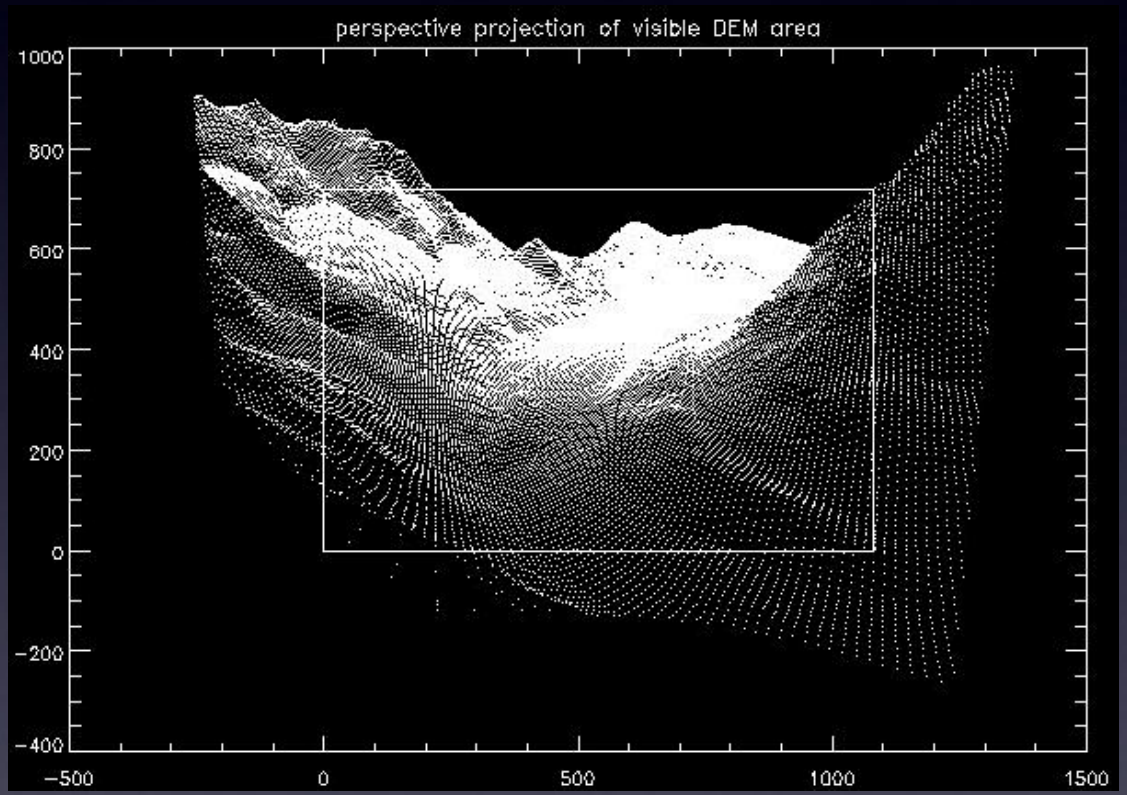
Using Oblique Historical Photos to Determine Past Mountain Pine Beetle Susceptibility

Principal Investigator:
Chris Stockdale
burning ecoLogic

Phase I Collaborators:

Eric Higgs (UVic)
Rick Arthur (AB SRD)
Katelyn Loukes (BCIT)
Oliver Clovis (BCIT)



Understanding the Epidemic

- Why is current epidemic so massive?
  - Convergence of many factors
  - Primarily an interruption/alteration of the factors that normally control landscape outbreaks

Cross-scale Drivers of Natural Disturbances Prone to Anthropogenic Amplification: The Dynamics of Bark Beetle Eruptions

KENNETH F. RAFFA, BRIAN H. AUKEMA, BARBARA J. BENTZ, ALLAN L. CARROLL, JEFFREY A. HICKE, MONICA G. TURNER, AND WILLIAM H. ROMME

Bioscience 58(6) 2008

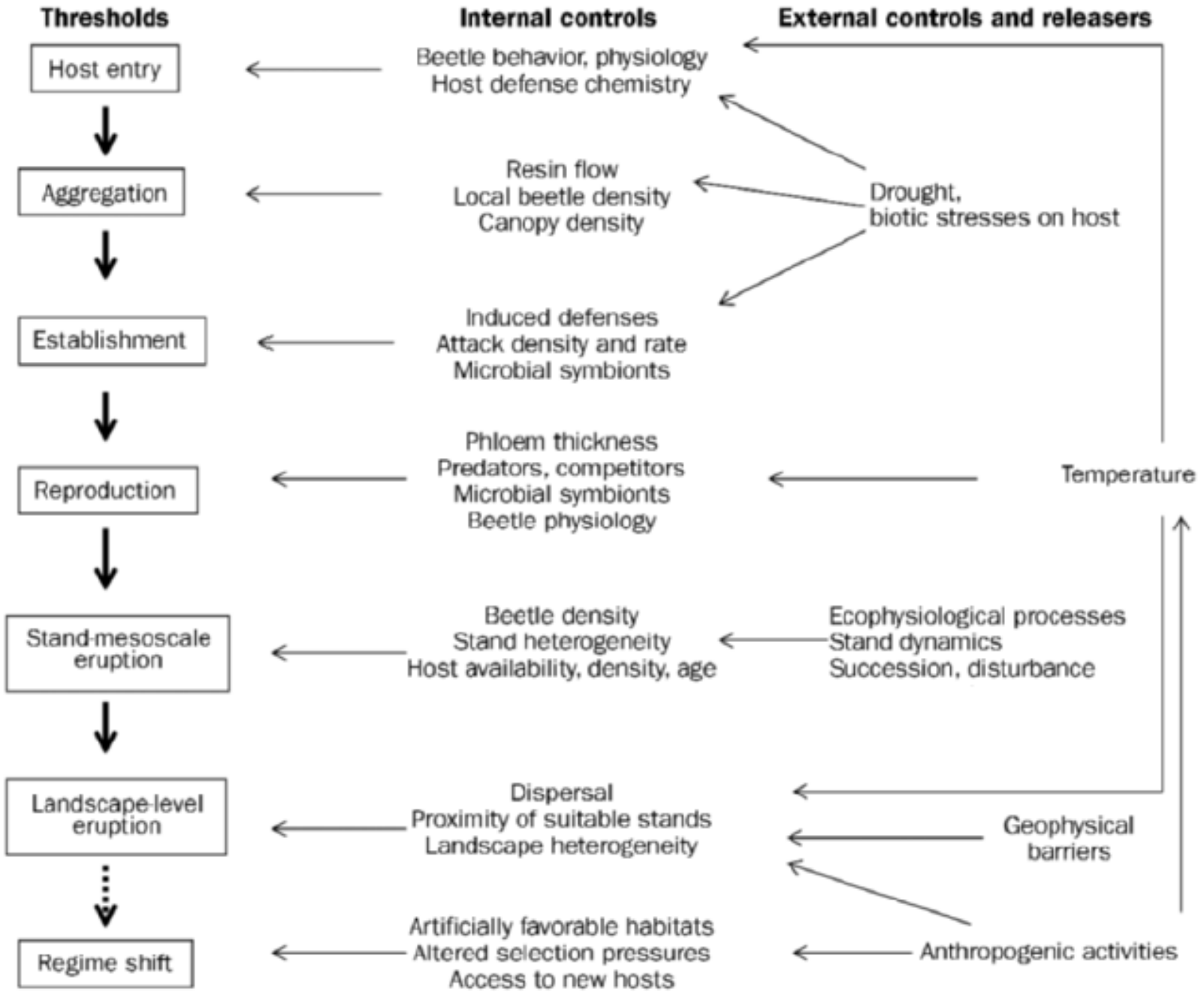


Figure 2. Thresholds, multiple causalities, and sources of feedback in the population dynamics of bark beetles: Conceptual diagram of the sequence of thresholds (solid boxes) that must be crossed to produce a landscape-scale eruption. Thresholds progress across hierarchical scales from individuals (host entry),

We have an old forest

- In 1950, only 4% of our trees were over 120 years old

- In 1998, 58% were over 120 years old

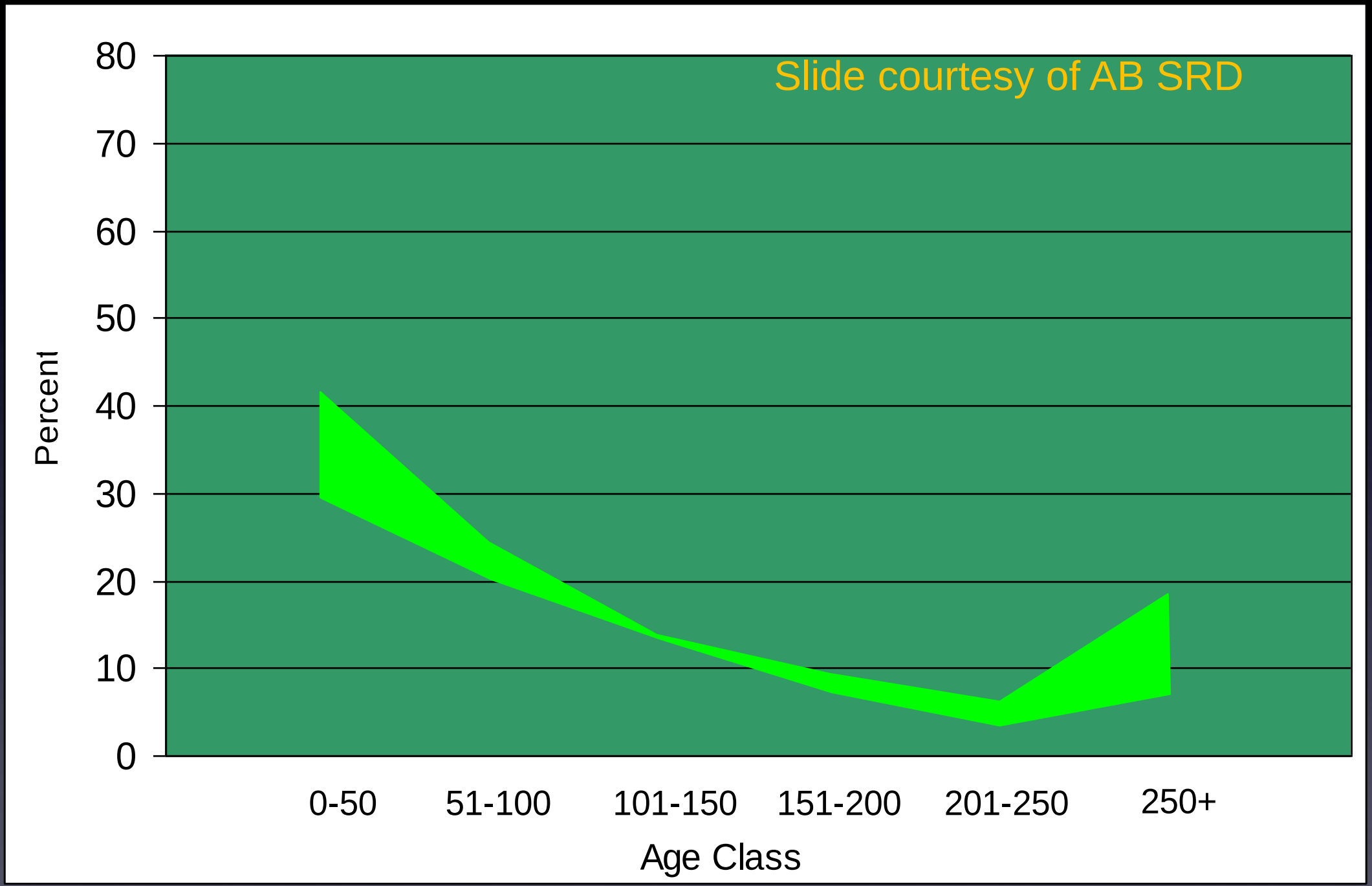
Slide courtesy of AB SRD

4%

58%

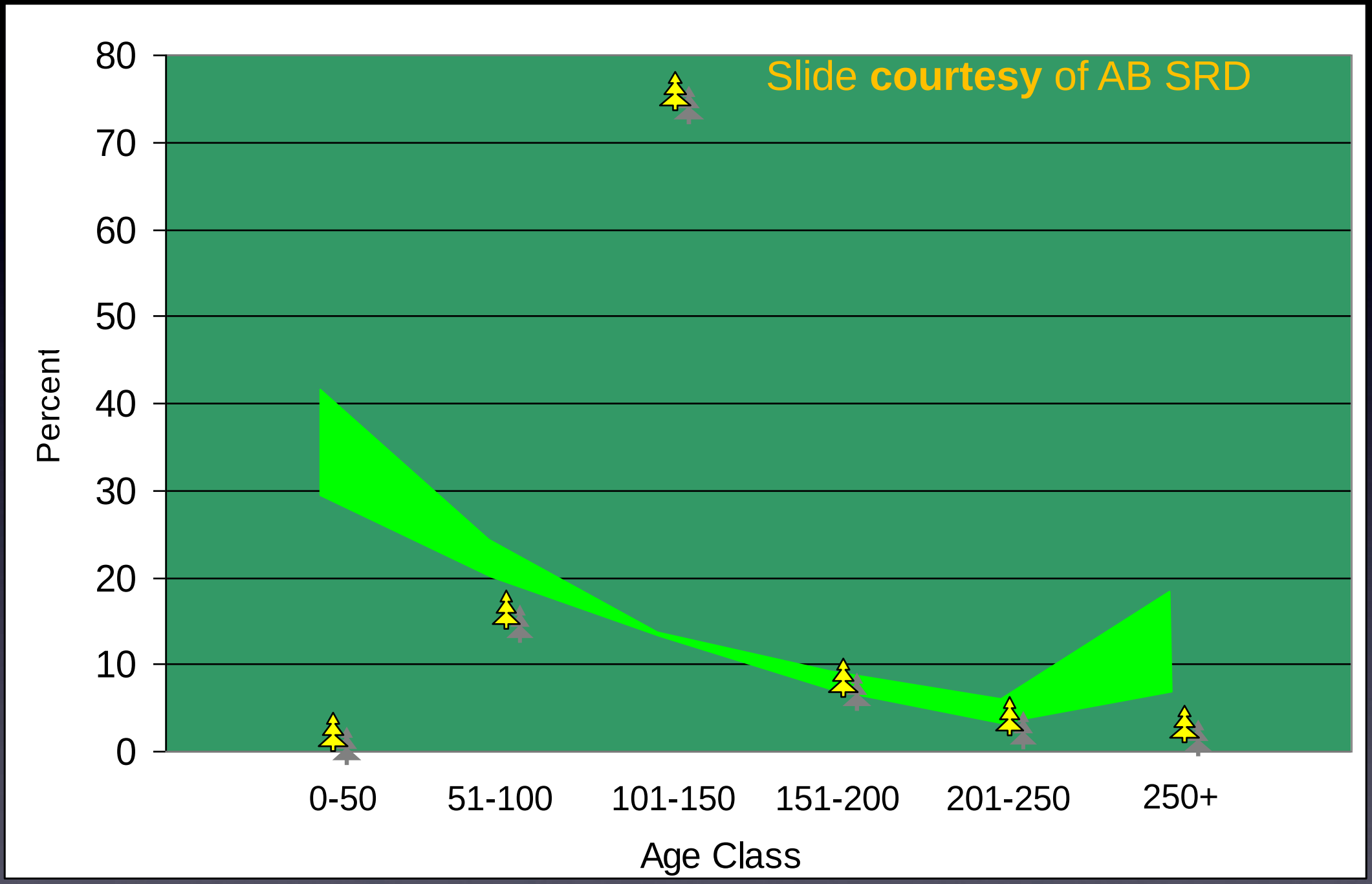
Are either of these numbers typical?
How much variation would we expect “normally”?

Natural Range of Age Classes in the Montane



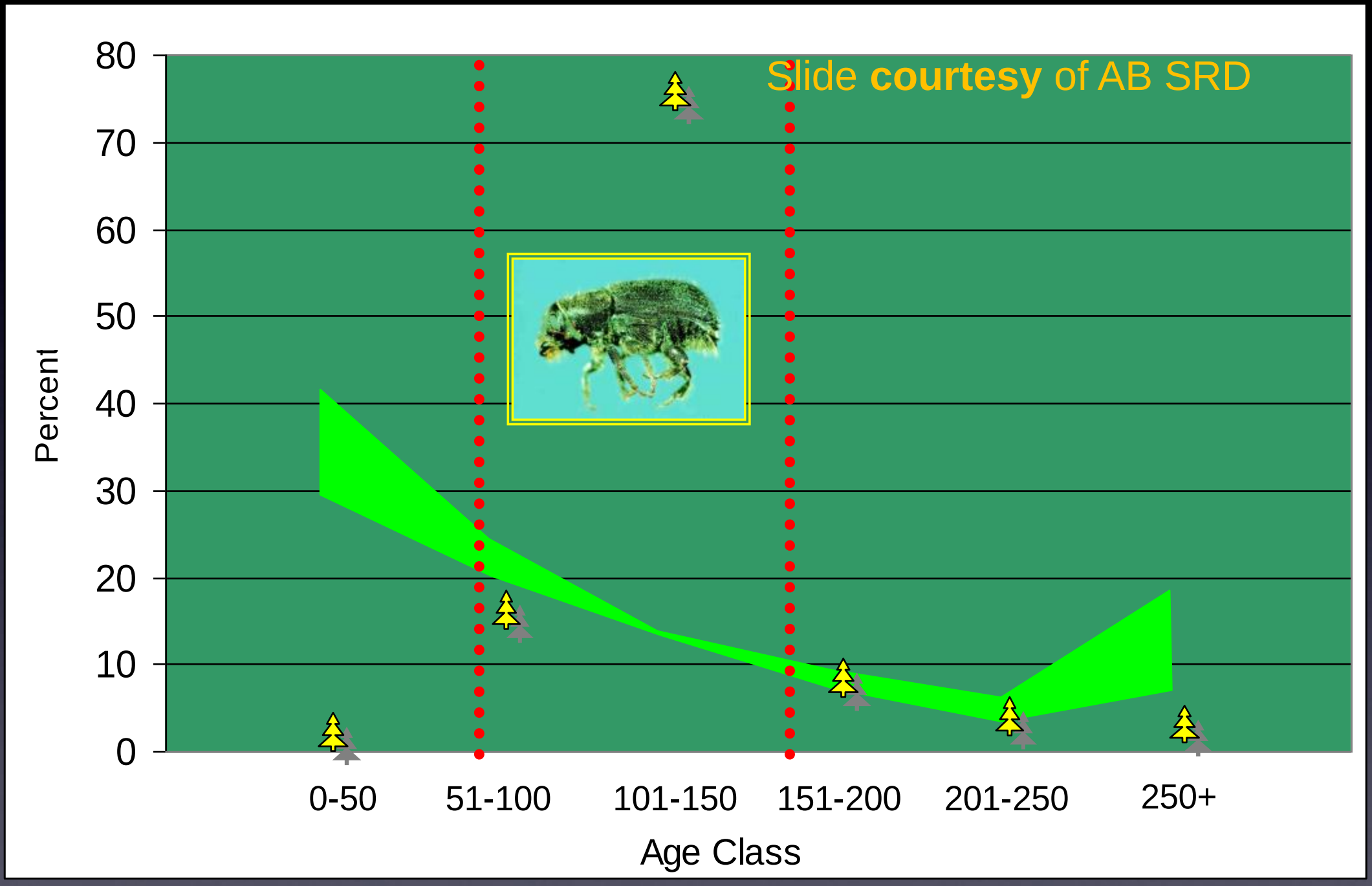
Natural Range of Age Classes in the Montane

With Current Age Class



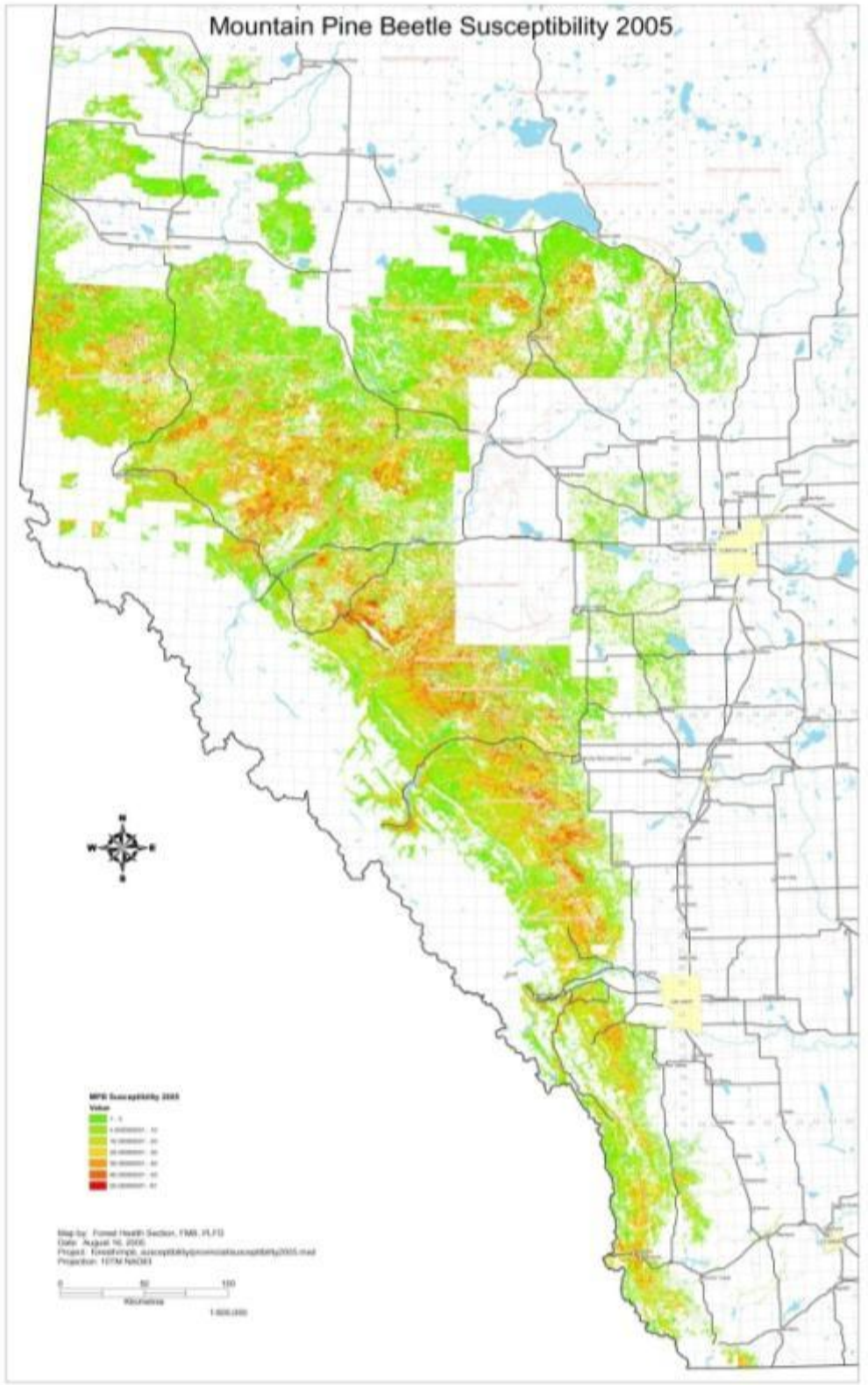
Natural Range of Age Classes in the Montane

With Current Age Class



- In Alberta 42% of the forest is pine.
- There is 6 million ha. of susceptible pine in Alberta

Slide **courtesy** of AB SRD



Understanding the Epidemic

- Interruption of disturbance dynamics
- Less fire = more trees. Mostly pine. Mostly beetle food.
  - But we have not quantified changes in landscape structure directly (has been inferred, and back-casted, but not directly measured)

Learning from the Past

- What if we could directly measure historical landscape structure?
  - Could evaluate many historical changes:
    - MPB susceptibility
    - Grizzly habitat
    - Caribou habitat
    - Fire risk
    - Fire regimes

Requirements

Photos

Multiple photo stations

Clear images

Original and Repeat images

Accurate location data

Data/Technology

Detailed DEM

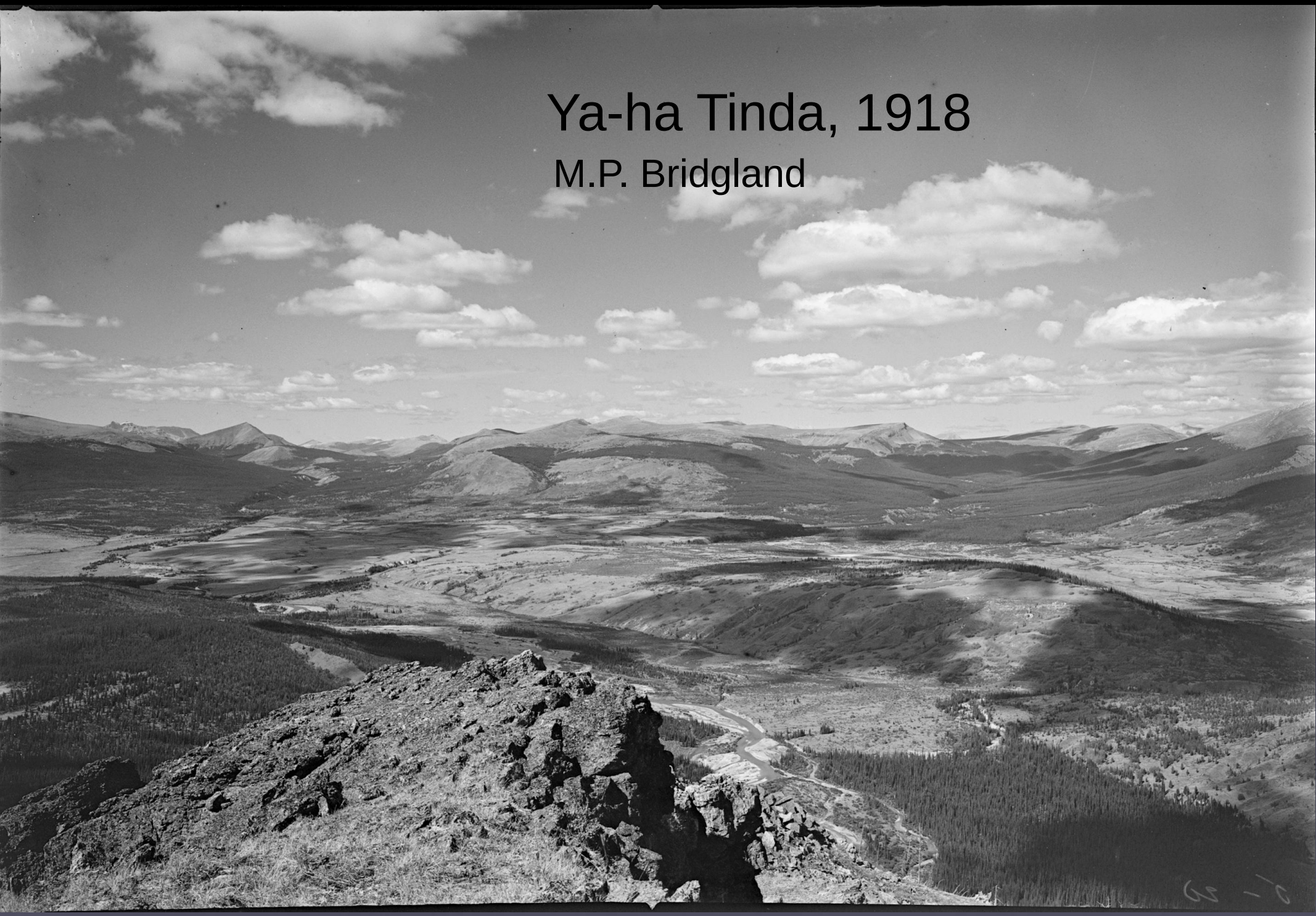
Readily available software

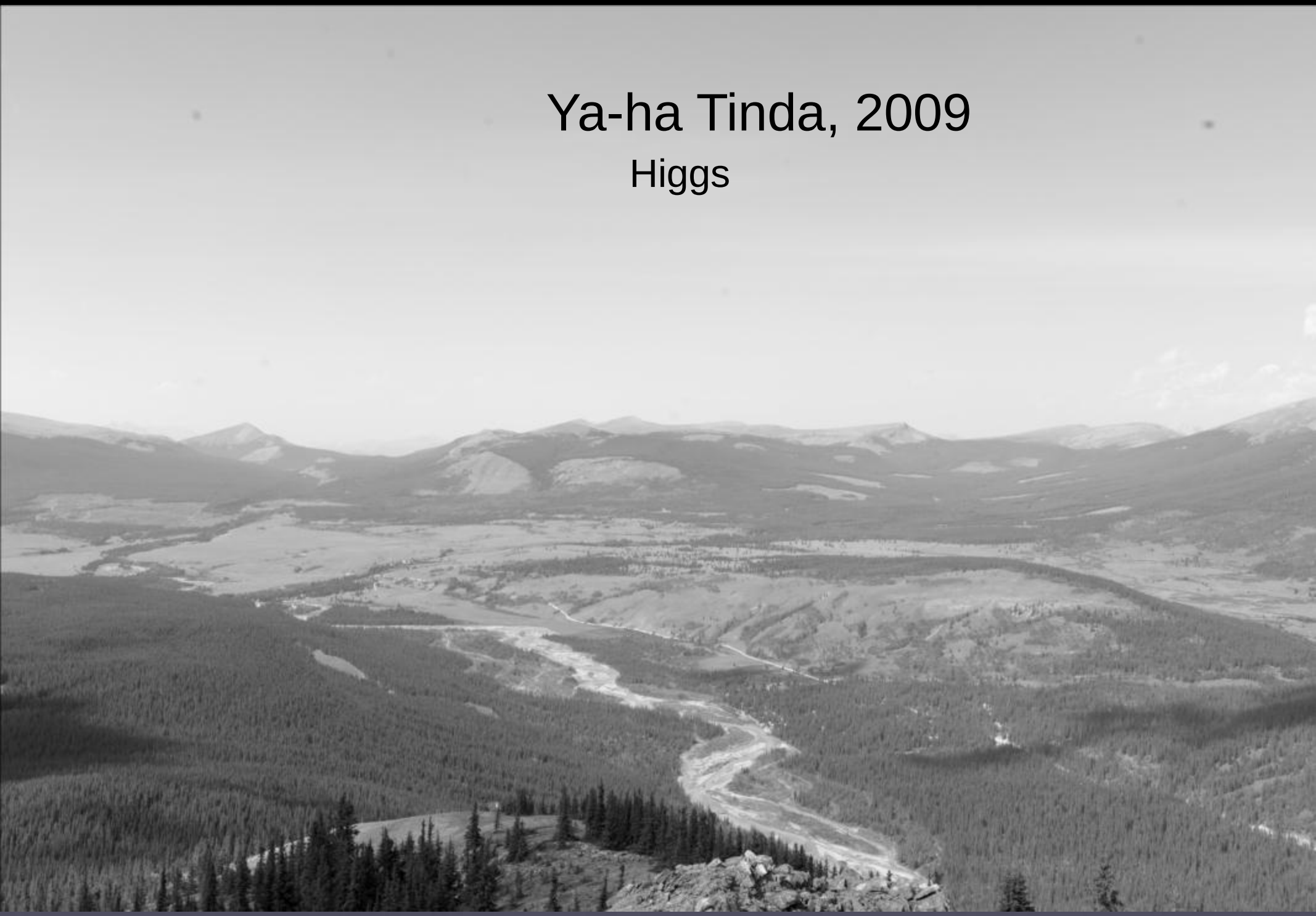
Affordable software

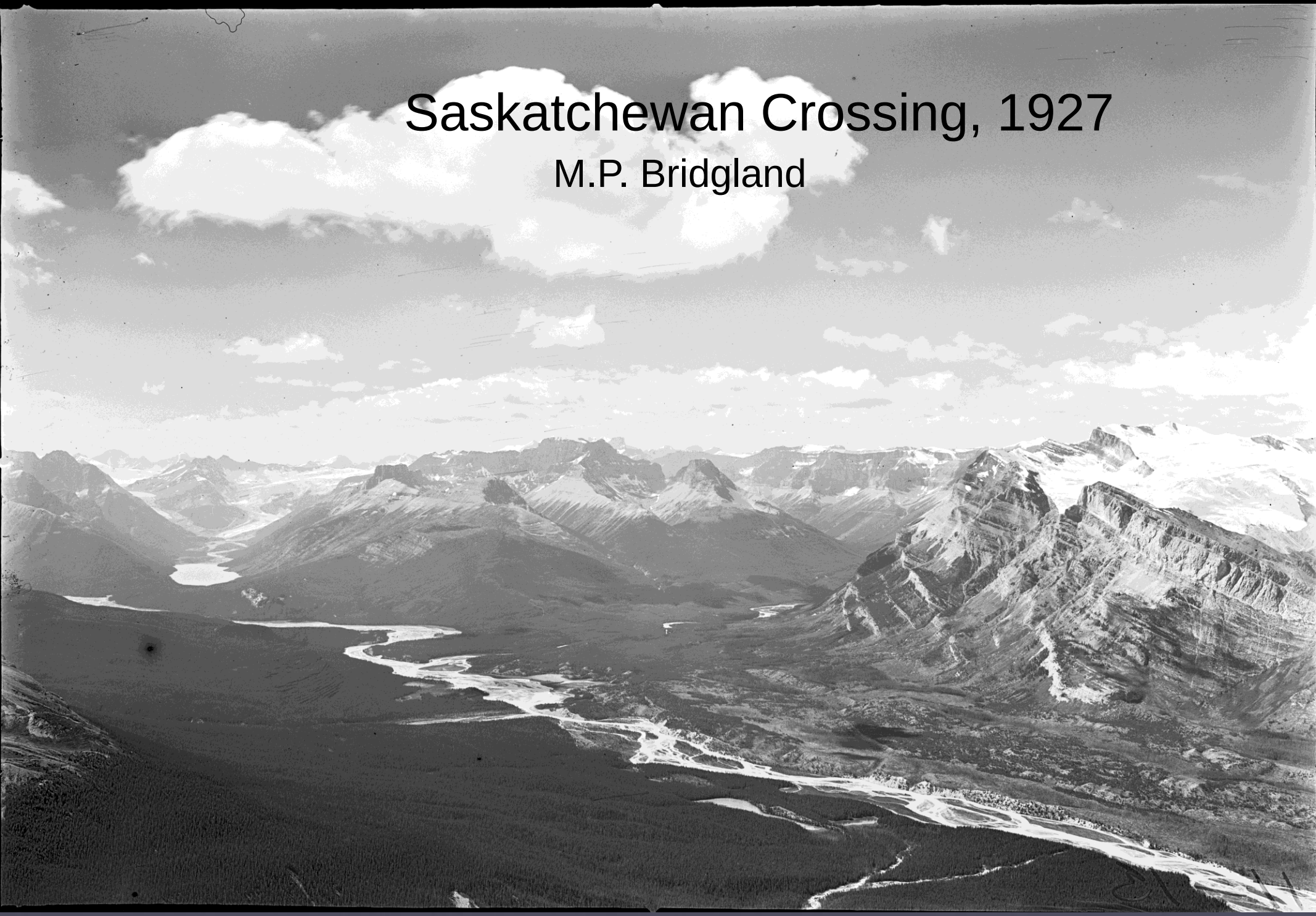
Mountain Legacy Project

- Photos from 1880's-1930's along entire east slopes, most of foothills
- Photos being retaken, significant progress on this endeavour has been made
- Still, these offer only a QUALITATIVE picture
- How can we quantify this?

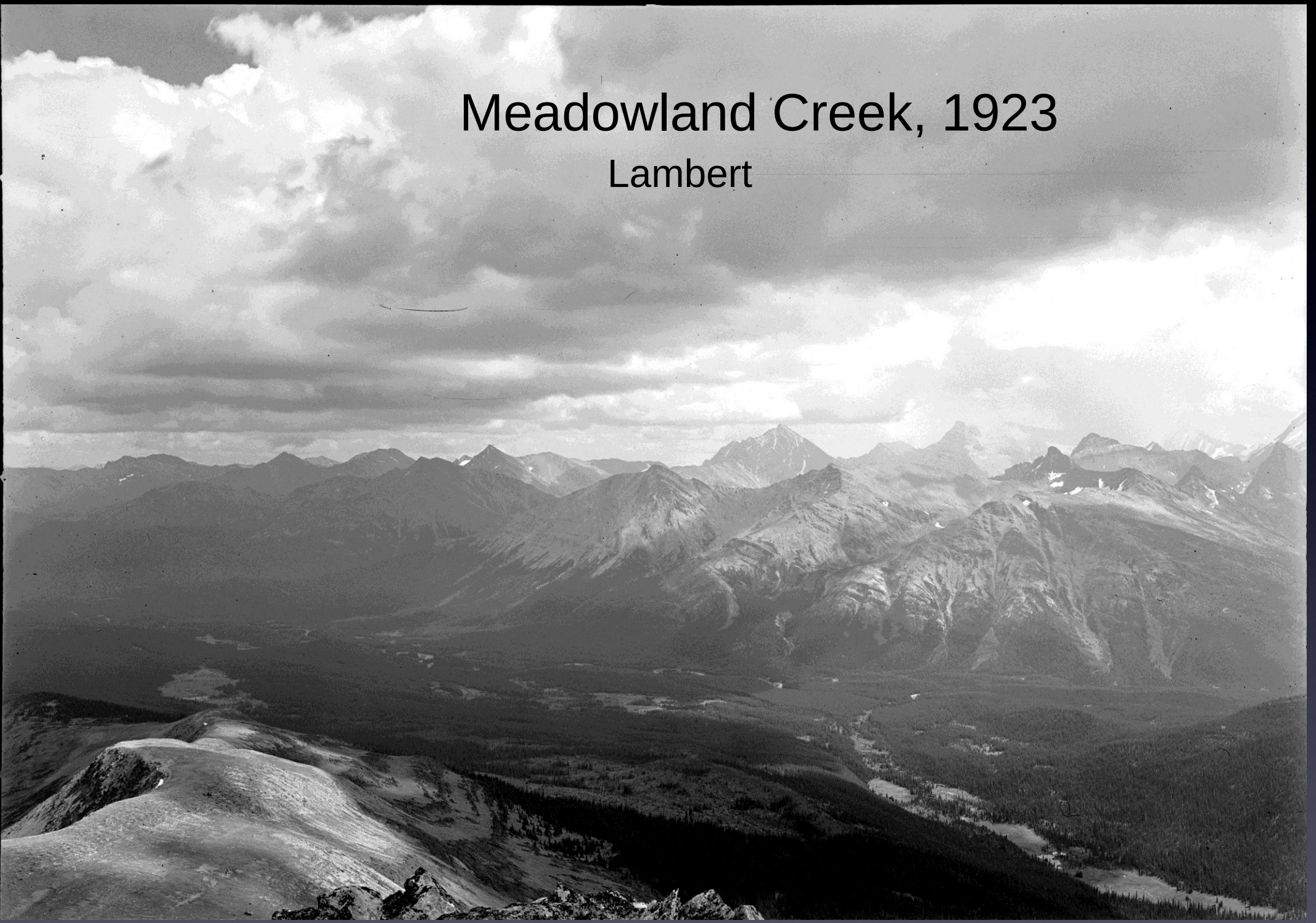
Phototopographic surveying: 1880's-1950's
Repeat Photography (Mountain Legacy Project): 1998-Ongoing


Ya-ha Tinda, 1918
M.P. Bridgland


Ya-ha Tinda, 2009
Higgs


Saskatchewan Crossing, 1927
M.P. Bridgland

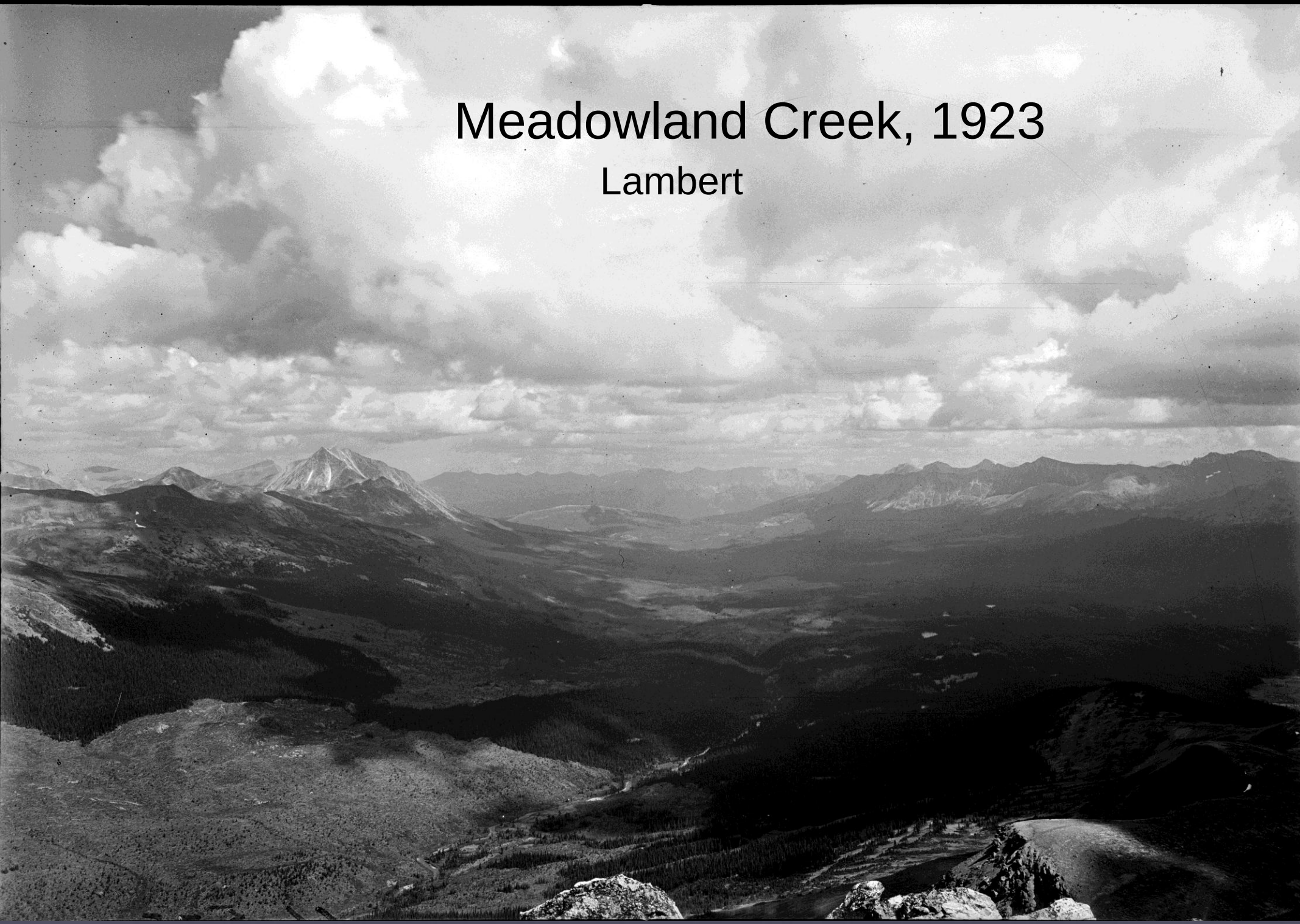

Saskatchewan Crossing, 2009
Higgs



Meadowland Creek, 1923

Lambert


Meadowland Creek, 2009
Higgs



Meadowland Creek, 1923

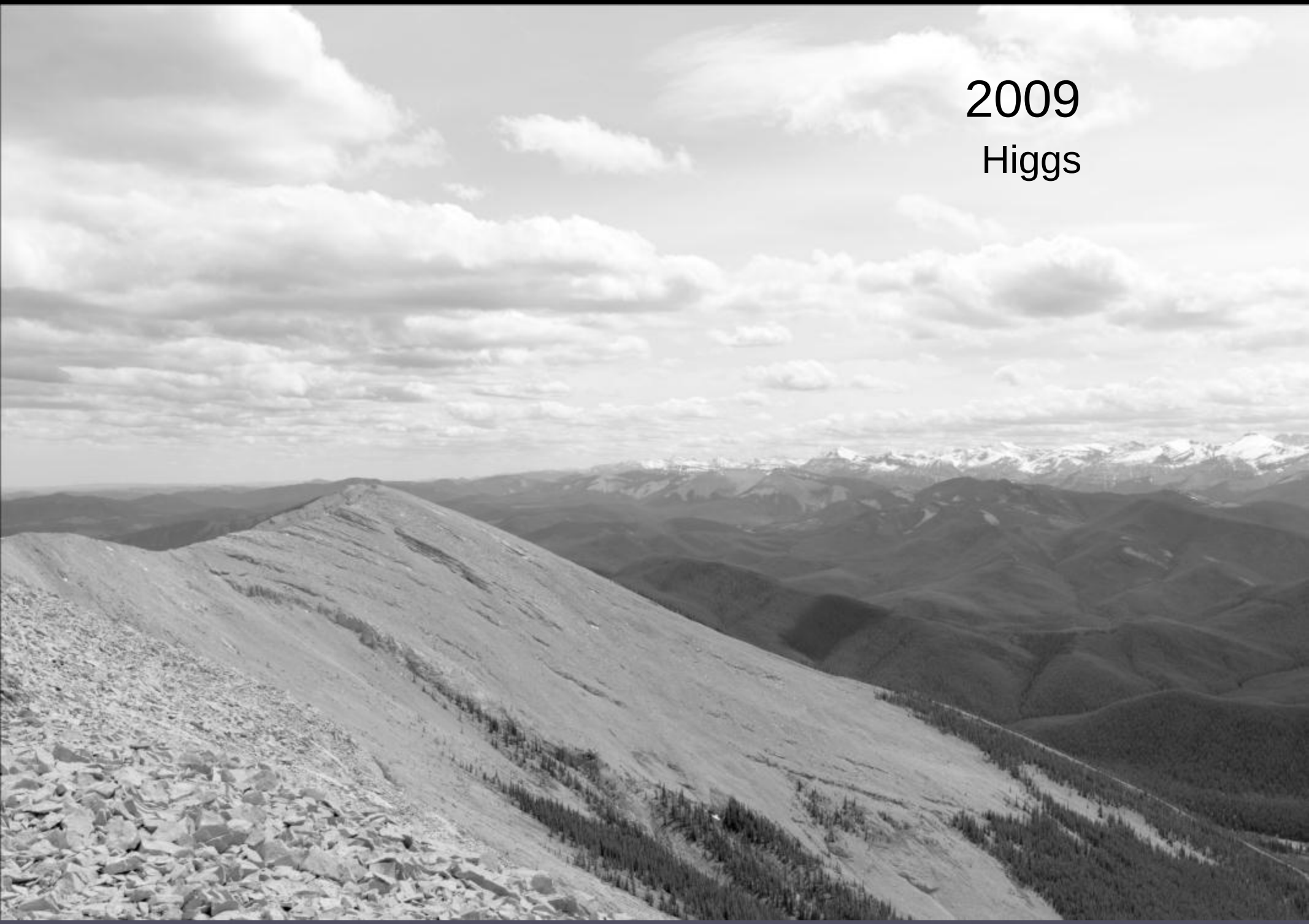
Lambert


Meadowland Creek, 2009
Higgs

Wheeler Irrigation Survey, 1895-1897


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
2009 Google
ery Date: Sep 12, 2002
11 U 642966.55 m E 5647933.44 m N elev 1765 m
Eye alt 13.35 km


~1895
Wheeler


2009
Higgs


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
2009 Google
Imagery Dates: Jun 16, 2002 - Sep 12, 2002
11 U 649175.54 m E 5645047.02 m N elev 1828 m
Eye alt 13.35 km

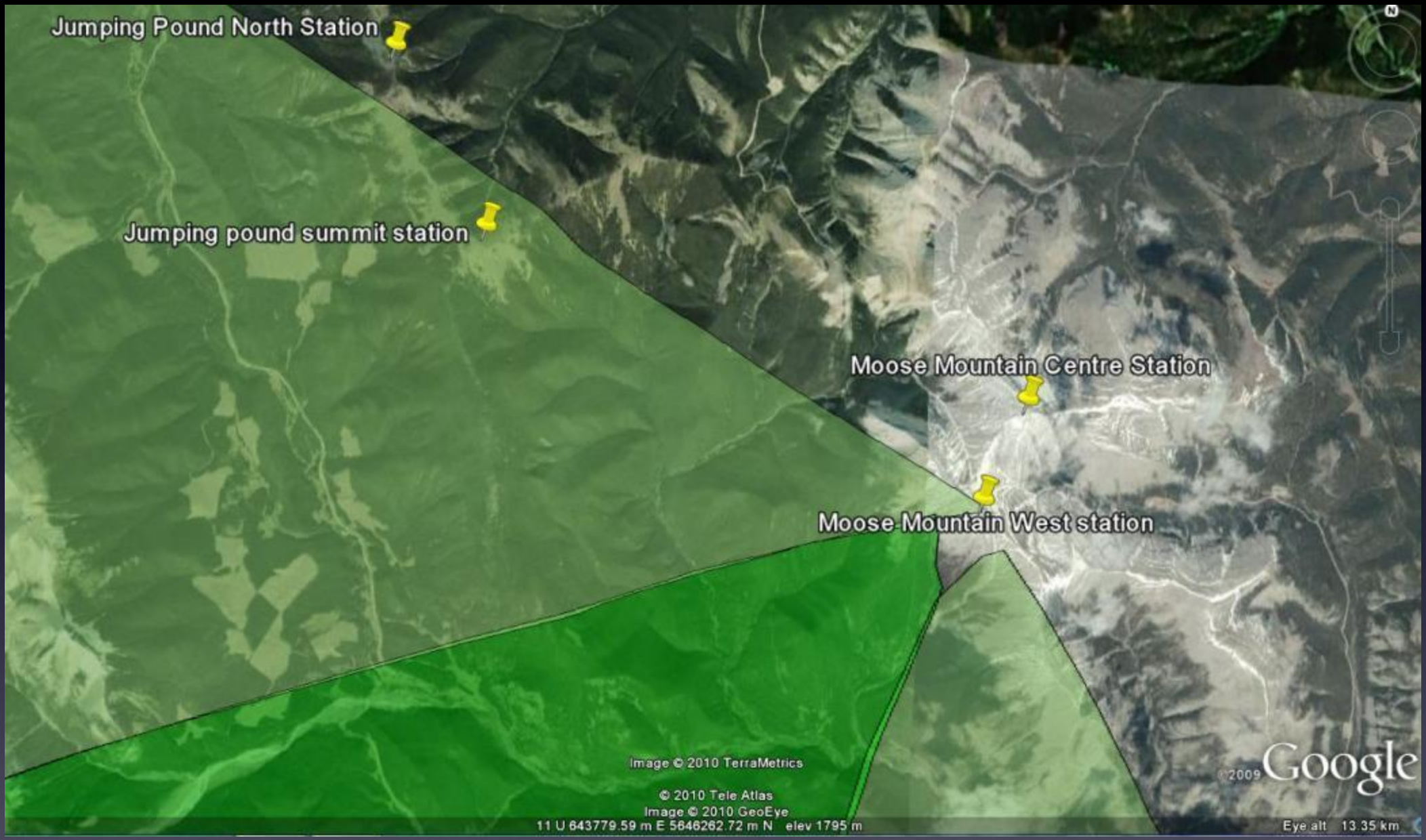

~1895
Wheeler


2009
Higgs

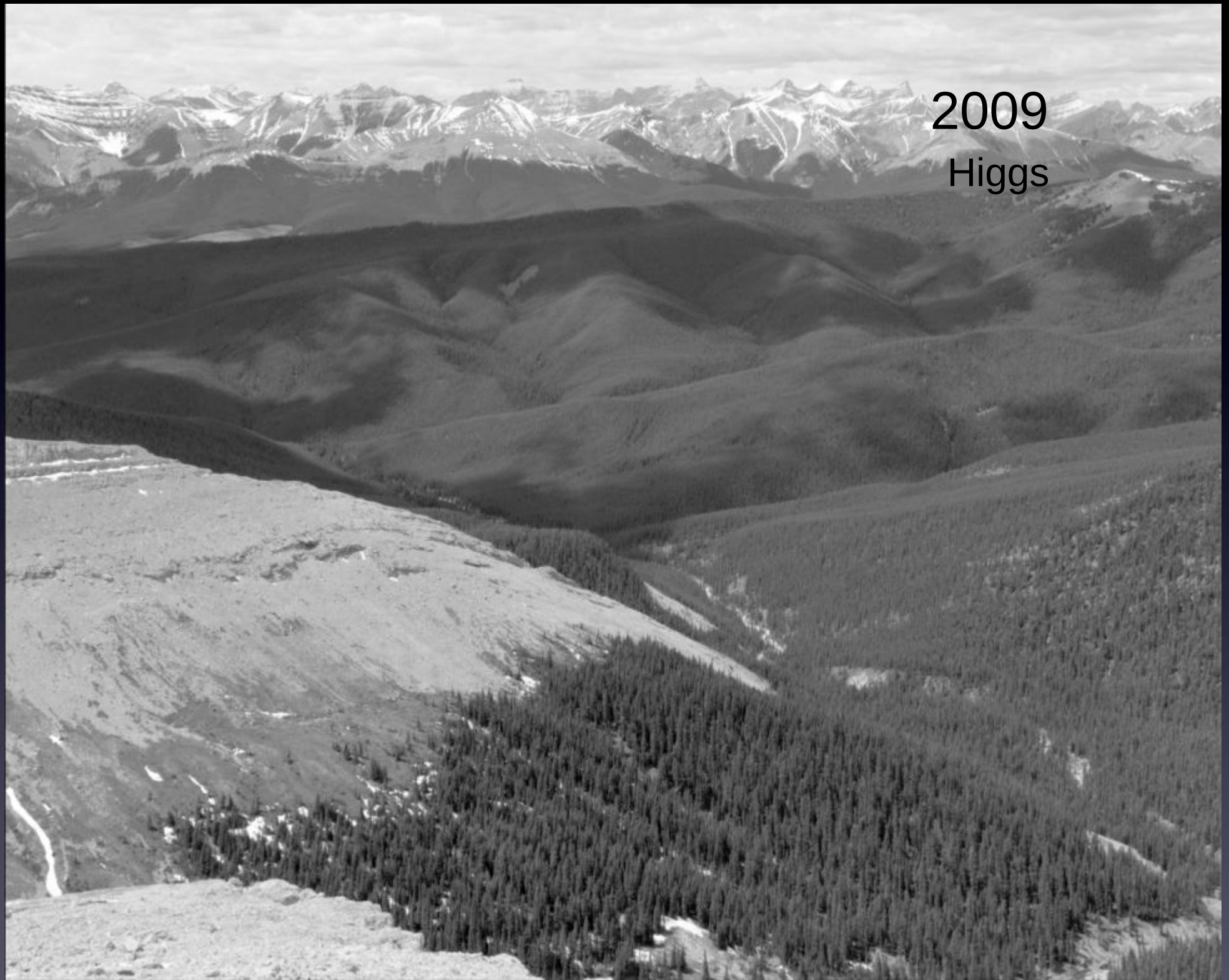

Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
2009 Google
Imagery Date: Sep 12, 2002
11 U 642457.76 m E 5648238.87 m N elev 1789 m
Eye alt 13.35 km

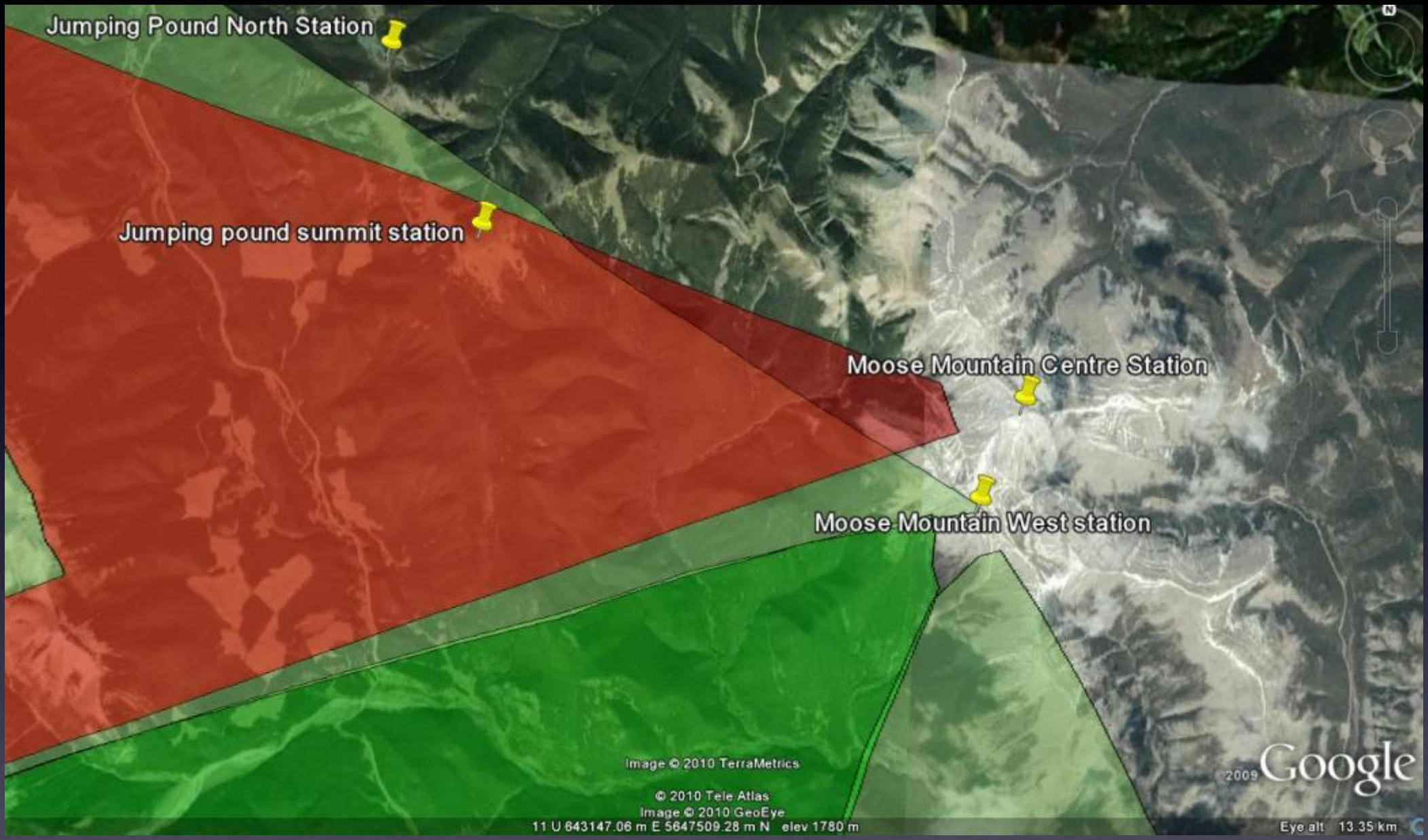

~1895
Wheeler


2009
Higgs


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
11 U 643779.59 m E 5646262.72 m N elev 1795 m
© 2009 Google
Eye alt 13.35 km

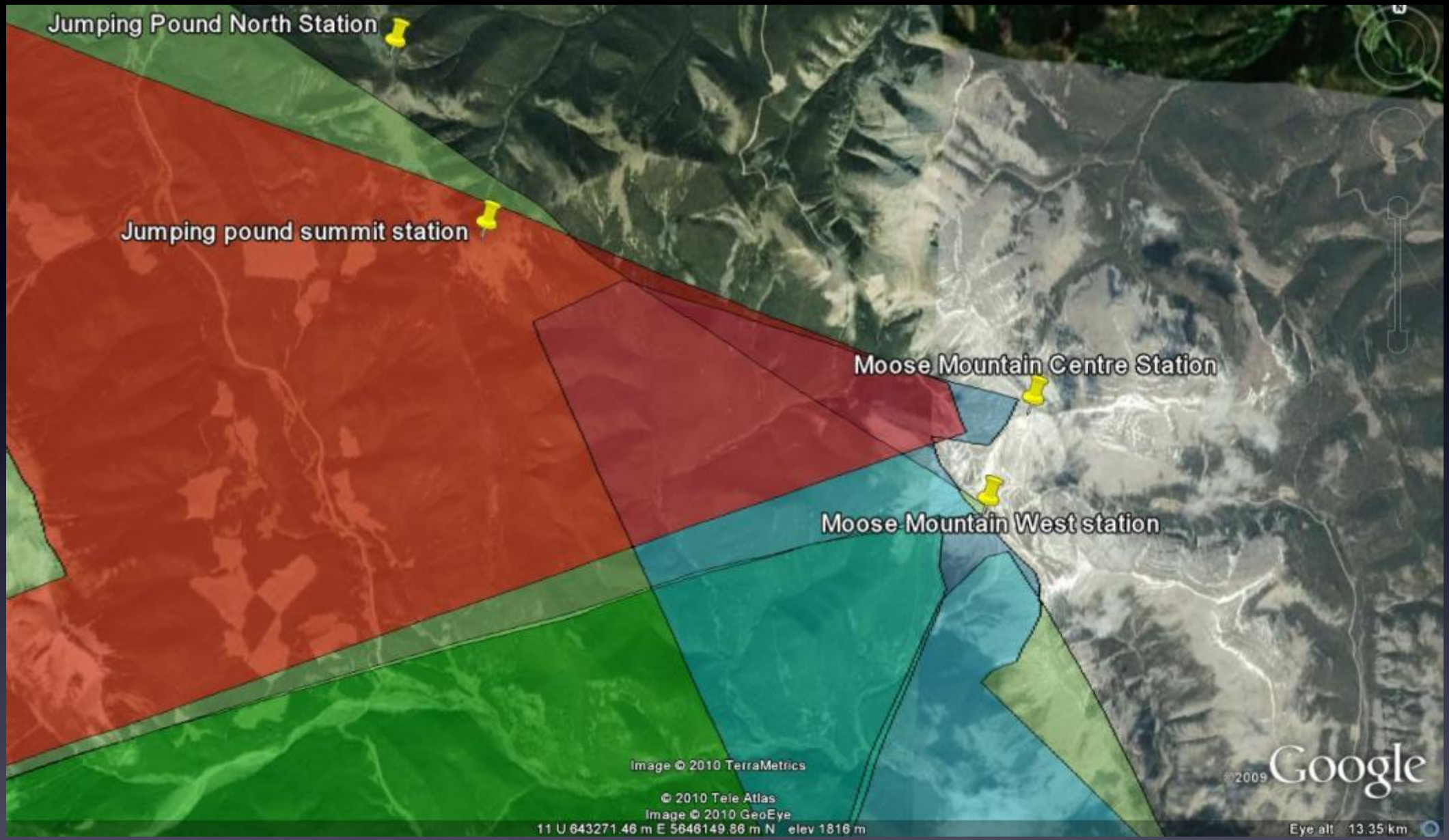

~1895
Wheeler


2009
Higgs


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
11 U 643147.06 m E 5647509.28 m N elev 1780 m
2009 Google
Eye alt 13.35 km

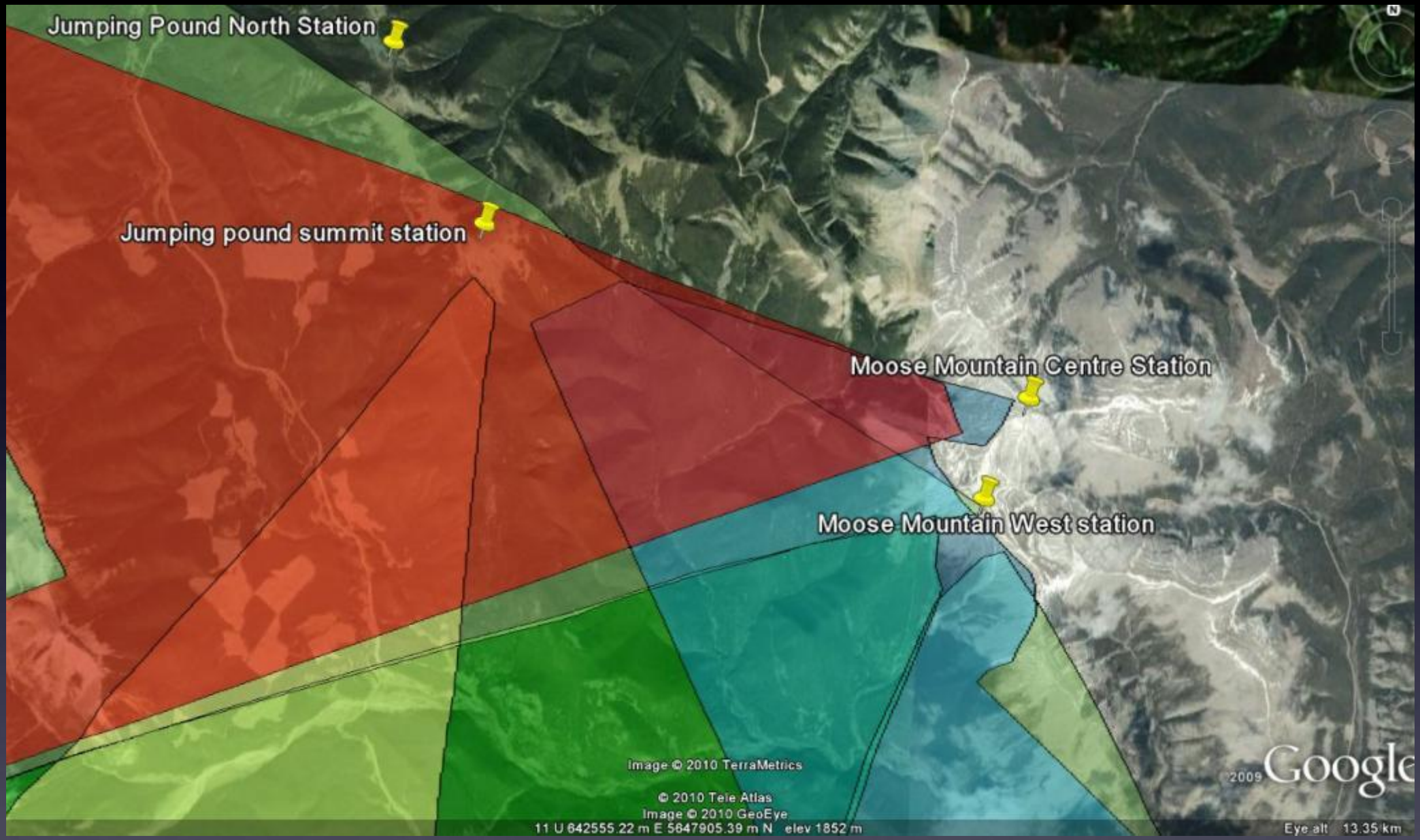

~1895
Wheeler


2009
Higgs

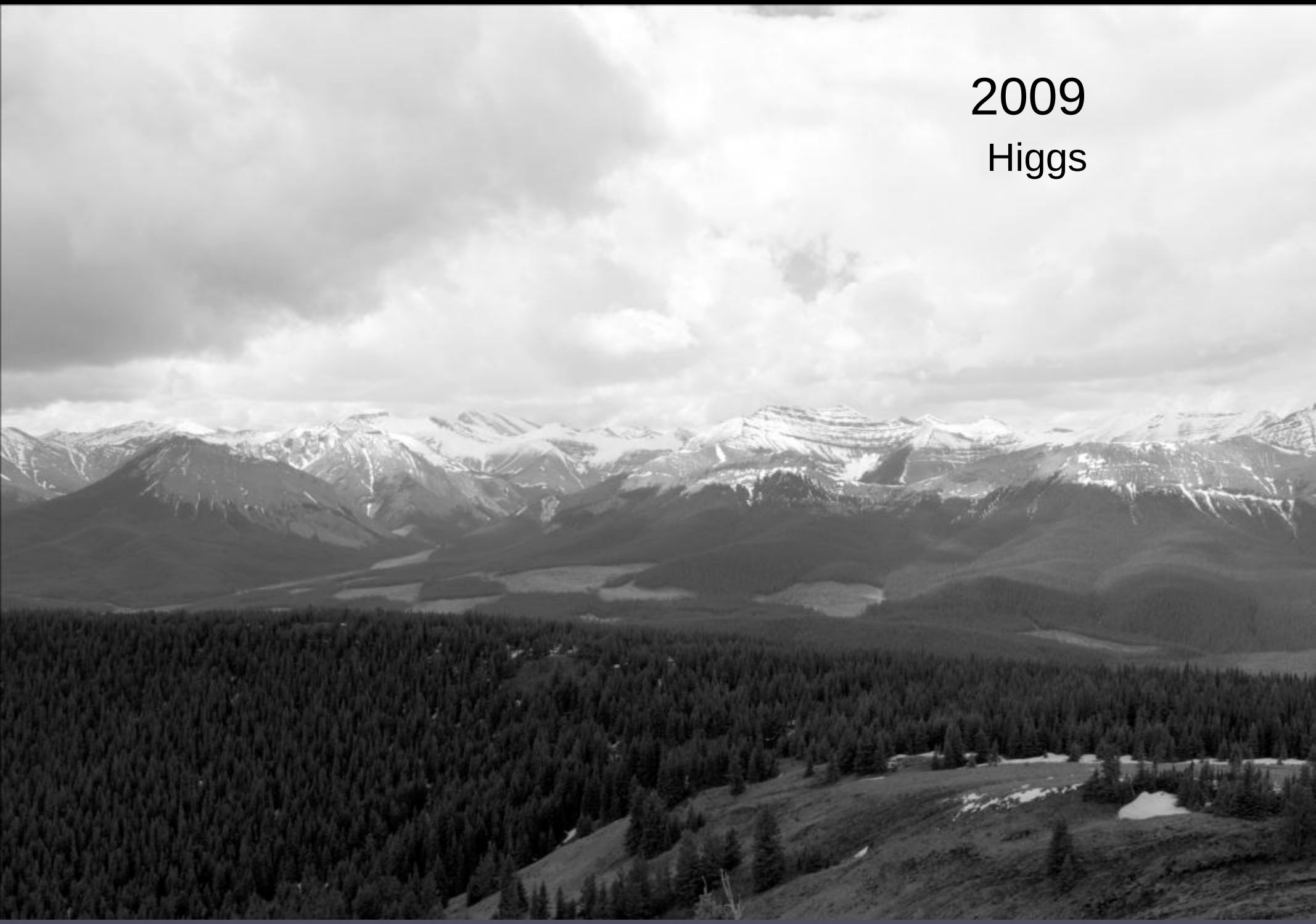

Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
11 U 643271.46 m E 5646149.86 m N elev 1816 m
©2009 Google
Eye alt 13.35 km

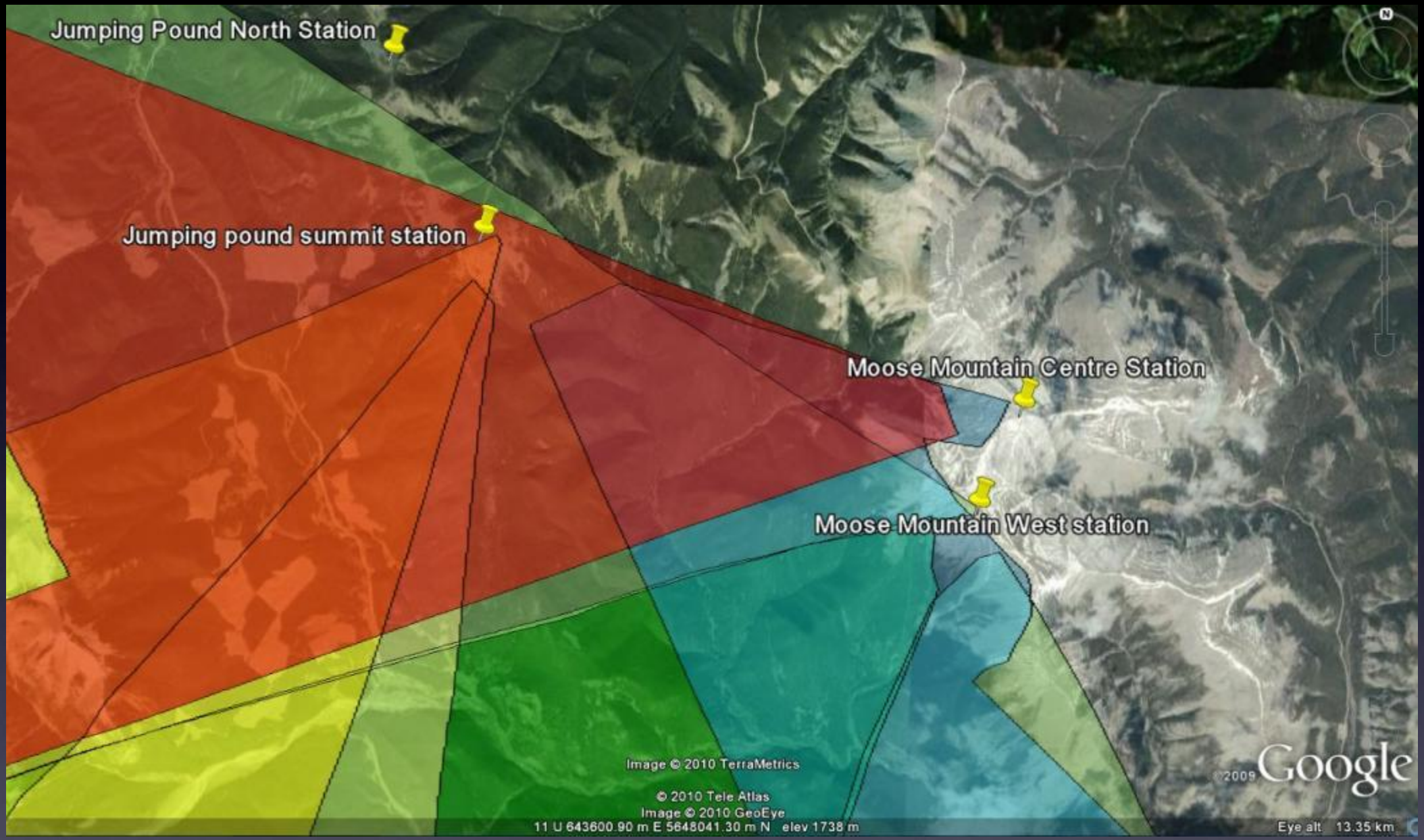

~1895
Wheeler


2009
Higgs


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
11 U 642555.22 m E 5647905.39 m N elev 1852 m
2009 Google
Eye alt 13.35 km


c.1895
Wheeler


2009
Higgs


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
© 2010 Tele Atlas
Image © 2010 GeoEye
11 U 643600.90 m E 5648041.30 m N elev 1738 m
2009 Google
Eye alt 13.35 km

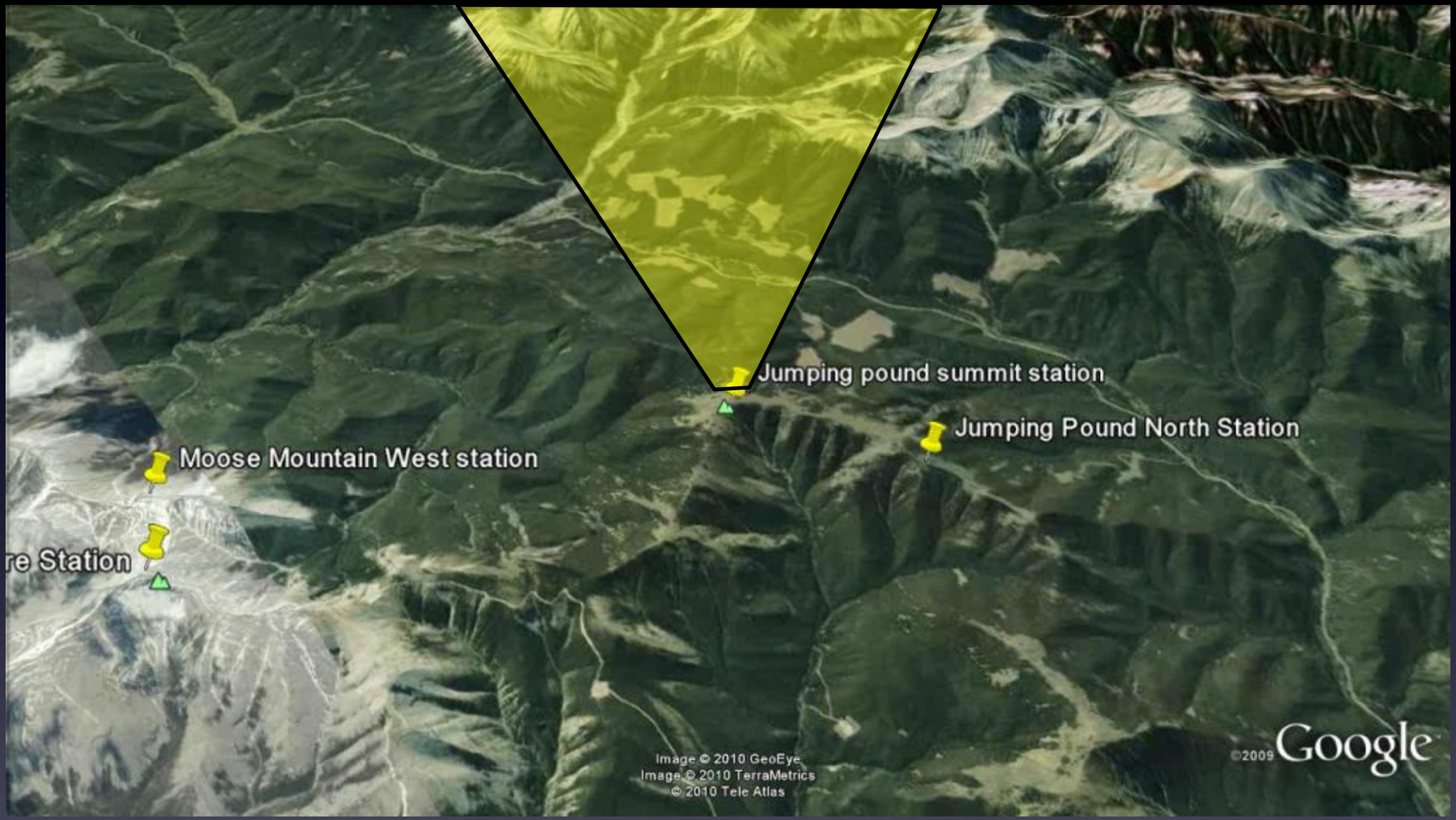
TECHNOLOGY

- Exploring existing and potentially new methods of deriving spatial data from the images:
  - Orthorectification
    - Advantages/disadvantages
  - Vector spatialization
    - Advantages/disadvantages
    - How?

- BCIT students have examined:
  - Three methods
  - Describe and show images from Corripio

- Burning ecoLogic is exploring:
  - Google Earth Pro
  - Other display options
  - Demonstrate what has been done to date


Jumping pound summit station
Image © 2010 GeoEye
© 2010 Tele Atlas
©2009 Google


Jumping pound summit station
Jumping Pound North Station
Moose Mountain West station
re Station
Image © 2010 GeoEye
Image © 2010 TerraMetrics
© 2010 Tele Atlas
©2009 Google

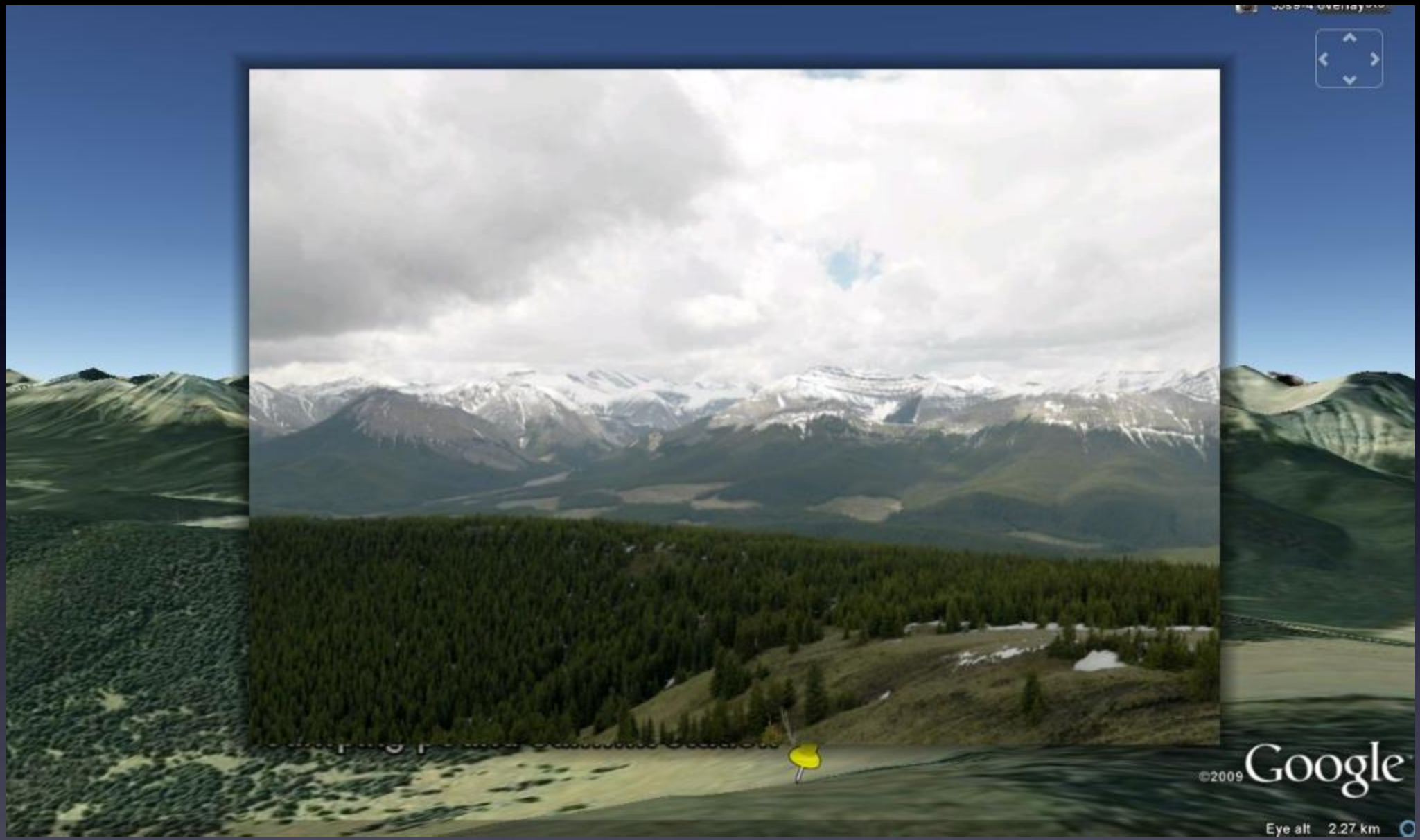

©2009 Google
Eye alt 2.27 km


Image © 2010 GeoEye
© 2010 Tele Atlas
©2009 Google
11 U 644362.43 m E 5641055.12 m N elev 1796 m
Eye alt 5.89 km


Image © 2010 GeoEye
© 2010 Tele Atlas
©2009 Google
11 U 644038.06 m E 5640922.30 m N elev 1832 m
Eye alt 5.89 km


Image © 2010 GeoEye
© 2010 Tele Atlas
©2009 Google
11 U 644037.20 m E 5641055.55 m N elev 1872 m
Eye alt 5.89 km


Jumping Pound North Station
Jumping pound summit station
Moose Mountain Centre Station
Moose Mountain West station
Image © 2010 TerraMetrics
Image © 2010 GeoEye
© 2010 Tele Atlas
11 U 642536.06 m E 5648752.85 m N elev 1760 m
Google
Eye alt 13.34 km


JJs9-4 overlay
Edit Photo
Jumping pound summit station
©2009 Google

Using a 1m DEM shows improvement in polygon placement without adjusting image overlay

What is the error in SIZE?
Will be testing in April-May

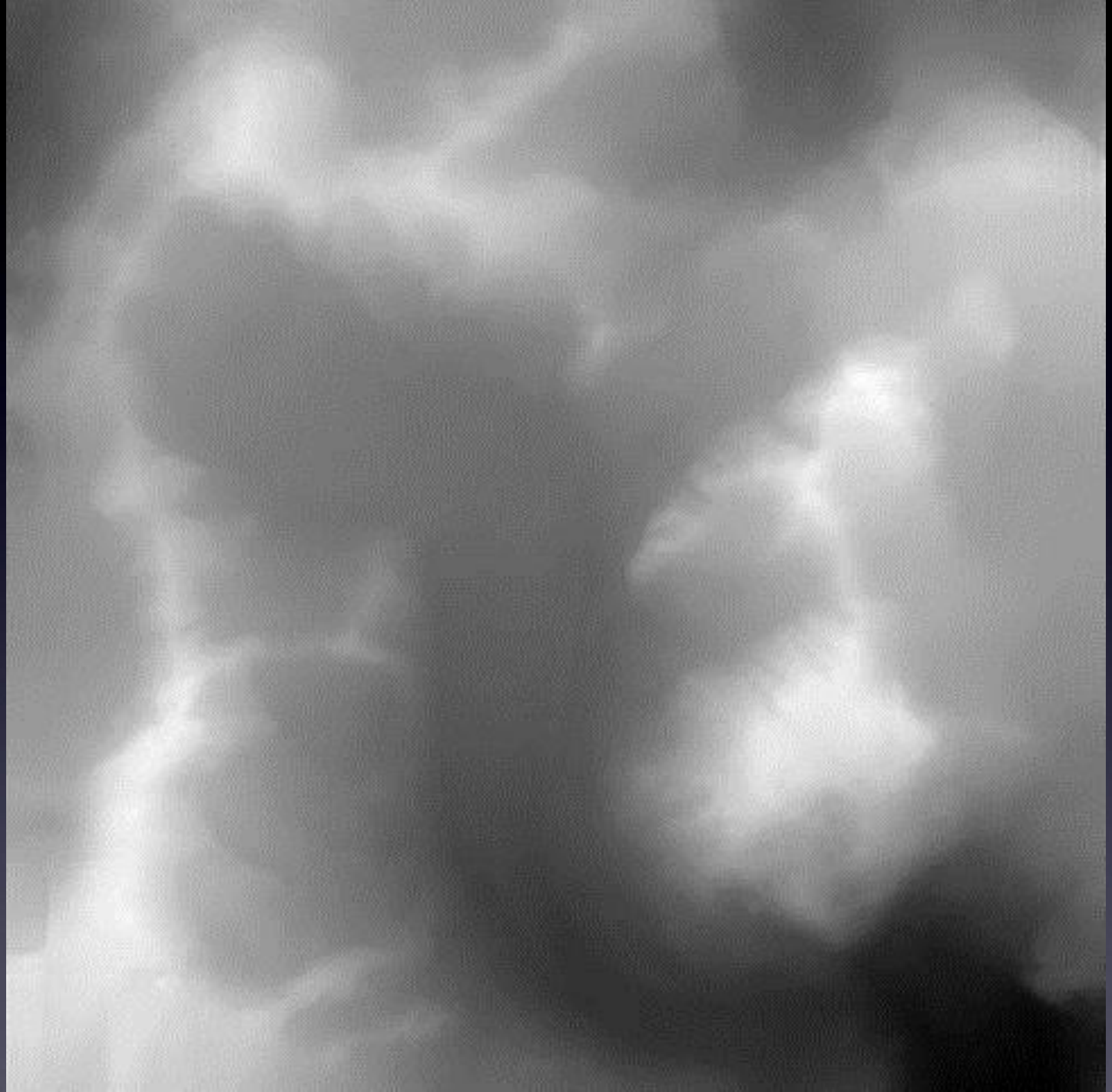
INT. J. REMOTE SENSING, 20 DECEMBER, 2004,
VOL. 25, NO. 24, 5705–5729

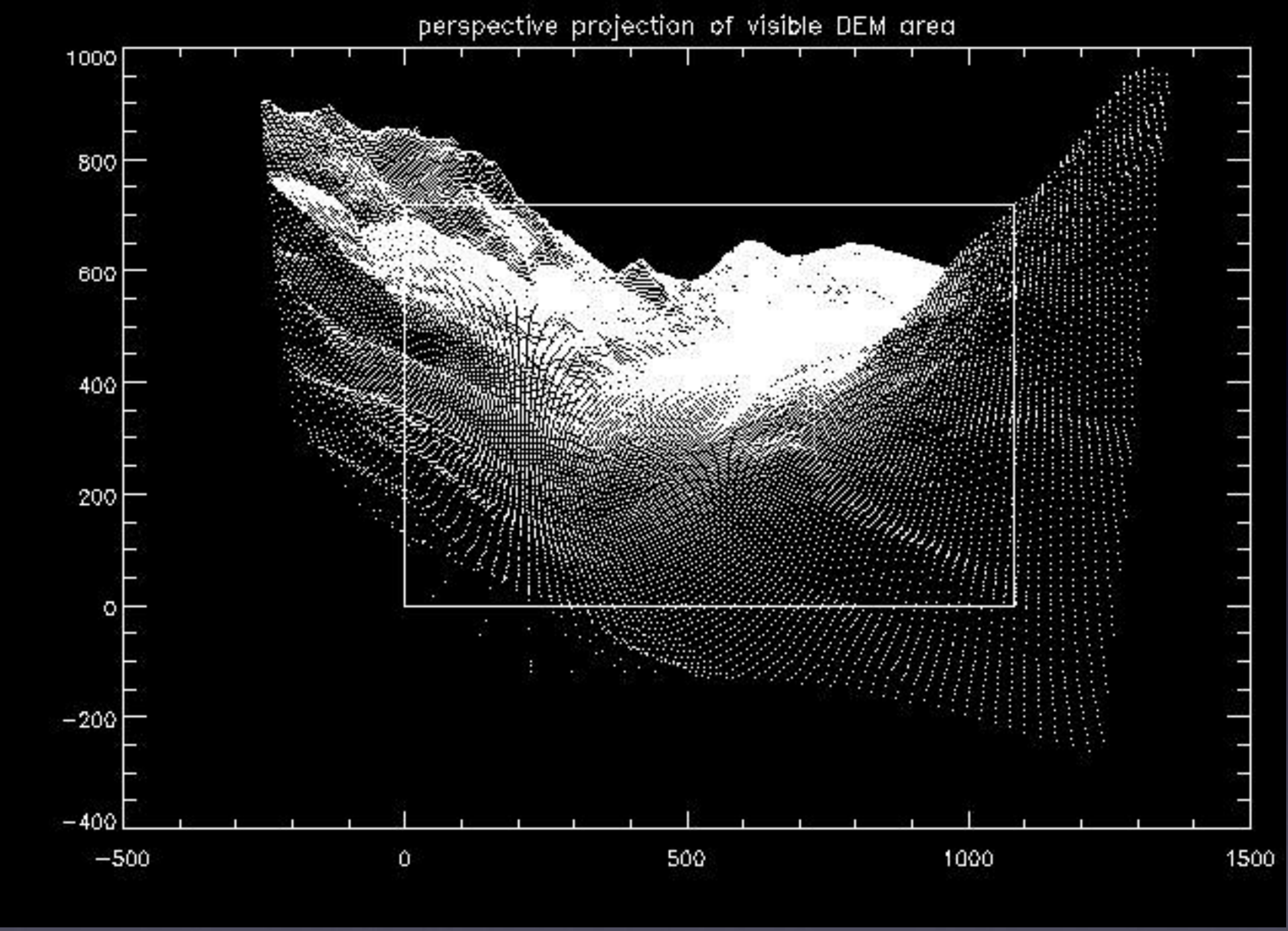
Taylor & Francis
Taylor & Francis Group

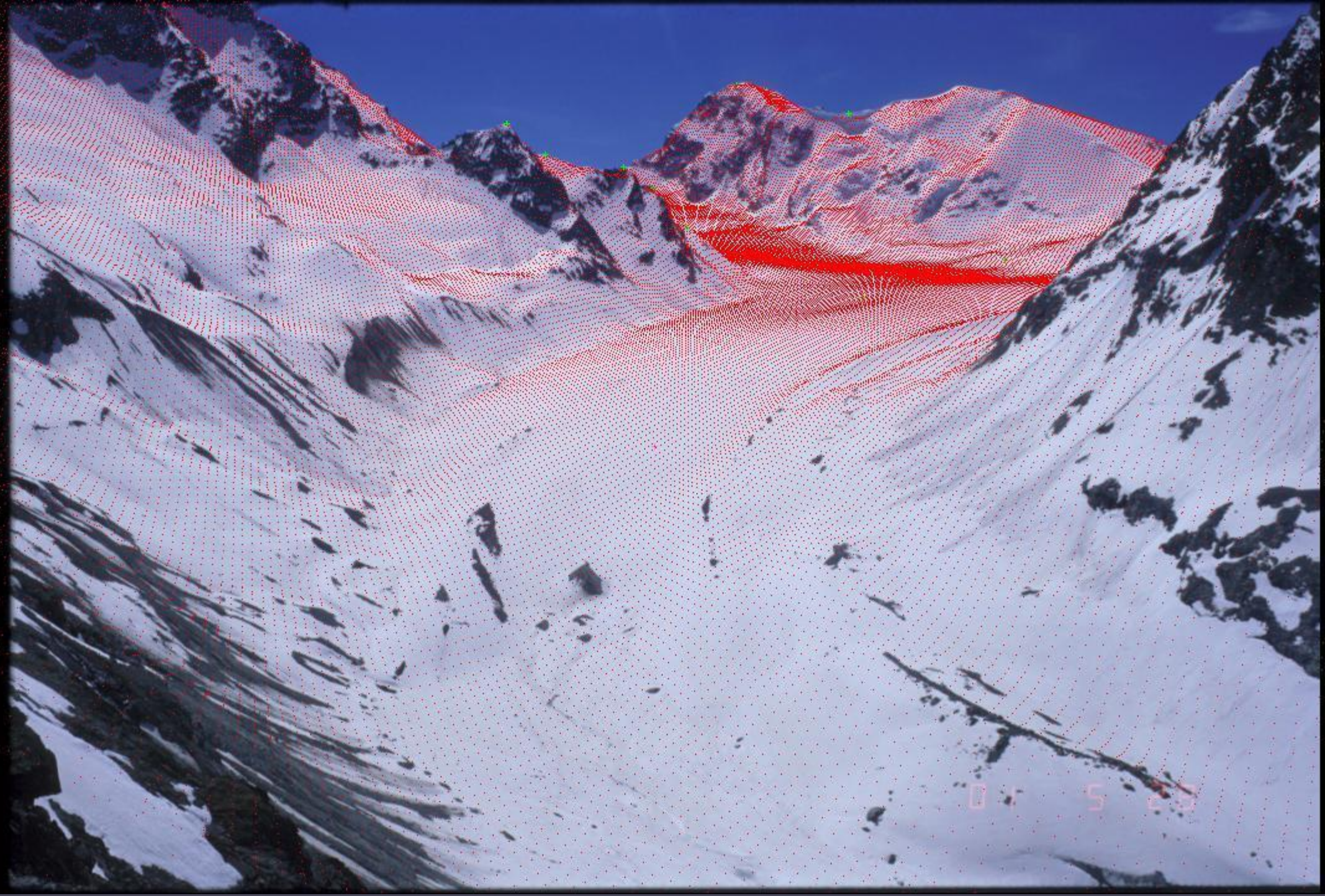
Snow surface albedo estimation using terrestrial photography

J. G. CORRIPIO*

Department of Geography, University of Edinburgh, Drummond Street, Edinburgh EH8 9XP, UK




perspective projection of visible DEM area
1000
800
600
400
200
0
−200
−400
−500
0
500
1000
1500



Stay tuned!

More to come by Sept, 2010