The Canadian Wildland Fire Information System in support of the National Forest Carbon Accounting System and the National Sustainable Development Strategy

NRCan Initiative

Earth Science Sector (ESS) and Canadian Forest Service (CFS)

Who are we?

Natural Resources Canada (NRCan):

Canadian Wildfire Fire Information System Emissions Team (CET)

- ESS (CCRS)
- NoFC
- GLFC

NRCan Carbon Accounting Team (CAT)

- PFC

With assistance from…

Canadian Space Agency (CSA)
- $800,000 over 4 years

Canadian Fire Management Agencies (SK, MN, ON)
- logistic support
- transportation

What are we doing for Canada?

We will deliver national estimates of carbon emissions from forest fires by April 1, 2006 (prototype) and 2008 (final), using satellite data.

Why?

This will be required for national reporting under the Kyoto Protocol.

Why use Satellite data for fire monitoring and mapping?

- product is nationally consistent & internationally defendable
- it's timely for annual, operational reporting
- it provides 1st cut at national estimates of area burned and carbon emissions (but ultimately, better data may be available)
- increased accessibility of natural resource information for the public
- tools to facilitate planning and monitoring_of changes

The value of a hotspot

- shows the location of current fires

- confirms that a disturbance or landuse change is a fire

- places a date stamp on burning pixels
  (may be necessary for completing emissons calculations)

What is the CWFIS?

- A kitbag of fire management tools
  - danger rating
  - satellite data acquisition/archiving
  - spatial fire management (e.g. fuel consumption)
  - hotspot monitoring & fire mapping
  - data warehouse
  - carbon emissions
  - fire occurrence prediction

- A web portal for accessing fire statistics & information

Different problems
require
Different CWFIS tools

Many of the current CWFIS tools are being developed to address the connection between fire emissions and national carbon accounting

Project: The Canadian Wildland Fire Information System in support of the National Forest Carbon Accounting System and the National Sustainable Development Strategy

- **EO - Implement procedures to produce unbiased, spatially and temporally explicit burned area measurements at a national scale through multi-sources EO imagery,**
- **DiMAPS - Develop the Landsat Disturbance Monitoring & Acquisition Planning System (Landsat-DiMAPS) to optimize the national Landsat or EO acquisition plan for large natural disturbance mapping operations and reduce reporting responses time,**
- **Modeling - Develop a procedure to estimate carbon emissions from wildfires by integrating burn area estimates with fuel consumption estimates from fire behavior modeling, forest inventory data and EO imagery,**
- **Data Framework - Implement the National Forest Fire Facility (NFFF) of the CWFIS to gather, manage and archive geo-spatial data required for and generated from the CWFIS. Ensure the NFFF provides secure and public access of fire statistics through map and feature services technology,**
- **Implementation of the CWFIS Framework .**

Influence through enhancing current DSS
~ Focus on fire disturbances ~

- CWFIS will report national fire statistics, respond to the development of a reliable and defendable forest fire emissions reporting system, and to support Canada's policy and decision strategy in respect to UNFCC, C&I and Kyoto reporting obligations, by 2006-07

- CWFIS reporting capability will meet requirements of the national Forest Carbon Accounting System and Environment Canada's Greenhouse Gas Division through the Monitoring, Accounting and Reporting System (MARS).

CWFIS: Canadian Wildland Fire Information System

The CWFIS includes…

– The National Forest Fire Facility (NFFF) to produce, compile, archive, report forest fire statistics and geo-spatial information to meet national and international reporting obligations, such as State of Canada's Forest, UNFCCC, Kyoto, C&I…

– The NRCan unique voice for forest fire related statistics at the national scale,

– CWFIS will sustain its mandate through

- daily monitoring at the national scale fire activity,
- estimate national burned area at coarse and fine (sampling basis) spatial resolution at the end of each fire season,
- compile, and archive forest fire geo-spatial boundaries and statistics produced by provinces and territories,
- develop partnership with national programs which requires forest fire information, such as Earth Observation for Sustainable Development, Carbon Accounting team, Criteria & Indicators, NFIS, biodiversity program…
- sustain transfer of forest fire related geo-spatial technology and tools to CIFFC, provincial and territorial partners,
- enhance existing services, such as sFMS, CFFDRS, FWI…

The Role of a Fire Information System in National Carbon Accounting
(A joint Canadian Forest Service and Canada Centre for Remote Sensing initiative with support from the Canadian Space Agency)
Adapted from an original version by Robert Landry (CCRS)

Version Feb., 2005

Fire Season

DAILY PROCESSES

Hot Spot Monitoring (GOES, MTSAT. MSG, AVHRR, MODIS, AATSR)

Fire Information System Web Portal

Daily Monitoring

Satellite (LANDSAT)

Disturbance Monitoring & Acquisition Planning System (DiMAPS)

Daily acquisition planning ordering report (services)

Landsat Ordering Process (rule based)

Landsat DB

Landsat Burn Area Mapping (SAFiMS, MAFiMS)

Current and past burn area vectors

END of FIRE SEASON PROCESSES

SPOT-VGT multi-date Burn Area Mapping

ANNUAL PROCESSES

spatial Fire Management System (sFMS)

Fuels

Weather

Topography

Fuel Map Generating System

EOSD
- Land Cover
- Biomass

Emissions estimates

Fire Severity

National Forest Fire Facility (includes National Large Fire Database)

Selection of burn area products (rule based)

Burn polygons provided by Fire Management Agencies (photo, helicopter, SAFiMS, MAFiMS...)

Fire Information System Reporting and Web Portal

Individual fire event report:
- burn area
- burn vector
- emission estimate

Clients

Earth Observation for Sustainable Development (EOSD)

National Carbon Accounting

Interagency Forest Fire Centre

Fire Agencies

National Forestry Database

Global Observation of Forest Cover (GOFC)

Public

National Forest Fire Facility - Burn Area
(contributions from different sources through time…)

Reporting 2004
(Feb. 2005)

Fire Season	VGT	Landsat[1]	Prov/Terr.
2004[2]	100%	10%	0%

Reporting 2005
(Feb. 2006)

Fire Season	VGT	Landsat	Prov/Terr.
2004	100%	18%	0%
2005	100%	10%	0%

Reporting 2006
(Feb. 2007)

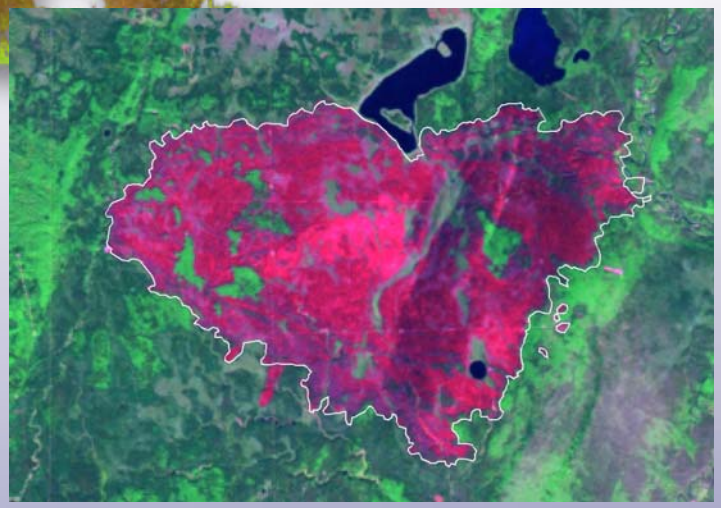
Fire Season	VGT	Landsat	Prov/Terr.
2004	100%	35%	40%
2005	100%	24%	0%
2006	100%	15%	0%

1 The Landsat figures could be significant higher if a strategic decision is made to focus on mapping larger burns within the Managed Forest (Kyoto Art.3.4)

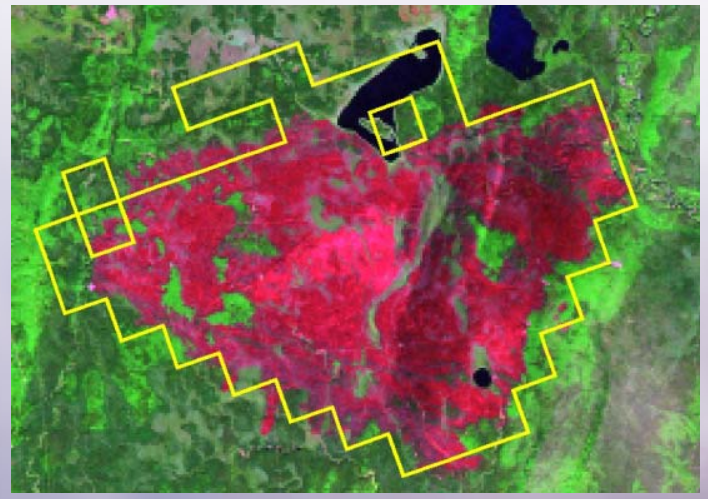
2 From 2004 up, there is also the possibility of increase the 1999-2003 LFDB with Landsat based vectors

These figures are hypothetical numbers. Careful simulation should be investigated to support these tables

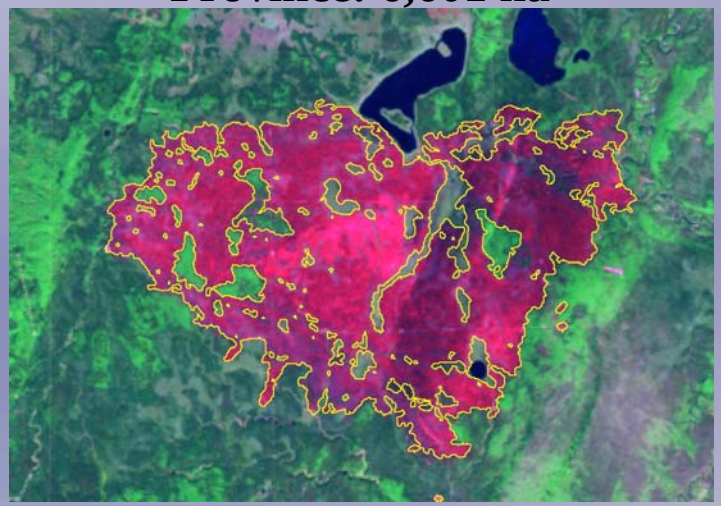
National Forest Fire Facility - Burn Area
(contributions from different sources)



Province: 6,601 ha



SPOT-VGT: 7,600 ha



SAFiMS (Landsat): 5,263 ha

Area comparison: OP0039

Source	Province	VGT	SAFiMS
Province	1.00	1.15	0.80
VGT		1.00	0.69
SAFiMS			1.00

Canadian Wildland Fire Information System (CWFIS)

Validation and calibration of Canada-wide coarse-resolution satellite burned area maps

(Continental-scale burned area maps derived from SPOT VGT and NOAA/AVHRR satellite imagery were validated and calibrated using a large sample of Landsat TM scenes)

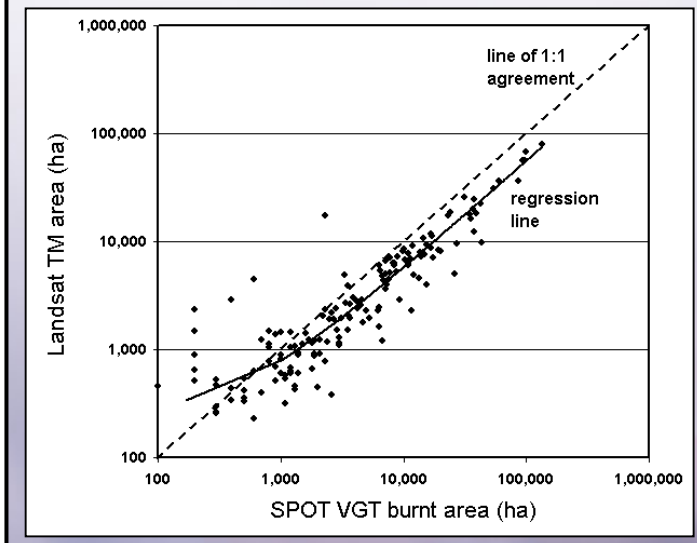
R.H. Fraser[1†], R.J. Hall[2†], R. Landry[1†], T. Lynham[3], D. Raymond[4], B. Lee[2], and Z. Li[1*]

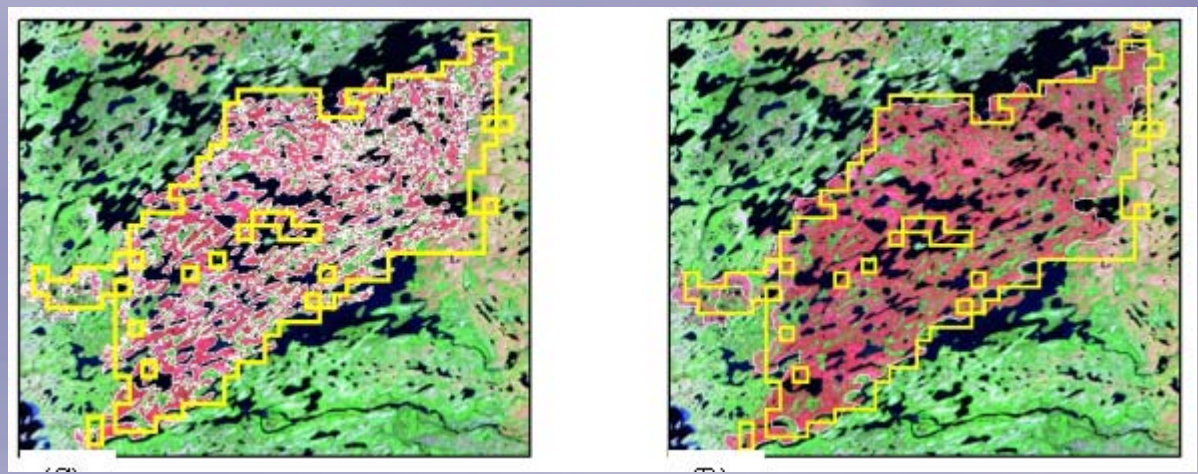
[1]Natural Resources Canada, Canada Centre for Remote Sensing, 588 Booth St., Ottawa, ON, Canada, K1A-0Y7

[2]Canadian Forest Service, Natural Resources Canada, 5320 – 122 St., Edmonton, ALTA, Canada, T6H-3S5

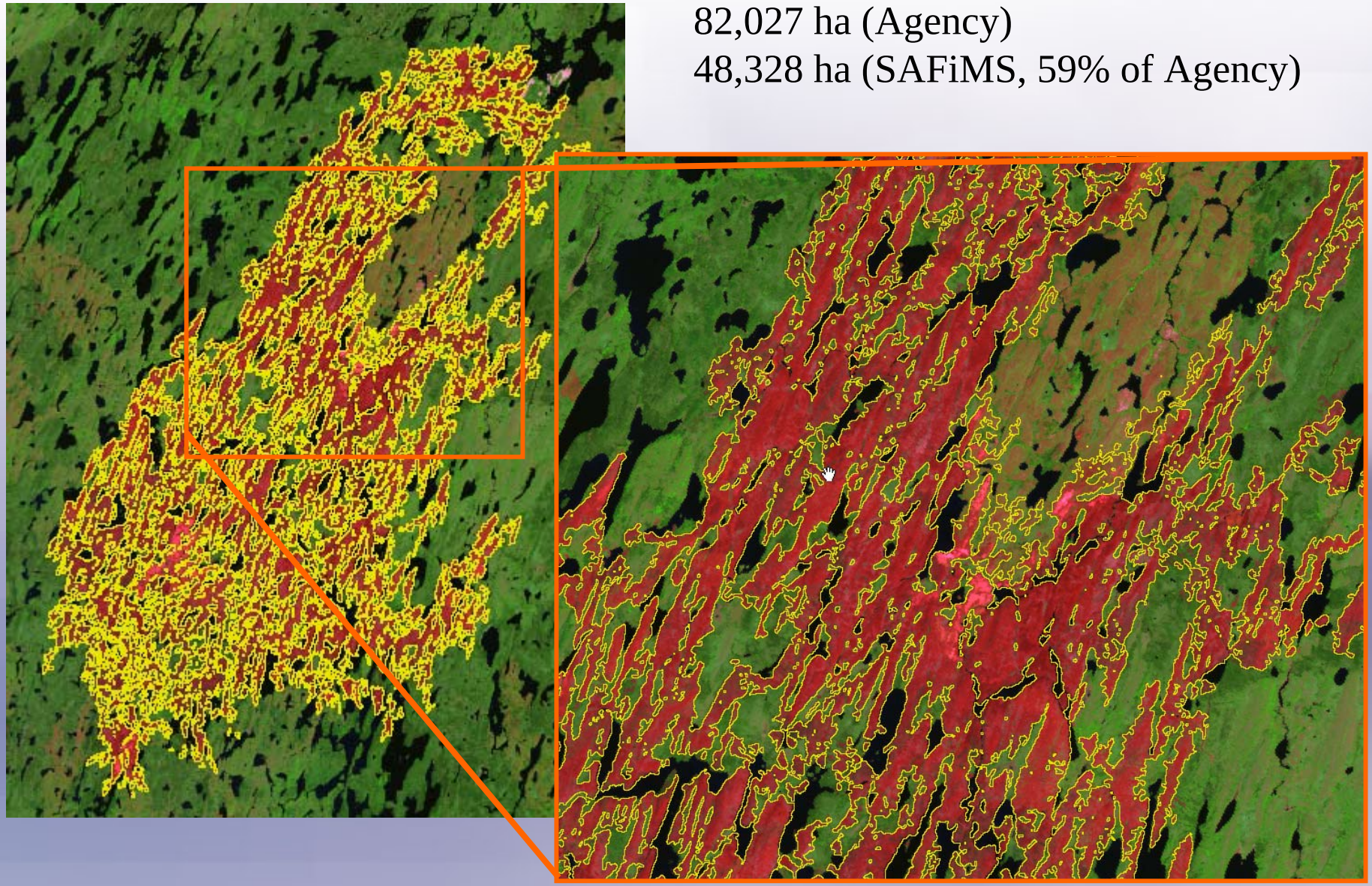
[3]Canadian Forest Service, Natural Resources Canada, 1219 Queen Street East, 490, Sault Ste. Marie, ON, Canada, P6A-5M7

[4]Dendron Resource Surveys Inc., 880 Lady Ellen Place, Suite 206, Ottawa, ON, Canada, K1Z-5L9





82,027 ha (Agency)
48,328 ha (SAFiMS, 59% of Agency)

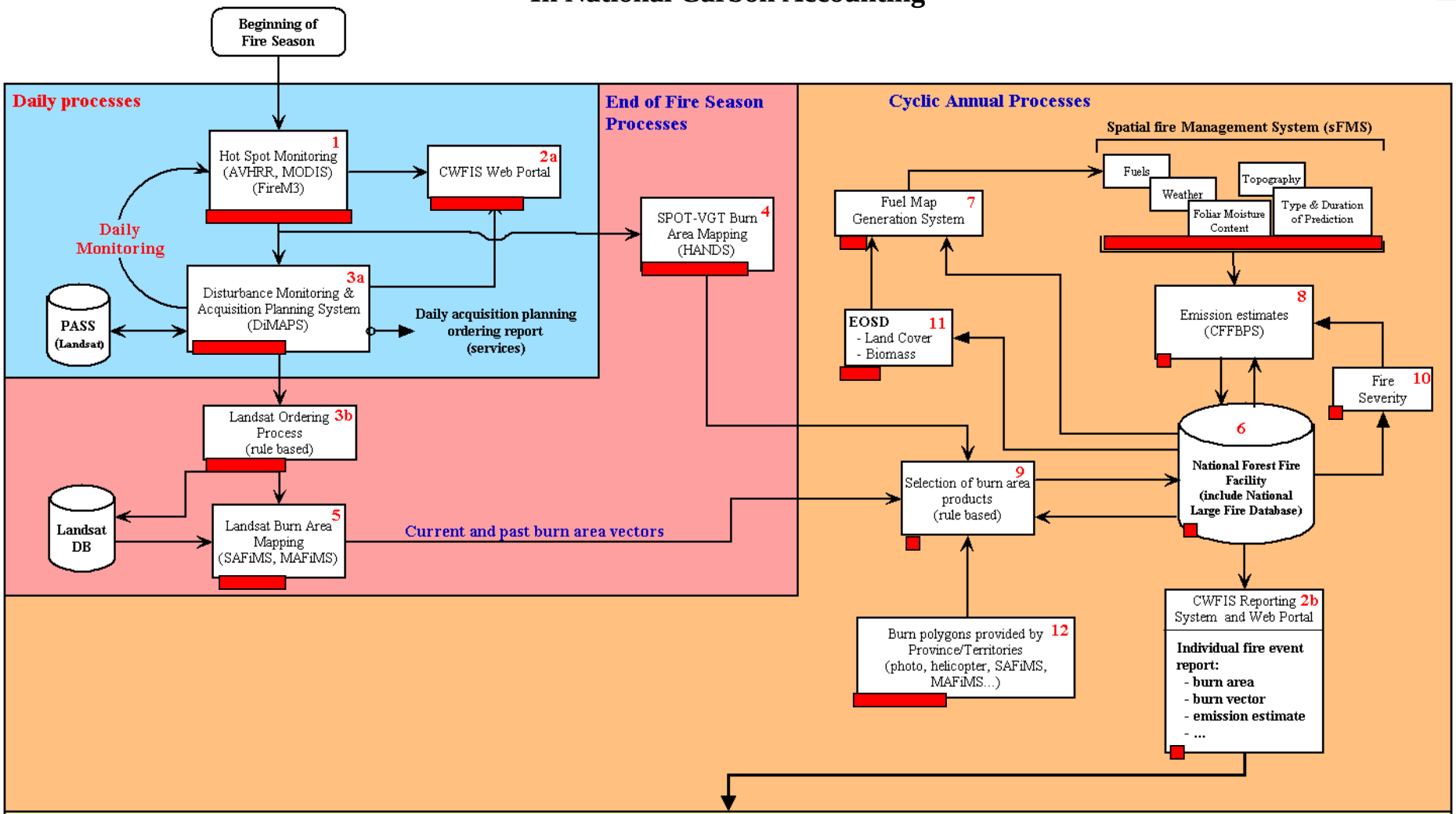


Communications and Implications

- completed briefing note for ADMs at request of DG at NoFC
- flowchart has been presented to Mgt. at CCRS, NoFC & GLFC
- flowchart represents a general scheme for deriving carbon emissions from other forest disturbances (i.e., not restricted to fire)
- flowchart has been shown to GOFC/GOLD Fire Team as a template that could be adopted internationally for fire mapping and deriving carbon emissions
- mapping and fire emissions from peat lands are a developing issue which could be addressed using a similar process
- looking at the role of Canada in promoting the use and/or development of additional RS systems (e.g., DMC, BIRD)---Not within current project but in parallel
- carrying out validation of AVHRR, MODIS, AATSR & GOES hotspots using polygons from agencies (YK, AB, SK, ON, PQ).

The Role of the Canadian Wildland Fire Information System (CWFIS)

In National Carbon Accounting



Version Nov. 24, 2003

From the Canadian CWFIS team you will hear about…

- course-scale burned area mapping
- fine scale disturbance monitoring & mapping
- modeling wildfire carbon emissions
- spatial modeling of fire weather, fuels & behavior
- hotspot assisted fire spread
- field validation