing its GIS since 1982 and now has a well established, state-of-the-art system. Its client-server architecture consists of a central corporate database, more than 40 workstations, ARC/INFO software, and nearly 400 trained DNR staff. The GIS has become integrated into almost every facet of DNR's daily operations.

For the HCP, DNR's GIS has been used in two general phases: (1) initially providing information to evaluate the current situation, and (2) modeling potential conservation strategies and analyzing results. For the first phase, a large amount of statewide geographic data was required to help lay the foundation of the HCP and define conservation objectives. To avoid producing endless numbers of maps with all possible combinations of geographic data, DNR staff developed a computer menu that allowed any combination of data to be selected and mapped on the computer screen. During Science Team meetings, the maps were displayed through an overhead projector so that the scientists could query the GIS and see the results. Aided by map analyses, the Science Team and DNR determined the wildlife species on which to focus efforts, the resulting geographic extent of the HCP, and the appropriate geographic subunits to use for more detailed analysis.

The second phase — modeling and analysis — used the GIS to its full potential. The breadth and variety of GIS use in this context can best be shown by the following examples. For modeling the conservation strategies for the northern spotted owl and marbled murrelet, the GIS was used to map and evaluate:

- elevation breaks and observed sightings defining the Washington range of both species;
- spatial relationships between DNR-managed forest lands and federal reserves;

- distribution of potential habitat across lands managed by various state and federal agencies; and
- timber age distributions on DNR-managed forest lands.

For developing riparian ecosystem conservation strategies, the GIS was used to map and evaluate:

- stream densities (miles of stream per square mile) by stream type;
- miles of stream, summarized by stream type;
- stream gradients, summarized by stream type;
- hillslopes and slope shapes (for predicting areas of slope instability);
- elevation, rainfall, vegetation, and latitude (to predict rain-on-snow zones, which in turn may predict runoff problems);
- areas where soils may be susceptible to erosion when disturbed;
- various stream buffering scenarios, along with their contribution to habitat and effect on timber harvest activities;
- road densities (miles of road per square mile);
- road/stream intersections (bridges, culverts, fords) as potential trigger points for storm runoff; and
- stream stocking status for anadromous fish.

Approximately 85 percent of the geographic data utilized were already resident in DNR's GIS. The remainder was acquired primarily from the U.S. Forest Service and the Washington Department of Fish and Wildlife.

Any GIS data is, by definition, only a *model* of reality — a snapshot of conditions that are highly complex and dynamic. Although computer automation can give a very high level of precision, it does not in itself assure accuracy. Accuracy is achieved and maintained only at significant cost and is relative to the specific need. Therefore, while all the data used in GIS analysis are of a reasonably high quality, great diligence was exercised throughout the process to assure that the data were not used beyond their inherent limitations.

The GIS has been an important tool for communicating among the scientists, DNR staff, other government agencies, the beneficiaries, and the general public. It was a fundamental aid in establishing confidence in the conservation strategies. The GIS will continue to play a large part in implementing and monitoring the HCP.