Coastal Douglas Fir (CDF) Zone Protected Areas Ecosystem Representation Analysis

Deliverables Report

Ministry of Forests, Lands & Natural Resource Operations

Jenna Cook

August 27, 2011

List of Acronyms

ACRONYM	DESCRIPTION
CDF	Coastal Douglas-Fir Zone
CDFmm	Coastal Douglas-Fir Moist Maritime Subzone
TEM	Terrestrial Ecosystem Mapping
LUO	Land Use Order
WMA	Wildlife Management Area
WHA	Wildlife Habitat Area
OGMA	Old Growth Management Area
SQL	Structured Query Language used to manage and query a database

Table of Contents

Appendix

Abstract

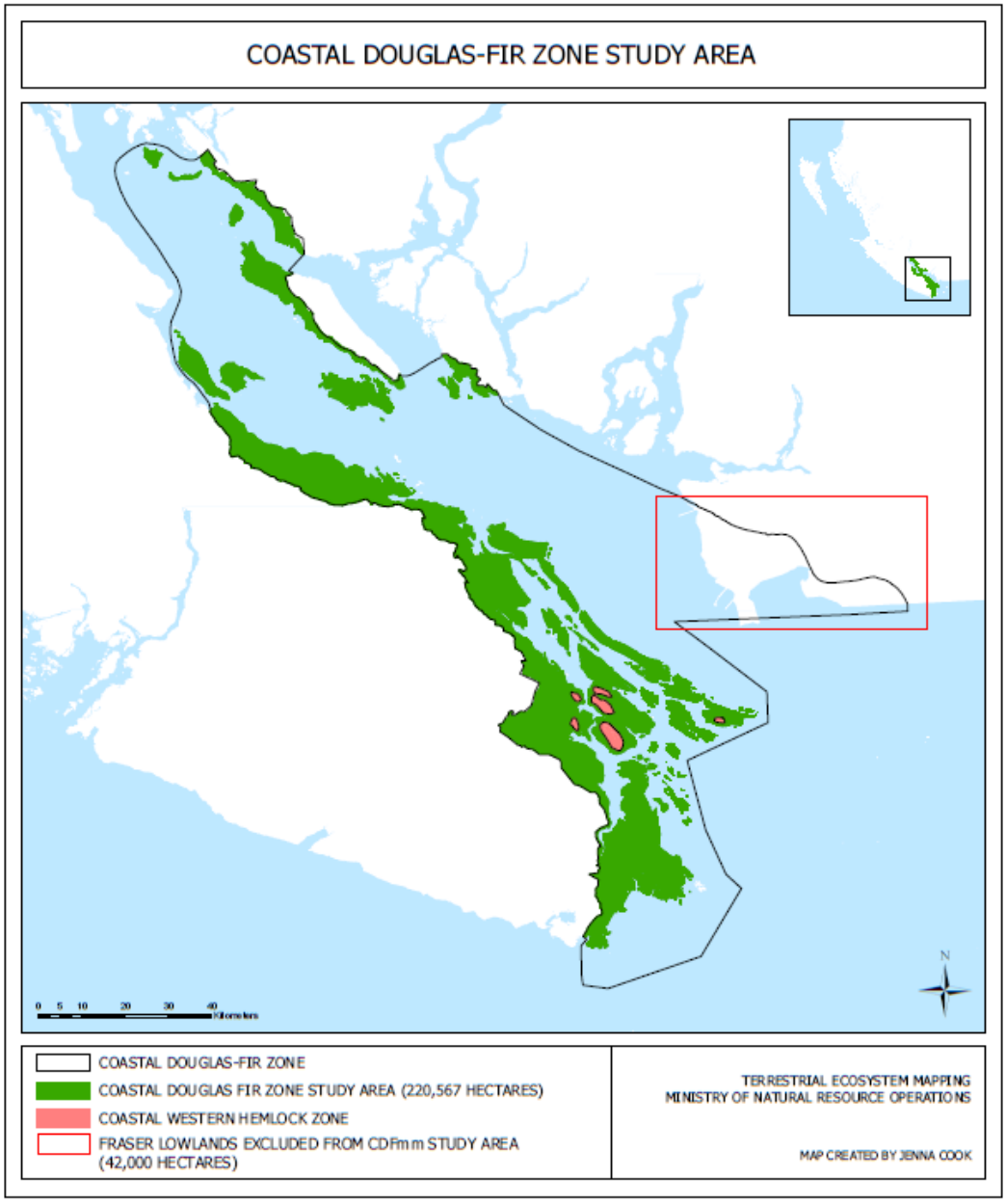
This deliverables report discusses the necessary information for those who are using the deliverables generated. Such deliverables are an Excel summary document with tables, pivot tables, and calculation datasheets that display the ecosystem and protected area summaries; and protected areas maps. Topics discussed are the study area, objectives and deliverables, methodology (data layers used, software used, data preprocessing, ecosystem summarizing, protected area disturbance identification), changes made to the data, limitations of the data, quality assurance, and recommendations for further analysis.

Project supervisors:

- Darryn McConkey (Ministry of Forests, Lands, and Natural Resource Operations)
- Carmen Cadrin (Conservation Data Centre)

Study Area

The CDFmm zone is located in the Georgia Strait's low elevation coastal environment. It includes Vancouver Island's southeastern coast (from Deep Bay in the north to Victoria in the south); Gulf Islands; and portions of Powell River, the Sunshine Coast, and the Fraser Valley. There are pockets of the higher elevation Coastal Western Hemlock zone on Saltspring Island, Saturna Island, and in the Cowichan Valley. Terrestrial Ecosystem Mapping of the CDFmm excluded the Fraser Valley (42,000 hectares); therefore it is not included in this project's study area (Madrone, 2008). The CDFmm study area includes all other portions of the zone, making it 220,567 hectares in total.



Objectives and Deliverables

The goal of this project was to provide detailed information on protected areas in the CDFmm study area:

- The area of ecological communities (including structural stage), sparsely vegetated/nonvegetated ecosystems, and anthropogenic land use within each protected area.
- The total area of ecological communities (including structural stage), sparsely vegetated/nonvegetated ecosystems, and anthropogenic land use within the CDFmm study area protected areas.

The following deliverables have been produced:

- **CDFmm PA Ecosystems** excel document with the CDFmm protected area ecosystem summaries that includes datasheets, pivot tables, and calculation datasheets:
  - **PA's Pivot** includes area summaries of protected area ecosystems. Allows user to sort on the following fields: political designation, protected area type, protected area name, ecosection, TEM mapcode, ecosystem category, ecosystem name, ecosystem group, BC List, structural stage, site series, and ecosystem area.
    - **PA's Table** includes the data used to create the PA's Pivot.
  - **StudyArea Pivot** includes area summaries of the CDFmm study area. Allows user to sort on ecosection, TEM mapcode, ecosystem name, ecosystem group, BC List, structural stage, site series, and ecosystem area.
    - **StudyArea Table** includes the data used to create StudyArea Pivot.
  - **StudyArea&PA's Pivot** includes data from the above two tables to allow the user to compare ecosystem summaries between CDFmm protected areas and the CDFmm study area. User is able to sort on the fields listed in PA's Pivot and StudyArea Pivot.
    - **StudyArea&PA's Table** includes the data used to create StudyArea&PA's Pivot.
  - **%Protected StudyArea** includes the percent of how much each CDFmm protected ecological community is representative of the CDFmm study area.
  - **%Protected Ecosys** includes the percent of how much each CDFmm ecological community (including structural stage) is protected, out of how much that particular ecological community remains in CDFmm the study area.

- **CDFmm Maps** folder which includes a study area map, protected area maps (eleven sheets), and six thematic maps. Of the thematic maps, there is one of Lasqueti Island mature and old forest; two of the Lasqueti Island Ecological Reserve (one by ecosystem category and one by ecosystem polygons); Raththrevor Provincial Park by ecosystem category; the Nanaimo Area by ecosystem category, with protected areas; and one of the northwest CDF by ecosystem category, with protected areas.

Methodology

Data Layers Used

- Protected areas: Federal, Provincial Parks, Regional, Islands Trust Fund, Private, LUOs, WHAs, WMAs, (Draft) OGMAs.
    - Note: Although Draft OGMAs are not yet legal, they are considered protected areas in this analysis.
- Study area: Study Area TEM
- Disturbance identification: 2004-2007 Vancouver Island Change Detection
- 2007 SPOT imagery
- Data sources can be viewed in Appendix III

Software Used

- ArcGIS 10
- MS Access 2010
- Excel 2010

Data Preprocessing

- File geodatabase created with protected areas layers and study area TEM
- All layers projected in BC Albers NAD 83.
- All protected areas layers intersected with the study area TEM
- Topology created for the protected areas layers intersected with TEM. Topology rules are:
    - All layers must not self-overlap
    - There must be no overlap between layers

Ecosystem Summarizing

- Protected areas layers intersected with TEM and the study area TEM exported as dbf files and imported into MS Access. Note: dbf files needed to be 8 characters or less to be imported into MS Access.
- Four SQL queries were created for each of the protected areas layers:
    - A query for each of the three deciles to extract the ecosection, TEM mapcode, structural stage, site series, and area; as well as the protected area type and protected area name. Political designation was inserted into the table. The results from the three decile queries were inserted into an amalgamated table.
    - A query to join the ecosystem category, ecosystem name, ecosystem group, and BC List on the TEM mapcode field in the amalgamated table.

- Four SQL queries were created for the study area layer
    - A query for each of the three deciles to extract the ecosection, TEM mapcode, structural stage, site series, and area. The results from the three decile queries were inserted into an amalgamated table.
    - A query to join the ecosystem category, ecosystem name, ecosystem group, and BC List on the TEM mapcode field in the amalgamated table.
- The new summary tables for each layer were brought into excel document CDFmm PA Ecosystems. They were inserted in three different excel datasheets:
    - PA's Table for the protected areas data.
    - StudyArea Table for the study area data.
    - StudyArea&PA's Table for both the protected areas data and the study area data.
- The three datasheets above were made into pivot tables:
    - PA's Pivot
    - StudyArea Pivot
    - StudyArea&PA's Pivot
- The representation (%) of protected ecological communities in the study area was calculated in separate datasheet %Protected StudyArea.
- The representation (%) of protected ecological communities of the study area remaining ecological community area was calculated in separate datasheet %Protected Ecosys.

Protected Area Disturbance Identification

As the majority of air photos used to create the CDFmm TEM data were not up to date (see appendix IV for dates), disturbances in protected areas were searched for and recorded. This was done by using the 2004-2007 Vancouver Island change detection data and by visual examination. The TEM data was not altered to account for disturbances. Instead, the disturbance type and area (ha) were recorded in two extra fields ("Dist Type" and "Ha Dist") added to the protected area layers. They are meant to be reviewed at a later date when the TEM will be updated.

Disturbance identification rules:

- Disturbance area (ha) recorded at 1:5000 scale
- Minimum polygon size: 0.125 hectares
- Minimum polygon width: 25m
- Recorded using the ArcMap measure tool

Changes Made to the Data:

- Study Area TEM data:
  - CWH zone data deleted from the CDF Study Area TEM data.
  - Transferred misplaced TEM mapcode records from SITE_S1 field to empty SITEMC_S1 field, from SITE_S2 field to empty SITEMC_S2 field, and from SITE_S3 field to empty SITEMC_S3 field.
  - Changed site series records that were single digits (#) to be prefixed with zero (0#).
- Gulf Islands National Park:
  - Self-overlapping polygons among different parks and the same parks.
  - 19.7 hectares of self-overlap was identified by the topology error inspector.
  - Polygons were removed from Eagle Island, Tortoise Islets, Princess Margaret Marine Park, Isabella Islets, Unnamed, and Russell Island.
- The area for the Savary Island private protected area was reduced by half, as the Nature Trust only has half of the legal rights to it. Originally it was 143 ha; yet 71.5 ha was used for the analysis.

Limitations of the Data

- Study Area:
  - The CDFmm in the Fraser Valley (42,000 ha) was not TEM mapped. This region is approximately 80 percent disturbed. Including TEM data for the Fraser Valley would have significantly changed the results of the analysis.
- Dates of air photos that some CDFmm TEM regions are based on:
  - Some air photos used to create the TEM are as out of date as 1980 (see Appendix IV for all dates). Disturbances since the dates of the air photos are not included in the TEM and are inaccurately represented as ecosystem.
- Poor TEM data capture of non-forested ecosystems:
  - There are beach ecosystems in the CDFmm that were mismapped as Beach (TEM mapcode = BE) and dune wildrye - beach pea (TEM mapcode = LM).
- The Private Land Conservancy layer does not contain approximately 800 new parcels.

Quality Assurance

- Topology was used to ensure that there was no area overlap between layers or self-overlap within layers. The protected areas layer boundaries are accurate to 1 meter.
- Results of querying the study area TEM were consistent with the excel document cdfmm unique sort provided to me by Linda Sinclair (FLNR) at the onset of the project. This ensures the SQL queries used in MS Access were generating accurate results.

Recommendations for Further Analysis

More accurate results of the CDFmm protected areas ecosystem representation analysis could be achieved if:

- TEM data for the Fraser Valley was included. The study area would then be the entire CDFmm zone.
- TEM data for the CDFmm was updated based on recent air photos / satellite imagery.
- TEM data for the CDFmm was revised to better capture non-forested ecosystems.
- Updated change detection analysis for the CDFmm zone was created. This would allow for up to date disturbance capturing in the CDFmm.
- Municipal parks were included. Some municipal parks have high amounts of disturbance, but many contribute to conservation.
- Private conservation lands held under conservation covenants were included.

Conclusion

The purpose of this report was to describe the necessary information for those who are using the deliverables generated in this project. The hope is that the data will be interpreted by those who have the expertise to do so. This report discussed the project study area, objectives and deliverables (excel summary document, protected areas maps, and thematic maps); methodology used to generate the results (data layers used, software used, data preprocessing, ecosystem summarizing, protected area disturbance identification); changes made to the data; limitations of the data; quality assurance; and recommendations for further analysis.

References

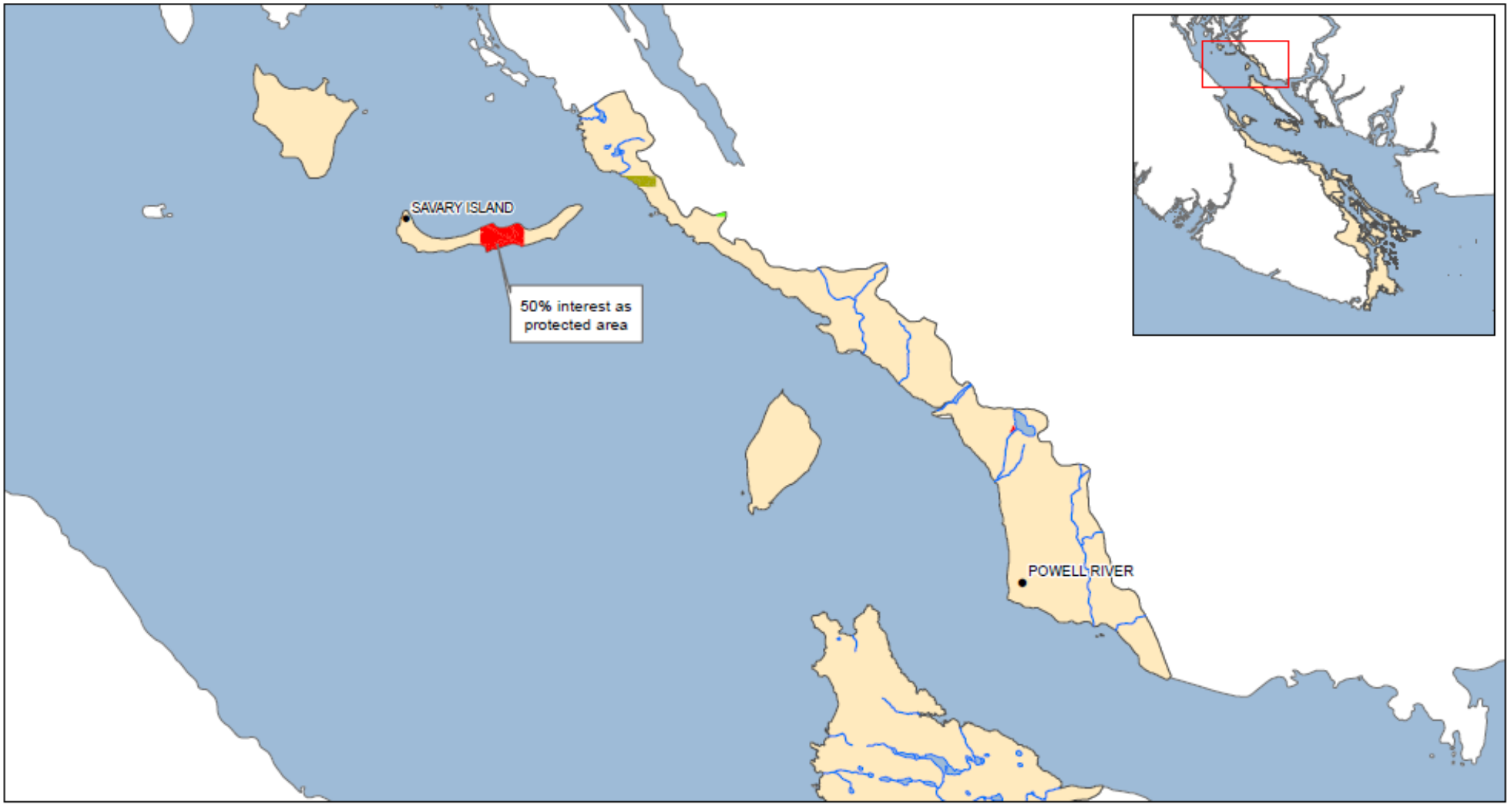
Madrone Environmental Services Ltd. (2008). Terrestrial Ecosystem Mapping of the Coastal Douglas-Fir Biogeoclimatic Zone. Duncan, B.C.

Appendix I

CDF Protected Areas Maps

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

POWELL RIVER
MAP 1 OF 11



CDFmm ZONE

NATIONAL PARK
PROVINCIAL PARK
REGIONAL PARK
ISLANDS TRUST FUND
LAND USE ORDER
PRIVATE CONSERVANCY
WILDLIFE HABITAT AREA
WILDLIFE MANAGEMENT AREA
DRAFT OLD GROWTH MANAGEMENT AREA

MINISTRY OF FORESTS, LANDS, & NATURAL RESOURCE OPERATIONS

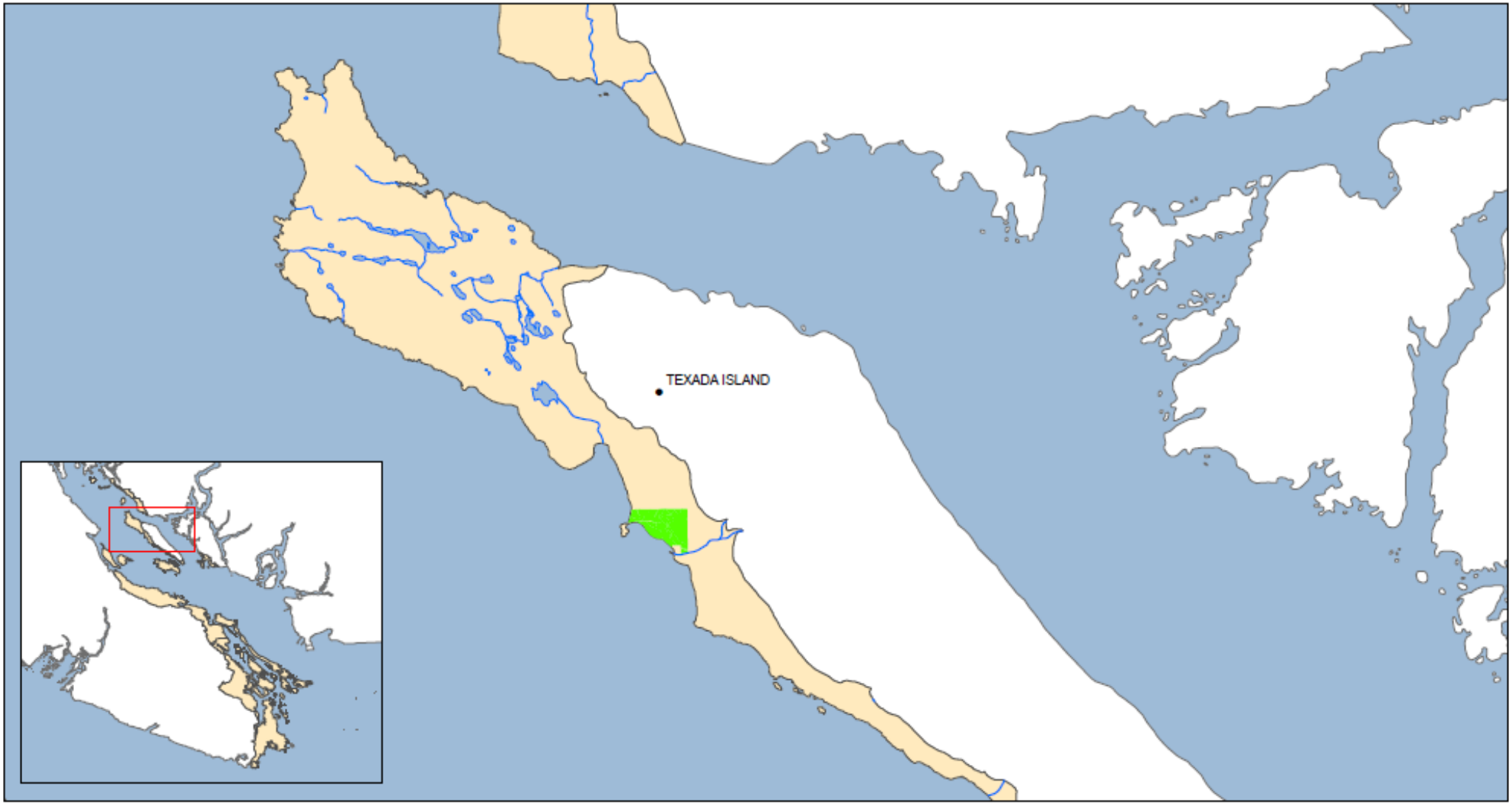
MAP CREATED BY JENNA COOK

0 1 2 4 6 8 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

NORTH TEXADA ISLAND
MAP 2 OF 11



CDFmm ZONE

NATIONAL PARK
PROVINCIAL PARK
REGIONAL PARK
ISLANDS TRUST FUND
LAND USE ORDER
PRIVATE CONSERVANCY
WILDLIFE HABITAT AREA
WILDLIFE MANAGEMENT AREA
DRAFT OLD GROWTH MANAGEMENT AREA

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0 1 2 4 6 8 Kilometers

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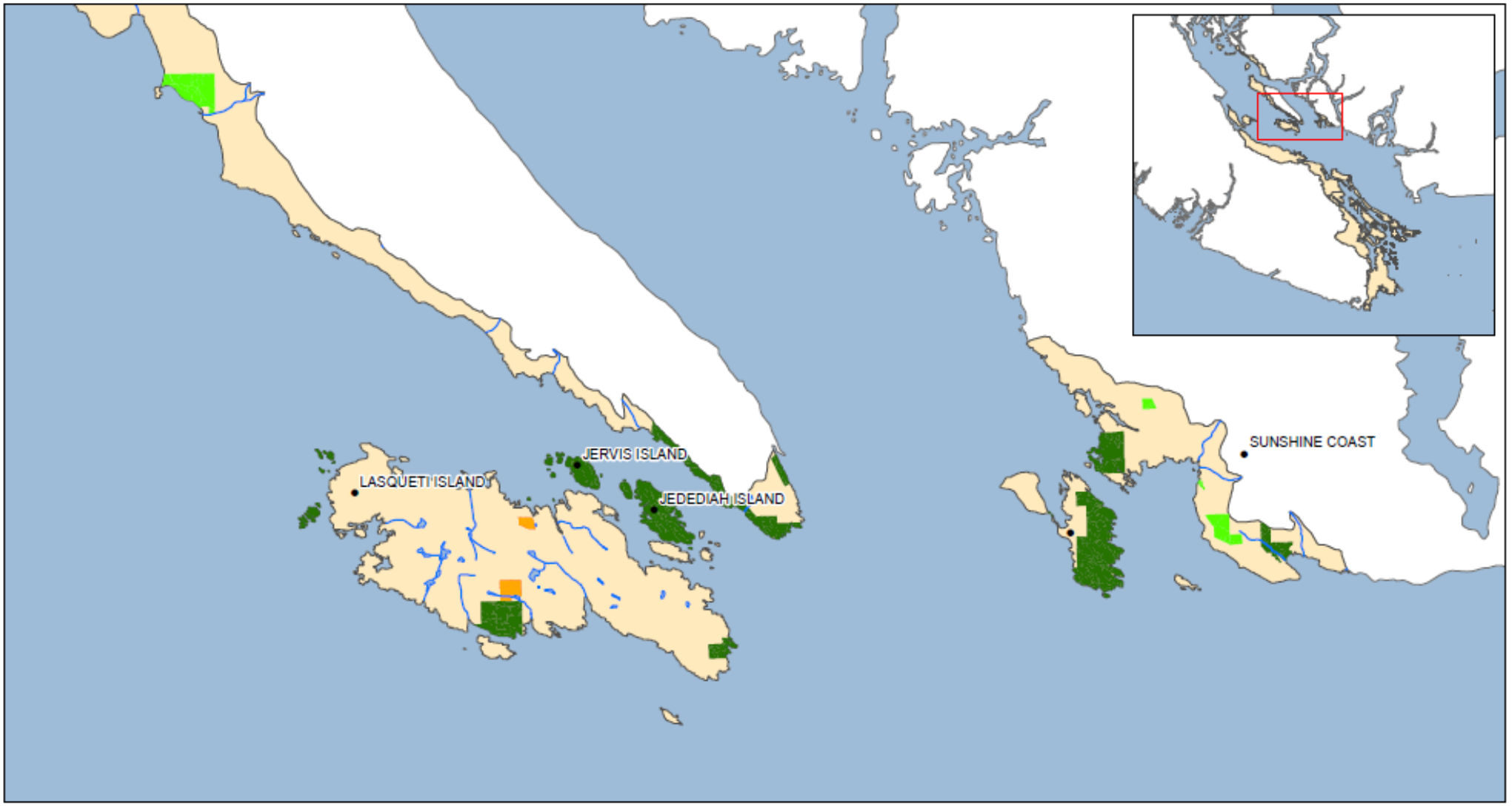
COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

SOUTH TEXADA ISLAND, LASQUETI ISLAND, & SUNSHINE COAST
MAP 3 OF 11



CDFmm ZONE

NATIONAL PARK
PROVINCIAL PARK
REGIONAL PARK
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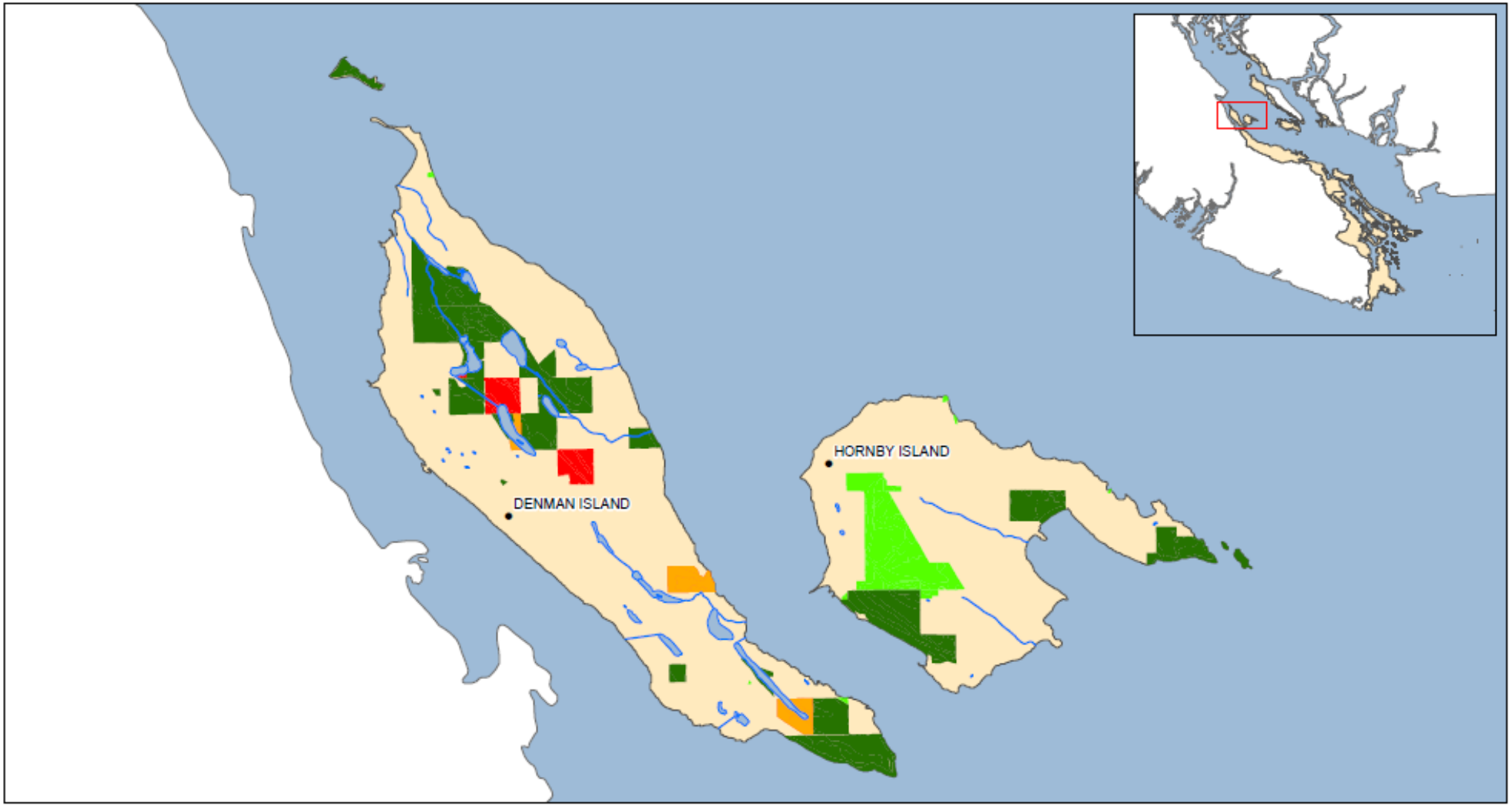
0 1 2 4 6 8 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

DENMAN ISLAND & HORNBY ISLAND
MAP 4 OF 11



CDFmm ZONE

NATIONAL PARK
PROVINCIAL PARK
REGIONAL PARK
ISLANDS TRUST FUND
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WILDLIFE MANAGEMENT AREA
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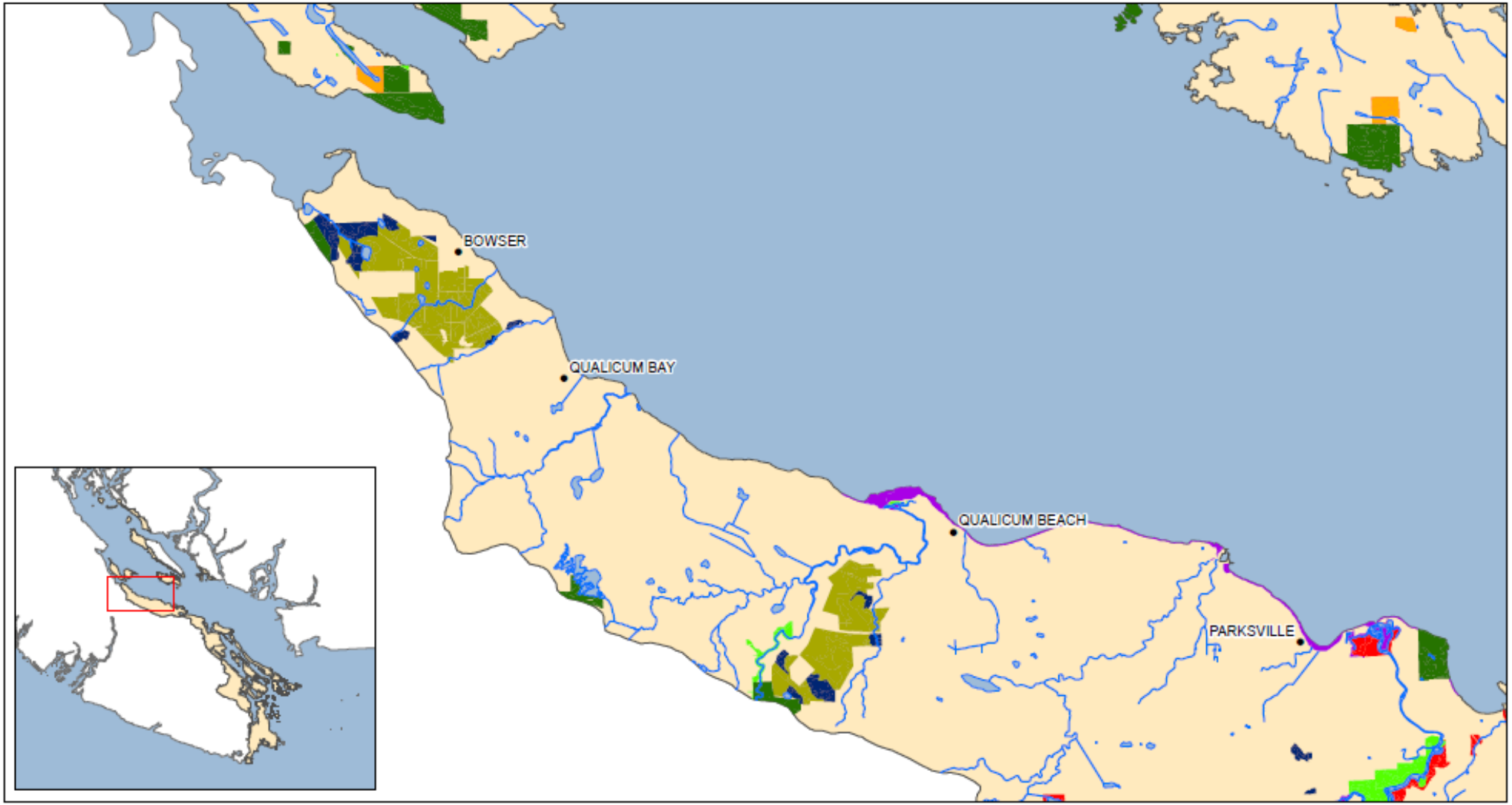
0 0.5 1 2 3 4 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

BOWSER & QUALICUM
MAP 5 OF 11



CDFmm ZONE

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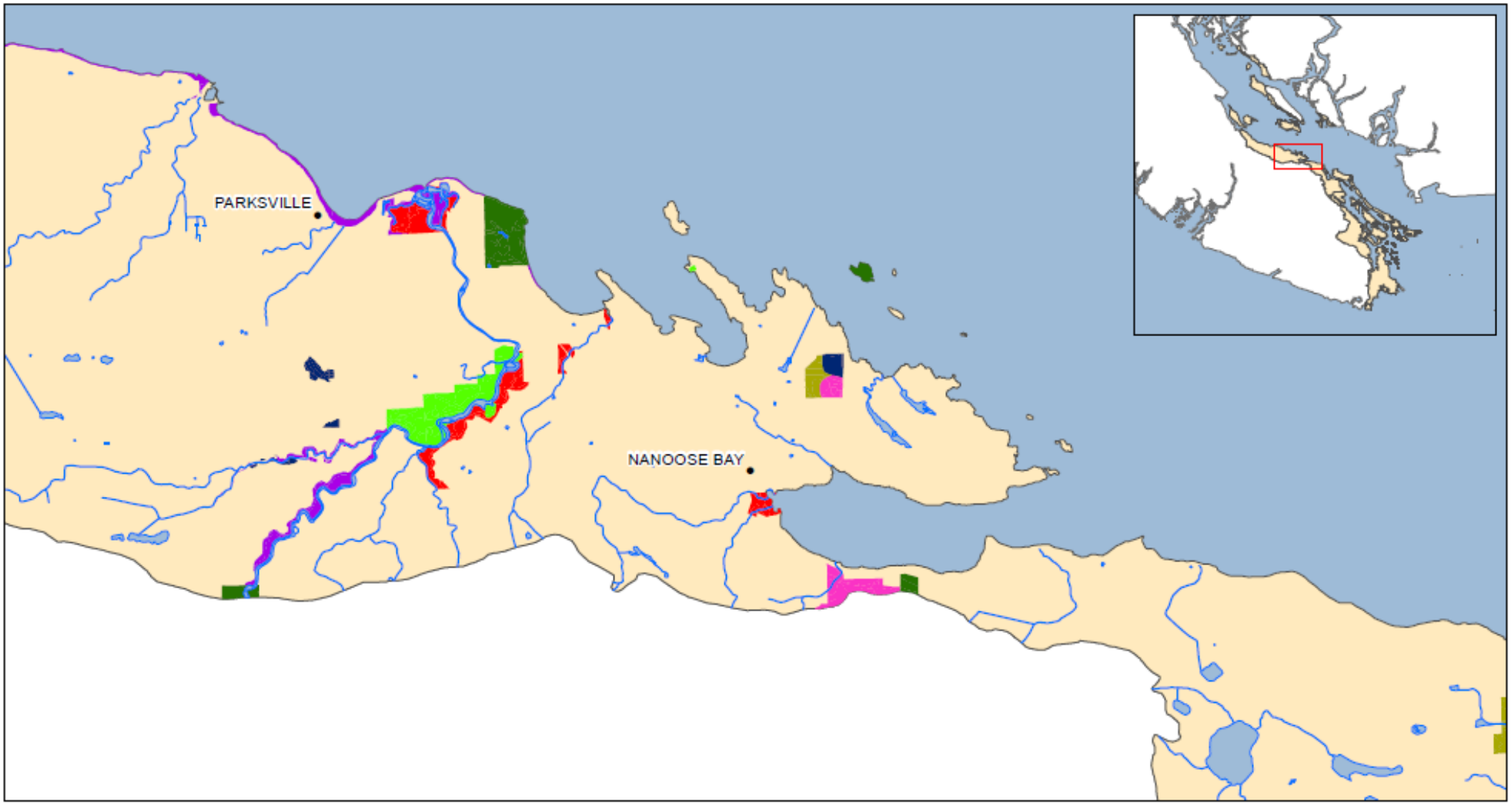
0 1 2 4 6 8 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

PARKSVILLE & NANOOSE BAY
MAP 6 OF 11



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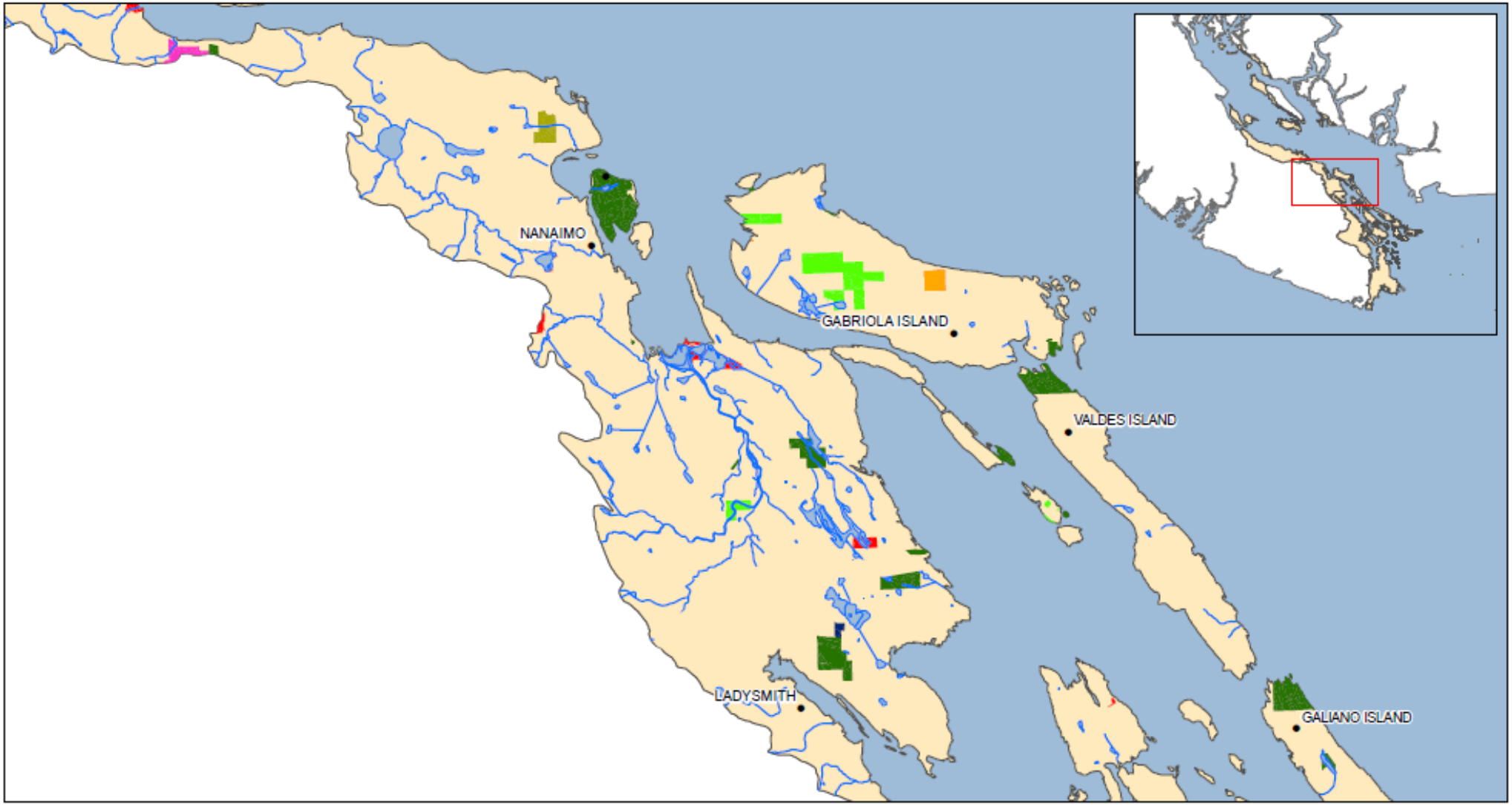
0 0.5 1 2 3 4 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

NANAIMO, GABRIOLA ISLAND, & LADYSMITH
MAP 7 OF 11



CDFmm ZONE

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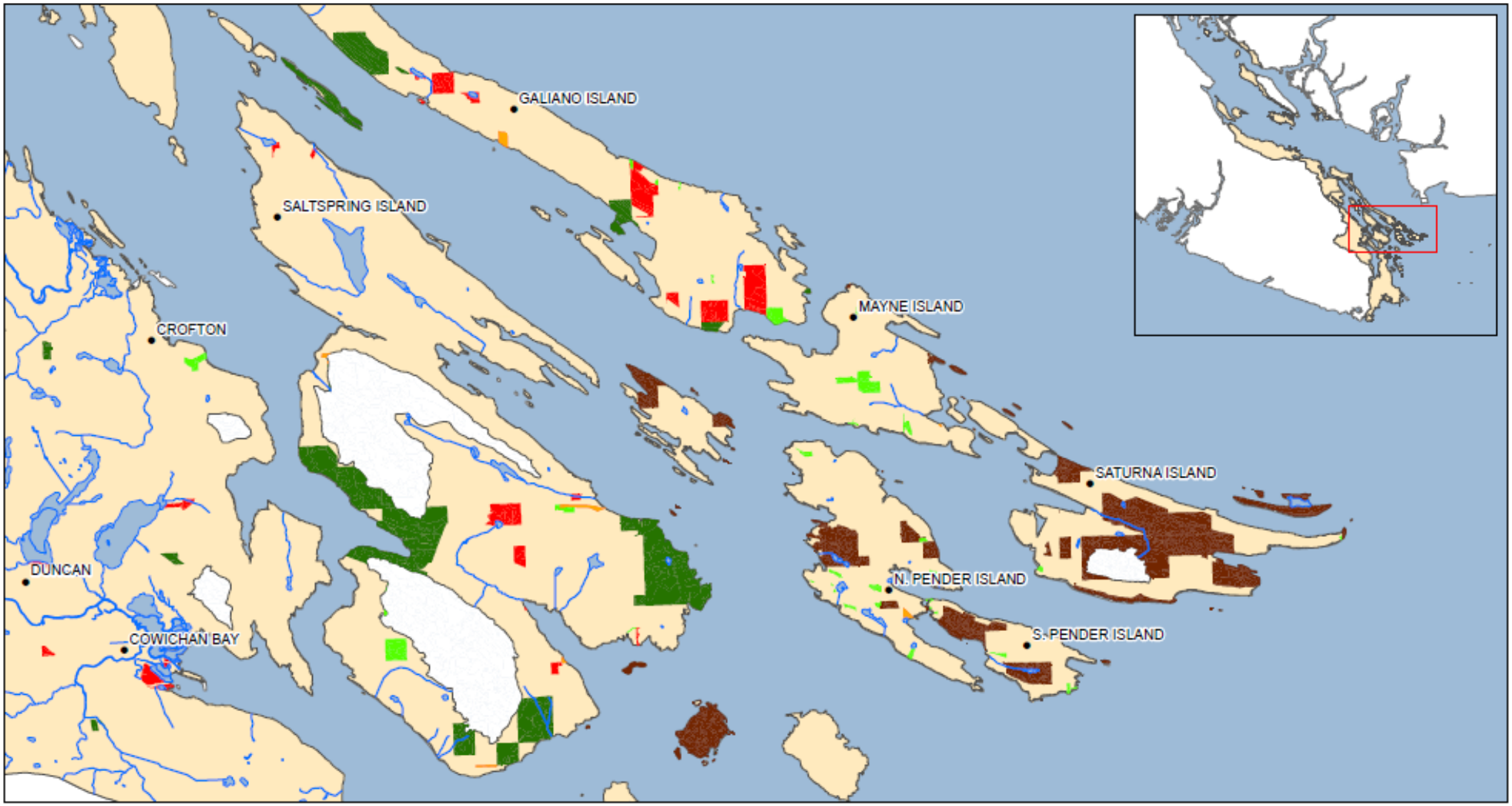
COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

SOUTHERN GULF ISLANDS
MAP 8 OF 11



CDFmm ZONE
CWHxm ZONE

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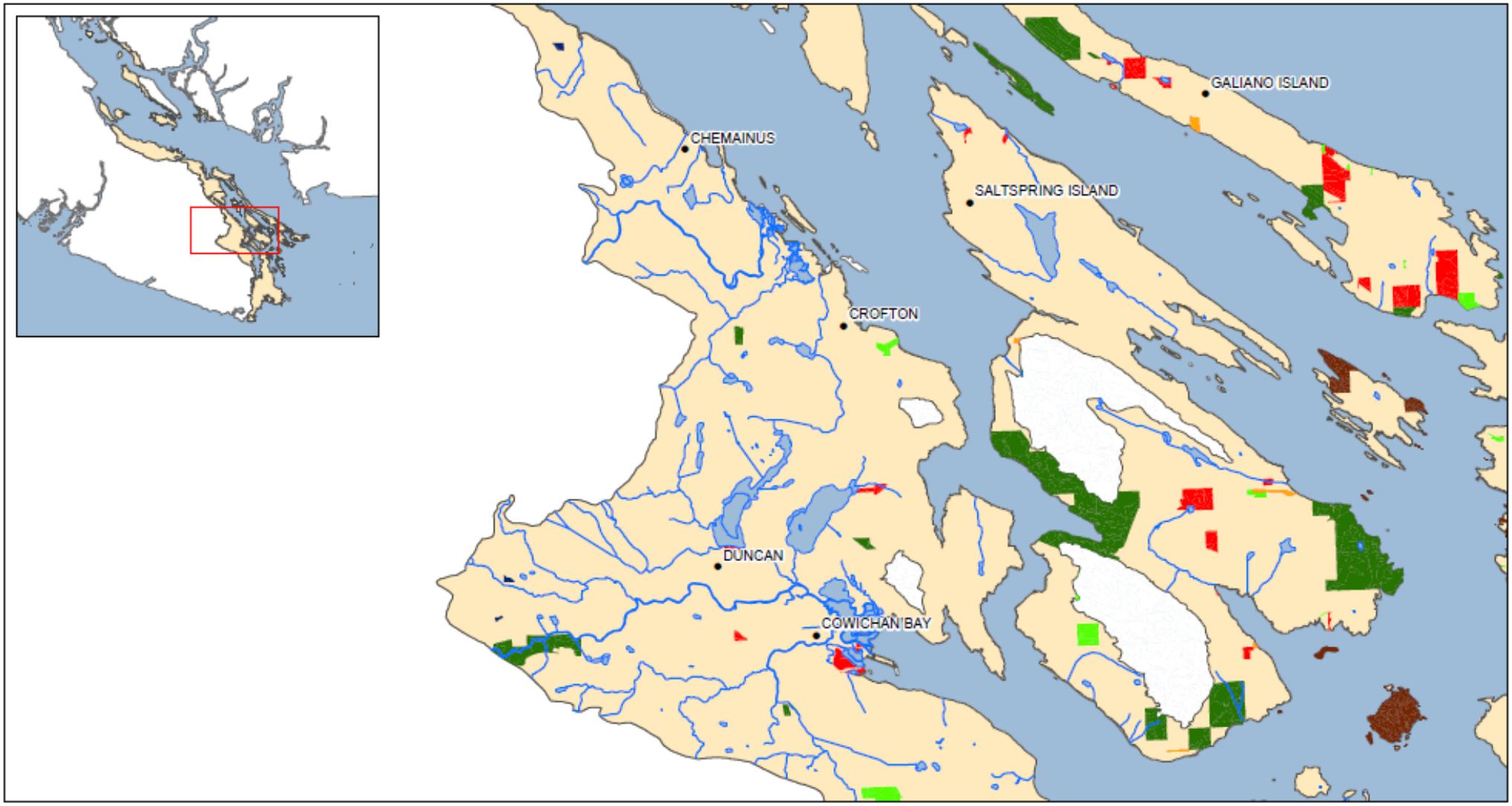
0 1 2 4 6 8 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

NORTH COWICHAN
MAP 9 OF 11



CDFmm ZONE
CWHxm ZONE

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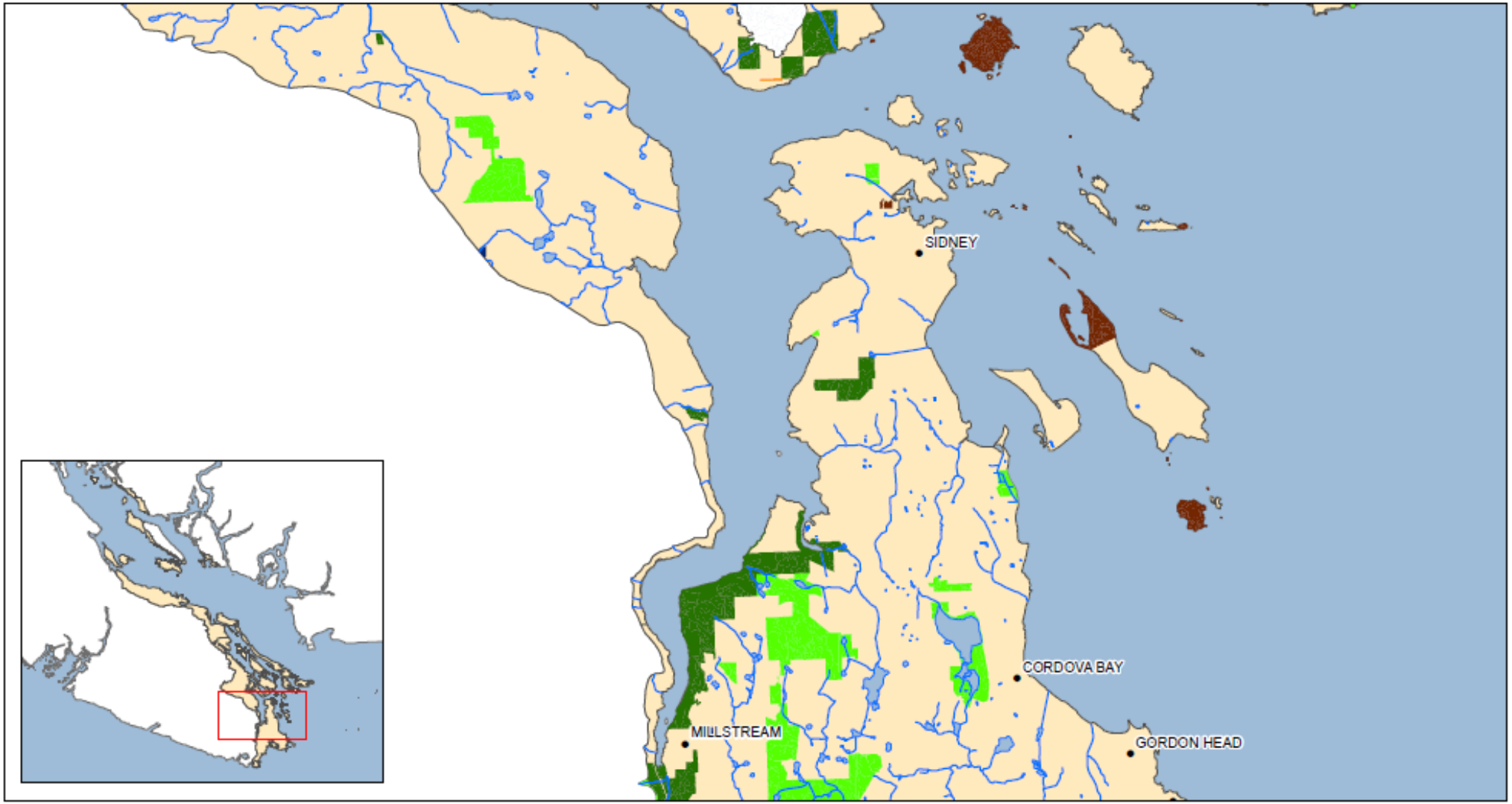
COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

SOUTH COWICHAN & NORTH SAANICH
MAP 10 OF 11



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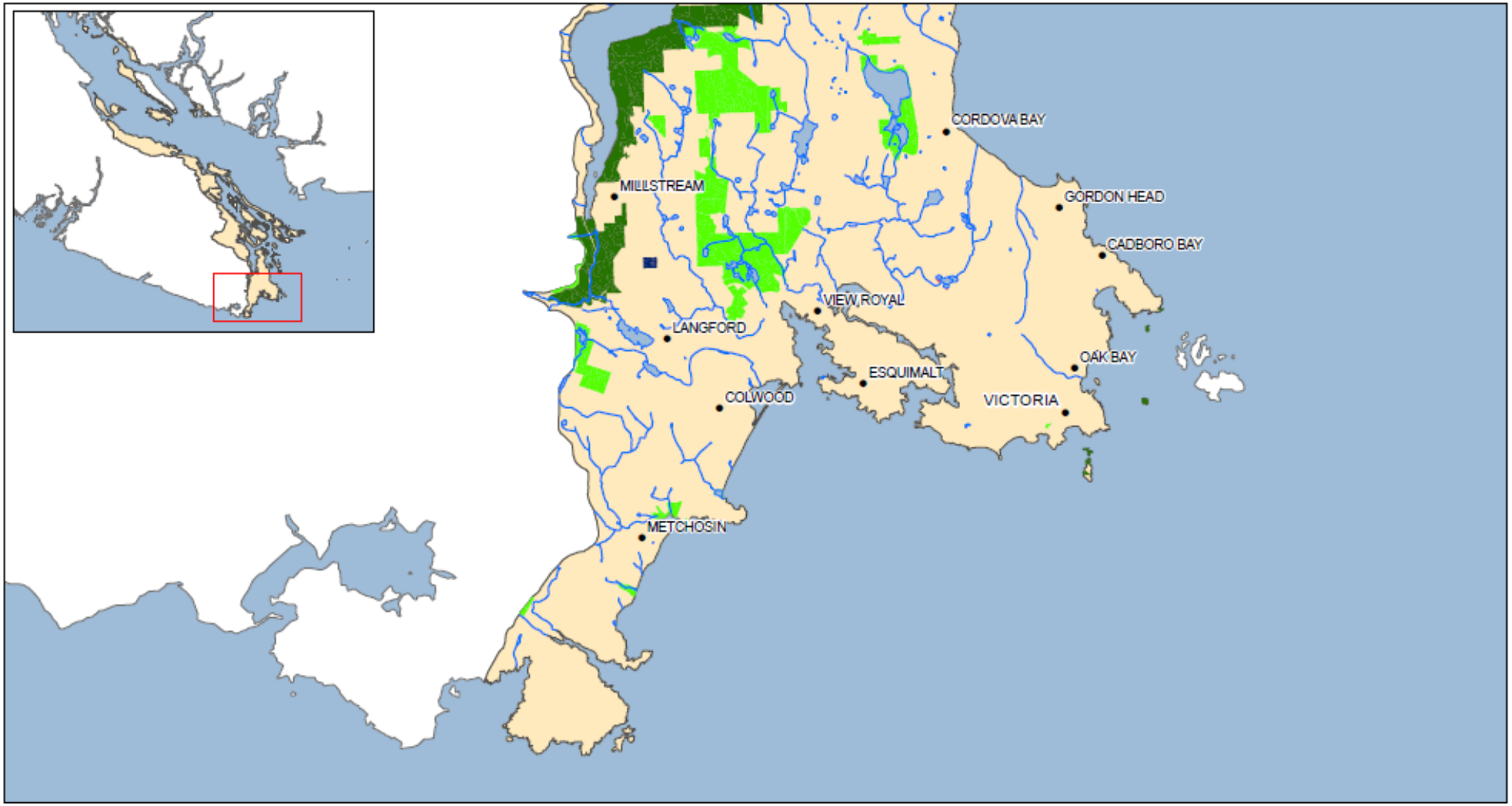
0 1 2 4 6 8 Kilometers

August 2011

COASTAL DOUGLAS-FIR ZONE PROTECTED AREAS

SOUTH SAANICH & GREATER VICTORIA
MAP 11 OF 11



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MINISTRY OF FORESTS, LANDS, & NATURAL RESOURCE OPERATIONS

MAP CREATED BY JENNA COOK

0 1 2 4 6 8 Kilometers

August 2011

Appendix II

Protected Area Ecosystem Representation Summaries

PROTECTED AREA REPRESENTATION BY POLITICAL DESIGNATION & PROTECTED AREA TYPE	
POLITICAL DESIGNATION & PROTECTED AREA TYPE	**PROTECTED AREA (HA)**
FEDERAL	**2560.29**
NATIONAL PARK	2560.29
ISLANDS TRUST FUND	**305.30**
TRUST FUND BOARD	305.30
PRIVATE	**1405.58**
DENMAN CONSERVANCY ASSOCIATION	124.14
DUCKS UNLIMITED CANADA	91.11
FULFORD COMMUNITY HALL ASSOCIATION	0.53
GALIANO CLUB	345.17
GALIANO CONSERVANCY ASSOCIATION	109.62
NATURE CONSERVANCY OF CANADA	36.71
THE NATURE TRUST AND PROVINCE OF BC	2.69
SALT SPRING ISLAND CONSERVANCY	37.20
THE LAND CONSERVANCY	42.31
THE NATURE TRUST	391.13
THE NATURE TRUST & DUCKS UNLIMITED CANADA	114.98
THE NATURE TRUST & REGIONAL DISTRICT OF NANAIMO	93.07
TLC THE LAND CONSERVANCY OF BRITISH COLUMBIA	11.83
WILD BIRD TRUST OF BRITISH COLUMBIA	5.09
PROVINCIAL	**10776.27**
CROWN LAND ADDITION	63.37
CROWN LAND TRANSFER (DENMAN ISLAND)	198.41
DRAFT OLD GROWTH MANAGEMENT AREA	448.56
LAND USE ORDER	1593.73
PRIVATE ACQUISITION (DENMAN ISLAND)	477.74
PROVINCIAL ECOLOGICAL RESERVE	1296.62
PROVINCIAL PARK	6297.04
WILDLIFE HABITAT BUFFER AREA	18.51
WILDLIFE HABITAT CORE AREA	64.97
WILDLIFE MANAGEMENT AREA	312.34

(blank)	5.00
REGIONAL	**4638.22**
CAPITAL REGIONAL DISTRICT	2853.48
COMOX VALLEY REGIONAL DISTRICT	341.45
COWICHAN VALLEY REGIONAL DISTRICT	436.70
NANAIMO REGIONAL DISTRICT	370.87
POWELL RIVER REGIONAL DISTRICT	196.51
REGIONAL DISTRICT OF NANAIMO	327.23
SUNSHINE COAST REGIONAL DISTRICT	111.99
BLANK	**7.81**
Grand Total	**19693.47**

REPRESENTATION OF PROTECTED AREAS BY CDFmm ECOSECTION (ALL ECOSYSTEM CATEGORIES: ECOLOGICAL COMMUNITIES, SPARSELY VEGETATED/NON-VEGETATED, ANTHROPOGENIC)			
ECOSECTION	**STUDY AREA (HA)**	**PROTECTED AREAS (HA)**	**PERCENT OF ECOSECTION IN PROTECTED AREAS**
Georgia Lowlands	9630.46	409.56	4.2527%
Nanaimo Area Lowlands	96823.43	5169.05	5.34%
Southern Gulf Islands	83780.45	10440.78	12.46%
Strait of Georgia	30332.21	3674.08	12.11%
Grand Total	**220566.56**	**19693.47**	**8.923%**

REPRESENTATION OF PROTECTED AREAS BY CDFmm ECOSECTION (ECOLOGICAL COMMUNITIES ONLY)			
ECOSECTION	**STUDY AREA (HA)**	**PROTECTED AREAS (HA)**	**PERCENT OF ECOSECTION IN PROTECTED AREAS**
Georgia Lowlands	9630.46	380.40	3.95%
Nanaimo Area Lowlands	96823.43	4569.40	4.72%
Southern Gulf Islands	83780.45	9687.20	11.56%
Strait of Georgia	30332.21	3297.67	10.87%
Grand Total	**220566.56**	**17934.68**	**8.1312%**

REPRESENTATION OF CDFmm PROTECTED ECOLOGICAL COMMUNITIES IN THE STUDY AREA		
ECOLOGICAL COMMUNITY NAME & STRUCTURAL STAGE	**PROTECTED ECOLOGICAL COMMUNITY AREA (HA)**	**% OF STUDY AREA**
American glasswort - sea-milkwort	**25.3903**	**0.0115%**
2	25.3903	0.0115%
arctic rush - Alaska plantain	**11.2077**	**0.0051%**
2	11.2077	0.0051%
beaked ditch-grass Herbaceous Vegetation	**10.7981**	**0.0049%**
2	10.7981	0.0049%
black cottonwood - red-osier dogwood	**27.8654**	**0.0126%**
3	4.9307	0.0022%
4	10.7825	0.0049%
5	12.1522	0.0055%
black cottonwood - willow	**9.7259**	**0.0044%**
3	2.9551	**0.0013%**
4	3.2731	0.0015%
5	3.4977	0.0016%
Cladina - Wallace's selaginella	**638.5190**	**0.2895%**
1	571.8043	0.2592%
2	66.7147	0.0302%
common cattail Marsh	**44.9030**	**0.0204%**
2	44.9030	0.0204%
common spike-rush Herbaceous Vegetation	**1.8389**	**0.0008%**
2	1.8389	0.0008%
Douglas-fir - arbutus	**2083.1709**	**0.9445%**
2	5.9609	0.0027%
3	100.5316	0.0456%
4	230.9693	0.1047%
5	1171.3880	0.5311%
6	483.0305	0.2190%
7	91.2907	0.0414%
Douglas-fir / Alaska oniongrass	**264.1516**	**0.1198%**
2	11.0836	0.0050%
3	19.4626	0.0088%
4	78.4158	0.0356%

5	68.5636	0.0311%
6	76.4032	0.0346%
7	10.2228	0.0046%
Douglas-fir / dull Oregon-grape	**10314.0695**	**4.6762%**
2	18.0856	0.0082%
3	907.9547	0.4116%
4	1257.6306	0.5702%
5	5531.7661	2.5080%
6	2518.2896	1.1417%
7	80.3428	0.0364%
dune wildrye - beach pea	**44.8832**	**0.0203%**
1	0.5101	0.0002%
2	35.3277	0.0160%
3	9.0454	0.0041%
Garry oak / California brome	**150.8052**	**0.0684%**
3	54.7450	0.0248%
4	26.2096	0.0119%
5	53.0098	0.0240%
6	15.2326	0.0069%
7	1.6082	0.0007%
Garry oak / oceanspray	**6.1307**	**0.0028%**
3	5.2920	0.0024%
6	0.8386	0.0004%
grand fir / dull Oregon-grape	**738.9226**	**0.3350%**
2	11.3364	0.0051%
3	31.3375	0.0142%
4	95.6197	0.0434%
5	363.9417	0.1650%
6	227.7634	0.1033%
7	8.9240	0.0040%
grand fir / three-leaved foamflower	**1354.8082**	**0.6142%**
2	7.2626	0.0033%
3	95.1426	0.0431%
4	145.8752	0.0661%

5	630.8844	0.2860%
6	439.6798	0.1993%
7	35.9636	0.0163%
great bulrush	**0.1879**	**0.0001%**
2	0.1879	0.0001%
hardhack / Sitka sedge	**146.0206**	**0.0662%**
2	2.9318	0.0013%
3	134.5642	0.0610%
4	8.5246	0.0039%
lodgepole pine / peat-mosses CDFmm	**20.4806**	**0.0093%**
3	15.0732	0.0068%
5	5.4074	0.0025%
Lyngbye's sedge herbaceous vegetation	**128.7184**	**0.0584%**
2	128.7184	0.0584%
Nootka rose - Pacific crab apple	**30.2083**	**0.0137%**
3	30.2083	0.0137%
oceanspray - rose	**1.2582**	**0.0006%**
3	1.2582	0.0006%
red alder / skunk cabbage	**50.8333**	**0.0230%**
2	0.7778	0.0004%
3	10.5617	0.0048%
4	5.1394	0.0023%
5	24.7134	0.0112%
6	9.3771	0.0043%
7	0.2638	0.0001%
red alder / slough sedge [black cottonwood]	**234.7325**	**0.1064%**
2	5.1789	0.0023%
3	14.6492	0.0066%
4	51.0821	0.0232%
5	137.2334	0.0622%
6	26.5889	0.0121%
Roemer's fescue - junegrass	**78.3388**	**0.0355%**
2	78.3388	0.0355%
seashore saltgrass Herbaceous Vegetation	**14.3582**	**0.0065%**

2	14.3582	0.0065%
Sitka sedge - Pacific desert parsley	**22.1661**	**0.0100%**
2	22.1661	0.0100%
Sitka sedge - peat moss	**8.8769**	**0.0040%**
2	8.8769	0.0040%
Sitka willow - Pacific willow / skunk cabbage	**132.1989**	**0.0599%**
3	103.9257	0.0471%
4	19.4791	0.0088%
5	8.7941	0.0040%
slender sedge - white beak-rush	**4.6765**	**0.0021%**
2	4.6765	0.0021%
sweet gale / Sitka sedge	**3.0150**	**0.0014%**
2	3.0150	0.0014%
three-way sedge	**3.0939**	**0.0014%**
2	3.0939	0.0014%
trembling aspen / Pacific crab apple / slough sedge	**0.8232**	**0.0004%**
3	0.3963	0.0002%
4	0.4268	0.0002%
tufted hairgrass - meadow barley	**57.1113**	**0.0259%**
2	57.1113	0.0259%
western redcedar - Douglas-fir / Oregon beaked-moss	**305.2834**	**0.1384%**
3	17.0319	0.0077%
4	46.8673	0.0212%
5	178.2198	0.0808%
6	56.6104	0.0257%
7	6.5540	0.0030%
western redcedar / common snowberry	**18.0435**	**0.0082%**
3	0.0181	0.0000%
4	0.6343	0.0003%
5	10.6968	0.0048%
6	6.6943	0.0030%
western redcedar / Indian-plum	**719.5573**	**0.3262%**
2	7.3063	0.0033%
3	43.7222	0.0198%

4	55.2723	0.0251%
5	445.5772	0.2020%
6	167.6794	0.0760%
western redcedar / vanilla leaf	**227.5106**	**0.1031%**
3	24.4178	0.0111%
4	33.5223	0.0152%
5	119.4075	0.0541%
6	50.1631	0.0227%
GRAND TOTAL	**17945.6894**	**8.1362%**

REPRESENATION OF PROTECTED ECOLOGICAL COMMUNITIES OUT OF THE STUDY AREA REMAINING ECOLOGICAL COMMUNITY AREA			
ECOLOGICAL COMMUNITY NAME & STRUCTURAL STAGE	AREA (HA) OF ECOLOGICAL COMMUNITY IN STUDY AREA	AREA (HA) OF ECOLOGICAL COMMUNITY IN PROTECTED AREAS	% OF REMAINING ECOLOGICAL COMMUNITY PROTECTED
American glasswort - sea-milkwort	**144.1638**	**25.3903**	**17.6121%**
2	144.1638	25.3903	17.6121%
arctic rush - Alaska plantain	**20.9251**	11.2077	**53.5609%**
2	20.9251	11.2077	53.5609%
beaked ditch-grass Herbaceous Vegetation	**33.6756**	**10.7981**	**32.0651%**
2	33.6756	10.7981	32.0651%
black cottonwood - red-osier dogwood	**224.2805**	**27.8654**	**12.4244%**
2	2.3749		0.0000%
3	60.2739	4.9307	8.1805%
4	68.0112	10.7825	15.8540%
5	93.6205	12.1522	12.9803%
black cottonwood - willow	**38.5158**	**9.7259**	**25.2518%**
3	16.1945	2.9551	18.2476%
4	14.0714	3.2731	23.2603%
5	8.2499	3.4977	42.3976%
Cladina - Wallace's selaginella	**3108.9197**	**638.5190**	**20.5383%**
1	2508.8391	571.8043	22.7916%
2	600.0806	66.7147	11.1176%
common cattail Marsh	**375.1023**	**44.9030**	**11.9709%**
2	372.3682	44.9030	12.0588%
3	2.7340		0.0000%
common spike-rush Herbaceous Vegetation	**1.9634**	**1.8389**	**93.6609%**
2	1.9634	1.8389	93.6609%
Douglas-fir - arbutus	**11635.2435**	**2083.1709**	**17.9040%**
2	22.2542	5.9609	26.7854%
3	760.5250	100.5316	13.2187%
4	1750.3452	230.9693	13.1956%
5	6740.9866	1171.3880	17.3771%
6	2164.9537	483.0305	22.3114%
7	196.1788	91.2907	46.5344%
Douglas-fir / Alaska oniongrass	**1463.2399**	**264.1516**	**18.0525%**

2	61.7599	11.0836	17.9463%
3	70.5807	19.4626	27.5749%
4	492.9626	78.4158	15.9070%
5	577.7470	68.5636	11.8674%
6	247.8151	76.4032	30.8307%
7	12.3746	10.2228	82.6113%
Douglas-fir / dull Oregon-grape	**83473.0348**	**10314.0695**	**12.3562%**
2	124.0074	18.0856	14.5843%
3	9896.7014	907.9547	9.1743%
4	11127.0658	1257.6306	11.3024%
5	47898.4858	5531.7661	11.5489%
6	14142.7830	2518.2896	17.8062%
7	283.9913	80.3428	28.2906%
dune wildrye - beach pea	**147.6964**	**44.8832**	**30.3888%**
1	11.1438	0.5101	4.5771%
2	103.3910	35.3277	34.1691%
3	33.1617	9.0454	27.2767%
Garry oak / California brome	**1013.0038**	**150.8052**	**14.8869%**
3	297.0202	54.7450	18.4314%
4	189.0575	26.2096	13.8633%
5	481.0033	53.0098	11.0207%
6	39.2818	15.2326	38.7777%
7	6.6409	1.6082	24.2160%
Garry oak / oceanspray	**11.3614**	**6.1307**	**53.9608%**
3	10.3513	5.2920	51.1245%
5	0.1704		0.0000%
6	0.8397	0.8386	99.8731%
grand fir / dull Oregon-grape	**5136.9076**	**738.9226**	**14.3846%**
2	84.7619	11.3364	13.3744%
3	238.2609	31.3375	13.1526%
4	837.8734	95.6197	11.4122%
5	2829.2544	363.9417	12.8635%
6	1099.0153	227.7634	20.7243%
7	47.7418	8.9240	18.6922%

grand fir / three-leaved foamflower	**15927.8087**	**1354.8082**	**8.5059%**
2	55.3021	7.2626	13.1327%
3	1079.6533	95.1426	8.8123%
4	2645.8283	145.8752	5.5134%
5	9030.3010	630.8844	6.9863%
6	3026.5460	439.6798	14.5274%
7	90.1779	35.9636	39.8807%
great bulrush	**1.7498**	**0.1879**	**10.7377%**
2	1.7498	0.1879	10.7377%
hardhack / Sitka sedge	**1266.8813**	**146.0206**	**11.5260%**
2	17.5687	2.9318	16.6875%
3	1235.6526	134.5642	10.8901%
4	13.6600	8.5246	62.4060%
lodgepole pine / peat-mosses CDFmm	**153.9050**	**20.4806**	**13.3073%**
3	61.4562	15.0732	24.5268%
4	13.9574		0.0000%
5	78.4914	5.4074	6.8892%
Lyngbye's sedge herbaceous vegetation	**232.1924**	**128.7184**	**55.4361%**
2	232.1924	128.7184	55.4361%
Nootka rose - Pacific crab apple	**81.5294**	**30.2083**	**37.0520%**
3	81.5294	30.2083	37.0520%
oceanspray - rose	**8.0805**	**1.2582**	**15.5708%**
3	8.0805	1.2582	15.5708%
red alder / skunk cabbage	**942.9151**	**50.8333**	**5.3911%**
2	17.8463	0.7778	4.3585%
3	112.1906	10.5617	9.4140%
4	170.9457	5.1394	3.0065%
5	547.9955	24.7134	4.5098%
6	93.5608	9.3771	10.0225%
7	0.3762	0.2638	70.1186%
red alder / slough sedge [black cottonwood]	**1527.1925**	**234.7325**	**15.3702%**
2	48.2314	5.1789	10.7376%
3	212.0280	14.6492	6.9091%
4	314.7983	51.0821	16.2269%

5	758.1065	137.2334	18.1021%
6	194.0283	26.5889	13.7036%
Roemer's fescue - junegrass	**407.6391**	**78.3388**	**19.2177%**
2	407.6391	78.3388	19.2177%
seashore saltgrass Herbaceous Vegetation	**54.1931**	**14.3582**	**26.4944%**
2	54.1931	14.3582	26.4944%
Sitka sedge - Pacific desert parsley	**61.0591**	**22.1661**	**36.3027%**
2	61.0591	22.1661	36.3027%
Sitka sedge - peat moss	**143.5236**	**8.8769**	**6.1850%**
2	127.3591	8.8769	6.9700%
3	16.1645		0.0000%
Sitka willow - Pacific willow / skunk cabbage	**899.7608**	**132.1989**	**14.6927%**
2	8.8459		0.0000%
3	755.4929	103.9257	13.7560%
4	79.8181	19.4791	24.4044%
5	55.6040	8.7941	15.8156%
slender sedge - white beak-rush	**12.8619**	**4.6765**	**36.3591%**
2	12.8619	4.6765	36.3591%
sweet gale / Sitka sedge	**30.0658**	**3.0150**	**10.0280%**
2	3.0294	3.0150	99.5239%
3	27.0364		0.0000%
three-way sedge	**22.1998**	**3.0939**	**13.9367%**
2	22.1998	3.0939	13.9367%
trembling aspen / Pacific crab apple / slough sedge	**12.5450**	**0.8232**	**6.5617%**
3	0.4006	0.3963	98.9324%
4	11.2076	0.4268	3.8085%
5	0.9368		0.0000%
tufted hairgrass - meadow barley	**134.1903**	**57.1113**	**42.5599%**
2	134.1903	57.1113	42.5599%
western redcedar - Douglas-fir / Oregon beaked-moss	**3941.0529**	**305.2834**	**7.7462%**
2	47.1988		0.0000%
3	239.9449	17.0319	7.0982%
4	633.4865	46.8673	7.3983%
5	2323.8347	178.2198	7.6692%

6	682.3921	56.6104	8.2959%
7	14.1958	6.5540	46.1683%
western redcedar / common snowberry	**398.1687**	**18.0435**	**4.5316%**
3	36.5657	0.0181	0.0495%
4	50.2440	0.6343	1.2625%
5	206.6474	10.6968	5.1763%
6	104.7116	6.6943	6.3931%
western redcedar / Indian-plum	**7861.8477**	**719.5573**	**9.1525%**
2	39.4538	7.3063	18.5185%
3	1152.5731	43.7222	3.7934%
4	1700.7249	55.2723	3.2499%
5	4241.5531	445.5772	10.5050%
6	727.5428	167.6794	23.0474%
western redcedar / vanilla leaf	**3108.7467**	**227.5106**	**7.3184%**
2	3.6036		0.0000%
3	387.4959	24.4178	6.3014%
4	312.7069	33.5223	10.7200%
5	1879.8555	119.4075	6.3520%
6	525.0848	50.1631	9.5533%
GRAND TOTAL	**144058.1429**	**17934.6833**	**12.4496%**

Appendix III

Data Sources

DATA SOURCES USED FOR ANALYSIS		
DATA NAME	**DATA SOURCE NAME**	**SOURCE**
CDFmm TEM	cdfmm_all	Dan Sirk via Linda Sinclair (FLNR)
Provinal Parks & Ecological Reserves	CDF_Prov_Parks_and_Pas_Jan7_11	Linda Sinclair (FLNR)
Wildlife Management Areas	CDF_WMAs_Jan10_11	Linda Sinclair (FLNR)
Land Use Orders	Final_Land_Use_Order_Selections	Linda Sinclair (FLNR)
Draft Old Growth Management Areas	Draft_OGMAs_East_Coast	Linda Sinclair (FLNR)
Wildlife Habitat Areas	CDF_Approved_WHAs Jan 7 11	Linda Sinclair (FLNR)
Gulf Islands National Park	Gulf_Islands_Nat_Park	Linda Sinclair (FLNR)
Private Conservancies	ConsDB_Fee_Simple_vOct2010	Jason Northcott (The Nature Trust) via Carmen Cadrin
Sunshine Coast Regional Parks	Parks	Trevor Fawcett (SCRD)
Powell River Regional Parks	Regional_Parks	Nancy Schmeister (PRRD)
Nanaimo Regional Parks	RDNparks	Tom Sohier (NRD)
Cowichan Valley Regional Parks	parks	Downloaded from CVRD's website
Capital Regional District Regional Parks	CRD_Regional_and_Community_Parks	Kelly Edwards (CRD)
Comox Valley Regional Parks	CVRD_RegionalParks	Tania Bonner (CVRD)
Islands Trust Trust Fund Properties	TrustFundProperties	Mark Van Bakel (Islands Trust) via Darryn McConkey
Islands Trust Public Conservancy Lands	PrivateConservancyLands	Mark Van Bakel (Islands Trust) via Darryn McConkey
Islands Trust Parks	parks	Mark Van Bakel (Islands Trust) via Darryn McConkey
2004-2007 Vancouver Island Change Detection	Change_det_CDF_Jan11 11	Linda Sinclair (FLNR)
2007 Spot Imagery	s5l5_092b_2007_bcalb_5m_panb321_enh.tif s5l5_092c_2007_bcalb_5m_panb321_enh.tif s5l5_092f_2007_bcalb_5m_panb321_enh.tif s5l5_092g_2007_bcalb_5m_panb321_enh.tif	Linda Sinclair (FLNR)

Appendix IV

TEM Air Photo Dates

TEM AIR PHOTO DATES	
REGION	**YEAR**
Powell River	2003
Texada Island	2003
Sunshine Coast	2003
Denman Island	2001
Northeast Vancouver Island	1998
Gabriola Island, Thetis Island, Valdes Island	2007
Ladysmith	1980
Saltspring Island	2005
Galiano Island	2005
Duncan/Cowichan	1992
West Cowichan	1998
Cowichan Bay	1992
Bamberton	1992
Saanich Peninsula/CRD	2007

(Madrone, 2008)