

North Pacific Temperate Rainforests: Ecology and Conservation

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It's only truly possible to appreciate the geographical complexity of the region covered in this book by flying over it, as I had the opportunity to do this past summer while flying between Seattle, WA, and Fairbanks, AK. There are more than 6000 islands, ranging in size from less than 1 ha to more than 6000 sq km, between the north end of Vancouver Island and Yakutat, near the Alaska-Yukon border. The adjacent mainland is dissected by a handful of large river valleys draining the interior, and numerous small, steep waterways cascading down from the glaciers of the coastal ranges. The biological complexity is correspondingly enormous and of global importance.

The genesis of this book was a science cruise and tightly structured workshop to incorporate conservation biology concepts into management strategies for conserving the biodiversity and ecological integrity of the Tongass National Forest in southeast Alaska, which at 6.8 million ha encompasses 80% of the land area in that region. During the workshop, it was decided to produce a book and to expand the scope to include the broader North Pacific temperate rainforest region. While much of the text still focuses on the Tongass, there is considerable input from the British Columbia part of the rainforest and the concepts are broadly applicable. Each of eight chapters is written by one or more experts in the topic under discussion, which are then synthesised in a final chapter which includes conclusions and recommendations.

Much of the biodiversity and endemism of the region stems from its glacial history when some of the area, particularly along the outer continental shelf, remained ice-free during recent glacial advances (chapter 1). Species colonised the rest of the region from these refugia or along a tidewater route from the north and south, or later along ice-free corridors from the interior of the continent. Preservation of these corridors and linkage sites should be the goal of management plans because gene flow is a critical process with benefits ranging from persistence of small populations to introduction of traits necessary to adapt to fluctuating environments. And fluctuate it will, as the region is expected to experience significant climate change in the future, particularly for the small, steep watersheds where water and nutrients are transported quickly to estuaries (chapter 2). Recent modelling forecasts a shift from hydrological processes dominated by ice and rain-on-snow events to purely rain-dominated responses; discharge will become more seasonal, with lower discharge during summer (the result of fewer glaciers) and higher discharge during winter (more rain than snow). These changes are expected to have regional-scale influences across much of the North Pacific rainforest, and impact estuarine and marine production through effects on amount and timing of carbon and nutrient export. Most

riparian management focuses on fish-bearing streams, often ignoring headwater streams, but recent research shows that the structure and function (e.g., inputs of litter, invertebrates and nutrients) of headwaters is important to lower stream reaches. Changes in the life history of invertebrates due to climate change, as well as the magnitude, frequency and duration of floods affecting stream morphology, have huge implications for the adaptation and survival of salmon, a mainstay of wild food webs, aboriginal culture and economic opportunities in the region.

Natural disturbance patterns (chapter 3) are typified by mass wasting events on steep, unstable slopes with thin soils, flooding, avalanches, and many small scale gap disturbances due to wind throw or stem breakage from insects/disease, but rarely from fire. Large-scale clear-cut logging contrasts sharply with this historical pattern of disturbance because of its location on less-steep slopes, larger patches of disturbance, and typical short time to re-harvest. One of the greatest challenges to developing a scientific approach to conservation in these forests is to reconcile the temporal scale and pattern of timber harvesting with the long-term patterns of forest dynamics, complicated by the likely effects of climate change (e.g., it may be drier, so more fires).

Chapter 5 discusses the Tlingit and Haida traditional use of trees, other plants and animals (salmon was especially important), and minerals, and the transition to commercial exploitation. Mining began with the gold rush in the 1880s, followed by silver, copper, lead, zinc, barite and marble, but the early operations were mostly over by the 1940s. High prices for rare earth elements are driving more recent explorations. Large-scale timber harvesting of old-growth forests didn't take off until the 1950s, and are currently uneconomic and require subsidies, while second-growth harvests will likely require even greater subsidies because they are competing with lower-cost products from many other regions around the world.

The short-term economic and social benefits of industrial logging will be paid for by long-term ecological consequences as the result of forest succession and roads – termed succession debt – even though there may be short-term (0-19 years after logging) benefits for some wildlife species, such as deer (chapter 6). Heavy logging reduces winter range (the old growth intercepted snowfall), causing a decline in deer numbers, which humans blame on predators, and the roads allow increased legal and illegal harvest of wolves ... and the cycle continues. It is a perverse irony of the supply system in the US that timber harvesting, with attendant new roads, is necessary for the Forest Service to get funds to decommission, restore and monitor old ones!

Chapters 7 and 8 address the issues of choosing areas for protection in reserves. The concepts of conservation biology are used to discuss three categories of reserve design criteria: reserve content (species, ecosystems and processes internal to a reserve), reserve context (interactions between a reserve and its surroundings, i.e., transboundary processes), and emergent properties (interactions among different components, and between content and context). The authors also raise the question – are intact watersheds good reserves? – and make the determination that they have a better chance of maintaining ecological integrity over the long term without human subsidies, but that smaller size reserves may be beneficial in some cases. Under climate change scenarios, reserves that incorporate a range of climates, site types and elevations will allow for movement within the reserve, and managing the matrix habitat around protected areas to facilitate species migration will be an important component. Conservation strategies that rely on habitat reserves and roadless patches often fail because they ignore the importance and function of the intervening matrix of unprotected lands (e.g., a wolf pack's range is larger than most reserves). Variable retention harvesting (chapter 9), particularly group or aggregated retention rather than dispersed retention, is very important in landscapes that are unlikely to have enough protected areas and reserves to maintain biodiversity on their own. It is important, though, that monitoring of trends and conditions of major indicators (forest structure, windthrow, growth and regeneration, species and biological diversity) be done over an entire landscape, since it is critical to adaptive management practices. However, the authors caution that most adaptive management examples have failed because: 1) lack of funding for monitoring, 2) failure of decision makers to

embrace the concept, and 3) lack of leadership to sustain what is a complex, lengthy process.

The final chapter reviews and synthesises the concepts presented, describes lessons learned from years of research, highlights uncertainties and gives suggestions how these might be reduced, evaluates potential new avenues of research, and provides conclusions and recommendations relating to the challenges and promises. Forest managers tend to seek solutions that are a compromise among complementary and competing objectives, which are generally highly technical, scientific solutions to what are truly political problems, and they need to start factoring in global implications, whether or not they are beyond local control. The cornerstone of management or rehabilitation should be to maintain an ability to adjust in the face of changing natural conditions; restoring and maintaining processes that generate habitat, rather than reference conditions, will enable organisms to adapt to change. The authors contend that if managers get the scale of their interventions right, as well as ensuring functional and economic connectivity, they will be well on their way.

Overall, this is a very valuable book which covers the basics of conservation biology and island biogeography theory as applicable to the region, aboriginal and commercial uses of its natural resources, management challenges, and opportunities to find a better way forward. Researchers, students and managers will find it very useful. The centre-piece of 23 black-and-white photographs has excellent captions, some annotated to illustrate concepts or issues with forests. There is a good index and extensive bibliography. Some figures are reproductions from scientific papers, and are small and almost illegible, and having a more legible full-page map of the area would have been helpful.

CYNDI M. SMITH

P.O. Box 70, Mountain View, Alberta T0K 1N0 Canada