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A deep learning approach for modeling forest structure and classifying disturbance across ecotypes and time

By: Tony Chang, Barry Tyler Wilson, Karen Schleeweis

About Me

Tony Chang, PhD, Data Scientist, Conservation Science Partners
Tony (he/him) has over 12 years of experience in landscape ecology and remote sensing. He has been a NASA Earth and Space Science Fellow (2014-2017), David H. Smith Fellow Post-doctoral Research Fellow (2017-2019), and National Geographic/Microsoft AI for Earth Grant Recipient (2020)

Tony is an ecological data scientist with a background in forest modeling, species distribution modeling, data visualization, machine learning, and big data analysis. He specializes in applying state-of-the-art deep learning techniques to ecological issues, including climate change and forest disturbances.
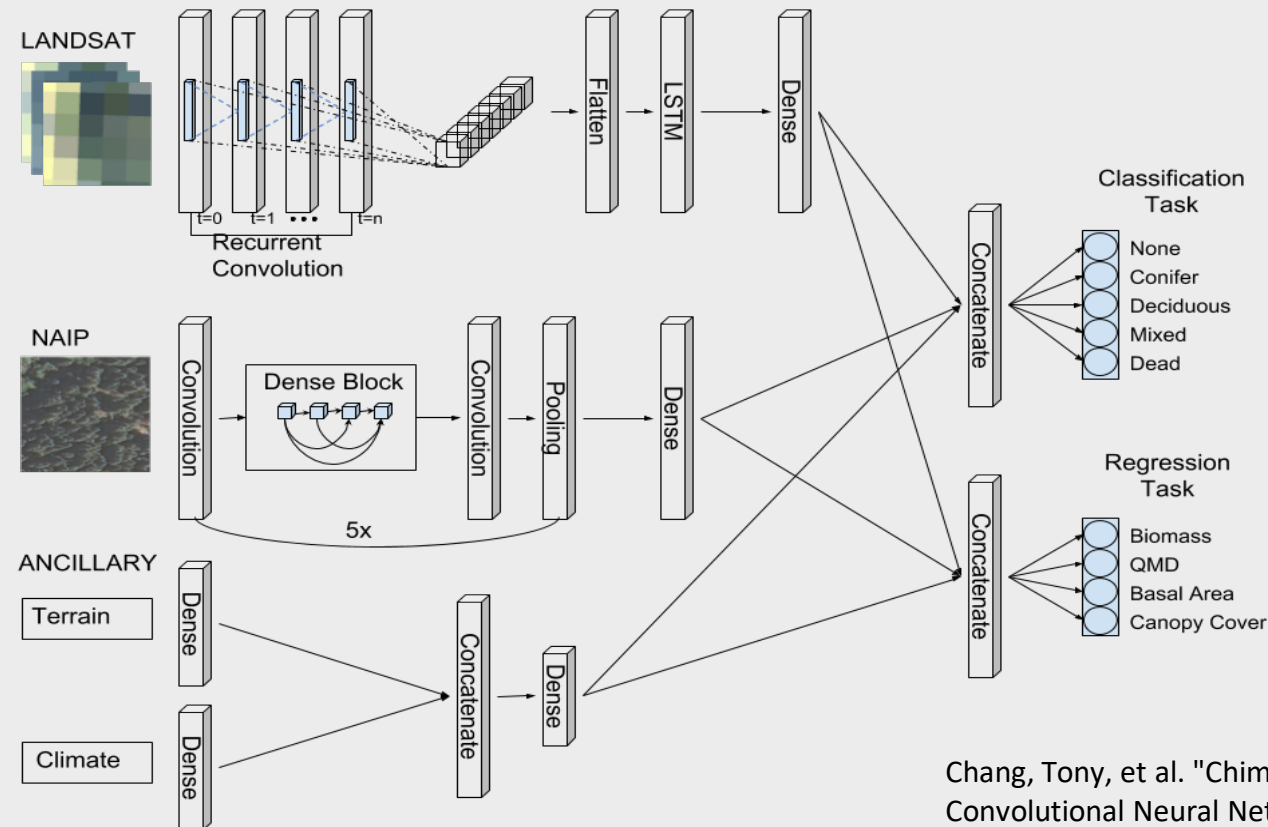
Barry Tyler Wilson, PhD, Research Forester, USFS Northern Research Station

Karen Schleeweis, PhD, Research Ecologist, USFS Rocky Mountain Research Station

The Idea

- **A deep learning approach for modeling forest structure and classifying disturbance across ecotypes and time**

- **National scale scope, regional/local scale model comparisons**

Chang, Tony, et al. "Chimera: A Multi-Task Recurrent Convolutional Neural Network for Forest Classification and Structural Estimation." Remote Sensing 11.7 (2019): 768.

The Idea

- A deep learning approach for modeling forest structure and classifying disturbance across ecotypes and time

- This project proposes an analysis of the performance of a deep learning (DL) model for forest structure and classification estimates across the entire US. This analysis will provide an understanding of how new deep learning approaches perform across a variety of ecotypes and help forest managers monitor changes in forest structure over time post-disturbance/fuels treatment. The major questions of this research are:

  - 1. How does the DL model performance vary across various ecotypes of the United States?
  - 2. What is the performance of the DL model across a time-series input data compared to resampled FIA data?
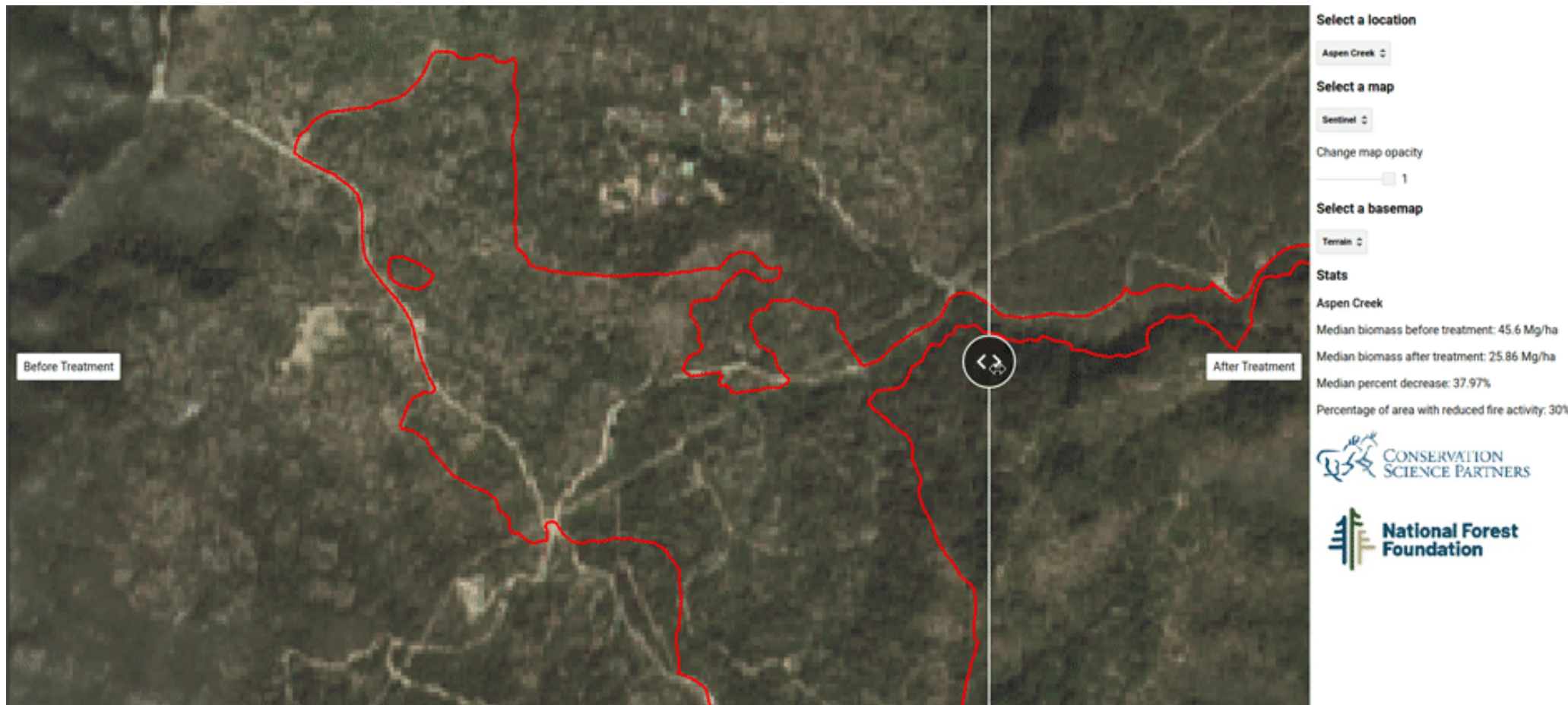
Issue(s) being addressed

- Wildfire hazard
- Fuel loading
- Wildfire impacts
- Forest health

- Water and aquatic resources
- Vegetation mapping
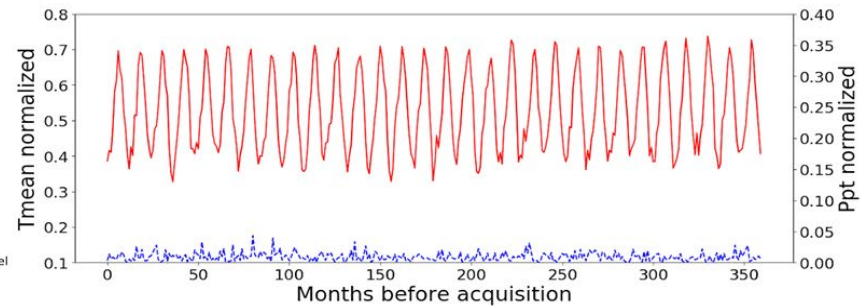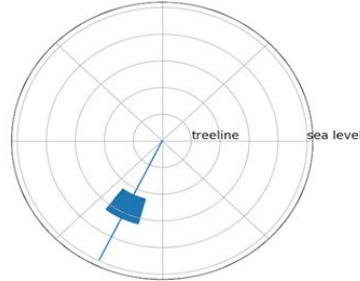- Rangeland management
- Other

The Idea

Select a location

Aspen Creek

Select a map

Sentinel

Change map opacity

1

Select a basemap

Terrain

Stats

Aspen Creek

Median biomass before treatment: 45.6 Mg/ha

Median biomass after treatment: 25.86 Mg/ha

Median percent decrease: 37.97%

Percentage of area with reduced fire activity: 30%

Before Treatment

After Treatment

CONSERVATION SCIENCE PARTNERS

National Forest Foundation

What EO data does your idea utilize?

- Landsat, Sentinel-2, High spatial resolution R-G-B-NIR, SRTM
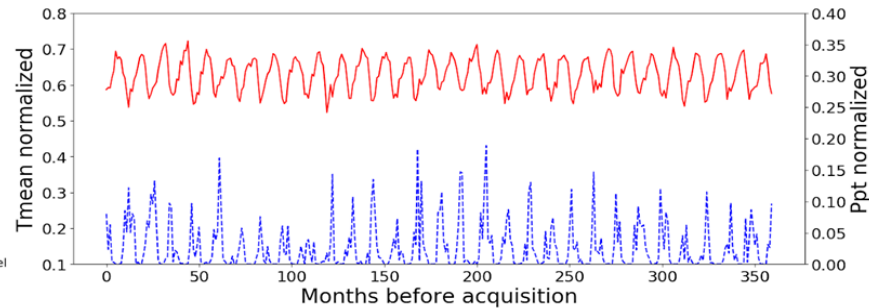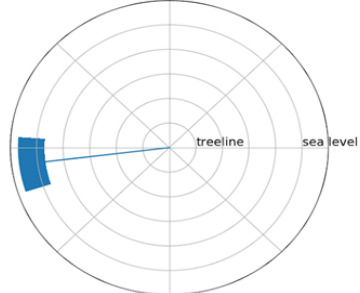
The Idea – Outcomes / Societal Benefits

- **Expected management and/or decision support outcomes**
  - Wall-to-wall estimates of forest structure metrics and classification nationally.
  - "Near real-time" updated of forest structure maps and changes with new EO acquisitions to provide monitoring for management actions.

- **How does this idea benefit the Forest Service and other land management agencies?**
  - A QA/QC'ed training dataset of high resolution imagery, EO reflectance, and abiotic data for all FIA locations within sampling period.
  - State-of-the-art deep learning models and API parameterized at specific regional ecosystem types with performance metrics.

Thank You!

CSP Wood Supply Model (Beta)

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