North Yukon Disturbance Tracking

Sam Skinner[1], Manon Desforges[2], Kirstie Simpson[2]

[1]Yukon Land Use Planning Council
[2]Yukon Government – Energy Mines and Resources
Yukon, Canada

14th International Circumpolar Remote Sensing Symposium
September 12-16, 2016
Homer, Alaska

YUKON LAND USE PLANNING COUNCIL

Outline

- Context:
  - Regional Planning in the Yukon
  - The North Yukon Regional Land Use Plan
- Disturbance Tracking
  - Why
  - How
  - Examples and Issues

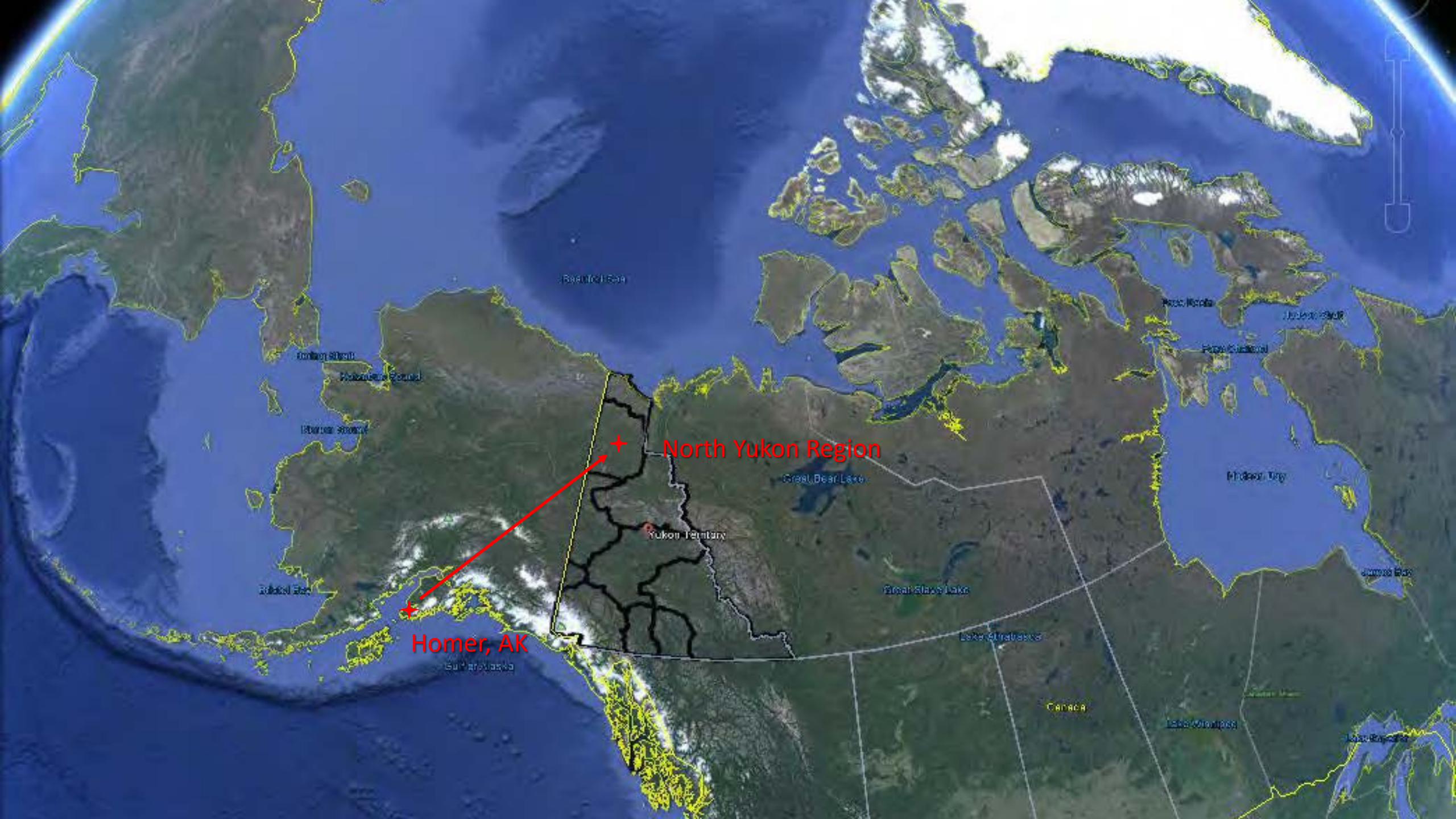
✗ Conclusions

YUKON LAND USE PLANNING COUNCIL

Regional Planning in the Yukon

- Land Claims with Yukon First Nations (~Tribes) set up a general regional planning framework
- Neutral advisory Council
- Council makes recommendation to the FNs and Yukon Govt., assist Commissions
- Commissions +/- independently develop regional plans

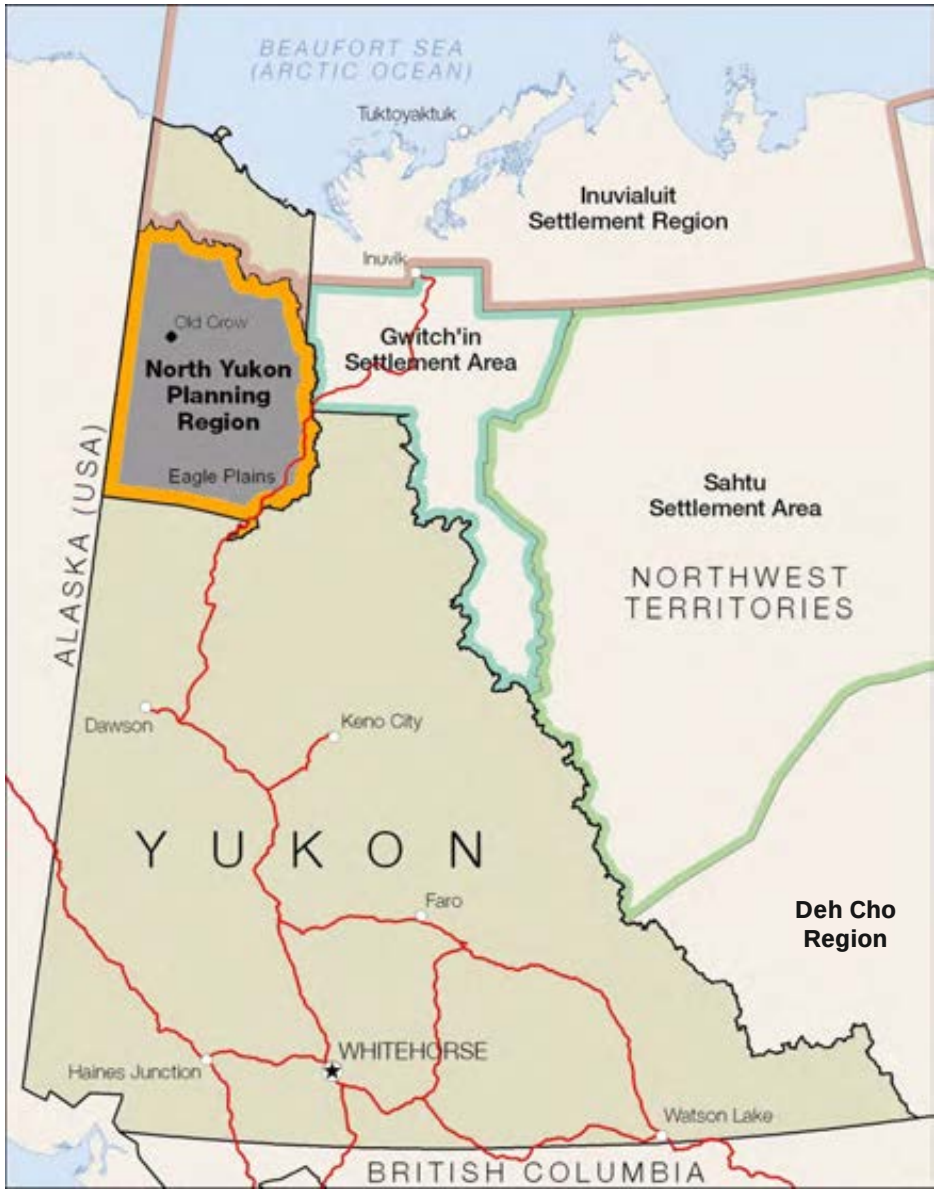
YUKON LAND USE
PLANNING COUNCIL


North Yukon Region
Homer, AK

Planning Region

Key Features

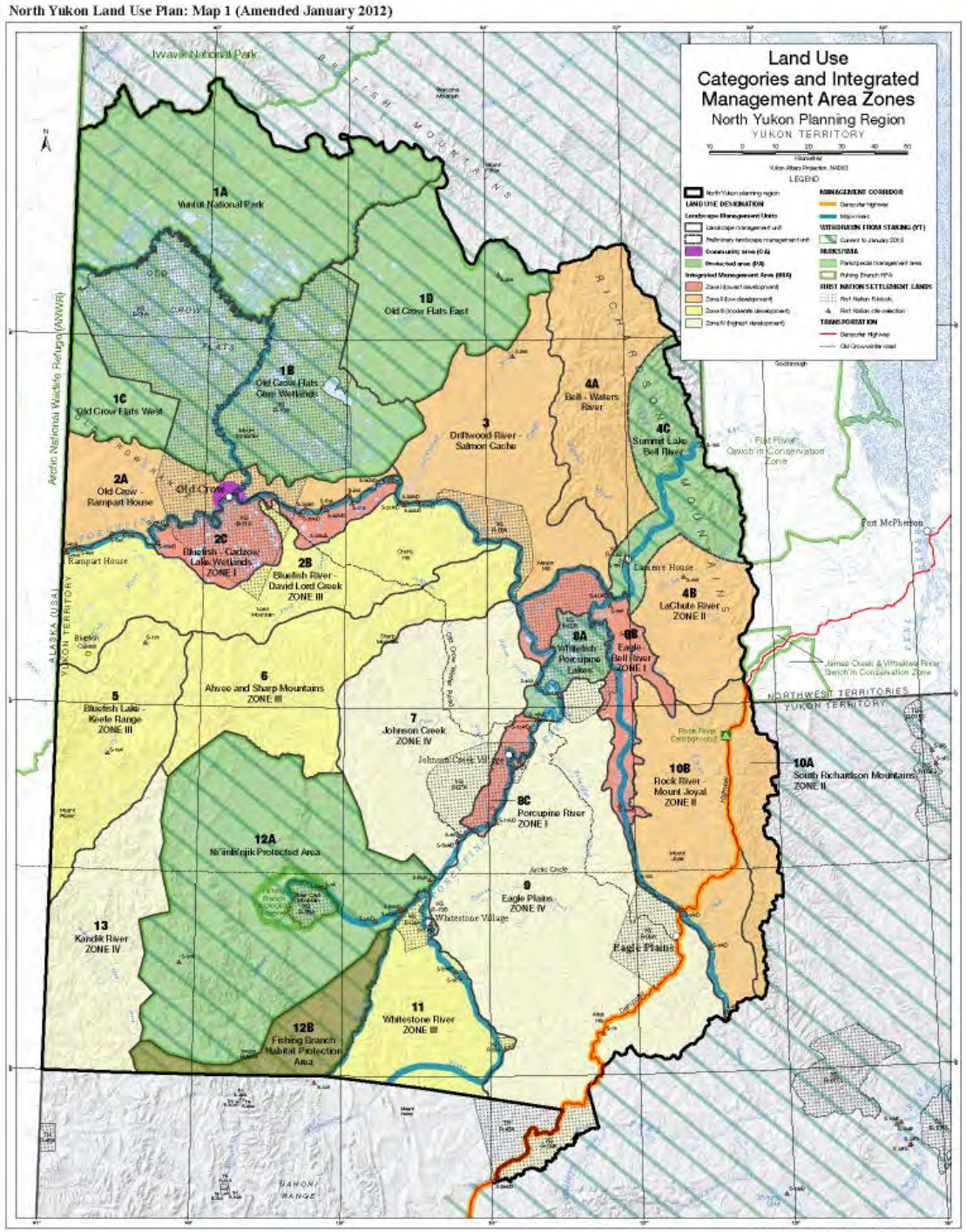
- Traditional Territory of the Vuntut Gwitchin
- Community of Old Crow (300 people)
- 56,000 km^2
- Beringian
- Continuous permafrost zone
- Oil & Gas basin
- Caribou winter range



North Yukon Land Use Plan

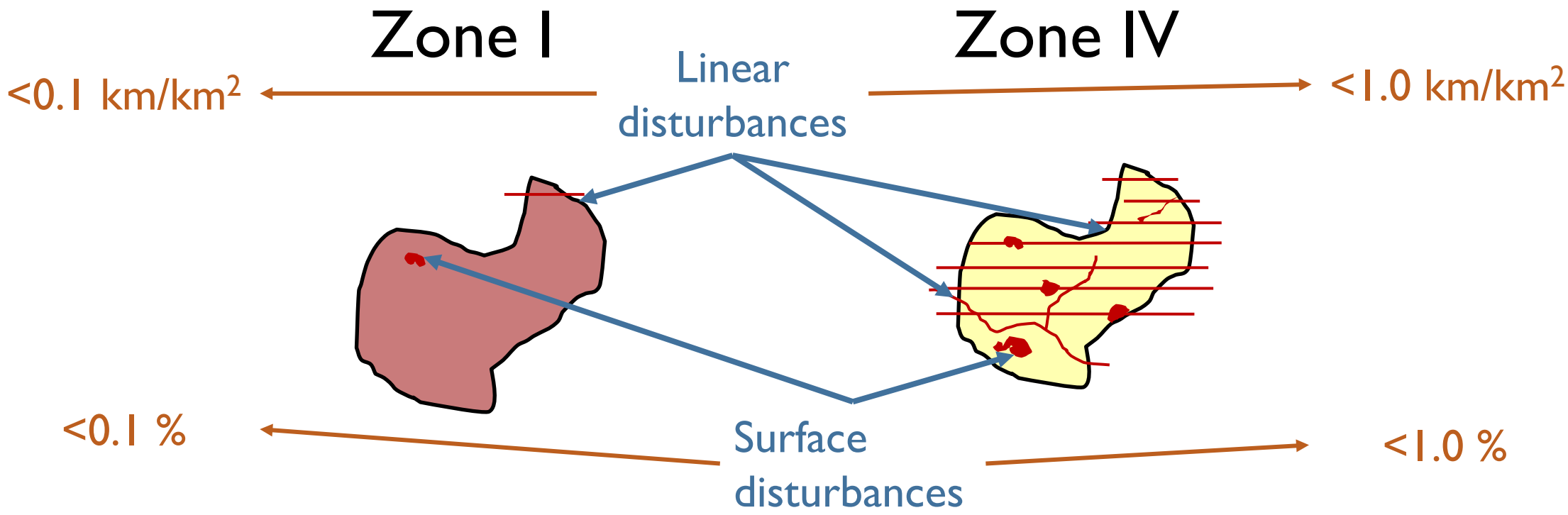
Protected		No acceptable change
Integrate Management Areas		
Zone I		Lower
Zone II		
Zone III		
Zone IV		Higher

acceptable change

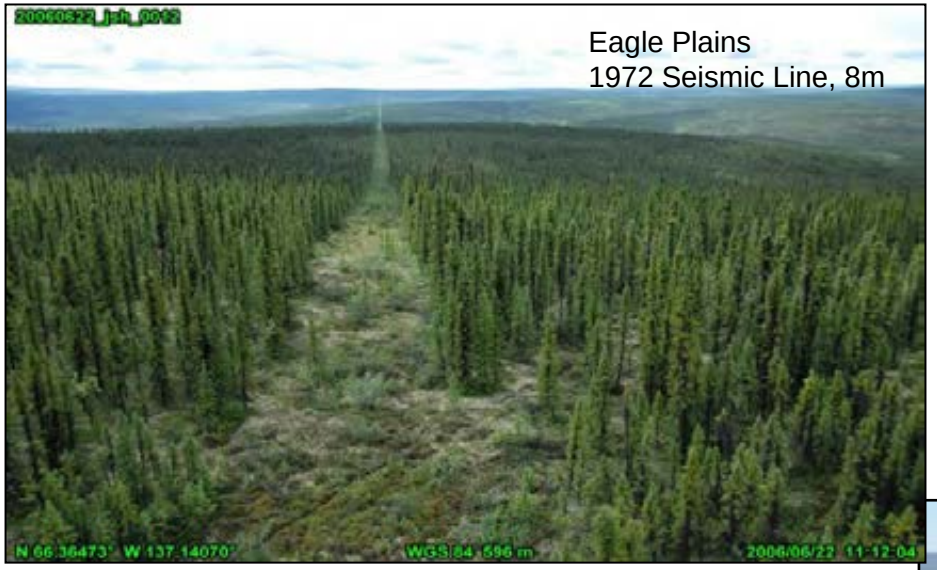


Levels of Acceptable Change

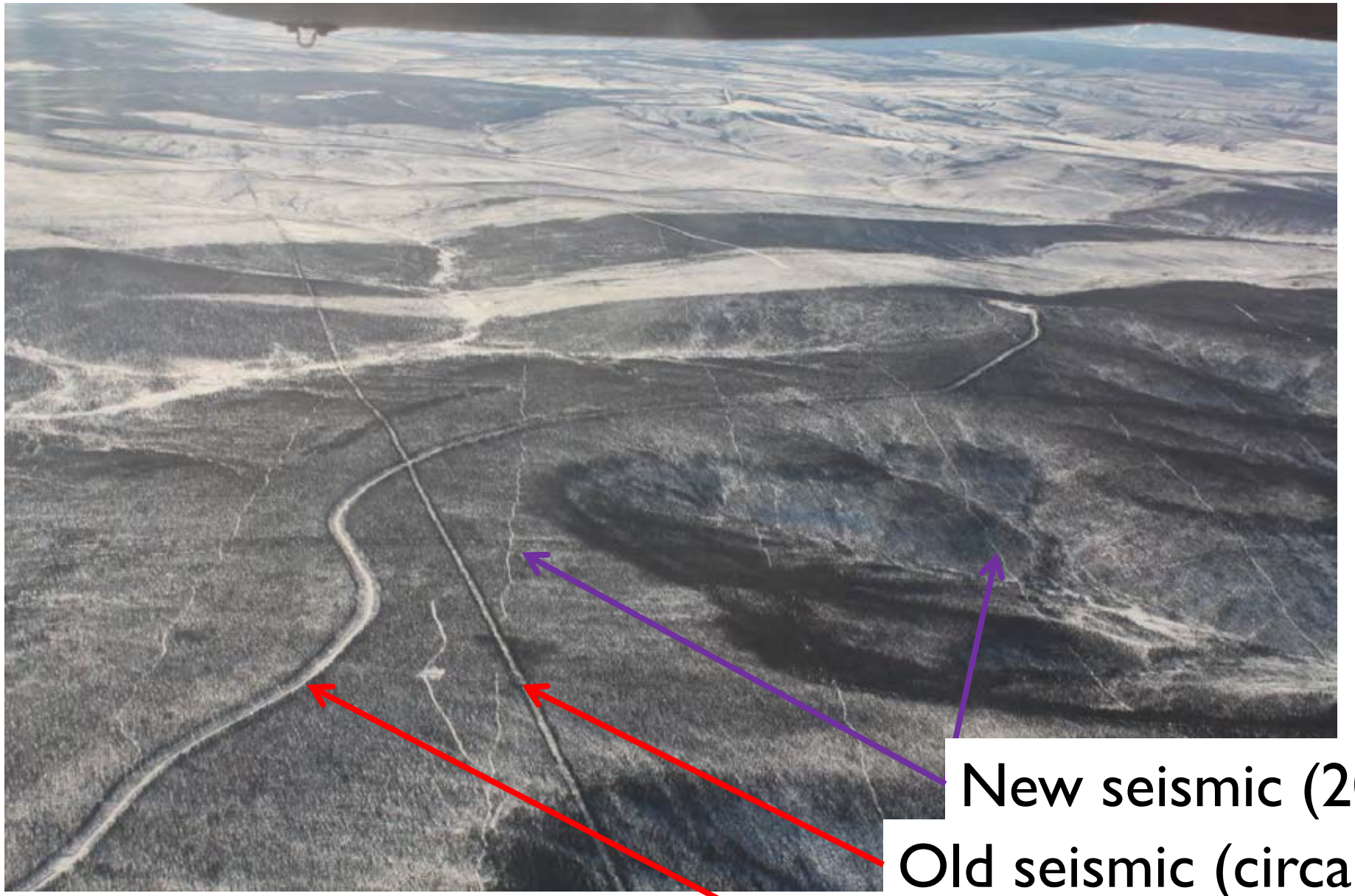
- Cut trees or disturbed hydrology/soil
- *Surface disturbances* (polygonal), and
- *Linear disturbances* (lines) (>1.5m wide)



But what kind of changes are we talking about?

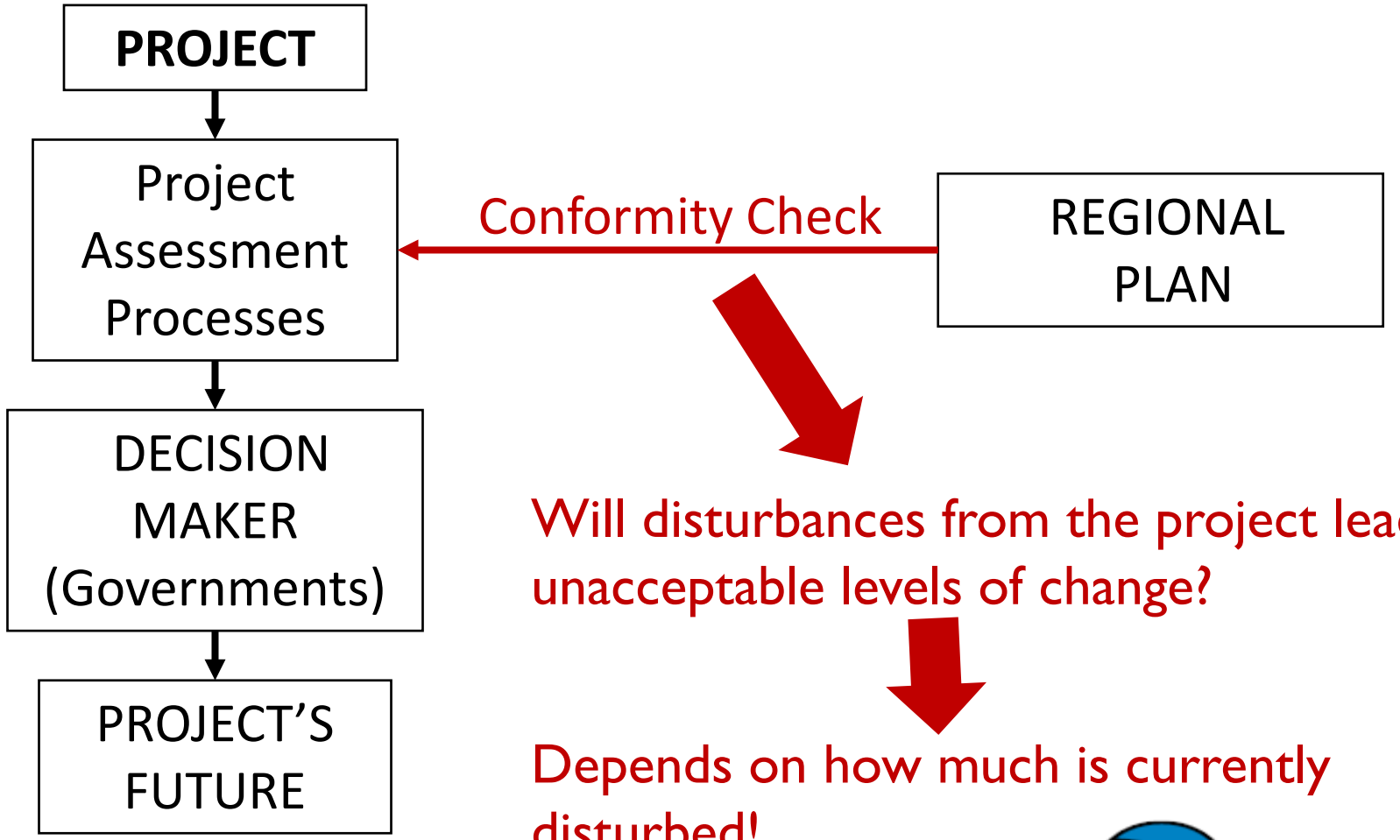


PLANNING COUNCIL



YUKON LAND USE
PLANNING COUNCIL

End Use: Project Specific Review



YUKON LAND USE PLANNING COUNCIL

Commission's estimate of cumulative disturbance =

Cut-lines and trails from national topographic database +

Oil & Gas exploration data –

Double-counted features –

20%

Lots has recovered, but lots was not mapped or archived

YUKON LAND USE PLANNING COUNCIL

Tracking cumulative disturbance totals …

Current cumulative disturbance =

Baseline disturbance **+** ← Initial inventory

Recent disturbance **–** ← Reports from developer

Recovered disturbances ← Recovery models

- When soil/hydrology disruptions no longer apparent, or
- When trees or shrubs >1.5m are present

YUKON LAND USE PLANNING COUNCIL

OR...

Current cumulative disturbance =

Updated baseline disturbance ← Frequent inventories

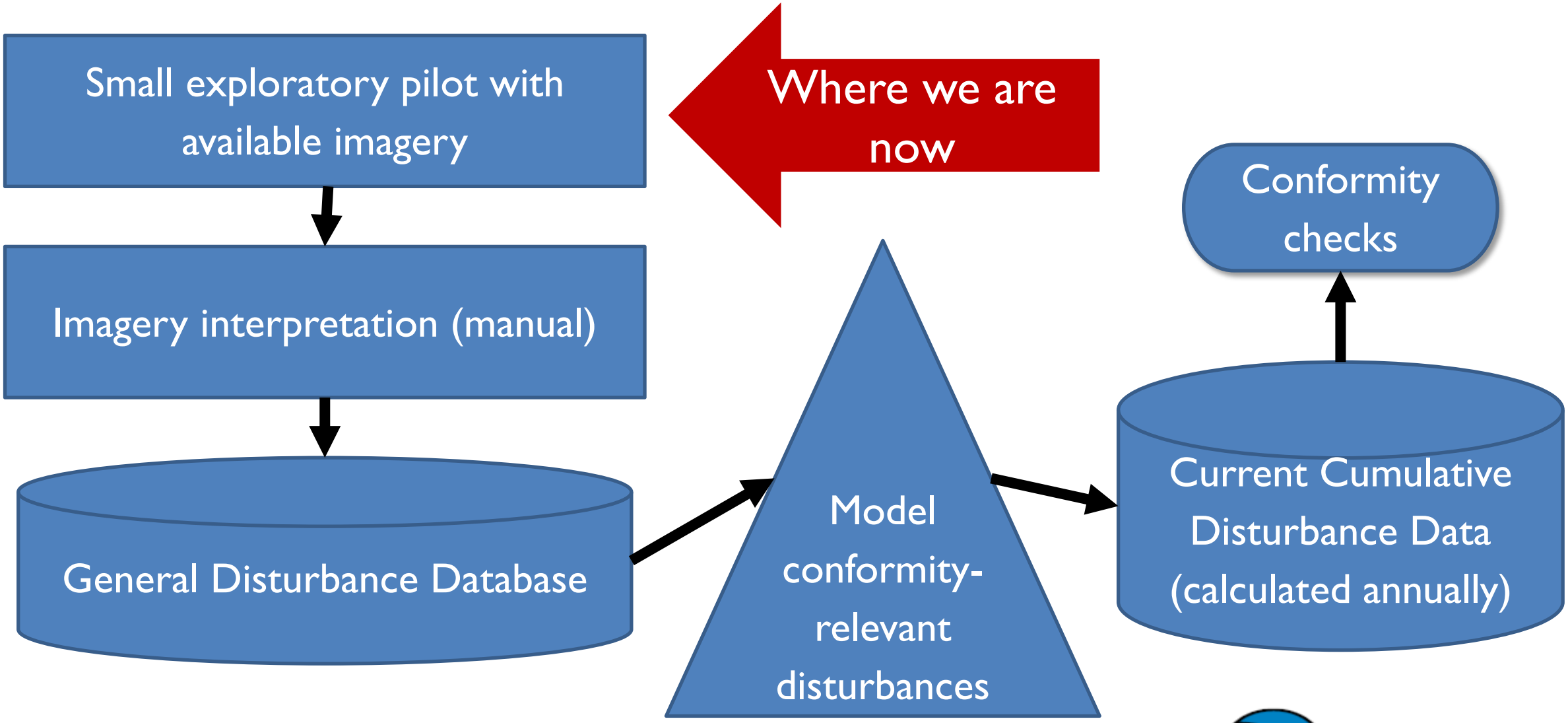
+

New disturbance ← Reports from developer

~~Recovery models~~

YUKON LAND USE PLANNING COUNCIL

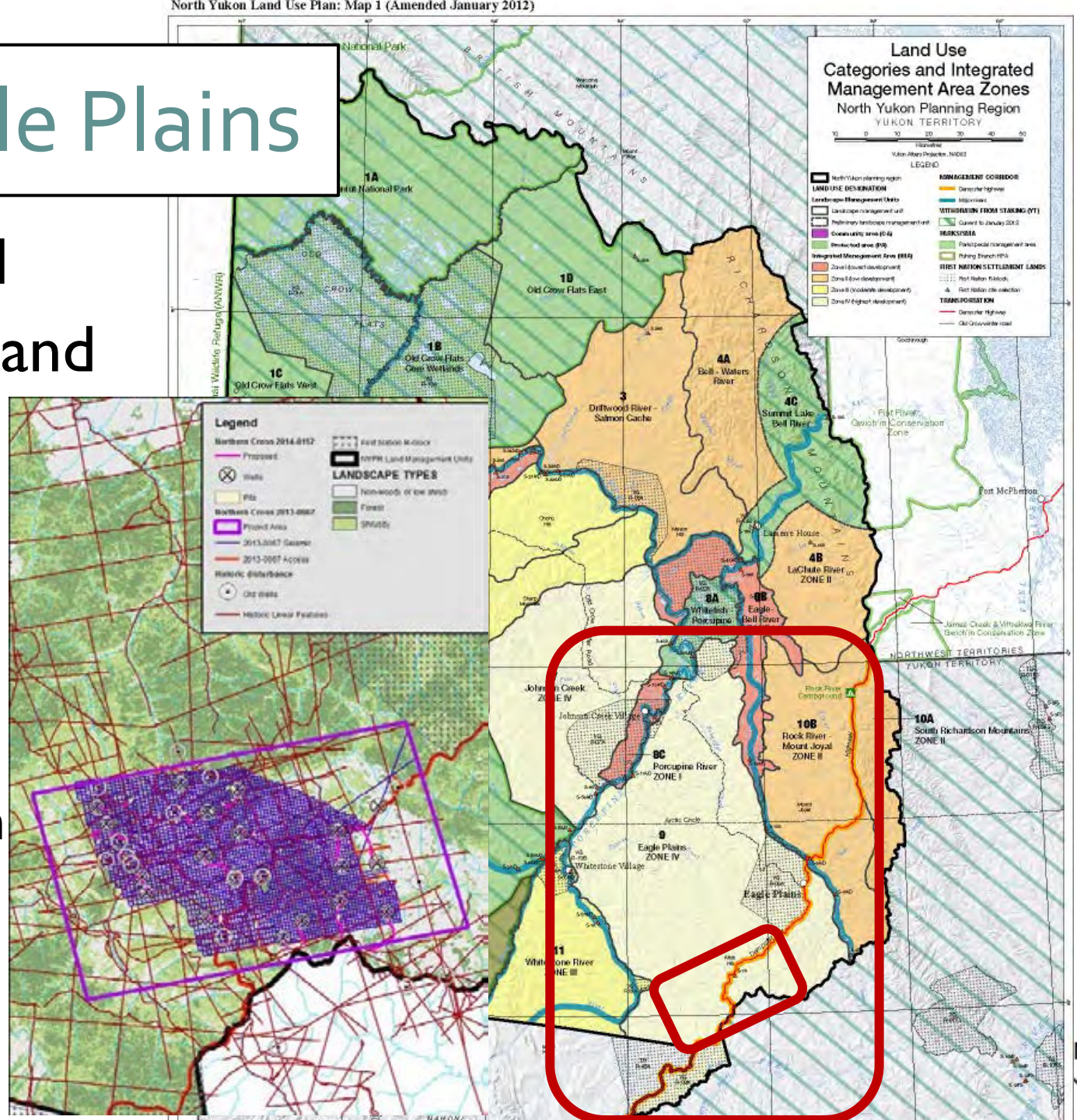
General Approach



YUKON LAND USE PLANNING COUNCIL

Case Study: Eagle Plains

- Baseline data needed
- Lots of past present and future disturbances
- Data rich pilot area:
  - SPOT6 (1.5m)
  - Pleiades (0.5m)
  - LiDAR
  - Predictive ecosystem mapping
  - Ancillary data
  - Field observations



Field Observations

Goals:

- Define ecological status and succession of legacy disturbances
- Understand recovery dynamics and variation

Paired plots:

- Soil characteristics
- Active layer depth
- Plant communities
- Tree mensuration
- Visibility
- …

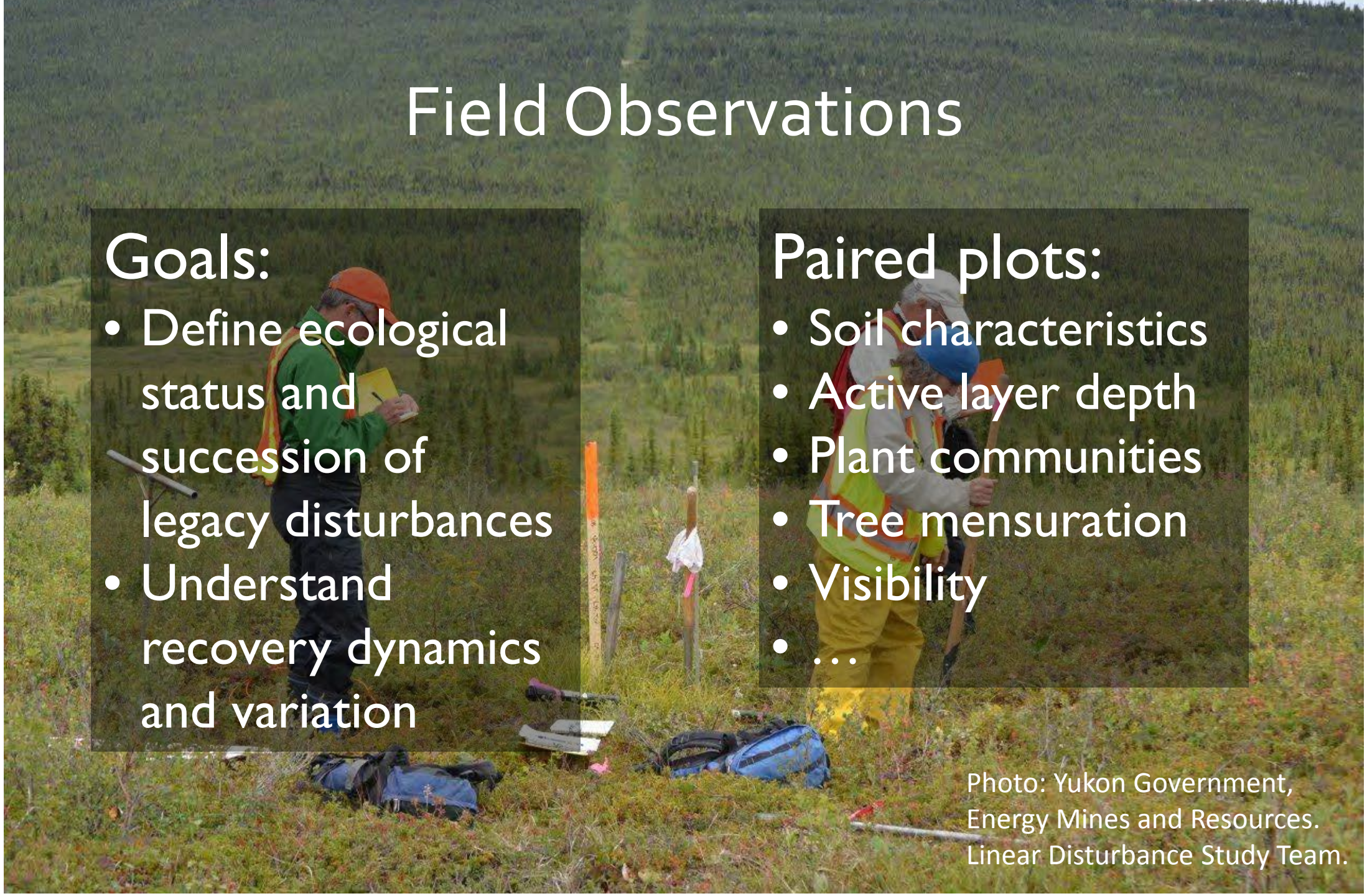


Photo: Yukon Government, Energy Mines and Resources. Linear Disturbance Study Team.

What do we need to discern?

Disturbances:

- Trees cut and no woody regen >1.5m
- Soil/hydrology changes
- Linear features >1.5m wide

Attributes from other data that may help

- Surrounding veg community
- Landscape position

Interpreted attributes that may help

- Veg community of disturbance (esp. herbs vs shrubs)
- Surrounding veg community
- Width of disturbance (linear)
- Type and approx. age of disturbance
- Re-use? How & when?

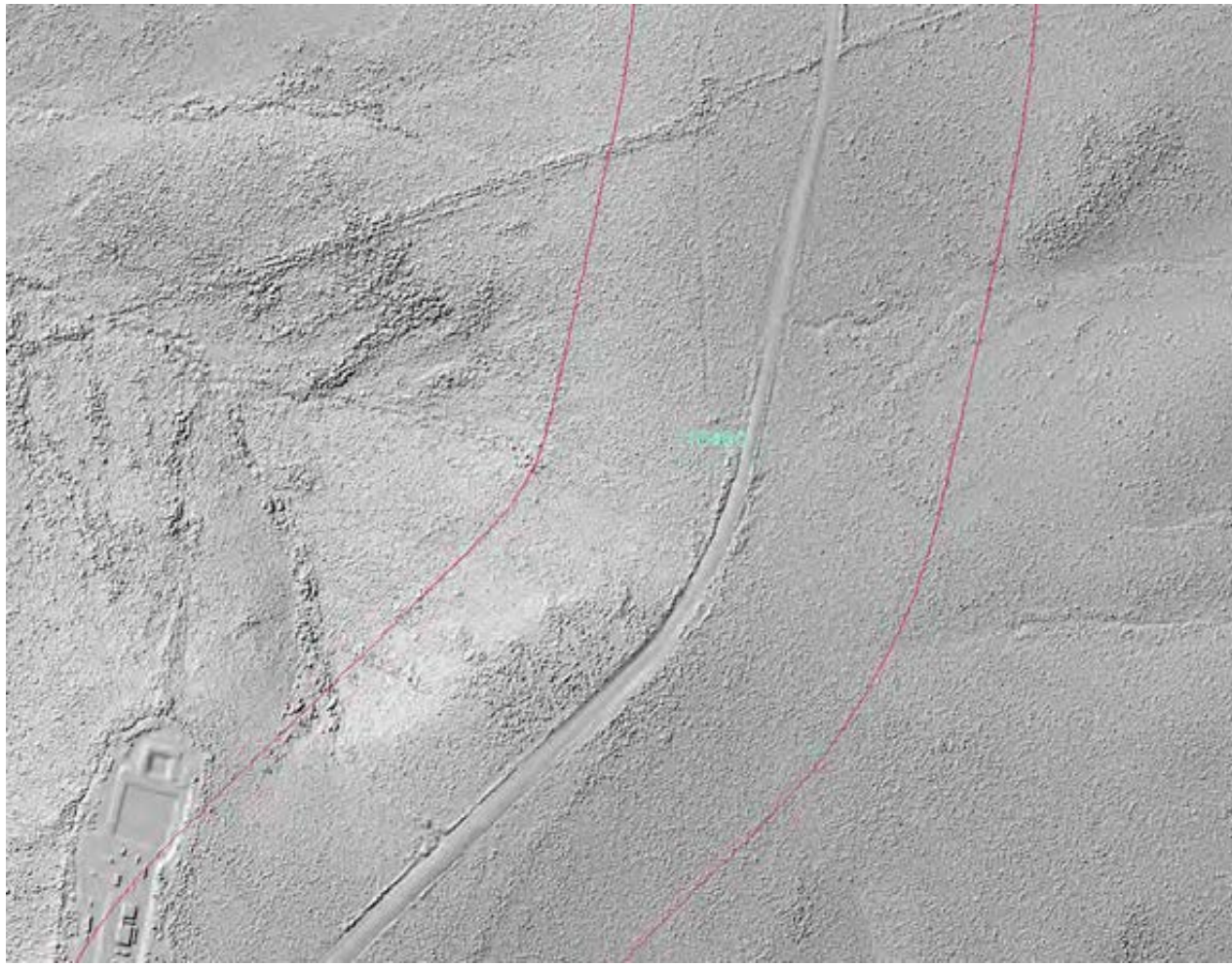
YUKON LAND USE PLANNING COUNCIL

What have we found?

YUKON LAND USE
PLANNING COUNCIL

LiDAR?

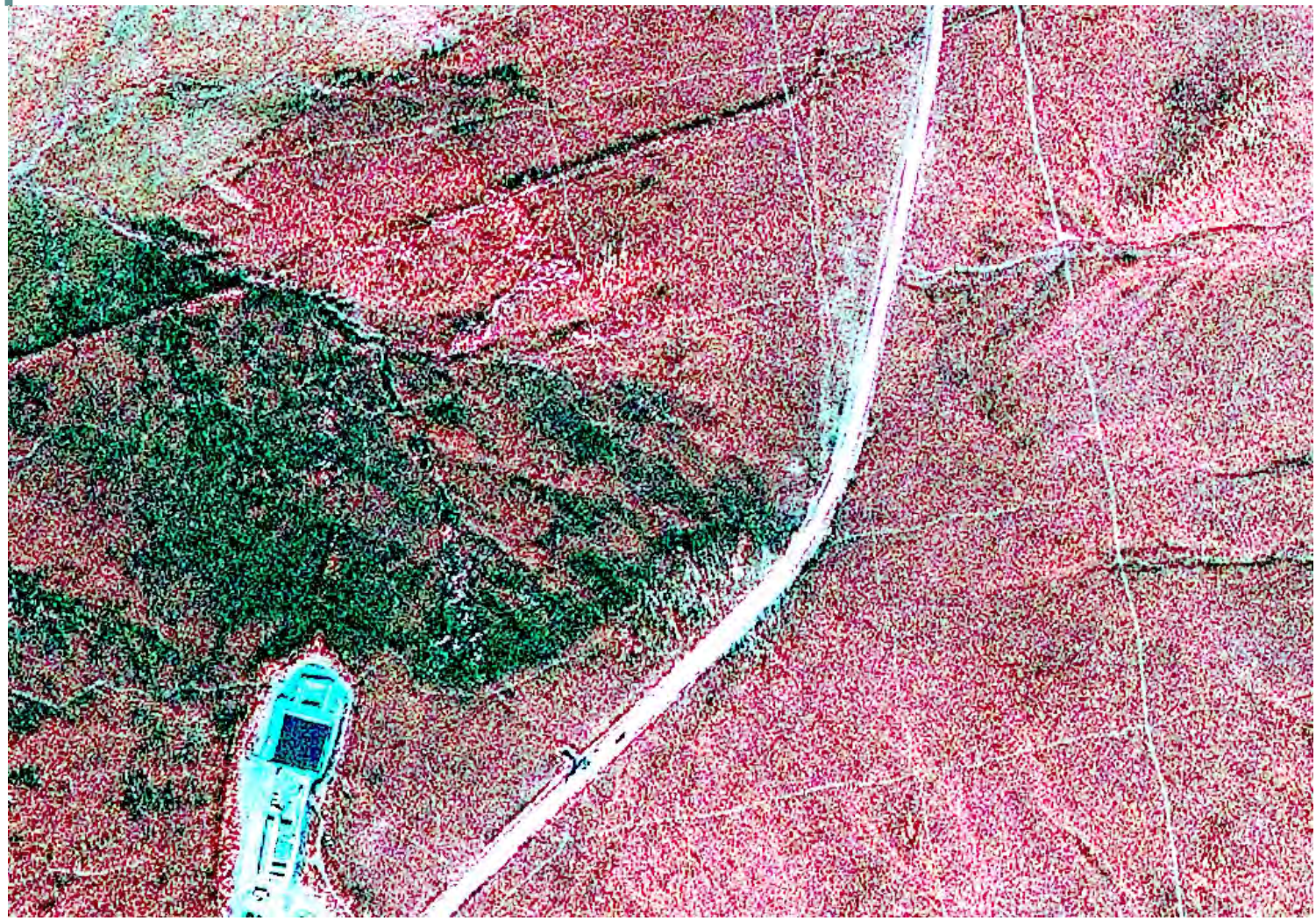
- LiDAR should be able to get height of regen (DSM – DEM), BUT $$$
- Less useful for soil/hydrological disturbances
- Just received sample – no work yet



YUKON LAND USE PLANNING COUNCIL

Multispectral Indices?

- NDVI etc may be able to help differentiate different plant communities
- 4th band (NIR) being worked up (SPOT6 & Pleiades)

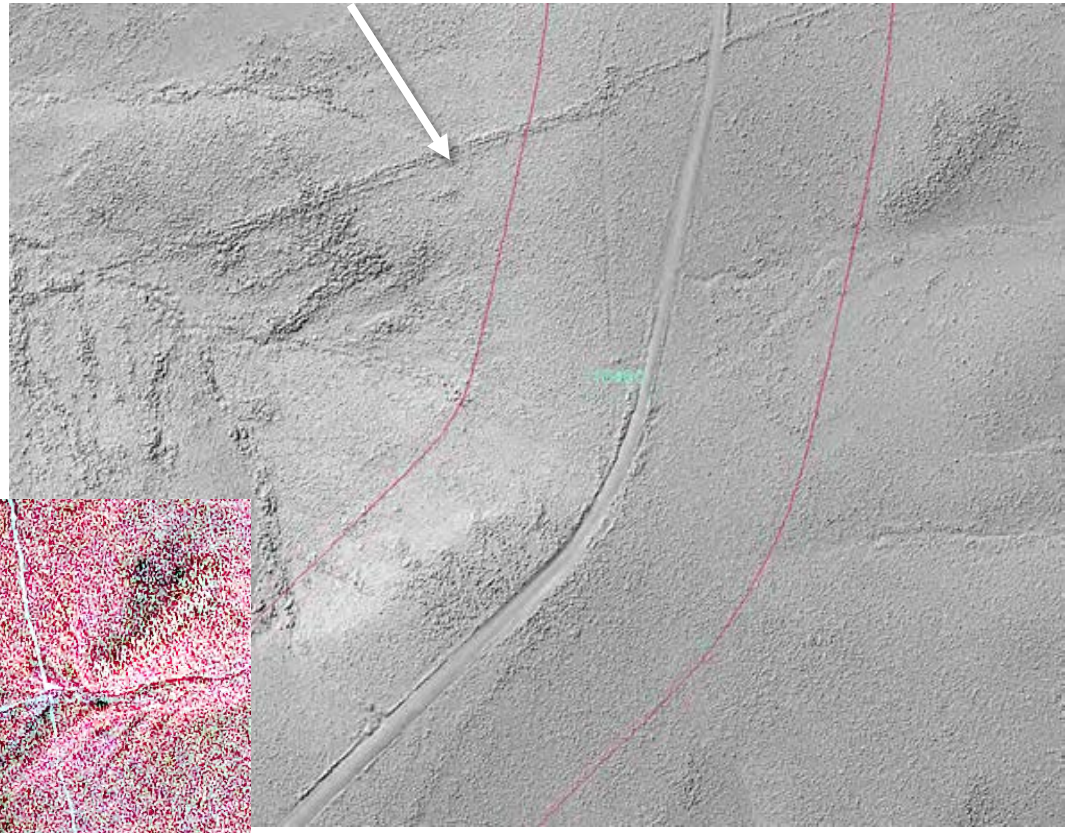


SPOT6 (432 bands)

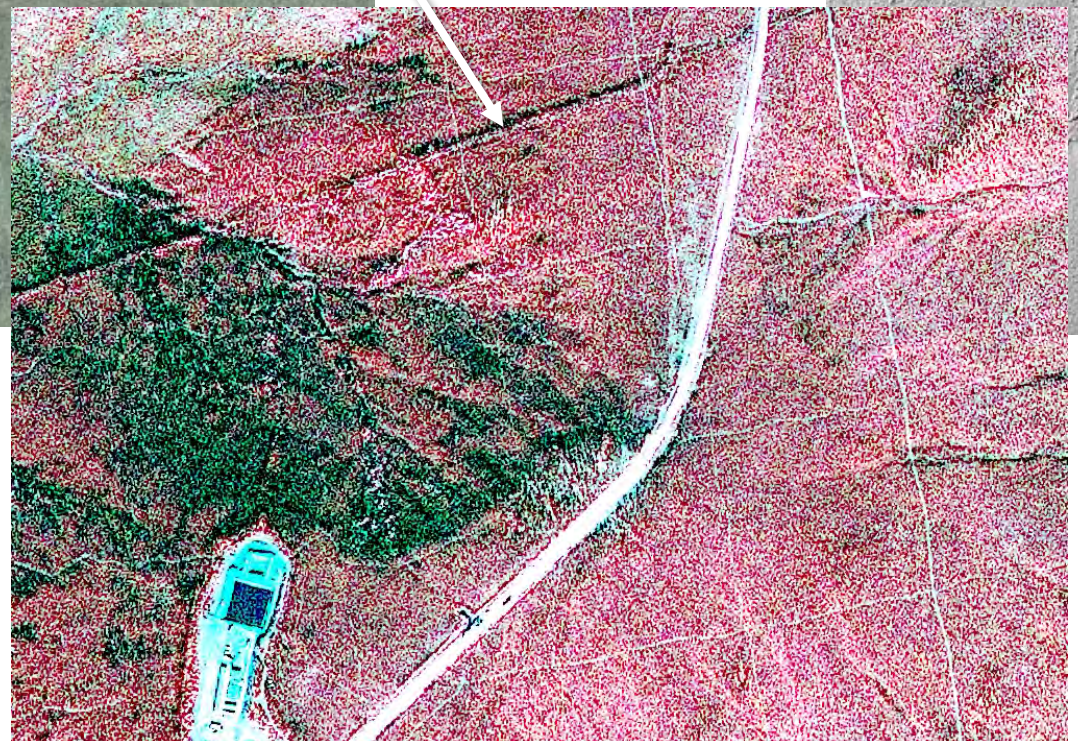
YUKON LAND USE PLANNING COUNCIL

Pleiades

LiDAR



SPOT6 (432)



YUKON LAND USE
PLANNING COUNCIL

Automated Classification

- Polygonal: yes, lines: no (?)
- Anthropogenic vs natural

YUKON LAND USE
PLANNING COUNCIL

“Road” with successional stagnation

SPOT6 Aerial

Ground

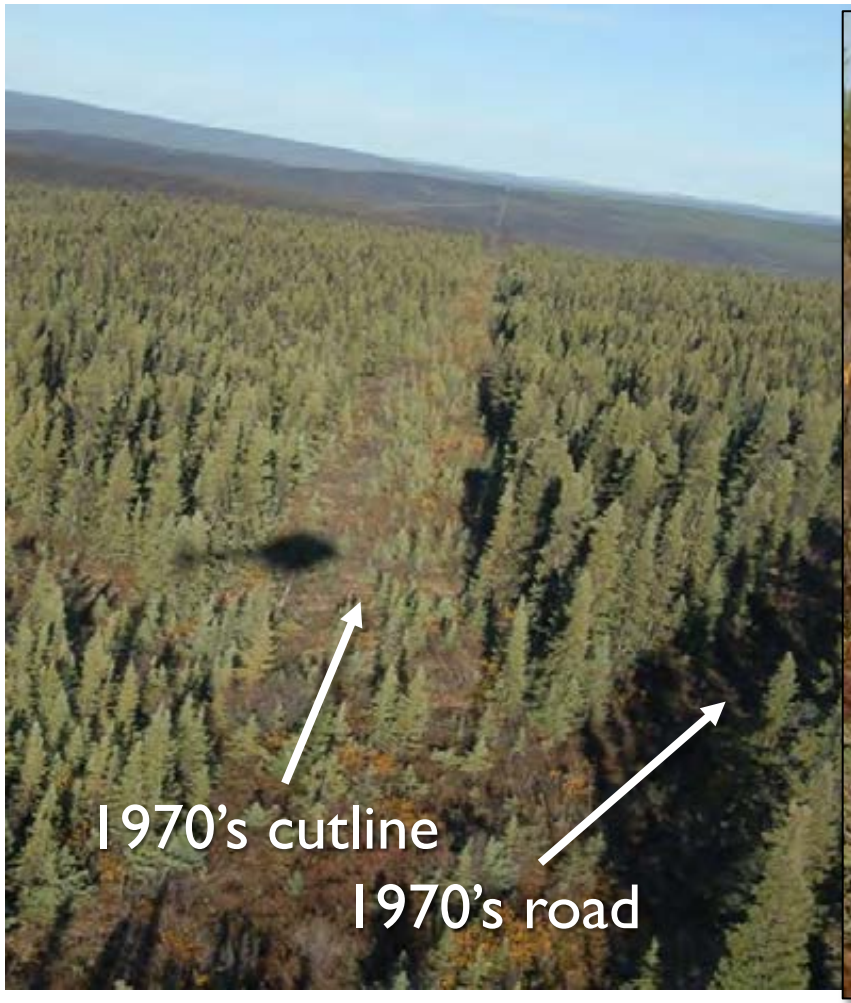
Pleiades

Photo: Yukon Government, Energy Mines and Resources. Linear Disturbance Study.

YUKON LAND USE PLANNING COUNCIL

Good recovery: 1970's Linear Features

Aerial



Ground

GeoEye (0.5m)

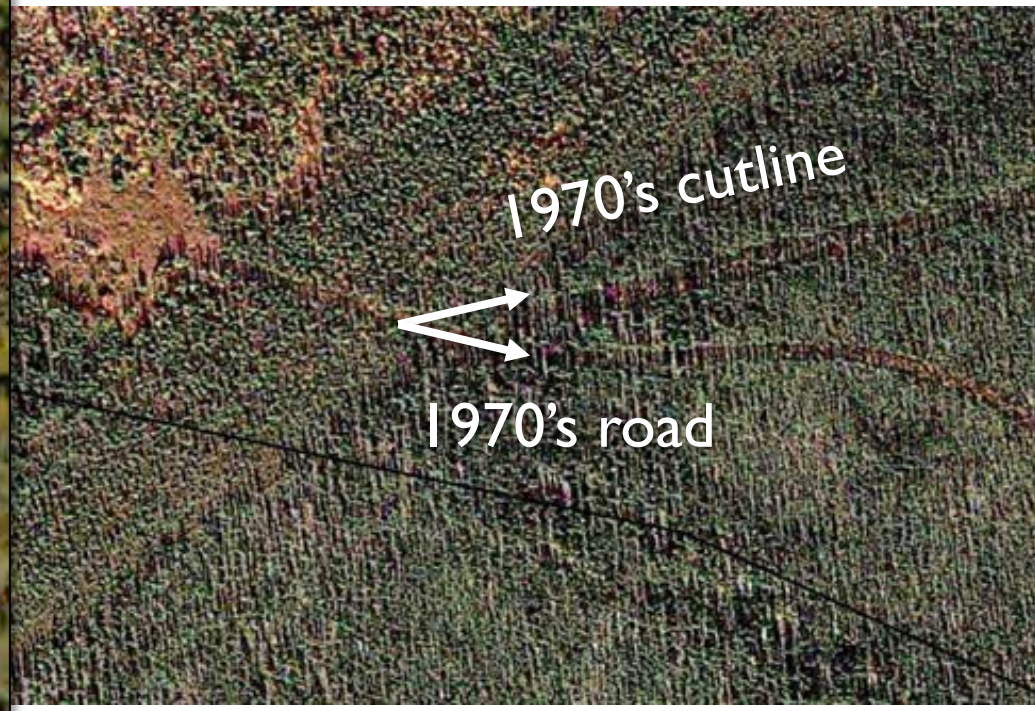


Photo: Yukon Government, Energy Mines and Resources.
Linear Disturbance Study.

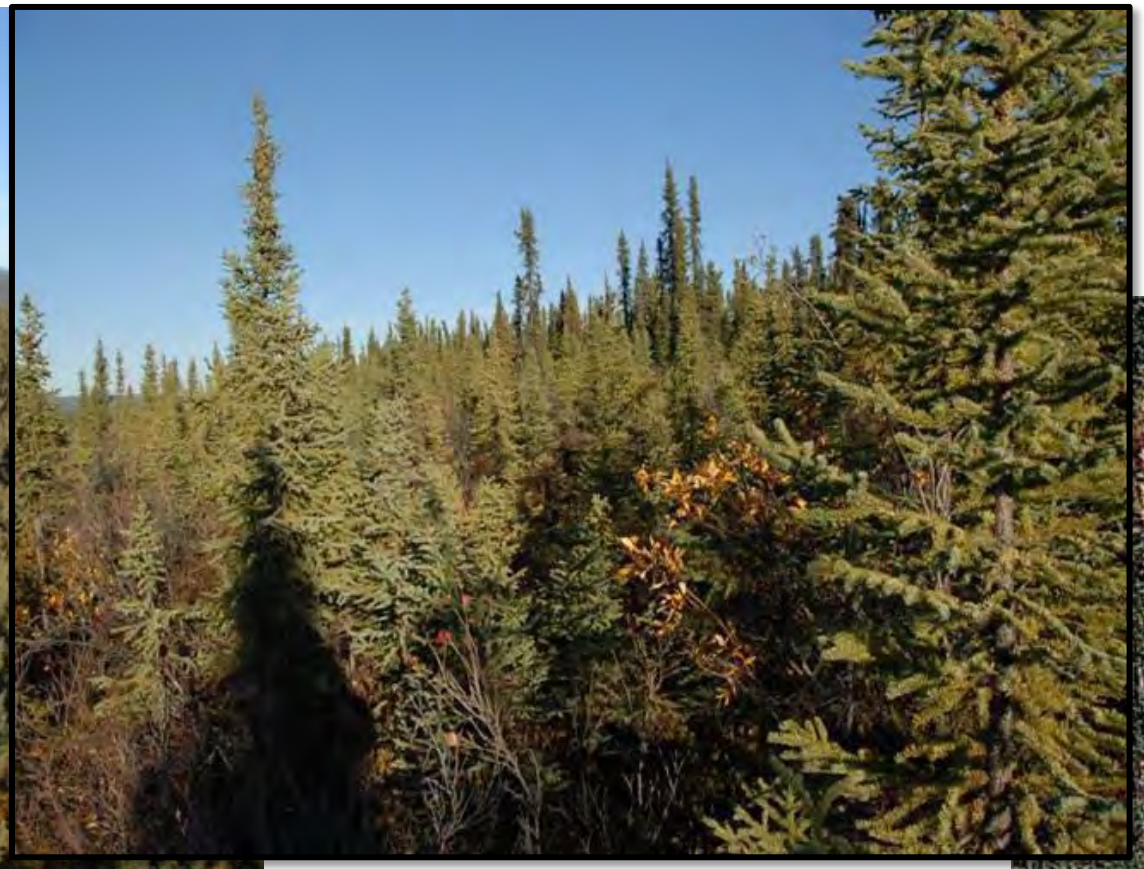
YUKON LAND USE
PLANNING COUNCIL

Good recovery: 1969 Airstrip

Aerial

Ground

GeoEye (0.5m)



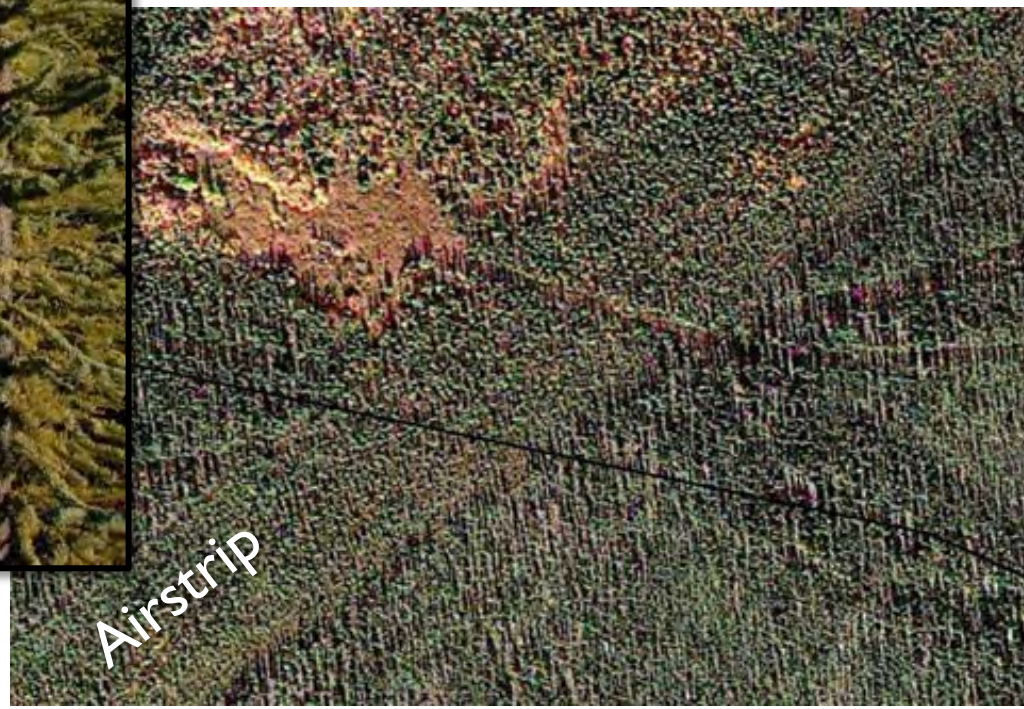


Photo: Yukon Government, Energy Mines and Resources. Linear Disturbance Study.

YUKON LAND USE PLANNING COUNCIL

Cutline subsequently burned

Ground

Pleiades

Photo: Yukon Government, Energy Mines and Resources.
Linear Disturbance Study.

YUKON LAND USE
PLANNING COUNCIL

Re-used cutlines

Aerial

Pleiades

Photo: Canadian Wildlife Service.

YUKON LAND USE PLANNING COUNCIL

Recovery in >1 topographical positions

Aerial

Pleiades

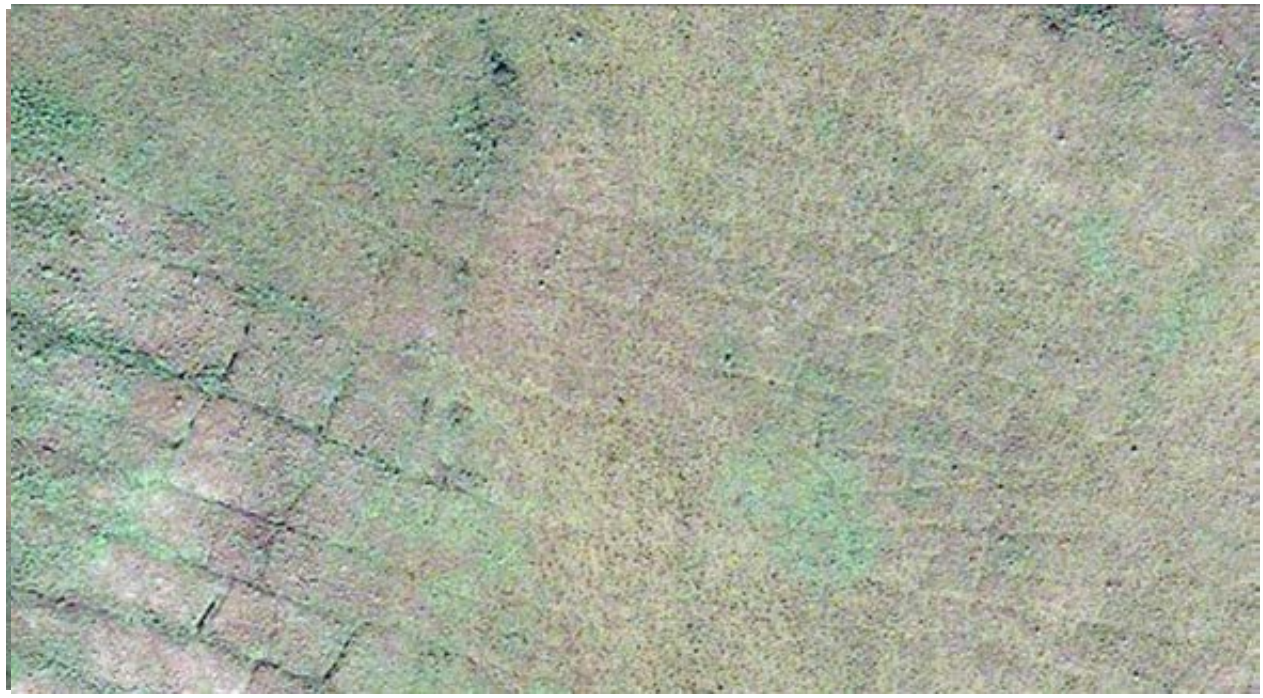
Photo: Canadian Wildlife Service.

PLANNING COUNCIL

Ice Wedge Polygons

SPOT6

Pleiades



YUKON LAND USE
PLANNING COUNCIL

Ambiguous plant communities

SPOT6

Aerial

Pleiades

Photo: Canadian Wildlife Service.

YUKON LAND USE PLANNING COUNCIL

Next Steps

- Get NIR 4th bands
- Explore NDVI etc and LiDAR
- Finalize process
- Purchase imagery to fill gaps
- Interpret disturbances
- Derive and publish disturbance metrics

YUKON LAND USE
PLANNING COUNCIL

Thank You!

Questions?