

## What is HyLab?



Jordi teaches spectroscopy to UAF students.

- An NSF funded research facility at the Geophysical Institute (GI), University of Alaska Fairbanks (UAF)
  - Provides low-cost in-state airborne hyperspectral data acquisition capabilities
  - Supports data acquisition, processing, and analysis for resource exploration and ecological research
- Coordinates education, training and public outreach activities related to techniques and applications of imaging spectroscopy

Would you like to know more?

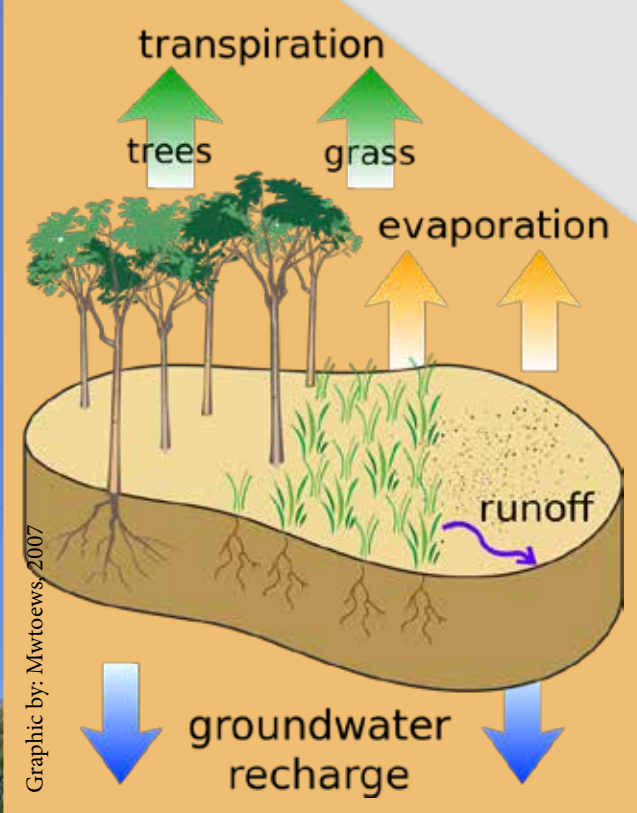
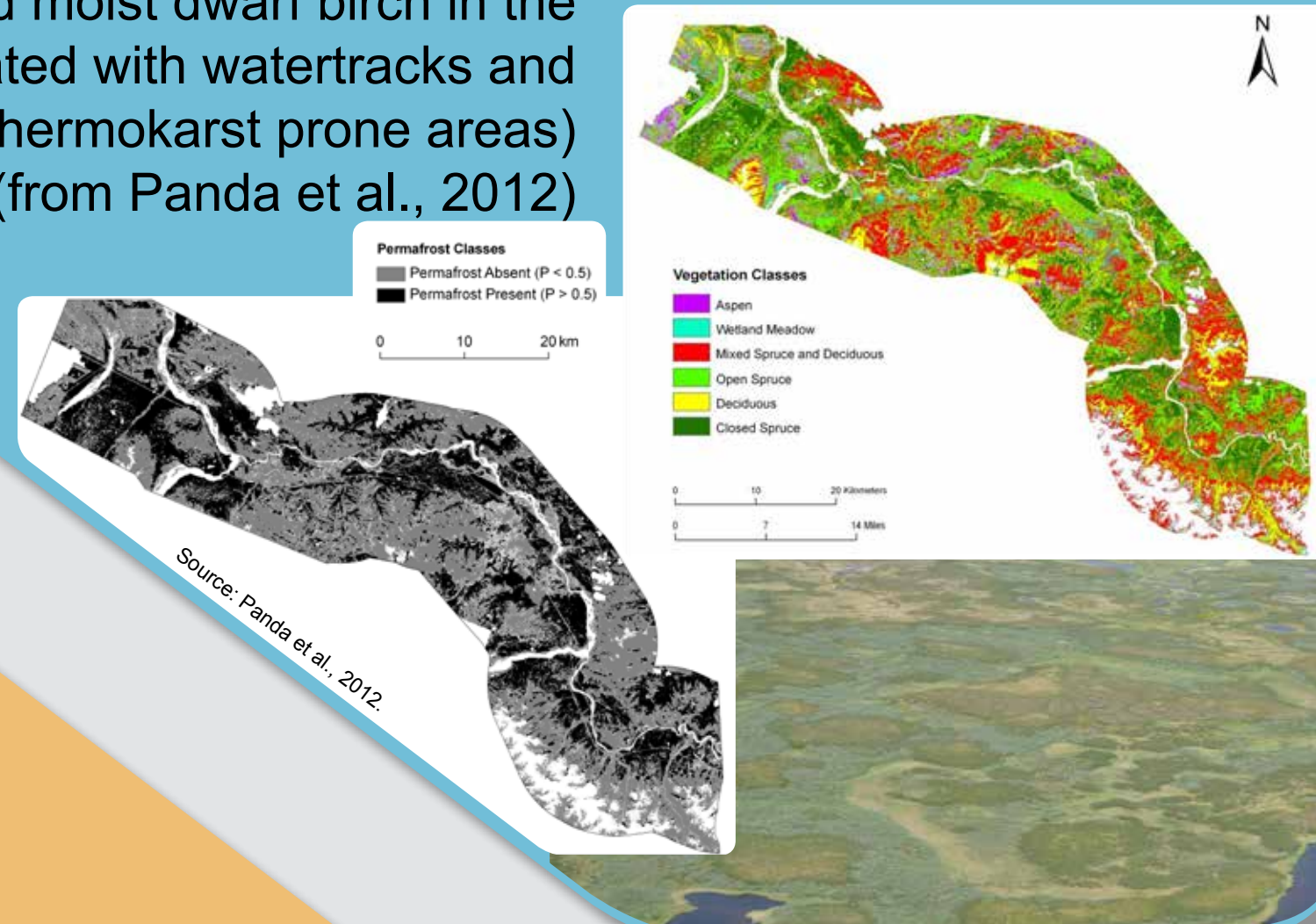
[www.hyperspectral.alaska.edu](http://www.hyperspectral.alaska.edu)



The Geophysical Institute at the UAF.

### Permafrost

- There is a documented correlation between vegetation and presence / absence of near-surface permafrost
  - Hyperspectral imaging will be used for improved detection and mapping of black spruce in boreal forests (associated with presence of near surface permafrost) and moist dwarf birch in the tundra (associated with watertracks and thermokarst prone areas) (from Panda et al., 2012)



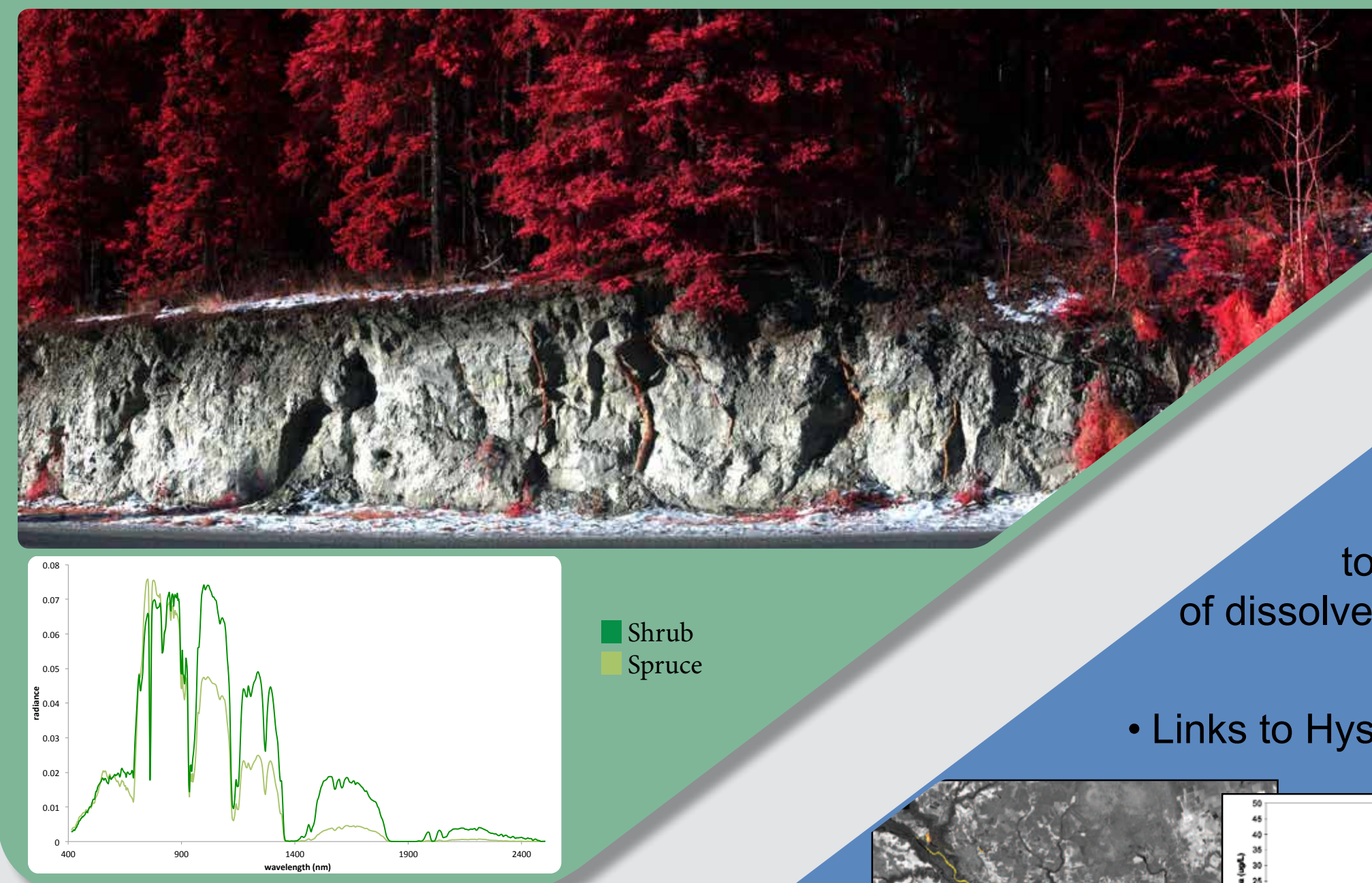
HySpex will be used to improve:

- albedo characterization
- organic layer (moss) classification
- Cal/Val activities

### Evapotranspiration

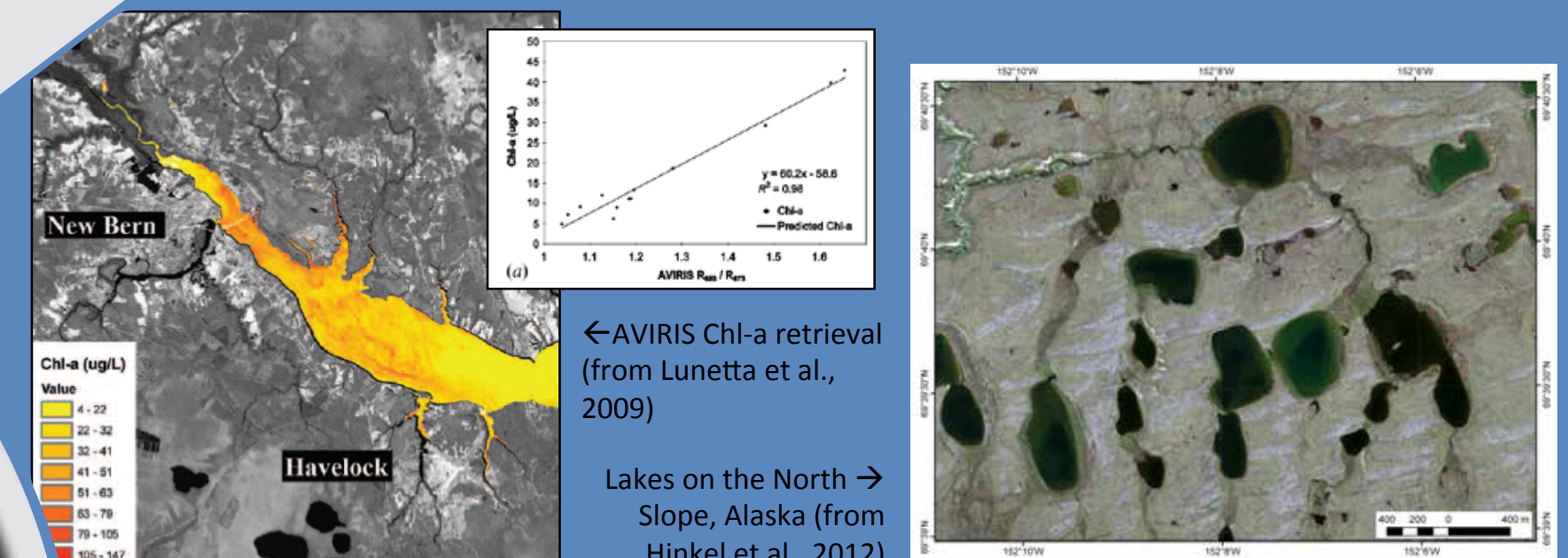
### Vegetation

This example shows a hyperspectral false color infrared image (vegetation in red) as part of the UAF campus, Fairbanks, AK (image acquired on Nov 3, 2014).

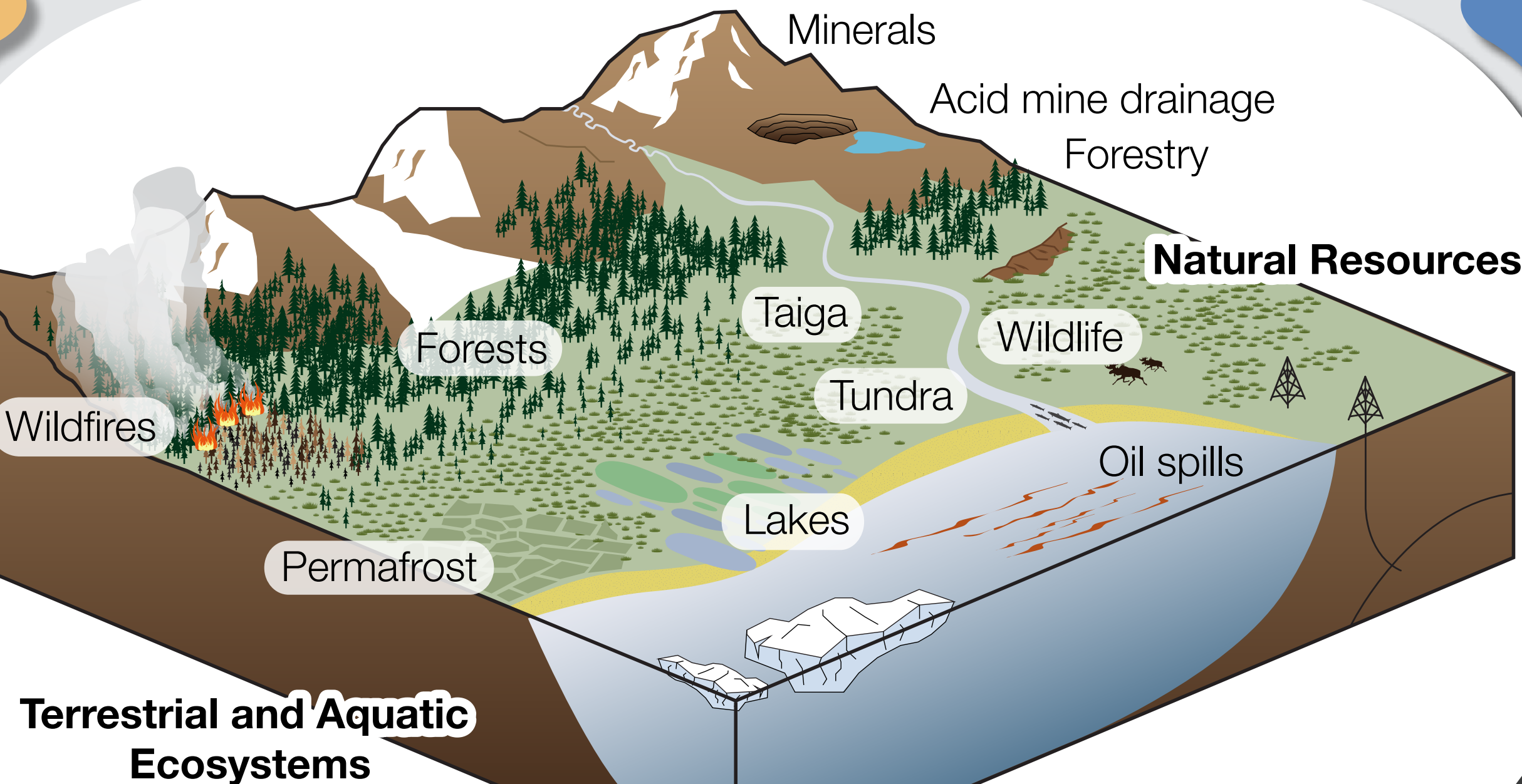


- Hyperspectral imaging will help to retrieve lake properties, e.g. amount of dissolved organic matter, chlorophyll content, lake depth, and substrate type

- Links to HypsIRI / EnMAP: algorithms / upscaling



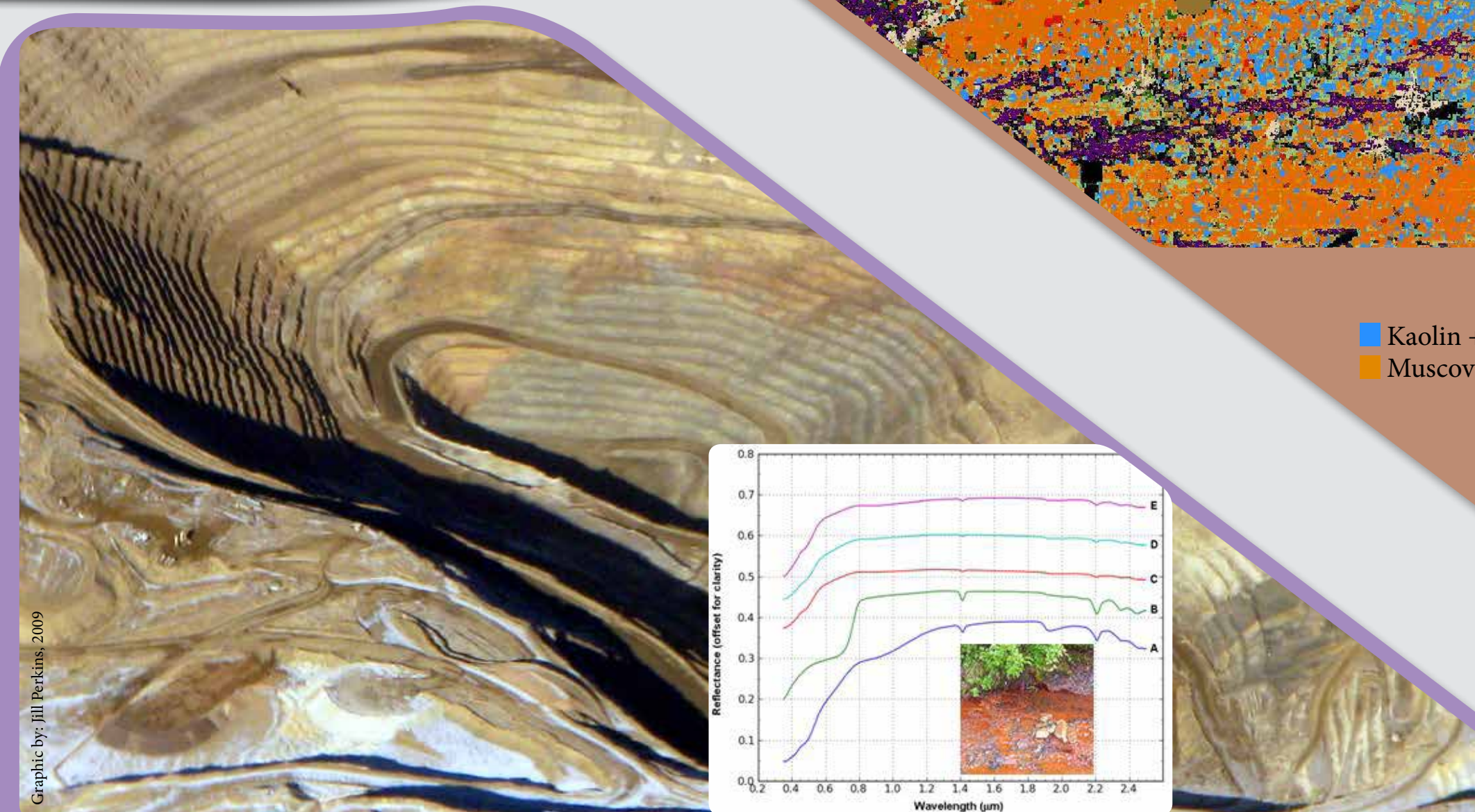
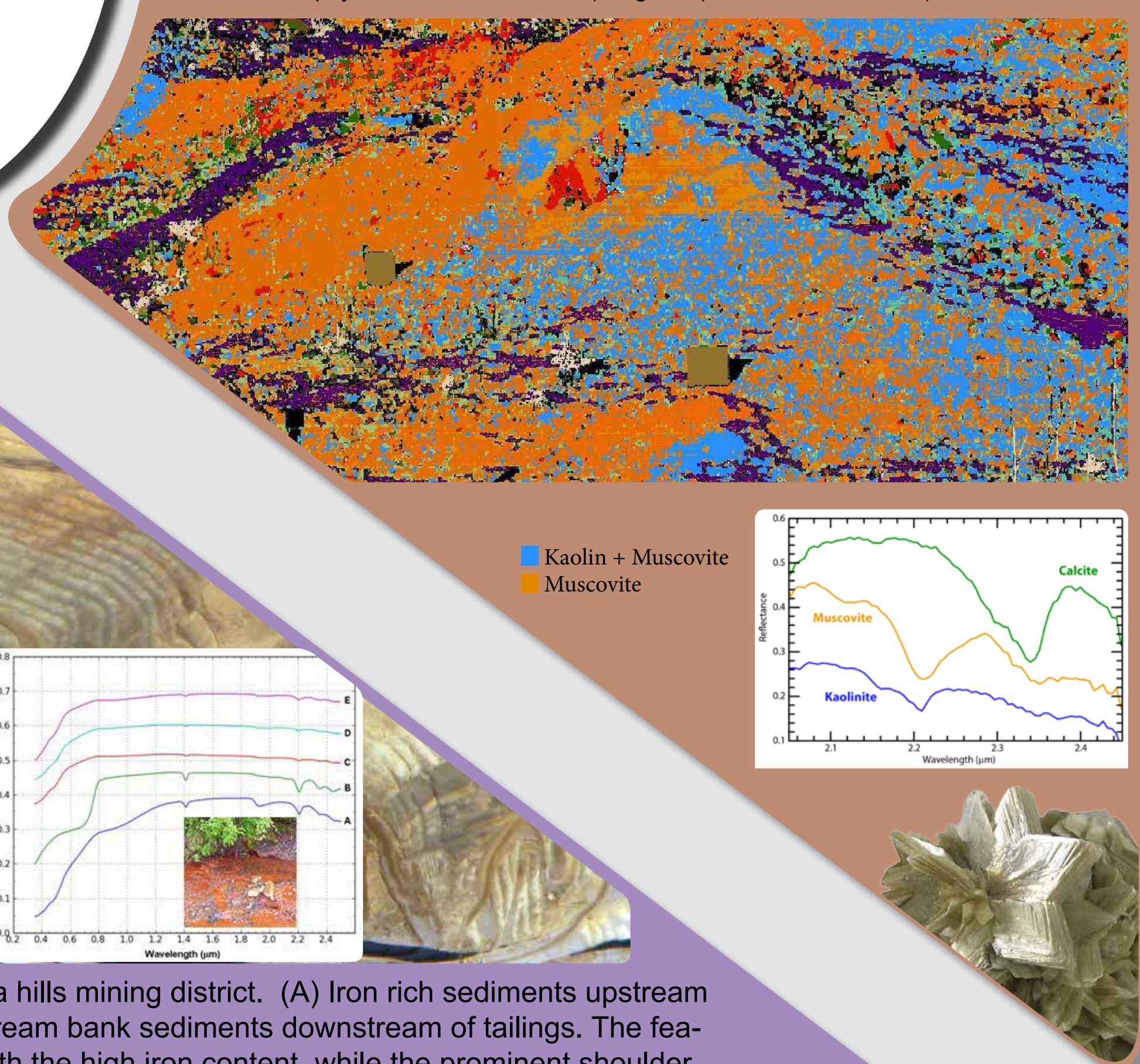
### Aquatic ecosystems



### Terrestrial and Aquatic Ecosystems

### Mineral exploration

This example shows a hyperspectral derived mineral map of the abandoned mine near Murphy Dome, Fairbanks, AK (image acquired on Nov 8, 2014).

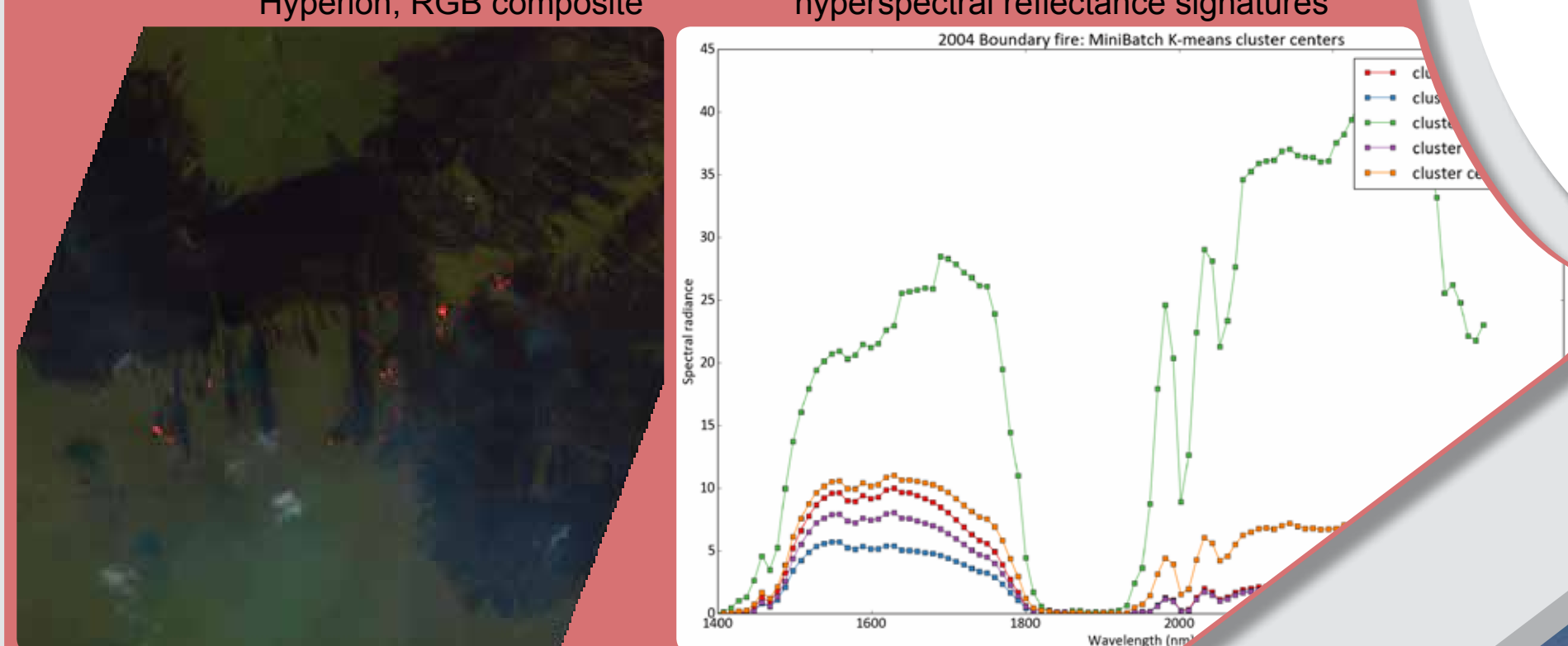


Reflectance spectra of samples from Kantishna hills mining district. (A) Iron rich sediments upstream of tailings pile, (B) sulfide rich tailings, (C-E) stream bank sediments downstream of tailings. The feature at ~ 0.9 μm in A is associated with the high iron content, while the prominent shoulder at ~ 0.5 μm in B is characteristic of sulfide minerals. Credits: Tom Trainor, UAF.

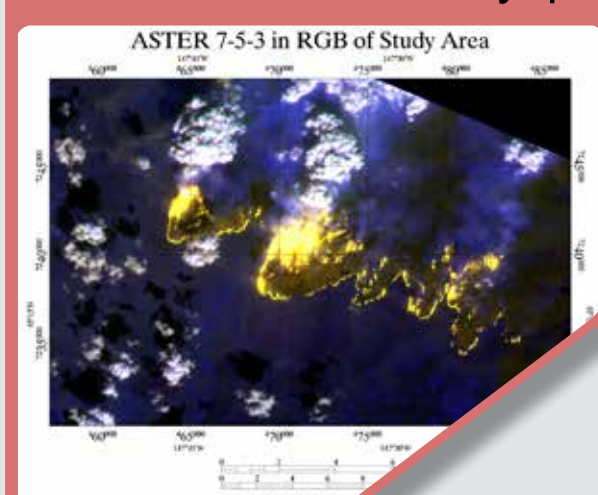
### Soil contaminants & mining impacts

### Wildfire investigations

7-17-04, 21:42 UTC, Boundary fire; Credits: Chris Waigl, UAF

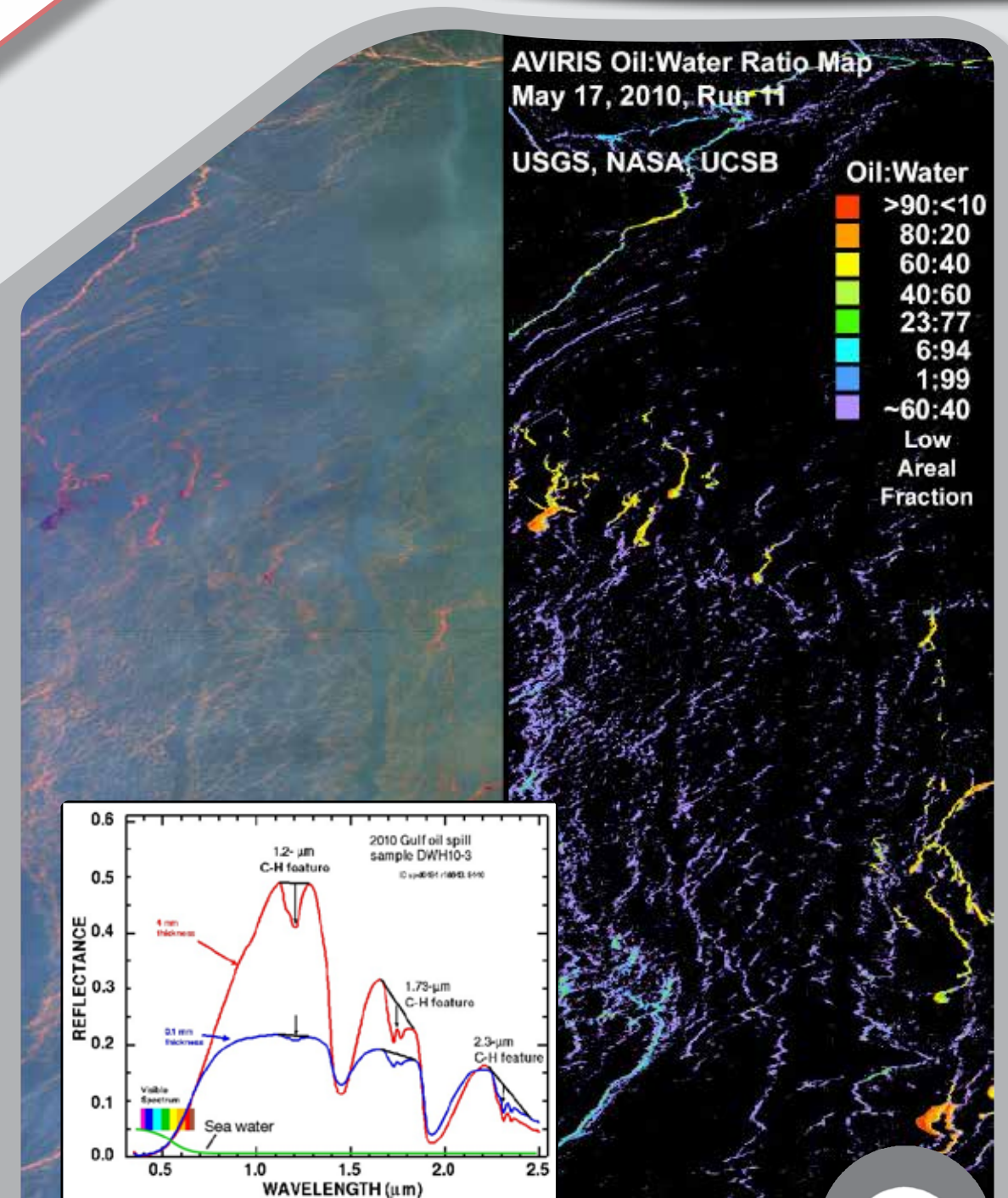


Boreal forest fires are extensive and can have flaming fronts with temperatures over 1000K, providing opportunities for temperature retrievals, mapping of low-intensity fires and the fire-affected area from Hyps SWIR channels.



Mapping results for oil-to-water ratio (right) calculated from AVIRIS hyperspectral data acquired over part of the Gulf of Mexico oil spill (from Clark et al., 2010).

HySpex will be used to undertake a critical assessment of the applicability of airborne HS remote sensing for oil spill mapping under potential Arctic oil spill scenarios (e.g. oil spill under ice, with partial ice cover, etc.).



### Oil extraction and oil spills

## The HySpex instrument

The HySpex instrument specs are:

- VNIR-1800 and SWIR-384 cameras (400 - 2,500 nm)
- Pushbroom HS cameras with low stray light levels, low sensitivity to polarization, and low smile and keystone effects
- Across track FOV of 17° and 16° respectively that can be increased to 34° and 32° (using a FOV expander)



### Airborne setup

In airborne mode the instrument:

- Is mounted with a passive vibration dampening to an Aviat Husky A-1B airplane
- Is connected to an IMAR iTrace RT-F400 IMU/GPS (Inertial Measurement Unit / Global Positioning System) unit
- Is controlled by a compact, high-performance data acquisition unit (DAU), connected with a 1 terabyte solid state drive and a compact, touch screen flat-panel monitor



Aviat Husky A-1B airplane - adapted to the rough Alaska conditions.

### Field setup

In the field configuration:

- The two HS cameras are mounted on an automated rotation stage affixed to a surveyors-grade tripod
- The horizontal swaths of HS data are possible for targets at a distance of ~3 meters to hundred's meters
- A rugged, field portable data acquisition unit is used to control the rotation stage and cameras during in-situ imaging
- Power supply is provided by a generator



Use of the HySpex for mineral exploration near Murphy Dome.