Selbyana 17: 22–26

COASTAL TEMPERATE RAINFOREST CANOPY ACCESS SYSTEMS IN BRITISH COLUMBIA, CANADA

RICHARD A. RING[1] AND NEVILLE N. WINCHESTER

Department of Biology University of Victoria P.O. Box 1700, Victoria, British Columbia, Canada V8W 2Y2

ABSTRACT. In British Columbia, we have constructed three old-growth forest research sites, each with a canopy access system. Another is in the planning stages. Each site is located in a different forest biotope. The first is in old-growth Sitka spruce/western hemlock in the Upper Carmanah Valley. The second is in old-growth dry, coastal Douglas-fir on the southern tip of Vancouver Island. Less than 1% of this unique habitat remains intact. The third is at Bamfield Marine Station in an old-growth western red-cedar forest, and the fourth is planned for wet, coastal Douglas-fir in the Megin River watershed, an area that is part of the Long Beach Model Forest in Clayoquot Sound. This unique transect of canopy access systems within four distinct forest community types offers important opportunities for national and international collaborative projects on temperate rainforest canopy research.

INTRODUCTION

The Pacific Coast of North America contains some unique ecosystems. In 1990, Paul Alaback, Jim Weigand and others suggested that, because of the unique features of the climate, topography and forests of this region, a new biome should be erected—the Coastal, Temperate Rainforest (CTRF) (Alaback 1990, Weigand 1990). This biome, then, constitutes a relatively rare forest type, ~ 1.5% of the extent of tropical rainforests. The three main features of the biome are: (1) proximity to oceans and/or other large water bodies, (2) the presence of mountains and, therefore, (3) high rainfall—an average of at least 2200 mm per annum. All CTRFs lie within the ordinates of 32° to 60° in latitude and are found in western North America, the western coasts of Chile and Argentina, Tasmania, New Zealand, northwestern Europe, the eastern coast of the Black Sea, and Japan. Over one half of this biome has been lost due to logging and other non-forest uses (Kellogg 1992). The largest undeveloped tracts of CTRF are found in North and South America, yet no intact unlogged watersheds of any size remain in the United States. The largest undeveloped areas in the Pacific Northwest are found in British Columbia (e.g. the Kitlope Valley that extends 317,291 ha). Coastal, temperate rainforests can accumulate 500–2,000 metric tons of organic material, anywhere between 2–5 times that recorded in tropical rainforests. The tree species grow to enormous size and age, and constitute the highest standing biomass on Earth (Kellogg 1992).

SITE DESCRIPTIONS

In British Columbia, 14 biogeoclimatic zones are recognized (Meidinger & Pojar 1991). On Vancouver Island, site of the four canopy access systems, Coastal Western Hemlock (CWH) is the predominant biogeoclimatic zone, with small pockets of Mountain Hemlock (MH) and, along the southeast coast, a narrow strip of dry, coastal Douglas-fir (CDF). This latter zone is unique to B.C., to Canada and, indeed, to North America. It lies in the rainshadow of the Vancouver Island and Olympic Mountains, and has warm, dry summers and mild, wet winters. Mean annual precipitation lies in the range of 647–1263 mm. The main tree species are the coastal variety of Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*), western red-cedar (*Thuja plicata*), grand fir (*Abies grandis*), arbutus (*Arbutus menziesii*), red alder (*Alnus rubra*) and Garry oak (*Quercus garryana*). Also present are about 50 rare species of plants restricted to this zone (Meidinger and Pojar 1991). Less than 1% of this rare habitat type remains undisturbed by recent human perturbances and, recognizing this uniqueness, one of our canopy access systems is located within this zone. (Site #2, FIGURE 1).

The other two canopy access systems (and potentially a fourth) are located in the CWH zone. This zone occurs at low to middle elevations, mostly west of the coastal mountains along the entire coast of B.C. as well as north into Alaska and south into Washington and Oregon. It covers most of Vancouver Island and the Queen Charlotte Islands. It is the rainiest biogeoclimatic zone in B.C. with a mean annual precipitation of 2228 mm. It roughly coincides with the coastal, temperate rainforest described by Alaback and Wei-

[1] Corresponding author.

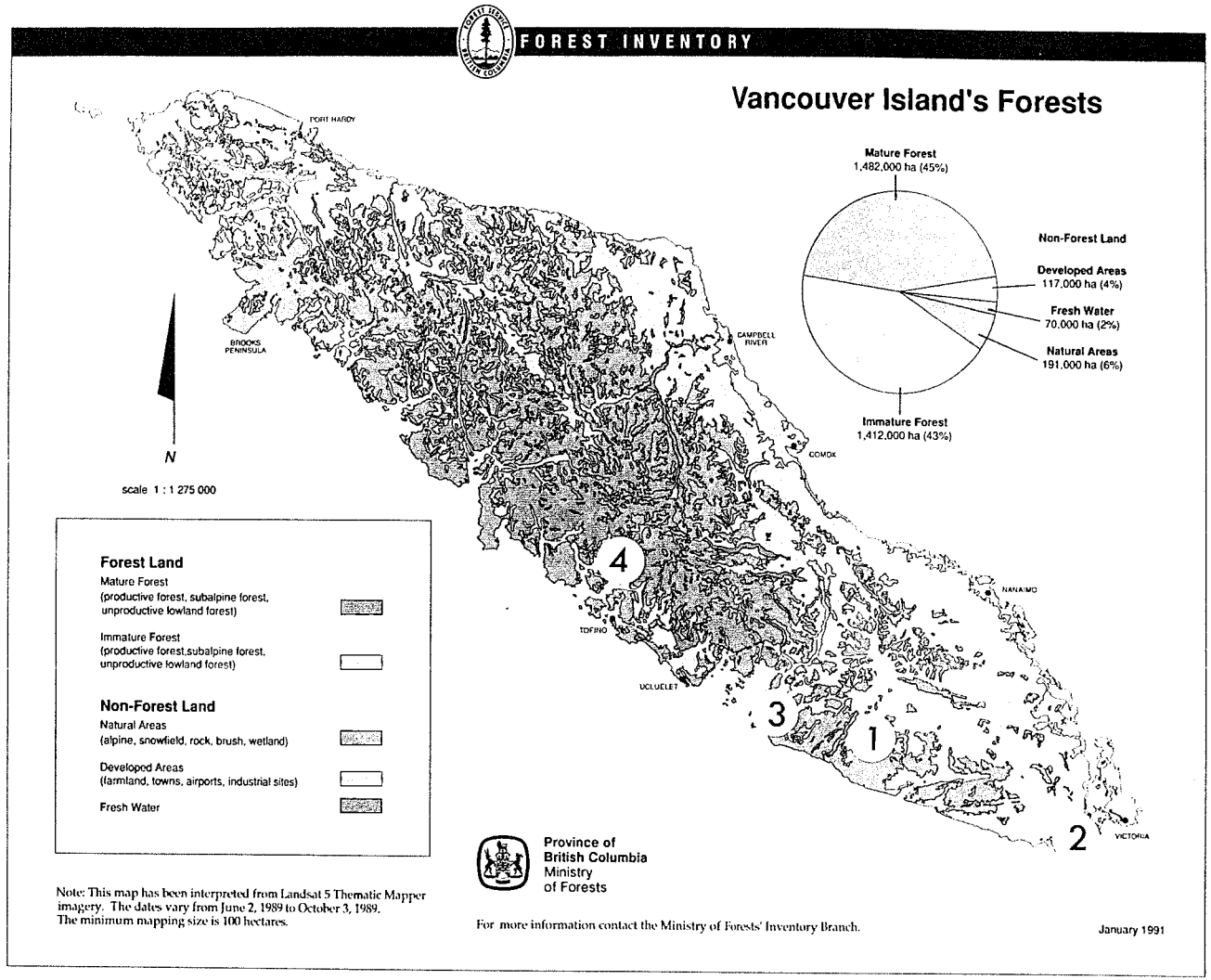

FIGURE 1. Locations of the four canopy access systems on Vancouver Island.

gand (Weigand 1990). There are 10 sub-zones of the CWH and each of our 3 canopy sites is located in a different one. Although western hemlock (*Tsuga heterophylla*) is the most common species in the forest cover, other species such as Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), western red-cedar (*Thuja plicata*), yellow-cedar (*Chamaecyparis nootkatensis*), and amabilis fir (*Abies amabilis*) can be regionally abundant.

The four sites that have been selected for study are each in a different old-growth forest community type, based on tree cover, on southern Vancouver Island (FIGURE 1). The first site is situated in old-growth Sitka spruce/western hemlock in the Upper Carmanah Valley (#1 in FIGURE 1); the second site (#2 in FIGURE 1) is in dry, coastal Douglas-fir at Rocky Point; the third site (#3 in FIGURE 1) is in western red-cedar at Bamfield Marine Station; and the fourth is in wet, coastal Douglas-fir in the Megin Creek watershed, Clayoquot Sound (#4 in FIGURE 1).

The arthropod sampling techniques used as well as the time scale and the data analyses involved are similar in each site, thus allowing direct comparisons and contrasts between areas, both spatially and temporally. Since our study in the Upper Carmanah Valley is the "flagship" of our program, a more detailed description of this project follows. The Carmanah Valley is a typical U-shaped coastal valley situated on the southwest coast of Vancouver Island. It is approximately 6731 ha in size and lies within the CWH zone. The dominant conifers in the entire Carmanah drainage system are Sitka spruce, western hemlock, western red-cedar and amabilis fir. In 1990, the Western Canada Wilderness Committee constructed a facility that would enable scientists to conduct ecological research projects aimed at gaining insights into old-growth forest processes. Our laboratory took advantage of this opportunity to develop a canopy research station. The study area at 48° 44′N; 124° 37′W includes 4 habitat types: old-growth canopy, old-growth forest floor, transition zone (between old-growth and clear-cut) and a recent, 10-year-old clear-cut.

Access to the Sitka spruce canopy is by means of a 2:1 mechanical advantage pulley system. Strapped into a harness and attached to a series of climbing ropes we are able to sample the central Sitka spruce tree (FIGURE 2). Four wooden platforms strapped onto the trunk and branches of the main tree give us consistent heights between 31 and 67 m from which to sample. A series of burma bridges enables access to 4 adjacent Sitka spruce trees complete with platforms, and the entire system, the first of its kind in North America, has become a springboard for a series of unprecedented scientific discoveries (Winchester & Ring 1995).

RESEARCH PROGRAM

The main objectives of our research program are to document the community composition of the canopy and forest-floor insect/arthropod fauna of these four different old-growth forest communities and correlate the ecological data collected with environmental factors operating within each biogeoclimatic zone or sub-zone. Our focus concentrates on community composition, structure and patterns within and among old-growth forest sites. The influence of habitat structure on insect-arthropod distributions, host-plant interactions and survivorship is also being addressed in order to elucidate the main factors that shape community composition. The major emphasis, however, is dedicated to establishing a structured inventory of insects and other related arthropods, and to describing the unique and previously un-named species that inhabit each of these forest biotopes. The most important questions asked are: (1) What are the insect/arthropod species that make up the canopy and forest floor communities in coastal temperate old-growth rainforests? (2) What changes in community composition can be observed when comparing the forest canopy, the forest floor, adjacent clear-cut areas and the transition zone between the old-growth and the clear-cut? (3) What implications will these studies have for satisfying the commitments made in our national "Canadian Biodiversity Strategy" document?

Insects and other arthropods are an integral part of old-growth forest ecosystems (Winchester & Ring 1995). Complex communities extend from the deep litter/soil layer and the large accumulations of coarse woody debris to the top of the tree canopy some 70 m above ground. To date our project has sampled four sites in the Upper Carmanah Valley: Sitka spruce canopy, forest floor, transition zone between the forest and a clear-cut, and an adjacent clear-cut. Several species appear to have restricted distributions, but there is still much to learn about their life histories. Also, many new species, endemic species and first records for B.C. and/or Canada have been identified. Therefore, although this study is in its initial stages, there are some revealing trends that support the contention that this complex insect community has taxonomically distinct components across our sample site gradient. Several species are canopy-specific and occur at no other sites within the old-growth or clear-cut systems. That these species are canopy-specific clearly demonstrates to us that removal of this habitat will cause an abrupt alteration in

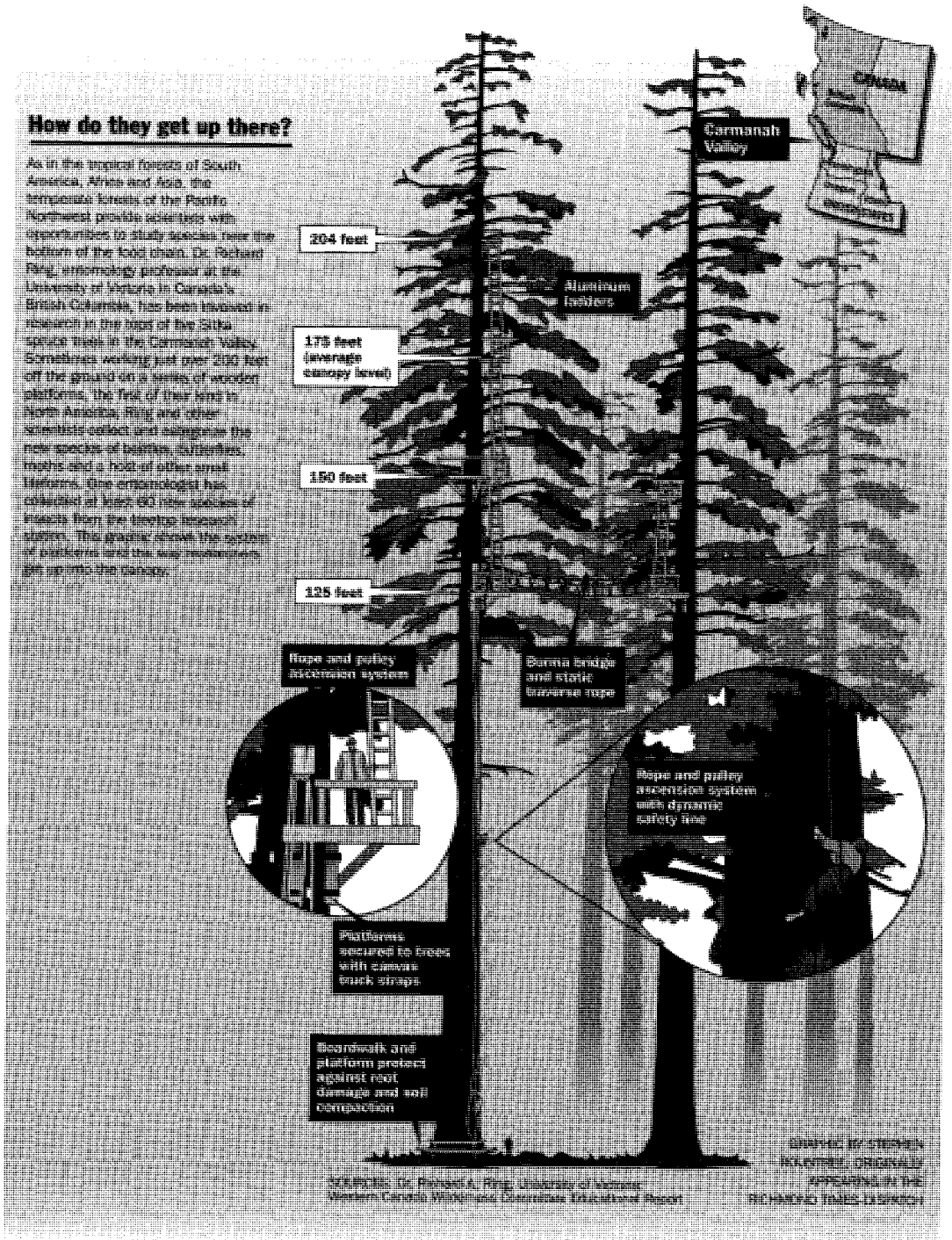

FIGURE 2. Diagram of the canopy access system in Sitka spruce in the Upper Carmanah Valley.

biological diversity and many species may be lost.

Acknowledgements

We acknowledge with thanks the Western Canada Wilderness Committee who made available the research facility and our first canopy access system in the Upper Carmanah Valley; the Lester B. Pearson College of the Pacific and the Richard Ivey Foundation who were instrumental in having the second canopy access system built at Rocky Point, Victoria; and Dr. Andrew Spencer, Director of the Bamfield Marine Station, for having the third system built on BMS property. We also express our appreciation to Kevin Jordan and Stephanie Hughes of Arbornaut Access, Victoria, B.C. who constructed the latter two canopy access systems and who also assisted us in many aspects of our sampling program.

Literature Cited

Alaback P. 1990. Comparative ecology of temperate rainforests of the Americas along analagous climatic gradients. U.S. Forest Service, Pacific Northwest Research Station, Juneau, AK.

Kellogg E. 1992. Coastal Temperate Rain Forests: Ecological Characteristics, Status and Distribution Worldwide. Occasional Paper Series, #1. Ecotrust, Portland, OR. 64 pp.

Meidinger D. and J. Pojar. 1991. Ecosystems of British Columbia. Special Report Series #6. B.C. Ministry of Forests, Victoria, B.C. 330 pp.

Weigand J. 1990. Coastal Temperate Rain Forests: Definition and Global Distribution with Particular Emphasis on North America. Unpublished report prepared for Ecotrust/Conservation International, Portland, OR.

Winchester N.N. and R.A. Ring. 1995. Centinelan extinctions: extirpation of northern temperate old-growth rainforest arthropod communities. Selbyana 16(2), (in press).