

# An Assessment of the Potential Contribution of Satellite Earth Observation to Watershed Management Programs

## Executive Summary

Report for  
The Canadian Space Agency  
Saint Hubert, Quebec

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## SUMMARY

The relatively recent holistic approach to landscape level or integrated resource planning is inclusive and cross disciplinary, and does not fit with the past approach to narrow focus in policy development (stove pipes). Most governments now recognise the necessity of integrated planning, and have chosen the watershed as the basic planning unit. Many are moving to establish planning and programs along these lines.

However, integrated inclusive planning is difficult, since it must include all levels of government and all departments, industry, groups and individuals. There has been an increasing reliance by federal and provincial governments on partnerships with all of these groups, in response to the challenge and many government programs are now delivered via partnerships.

Watershed management is as much about modifying human behaviour as it is about managing the environment. There now is a strong recognition that action to preserve and protect the environment must be at the local level. As part of this realisation, the concept of stewardship concept has arisen. Stewardship, simply stated, means that *everyone* - including landowners, private companies, voluntary organizations, and individual citizens - are caring for our land, air and water, sustaining the natural processes on which life depends.

Rapid change (either through urbanisation, agriculture, forestry, or oil, gas or mineral exploitation) is a problem, and lack of up-to-date data hampers integrated planning. Lack of regional models is also a problem. At the simplest level, making people understand what they have, and how things are changing is critical to building consensus about what should be done. Earth Observation (e.g. Landsat imagery) can provide natural colour image maps (possibly only a few weeks old) and make an important contribution to consensus building. Image maps can be obtained for all or part of a watershed with a resolution equivalent to a scale of about

1:60,000. Relatively inexpensive archived imagery from as far back as 1972 can provide an excellent means of tracking change in land use/land cover and other spatial features within a watershed. Free Landsat data are available for most of Canada for the 1999-2000 time frame, around 1990 and in some cases around 1980.

While not new or 'front line science', land use classification and change detection using Landsat imagery is probably the single most important contribution Earth Observation can make to watershed management. Land use classification already forms the basis of most land use plans, watershed models, and decision support systems within government.

However, these data, and the systems and expertise to run them are not leaking out of government at a very high rate. The Stewardship Organisations, where much of the work of watershed management is actually beginning to be done, could benefit greatly from the use of EO products.

Table 1 is a summary of the contributions (ranked high, medium or low) that Earth Observations can make to a number of watershed indicators and practical applications.

**Table 1.** The present contribution of Satellite Remote Sensing to tracking some water-related Environmental Indicators (including those proposed by NRTEE on 12 May 2003). Ranking of possible remote sensing contribution:  
H = high; M = medium; L = low; NA = not applicable

Trend Indicator and Timeframe	Examples of Applications	Visible-Infrared	Active Microwave	Passive Microwave
Short-term trends (hours): Generally weather and catastrophic events				
Severe weather forecasts Location and Rate of Precipitation Water level and flow rate	Flood prediction	L	L	M
	Farm run-off	L	L	M
	Landslides	L	L	NA
	Reservoir management	L	L	H
	Weather forecasts	H	L	H
Medium-term trends (days-weeks): Generally regulatory monitoring				
Water quality (NTREE) Water levels Soil moisture Wetlands (NRTEE) Snow cover and snow/water equivalent	Wetlands management	H	H	L
	Watershed management	H	H	M
	Water withdrawal rates	L	L	NA
	Reservoir management	M	H	NA
	Run-off rates	L	L	H
Long-term trends (months-years): Generally climatology and land use change				
Land use/land cover (NRTEE)	Watershed management	H	H	H

Surface water mapping	Ecosystem 'health'	H	H	H
	Climate change (general)	H	H	H
	Contribution to Green house gas estimates	H	H	L

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