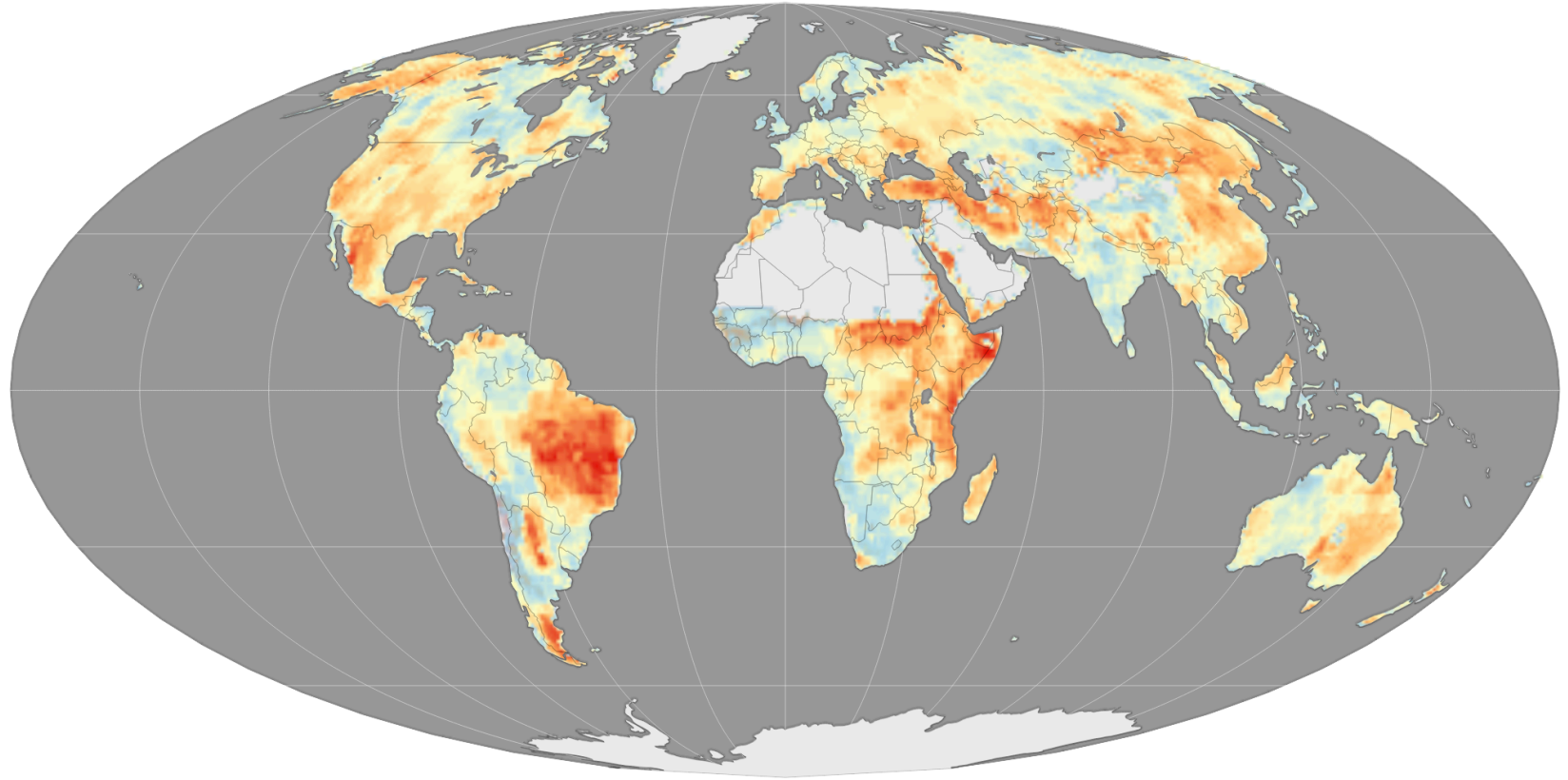# Monitoring the Impact of Wildfires on Tree Species with Deep Learning

Wang Zhou, Levente Klein
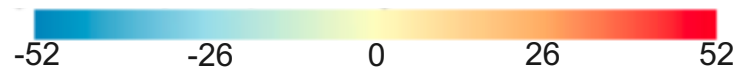IBM Research

IBM

Growing wildfires due to climate change
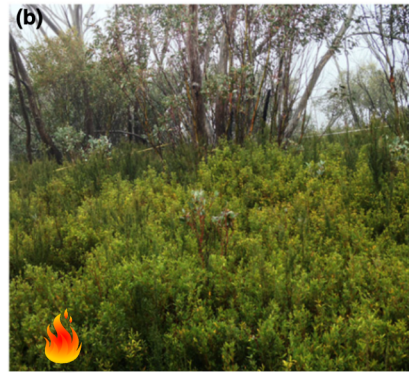

1979 - 2013

Change in Frequency of Long Fire Weather Seasons (%)

By: NASA

-52 -26 0 26 52

Wildfires affect tree species

(a) none
(b) 🔥
(c) 🔥🔥
(d) 🔥🔥🔥

*Fairman et al., *Journal of Vegetation Science* 28, no. 6 (2017): 1151-1165.

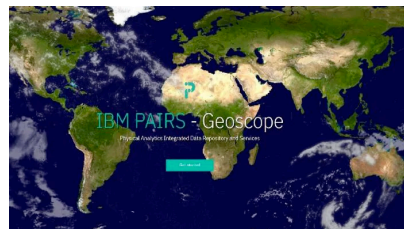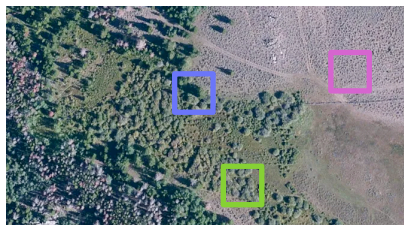Conventional approaches to monitor tree species
1) Select a few burnt sites
2) Go to the sample sites, and manually document tree types/sizes/status…
3) Extrapolate to the whole area
4) Repeat 1-3 for another couple of years

Our approach: classify tree species with DL

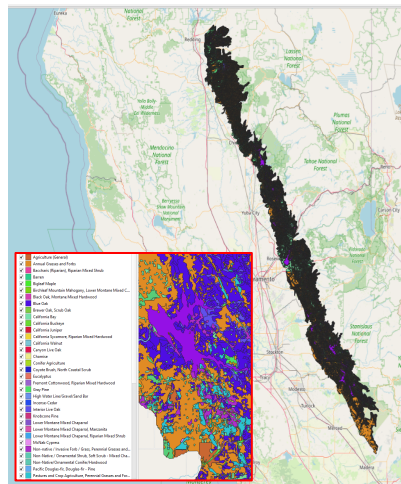## Data

- NAIP data from PAIRS
- RGB-NIR

Label

Sierra Nevada Vegetation Mapping Report (2011)

Model

- Modified ResNet34
- 32 x 32 x 4 image tiles
- Data cleaning
- Data from 2009-2018
- Five classes
- **92%** accuracy on test

Tree type	Label	# points
Conifer	0	18,708
Hardwood	1	19,873
Shrub	2	24,430
ReforestedTree	3	21,701
Barren	4	19,137
Total		103,849

Wildfires

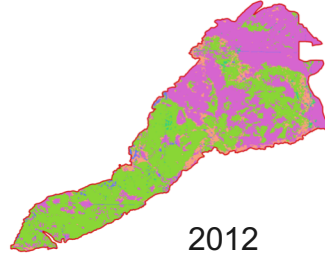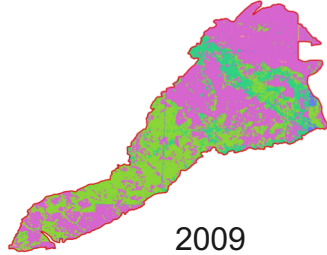Fletcher Fire 2007

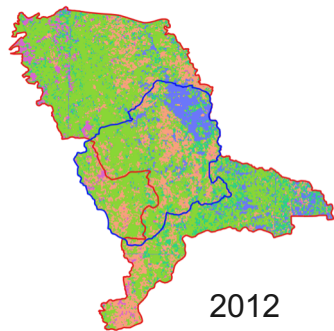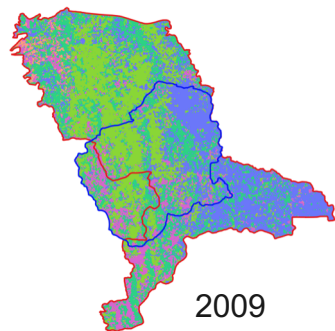Swedes Fire 2013

Wall Fire 2017

Trees regrow after a wildfire

Fletcher Fire
Modoc County, CA
8,121 Acres
July 10, 2007 -
July 19, 2007

2009

2012

2014

2016

2018

Conifer
Hardwood
Shrub
ReforestedTree
Barren
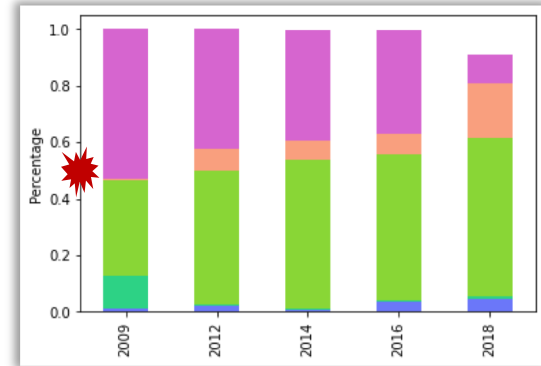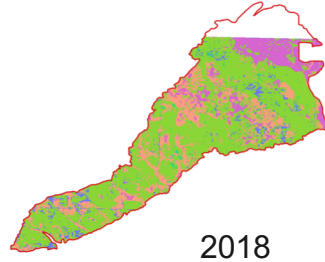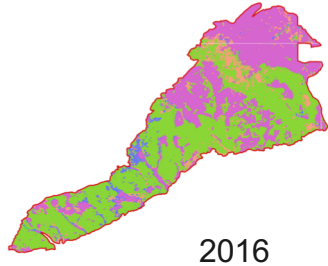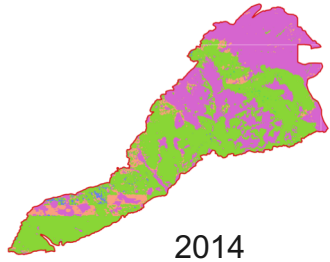
Repeated wildfires change the landscape

2009

2012

Swedes Fire
Butte County, CA
2,264 Acres
August 16, 2013 -
August 22, 2013

2014

Legend:
- Conifer
- Hardwood
- Shrub
- ReforestedTree
- Barren

2016
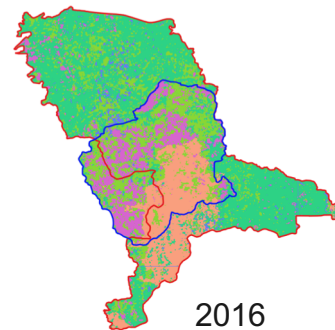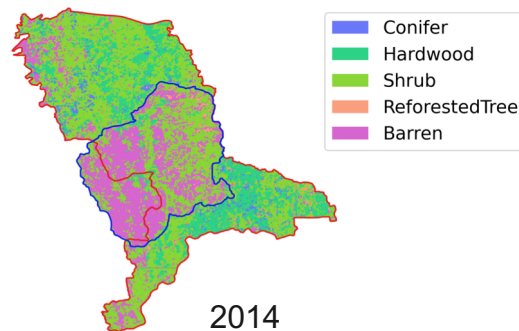
Wall Fire
Butte County, CA
6,033 Acres
July 7, 2017 -
July 17, 2017

2018
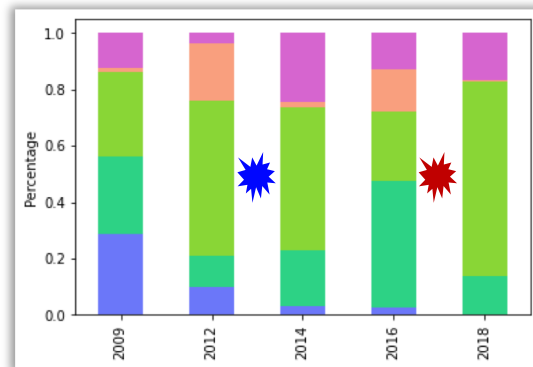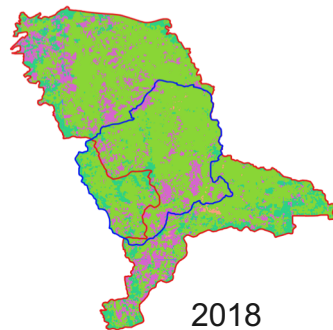
Conclusion

- We propose a deep learning pipeline to classify and track tree species to study the impact of wildfires

- Geospatial data platforms provide easy access to data and model development

- Multi-year remote sensing data help to study climate change at large scale

- Quantitative estimate of land cover changes before and after wildfires for multiple vegetation species are conducted

- The tool can help rangers and foresters to track vegetation regeneration and forest compositions

Link to paper: https://arxiv.org/abs/2011.02514