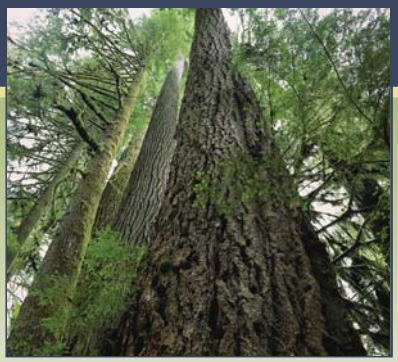
CAPITAL REGIONAL DISTRICT LAND COVER MAPPING - 1986, 2005 AND 2011



Summary Report

March 2013

Prepared by:

CASLYS CONSULTING

CAPITAL REGIONAL DISTRICT LAND COVER MAPPING
1986, 2005 AND 2011
SUMMARY REPORT

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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.

In 2007, HAT sponsored a project to map the region's tree cover and impervious surface densities. To evaluate change over time this project considered two time periods – 1986 and 2005. As part of an ongoing effort to manage the region's tree cover, HAT identified the need to update dataset using 2011 imagery to quantify the impacts of recent development activities. In addition, the extent of the mapping was expanded beyond the original study area (the Core Municipal Study Area (CMSA)) to include the entire Juan de Fuca Electoral Area (mapped for only one time period). The portion of the Electoral Area falling outside the CMSA is subsequently referred to as Juan de Fuca West (JDFW). This report presents the updated results.

Land Cover

Table E1details the changes in the amount of area covered by both treed and impervious land covers. The results indicate a 2.9% increase in impervious surface over the six year time period with a 2.0 percent decrease in the amount of tree cover in the CMSA. The majority of JDFW consists of treed land cover (84.5%).

Table E1. Percentage of Tree Cover and Impervious Surface in the CMSA and JDFW

Major Land Cover Class	2005 Area (ha)	2005 % of CMSA	2011 Area (ha)	2011 % of CMSA/JDFW	Difference Area (ha)	% Change 2005 to 2011	% Difference 2005 to 2011
Core Municipal Area							
Treed	30,659.2	59.4%	29,621.4	57.4%	-1,037.8	-3.4%	-2.0%
Impervious	6,752.3	13.1%	8,254.5	16.0%	1,502.2	22.2%	2.9%
Juan de Fuca West							
Treed	-	-	124,446.1	84.5%	-	-	-
Impervious	-	-	812.7	0.6%	-	-	-

*Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the six year time period. Percent change quantifies change in the class (i.e., the difference between two time periods divided by the area of that class in the earlier time period), whereas percent difference compares the class to the overall composition in the area of interest (i.e., a 2011 % of CMSA value is subtracted from the 2005 value).

Tree Cover Density

The tree cover density statistics are based on the percentage of tree cover in each one-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 CMSA; 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.

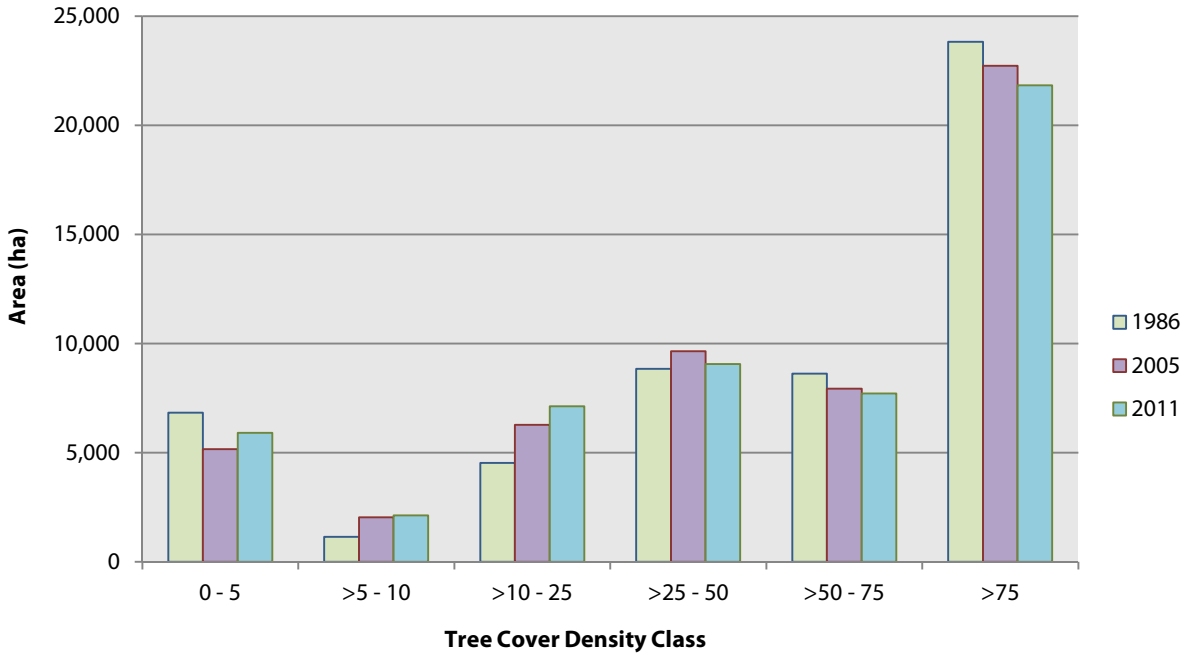
Tree cover density values in the CMSA for the three time periods are presented in Table E2 and illustrated in Figure E1.

Table E2. Tree Cover Density in the Core Municipal Study Area – 1986, 2005 and 2011

Tree Cover Density Class (%)	1986		2005		Change in Area 1986 to 2005 (ha)	% Change 1986 to 2005	2011		Change in Area 2005 to 2011 (ha)	% Change 2005 to 2011
	Hectares	Percent of CMSA	Hectares	Percent of CMSA			Hectares	Percent of CMSA		
0 - 5	6,833	12.7%	5,159	9.6%	-1,674	-24.5%	5,906	11.0%	747	14.5%
>5 - 10	1,147	2.1%	2,034	3.8%	887	77.3%	2,129	4.0%	95	4.7%
>10 - 25	4,523	8.4%	6,270	11.7%	1,747	38.6%	7,118	13.2%	848	13.5%
>25 - 50	8,835	16.4%	9,643	17.9%	808	9.1%	9,063	16.9%	-580	-6.0%
>50 - 75	8,623	16.0%	7,931	14.8%	-692	-8.0%	7,709	14.3%	-222	-2.8%
>75	23,835	44.3%	22,729	42.3%	-1,106	-4.6%	21,841	40.6%	-888	-3.9%
Total	**53,796**	**100.0%**	**53,766**	**100.0%**			**53,766**	**100.0%**		

*Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the six year time period. Percent change quantifies change in the class (i.e., the difference between two time periods divided by the area of that class in the earlier time period), whereas percent difference compares the class to the overall composition in the area of interest (i.e., a 2011 % of CMSA value is subtracted from the 2005 value).

Figure E1. Tree Cover Density Class Frequency in the Core Municipal Study Area – 1986, 2005 and 2011



Between 1986 and 2005, the results indicate that:

- The number of cells that are primarily unforested (0-5% tree cover) are decreasing by 24.5% which could be a result of an increase in the number or trees planted or regrowth in urban or rural cleared areas, however, an inspection of the results indicates that this is primarily due to resolution issues associated with the 1986 imagery.

- The number of very high density forest cells (>75% tree cover) is decreasing during this time period by 4.6% (1,106 ha). These areas represent the removal of relatively intact forest from the landscape generally due to urban and agricultural expansion.

The changes between 2005 and 2011 indicate a trend toward lower density tree stands in the CMSA:

- The three higher density classes are all decreasing while the three lower density classes are all increasing.
- The rate of change in the highest density class (>75% tree cover) appears to be increasing – in the 19 years between 1986 and 2005 the loss was 58.2 ha per year, whereas in the six years between 2005 and 2011 the rate of loss was 148.0 ha per year

As indicated in Table E3, the vast majority of JDFW falls within the top two tree cover density class – 83.3% of the land base has a tree cover greater than 75% and 8.6% of the land base falls in the >50-75% class.

Table E3. Tree Cover Density in Juan de Fuca West

Tree Cover Density Class (%)	Hectares	Percent of JDFW
0 - 5	2,715	1.8%
>5 - 10	1,182	0.8%
>10 - 25	2,776	1.9%
>25 - 50	5,299	3.6%
>50 - 75	12,683	8.6%
>75	122,891	83.3%
Total	**147,546**	**100.0%**

The two most densely treed classes (>50–75% and >75%) were grouped to examine the change in tree cover density between the three time periods within each of the municipalities. As indicated in Table E4 and Figure E2, the municipalities with the largest absolute change in these two classes were: Saanich (a loss of 585 ha); Langford (a loss of 452 ha); and Colwood (a loss of 429 ha). The three municipalities with the highest percentage change from 1986 in tree cover density are Colwood (a 24.2% decrease), View Royal (a 11.3% decrease); and Langford (a 11.0% decrease). The change in Colwood is potentially more significant because it represents both a relatively large absolute and high percentage change. The results indicate a total reduction of 2,025 ha in the two most densely treed classes between 1986 and 2011 within the municipalities.

Table E4. Change in Tree Cover Densities Greater than 50% by Municipality – 1986 to 2011

Municipality	Area of the Municipality (ha)	1986 Tree cover density >50% (ha)	2005 Tree cover density >50% (ha)	2011 Tree cover density >50% (ha)	Difference 1986 to 2011	% Change from 1986 to 2011
Central Saanich	4,167	1,164	1,141	1,072	-92	-2.2%
Colwood	1,770	1,057	679	628	-429	-24.2%
Esquimalt	705	70	87	74	4	0.6%
Highlands	3,814	3,467	3,577	3,534	67	1.8%
Juan de Fuca EA (in CMSA)	4,315	4,039	4,121	4,105	66	1.5%
Langford	4,099	2,984	2,694	2,532	-452	-11.0%
Metchosin	6,978	5,800	5,727	5,685	-115	-1.6%
North Saanich	3,721	1,739	1,659	1,582	-157	-4.2%
Oak Bay	1,045	250	239	196	-54	-5.2%
Saanich	10,708	4,775	4,602	4,190	-585	-5.5%
Sidney	514	20	15	14	-6	-1.2%
Sooke	5,079	3,988	3,983	3,888	-100	-2.0%
Victoria	1,946	107	140	105	-2	-0.1%
View Royal	1,503	1,143	1,014	973	-170	-11.3%
TOTAL	**50,364**	**30,603**	**29,678**	**28,578**	**-2,025**	

*Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the six year time period. Percent change quantifies change in the class (i.e., the difference between two time periods divided by the area of that class in the earlier time period).

Figure E2. Area of Tree Cover Density Greater than 50% within each Municipality – 1986, 2005 and 2011

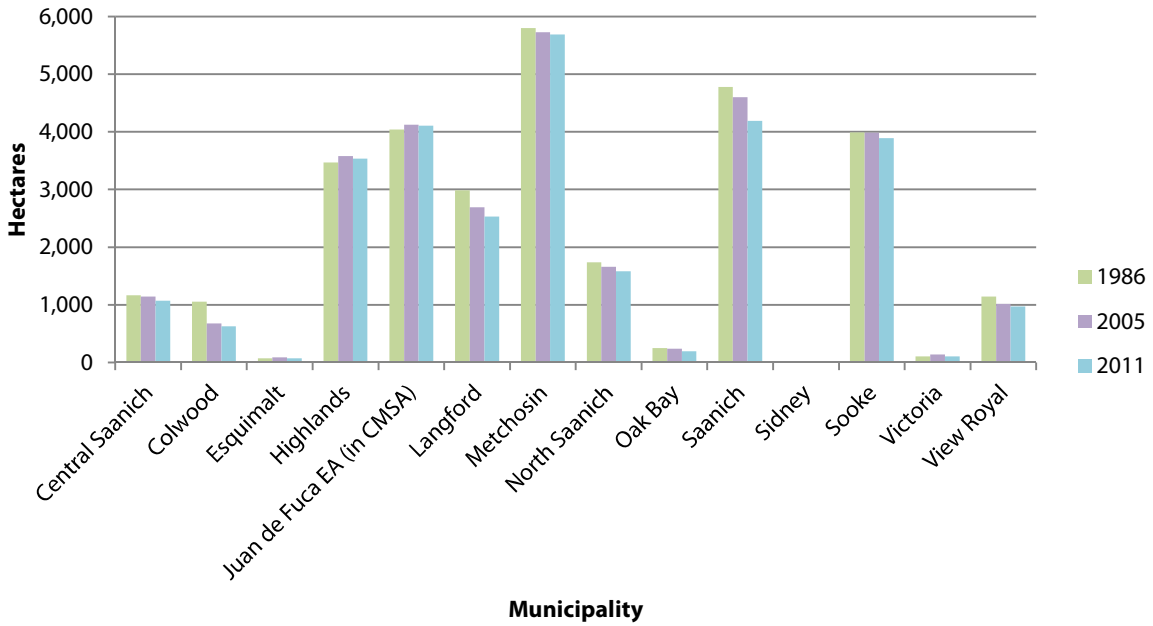


Figure E3 maps the locations with the highest change in tree cover density (a reduction in density of two classes or more) between the two time periods.

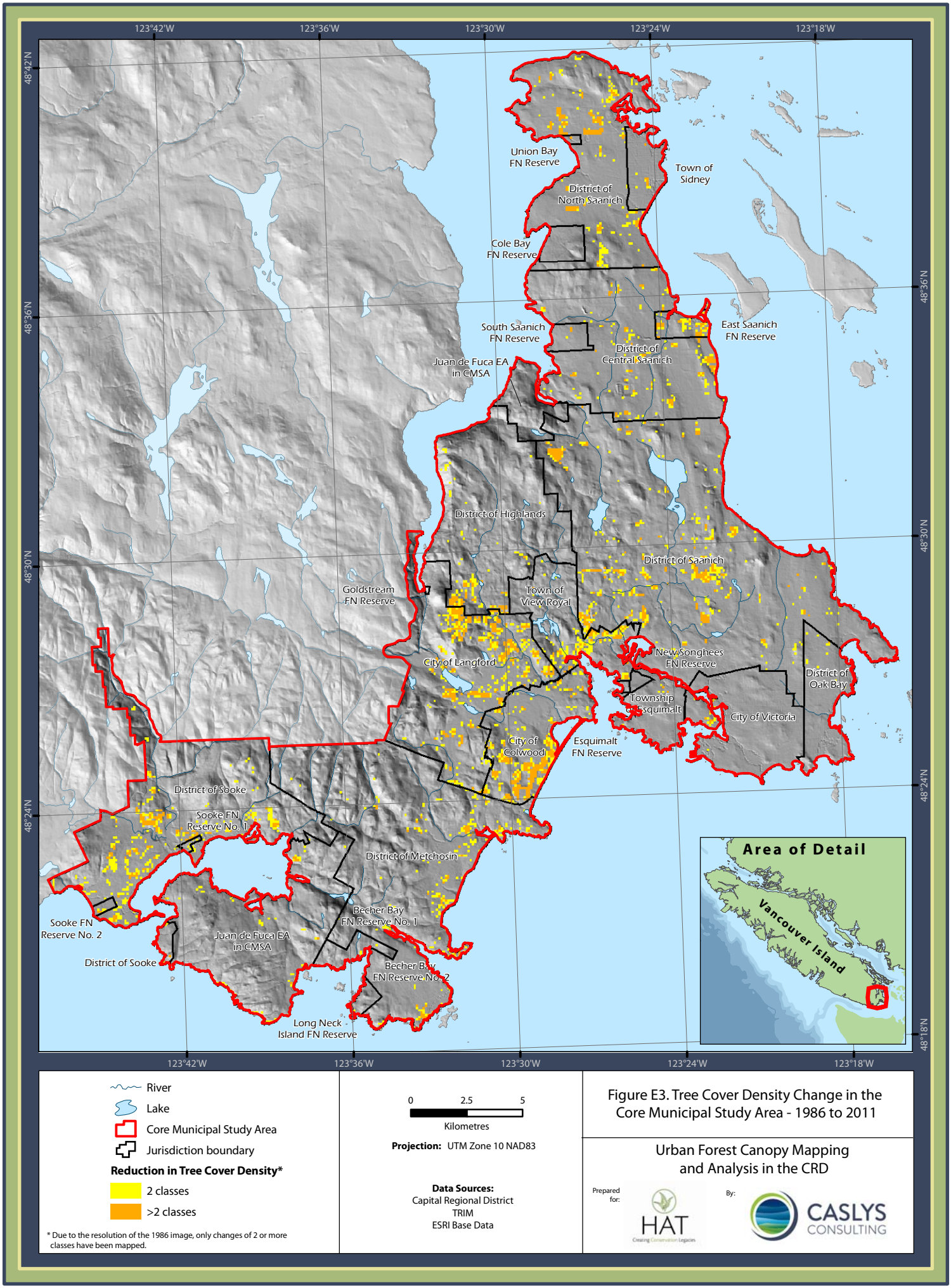


Figure E3. Tree Cover Density Change in the Core Municipal Study Area - 1986 to 2011

Urban Forest Canopy Mapping and Analysis in the CRD

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Impervious Surface Density

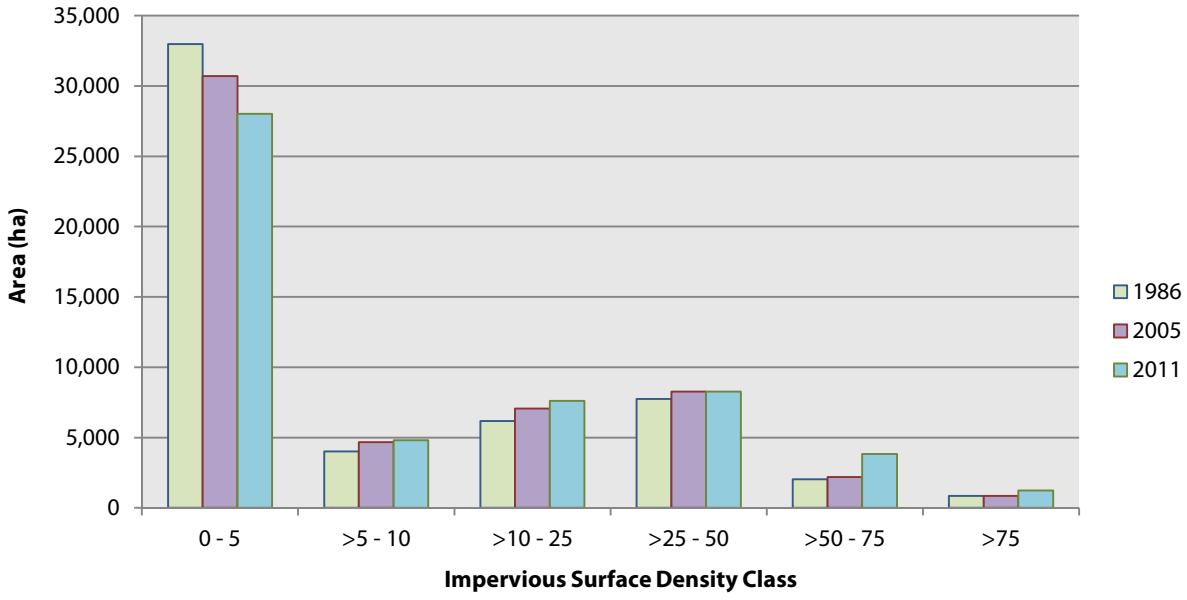
Impervious surface density values for the three time periods for the study area are presented in Table E5 and illustrated in Figure E4. The results indicate a consistent increase in impervious surface throughout the CMSA between 1986 and 2011. The number of cells with minimal impervious surface (the 0-5 % class) decreased by 8.7%. In other words, there are 2,678 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 2011 time period. All of the other classes indicate an increase in density with 376 hectares moving to the very highly developed (>75%) class.

Table E5. Impervious Surface Density in the Core Municipal Study Area – 1986, 2005 and 2011

	1986		2005		Change in Area 1986 to 2005 (ha)	% Change 1986 to 2005	2011		Change in Area 2005 to 2011 (ha)	% Change 2005 to 2011
Impervious Surface Density Class (%)	Hectares	Percent of CMSA	Hectares	Percent of CMSA			Hectares	Percent of CMSA		
0 - 5	32,976	61.3%	30,700	57.1%	-2,276	-6.9%	28,022	52.1%	-2,678	-8.7%
>5 - 10	4,020	7.5%	4,679	8.7%	659	16.4%	4,812	8.9%	133	2.8%
>10 - 25	6,180	11.5%	7,069	13.1%	889	14.4%	7,604	14.1%	535	7.6%
>25 - 50	7,739	14.4%	8,276	15.4%	537	6.9%	8,262	15.4%	-14	-0.2%
>50 - 75	2,042	3.8%	2,184	4.1%	142	7.0%	3,832	7.1%	1,648	75.5%
>75	839	1.6%	858	1.6%	19	2.3%	1,234	2.3%	376	43.8%
Total	**53,796**	**100.0%**	**53,766**	**100.0%**			**53,766**	**100.0%**		

*Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the six year time period. Percent change quantifies change in the class (i.e., the difference between two time periods divided by the area of that class in the earlier time period), whereas percent difference compares the class to the overall composition in the area of interest (i.e., a 2011 % of CMSA value is subtracted from the 2005 value).

Figure E4. Impervious Surface Density Class Frequency in the CMSA – 1986, 2005 and 2011



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 E6 and Figure E5, the municipalities with the largest absolute change in these two classes were: Saanich (an increase of 1,148 ha); Langford (an increase of 282 ha); and Victoria (an increase of 188 ha). The municipalities with the highest percentage change in impervious surface density are Sooke (a 220.5% increase), Metchosin (a 200.0% increase) and Saanich (a 169.6% increase). The results indicate a total increase of 2,223 ha in the two highest impervious surface density classes within the municipalities in the study area.

Table E6. Change in Impervious Surface Densities Greater than 50% by Municipality – 1986 to 2011

Municipality	Area of the Municipality (ha)	1986 Impervious density >50% (ha)	2005 Impervious density >50% (ha)	2011 Impervious density >50% (ha)	Difference 1986 to 2011	% Change from 1986 to 2011
Central Saanich	4,167	151	169	246	95	62.9%
Colwood	1,770	106	102	193	87	82.1%
Esquimalt	705	201	202	247	46	22.9%
Highlands	3,814	13	18	27	14	107.7%
Juan de Fuca EA (in CMSA)	4,315	0	0	0	0	0.0%
Langford	4,099	268	335	550	282	105.2%
Metchosin	6,978	5	5	15	10	200.0%
North Saanich	3,721	117	148	202	85	72.6%
Oak Bay	1,045	66	65	100	34	51.5%
Saanich	10,708	677	734	1,825	1,148	169.6%
Sidney	514	195	195	250	55	28.2%
Sooke	5,075	39	52	125	86	220.5%
Victoria	1,946	868	868	1,056	188	21.7%
View Royal	1,503	72	105	165	93	129.2%
TOTAL	**50,360**	**2,778**	**2,998**	**5,001**	**2,223**	

*Negative numbers indicate a decrease and positive an increase in the number of hectares within each class over the six year time period. Percent change quantifies change in the class (i.e., the difference between two time periods divided by the area of that class in the earlier time period).

Figure E5. Area of Impervious Surface Density Greater than 50% within each Municipality – 1986, 2005 and 2011

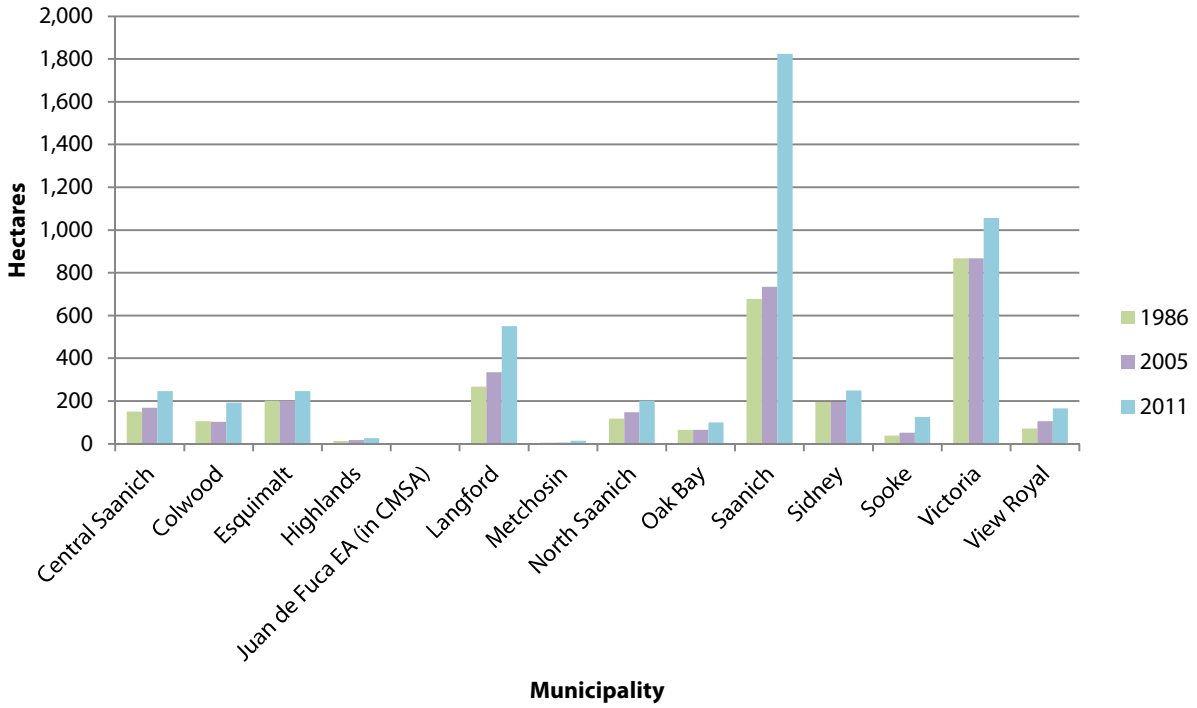


Figure E6 maps the locations with the highest increase in impervious surface density (an increase in density of two classes or more) between the two time periods.

Summary

When interpreting the data, it is important to remember 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[1]. 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 the following trends:

- Both tree cover and tree cover densities are decreasing; and
- The amount of impervious surface and impervious surface densities are increasing.

[1] Section 1.3 details the limitations of the data used in the study.

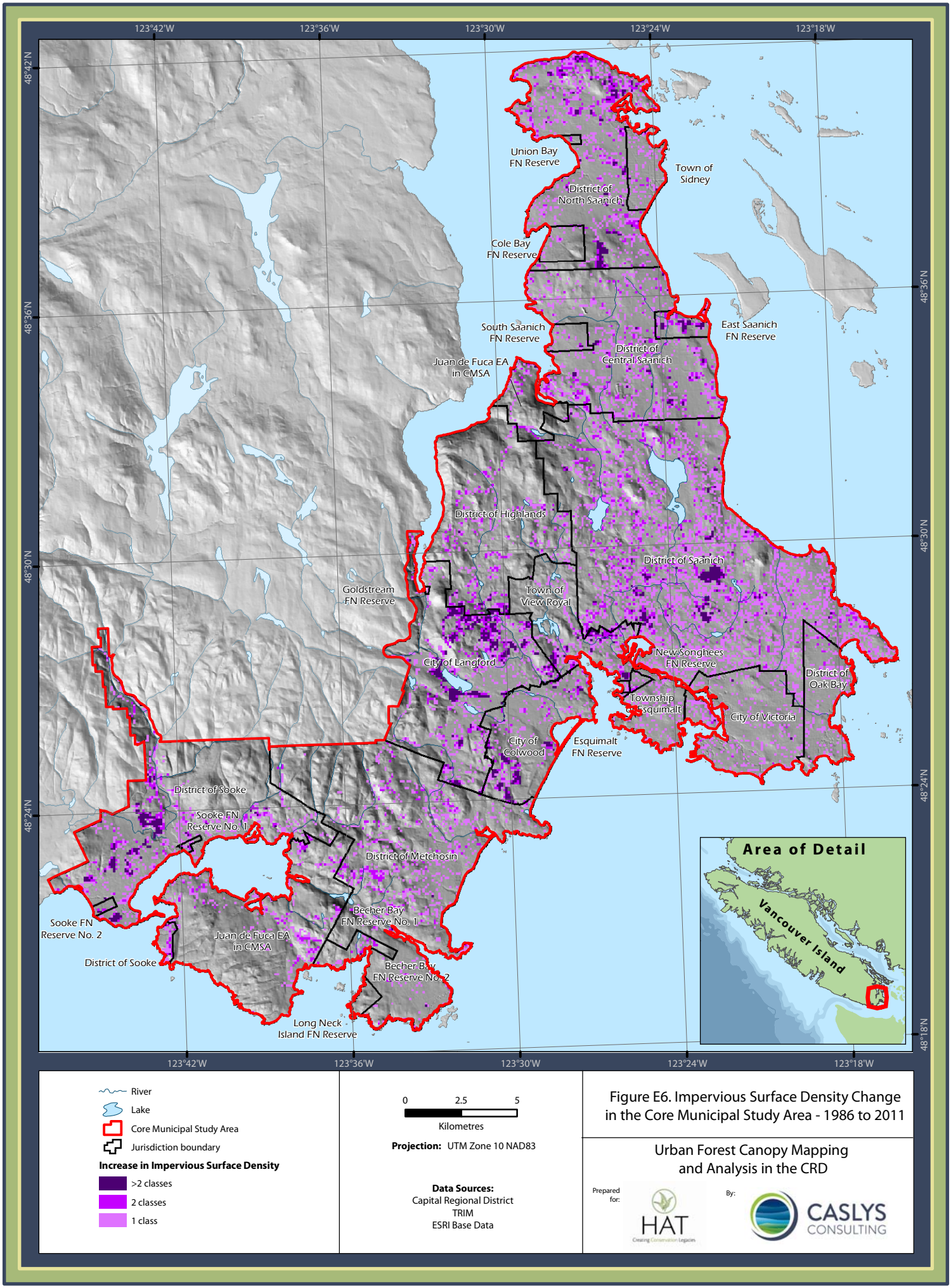


Figure E6. Impervious Surface Density Change in the Core Municipal Study Area - 1986 to 2011

Urban Forest Canopy Mapping and Analysis in the CRD

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