Alaska Burn Severity Working Group Meeting
International Arctic Research Center
22 February 2006

Meeting Minutes

The meeting was attending by:

Mike Balchi (UAF)
Terry Chapin (UAF)
Jennifer Harden (USGS)
Randy Jandt (AFS/BLM)
Eric Kasischke (UMD)
Dave McGuire (UAF)
Karen Murphy (FWS)
Joel Reynolds (FWS)
Scott Rupp (AFS)
Andy Ruth (UAF)
Brian Sorbel (NPS)
Dave Verbyla (UAF)

Andy Ruth gave an overview of the project being carried out for the Fire Science Program by Dave Verbyla and Andy. They noted that there sites were those established by Teresa Nettleton for her dissertation in unburned black spruce stands, and there task was to collect CBI information at these plots. They presented their results from two fires, which showed that the correlation between CBI and dNBR were low (r2 between 0.4 and 0.5). Issues they identified were variations in dNBR caused by the timing of the Landsat data collections. Because of these, they caution on combining data from multiple burns. Also, they feel that topography may impact dNBR as well because of its influence on local solar angle of incidence.

Brian Sorbel attended for Jennifer Allen, who had another commitment. NPS did not do any new work last summer on CBI measurements, so Brian presented the results from previous research that NPS has conducted. This overview was included in the article that they put together for an NPS magazine that Jennifer had previously sent to us. In these studies, they found a strong correlation (r2 = .75 to .84) in most fires they studied, with the exception of one fire that burned in an area primarily consisting of shrubs (r2 = 0.46).

Randi Jandt gave a short presentation on the interests of AFS/BLM in assessing burn severity. She identified 3 areas of interest:

1. Estimation of raw acres (e.g., how many acres turned black), as well as information "beyond black", including mapping acres of where actual mortality occurred, coarse estimates of severity, and the mosaic or patchiness of the fire.
2. Prediction of expected recovery at a landscape scale
3. Identification of areas requiring mediation

She next gave an overview of the aerial surveys she conducted to assist the group at EROS Data Center who were creating burned severity maps on a statewide basis. This was referred to as the BARC (?? I think project). Randi came up with an approach to assess severity from low flying fixed wing aircraft, and later checked this approach using ground-based CBI measures.

Karen Murphy summarized the efforts of FWS in analyzing CBI/NBR data they collected last summer. They collected data from 6 different burn events, 5 from 2004 fires and one from a 2003 fire (in the Tetlin area). Overall, they found lower correlations than the NPS studies (r2 between 0.4 and 0.5), results that were disappointing. They examined potential sources of errors in their data, including co-registration of scenes and biases in collection of the CBI data. However, they could not identify any problems in these areas. Karen also noted that in addition to the CBI data, they also made observations on vegetation cover and measurements of the surface organic layers at her sites.

Scott Rupp discussed his group's interest in using NBR data. They have a desire to provide input parameters for their model that assesses the impacts of fire, fire severity, and climate change on vegetation cover in Alaska. They are hoping to using NBR information to provide more accurate inputs for their models. Their studies last summer examined the hypothesis that burn severity changes as a function of stand age – To test this hypothesis, they processed the tree cookies that were collected by the Verbyla and Kasischke teams, and they also collected additional CBI and tree cookie data from sites his team visited himself. They noted that there appeared to be slight correlations between CBI and stand age.

Jennifer Harden gave a brief overview of her group's studies on assessing burn severity in the 1999 Donnelly Flats fire in black spruce stands. She also discussed her interest in fractal analysis of fire sizes.

Finally, Eric Kasischke presented an overview of the studies the Kasischke/Turetsky/McGuire group carried out last summer in burned black spruce forests. These studies showed low correlations between dNBR and different CBI indices ($r2 = 0.1$ to 0.2). He also showed results the depth of the organic layer remaining was dependent on topography and topographic position.

Discussions by the Working Group resulted in the following items:

1. Everyone agreed that a special section 3rd International Fire Ecology & Management Congress scheduled for 13-17 November 2006 in San Diego,

California would be an ideal opportunity to present the results from the research on fire severity in Alaska along with that of the CFS/CCRS group. Action – Eric Kasischke will contact the organizers of this meeting with a proposal for a special section..

2. Everyone agreed to the proposal of organizing a special section in a scientific journal to present the results from the research. The preferred journal was *International Journal of Wildland Fire.* It was also agreed that a summary paper on the results from the satellite studies would be prepared for *Remote Sensing of Environment.*
3. While the results of the initial CBI/dNBR were not encouraging, it was thought that satellite data may in fact be able to discriminate sites that underwent severe burning, e.g., sites where the organic layer was consumed all the way to mineral soils. To assess this potential, it was agreed that everyone would review their data sets from 2004 and identify sites that represent 3 different burn severity classes (see Powerpoint): (a) heavy severity, where all organic soil was consumed to mineral soil, and all trees were downed (see attached Powerpoint); (b) moderate burn, e.g., the site was black – majority of forest floor consists of charred organic matter and all trees were charred and black, but all trees are standing; and (c) light burn, where the black spruces trees have low levels of consumption of the foliage (may contain some live trees) and the ground layer contains between 25 to 50% of live or singed moss. If everyone can review their data and send the following information to Eric Kasischke, we can begin this analysis. Information required includes: (a) Burn number or name; (b) location (lat/long) of sample; (c) burn category; (d) pictures of sites (if available); and (e) CBI (if available). Eric will then compile and distribute this information to all teams.
4. The group will get together in early June in Fairbanks (UAF) to further discuss results from the satellite studies. At this meeting, we will discuss the steps necessary to further integrate the results of the study, and the steps we need to take as a group to: (a) understand the sources of variations in the CBI vs. NBR comparisons (e.g., topographic effects, seasonal differences in dNBR pairs; (c) post-fire vegetation recovery. We will also discuss further steps to develop approaches to assess burn severity using satellite data, including the use of other indices (e.g., tasseled cap) or processing approaches (supervised classification, decision trees, etc), or using multiple season dNBR data.
5. It was agreed that we should continue to have an annual meeting of the group. The next meeting of the group will be at the San Diego Fire Ecology/Management meeting – at that time, we will plan for the special issue and discuss future meeting dates.

Remote Sensing Meeting on Alaska Projects
UAF Campus, IARC Conference Room 417
June 6, 2006 9:30am

Attendees:
Skip Tyson (BLM, projects include mapping Alaska), Scott Rupp (UAF, landscape level model of simulating fire severity), Jennifer Allen (NPS, burn severity), Randi Jant (AFS/BLM, rapid economic measure of burn severity/rehabilitation/vegetation shifts), Joe (UAF, graduate student doing statistical work from Scott Rupp's group), Mark Olsen (member of Scott Rupp's group), Dave Verbyla (UAF, regeneration and dNBR), Karen Murphy (FWS, baseline NBR and burn severity data for future research), Eric Kasischke (UMD, burn severity and carbon cycling), Nancy French (Altarum, ecognition and burn severity/vegetation mapping), Rick Powell (Altarum, ecognition and burn severity/vegetation mapping), Elizabeth Hoy (UMD, burn severity and carbon cycling), Merritt Turetsky (MSU, fire and peat land research)

Meeting Notes:
The meeting began with an introduction from Dave V. regarding the issues many Alaskan researchers are having with the dNBR. He discussed Landsat's bands 4 and 7 and referred to van Wagtendonk et al 2004 and Key and Benson's work. He is focused on understanding severe NBR and CBI scores and their correlation, especially in sites with fires which severely burned the organic layer and resulted in fallen trees. His working hypothesis is that when the stems fall down, what the satellite "sees" changes: 3D to 2D changes affecting the spectral signature; a shadowing effect; greater amounts of mineral soil, char and ash are showing; and finally increased invasions by plant colonizers could occur. Also, Dave will be focusing on the Boundary fire in most of his work.

Throughout the meeting, issues concerning the dNBR were raised including:

- Limitations in the imagery (spatial and temporal resolution)
    - On occasion, 1 plot could be located within 4 pixels. Dave has found that this did not seem to significantly affect the results
    - It can be difficult to find imagery of an appropriate date due to the problems with the Landsat systems and the smoke caused by the fires.
    - The value of the NBR could potentially change from year to year following the fire. It is not yet known how to account for that.
- Site conditions aside from burn severity which may be influencing the NBR such as standing water, tussocks, sphagnum, fallen trees and fallen green trees (Karen M. and Dave V. addressed these issues)

Issues also arose in the meeting regarding the CBI itself and its use in Alaska:

- Using a CBI less than 2 gives a better correlation with the NBR than using severe CBI values
- Ground-truthing methods regarding the CBI – When the dNBR was developed, a supervised classification was performed first and plots to sample with the CBI were chosen based on that classification. This method was questioned.

- Understory and overstory CBI measures can vary greatly, but may have similar overall affects to the ecosystem (in terms of regeneration, erosion, etc.). It was suggested that it may be better to tailor a remote sensing index to one or the other and not to the average of both scores.
- Understory CBI scores can be difficult to judge due to the organic material at a site which can vary widely due to elevation, topography, etc.

Scott R. presented work understanding severity through a simulation model. He attempted to correlate age and severity, but did not find it to correlate highly, although the small correlation present was significant. He and his group also explored multiple other statistical models to understand burn severity through the NBR and CBI, although these other models also did not correlate strongly.

Nancy F. and Rick P. discussed their work with e-Cognition and the object based approach to understanding burn severity. They presented the potential for this type of research. Using this software, it may be possible to characterize burn severity into different categories over a large spatial extent while at the same time incorporate other sources of information about the terrain which could influence the spectral signature of the imagery.

Elizabeth H. presented work on the use of the tasseled cap transformation in drawing out additional information about burn severity. Her initial results did not show correlations between the NBR, tasseled cap or CBI. Others suggested that she compare the tasseled cap results to the ground measures collected at the site, not just the CBI and NBR.

Karen M. did not find the NBR to be a good remote indicator of burn severity for her sites. She is now attempting to separate her plots based on other site conditions such as standing water, tussocks and sphagnum. It was suggested that she may be able to try using radar imagery to determine the wetness within her plots.

Merritt T. discussed quantifying duff consumption on a plot by plot level using a simple 5 class index. She also discussed the need to incorporate the burning of peatland areas into carbon cycling and burn severity measures. She also discussed the potential benefit to incorporating the Fire Weather Indices into burn severity research.

Eric K. discussed the potential for using 3 categories of burn severity: the black forest, lightly burned, and toasted areas. He is interested in seeing if the NBR correlates with these three categories. He also discussed the idea of forming a more cohesive group representing those involved in remotely sensing burn severity and volunteered to draft a “charter” of some sort for the group.