CFS Activities Relevant to ABoVE

1. Project Title

THERMAL IR REMOTE SENSING APPLICATIONS FOR CHARACTERIZING WILDFIRES TO MEAURE REAL-TIME FIRE BEHAVIOUR AND ESTIMATING CARBON EMISSIONS FROM WILDFIRES

2. Investigators (include email).
a) Project Lead: Tim Lynham
b) CFS collaborators: Josh Johnston
c) external collaborators (individuals/institutions): CSA, KCL (UK), INO, ESA, UTIAS, MNR

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3. Project Description (200 words maximum)

This project helps guide the development of satellite TIR sensors for monitoring Fire Radiative Power (FRP) on wildfires. It requires the development of new satellites and fire algorithms for satellite data to get direct estimates of fire rate of spread, fire intensity, fuel consumption, smoke plume dynamics and effects of fire on carbon emissions. The work includes CSA, ESA, NASA, and KCL London. Close collaboration with CSA will position NRCan to utilize data from ESA's new Sentinel-3 satellites (CSA is a member of ESA). CFS is assisting CSA with the User requirements for a new airborne TIR scanner before development of a satellite. Algorithm development for fire products from TIR data sources is underway. A field campaign in the boreal forest is underway to collect data needed to develop future data products.

4. Timelines and current funding (level and source)

2015-2018: Calibration/Validation of Sentinel-3 satellite
2018-2020: Testing of CSA TIR airborne scanner
2014-2022: Development of User/Science Requirements, Business Case and Economic Analysis for Canadian fire satellite

5. Reference (1-2 key publication, website)

Direct calculation of Byram's fire intensity from infrared remote sensing imagery. 2016. J. M. Johnston, M. J. Wooster, R. Paugam, T. J. Lynham, L. M. Johnston (under review).

A Microsatellite-based Canadian Wildland Fire Monitoring System. T. J. Lynham, J. M. Johnston, M.van Mierlo, B. Lawrence, P. Briand, Linh Ngo Phong, J.-F.

Hamel, D. Dufour. 2015. 36th Canadian Symposium on Remote Sensing (CSRS 2015), St. John's, Newfoundland, Canada, June 08-11 2015.

Experimental confirmation of the MWIR and LWIR grey body assumption for for vegetation fire flame intensity. 2013. Johnston, J.; Wooster, M.; Lynham, T. International Journal of Wildland Fire 23:463-479.

6. ABoVE question being mainly addressed (please highlight)

1. How are environmental changes affecting critical ecosystem services - natural and cultural resources, human health, infrastructure, and climate regulation - and how are **human societies** responding?

2. What processes are contributing to changes in disturbance regimes and what are the impacts of these changes?

3. What processes are controlling changes in the distribution and properties of **permafrost** and what are the impacts of these changes?

4. What are the causes and consequences of changes in the **hydrologic system**, specifically the amount, temporal distribution, and discharge of surface and subsurface water?

5. How are **flora and fauna** responding to changes in biotic and abiotic conditions, and what are the impacts on ecosystem structure and function?

6. How are the magnitudes, fates, and land atmosphere exchanges of carbon pools responding to environmental change, and what are the biogeochemical mechanisms driving these changes?

7. Linkages with ABoVE:

a. Data being collected/generated

b. Expected key benefits and potential challenges from collaborating with ABoVE

c. Ongoing and / or interest in future involvement in ABoVE

a) TIR data for hotspots ad fire radiative power; fuel consumption on fires.
b) Complete characterization of primary outputs of wildfire behaviour
c) Possibility of obtaining novel estimates of carbon emissions from wildfires.