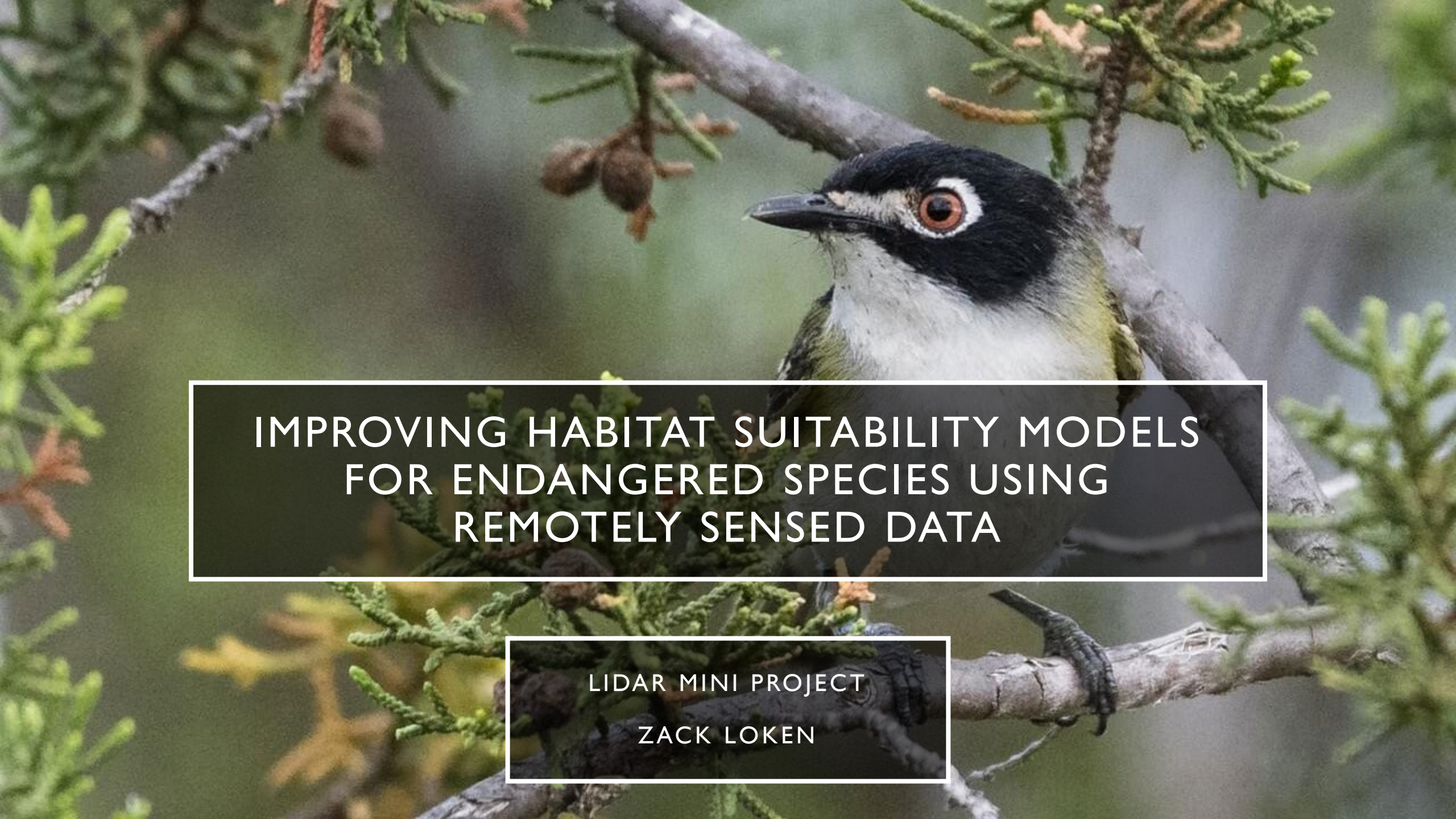


IMPROVING HABITAT SUITABILITY MODELS FOR ENDANGERED SPECIES USING REMOTELY SENSED DATA

LIDAR MINI PROJECT

ZACK LOKEN

MOTIVATION FOR STUDY

- Identifying suitable habitats is critical to endangered species management
- Veg structure & composition are strong determinants of habitat suitability for birds
- Black-capped vireo—an endangered bird with a small breeding range in central TX.
- LiDAR is becoming readily available—curious if LiDAR-derived measures of vegetation structure can improve habitat suitability models for the black-capped vireo in Fort Hood.

WHAT DID THE STUDY DO?

- Identified potential vireo habitat in Fort Hood using aerial imagery
- Surveyed these areas on foot—GPS locations of males recorded
- Constructed DEM using LiDAR point cloud
- Generated four LiDAR-derived variables for measuring vireo habitat
  - Mean height woody veg
  - Percent cover woody veg (1 – 30m tall)
  - Percent cover woody veg (1 – 3 m tall)
  - Total edge length
- Manually delineated veg patches using 0.35m resolution orthophotos

WHAT DID THE STUDY DO? CONTINUED

- Pulled soil data from the NRCS soils database
- Converted LiDAR, veg, and soil layers to raster grids at six spatial resolutions (10 – 500m)
- Constructed habitat suitability models (HSM) using the Random Forest algorithm
- Identified best-performing resolution for each data class, then constructed final models
  - Structure + Composition: 81% accuracy
  - Structure + Soil Depth: 80% accuracy
  - Composition + Soil Depth: 80% accuracy
  - Structure + Composition + Soil Depth: 82% accuracy
- Calculated variable importance in addition to model accuracy

WHAT DID THEY LEARN?

- Remotely sensed data products can be used effectively to scale up HSM predictions
- The 25-m resolution HSM performed best
  - Finer resolution may not capture grass and shrub patchiness associated with vireos
  - Aggregation to coarser resolutions likely introduces errors in the model
- Results suggest that in central TX, the veg composition is a more important predictor of vireo occupancy than structural (i.e., LiDAR-derived) attributes
- **A map based on vegetation composition is more suitable for conservation action because it identifies areas of current and potential habitat**

HOW'S IT DIFFER FROM CLASSWORK?

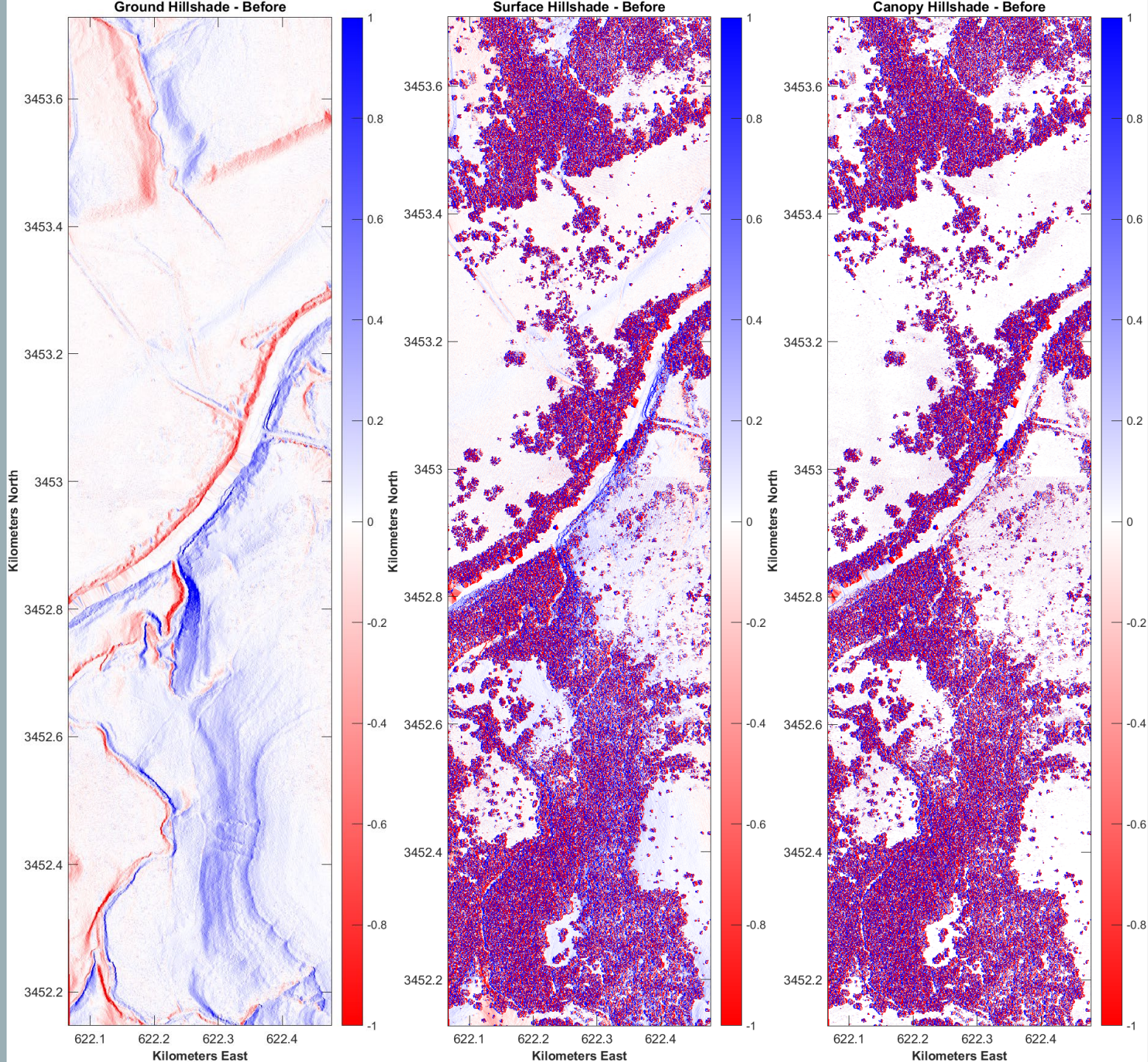
- This study only looked at LiDAR data from one time, whereas most of what we've done in class deals with change detection before and after some event.
- Furthermore, we've mostly focused on ground position change, whereas this study used LiDAR to derive metrics of vegetation structure (disregarding ground returns)

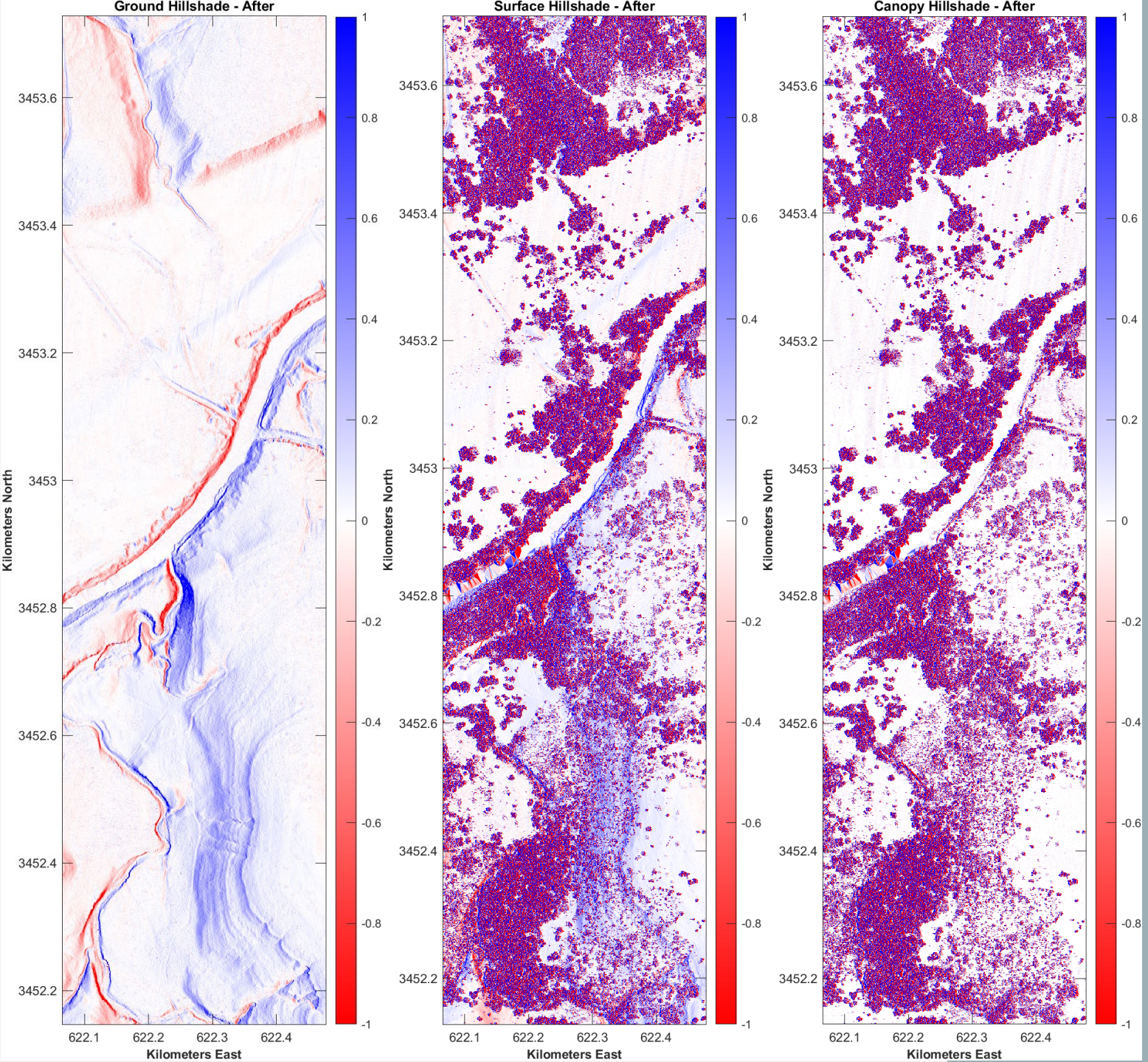
WHAT DID I DO?

- Background: Jack Mountain fire burned 11,380 acres across Fort Hood combined (2011)
- Their study concluded that a map of vegetation composition is more suitable for conservation action, but mapping vegetation is time-consuming and dataset quality is iffy.
- Hypothesis: Before and after 2D canopy height models can be differenced to **quickly** assess spatially explicit impacts of natural disasters on vegetation communities, which can be used to make inferences about where endangered species that require early-successional communities to survive (e.g., black-capped vireo).

FORT HOOD - 2011

- Months before Jack Mtn fire
- Data includes:
  - LiDAR-derived DEM
    - Ground returns
  - LiDAR-derived DSM
    - First returns
  - LiDAR-derived Canopy Height
    - DSM – DEM (first – ground)



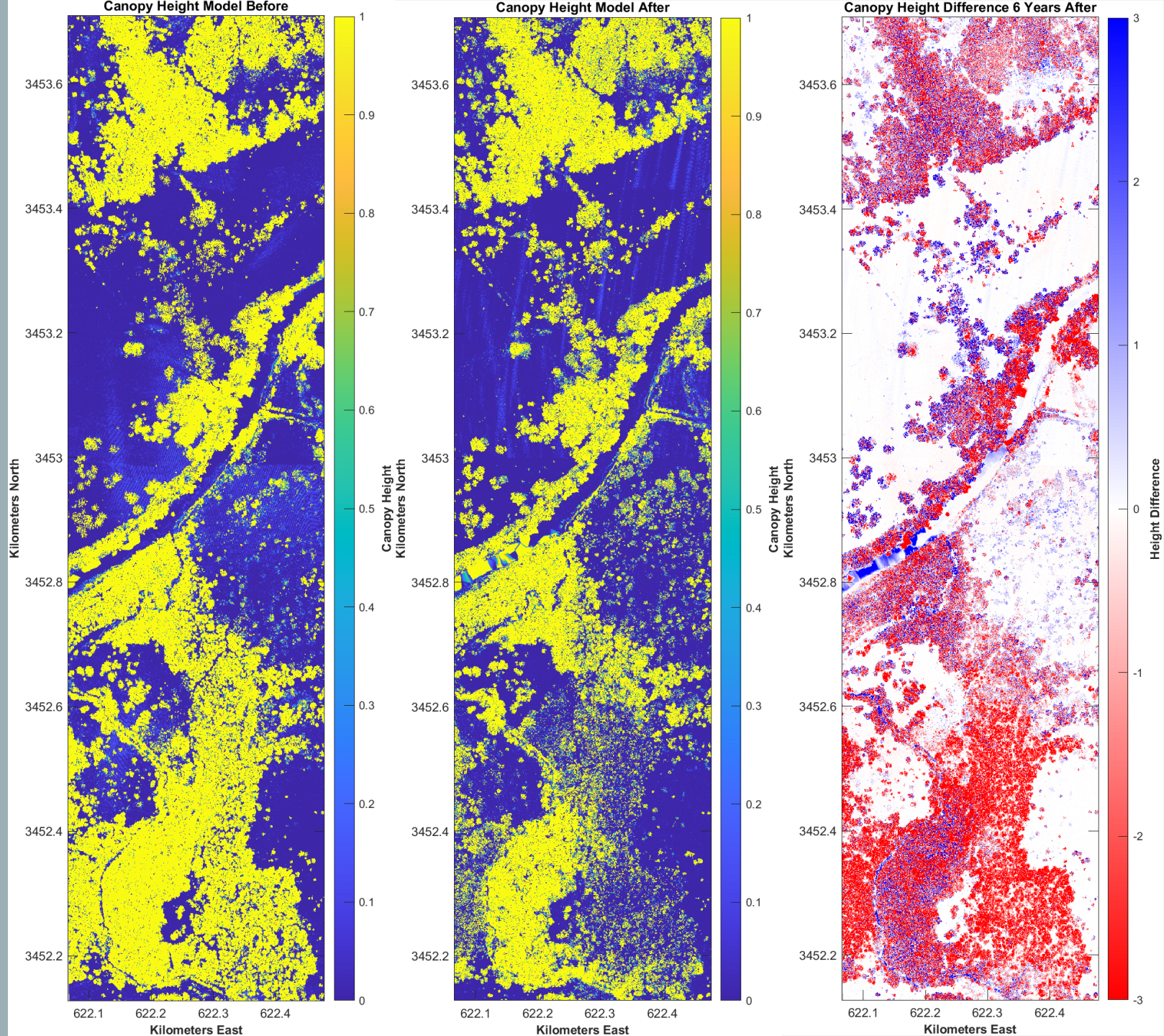


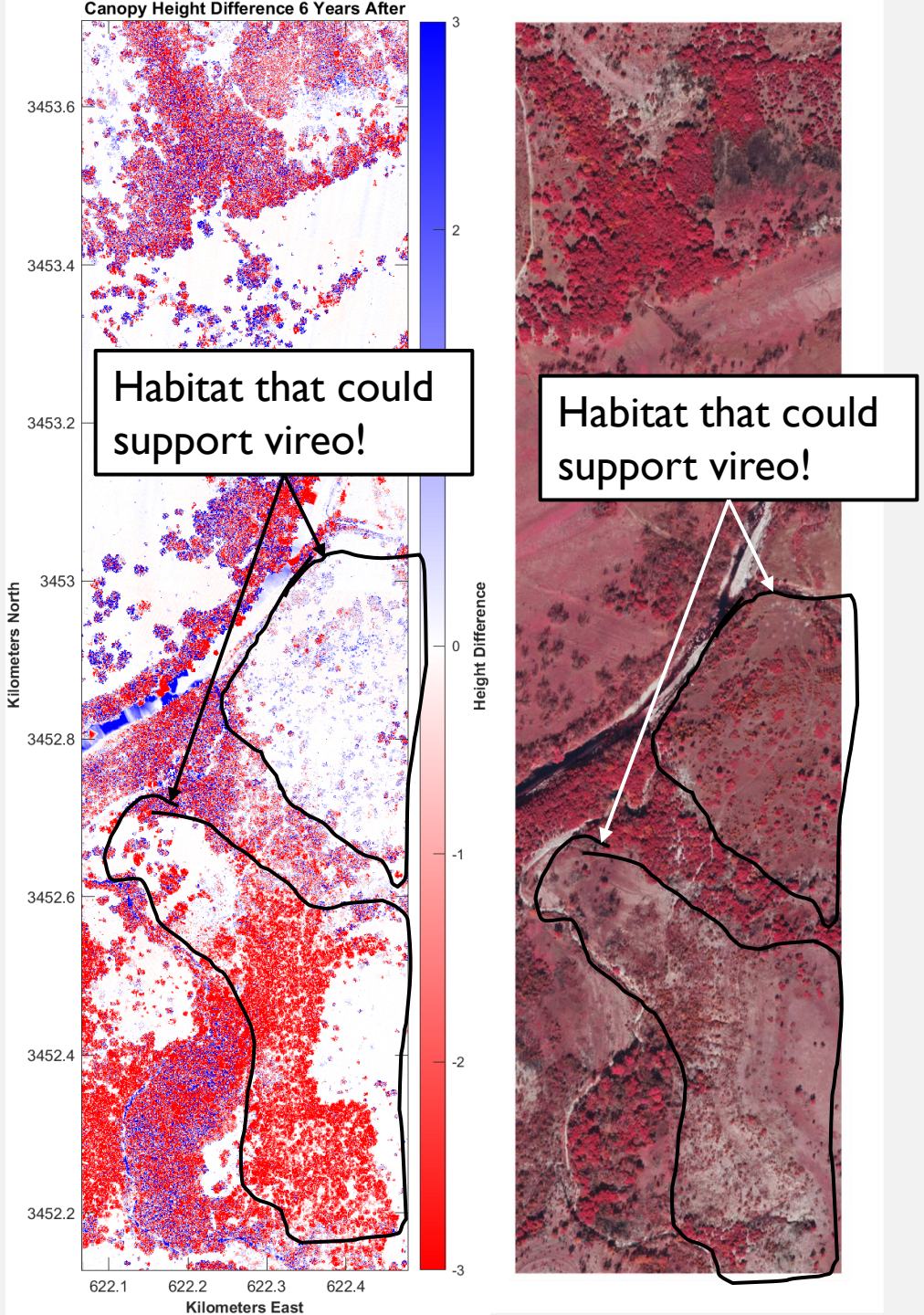
FORT HOOD - 2017

- Six years after Jack Mtn Fire
- Same 3 LiDAR-derived datasets
  - DEM - After
  - DSM - After
  - CHM - After

CANOPY HEIGHT DIFFERENCE

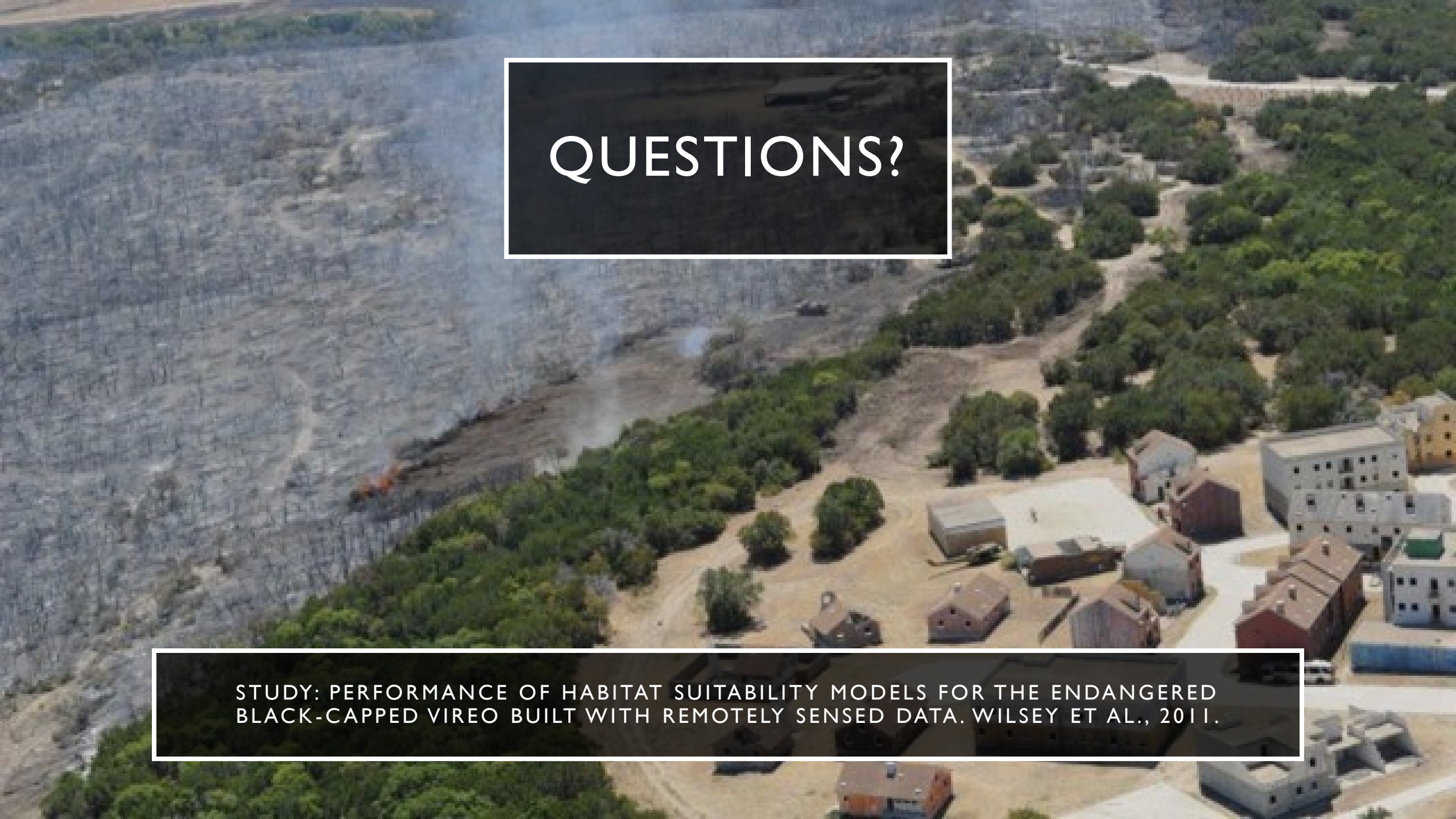
- Canopy height model after minus canopy height model before
- Shows overall canopy loss/gain
- Significant canopy loss in the southern third of the study area
- CHM Difference:
  - Dark blue—trees not burned; height increased
  - Dark red—trees burned; height decreased
  - Light blue—shrub growth after fire
  - Light red—shrubs lost during the fire





CONCLUSION

- LiDAR-derived canopy height differencing using pre- and post-event data can:
  - Spatially quantify structural changes to veg communities
  - Provide additional details about veg community composition when coupled with aerial imagery
- For example, aerial imagery can help visually separate plant communities (forest vs shrub vs tree) but fails to quantify important habitat metrics such as canopy height/density.
- Coupling aerial imagery with canopy height difference layer is sufficient to identify potentially suitable habitats for species of interest; no need to go through all the steps they did in the paper for preliminary analyses.



QUESTIONS?

STUDY: PERFORMANCE OF HABITAT SUITABILITY MODELS FOR THE ENDANGERED BLACK-CAPPED VIREO BUILT WITH REMOTELY SENSED DATA. WILSEY ET AL., 2011.