



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

# SOIL COVER CHANGE IN CANADA, 1981 - 2001

Soil and Water Conservation Society

Managing Agricultural Landscapes for Environmental Quality:  
**Strengthening the Science Base**

Kansas City, MO  
October, 2006

Ted Huffman Ph.D,  
Agriculture and Agri-Food Canada

Dick Coote, Ph.D.  
Jingyi Yang, Ph.D.  
Fulin Chen

Canada 



## Soil Cover Indicator

This Indicator provides an estimate of the number of days in a year that agricultural soil is covered by crop canopy, crop residue and snow,

The Soil Cover Indicator is a good 'common denominator' of a variety of environmental concerns, and is applicable at a variety of scales from field to national level.



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

## Soil Cover by residue





Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

## Soil Cover by crop and residue





Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

## Soil Cover by crop





## Soil Cover Indicator

The Indicator is built on Soil-Cover-Days “calculators”, which track a ‘typical’ production cycle of each crop over a year and accumulates “Soil-Cover-Days” (SCD) based on the level of cover and the number of days for each phase,

Initially, 76 “calculators”, were developed from field study data collected for erosion risk estimations.

These 76 were used as a base to build calculators for all crop/tillage/ecoregion combinations in the country.

Adjustments were made to account for regional variation in dates and practices and the resultant worksheets for 95% of crop area were verified by local crop specialists.

Soil-Cover-Days calculators operate at the Ecoregion level for each crop and each of 3 tillage practices; conventional, conservation and no-till.

# Soil Cover Indicator

## Examples of Soil-Cover-Days “calculators”

1st Fall tillage	Date of seeding	Pre-plant residue (%)	Windswept residue (%)	Erosion (%)	Final residue (%)	Date of seeding	Fall residue (%)	Final residue (%)	Pre-plant residue (%)	Total residue (%)	Final residue (%)	Erosion (%)	SCD
	15-Oct	100.0	100.0	100.0	100.0	15-Oct	29.8	101.3	100.0	100.0	100.0	100.0	2.0
	15-Oct	100.0	100.0	100.0	100.0	15-Oct	34.7	110.3	100.0	100.0	100.0	100.0	24.6
	15-Oct	100.0	100.0	100.0	100.0	15-Oct	30.7	113.7	100.0	100.0	100.0	100.0	0.0
	30-Oct	100.0	100.0	100.0	100.0	30-Oct	38.9	100.0	100.0	100.0	100.0	100.0	0.0
	22-Sep	100.0	100.0	100.0	100.0	22-Sep	25.3	104.3	100.0	100.0	100.0	100.0	9.3

# Soil Cover Days

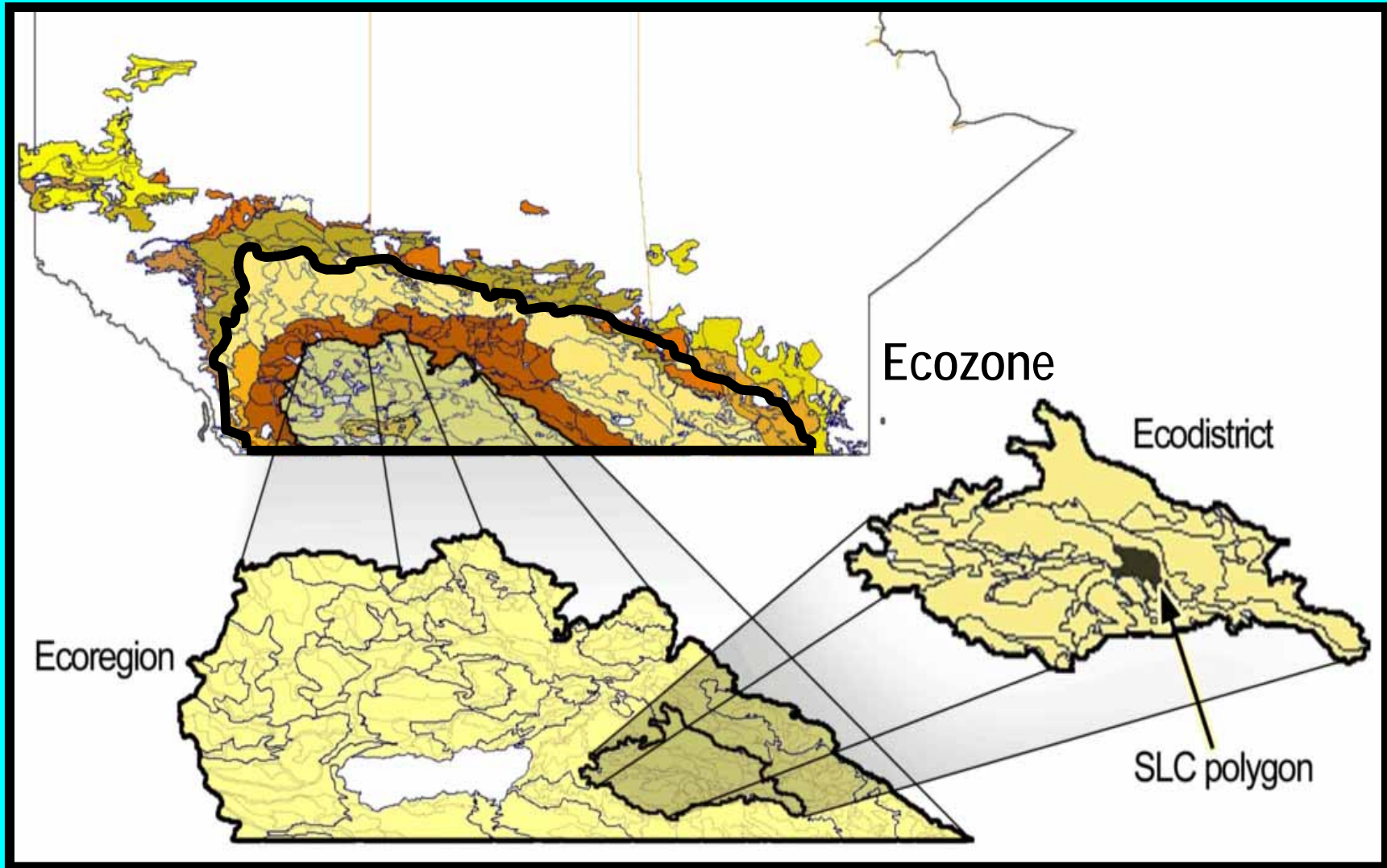
## Examples of Total Annual Soil Cover Days (SCD)

Crop	Tillage	Ecoregion				Mean	% diff
		130 (Prince Edward Island)	135 (Lake Erie Lowland)	156 (Aspen Parkland)	196 (Lower Mainland, BC)		
Spring Wheat	Conventional	238	250	301	96	241	
	Conservation	297	270	320	119	265	9.66
	No-till	225	294	329	125	280	15.79
Grain Corn	Conventional	246	227	n/a	132	213	
	Conservation	283	260	n/a	198	255	19.72
	No-till	327	315	n/a	297	316	48.63
Soybeans	Conventional	255	182	n/a	109	193	
	Conservation	286	213	n/a	143	223	15.51
	No-till	307	269	n/a	184	260	34.41

Crop and tillage impacts  
Ecoregion impacts

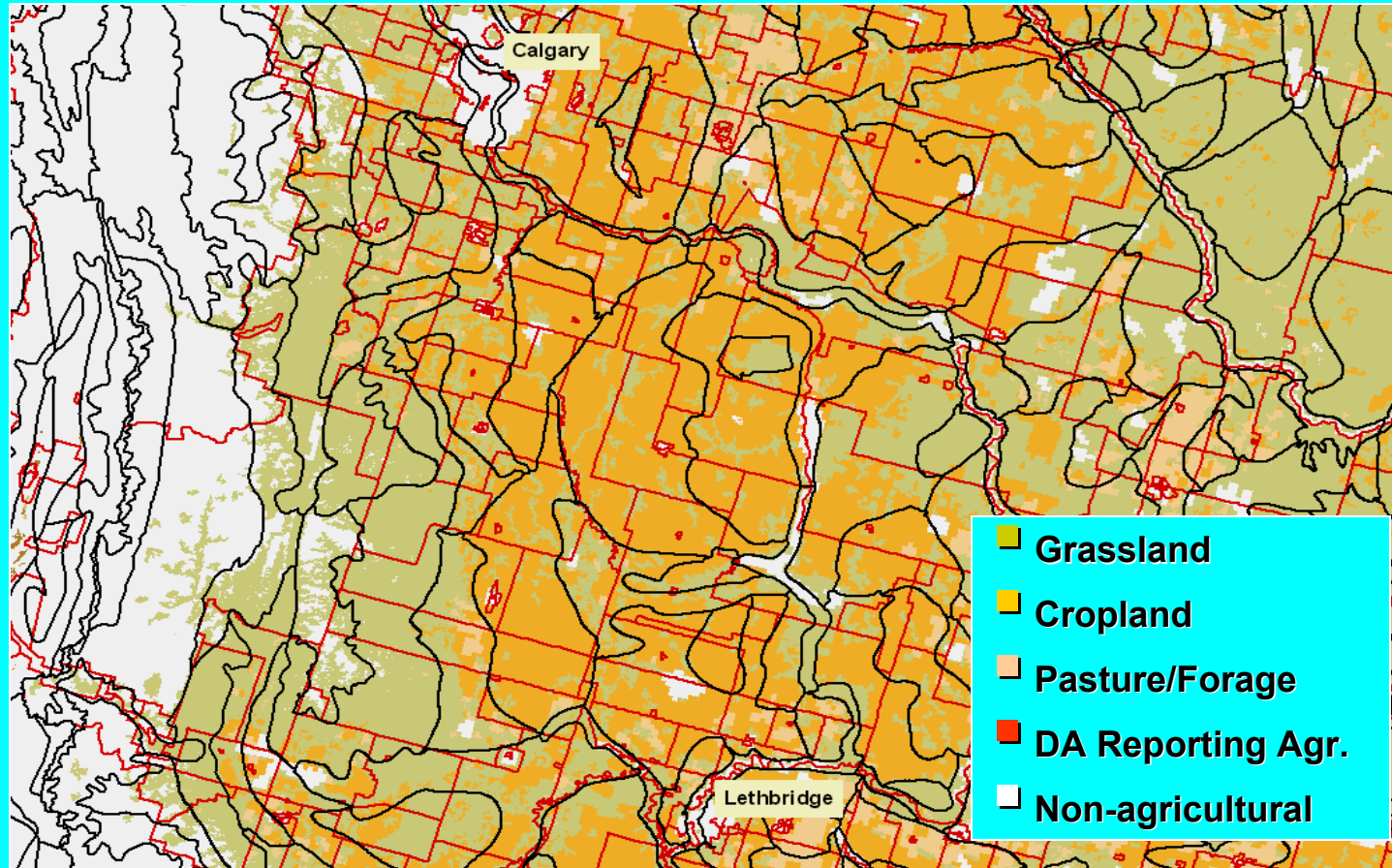
# SOIL COVER: Areal Calculations

## Ecostratification



# SOIL COVER: Areal Calculations

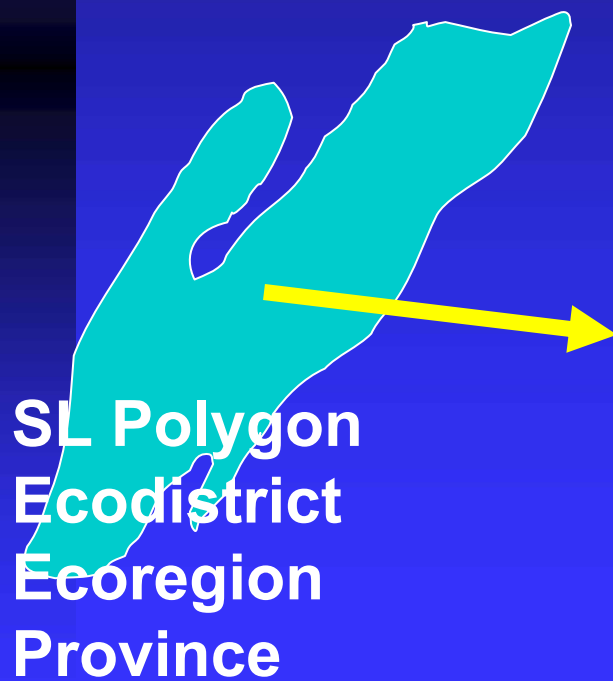
Census data to ecostratification units; 1981, 1986, 1991, 1996, 2001



Map scale: 1:1,000,000

## SOIL COVER: Areal Calculations

The soil cover days “calculators” are defined at the level of Ecoregions, and the results are multiplied by appropriate areas and then summed and area weighted for all crops and tillage practices to provide regional, provincial and national roll-ups.



Census    Census    SCD Calculator

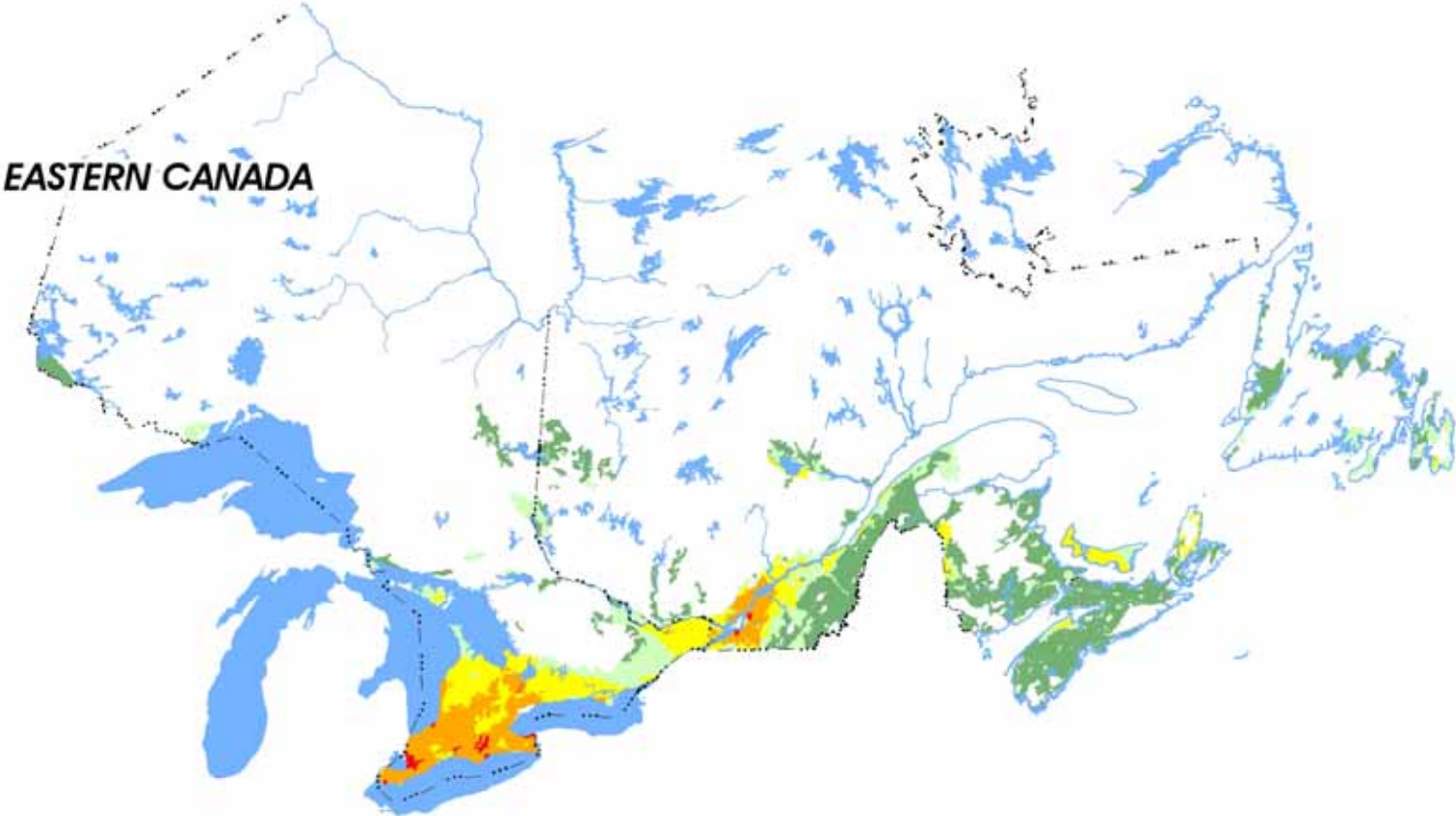


Ha Wheat x %Conv x SCD = Ha SCD  
Ha Wheat x %Cons x SCD = Ha SCD  
Ha Wheat x %Notill x SCD = Ha SCD

Ha Corn x %Conv x SCD = Ha SCD  
Ha Corn .....

ΣHa SCD  
Cropland area

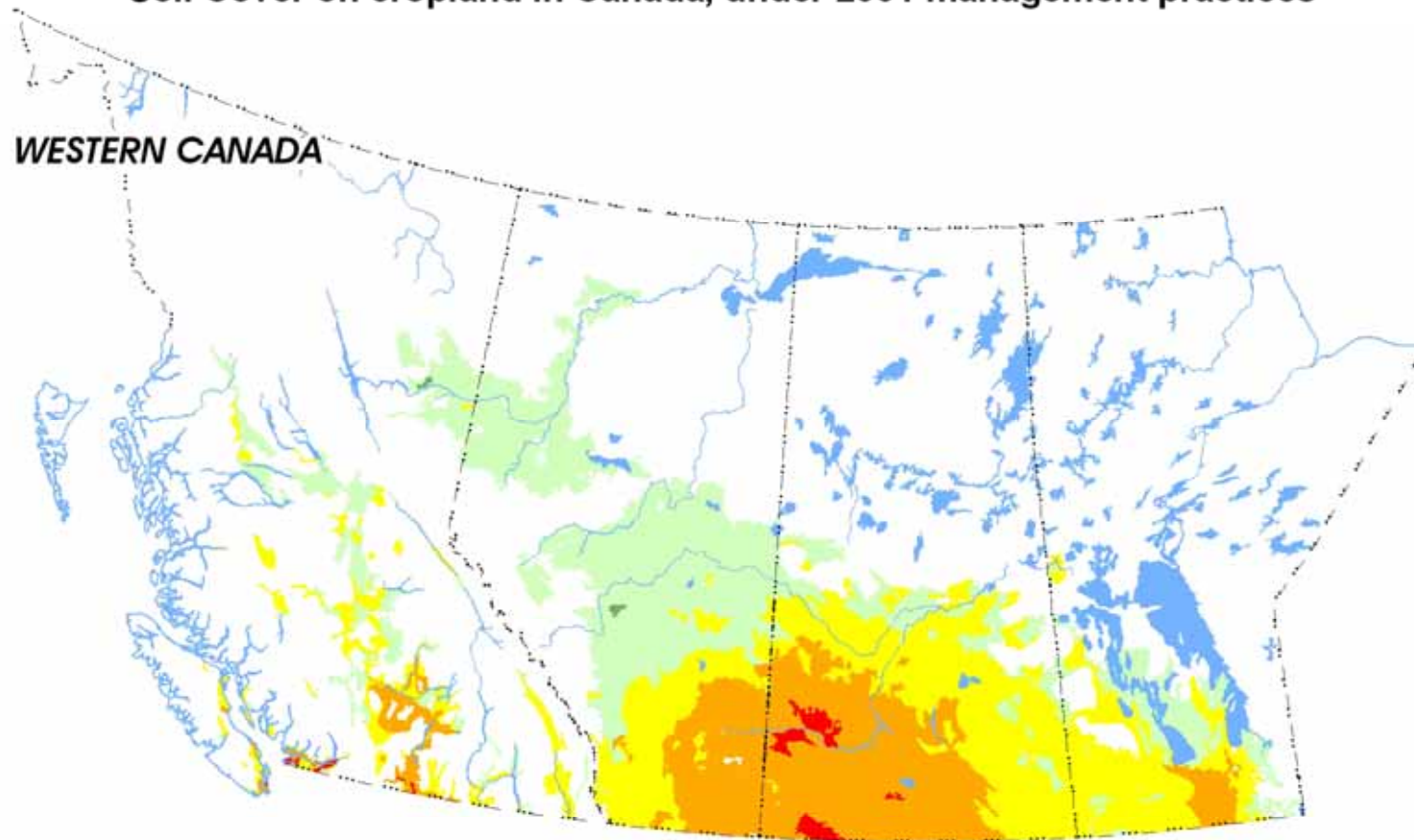
# Soil Cover on cropland in Canada, under 2001 management practices



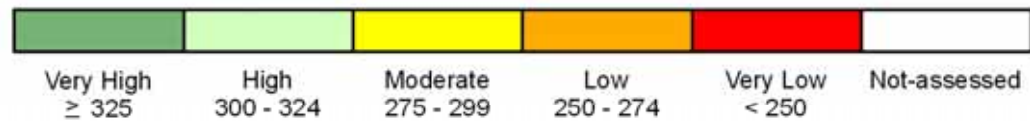
Soil Cover Classes (Soil-cover Days/year)



## Soil Cover on cropland in Canada, under 2001 management practices



Soil Cover Classes (Soil-cover Days/year)



## Soil Cover Change, 1981 - 2001

### Change in Average Annual Soil Cover Days, 1981 – 2001, by province

	Soil Cover Days					Change (%)
	1981	1986	1991	1996	2001	1981 to 2001
British Columbia	288	296	298	298	298	4
Alberta	297	299	303	307	308	4
Saskatchewan	266	270	277	283	282	6
Manitoba	280	284	290	292	294	5
Ontario	267	268	270	277	277	4
Quebec	303	304	304	303	300	-1
New Brunswick	322	326	324	324	323	0
Nova Scotia	324	327	328	329	328	1
Prince Edward Island	287	289	289	288	288	0
Newfoundland	299	326	323	335	330	10
Canada	280	284	289	293	293	5

## Soil Cover Change, 1981 - 2001

Ecoregion		Change in SCD, 1981 - 2001		
		Tillage	Crop	Sum
135	Lake Erie Lowlands (ON)	29.01	-7.11	21.90
157	Dark Brown Soils (AB & SK)	9.79	6.35	16.15
132	St Lawrence Lowlands (ON & QC)	6.04	-6.12	-0.08
159	Brown Soils (AB & SK)	5.24	3.59	8.84
120	St. John R. (NB)	2.97	-2.73	0.23
155	Interlake Plain (MB)	2.49	10.49	12.98
101	Lac St Jean (QC)	1.20	-8.59	-7.39
138	Peace River District (BC & AB)	1.01	20.12	21.13



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

## Soil Cover Indicator

### **Conclusions:**

The amount of soil cover at local, regional and national scales varies widely as a function of crop distributions and tillage practices.

Changes in crop distributions over the past 25 years in Canada have in some cases complemented and in other cases counteracted the positive effect conservation tillage has had on soil cover.

With a continuation of current trends in crop and tillage practices, we can expect declines in soil cover in an increasing area of Canada, especially in intensifying and specialty areas such as the St Lawrence Lowlands, the St John River Valley, southern New Brunswick and Lac St Jean.

Programs and/or policies intending to improve soil cover levels in Canada must take into consideration ongoing changes in both cropping patterns and tillage practices.



**Agriculture and  
Agri-Food Canada**

**Agriculture et  
Agroalimentaire Canada**

# **Thank You!**

**Ted Huffman  
Agriculture and Agri-Food Canada**