

2.0 State of the Natural Environment

2.1 Landbase

Introduction

Forested landscapes define British Columbia. The Cowichan Valley Regional District (CVRD) is located in the coastal temperate rainforest – a globally unique ecosystem. The CVRD's forest-dominated ecosystems are very diverse, and range from some of the driest to some of the wettest in the province.

Measuring trends for the thousands of individual living species is impossible, and broader indicators are typically used to understand ecological health. A broad "state of the landbase" indicator is useful because it reflects population trends for many other species. The closer a landscape is to its "natural" condition, the more likely that the associated biodiversity values are maintained and that natural processes such as hydrologic cycles continue to function.

Forest harvesting and land clearing have historically been the major agents of change for forested ecosystems on Vancouver Island and within the Cowichan Valley Regional District. Significant harvesting of easily accessible stands started in the 1800s and has continued to the present day, with changes in harvest pattern and profile over time.

Accessibility is different for different areas of the Island, resulting in variations in remaining forest cover today. In addition, clearing by Europeans for agriculture and settlement has significantly impacted land conditions, primarily of the eastern and southern portion of the Island, including the CVRD.

Measuring the Condition of the Landbase

Landbase condition can be measured and assessed at many different scales. For example, although the CVRD region is large, forested landscapes and many associated species generally function at a much larger scale. It therefore becomes important to understand how conditions in the CVRD fit into the broader condition of forests on Vancouver Island.

This section focuses on the broader forest condition, and assesses its state primarily by measuring the amount of old forest present in different ecosystems for Vancouver Island and within the CVRD. An analysis of smaller ecosystems is provided in Section 2.2 (Sensitive Ecosystems). A secondary measure used is the level of land under protection, as it provides a general assessment of the potential future condition of the landbase.

Current land use also interacts with condition and levels of protection – for example, Crown land and private forest land are managed under different regulations. As a result future condition may be different. In addition, lands that are converted from forest to other uses (development lands) make a different ecological contribution into the future. These factors are relevant in the CVRD where a significant area of forest land is held as private holdings; however, this factor was not included in this first State of the Environment Report (see Summary).

Three indicators are provided in this report:

- > Condition of Vancouver Island's forested landbase
- > Condition of the CVRD's landbase
- > Level of protected areas within the CVRD

Condition of Vancouver Island's Landbase

Indicator and Measure

This indicator examines the current forest condition for the different ecosections on Vancouver Island, as defined by the amount of forest >140 years in age. This indicator places information for the CVRD into an appropriate regional context.

Vancouver Island is classified into six ecosections, and the ecosystems within them are divided into a large number of "biogeoclimatic" units (Figure 2.1).²¹ The eastern side of the Island – the Nanaimo Lowland and Leeward Island Mountains – are characterized by dry forests dominated historically by Douglas-fir and Garry oak, which historically burned relatively frequently by both natural and First Nation-driven fires. This "Coastal Douglas-fir" zone is one of the most diverse forested regions in BC, and under natural conditions had about 50% in old forest condition at any one time,²² with many old fire-resistant trees scattered among younger forest stands.

21 A description of these zones can be found on the Ministry of Forest's Biogeoclimatic Ecosystem Classification (BEC) website: www.for.gov.bc.ca/HRE/becweb/resources/classificationreports/subzones/index.html

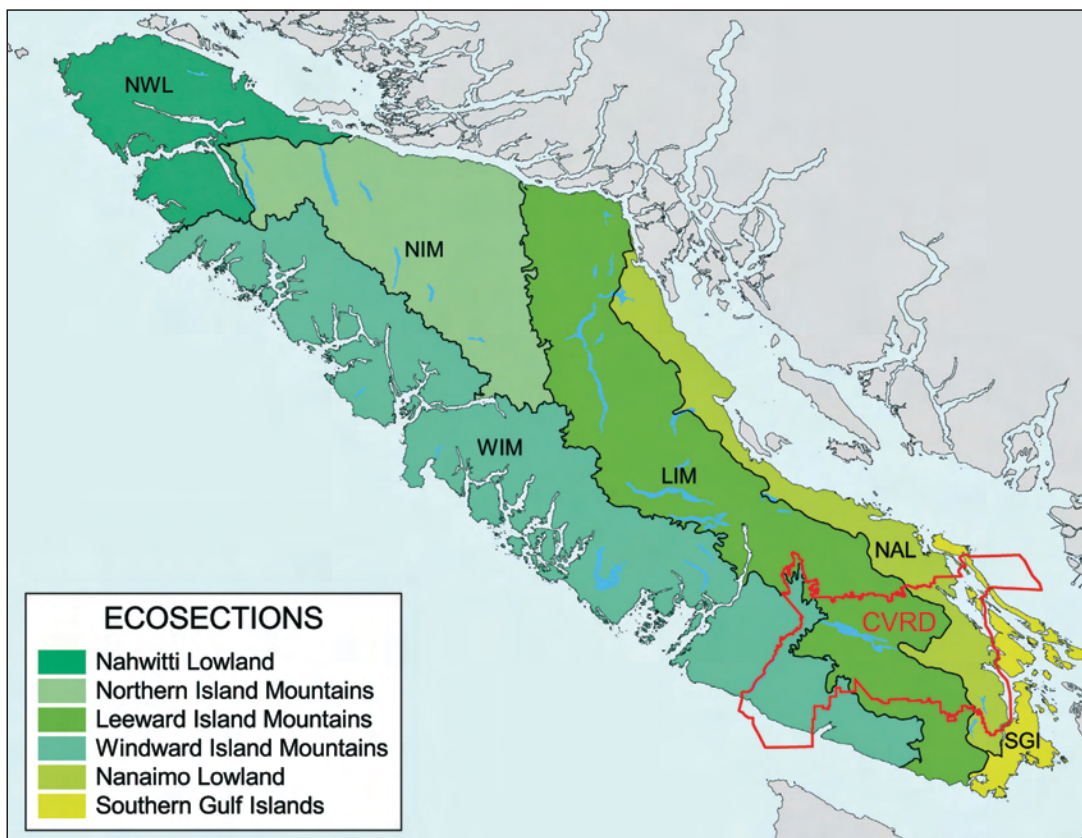
22 Percent in old forest condition is estimated based on stand-replacing fire interval estimates available from a variety of scientific studies for coastal ecosystems.

In contrast, the forests on the west side of Vancouver Island are some of the wettest in the province, and so burn very infrequently. As a result, they are characterized by huge-statured and often old or ancient western red-cedar, western hemlock and Sitka spruce forests, and under natural conditions typically had between 70–95% in old forest condition. These multi-storied canopy forests (forests with many layers) provide a home to a huge diversity of plants and animals and provide many natural functions.

British Columbia has some of the best forest classification systems and forest cover mapping available anywhere in the world, and this information is typically publicly available for Crown land. However, although the information exists for private forest land and tree farm licenses, it is sometimes not released by companies or is available only in summary form. This is the case for the CVRD, where much of the forest is held privately. In the absence of access to privately held information, this indicator relies on Baseline Thematic Mapping (BTM) data.²³ Although BTM data can provide an overview of general trends, the level of detail available in the data is relatively coarse and not as accurate as typical forest cover data.

The "age" of the forest stand is defined by air-photo interpretation, and presented by ecosection.

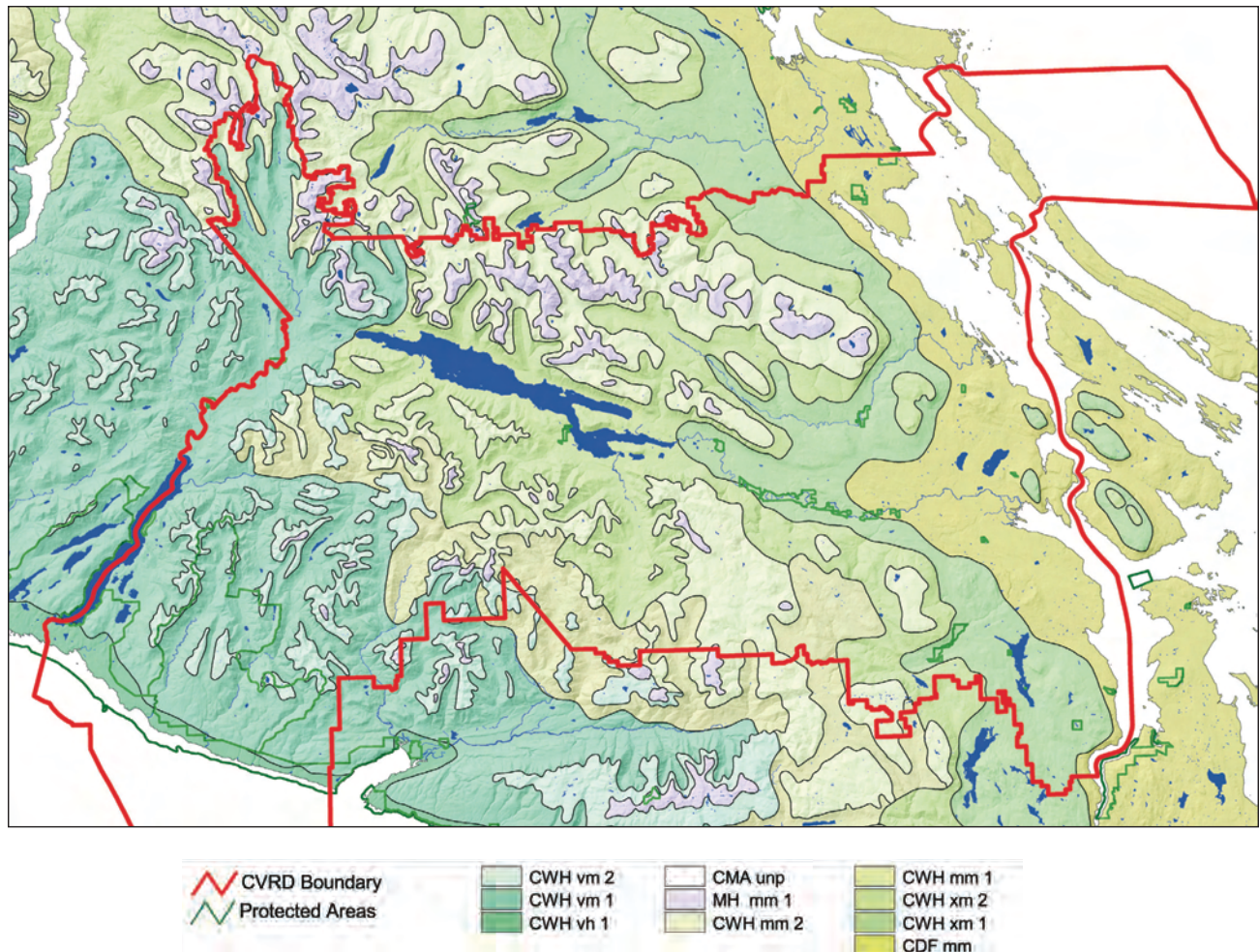
FIGURE 2.1: Distribution of ecosections on Vancouver Island, highlighting the CVRD



23 Baseline Thematic Mapping – available at: www.hectaresbc.org

In addition, the forests of the province are classified into biogeoclimatic zones, which provide a framework within which to categorize the condition of different "types" of forests. For example, Figure 2.2 shows the biogeoclimatic zones present within the CVRD. These forests differ in terms of their vegetation, soils and topography and span the range from dry Garry oak and arbutus woodlands in the east to wet cedar-dominated forests in the west.

FIGURE 2.2: Distribution of biogeoclimatic zones within the CVRD



CDF = Coastal Douglas-fir zone;

CWH = Coastal Western Hemlock zone;

MH = Mountain Hemlock zone.

The additional characters (e.g., vm1) describe the specific moisture and temperature regime within that specific region.

A detailed description of these biogeoclimatic zones is available online.²⁴

24 See www.for.gov.bc.ca/hfd/library/documents/TREEBOOK/biogeno/biogeno.htm

Findings

Coastal temperate rainforests are defined by their old-growth forests, so assessing the amount of remaining old forest provides an indicator of the health of the ecosystem as a whole today. In addition, it likely reflects the ability of the ecosystem to resist, at least to some degree, the coming impacts of climate change into the future.

For Vancouver Island, the distribution of older forests remaining in different ecosystems is very uneven. The drier zones on the east side of the Island (the Nanaimo Lowlands eco-section) have extremely low levels of old forest remaining, with 2.5% of the forested landbase greater than 140 years in age. This is a fraction of what would have existed under natural disturbance conditions.

Levels of older forest are higher on the western/northern sections of the Island – ranging from 40–55%. However, although these percentages are much higher, they are still considerably lower than the amount of old forest present under natural disturbance conditions, when typically 70%–>90% of the landbase would have been older than 140 years in age.

Table 2.1 shows a breakdown of the amount of older forest (>140 years in age²⁵) remaining in each of four eco-sections (locations shown in Figure 2.1 and Figure 2.2).

A recent detailed mapping exercise for part of the area – the Coastal Douglas-fir (CDF) zone²⁶ – provides more accurate and fine-scale information about the amount of older forest cover. For the whole CDF zone (not just the section within the CVRD), more than 33% of the land area has been converted to urban, rural, agricultural and industrial use, while 2% is wetlands, 4% is natural non-forested areas and 60% remains forested. Of the forested portion only 610 ha (less than 1%) remains as old growth (structural stage 7), with 13% remaining as mature forest. Wetland and estuary ecosystems represent only 2% of the entire CDF area.

This context analysis is important for the CVRD because it highlights whether the condition within the regional district is mirrored in adjacent areas, or whether the condition within the CVRD is an anomaly in the broader forest landscape. The low level of old forest remaining, particularly in the eastern portion of Vancouver Island, suggests that ecological functions and values may not be being maintained at this scale. Where forest condition is poor at this scale, and also found to be poor within the CVRD, additional concern and action within the CVRD may be warranted. A more detailed analysis particular to sensitive ecosystems within this zone is presented in Section 2.2 (Sensitive Ecosystems).

25 Forests greater than 140 years in age are used to identify "natural older" forests for the ecosystems in this analysis. Typically, an age of greater than 250 years is used to identify old forests, particularly in wetter west coast ecosystems, where natural old growth can be in excess of many thousands of years in age. However, for simplicity of presentation, and because of data limitations, 140 years is used to define "older" forests in this analysis since these forests likely established naturally – rather than as a result of harvesting – so represent naturally mature or old forests.

26 Madrone, 2008. Even this analysis is out of date since it is based on air photos taken since 1993.

TABLE 2.1: Vancouver Island – amount of old growth remaining in broad forested zones, by ecosection²⁷

Ecosection	ZONE	Area (ha) Forest > 140 years	Total Forest area (ha)	Percent >140 years	Estimated Percent of natural remaining	Total for Ecosection (%)
Nanaimo Lowland	CDF	245	86,626	0.3	<1%	
	CWH	7,145	211,559	3.4	6%	
Total		7,390	298,185			2.5%
Leeward Island Mountains	CWH	138,258	764,623	18.1	36%	
	MH	62,561	129,096	48.5		
Total		203,930	932,882			21.9%
Northern Island Mountains	CWH	167,044	421,928	39.6		
	MH	63,442	135,991	46.7		
Total		232,527	577,858			40.2%
Windward Island Mountains	CWH	555,907	992,004	56.0		
	MH	33,208	80,941	41.0		
Total		589,348	1,080,937			54.5%

CDF = Coastal Douglas-fir zone; CWH = Coastal Western Hemlock zone; MH = Mountain Hemlock zone.

²⁷ From analysis of 2002 BTM data, available at www.hectaresbc.org

Condition of the CVRD's Landbase

Indicator and Measures

The amount of old forest >140 years in age (as above) is now analyzed within the CVRD. This focus allows for a more detailed analysis of the condition of individual biogeoclimatic zones, compared to the natural level of old forest expected under natural disturbance conditions.

Findings

The CVRD is about 360,000 ha in size. Of this total area, around 8% is identified as developed for agriculture, residential and urban (note this does not include forested areas that contain rural properties). The biodiversity values and ecological functions (e.g., provision of clean water, productive soil, native biodiversity) provided by these "converted" forest lands are typically much lower than those provided by remaining forests. Of the remaining broad landbase, almost 70% is young forest or recently logged, with 18% in forest >140 years in age (Table 2.2).

TABLE 2.2: Approximate land use within the Cowichan Valley Regional District²⁸

Land Use Type	Area	Percent
Agriculture	9,164	2.6
Residential / Agricultural Mix	5,314	1.5
Urban	12,440	3.5
Freshwater	9,918	2.8
Recently Logged	91,917	25.8
Young Forest	156,234	43.9
Old Forest	65,302	18.4
Alpine	1,333	0.4
Wetlands	955	0.3

²⁸ Analysis of Baseline Thematic Mapping (BTM) from statistics generated from HectaresBC (www.hectaresbc.org)

Ecologically it is important to look in more detail at individual biogeoclimatic zones, especially given the diversity of ecosystems present within the CVRD. Figure 2.2 illustrates the diversity of forested biogeoclimatic zones present within the CVRD, as described above.

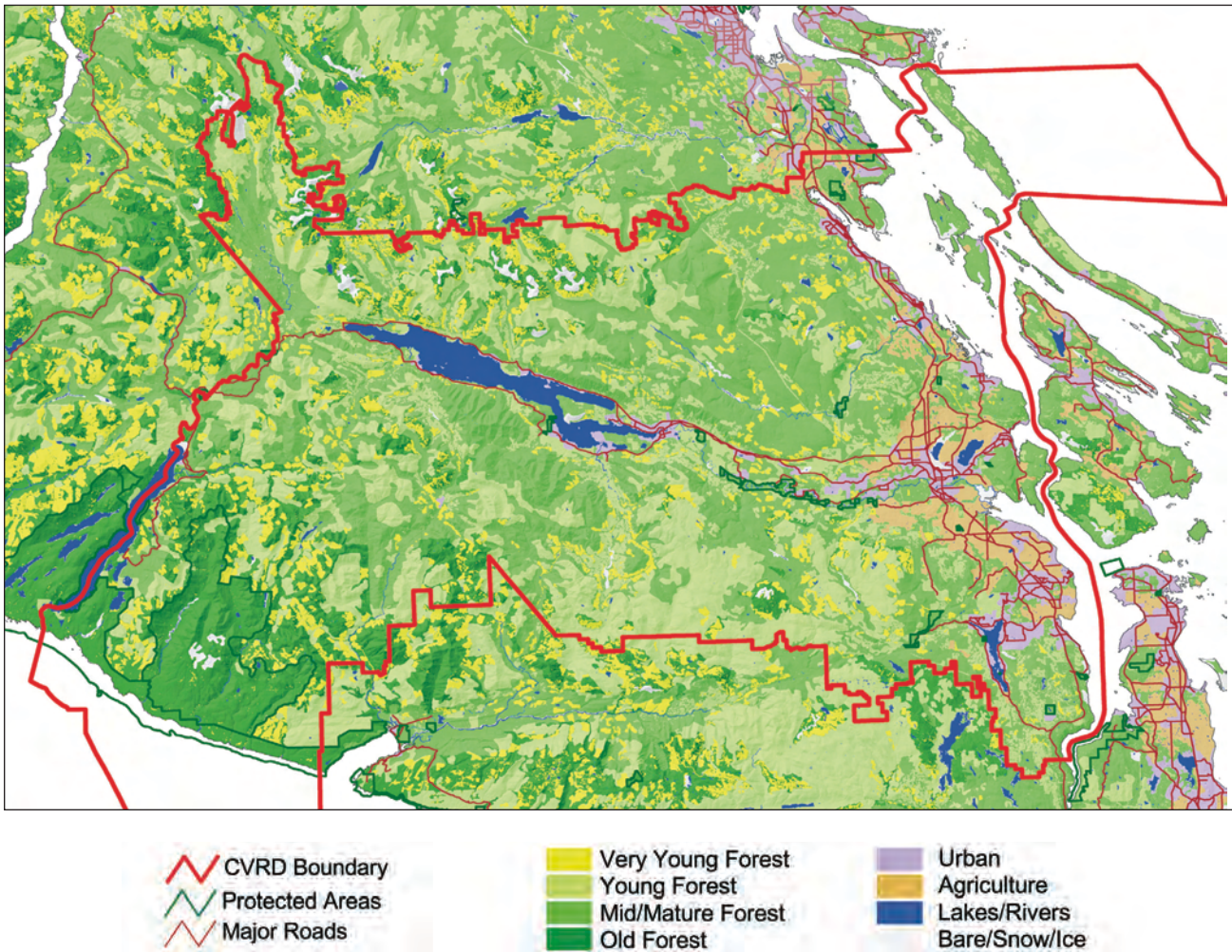
Figure 2.3 and Table 2.3 provide a more detailed illustration of the amount of old forest remaining in each zone within the CVRD, including the (largely) dry zone on the east coast, and the wettest zones on the west coast. The CDF zone has the highest percent of human settlement – almost 50% of the whole zone is agriculture/residential or urban. For the remaining forested portion within the CDF zone, no old forest remains.²⁹ Historically, around 50% of the CDF landscape would have been greater than 140 years in age.

The two drier Coastal Western Hemlock zones (adjacent to the Coastal Douglas-fir zone) also have extremely low levels of forest >140 years in age remaining (2% and 4% respectively), compared to an estimated historic level of around 50% or more, resulting in very poor forest condition today.

For this whole eastern portion of the CVRD, the vast majority of the landbase is in second growth forest less than 40 years in age. This is shown by the yellow and light green forests in Figure 2.3. The only significant areas of older forest remaining are within the Carmanah/Walbran valleys on the west coast of the region (shown by dark green).

²⁹ Very small areas of "high structure" forest remain in this zone, but they are sufficiently small as to not be visible using these data. These small areas are highlighted in the "Sensitive Ecosystems Inventory" (Section 2.2).

FIGURE 2.3: The CVRD landbase coloured by broad age group categories³⁰ of forest and other land use (urban/agricultural)



Source: Data analysis based on BTM Data, 2002.

³⁰ Approximate age group categories: Very young = less than 10 years old; Young = less than 40 years old; Mid / Mature = 41 – 140 years in age; Old = >140 years in age. Based on analysis of BTM data, current to 2002.

Land use and condition shifts towards the west, with the percentage of development declining and the percent of old forest increasing in general. However, the mid-elevation zones (CWHmm1 and CWHmm2) have some older forests remaining, but still very low levels of forest >140 years in age (7% and 12% respectively). Again, compared with the predicted historic level of old forest (around 50% old forest) this represents very low levels of older forest (Table 2.3).

As the higher elevation zones and west coast forests are reached, older forests are more prevalent (see dark green within the Carmanah/Walbran provincial park), but in general (except for the CWHvm1) at levels still considerably lower than the predicted levels of 70 – 95% forests > 140 years that would occur under natural disturbance conditions.

TABLE 2.3: Landbase condition data – area (in hectares) and percent in four broad age categories³¹ for forested zones, and percent in urban/agriculture/mixed zones

Biogeoclimatic Zone	Forest type	Permanent Conversion Area and Percent	Forested						
			Area and Percent Less than 20 years	Area and Percent 20 – 140 years		Area and Percent > 140 years		Percent of natural forest > 140 years	
CDF	Dry	20,000 (49%)*	1,280	6%	18,900	94%	0	0%	<1%
CWHxm1	Dry	3838 (7%)**	6,400	15%	34,300	82%	768	2%	4%
CWHxm2	Dry	1280 (2%)***	17,700	25%	49,900	71%	2,820	4%	8%
CWHmm1	Moist	-	11,000	42%	13,100	51%	1,790	7%	14%
CWHmm2	Moist	-	31,500	55%	18,900	33%	6,910	12%	24%
MHmm1	Moist/ Wet	-	4,610	37%	2,560	21%	5,120	42%	73%
CWHvm1	Wet	-	17,400	25%	16,600	24%	34,600	50%	61%
CWHvm2	Wet	-	5,890	37%	1,540	10%	8,450	53%	61%
CWHvh1	Wet	-	256	6%	0	0%	4,350	94%	98%

Note: This table is organized by biogeoclimatic zones (see Figure 2.2). The far right-hand column shows today's older forest as a percent of that occurring historically (red text indicates those below the "high risk to ecological integrity" threshold as defined below)

*CDF: 21% agriculture; 11% residential/agricultural mix, 17% urban.

** CWHxm1: 1% agriculture; 2% residential /agricultural mix; 4% urban

*** CWHxm2: 2% urban.

31 Note that these "age" cut-offs are approximate, and based on broad categories of photo-interpretation.

The estimated percent of natural forest remaining provides a more "ecosystem-specific" assessment of current condition – since naturally the levels of old forest differ across ecosystems. An analysis of science literature undertaken for the Coast Information Team³² looked at how the levels of old forest relate to potential "risk" to ecological integrity, and recommended that more than 70% of natural levels represented low risk, while less than 30% of total level of old forest represented high risk to ecological integrity.³³

For forest types within the CVRD, the wettest outercoast zone (CWHvh1) has a high proportion of its original old forest, so there is a high probability that ecological systems remain fully functioning. The other wetter zones have around 70% of the natural levels of old forest remaining – meaning there is reasonable probability that landscape-level ecological integrity is maintained.³⁴ However, east coast moist and dry zones all have considerably less than the "high risk threshold" of 30% of old forest remaining, meaning that there is a high probability that landscape level ecological integrity is not maintained.

Level of Protected Areas within the CVRD

Indicator and Measures

The level of "protection" for different ecosystems provides a general overview of the potential future condition for an area. Landscapes with high levels of "conservation focused" protected areas tend to have high-functioning ecosystems into the future irrespective of the condition today, as these areas are either maintained or allowed to restore back towards natural condition through time. Protected areas are often thought of as providing "core" areas within which biodiversity values can be maintained, which then help to maintain biodiversity and ecological functions in other non-protected parts of the landscape. However, for them to be effective in this role, there needs to be a relatively high percent of protection, and protected areas need to be large, well distributed and representative of the ecological diversity. The higher the level of core protection, the higher the likelihood of meeting these criteria.

There are a number of different ways in which lands can be "protected" and these can contribute towards conservation goals to varying degrees, including federal and provincial parks, ecological reserves, regional parks, municipal parks, and conservation lands.

32 www.citbc.org

33 Price, Holt and Kremsater, submitted.

34 This single indicator of course does not consider the implications of habitat fragmentation, road density, disturbance, etc., which may also result in increased risk, but which are not assessed here.

Findings

Table 2.4 shows a breakdown of the amount of protected area for each zone for each type of park. It does not include municipal parks, which are typically not managed specifically for conservation goals.

TABLE 2.4: Total area (hectares) and percent protected areas – by biogeoclimatic zone³⁵

Type	CDF	CWHxm1	CWHxm2	CWHmm1	CWHmm2	CWHvm1	CWHvm2	CWHvh1	MHmm1	TOTAL
National Park	0			0		1,790		3,330		5,120
Provincial Park	1,020	2,300	256	0	256	15,400	1,540	256		21,000
Regional Park	256	768		0						1,020
Total Park	1,276	3,068	256	0	256	17,190	1,540	3,586	0	27,140
Total Area	41,200	47,100	78,600	25,000	57,000	70,400	16,100	4,610	13,800	
Percent Park	3.1%	6.5%	0.3%	0.0%	0.4%	24.4%	9.6%	77.8%	0%	7.7%

In the east, there are generally very low levels of protected areas – 3% or less for the drier zones, except for the CWHxm1, which incorporates the Cowichan River Park. Working westwards, higher levels of protection are found – but the overall level of representation in protected areas for the CVRD remains low at 7.7%.

There is no set level of protected area that is considered necessary to maintain core ecological functioning. However, politically set levels of 12% are well known to be inadequate.³⁶ More recent scientific analyses suggest that to be effective, levels closer to 50% of the landscape managed with an emphasis on conservation are required for effective maintenance of biodiversity and ecosystem services.³⁷

³⁵ From www.hectaresbc.org

³⁶ Svancara et al., 2005.

³⁷ See review in Holt, 2007 and Svancara et al., 2005.

Summary

The CVRD landbase has been continuously utilized by humans since glacial retreat, but this utilization has expanded dramatically in scale and scope since European settlement. The human footprint now covers approximately 275,000 ha of the CVRD's 360,000 ha – over 75% of the total landbase (including development and logging), and affects the ability of the landbase to supply and maintain ecological values and services.

Impacts are particularly severe on the east coast, where around 50% of the landbase has been converted from its historic forested condition, and the remaining forested landbase has very little or no older forest or older forest attributes remaining. At higher elevations, and towards the west coast, the condition of the forested landbase is better – but is still lower than levels of old forest under natural conditions. Most protected areas within the CVRD serve to protect west coast forests, with almost no ecological protection on the east coast. The total level of protection (<8%) for the CVRD is much lower than what is needed to maintain ecological values into the future.

Missing Information

This analysis provides broad landscape trends, but could be improved by gaining access to more detailed or up-to-date forest cover information. The southern part of Vancouver Island, including the CVRD, is unusual for British Columbia in having a high proportion of forest land held as privately owned forests. This makes data availability and analysis more difficult than in areas of the province which are primarily Crown land. Most of the eastern forests of the CVRD are privately owned, and most of the western portion is Crown land managed as tree farm licenses where data are also not freely available. Compiling a complete and up-to-date database with up-to-date data is therefore difficult.

The Baseline Thematic Mapping (BTM) data used in this analysis are current to about 2002. Continued forest harvesting and conversion is ongoing within this region. An important "next step" in this analysis would be to assess the potential impacts of recent and already-planned development within the region. The broad "age class" breaks inferred from the BTM data are estimates only, based on photo-interpretation, and are useful in providing information on broad trends, but inaccurate when it comes to determining forest stand ages. A comprehensive data layer for conservation lands was not available, so these areas – which tend to be relatively small but focus on very high value areas – are not included in this analysis.

References

Baseline Thematic Mapping data available through www.hectaresbc.org

Holt, R.F. 2007. Conservation Planning and Targets for the Coastal Douglas-fir Ecosystem. A Science Review and Preliminary Approach. Prepared for ILMB, Nanaimo. Available at www.veridianecological.ca

Madrone Environmental Services. 2008. Terrestrial Ecosystem Mapping of the Coastal Douglas-fir Biogeoclimatic Zone. Prepared for B. Zinovich, ILMB.

Price, K, R.F. Holt and L. Kremsater. Submitted 2009. How Much is Enough: Can Threshold Science Inform Old Growth Targets? Submitted manuscript available at www.veridianecological.ca

Svancara, L.K., R. Brannon, M. Scott, C.R. Groves, R.F. Noss and R.L. Pressey. 2005. Policy-Driven Versus Evidence-Based Conservation: a Review of Political Targets and Biological Needs. *BioScience* 989: Vol. 55, No. 11.

