Historic contribution of silviculture and genetics to PNW Research

The Resource Management and Productivity Program is characterized by long term research in vegetation management that is successfully identifying and addressing new and changing issues. Western Washington and western Oregon represented the first place in the country where people didn't cut and run, but addressed forest growth and whether second-growth management could actually pay for itself. The west-side silviculture team was first established after WWII as the Olympic Research Center. Much of the early work was carried out on industrial experimental forests (e.g., Voight Creek, Simpson Timber lands, etc.). In late `40's to early 60's, focus was on management of young-growth forests, with emphasis on commercial thinning; primary clients were owners and managers of small private and industrial forest lands (some on NFS). In mid-60's to mid-70's, the focus was on intensive culture (i.e., show profitability) of Douglas-fir (thinning and fertilizer application); clients were industry, states, NFS, and consultants having more of a role. From late `70's to 1990, the focus was on biology and silviculture of west-side forests, beginning work with other conifers and hardwoods, with added skills in laboratory in soils and physiology; clients included those of previous period plus the DOE and bioenergy community. In the 1990's, the emphasis was to develop silviculture options for production of wood and other forest values, that includes a strong stand visualization component applicable to landscape and regional issues. The DOE-funded work on intensive culture of hardwoods was wrapped up. Clients have expanded to include the broader conservation community.

Likewise in Juneau (Southeast Alaska), where the dominant regeneration method for hemlock-spruce stands was by clearcutting old growth, the emphasis in the `70's and `80's was on thinning second growth hemlock-spruce stands and establishing a large network of permanent sample plots for growth and yield information. There was also significant work on silvics/distributions of spruce and other conifers (Al Harris); site-index curves, profile/volume equations, growth and yield models, and other mensurational tools (Farr, DeMars); effects of natural disturbances such as wind (Harris). In the `90's and beyond, the major gaps in research involve understanding ecosystem processes, especially wet soils. Emphasis has been to develop silviculture alternatives (to clearcutting) for production of wood and other forest values in old growth forests, and management of young-growth for values other than timber (e.g., understory diversity, wildlife and fish habitat). Very recent emphasis added wood quality (effects of thinning, pruning), as well as trade-offs and co-production functions for multiple values.

In Corvallis, a similar transition took place with research emphasis moving from regeneration problems associated with second growth management of Douglas-fir plantations to a broader understanding of biology and culture of understory plants. Since about 1990 this has included conservation and management of plant species used for special forest products and plant species of concern, and restoration of degraded uplands with native plants. Silvicultural research includes tools for management in riparian systems and assessment of understory micro-habitat and microclimate under different density management regimes. Genetics research began at the Station in 1912 with establishment of the Douglas-fir Heredity Study and the Ponderosa Pine Regional Races Study in the early 20's by Thorton Munger. Those two studies are the Forest Service's two oldest forest genetics investigations and both are still active and yielding valuable rotation age information. In the 1950's, the Station's first forest geneticist, Roy Silen formed the Genetics Project at Corvallis to research genetic problems of Northwest tree species. The primary scope of that research through the 1980's was genecology, breeding system dynamics, reproductive biology, and solving technical problems hindering tree improvement programs of private, state and federal land management organizations. Incidental research dealt with a broad array of problems such as inheritance of browse resistance by deer and resistance mechanism of Phellinus weirii in Douglas-fir, Christmas tree genetics, etc. Since the early 1990's, the research has become increasingly more interdisciplinary in examining disease resistance (e.g. Swiss needle cast in Douglas-fir and Phytophthora lateralis on Port Orford cedar), new genecology efforts on red alder and Willamette Valley ponderosa pine, black bear foraging, regeneration of bitter brush, genetics- by -silviculture interactions (wood quality traits, hardwood species) and the inheritance of adaptability of shade by intolerant species when used in silvicultural systems in which components of the residual stand are retained. In addition, the Genetics Team is providing essential technical support to the state, private and federal agencies that have active tree improvement and gene conservation programs.

Scaling up to large integrated studies

Many of the problems facing managers and policy makers are large in spatial or temporal scale (e.g., species viability, resource sustainability, and biodiversity). Scaling and integration are necessarily linked in most, if not all natural science disciplines. With this increase in system heterogeneity comes a likely increase in the amount and degree of interaction among system components, patterns, and processes. That is, as researchers scale up their studies, the heterogeneity that accompanies the increasing scales approaches the operational heterogeneity that managers face. Many such studies will likely produce too much noise to address the traditional research hypotheses with the high levels of confidence that researchers are accustomed to producing. As the amount and degree of interaction increases, the need for integrated knowledge increases. In designing studies to address large-scale, integrative problems, the relative importance of main effects should diminish and the relative importance of interaction effects should increase. This relation between main and interaction effects should hold for observational as well as experimental studies. Main effects are still important, especially to scientists; but because ecosystem patterns and processes at large scales tend to be heterogeneous, the way that they interact becomes an increasingly dominant question. In addition, our ability to manage at large scales is restricted by our inability to answer these integrative questions.

Increased scale beyond stand-to-landscape tends to become more of a test of management style, options, or policy rather than tests of traditional research hypotheses on biophysical effects. Commitment to long term large-scale experiments by land managers is more difficult to attain. Cooperation between research and management becomes a much bigger issue. In the RMP Program, it has been necessary to scale up science at this point in the evolution of scientific work in order to:

(1) operationalize experimental silviculture approaches, and

(2) provide sufficient experimental area/size to evaluate effects of silvicultural options on factors such as wildlife.

The RMP Program currently looks at managing for wood prodution of wood and other values, sometimes together and sometimes independently. In addition, a lot of fundamental work is needed to develop silvicultural tools at the stand level as basic building blocks for application at larger scales. ``Scaling up" to large integrated operational studies is not just a matter of increasing experiments in land area or size as commonly portrayed, but a "complexity" issue that includes increasing diversity and numbers of species. For example, the need to move from clusters of small (1/5-acre) research plots to blocks containing 40-acre plots that also address aquatic, wildlife, and biodiversity measures (operational scale) is very much a scaling-up effort, and is necessarily at the ``stand" level albeit with landscape context in mind, due to the complexity of the treatments, questions asked, disciplines and land managers involved, and the land on which to locate the work (on National Forest Land, this also involves following the NEPA process all the way to harvest). Scaling up requires modeling efforts that carry large assumptions regarding processes (e.g., reproductive biology; cause and effect), and the increased complexities (e.g., plants X lichens X amphibians X fungi X birds X small mammals) really challenge scientists as to which components are the most important.