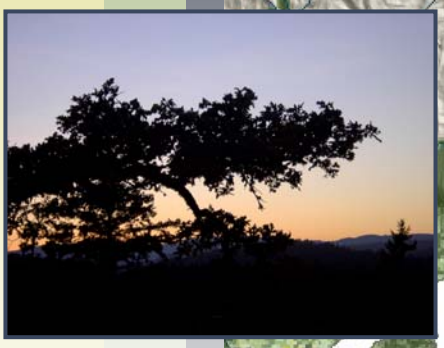
Urban Forest Canopy Cover Mapping and Analysis in the Capital Regional District, British Columbia: 1986 - 2005

March 2008



Submitted to:
Urban Forest Stewardship Initiative
c/o Habitat Acquisition Trust

Urban Forest Stewardship Initiative

HAT
Creating Conservation Legacies

Submitted by:

Caslys Consulting Ltd.

URBAN FOREST CANOPY COVER MAPPING AND ANALYSIS IN THE CAPITAL REGIONAL DISTRICT, BRITISH COLUMBIA: 1986-2005

Summary Report

Submitted to:

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Executive Summary

The Urban Forest Stewardship Initiative (UFSI) is a program of Habitat Acquisition Trust (HAT). It is a partnership of individuals, organizations and governments dedicated to the conservation, restoration and sustainable use of Greater Victoria's urban forest. Urban forests are treed landscapes found within a community. They include old-growth remnants, backyard fruit trees, urban parks and trail systems, Garry oak meadows, and treed boulevards. The challenge within Greater Victoria is that the population rate is estimated to increase by 33% over the next 20 years which emphasizes the need to increase the awareness of the benefits of urban forest, and the importance of implementing land use planning initiatives to promote the sustainable development of the region. A critical step in the process is the development of an urban forest stewardship strategy, however, very little information exists related to the characteristics and amount of urban forest and impervious surface within the region. As a result, the UFSI identified the need to map the urban forest in Greater Victoria for two time periods – 1986 and 2005. The mapping will help identify the quantity of the forest and provide a visual aid to support decision-making. The mapping outlined in this report is the first phase of a two-stage process, providing information on changes to the extent and density of the urban forest canopy cover and the amount of impervious surface in the study area as of 1986 and 2005, based on a one-hectare grid that was used to summarize the data.

Land Cover

Table E1details the changes in the amount of area covered by both trees and impervious surface. The results indicate a 13.2% increase in impervious surface over the 19 year time period with an 8.3 percent decrease in the amount of tree cover.

Table E1. Percentage of Tree Cover and Impervious Surface in the Study Area – 1986 and 2005*

Land Cover	Area (ha) 1986	Area (ha) 2005	Change in Area 1986 to 2005 (ha)	% Change 1986 to 2005
Impervious surface	6,975	7,897	922	13.2%
Tree cover	31,013	28,425	-2,588	-8.3%

* Values are interpolated from the 1 hectare grid cells. Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the 19 year time period.

Tree Cover Density

The tree cover density statistics are based on the percentage of tree cover in each 1 hectare grid cell. For interpretation purposes, the density values have been grouped into the following classes: 0-5, >5-10, >10-25, >25-50, >50-75, and >75. The tree cover density values were summarized for: the entire study area; each municipality; and for the parks within the study area. When interpreting the statistics it is important to consider the percent change in the context of the change in area – classes with small areas can have a large percentage changes.

Tree cover density values the entire study area for the two time periods are presented in Table E2 and illustrated in Figure E1. The results indicate that the number of cells that are primarily unforested (0-5 % tree cover) are decreasing by 11.7% which could be a result of an increase in the number or trees planted or regrowth in urban or rural cleared areas, however, the change

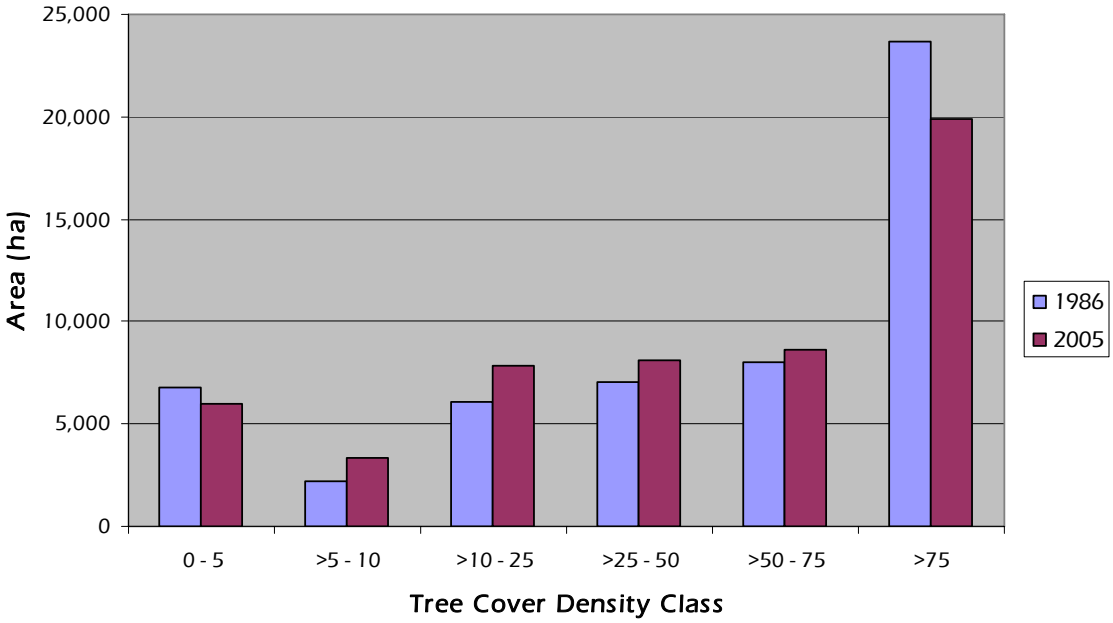
could be due to resolution issues with the 1986 imagery[1] and therefore should be investigated further. The number of very high density forest cells (>75% tree cover) is also decreasing throughout the study area by 16.1%. These areas represent the removal of relatively intact forest from the landscape generally due to urban and agricultural expansion. Decreases in tree cover do not necessarily reflect increases in impervious surfaces because lost trees may have been replaced by another pervious surface (e.g., grass or agricultural fields).

Table E2. Tree Cover Density in the Study Area – 1986 and 2005

	1986		2005		Change in Area 1986 to 2005 (ha)	% Change 1986 to 2005
Tree Cover Density Class (%)	Hectares	Percent of Study Area	Hectares	Percent of Study Area		
0 - 5	6,808	12.7%	6,011	11.2%	-797	-11.7%
>5 - 10	2,162	4.0%	3,314	6.2%	1,152	53.3%
>10 - 25	6,067	11.3%	7,831	14.6%	1,764	29.1%
>25 - 50	7,076	13.2%	8,133	15.1%	1,057	14.9%
>50 - 75	7,979	14.8%	8,619	16.0%	640	8.0%
>75	23,704	44.1%	19,888	37.0%	-3,816	-16.1%
Total	53,796	100.0%	53,796	100.0%		

* Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the 19 year time period.

Figure E1. Tree Cover Density Class Frequency in the Study Area – 1986 and 2005



[1] Section 2.5 details the limitations of the data used in the study.

The two most densely treed classes (>50–75% and >75%) were grouped to examine the change in tree cover density between the two time periods within each of the municipalities. As indicated in Table E3 and Figure E2, the municipalities with the largest absolute change in these two classes were: Colwood (a loss of 536 ha); Langford (a loss of 507 ha); Metchosin (a loss of 505 ha); and Saanich (a loss of 583 ha). The two municipalities with the highest percentage change from 1986 in tree cover density are Colwood (a 46.7% decrease) and Sidney (a 55.5% decrease). The change in Colwood is potentially more significant because it represents both a relatively large absolute and high percentage change. The four municipalities with the highest percentage change values as a percentage of the total area of the municipality are: Colwood (a 27.6% decrease); Juan de Fuca EA 1 (an increase of 11.8%); Langford (a decrease of 11.6%); and View Royal (a decrease of 11.1%). The results indicate a total reduction of 3,208 ha in the two most densely treed classes (a 10.1% decrease) between the two time periods within the municipalities in the study area.

Table E3. Change in Tree Cover Density by Municipality – 1986 and 2005

Municipality	Area of the Municipality (ha)	1986 Tree cover density >50% (ha)	2005 Tree cover density >50% (ha)	Change (ha)*	% Change from 1986	Change as a % of the municipality
Central Saanich	4,394	1,244	1,065	-179	-14.4%	-4.1%
Colwood	1,943	1,148	612	-536	-46.7%	-27.6%
Esquimalt	836	67	57	-10	-14.9%	-1.2%
Highlands	4,010	3,653	3,667	14	0.4%	0.3%
Juan de Fuca EA 1 (Willis Point)	662	566	644	78	13.8%	11.8%
Juan de Fuca EA 2 (Sooke)	4,032	3,770	3,530	-240	-6.4%	-6.0%
Langford	4,352	3,105	2,598	-507	-16.3%	-11.6%
Metchosin	7,426	6,139	5,634	-505	-8.2%	-6.8%
North Saanich	4,022	1,775	1,546	-229	-12.9%	-5.7%
Oak Bay	1,146	127	99	-28	-22.0%	-2.4%
Saanich	11,136	4,620	4,037	-583	-12.6%	-5.2%
Sidney	586	29	13	-16	-55.2%	-2.7%
Sooke	5,535	4,147	3,863	-284	-6.8%	-5.1%
Victoria	2,158	48	51	3	6.3%	0.1%
View Royal	1,682	1,235	1,049	-186	-15.1%	-11.1%
TOTAL	**53,920**	**31,673**	**28,465**	**-3,208**	**-10.1%**	**-5.9%**

* Negative numbers indicate a decrease and positive an increase in the class over the 19 year time period. This table does not include First Nations reserves.

Figure E2. Change in Tree Cover Density by Municipality – 1986 and 2005

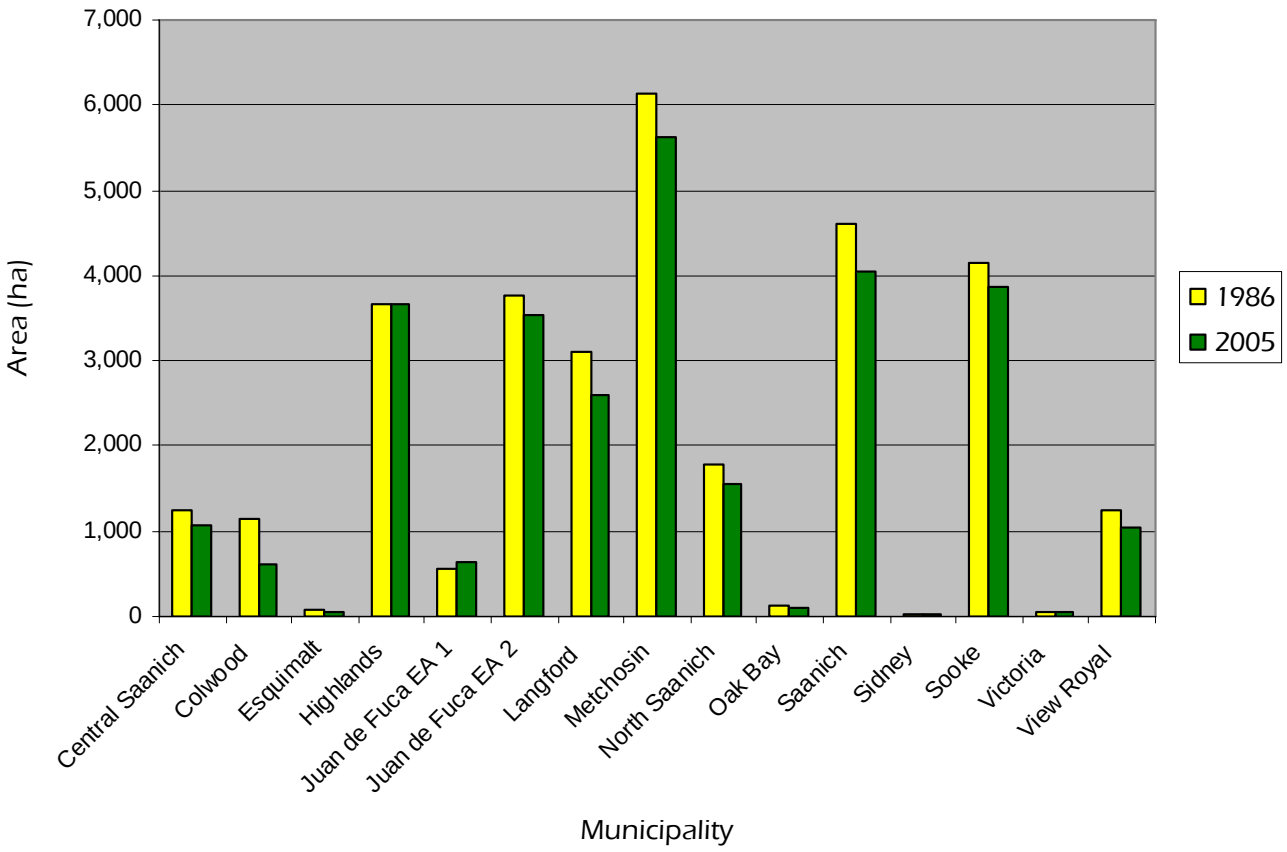
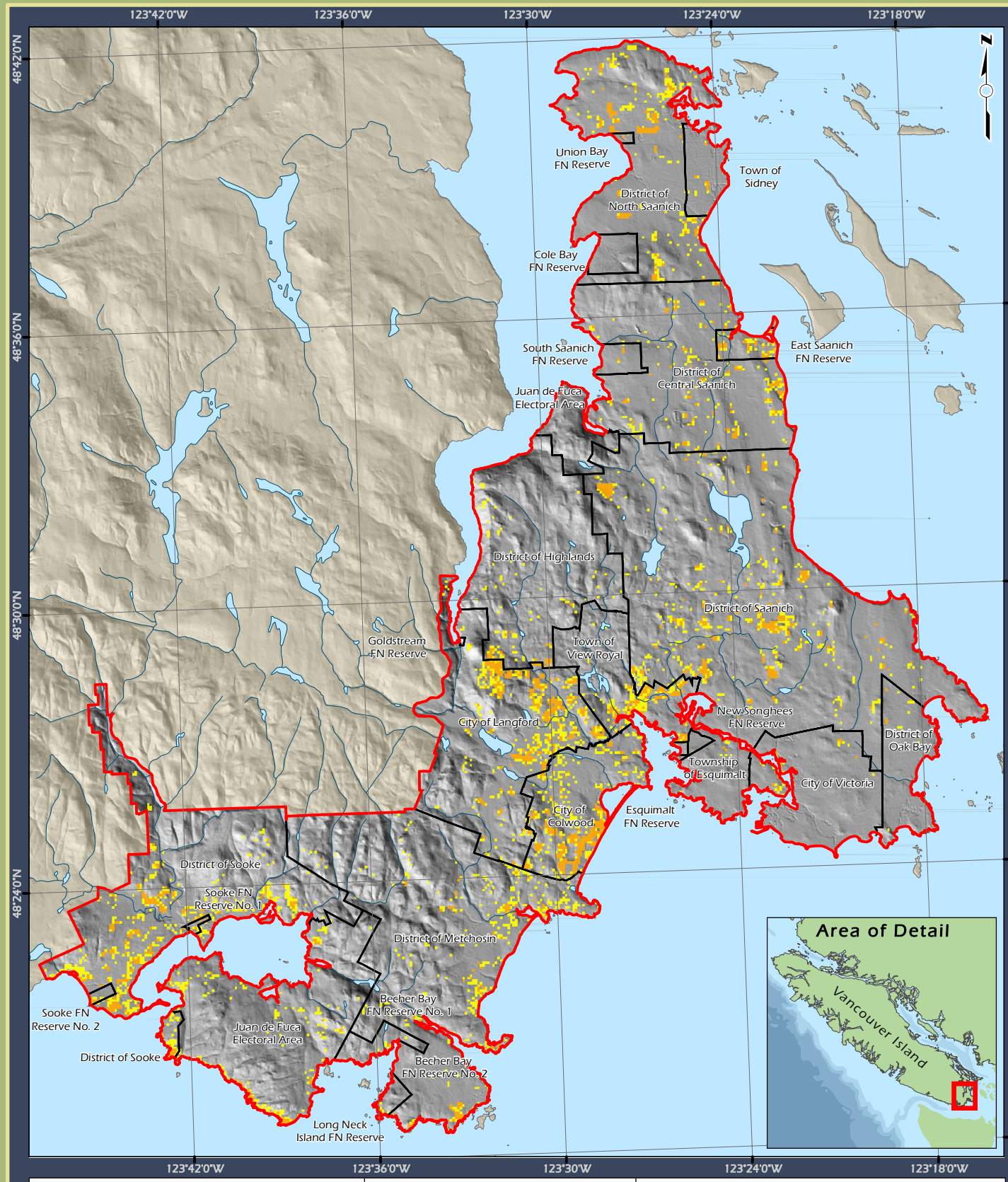


Figure E3 maps the locations with the highest change in tree cover density (a reduction in density of two classes or more) between the two time periods.



Legend

- Study area
- River
- Lake
- Municipal boundary

Reduction in Tree Cover

- 2 classes
- >2 classes

0 2.5 5

Kilometres

Projection: BC Albers NAD83

Data Sources:
Capital Regional District
TRIM
ESRI Base Data

Figure E3. Reduction in Tree Cover: Change in Class Assignment Between 1986 and 2005

Urban Forest Canopy Mapping and Analysis in the CRD

Prepared for: Urban Forest Stewardship Initiative

By: Caslys Consulting Ltd.

Impervious Surface Density

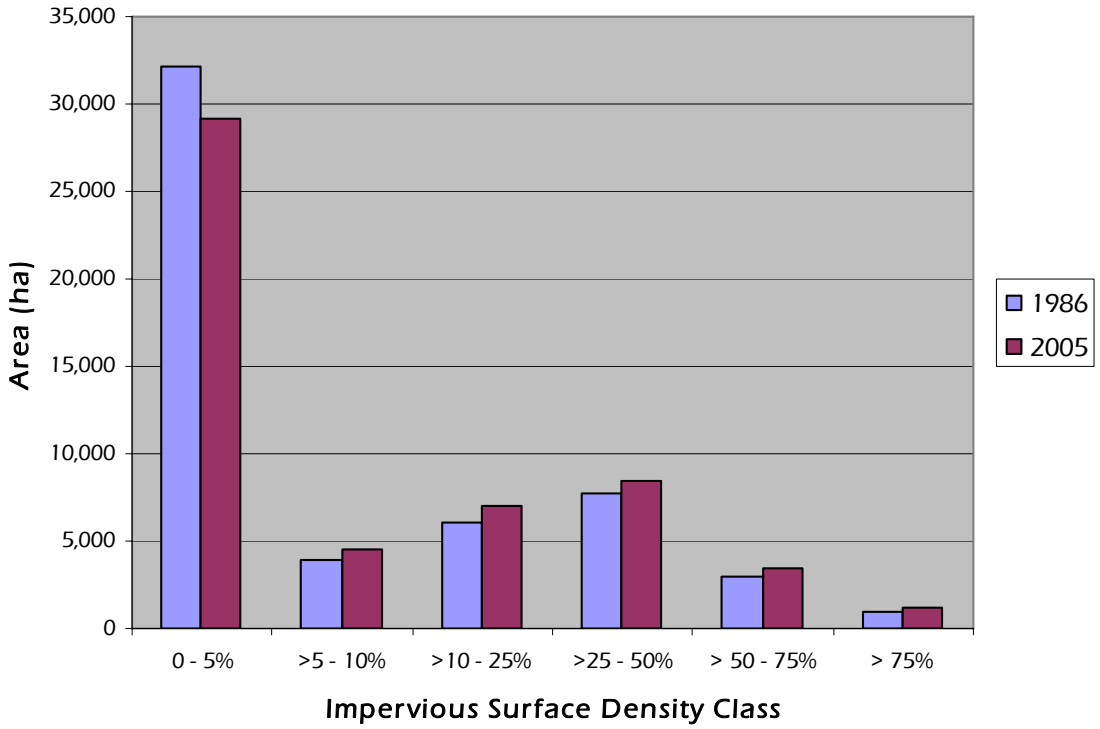
Impervious surface density values for the two time periods for the study area are presented in Table E4 and illustrated in Figure E4. The results indicate a consistent increase in impervious surface throughout the study area between 1986 and 2005. The number of cells with minimal impervious surface (the 0-5 % class) decreased by 9.2%. In other words, there are 2,942 hectares where pervious surfaces, present in 1986, have been replaced with enough impervious surface to move these cells into a higher density class in the 2005 time period. All of the other classes indicate an increase in density with 197 hectares moving to the very highly developed (>75%) class.

Table E4. Impervious Surface Density in the Study Area – 1986 and 2005

	1986		2005		Change in Area 1986 to 2005 (ha)	% Change 1986 to 2005
Impervious Surface Density Class (%)	Hectares	Percent of Study Area	Hectares	Percent of Study Area		
0 - 5	32,094	59.7%	29,152	54.2%	-2,942	-9.2%
>5 - 10	3,905	7.3%	4,494	8.4%	589	15.1%
>10 - 25	6,047	11.2%	7,051	13.1%	1,004	16.6%
>25 - 50	7,743	14.4%	8,500	15.8%	757	9.8%
>50 - 75	3,012	5.6%	3,407	6.3%	395	13.1%
>75	995	1.8%	1,192	2.2%	197	19.8%
Total	53,796	100.0%	53,796	100.0%		

* Negative numbers indicate a decrease and positive an increase in the class over the 19 year time period.

Figure E4. Impervious Surface Density Class Frequency in the Study Area – 1986 and 2005



The two most densely impervious classes (>50–75% and >75%) were grouped to examine the change in impervious surface density between the two time periods within each of the municipalities. As indicated in Table E5 and Figure E5, the municipalities with the largest absolute change in these two classes were: Colwood (an increase of 41 ha); Langford (an increase of 161 ha); North Saanich (an increase of 59 ha); Saanich (an increase of 112 ha); and View Royal (an increase of 45 ha). The municipalities with the highest percentage change in impervious surface density are Highlands (a 145.5% increase), Langford (a 33.3% increase), North Saanich (a 33.3% increase) and View Royal (a 46.9% increase). Langford, North Saanich and View Royal have a relatively high degree of both absolute and percentage change in impervious surface density. The four municipalities with the highest percentage change values as a percentage of the total area of the municipality are: Colwood (a 2.1% increase); Langford (an increase of 3.7%); Sidney (a 2.9% increase); and View Royal (an increase of 2.7%). The results indicate a total increase of 572 ha in the two highest impervious surface density classes (a 14.0% increase) between the two time periods within the municipalities in the study area.

Table E5. Change in Impervious Surface Density by Municipality – 1986 and 2005

Municipality	Area of the Municipality (ha)	1986 Impervious >50% (ha)	2005 Impervious >50% (ha)	Change (ha)	% Change from 1986	Change as a % of the municipality
Central Saanich	4,394	180	217	37	**20.6%**	**0.8%**
Colwood	1,943	379	420	41	**10.8%**	**2.1%**
Esquimalt	836	253	269	16	**6.3%**	**1.9%**
Highlands	4,010	11	27	16	**145.5%**	**0.4%**
Juan de Fuca EA 1 (Willis Point)	662	0	2	2	**na**	**0.3%**
Juan de Fuca EA 2 (Sooke)	4,032	2	4	2	**100.0%**	**0.0%**
Langford	4,352	484	645	161	**33.3%**	**3.7%**
Metchosin	7,426	26	32	6	**23.1%**	**0.1%**
North Saanich	4,022	177	236	59	**33.3%**	**1.5%**
Oak Bay	1,146	141	155	14	**9.9%**	**1.2%**
Saanich	11,136	911	1,023	112	**12.3%**	**1.0%**
Sidney	586	269	286	17	**6.3%**	**2.9%**
Sooke	5,535	80	100	20	**25.0%**	**0.4%**
Victoria	2,158	1,089	1,117	28	**2.6%**	**1.3%**
View Royal	1,682	96	141	45	**46.9%**	**2.7%**
TOTAL	**53,920**	**4,098**	**4,674**	**576**	**14.1%**	**1.1%**

* This table does not include First Nations reserves or the Electoral Areas.

Figure E5. Change in Impervious Surface Density by Municipality – 1986 and 2005

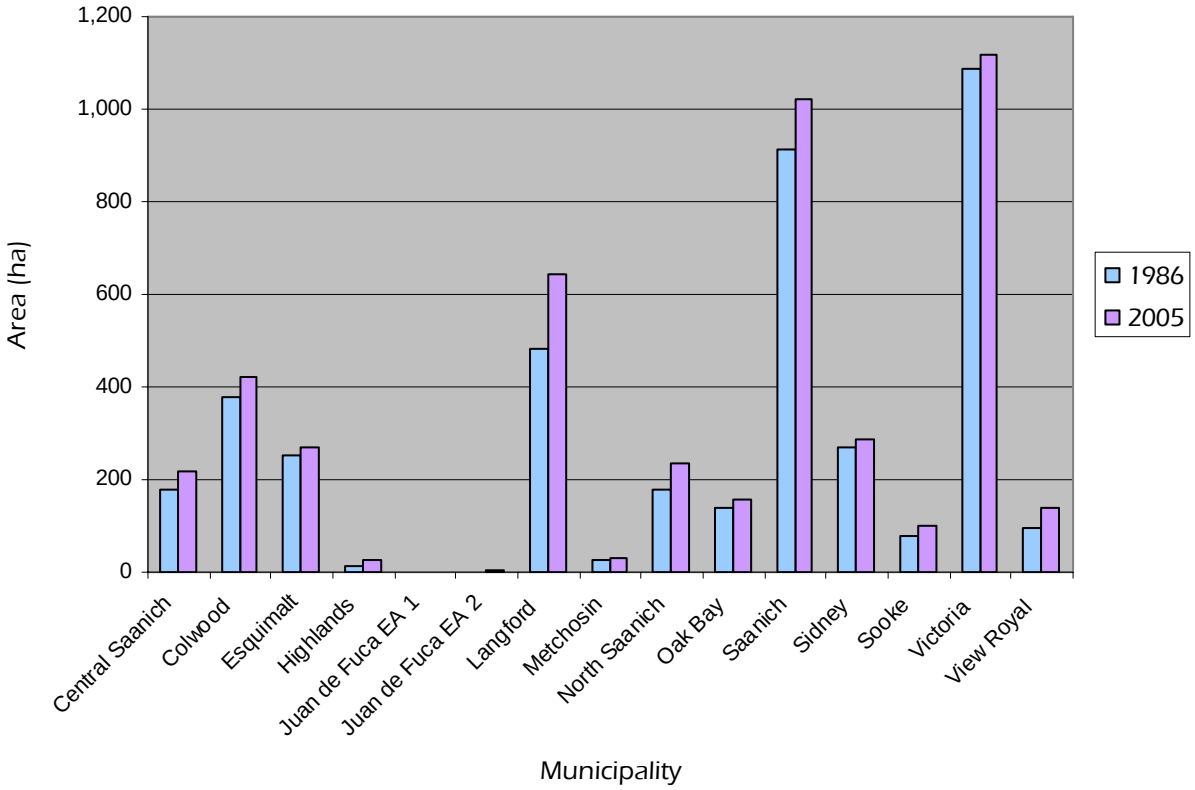


Figure E6 maps the locations with the highest increase in impervious surface density (an increase in density of two classes or more) between the two time periods.

Summary

It is important to remember when interpreting the data that a decrease in tree cover density does not always represent a corresponding increase in impervious surface density - trees may be replaced by impervious surfaces (e.g., buildings or roads) or by pervious surface (e.g., grass or agricultural fields). When we examine the change in both tree cover and impervious surface density any assumptions should be interpreted with caution[2]. More detailed mapping should be conducted in key areas to confirm what things are changing from and to. The results do allow us to identify areas where tree cover density is decreasing and those where impervious surface is increasing. In addition, we can conclude that the changes in tree cover density in Metchosin (a decrease of 505 ha in the top two classes) appear to be a result of treed land covers being replaced by pervious surfaces (e.g., grass or agricultural fields) rather than a conversion to impervious surface because the change in top two impervious surface density classes represents an increase of only 6 ha in this municipality.

[2] Section 2.5 details the limitations of the data used in the study.

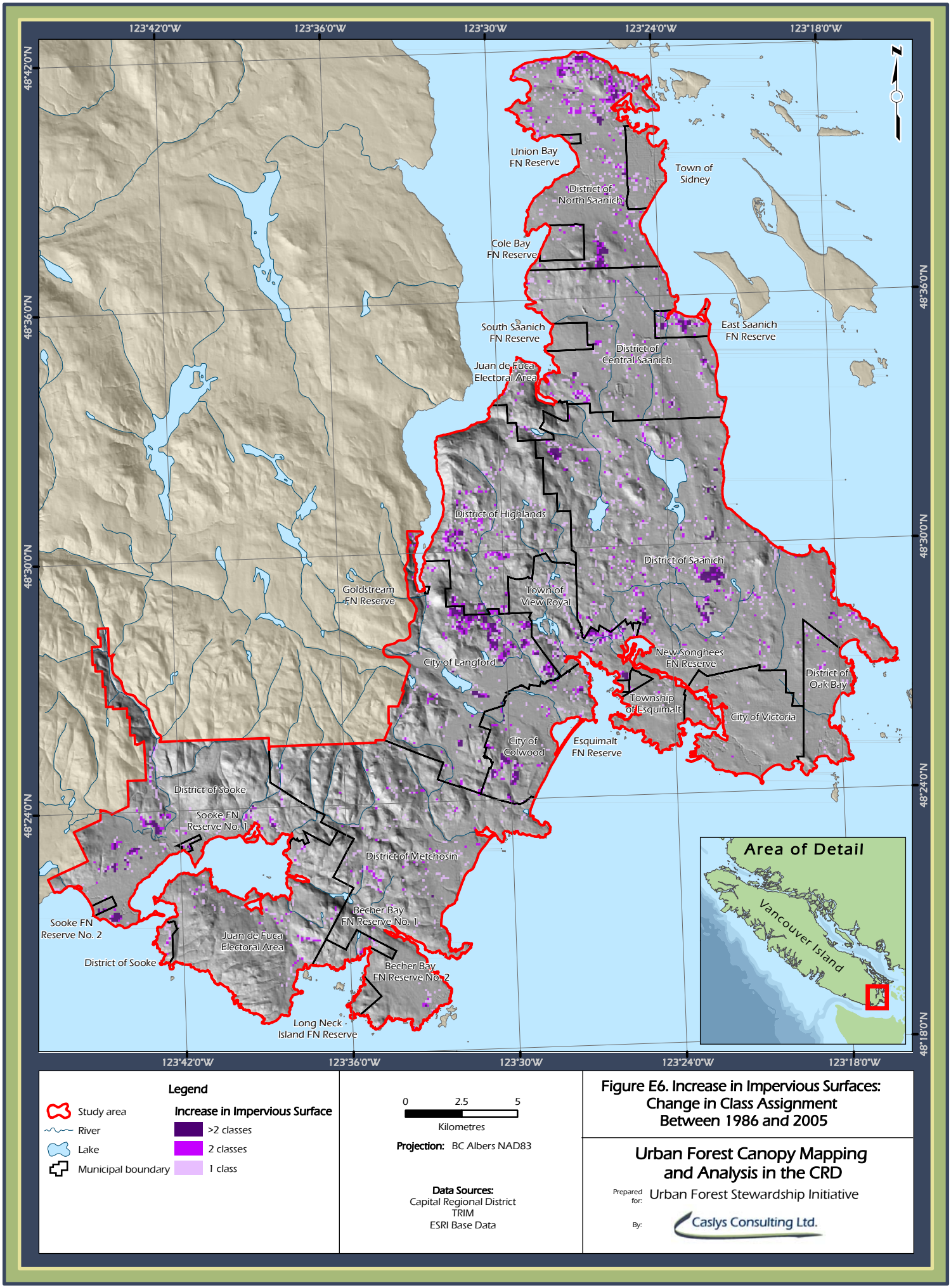


Figure E6. Increase in Impervious Surfaces: Change in Class Assignment Between 1986 and 2005

Urban Forest Canopy Mapping and Analysis in the CRD

Prepared for: Urban Forest Stewardship Initiative

By: Caslys Consulting Ltd.

Acknowledgements

The summary report was prepared by: Ann Blyth, Ian Laing and Jason Shaw of Caslys Consulting Ltd.

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District of Central Saanich

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