
Use of Remote Sensing
in Fire Management
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Remote Sensing for Fire Management

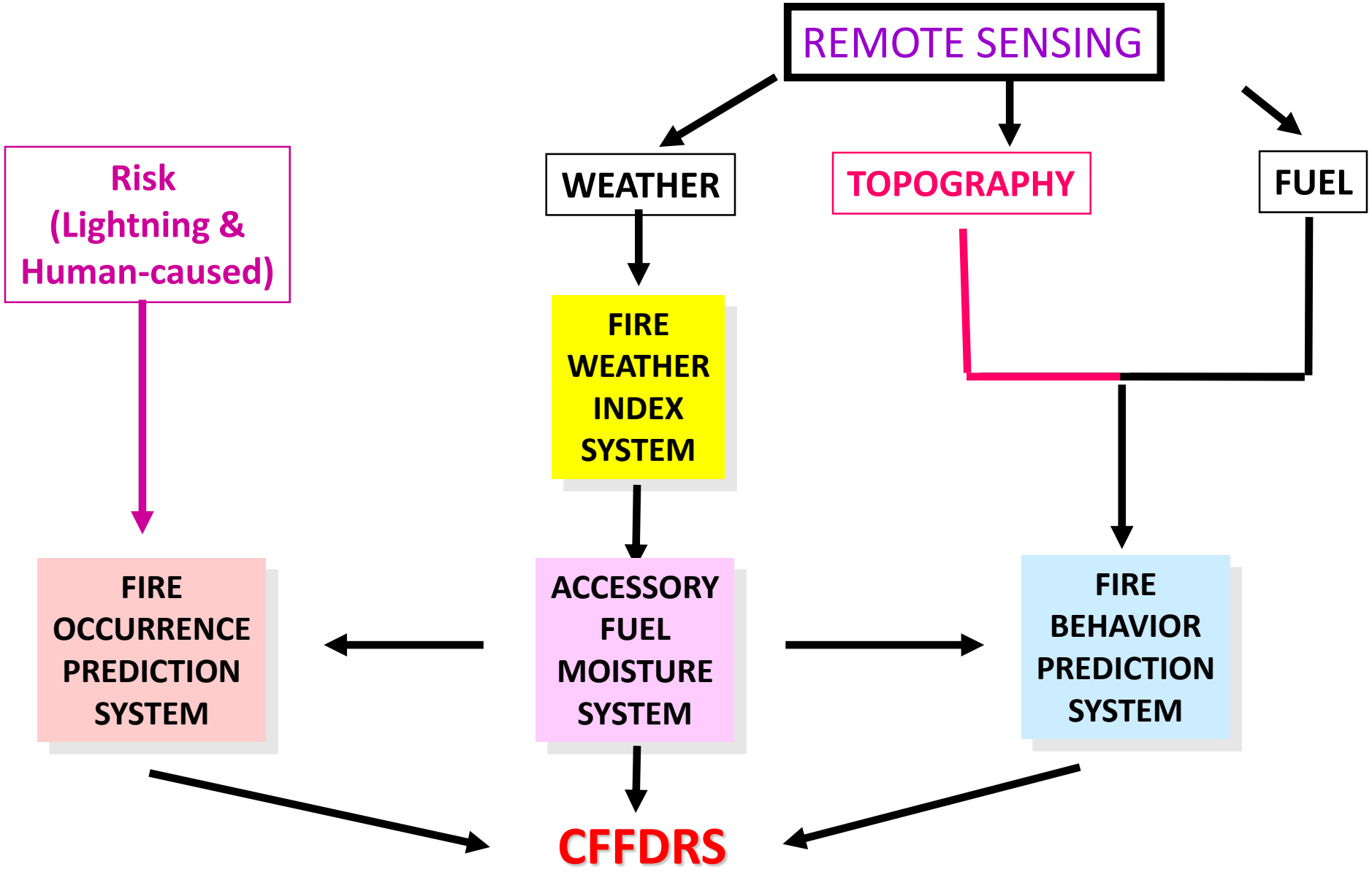
Fire Danger
(BEFORE)

Active Fire
(DURING)

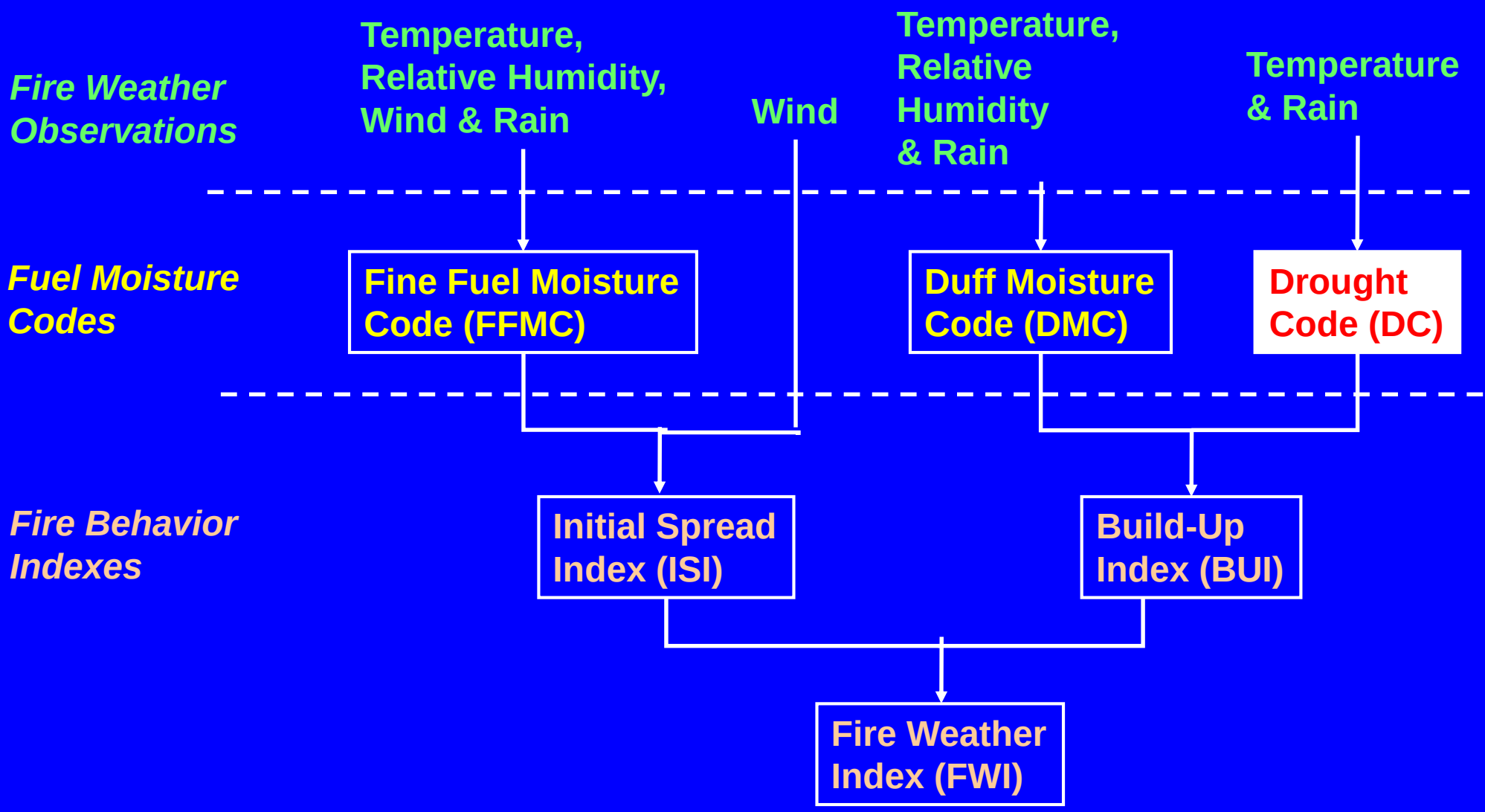
Fire Management Decision Support

Fire Impact
(AFTER)

Canadian Forest Fire Danger Rating System



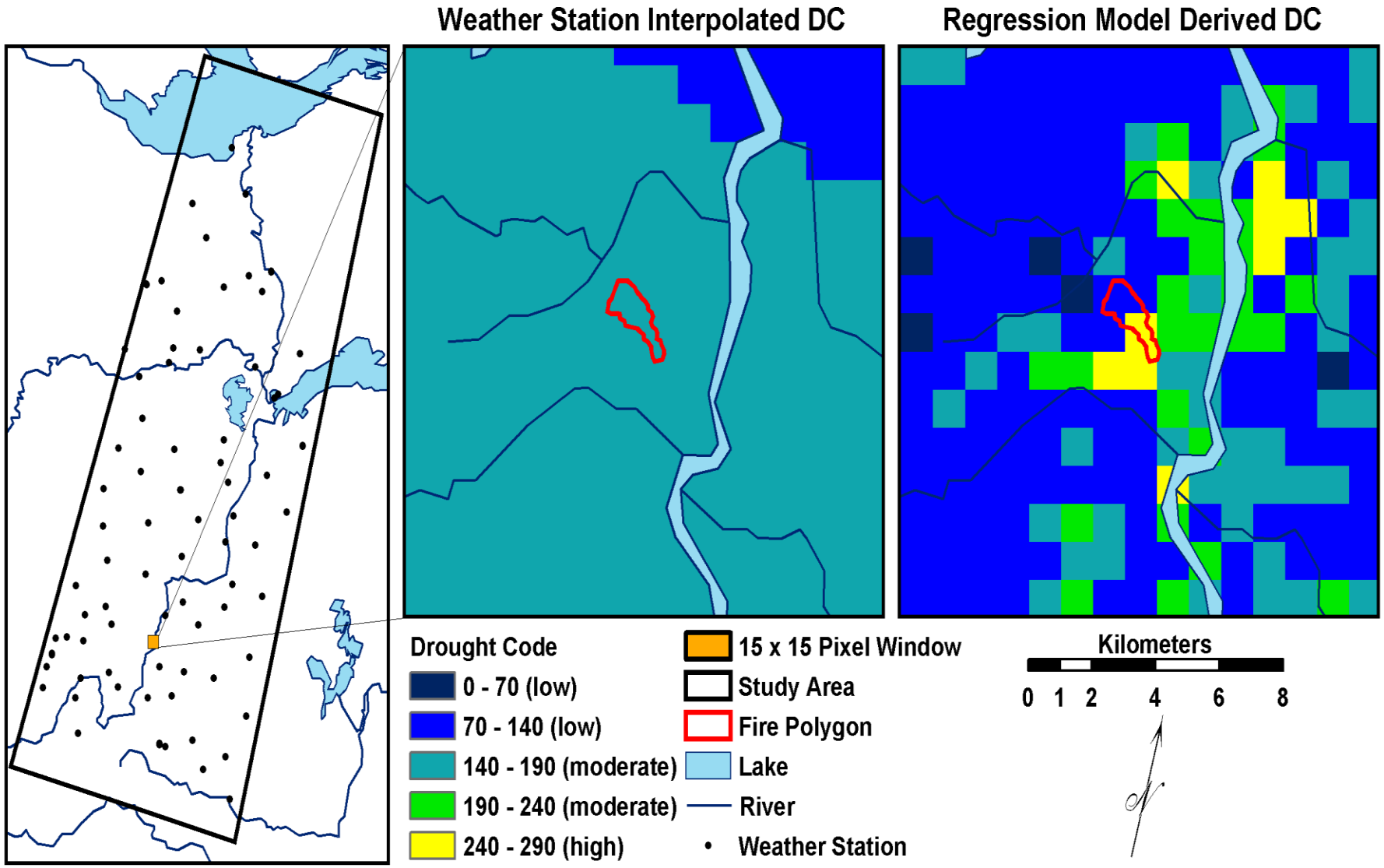
Fire Weather Index System



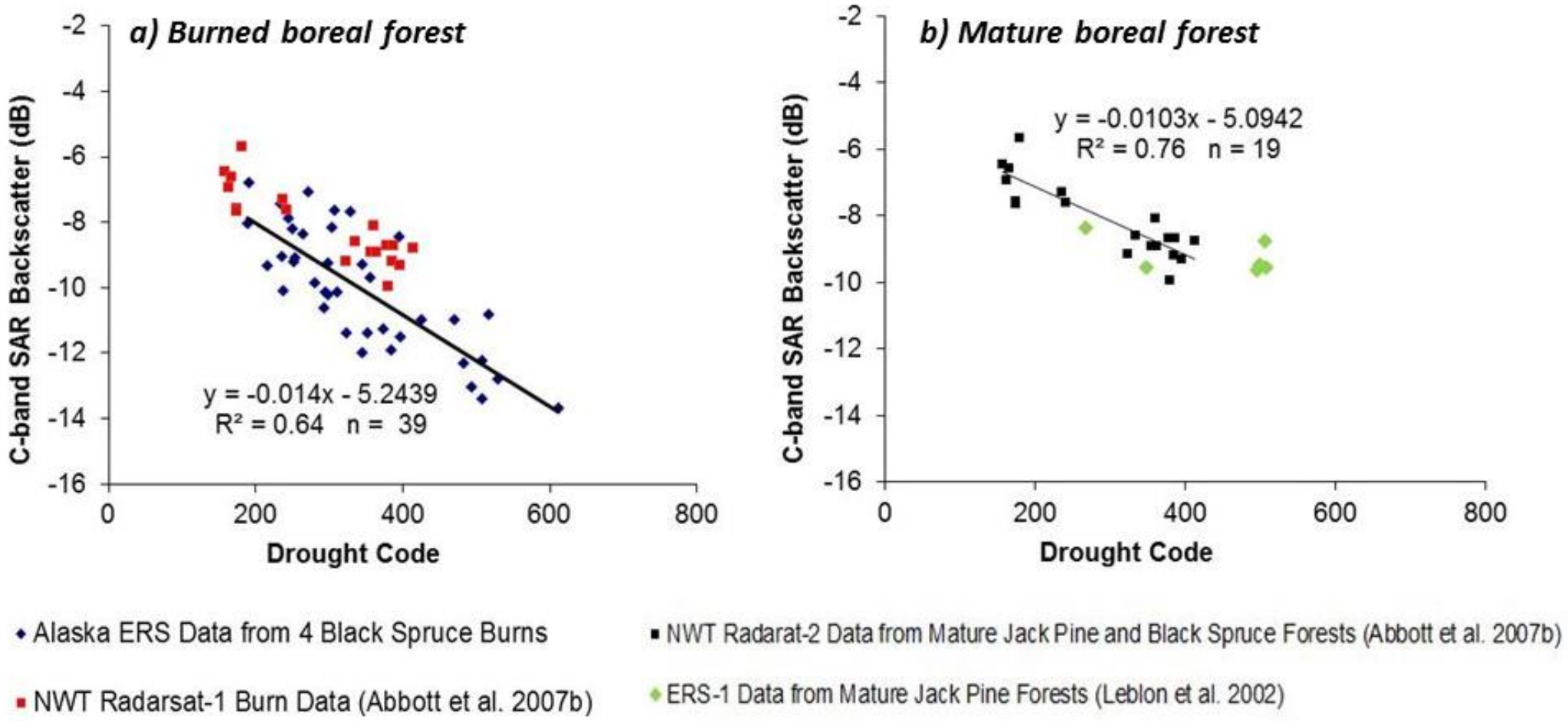
REMOTE SENSING

Bands	Variables
Optical (0.4-2.5 µm)	Chemical status Chlorophyll LAI IPAR, APAR Biomass
Thermal Infrared (3-15 µm)	AET LAI Biomass Surface t°
Microwave (mm-cm)	Moisture Content LAI Biomass

DC estimation using NOAA-AVHRR NDVI and Ts



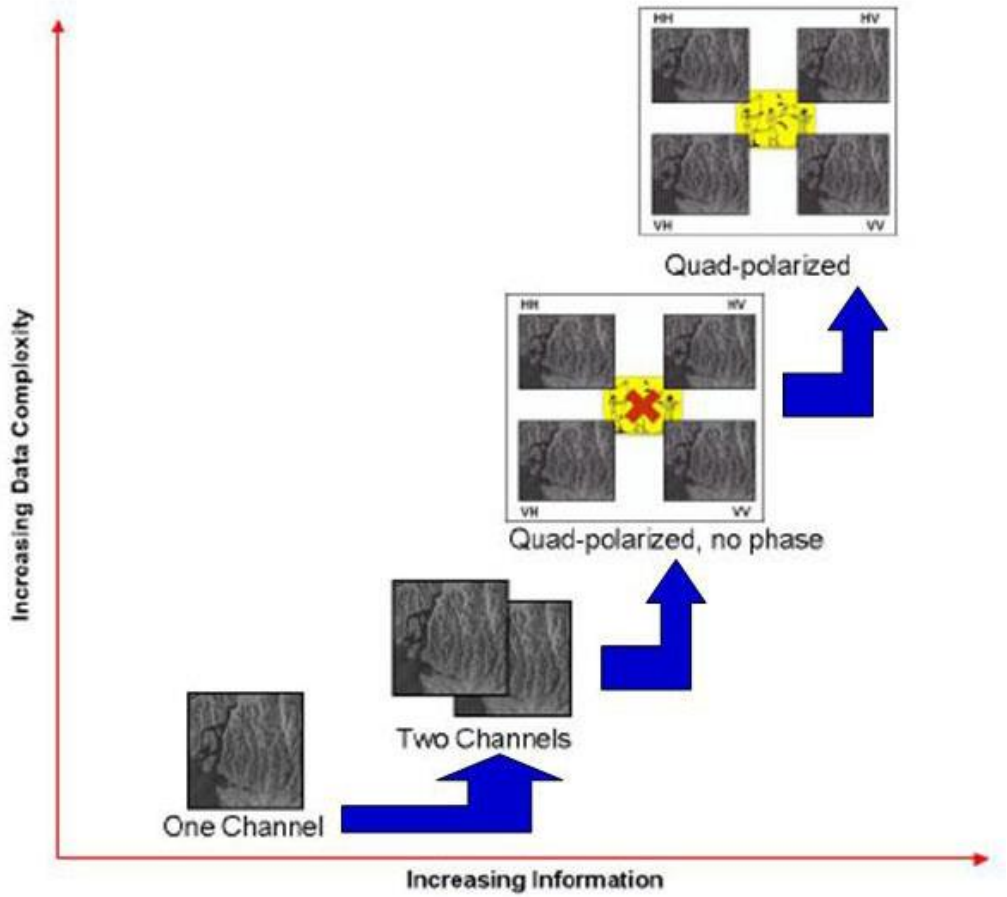
DC estimation using single-polarized SAR data



RADARSAT-2

RADARSAT-1

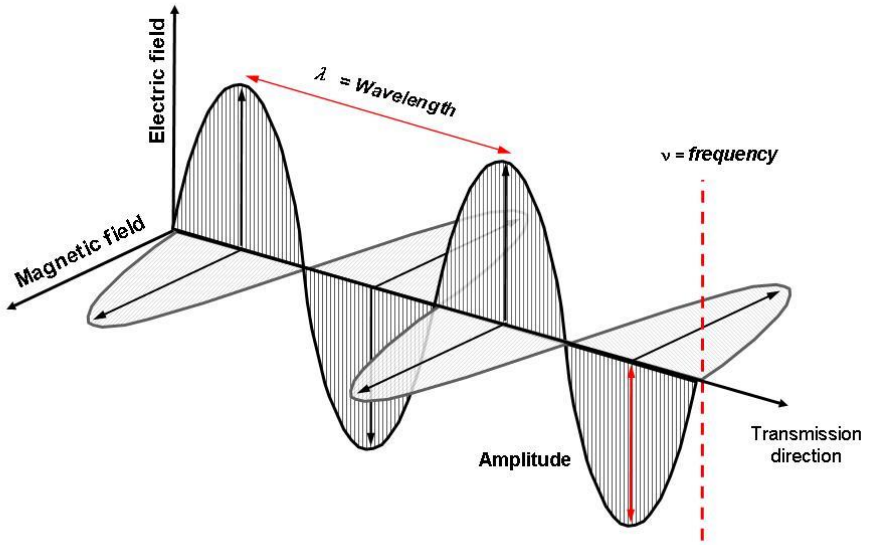
- C band
- HH

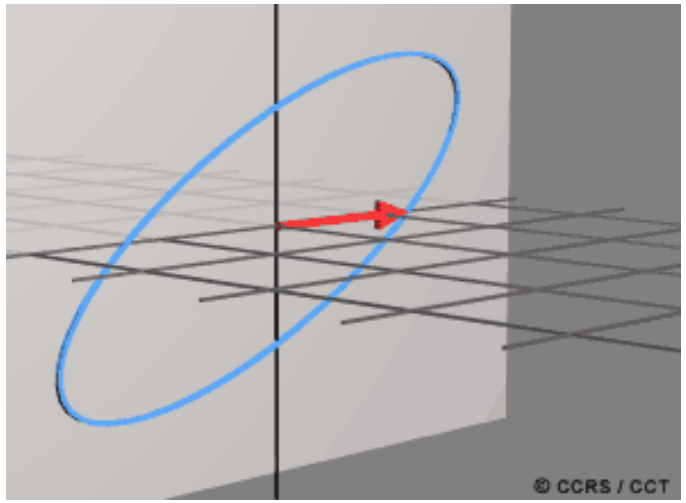


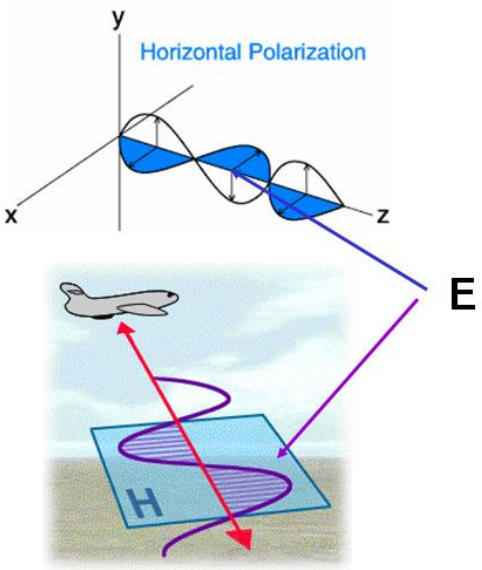
RADARSAT-2

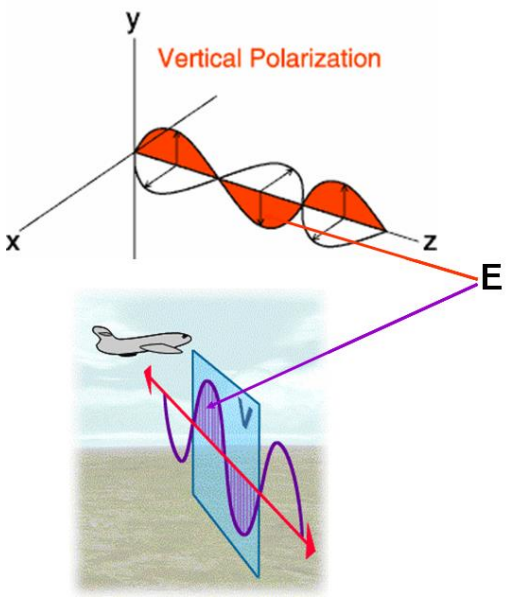
- C band
- HH, VV, VH, HV
- Polarimetric

Polarization

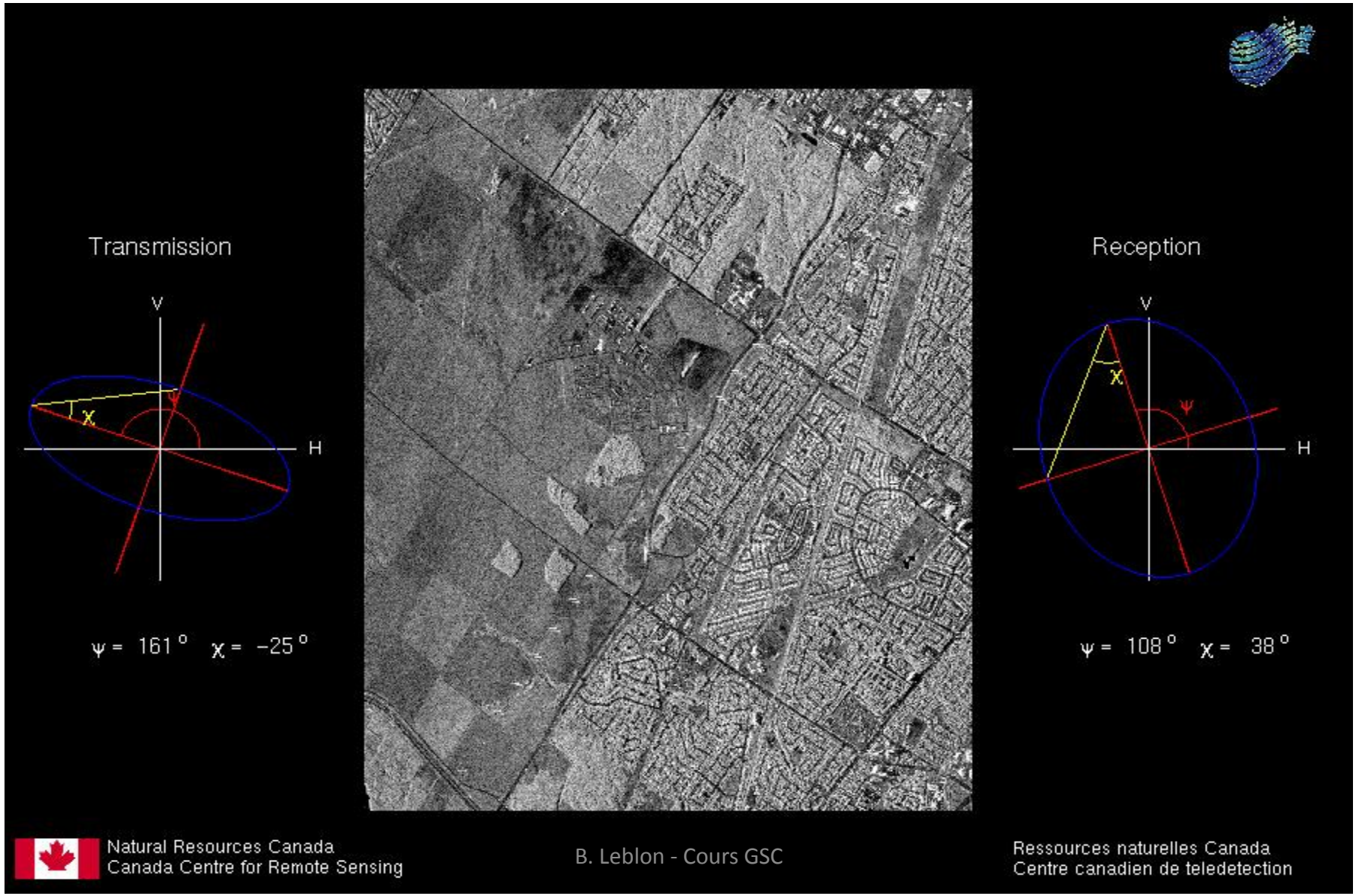




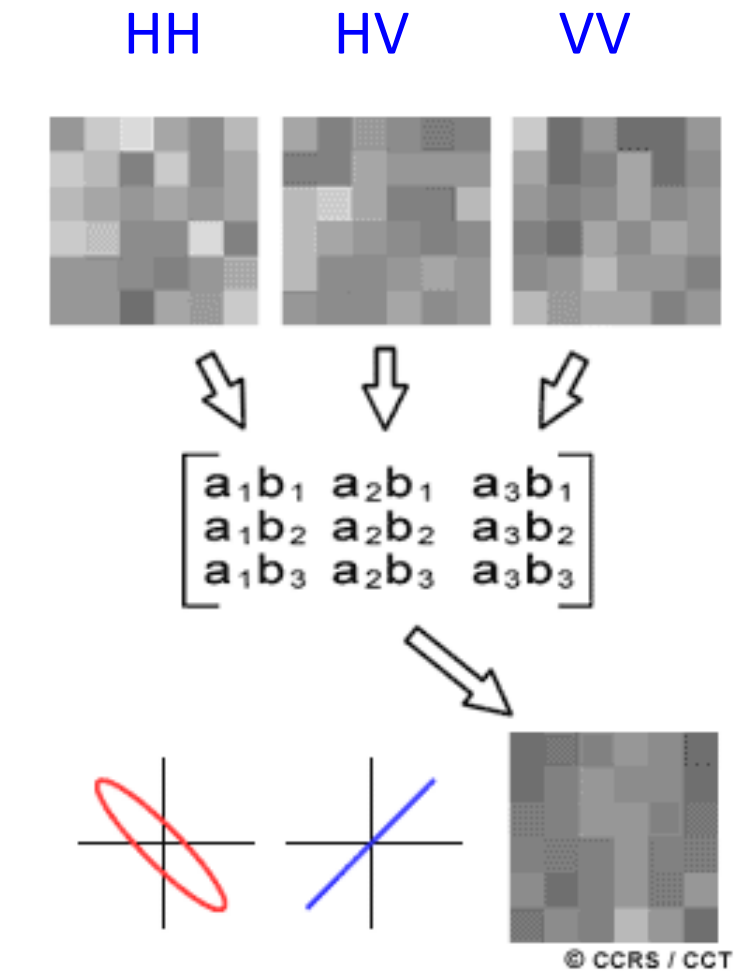




Effect of χ and ψ on the image



Polarization Synthesis



Fuel moisture with RADARSAT-2 polarimetric SAR

Laura Bourgeau-Chavez (UNB), Joseph Buckley (RMC) and François Charbonneau (CCRS)

Boreal Forests

Sparse Black Spruce Forest

Low Burn Severity

Moderate Burn Severity 2

Shrubby Revegetation

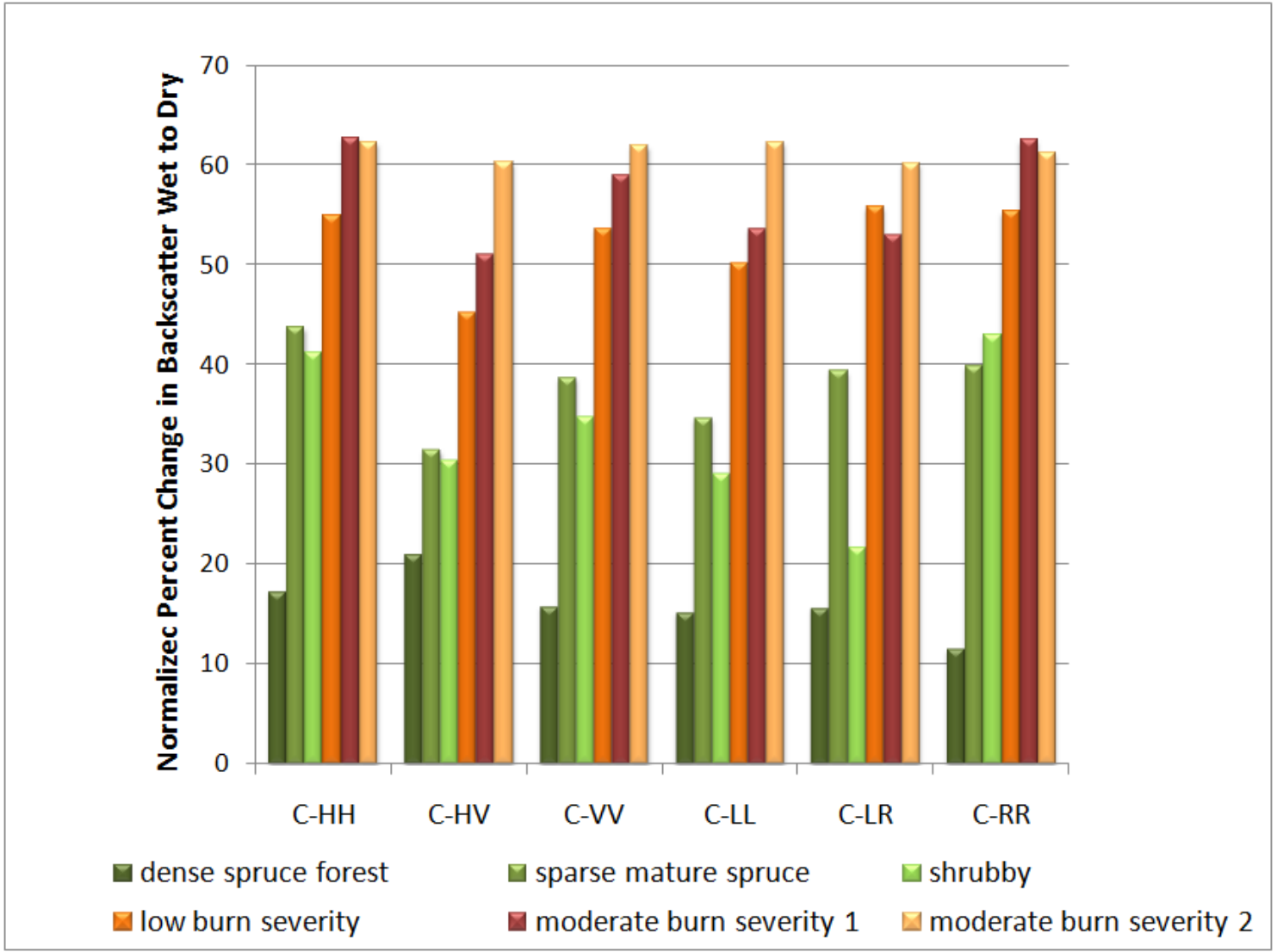
Moderate Burn Severity 1

Dense Black Spruce Forest

No Photo

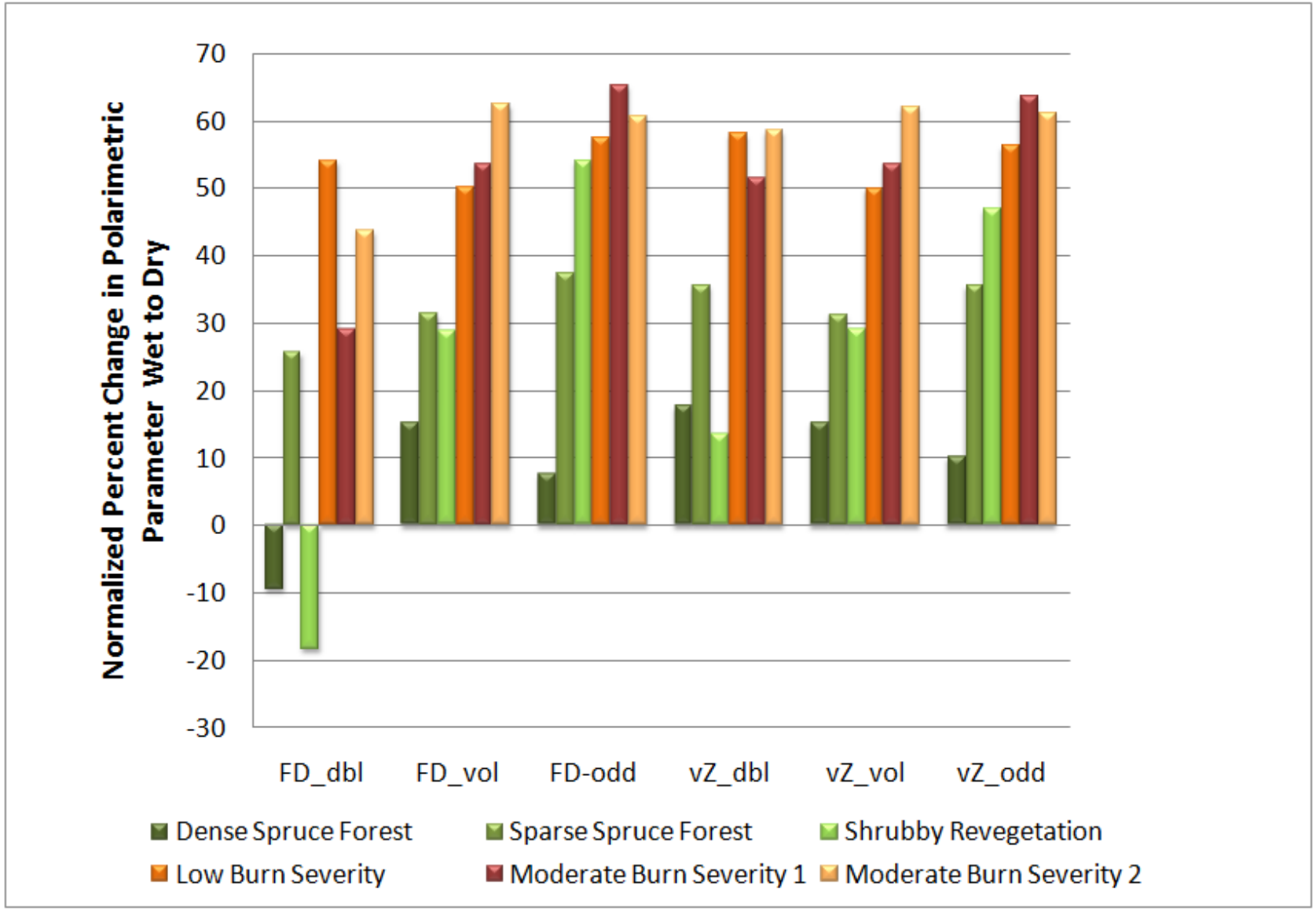
ND(%) wet-dry

Single-polarized backscatters



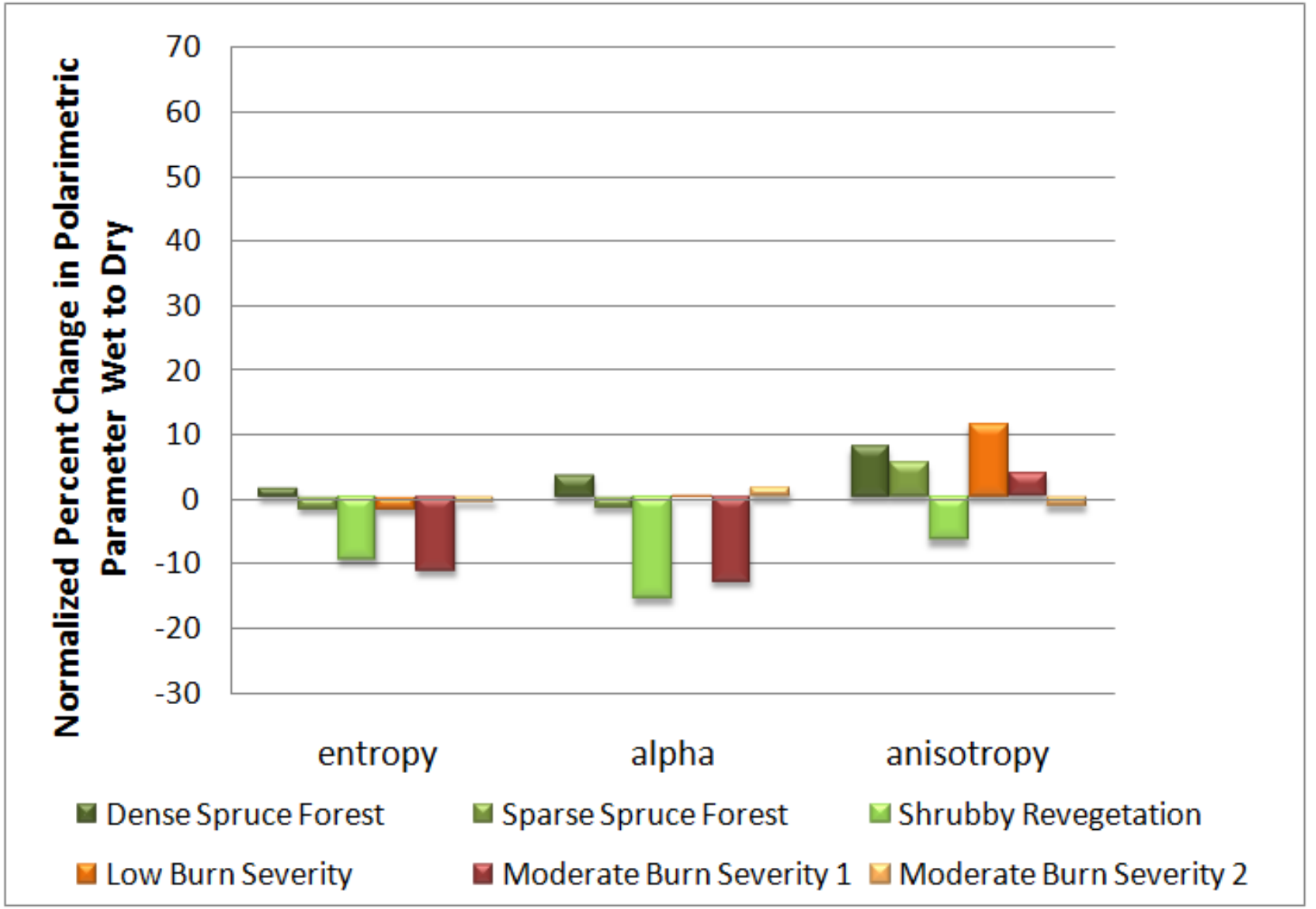
ND(%) wet-dry

Freeman-Durden and Van Zyl decompositions

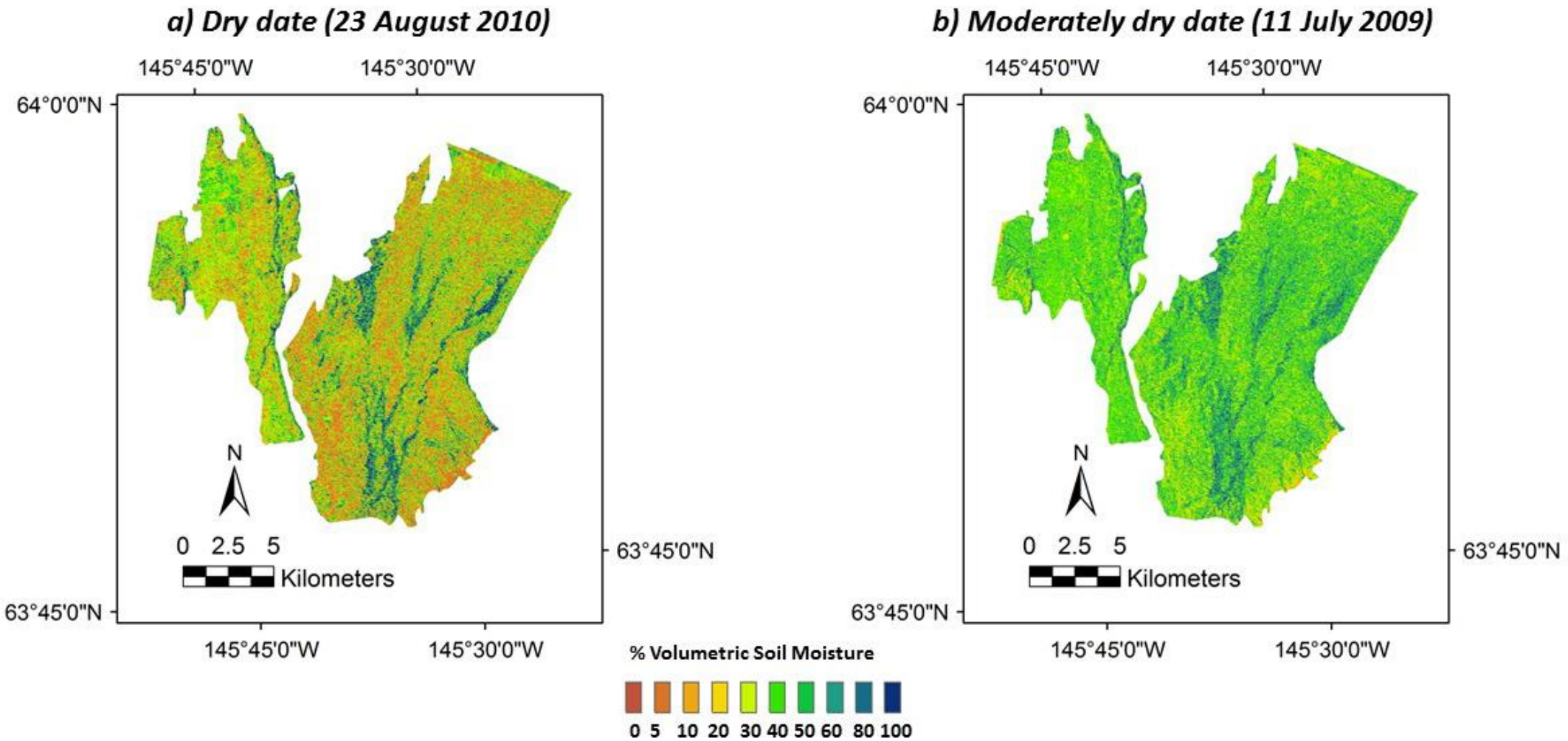


ND(%) wet-dry

Cloude-Pottier decomposition



Volumetric Soil Moisture Map using R-2 polSAR



RMSE (all sites)

Validation Image	07/11/2009 (wet date)	07/11/2009 (wet date) + 8/23/2010 (Dry Date)
C-HH	10.0	10.2
C-HH & C-HV	9.1	9.9
CHH & CHV & CVH & CVV	8.2	9.7
d_{max} & C-VH	8.6	9.3
d_{max} & $Unpol_{max}^{(*)}$ & C-VH	7.4	6.7
d_{max} & C-RR & C-VH	6.4	8.8

(*) *Maximum of the completely unpolarized component*

Models with d_{max} show improvement of 27-33% over C-HH and four polarized backscatter algorithms

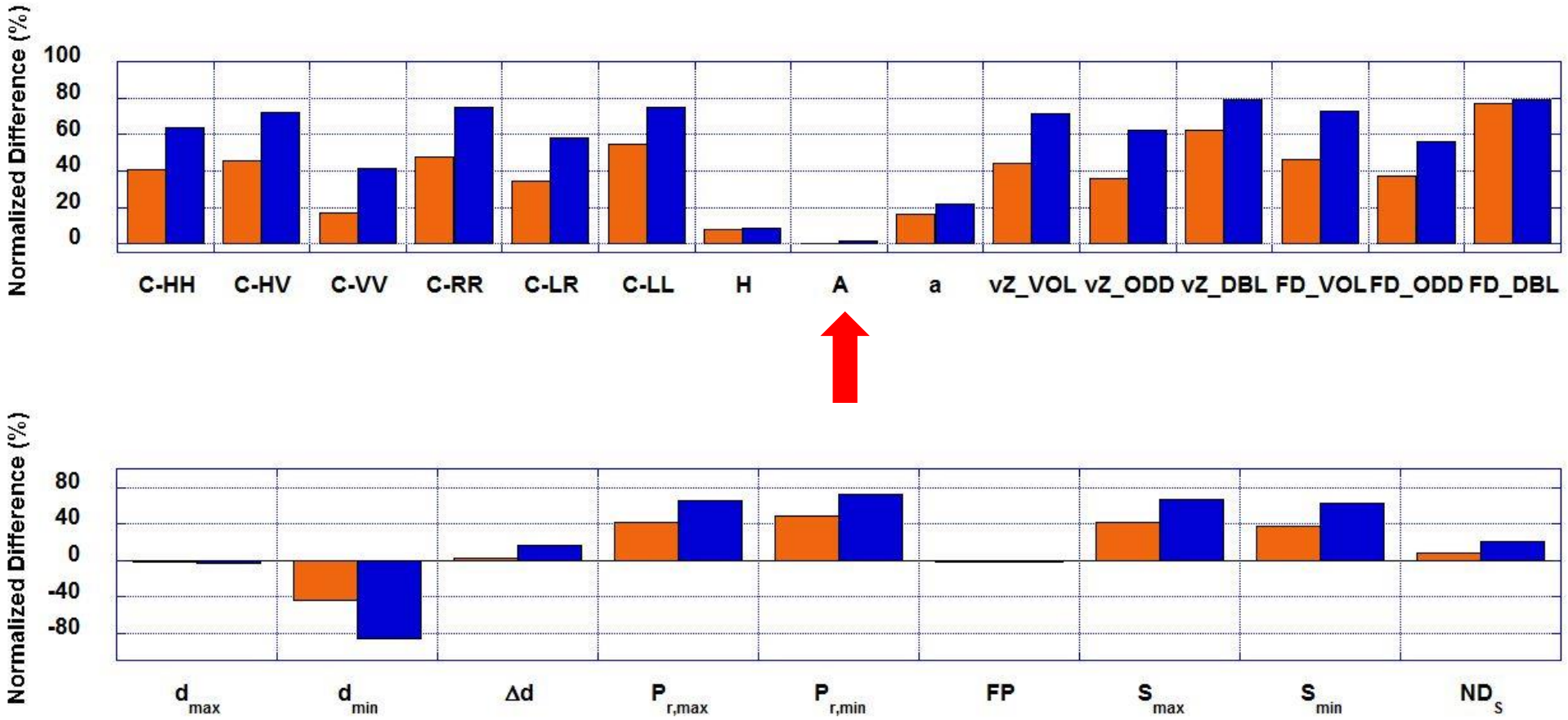
Fuel moisture estimation
Kruger National Park

- Martin Kong, UNB, Canada & U. Freiburg, Germany
- Renaud Mathieu, CSIR, South Africa
- L. Naidoo, CSIR, South Africa
- C. P. Gross, U. Freiburg, Germany
- J. Buckley, RMC, Canada
- L. Bourgeau-Chavez, UNB, Canada & MTRI, USA

Lowveld savannah

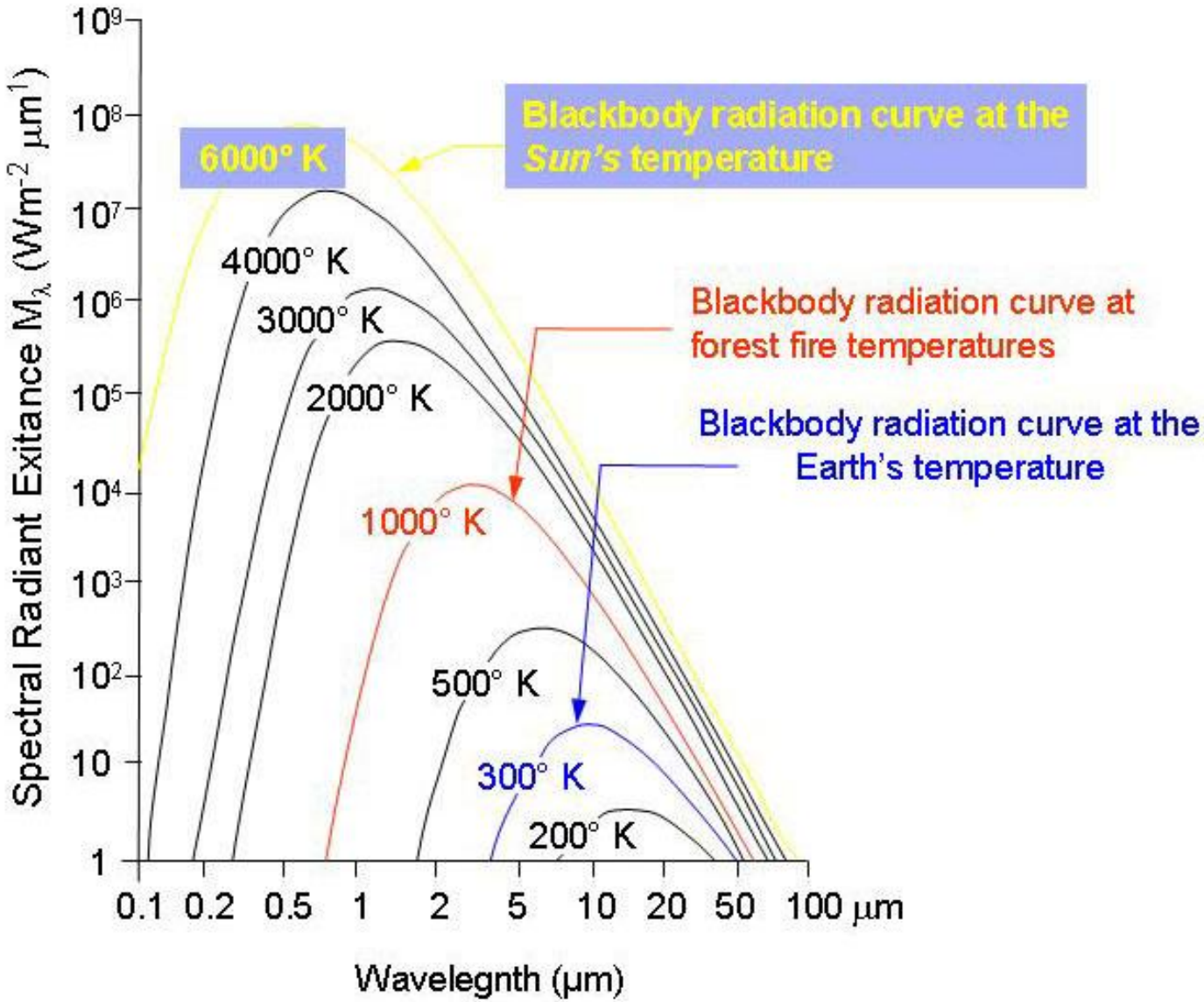
	Herbaceous plot	Shrub/Tree plot
Landscape		
Ground		

Savannahs

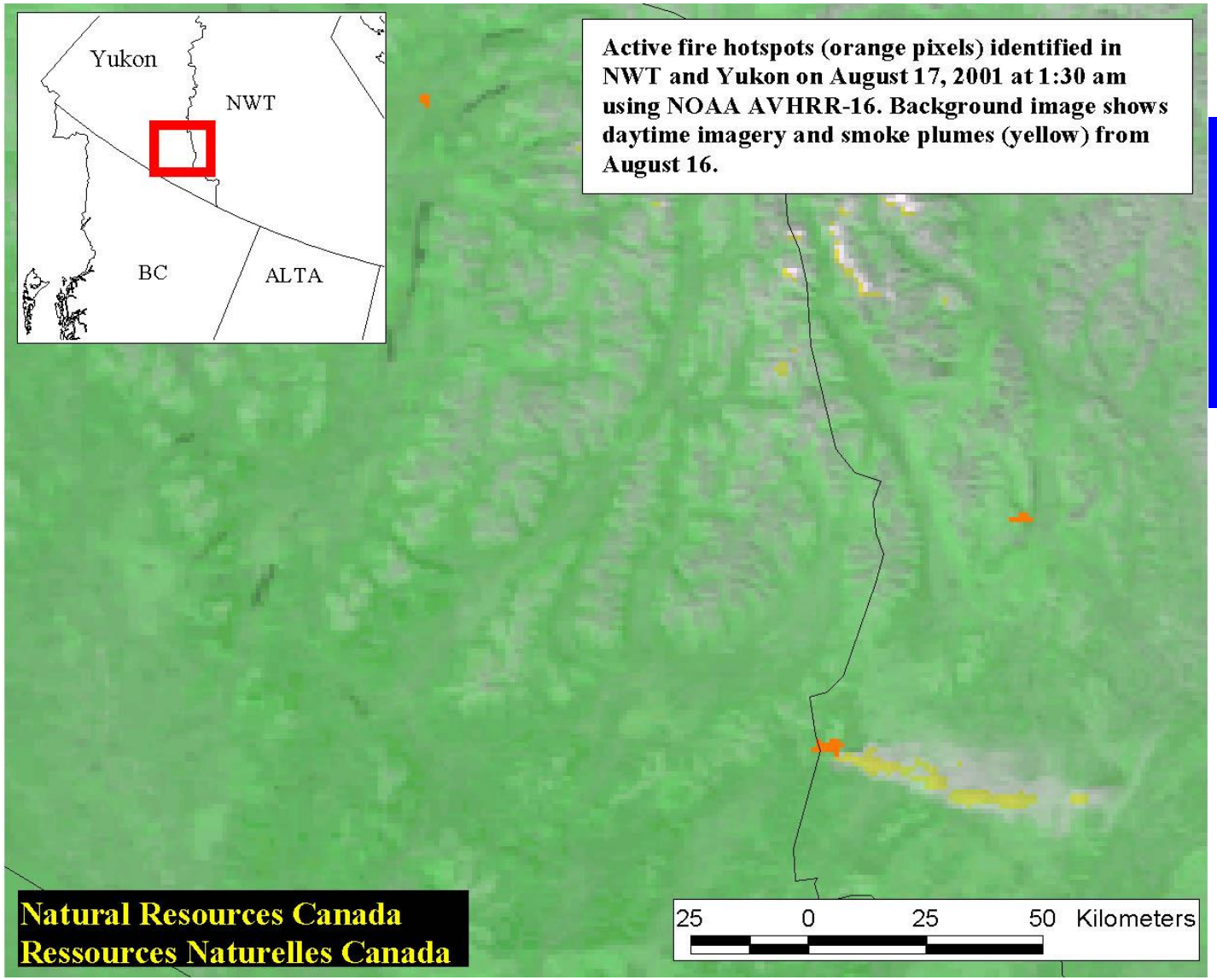


Shrub/Tree **Herbaceous**

Active fire detection



Fire M3 Fire Monitoring, Mapping & Modelling

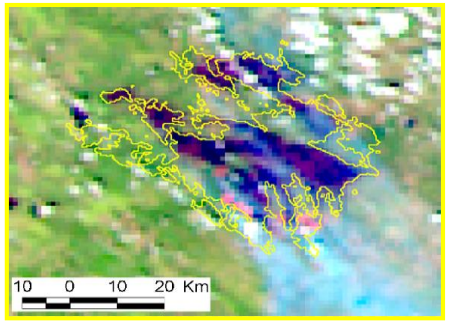


- NOAA-AVHRR Mid-IR image
- **Hot spot in orange**
- **Smoke plume in yellow**

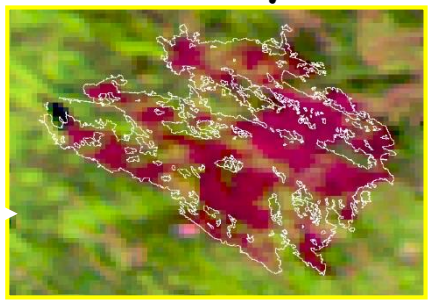
Mapping Burned Areas in Boreal Forests using SPOT-HRV images

Reflectance of boreal forest drops then increases after burning (combustion then re-growth)

Immediate



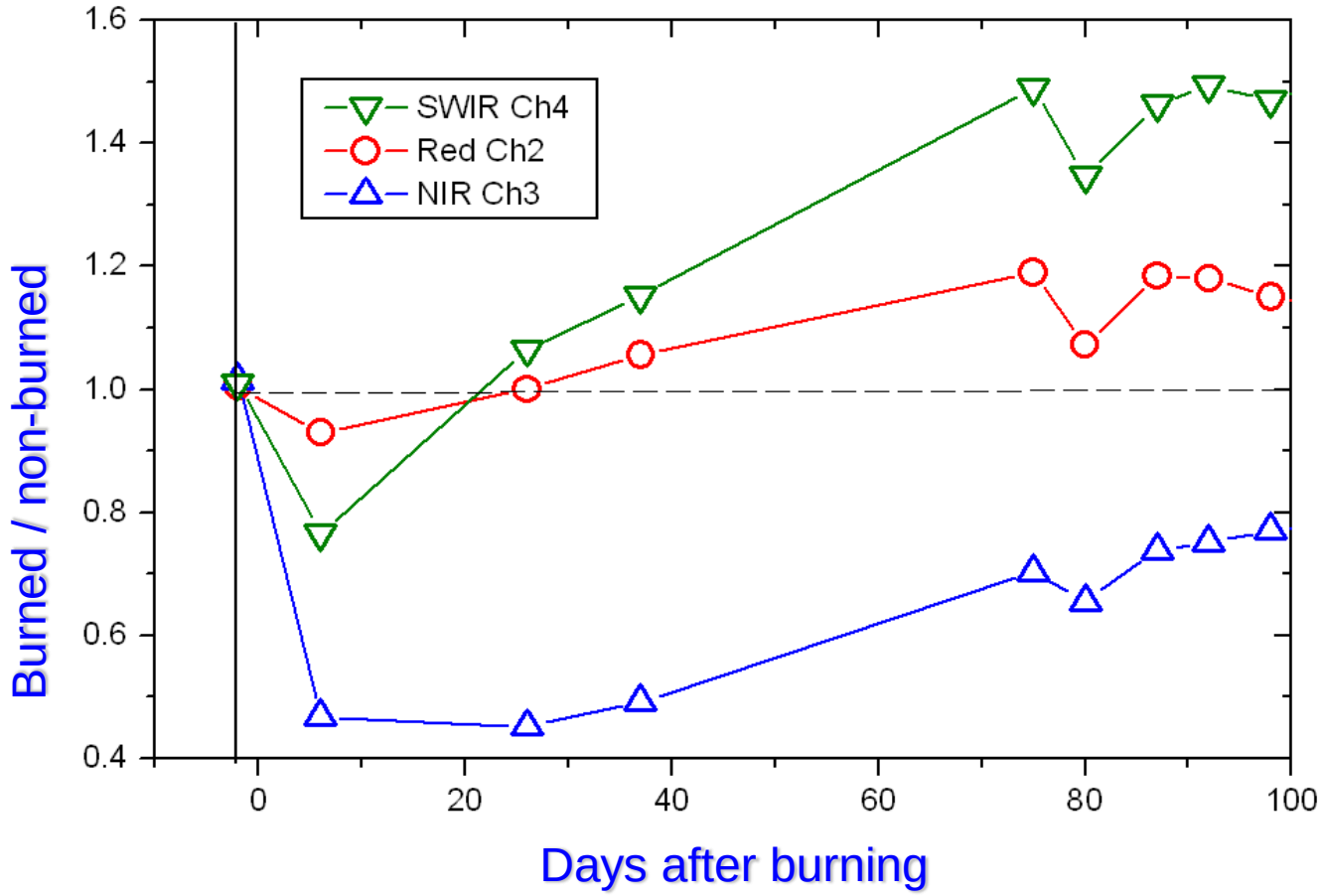
100 days



SWIR

NIR

Red

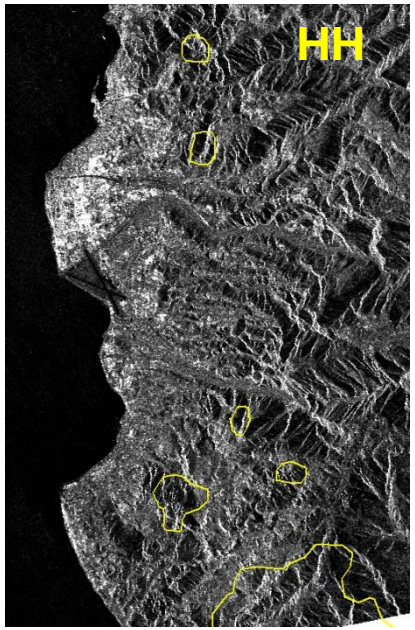


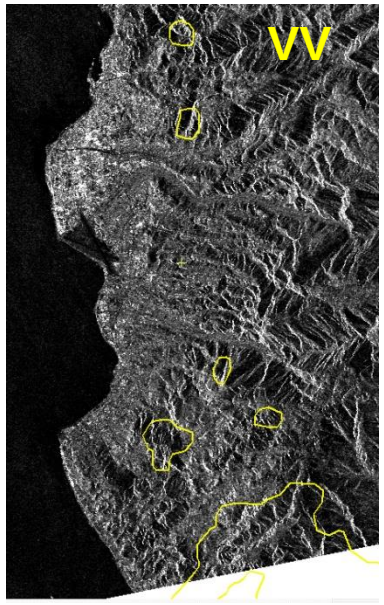
Source: R. Fraser (CMEO)

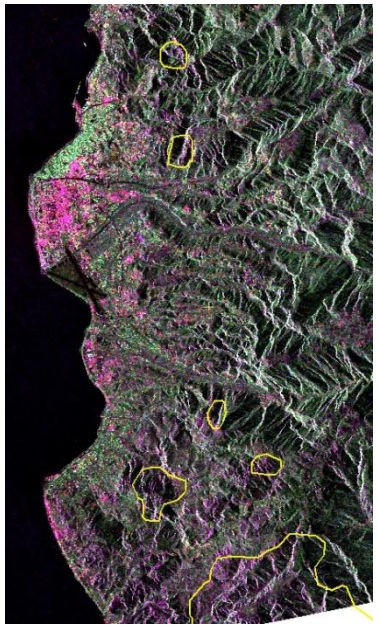
Fire M3 Fire Monitoring, Mapping & Modelling

Single-Polarized SAR Images or Composites

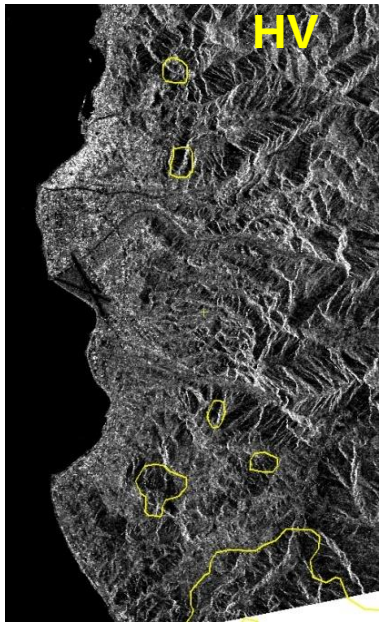
After fires (October 17, 2009)







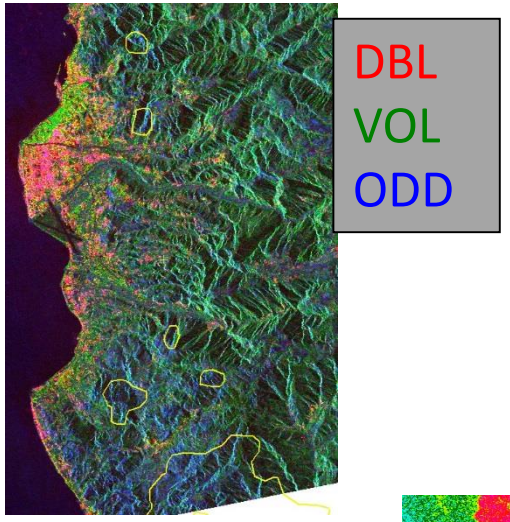
HH
HV
VV



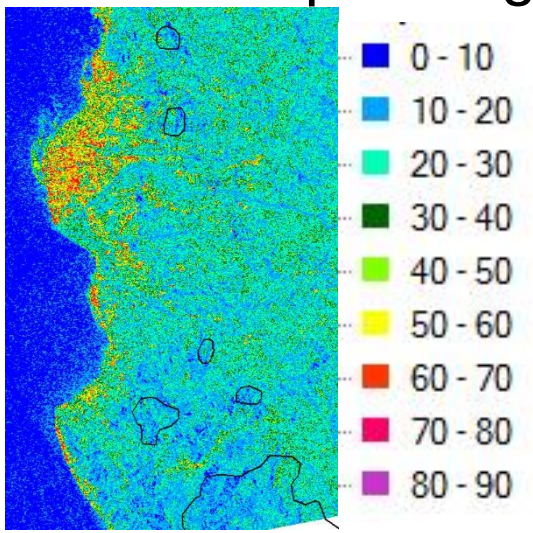
Fire scar➔ difficult to see

Polarimetric decomposition

Freeman-Durden

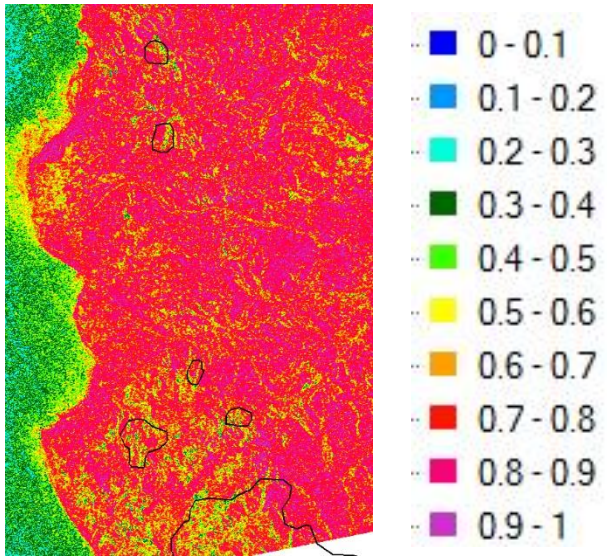


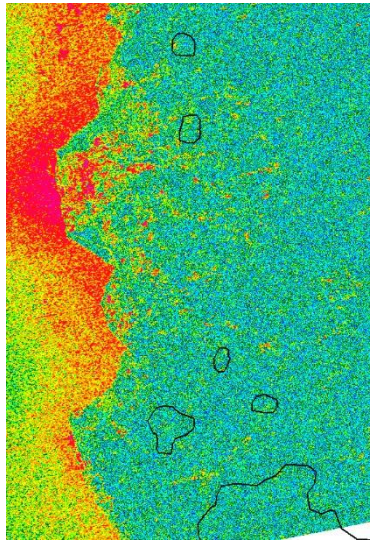
Alpha angle



Entropy

H



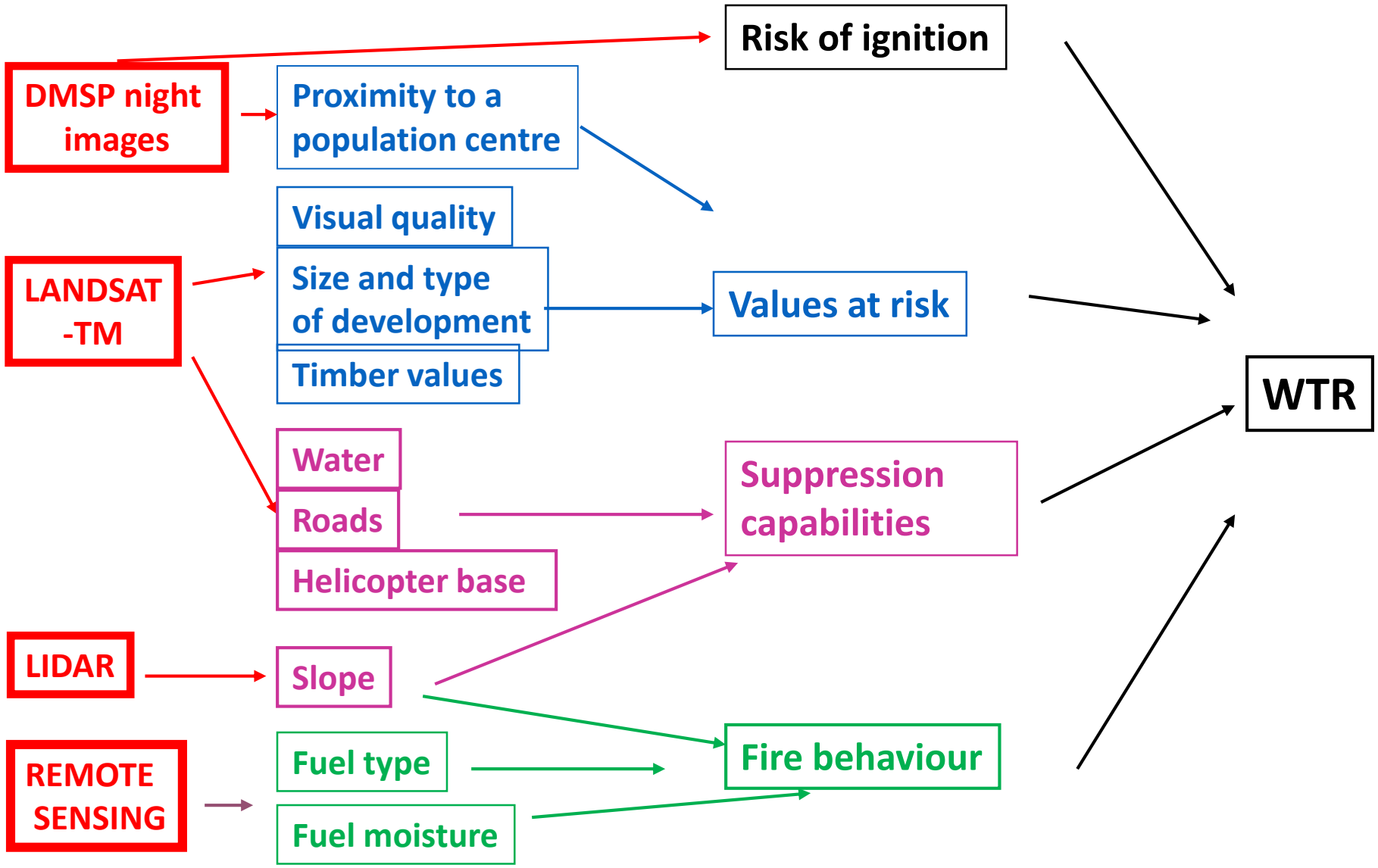


~~**Anisotropy**~~

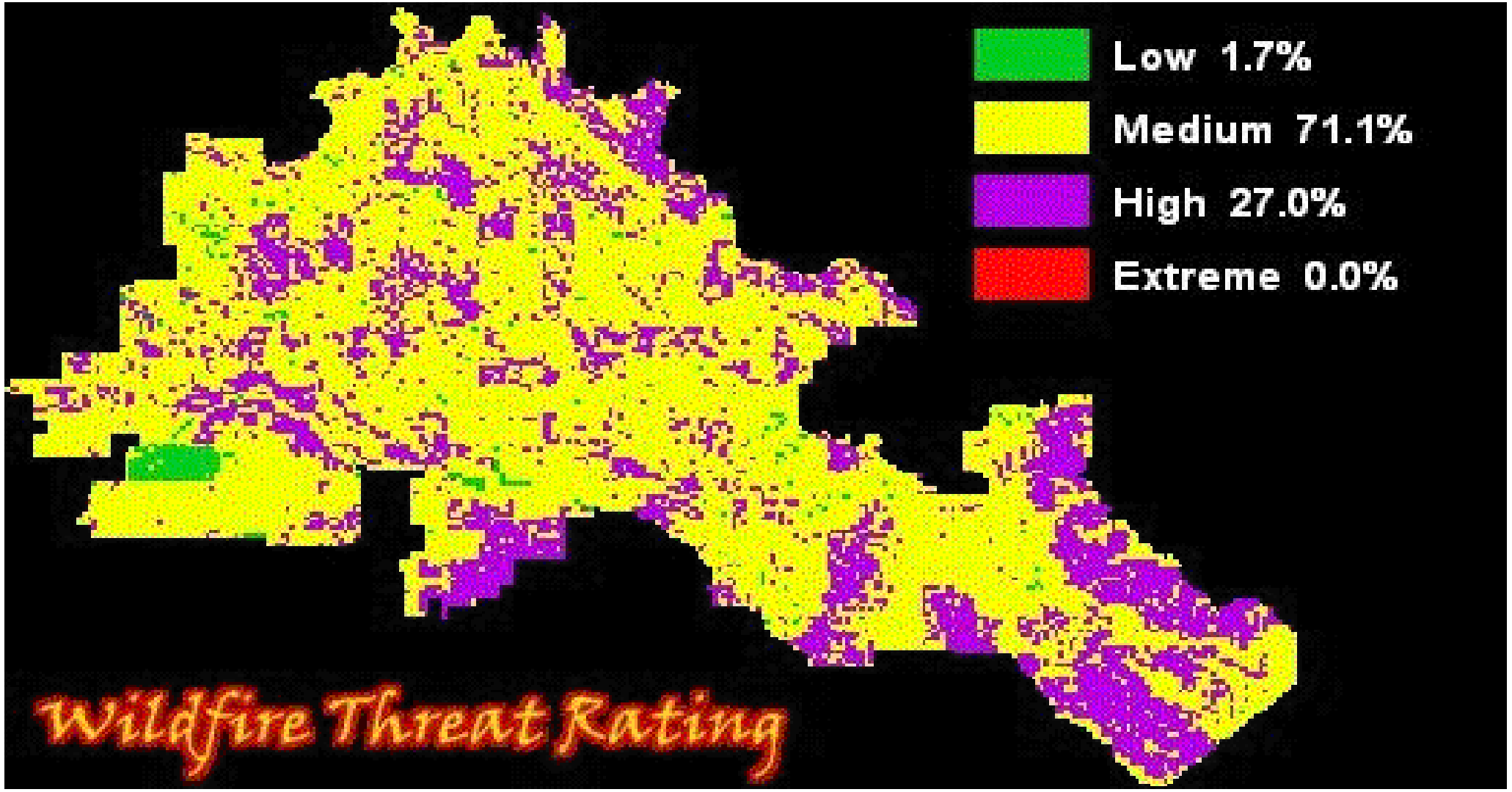
~~**A**~~

Fire scar➔ more ODD & low H

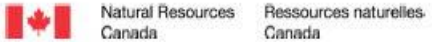
Wildfire Threat Rating System



Wildfire Threat Ratings



Acknowledgments



For more information

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