

Appendix D

October 20, 2004 Meeting with Nancy French: Remote Sensing and Fire Severity

<b>Attendees:</b>	CCRS	Robert Fraser	RF
		Robert (Robere) Landry	RL
		Vincent Decker	VD
		Nancy French	NF
	CFS-GLFC	Tim Lynham	TL
	CFS-NoFC	Bill DeGroot	BD
		Ron Hall	RH
		Vern Peters	VP

<b>AGENDA</b>		
<b>Wednesday, October 20</b>		
08:30 - 9:00	Overview of CWFIS	RL
9:00 - 9:30	Plan for collaborative project on fire severity in USA Background on Eric Kasischke's and Merritt Teretsky's work and how it intersects with French work (Nancy French)	NF
9:30 - 9:50	HANDS primer	RF
9:50 - 10:10	Break	
10:10 - 10:30	Plan for Fire Severity project in Canada	RH
10:30 - 10:50	Preliminary discussion of Canadian field data from 2004	VP
10:50 - 12:00	Additional Topics for Discussion:	
	1) The use of NBI (US Park Service Landsat burn index) pros & cons 2) Wei Min's work and how it may intersect with French & Canadian work 3) Creation of a North America fire emissions GOFC/GOLD working group	
12:00 - 13:00	Lunch	
13:00 - 16:30	Continue Discussion	

<b>1. Overview of the CWFIS</b>	<b>Tim Lynham</b>
Tim: Provided overview of CWFIS (presentation)	
<b>2. Quantifying biomass consumption variability in forest fires</b>	<b>Nancy French</b>
<ul style="list-style-type: none"> <li>- Issues on terminology, how interpreted, ask what they mean by the terms they use</li> <li>- Problem we don't know a lot about within burn variability and its effects on carbon cycling</li> <li>- Regions of interest includes northern boreal cordillera, taiga, Hudson plain, missing boreal plain</li> <li>- Find consumption levels within each of these regions. There was an earlier paper on consumption rates by ecozone but now wants to get better values of above ground and ground layer with error estimates on fuel consumption based on both remote sensing and field sampling</li> <li>- Fuel consumption = biomass consumption</li> </ul>	

- Pre-burn imagery looking at the vegetation before the fire (canopy), but the post-burn imagery is looking at something different (topography, bole density).
- Like to sample 1-2 burns to assess ground layer consumption
- Work through Carl Key burn severity and its relation to fuel consumption
- Obj to collect enough data on fuel consumption to statistically describe fuel consumption.
- Will work with USDA BAER team using burn area emergency response that uses Landsat, ASTER, MODIS that uses the burned maps. Focus is on management
- Carl Key work on NBR and CBI for USGS on National Park Service: Does this approach work in Canada? If another country comes and looks at our estimates and says we can use these approaches, we need to confirm whether they do.
- Lot of Landsat data being imaged for parks and national forest service
- FIREMON project funded through Joint Fire Science program to standardize fire monitoring and inventory in the US to collect and archive fire data. Provides funding for science-based investigations to help in the management of wildland fire
- MODIS product from University of Maryland
- NASA studies on Carbon Cycle Science program; Eric Kasischke to quantify emissions from fires in boreal peatlands, working with Merritt Turetsky and Jill Johnstone
- Wei Min Hao of USDA Forest Service to develop estimates of fire emissions for North America using MODIS and fire models
- Fire & Environmental Research Applications Team - Fire Emissions Production Simulator – Pacific NorthWest FS – out of Corvalis – David V. Sandberg (David Samburg)
- Possibly interested in joint work in field sampling
- \*\* Nancy’s interests span agencies much broader than ours – ecological monitoring groups – this is needed to understand ecological variability
  
- **Michalet et al 2000 (IJRS 21: 323-338: Using Landsat TM data to estimate carbon release from burned biomass in an Alaskan spruce complex)** assigned carbon fraction to burn severity class. The class breaks for severity was based on ground work to assess severity and used these as training areas in a supervised classification. It was a bit iterative. Thinking that it might require a different class range to map fire severity for different ecozones. Fire had consumed the entire organic layer and the trees fell over and had exposed mineral soil so spectral response was quite unique. Band 7 was the main channel. Mainly ground layer burning since that is where most of the fuel is. There was less above ground burning in the severe class than in the light class.
  
- Agrees terminology is important (unburned islands may be given a severity class – i.e. low or unburned)
- Study will provide info on the range of biomass consumption levels for the regions studied that will be used in carbon emissions models to account for the levels and range of variability in fire emissions for North America.
- Use of **Seiler and Crutzen (1980)** for total carbon emissions as basis where:  

$$C_t = A * B * f_c * \beta$$
 now represented as:  

$$C_t \text{ (Carbon total)} = A * [\text{aboveground emissions} + \text{ground-layer emissions}]$$

<p>Above ground:  <math>C_a = B_a * f_{c-a} * F_{b-a} * \beta_a</math> where:</p> <p><math>B_a</math> = ABG biomass density (t/ha)  <math>f_{c-a}</math> = fraction of biomass that is carbon (0.45-45%)  <math>F_{b-a}</math> = fraction of C available for burning (varies by fuel type)  <math>\beta_a</math> (t) = fraction of C consumed during burning (varies by fuel type &amp; condition)</p> <p>Ground layer emissions:</p> <p><math>C_g = C_g(d_s) * d</math></p> <p>Carbon Density – varies with soil depth  <math>d</math> = Depth of burn</p> <p>2-15 t C /ha C released in low intensity surface fires          40 to &gt;60 t C /ha</p> <ul style="list-style-type: none"> <li>- Robere raises issue that on optical Landsat data, most of the time you are only seeing areas at least 50% crown burn but don't see what's burned on the ground and yet most of the fuel is on the ground. Thus by remote sensing, may really not be able to map total fuel consumption since can't see below ground.</li> <li>- Kasischke in prep reporting on depth of ground organic layer in different types of boreal forests for warmer, well-drained forests vs those under permafrost and peatlands.</li> <li>- Could do a study on age, species composition and depth of ground organic layer and can summarize by ecozone.</li> </ul>	
<p><b>3. Coarse spatial resolution - HANDS</b></p>	
	<p>Robert Fraser</p>
<p>Coarse Resolution Burned Area Mapping for CWFIS and Emissions Reporting - <i>HANDS</i></p>	
<p>Robert presented an overview of HANDS for Nancy and an indicator of where it fit in the CWFIS flowchart.</p> <ul style="list-style-type: none"> <li>- Mentioned about adjusting for aggregation bias similar to previous</li> <li>- A subsample of “Hands” product burn maps was mapped with MaFiMS</li> <li>- Provinces used Modis as of last year for hot spot detection</li> <li>- Provinces don't use our AVHRR product from CFS</li> <li>- Validation and Calibration of Canada Wide burns (Photogramm Eng R.S 70:4:451-460)</li> <li>- Presented plans for revisions to the HANDS algorithm</li> <li>- Compared total burned area reported in Canada compared to total area generated from HANDS. Also showed the large difference in reported area for 2003 due to missing fire areas in Northern Manitoba and Ontario. Working with Manitoba to correct difference to CIFFC.</li> </ul>	
<p><b>4. Canada fire severity project</b></p>	
	<p>Ron Hall</p>
<ul style="list-style-type: none"> <li>- Provided an overview of the proposed fire severity work, background with reported journal papers that have used the Carl Key burn severity methods. Summarized the proposed</li> </ul>	

questions for the study in Canada and some preliminary indicators to get into the work.	
<b>5. Preliminary discussion of Canadian field data from 2004</b>	<b>Vern Peters</b>
<ul style="list-style-type: none"> <li>- Focused more on ground CBI, fuel consumption and its relations to NBR for Canadian fuel types</li> <li>- Paired sites on 5 fires to sample for fire severity and fuel consumption</li> <li>- Challenge also wanted to sample for a range of fuel consumption in addition to a range of burn severity.</li> <li>- Looked at duff consumption but depth of burn are other parameters that are worth looking at relative to CBI total and components that may vary by fuel type. Thus, may get some insights into stratifying the CBI and fuel consumption by fuel types rather than just looking over all fuel types.</li> <li>- Also, to look at variation within fires vs. among fires but it might be ecozone weighted.</li> <li>- Preliminary analyses suggest that fuel consumption is higher in wildfires vs. prescribed burns that was used to drive previous values.</li> </ul>	
<b>6. Group Discussions</b>	
<ul style="list-style-type: none"> <li>- Fundamentally, is it worth pursuing a study to characterize fuel consumption from satellite remote sensing when radiometric response is really only detecting overstory consumption in the boreal and most of the fuel consumption is on the ground. Most will recognize from the fire community that there is no physical basis to use remote sensing for measurement of ground level fuels. Without this basis there is difficulty in justifying the premise for this work in boreal conditions.</li> <li>- We see modulation of the signal within the fire so there is variation in the RS signal but we don't know what the response is caused by: stem density, topography, shadows from standing burned timber, overstory fuel consumption?</li> <li>- What is it about RS that makes us think it should be useful for measuring fuel consumption?</li> <li>- Overstory fuel consumption has little range in fuel consumed, so why would we want to explain this signal with R.S. Most of the boreal is crown fire, so there is little variation in overstory fuel consumption</li> <li>- In the lower 48, we don't know how much fuel is in the overstory vs. understory.</li> <li>- This could be the justification for the study and it will help to further assess or exploit what may be contained within the Landsat image.</li> <li>- What is driving the signature would be explained and the fuel consumption would be assessed as well.</li> <li>- Potential Collaborators: Martin Wooster – Kings University in London</li> <li>- Simon Trigg are looking at a fire intensity vs. remote sensing relationship (radiometric)</li> <li>- Imagery years after the burn could be used to assess temporal trend that would help assess regrowth that would lead to a source or sink but would need to keep fuels in context.</li> </ul>	
<b>7. GOFC</b>	
<ul style="list-style-type: none"> <li>- Suggest setting up a Emissions Working Group within GOFC. It could add in Wei Min</li> </ul>	

<p>and Eric to set up work for North America. Perhaps set up within GOFC Fire Implementation Team meeting for Feb in Edmonton. Could be used as a basis for the theme of that meeting. But Tim has proposed a theme on fire detection, mapping and linkage to emissions.</p> <ul style="list-style-type: none"> <li>- The North American Carbon program is just getting going, the funding mechanisms are still being created, etc. Thus, it might be worth delaying involvement with GOFC until this work is further developed.</li> <li>- Global Monitoring of Environment and Security: <a href="http://www.gmes.info/what_is/">http://www.gmes.info/what_is/</a></li> <li>- International disaster charter: <a href="http://www.esa.int">www.esa.int</a> or <a href="http://www.disasterscharter.org/main_e.html">http://www.disasterscharter.org/main_e.html</a></li> <li>- This provides opportunity to get emergency earth observation data for special cases such as the Kelowna fires in 2003.</li> <li>- From our side, we will be looking at different bands</li> <li>- Kings College, Luther: Martin Wooster: Tim Lynham has pdf that can be sent. Studied grasslands with cameras and is going after funding from the UK to try to study over forests. Simon Trigg is a post-doc at the University of Maryland who is working with David Roy (working on Modis fire products for burn area) developed by regionalizing the algorithm for specific regions of the country.)</li> <li>- Held discussions with Michael Brady, GOFC Executive Director and made suggestions to hold the meeting at CSA in Montreal. They have state of the art facilities and could provide an impressive tour over what could be provided in Edmonton. It would also provide the opportunity to showcase CSA to the international community. Michael will discuss with John Townshend. Meeting must be held by middle Feb latest in order to prepare for a follow-up meeting at the beginning of March.</li> </ul>	
<p><b>8. Discussions continue</b></p>	
<ul style="list-style-type: none"> <li>- Nancy suggests using Landsat to drive the field sampling but need to address fuel sampling. Approach would be to use delta NBR as a driver of fire severity, overlay with fuel type map, look at sampling done to date, and look for gaps for data collection.</li> <li>- Need a good spatial distribution of sites for assessing fire severity</li> <li>- <b>Nancy French suggested investigating: intensity can be derived from Modis sensors from hotspots, we could use this in our predictive equations of fuel consumption. Aster also could be used for thermal intensity</b></li> </ul>	
<p><b>9. Potential collaborations and joint field work</b></p>	
<ul style="list-style-type: none"> <li>- Discussion about co-ordinating efforts with Eric Kasischke, Merritt Turetsky, and Jill Johnstone. They will be doing work on fires in S.E Alaska, and the Yukon. Many Yukon fires are road accessible.</li> <li>- Merritt and Eric are working on peatlands so they already will be thinking about where to work.</li> <li>- Vern suspects they will be spending about 1-2 weeks on previous fires in SK and MB, and possibly more time if they do additional regeneration work this year. The YK is the most likely place for working on additional fires since there are the most new fires there. The SK and AB fires may be necessary for rounding out the mixedwood fuel types – or maybe the YK is adequate.</li> </ul>	

Appendix D

<ul style="list-style-type: none"><li>- <b>*Action:</b> Ron to check with Carl Key on future training during the winter on CBI, NBR</li><li>- (note: Email sent to Carl Key Oct. 21)</li><li>- <b>* Action:</b> Nancy to check with NASA contacts on possible access to SRTM 1 arc-sec data over Canada. No promises but asking the right people might help.</li><li>- Definitions key: fire severity relates to direct effects of the combustion process such as flames and burn severity is what is left after the fire. Thus, burn severity refers to the environmental characteristics after the fire, fire intensity relates to fire characteristics: Wildfire July-Aug 2004 issue</li><li>- Possibly plan a joint US and Canada field work trip next year to share protocols and methods of data collection</li></ul>	
<b>Meeting adjourned</b>	