SnowEx: a NASA airborne campaign leading to a snow satellite mission

SnowEx update: Sep 1, 2016

SnowEx Team/contributors to this report: Edward Kim, Charles Gatebe, Amy Misakonis, Dorothy Hall, HP Marshall, Ludovic Brucker, Kelly Elder, Chris Hiemstra, Matt Beckley

Sponsored by NASA Headquarters/Terrestrial Hydrology Program Manager: Jared Entin

Outline

- Welcome – Ed Kim/C. Gatebe (3 min)
- Schedule & Logistics – Amy (5 min)
- Ground truth/GBRS – Kelly/Ludo/HP/Chris (15min)
- Airborne– Ed/Gatebe/M.Beckley (10 min)
- Experiment Plan – Ed/Gatebe (3 min)
- Updates from HQ – Jared Entin (5 min)
- Q&A – (10 min)

For more information, see snow.nasa.gov → snowex

SCHEDULE STATUS AND RISKS

Amy Misakonis

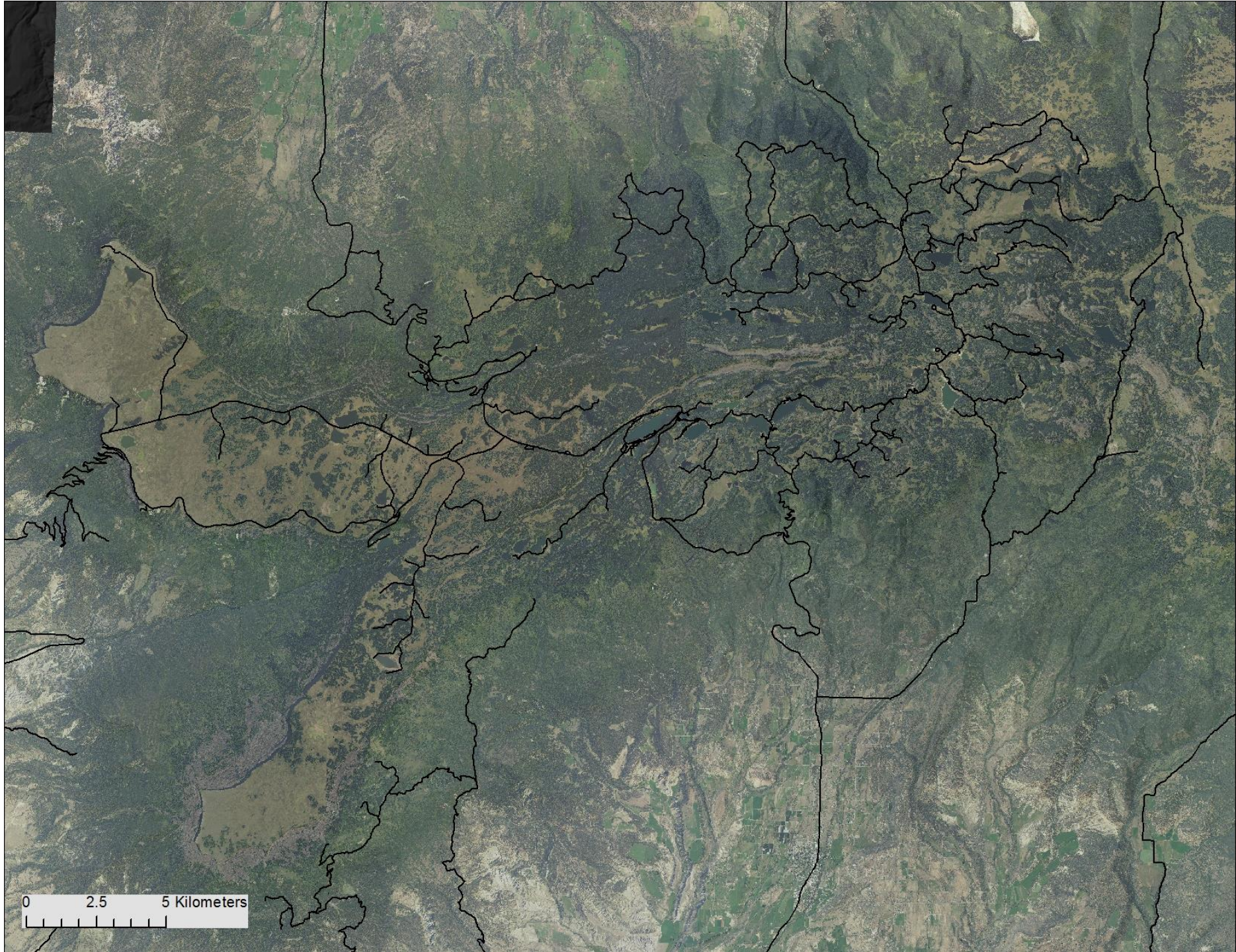
SnowEx Major Milestones

- Fall Deployment – 9/25/16 – 10/4/16
  - Ground Truth
  - ASO
- Instruments on Deck @ Aircraft Facility – 12/15/16
- Test Flight – 1/26/17 – 1/30/17
- Winter Deployment
  - Early GT Arrival – 2/1/17
  - Aircraft and GT Campaign – 2/6/17 – 2/24/17
- Final Data Delivery from all Instruments – 6/30/17

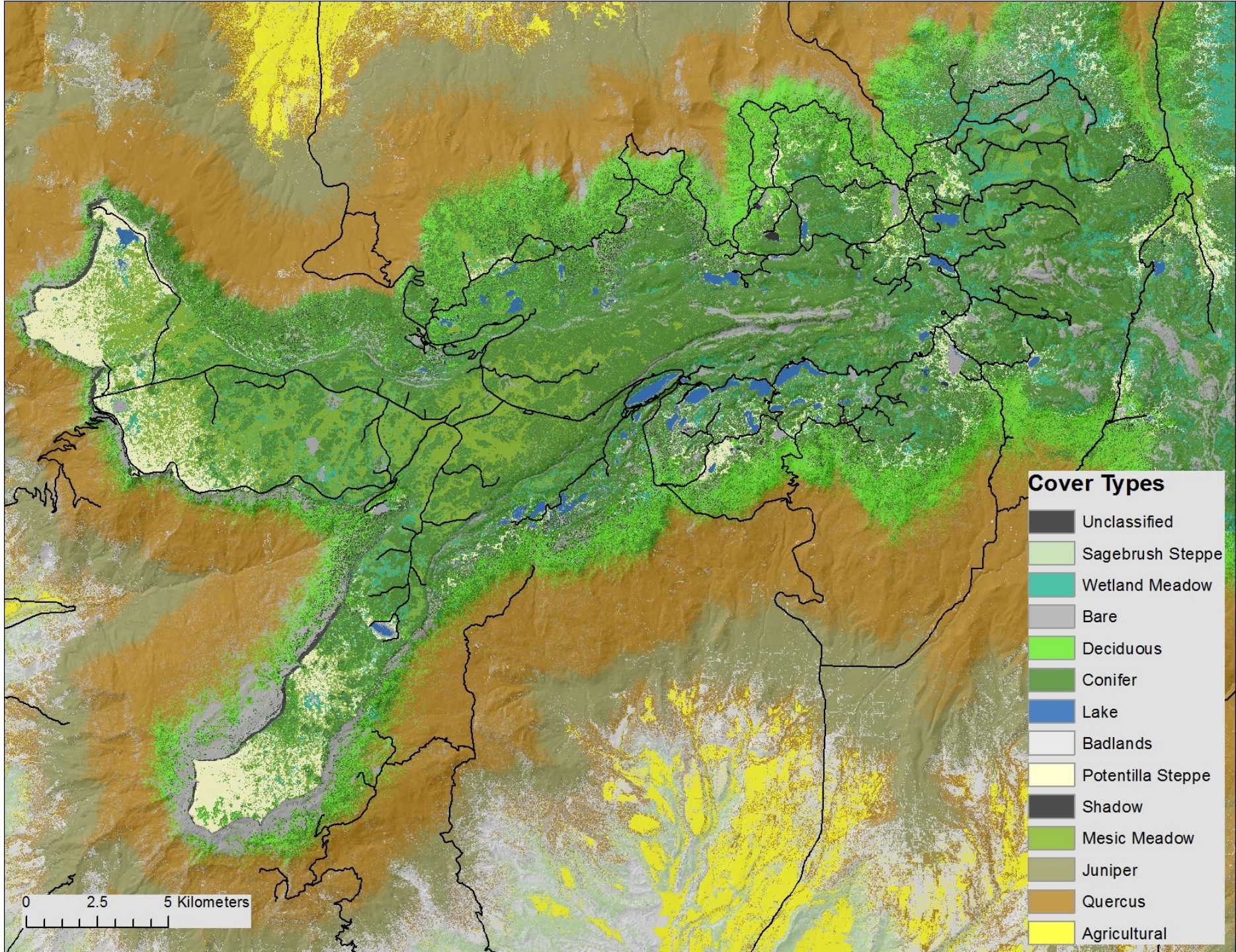
Ground truth/ Ground Based Remote Sensing update

K.Elder/L. Brucker/HP Marshall/C.Hiemstra

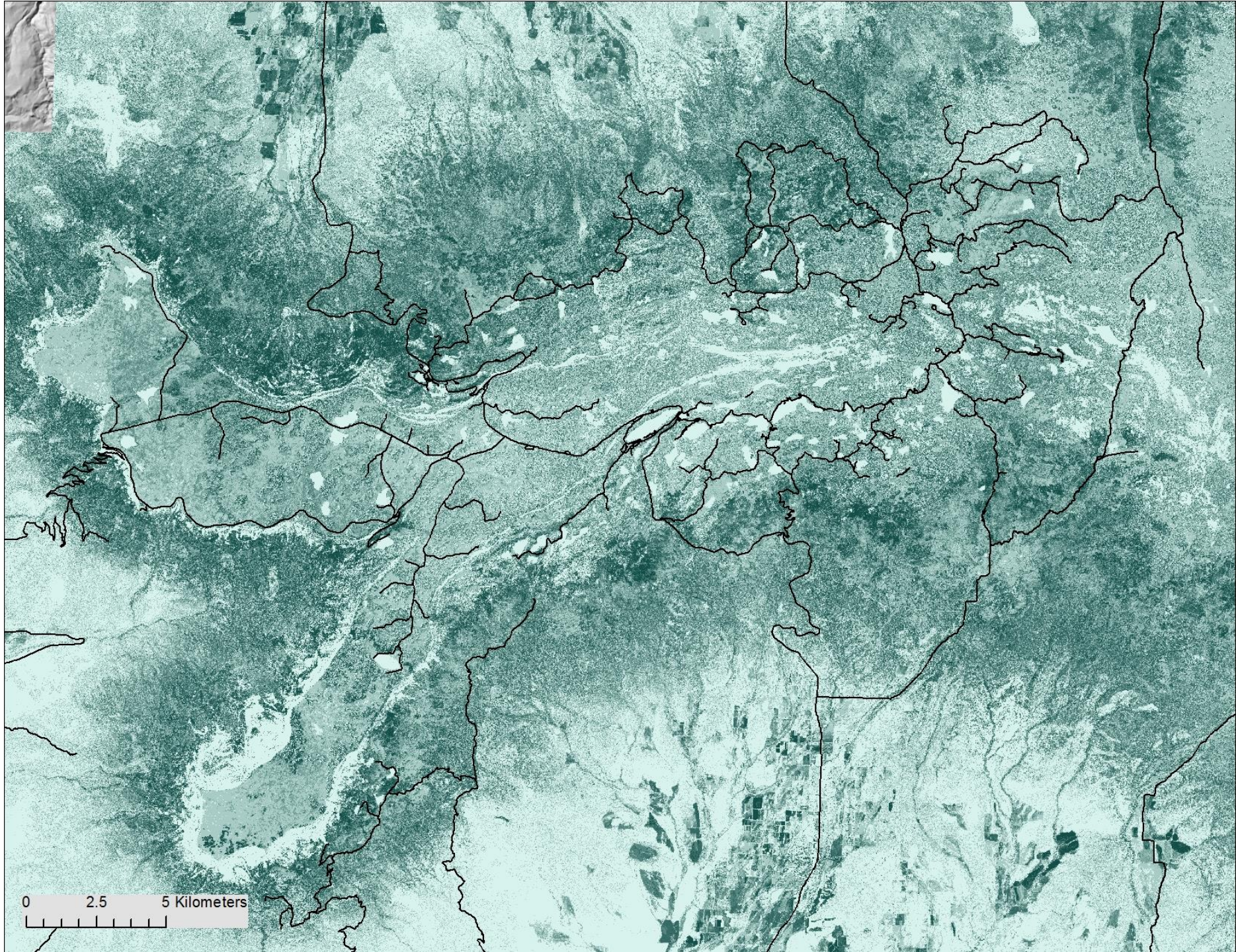
Grand Mesa (NAIP 2015, 4 bands, 1 m resolution)



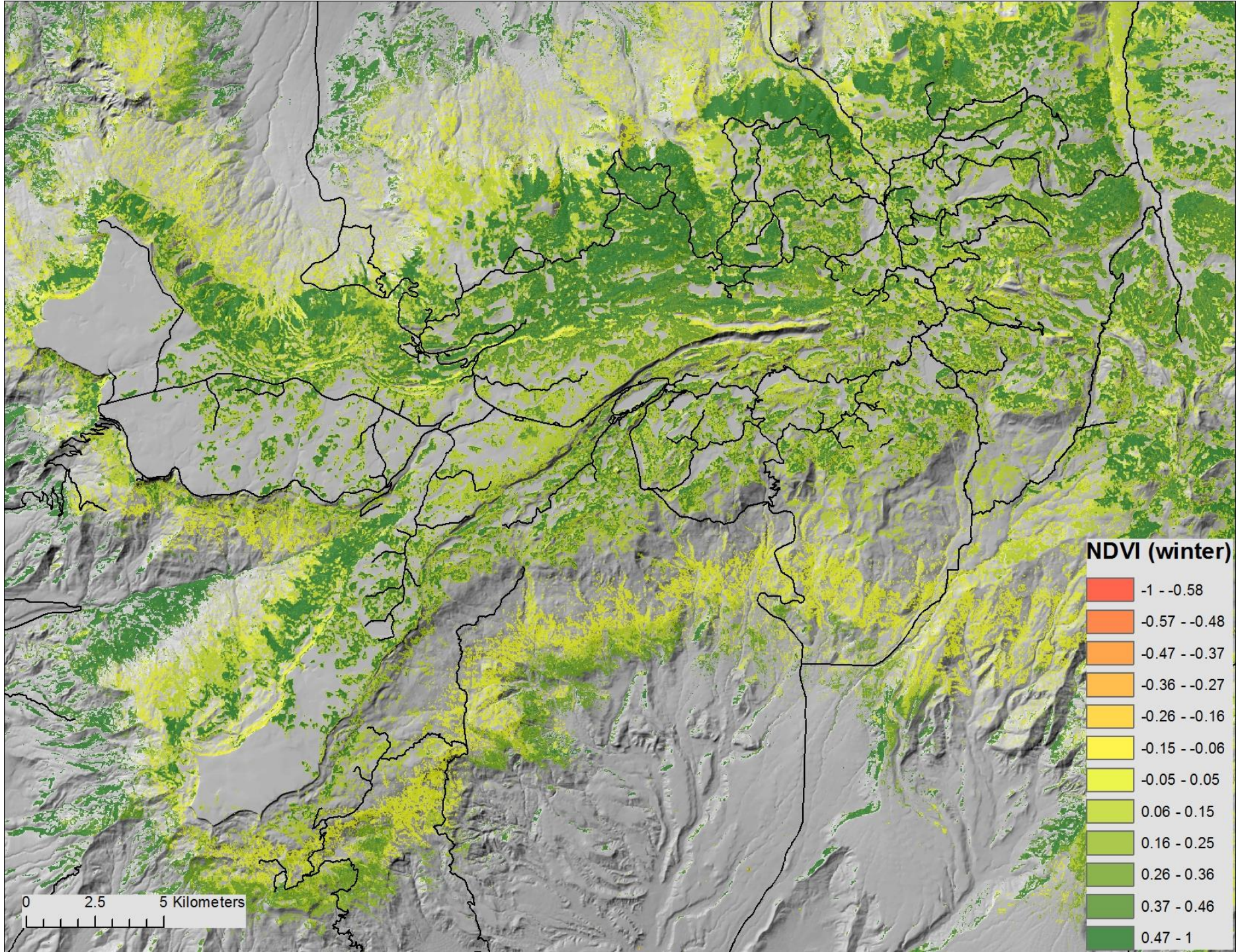
Grand Mesa Land Cover



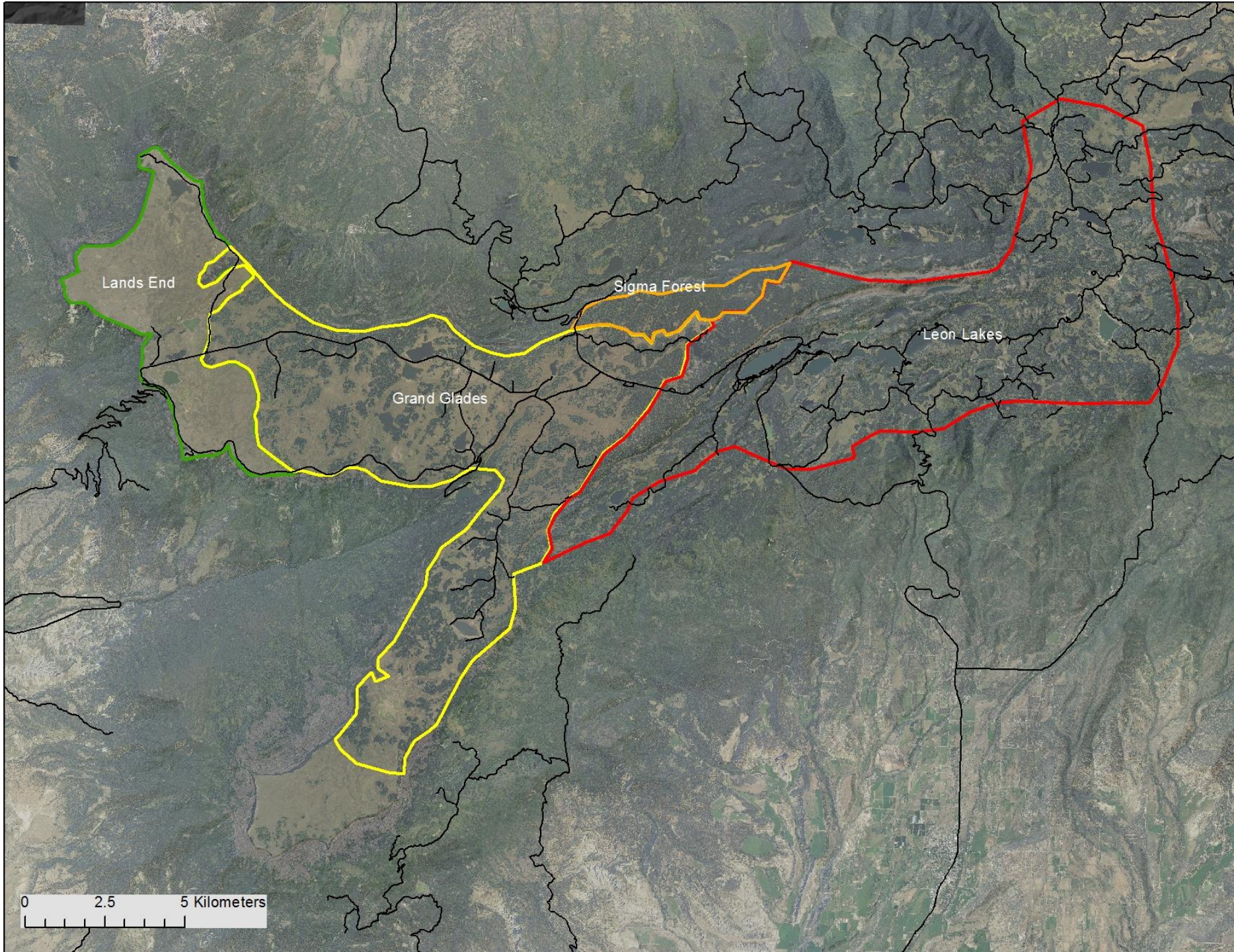
Grand Mesa NDVI (NAIP)



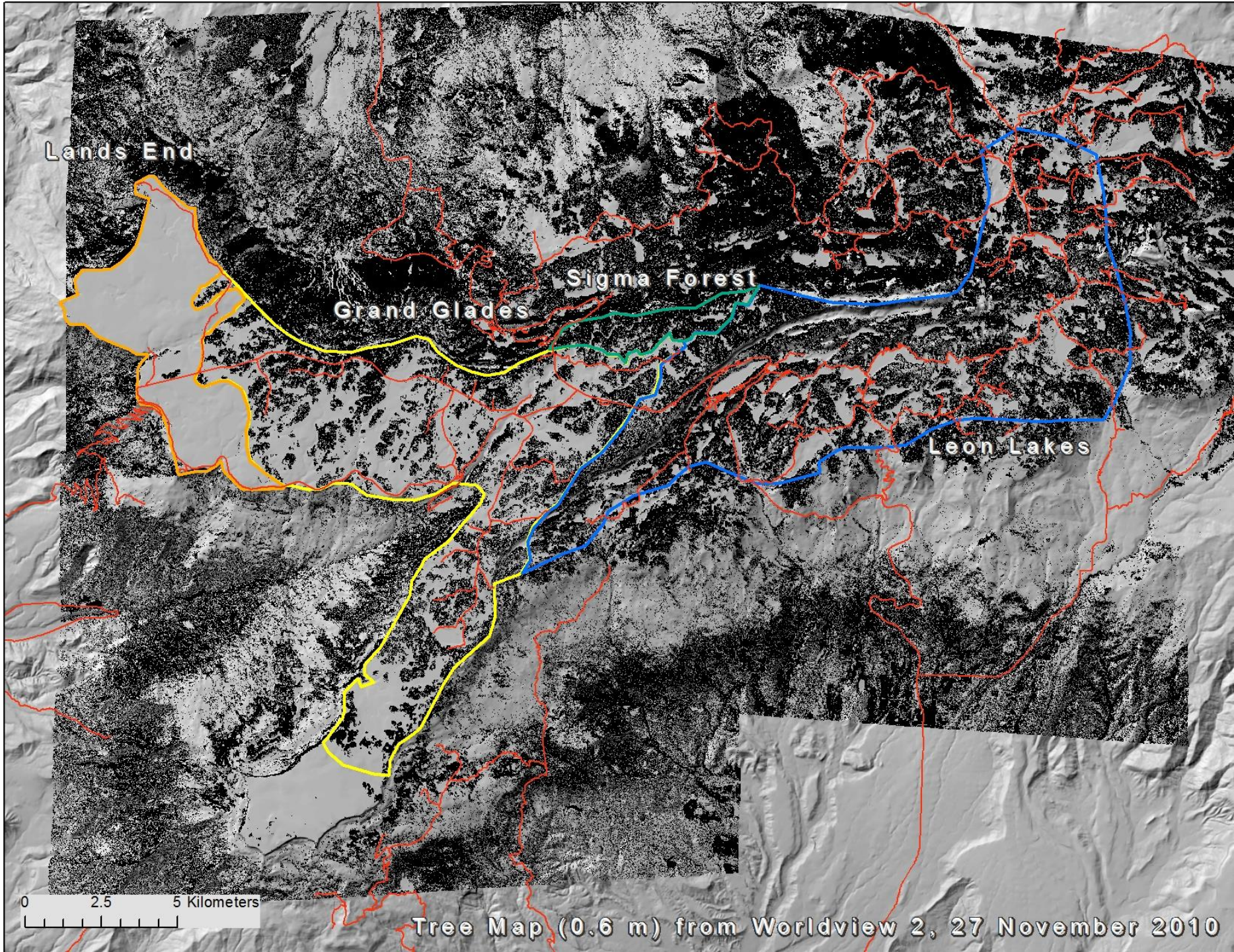
Grand Mesa Trees Landsat 8, March 2015 (snow covered)



Grand Mesa Study Areas



Pan-sharpened 27 Nov 2010 Worldview 2 Mosaic and NDVI



Terrestrial Lidar System (TLS) Measurements - Fall 2016

Based on the GBRS survey
3 groups expressed interest

3 groups will collect TLS observations this fall

- Boise State Uni.
  N. Glenn, L. Spaete, AM Raymondi, et al.

- Uni. of Colorado / NSIDC / CRREL
  J. Deems, P. Gadomski, A. LeWinter, D. Finnegan, et al.

- CRREL
  C. Hiemstra, A. Gelvin, et al.

Remote sensing instruments to be installed at LSOS – Season 2016-2017

Based on the GBRS survey

. 16 instruments available from October 2016 to late May 2017

. 13 of them can be used for continuous monitoring

After follow-up discussions with the instrument owners

. 8 instruments are available, readily capable of collecting data continuously and autonomously

. the others are ASD spectrometers, TLS, and a GPR

8 instruments will be installed at LSOS this fall
[1 is still pending discussion; it's a time-lapse camera]

- Microwave radiometers (R., De Roo Uni. of Michigan)
- Radar (HP Marshall, Boise State Uni.)
- GPS (E. Small, Uni. of Colorado)
- Tree accelerometers (M. Raleigh, Uni. of Colorado)
- Precipitation Imaging Package - PIP (GPM GV, NASA)
- Prototype in situ probes (R. De Roo Uni. of Michigan)
- Pluvio (GPM GV, NASA and A. Barros, Duke Uni.)
- Sun photometer (B. Holben, NASA)

Precipitation characterization instruments to be installed at LSOS – Season 2016-2017

W. Peterson, F. Bliven et al. (GPM GV, NASA)
- Precipitation Imaging Package
- Parsivel Disdrometer
- Pluvio

A. Barros (Duke Uni.)
- Pluvio

Time lapse cameras

Time-lapse cameras and sticks for monitoring snow accumulation
→ Lindquist, Musselman, Hiemstra, Deems

40+ cameras and sticks will be installed at LSOS, GM, and SB

SnowEx aircraft & instrument update

E.Kim/C.Gatebe/M.Beckley

Aircraft & Instruments for Each Deployment

- Fall 2016:
  - ASO on its aircraft
    - Lidar (1064 nm; 3.5 km/1m @ 3 km alt.)
    - Hyperspectral (350-1050 nm;±34°)
- Winter 2017:
  - NRL P-3
    - SAR (SnowSAR; X and Ku band polarimetric imaging radar, ~5m spatial resolution)
    - Passive microwave (AESMIR; 10, 19 and 37GHz; H and V; 200 m @ 600 m alt.)
    - BRDF (CAR) (multispectral: 340-2300 nm; iFOV:1°/FOV: 180°)
    - Thermal IR (TBD)
  - ASO on its aircraft
    - Lidar
    - Hyperspectral
- Summer 2017 (SAR (SnowSAR); aircraft TBD)

NO CHANGE

Flight line planning assumptions 1

- Using preliminary flight line scenarios to allocate flight hours. Assuming 5 identical flights during Feb deployment.
- P-3 & ASO will do triangle flights: base-> GM -> SB -> base
- Assuming P-3 base will be either Colorado Springs or Hill AFB, Utah. TBC with NRL. Choice does affect total flight hours for science.
- ASO base = Grand Junction (GJT)

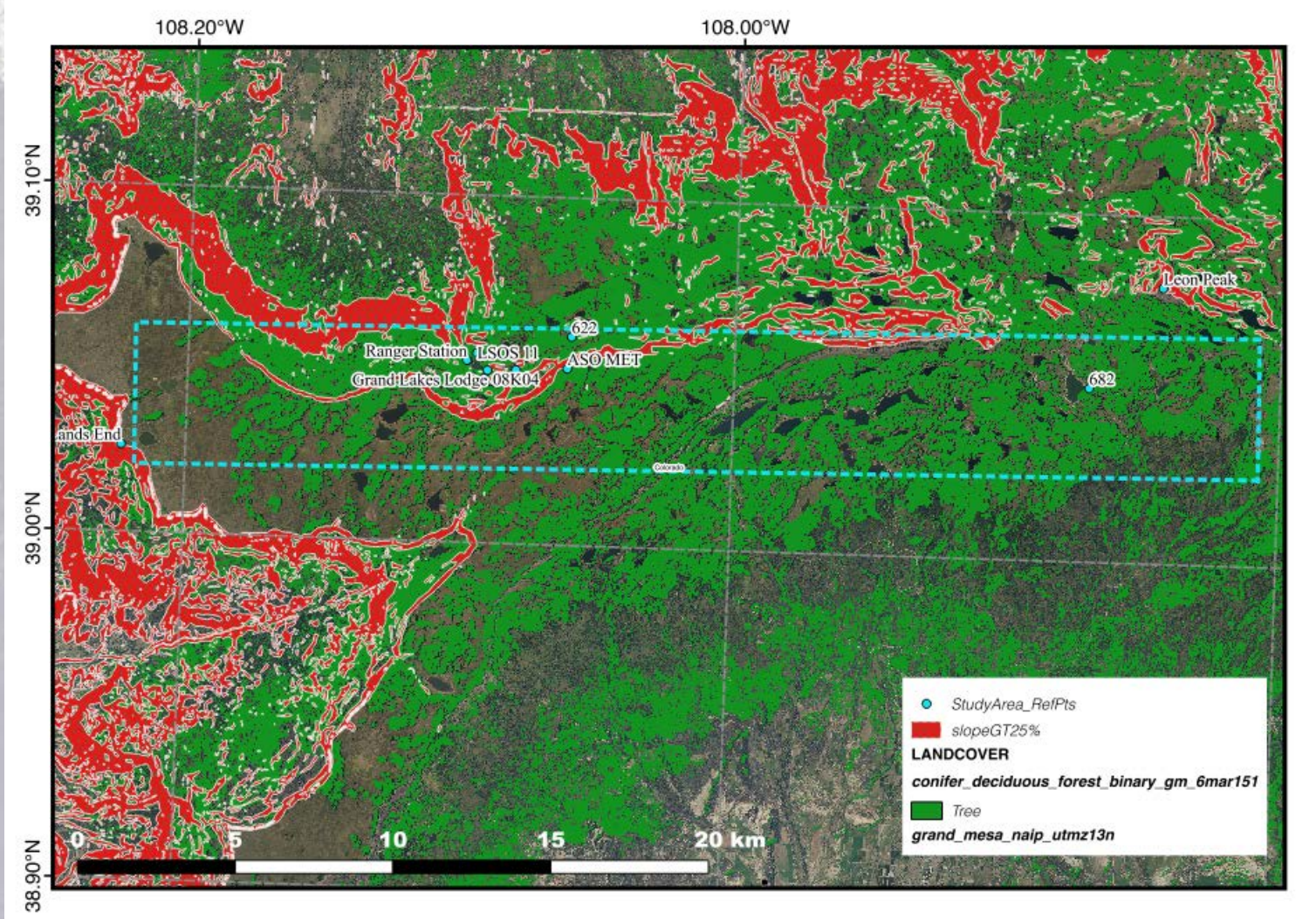
NO CHANGE

Flight line planning assumptions 2

- P-3 sensor swaths and ASO sensor swaths will overlap.
- 3 notional altitudes for P-3: very low, mid, high; all sensors taking data all the time.
- ASO at one altitude.
- Very low altitude (1000ft AGL): for smallest AESMIR footprints to ‘fit’ within width of strip forests; fore-aft elevation scanning to get range of incidence angles.
- Mid altitude: optimize for SnowSAR, notionally a few thousand feet AGL; ‘mow the lawn’ imaging of a box on the map; AESMIR will also get a conical scan image.
- High altitude: optimize CAR-hyperspectral (ASO) synergy; exact altitude TBD.
- Flight line ‘box’ on next slides optimized to match ground truth regions
- Overfly LSOS with a single separate flight line

Flight line example

Notional flight line box for all sensors



Experiment Plan update

E.Kim/C.Gatebe

Update from HQ

Jared Entin

Q & A