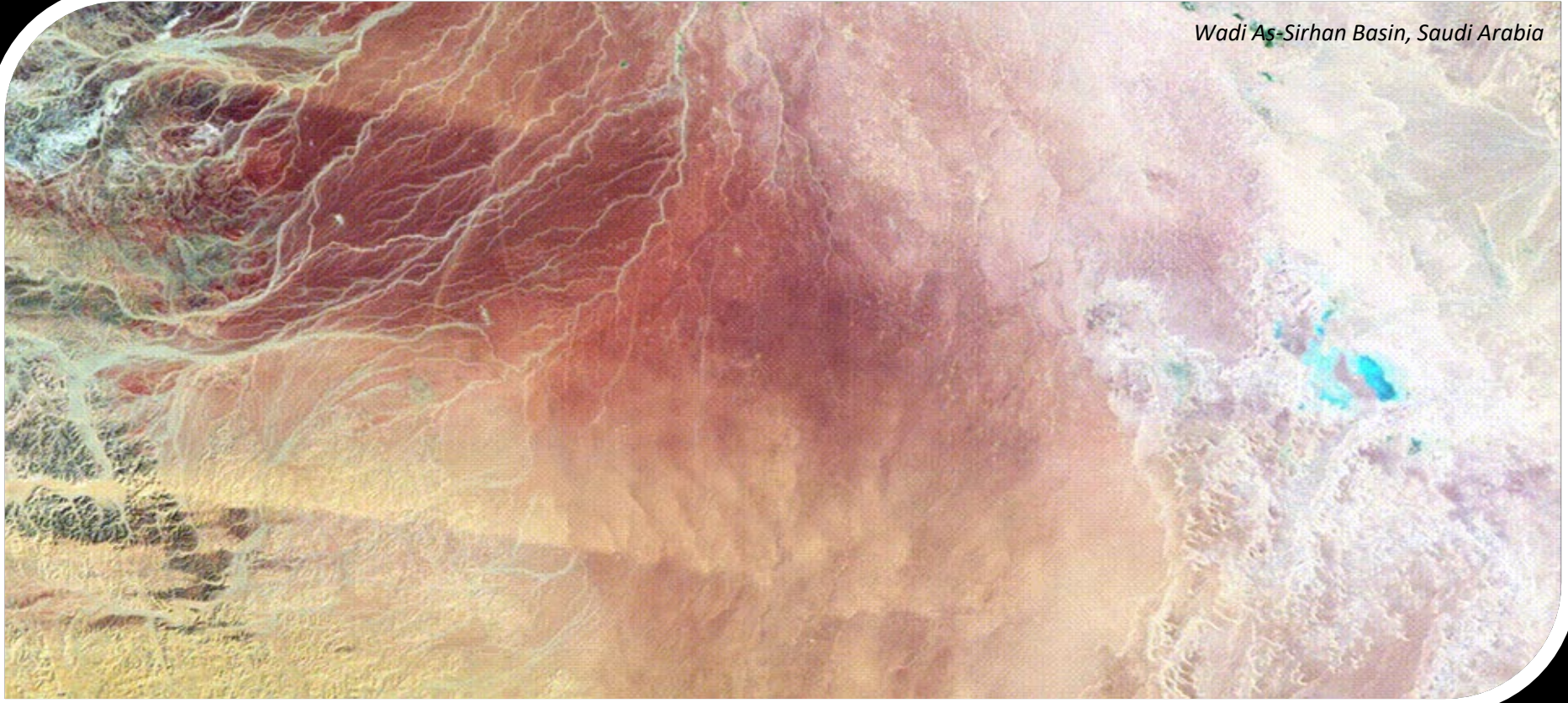


Remote Sensing Innovations and their Role in Shaping the Future of Evaluations



Wadi As-Sirhan Basin, Saudi Arabia

Kunwar K. Singh

Senior Geospatial Scientist

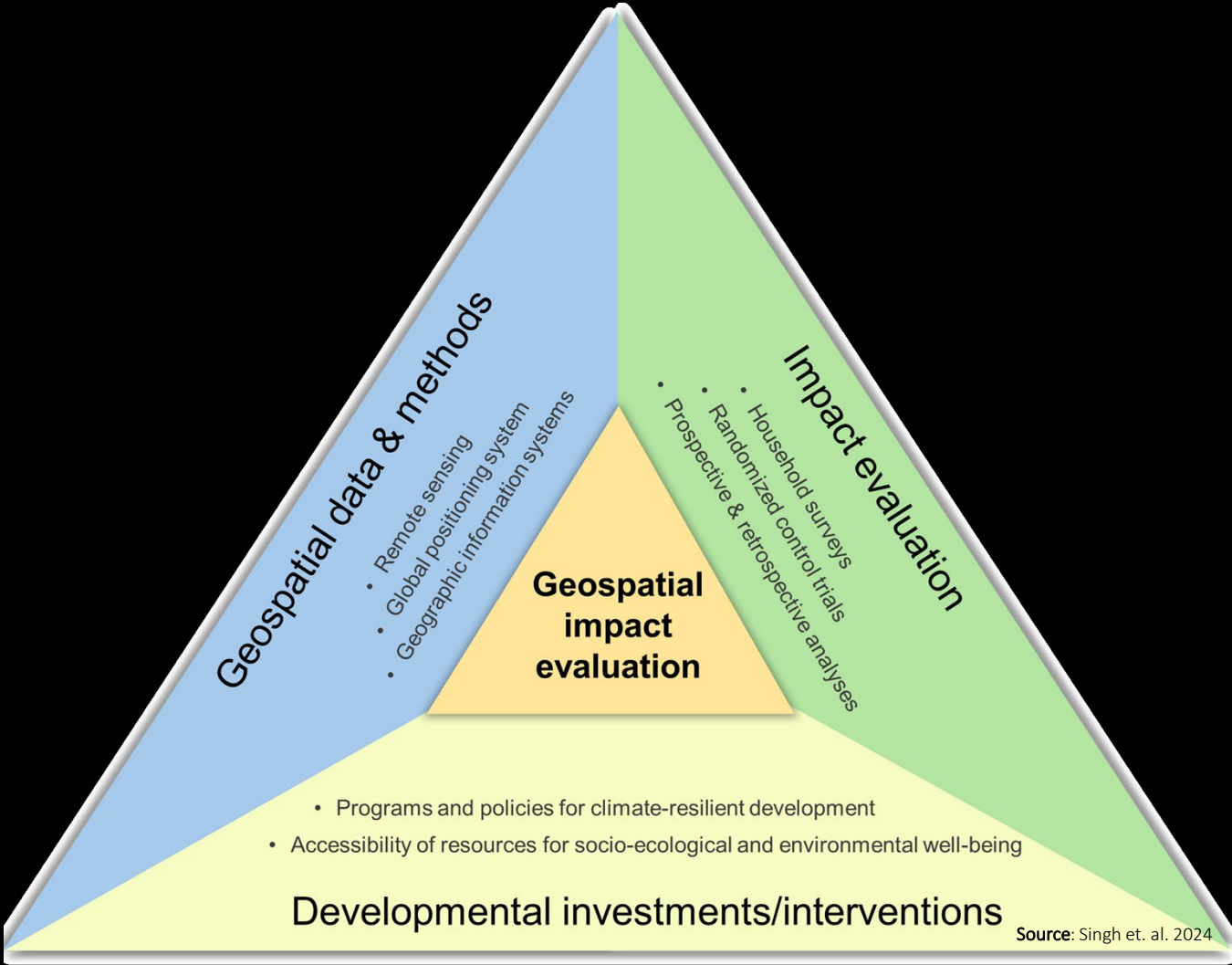
April 11th, 2023, World Bank



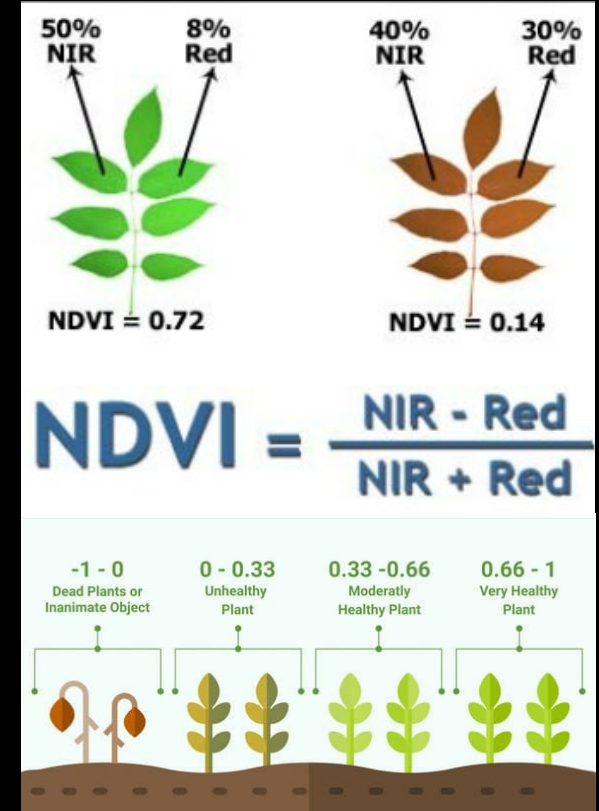
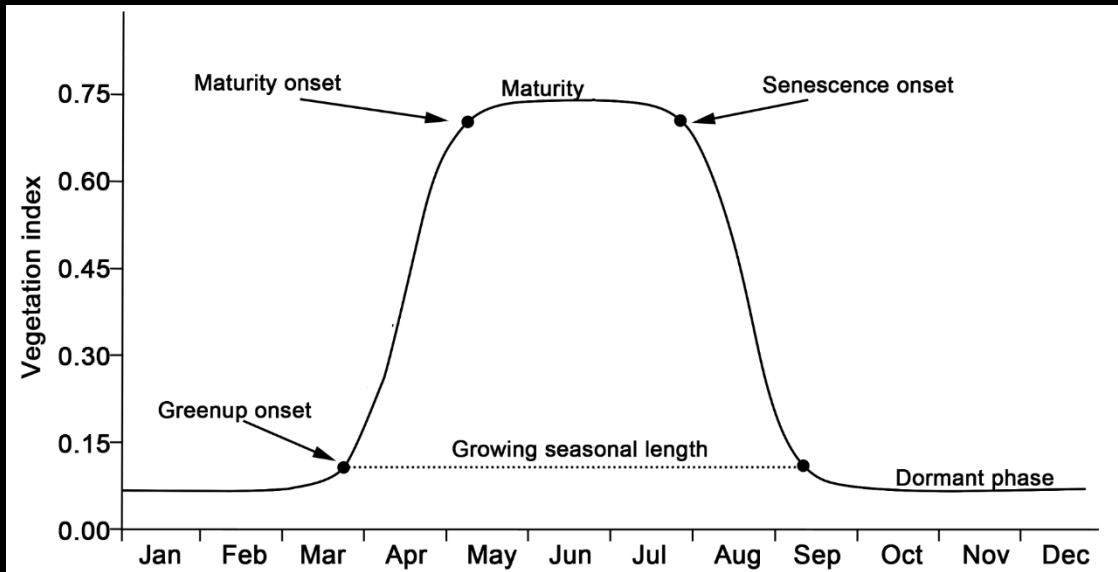
WILLIAM & MARY

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Geospatial Impact Evaluation



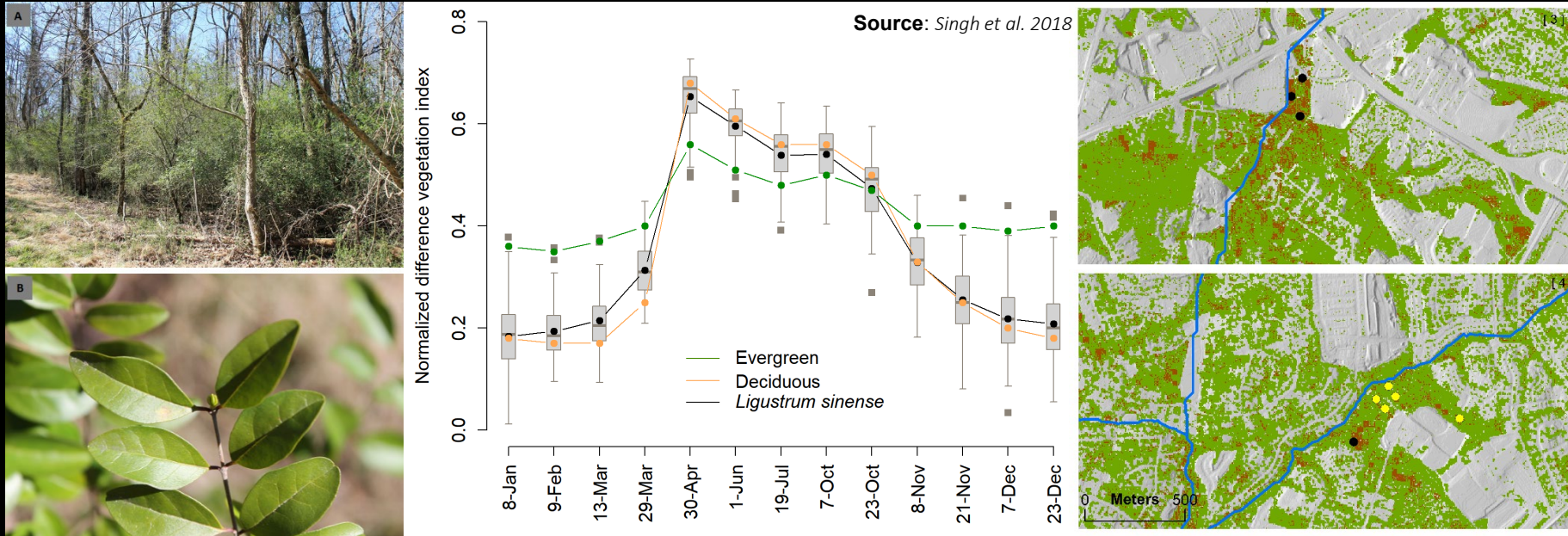
Remote Sensing of Plant Phenology



- **Time-series** remote sensing (e.g., normalized difference/enhanced vegetation indices – NDVI/EVI)
- Vegetation **phenology**

Remote Sensing of Plant Phenology

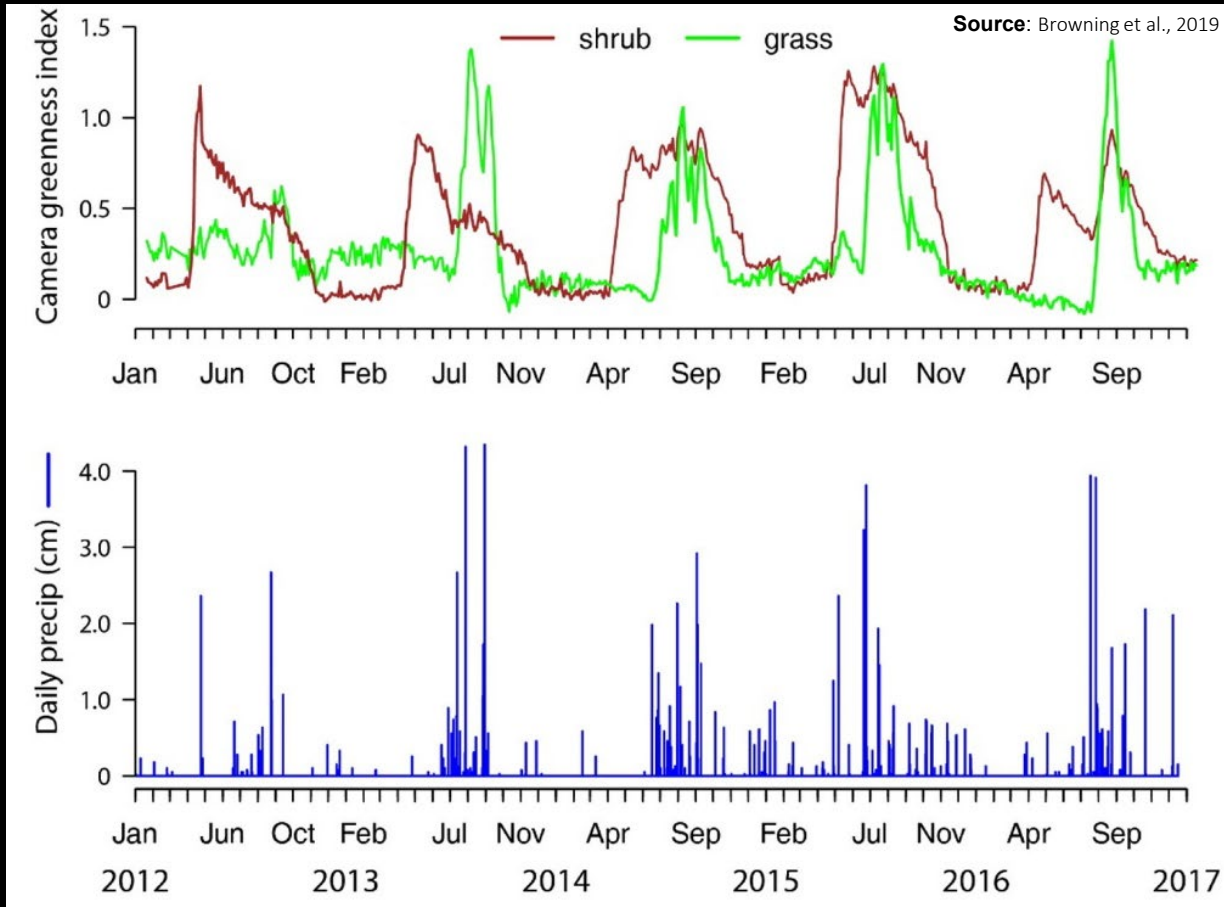
differentiate vegetation types



- **NDVI** from Landsat imagery
- The highest **phenology difference** during March

Remote Sensing of Plant Phenology

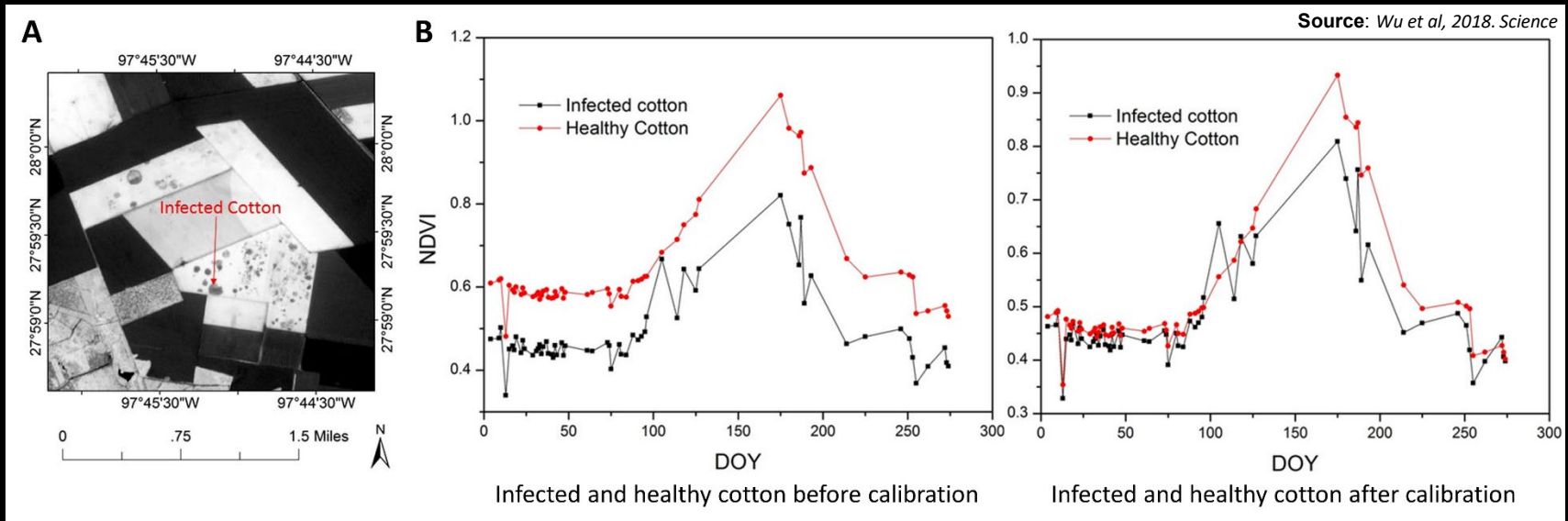
vegetation conditions



- Shrub vs. grass **greenness** from camera images
- Grass greenness **correlates with precipitation** in drylands

Remote Sensing of Crop Conditions

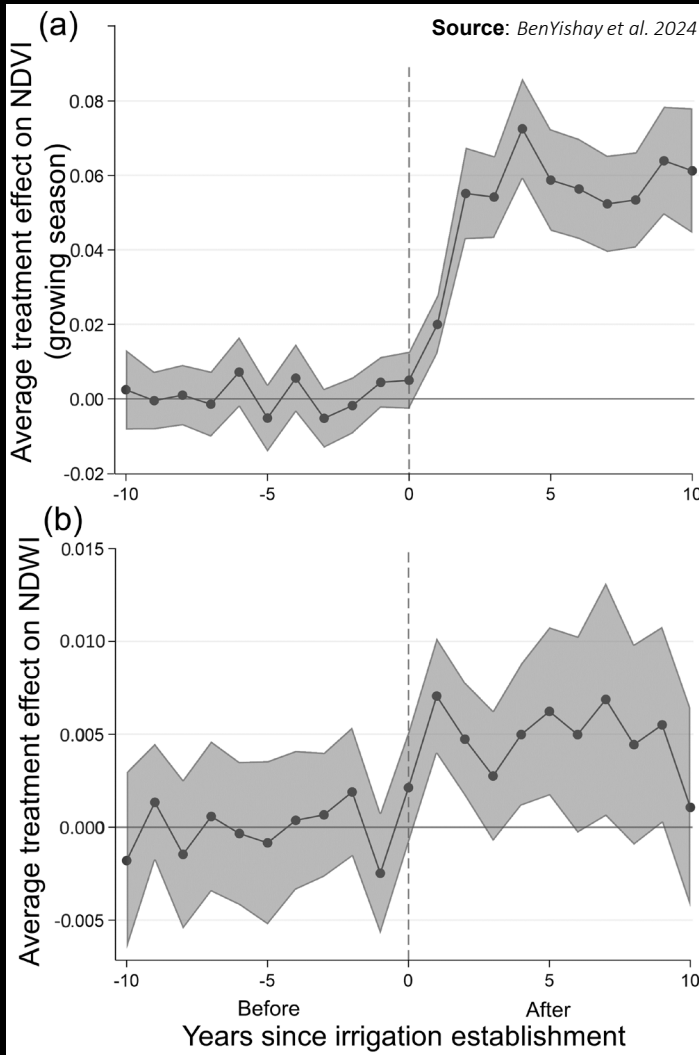
crop conditions



- **Time-series** remote sensing for detecting infected cotton
- Healthy cotton exhibits **greater vegetation greenness** than infected cotton

Remote Sensing of Crop Conditions

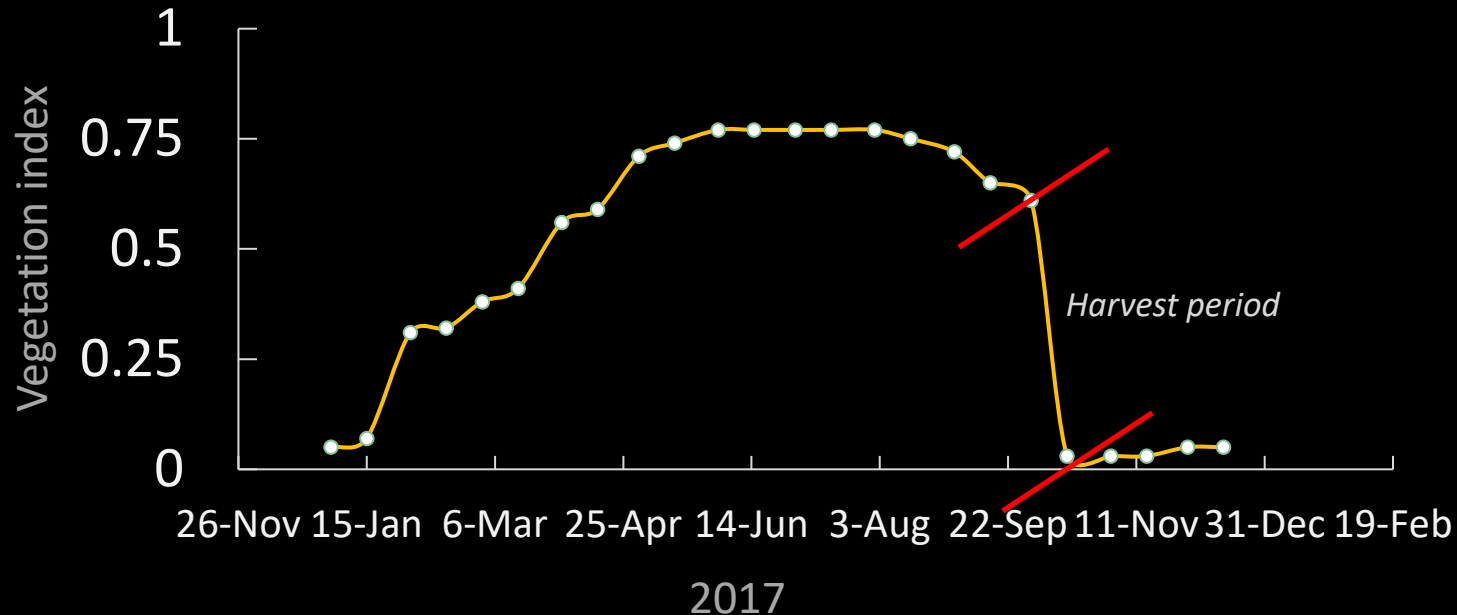
crop productivity



- **Increased NDVI** from the year after completion of irrigation projects
- **Improved water availability** for crop production after completion of irrigation projects

Remote Sensing of Crop Conditions

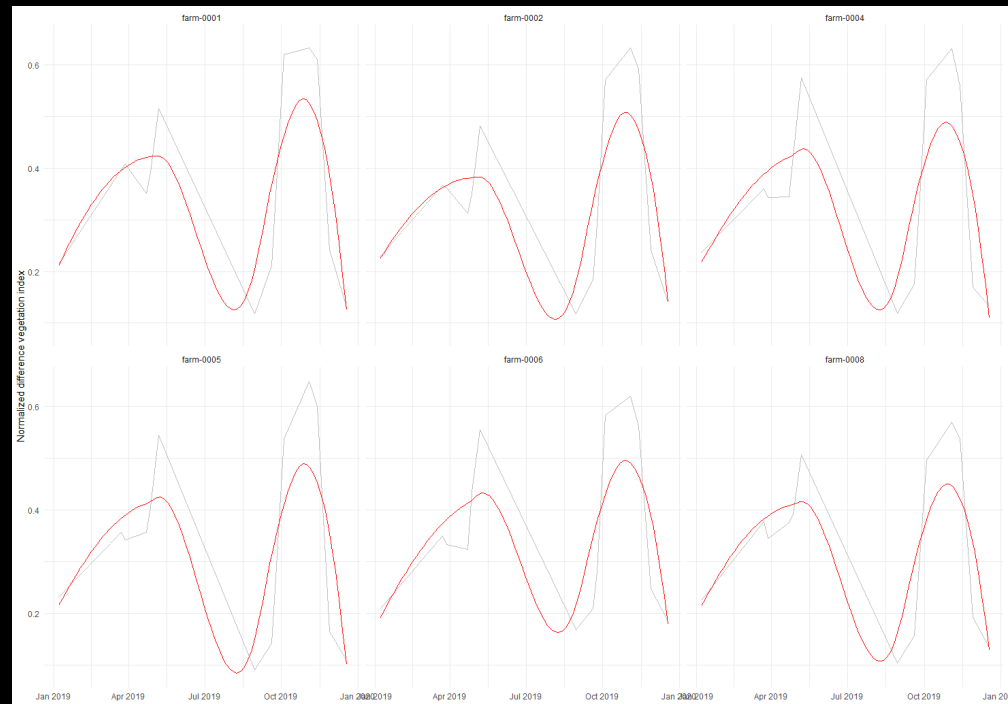
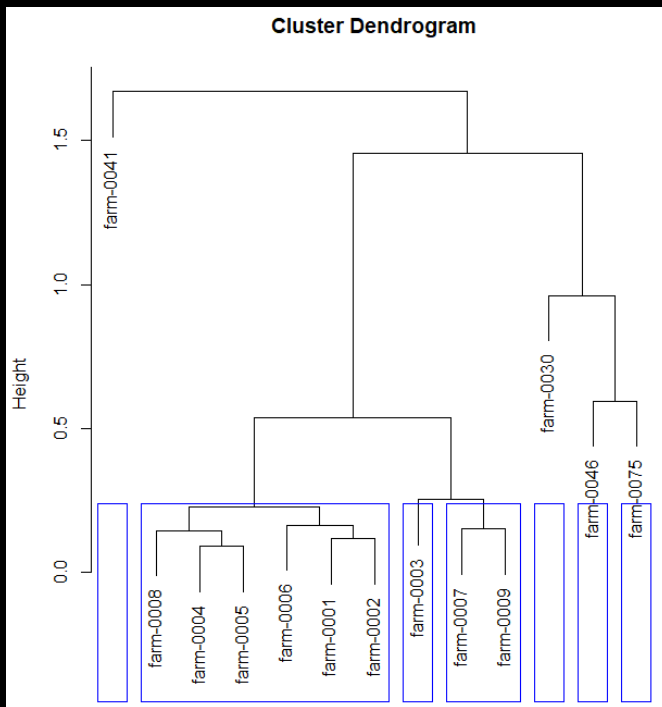
mapping crop types



The first few months right after sowing, shows a gradual green-up and vegetative growth. The maturity phase is a bit longer and follows a sudden decline due to harvest.

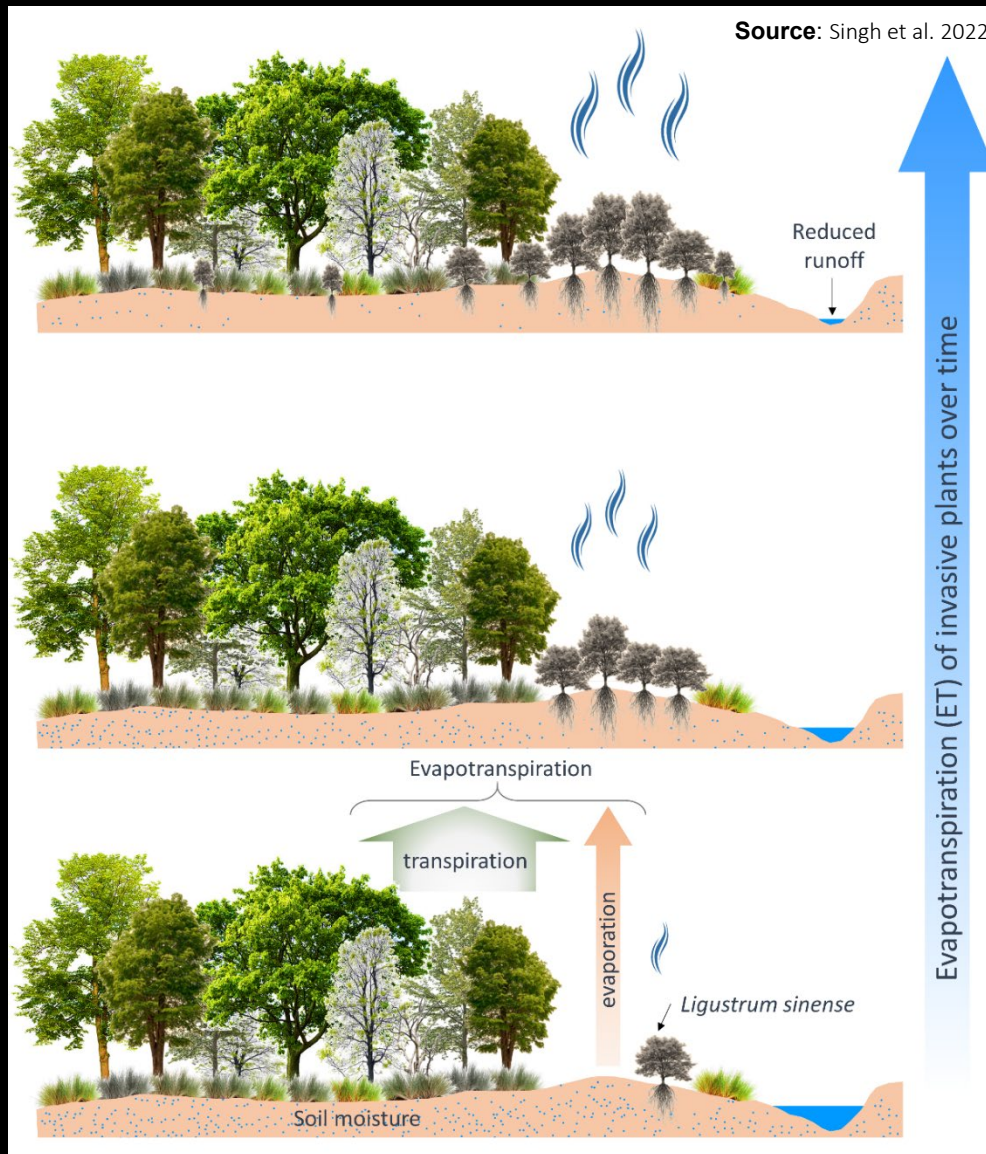
Remote Sensing of Crop Conditions

mapping crop types



- Limited ground observations hinder both **retrospective and prospective analyses**
- **Cluster analysis** groups similar data points together for analysis

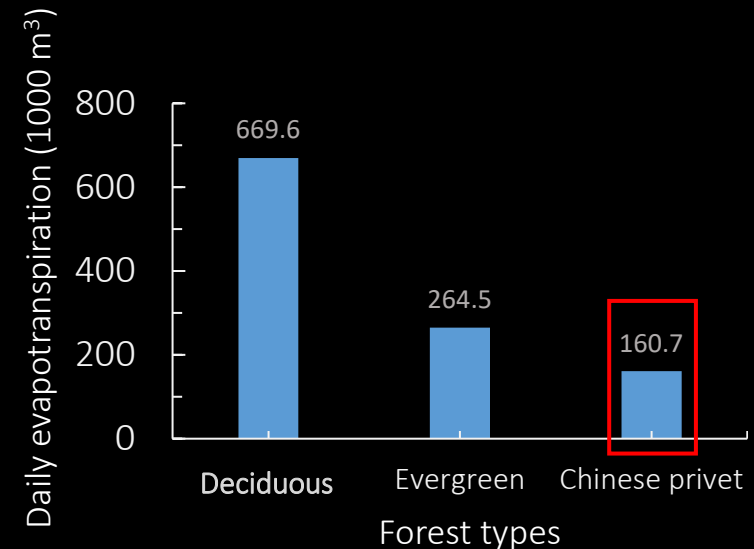
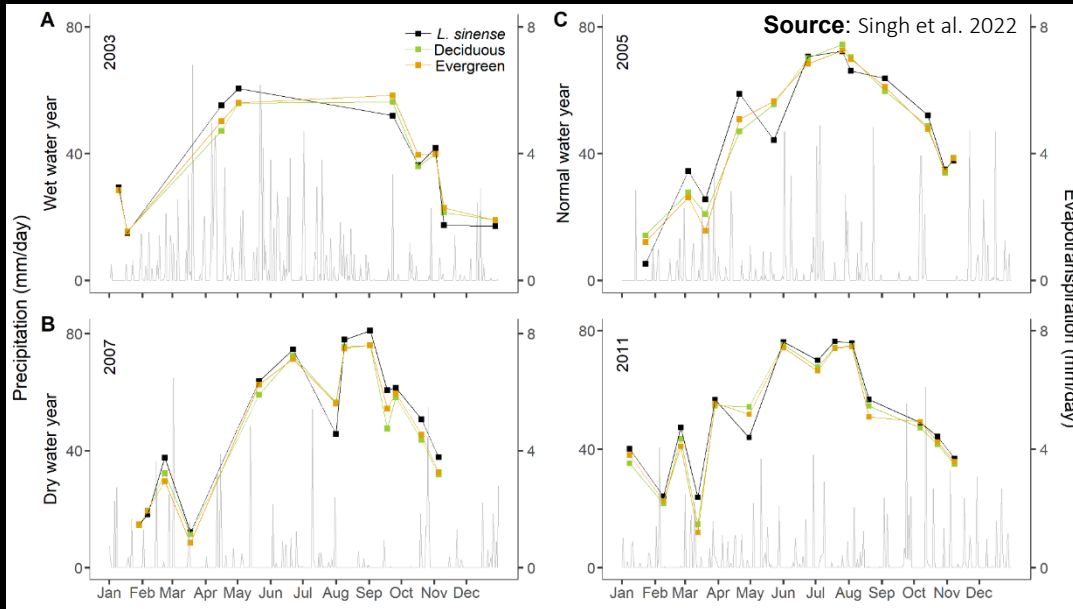
Remote Sensing of Evapotranspiration



- **Surface-Energy-Balance** model using Landsat/Sentinel imagery
- **Hydrologic response** of vegetation types (e.g., reforested stands, crops)
- Estimate **evapotranspiration** for water savings

Remote Sensing of Evapotranspiration

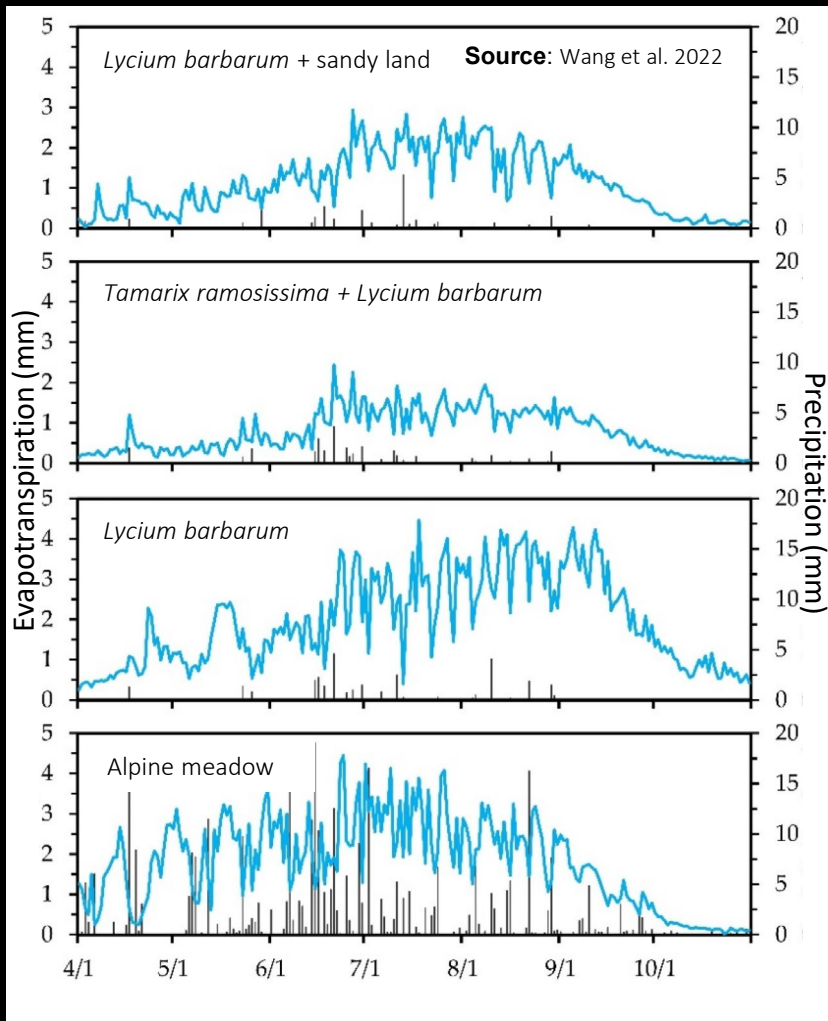
environmental implications



- **Daily average ET** and precipitation of forest types
- **Higher water demands** of invasive plants except during green up and post-high precipitation

Remote Sensing of Evapotranspiration

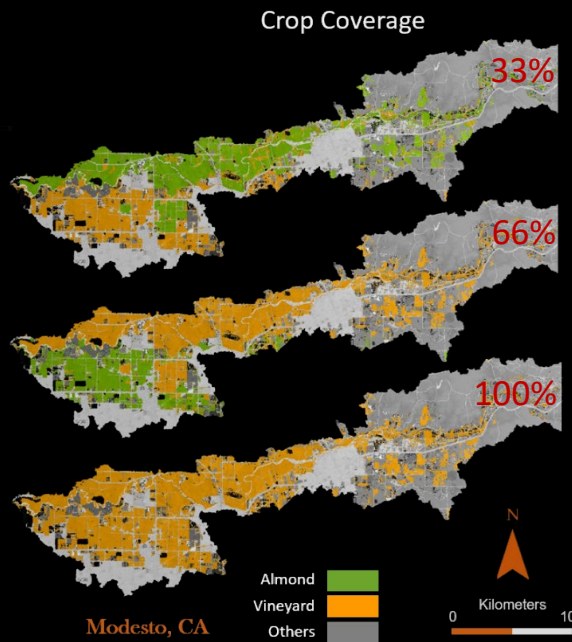
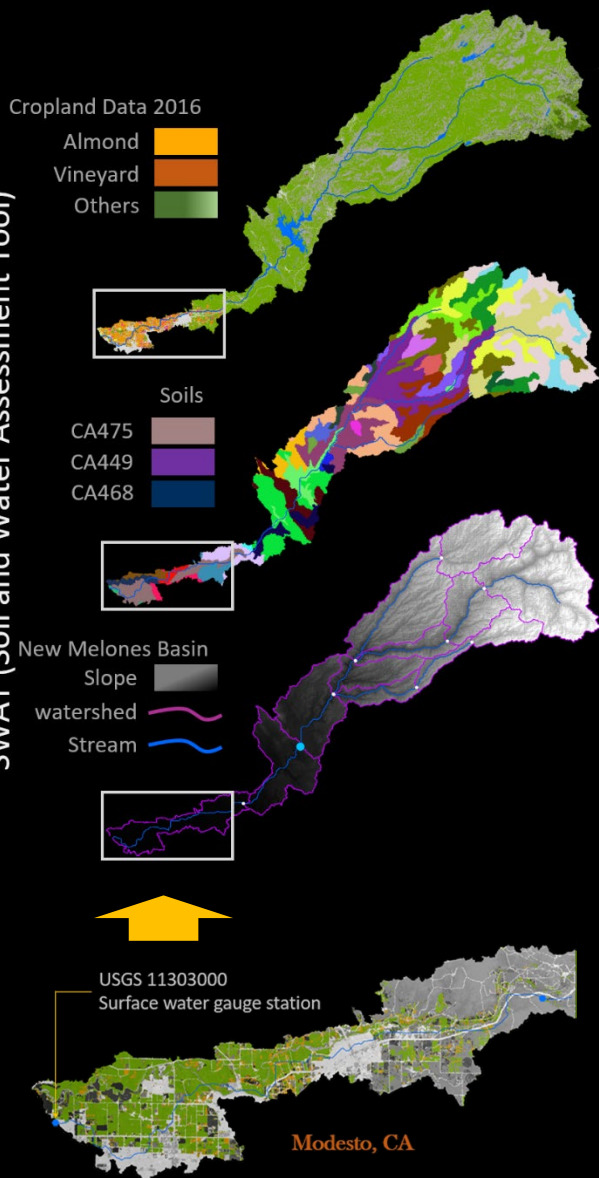
characteristics of crops



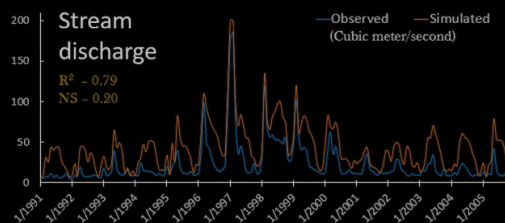
- Characteristics of evapotranspiration and **water consumption** of different underlying surfaces
- **Precipitation** is the main factor affecting the water consumption of the different underlying surfaces

Ecohydrological Modeling

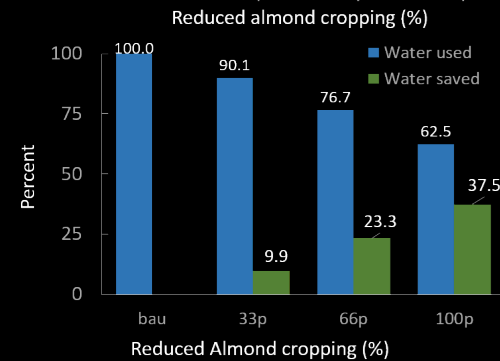
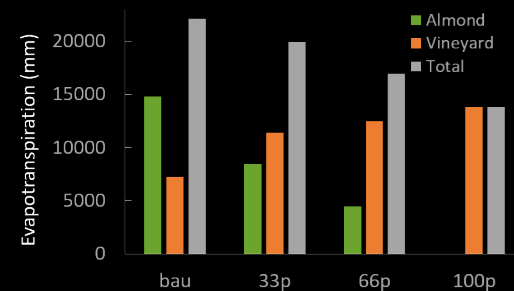
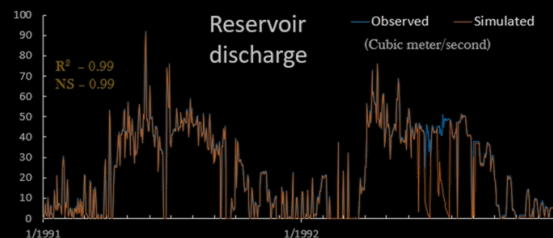
SWAT (Soil and Water Assessment Tool)



Stream discharge calibration



Reservoir discharge calibration



- Save ~38% water by replacing almond w/ vineyard farms
- Sustainable farming solutions

Remote Sensing & Cloud Computing



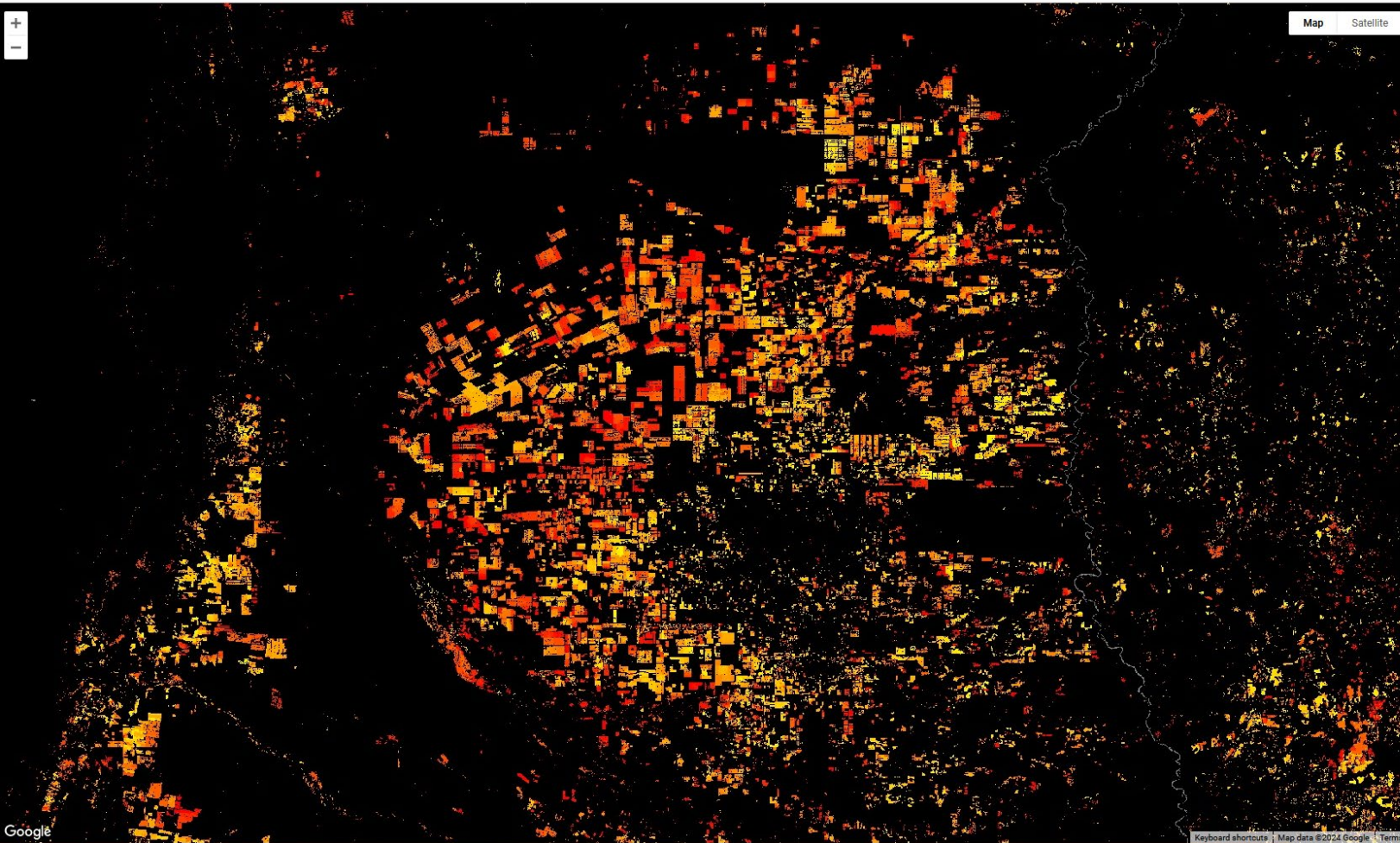
- Scalability
- Storage and handling of data
- Machine learning and AI capabilities
- Processing speed
- Cost efficiency
- Data security and compliance
- Integration capabilities
- Advanced analytics
- User-friendly interface
- Innovation and future readiness

Earth Engine Apps

global forest change

Earth Engine Apps

Search places



Map Satellite

Global Forest Change

Results from analysis of Landsat images characterizing forest extent and change.

For more information

Science paper by Hansen, Potapov, Moore, Hancher et al.

View Different Layers

Year of Loss

- Legend
- 2016
 - ...
 - 2000
 - No loss
 - Water or no data

Opacity 1

Visit Example Locations

Deforestation in Paraguay

Earth Engine Apps

grazing intensity

Earth Engine Apps

Search places

Pasture Parameters 2017

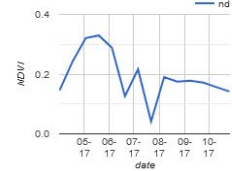
Click a point on the map to inspect. Please, note that grazing intensity and carbon sequestration values are valid for grassland areas only.

lon: 64.72

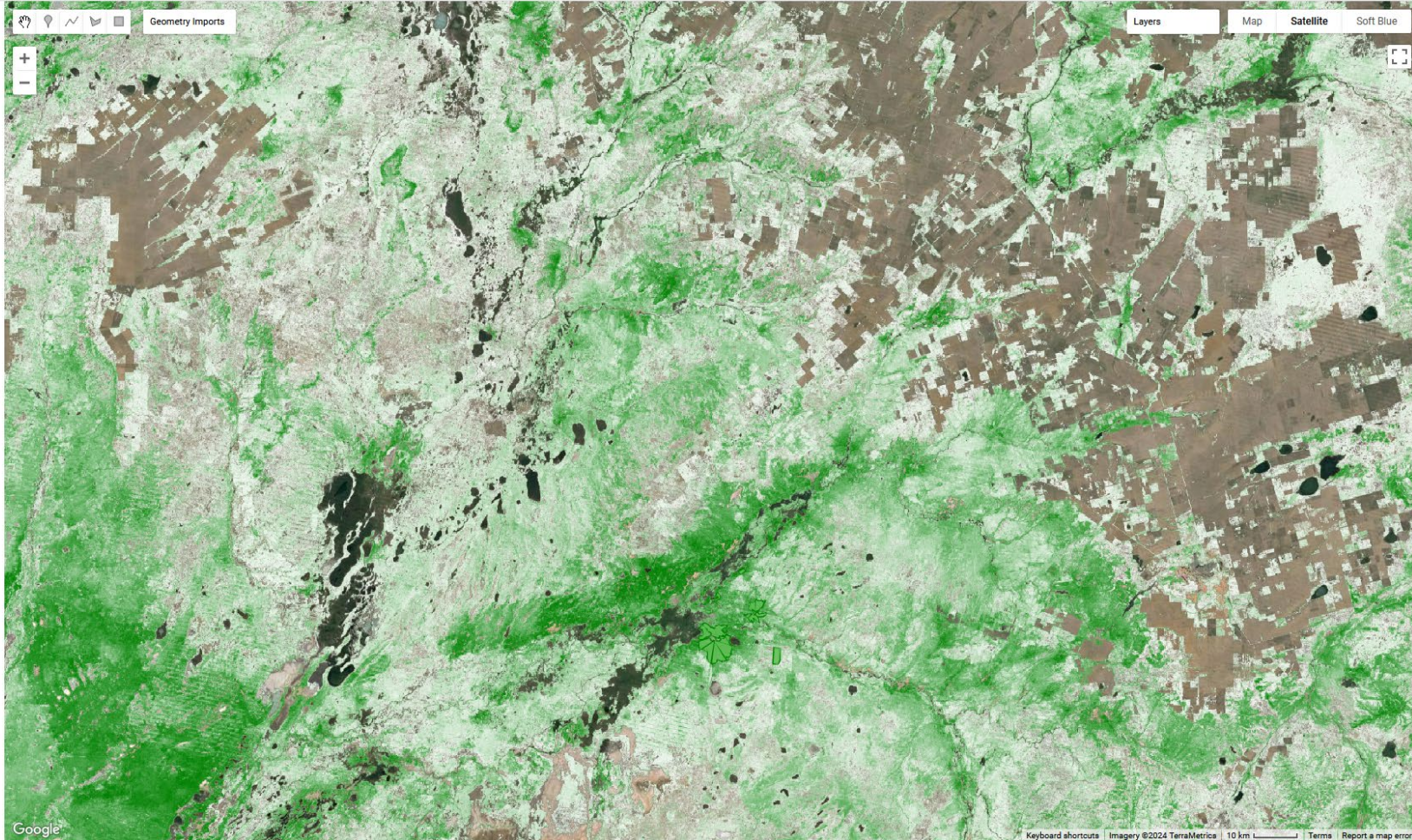
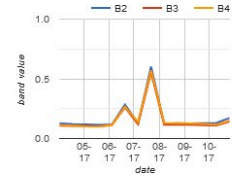
lat: 50.22

Grazing Intensity: 9.7 %

NDVI Over Time



RGB Reflectance Over Time



Earth Engine Apps

flood mapping

Earth Engine Apps

Search places

FLOOD EXTRACTION APPLICATION

This app allows a user to visualize the flooded area within the flood prone area in the Southern part of Somalia. It uses Sentinel 1 and it allows a user to select an area of interest, before floods period and after floods period. On the background, the script does an image difference between the two periods selected and assumes that whatever has changed between the two periods is the addition of floods. Additional information such as urban areas, population and crop lands affected is also added to the panel.

Select area of interest

Jowhar

Select Period Before Floods

Start Date(YYYY-MM-DD) End Date(YYYY-MM-DD)

2020-03-01 2020-03-31

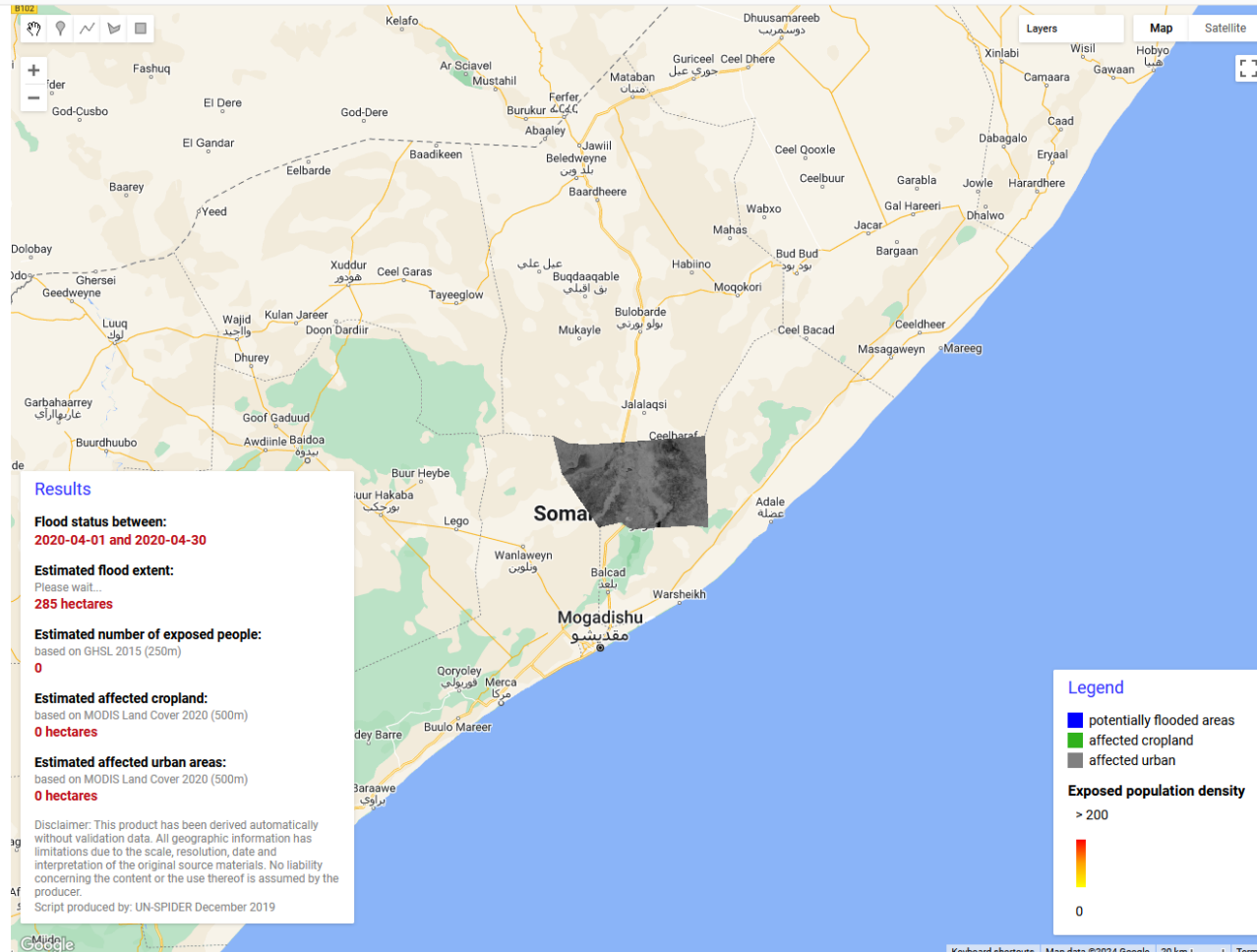
Select Period During Floods

Start Date(YYYY-MM-DD) End Date(YYYY-MM-DD)

2020-04-01 2020-04-30

Calculate

Reset Map



Thank You!

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