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Using dynamic remote sensing for early detection of forest stress in the Sierra Nevada Mountains.

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Using dynamic remote sensing for early detection of forest stress in the Sierra Nevada Mountains.

The Idea

- Sierra Nevada forests (largely managed by the USFS) provide critical ecosystem services and water resources to California
- Large increase in tree stress and mortality following recent droughts
- Extreme events likely to increase with climate change
- Increased monitoring and rapid response strategies are needed
- Many opportunities for dynamic remote sensing to support this need

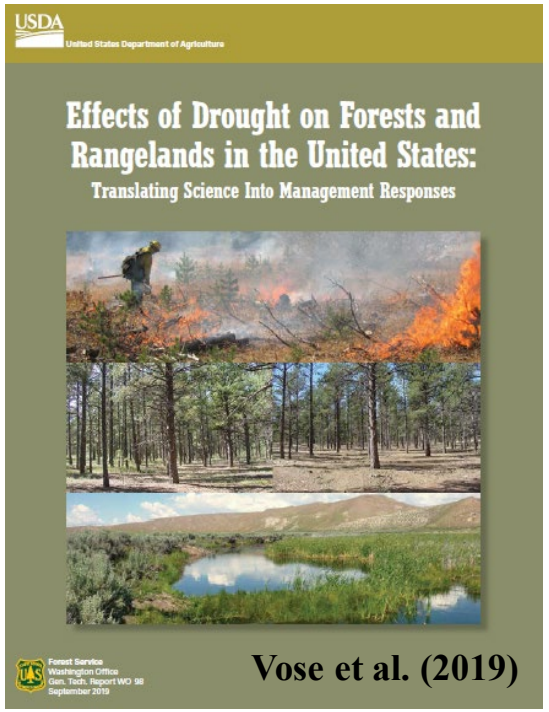
The Idea

Dynamic remote-sensing can inform both drought management and climate change adaptation strategies

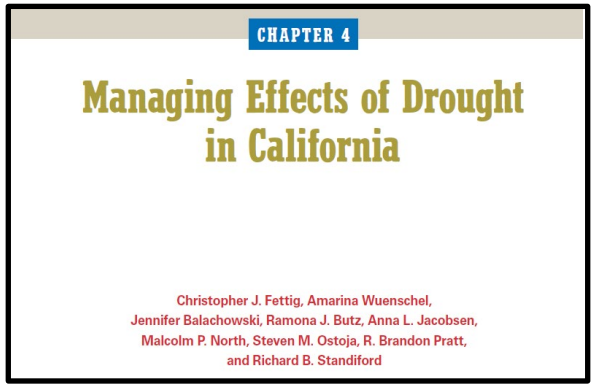
- The two aren't mutually exclusive, forest stress is a common theme
- Scientist-manager partnerships critical for the application of science, **management strategies have recently been identified in the PSW region.**
- Many of these strategies can be supported by dynamic remote sensing. However, partnerships and tool development need to be initiated if these datasets are going to inform decision making.
- New remote sensing applications may also lead to innovative management strategies, manager feedback is crucial

Climate Change Vulnerability and Adaptation for Infrastructure and Recreation in the Sierra Nevada

Halofsky et al. (in press)

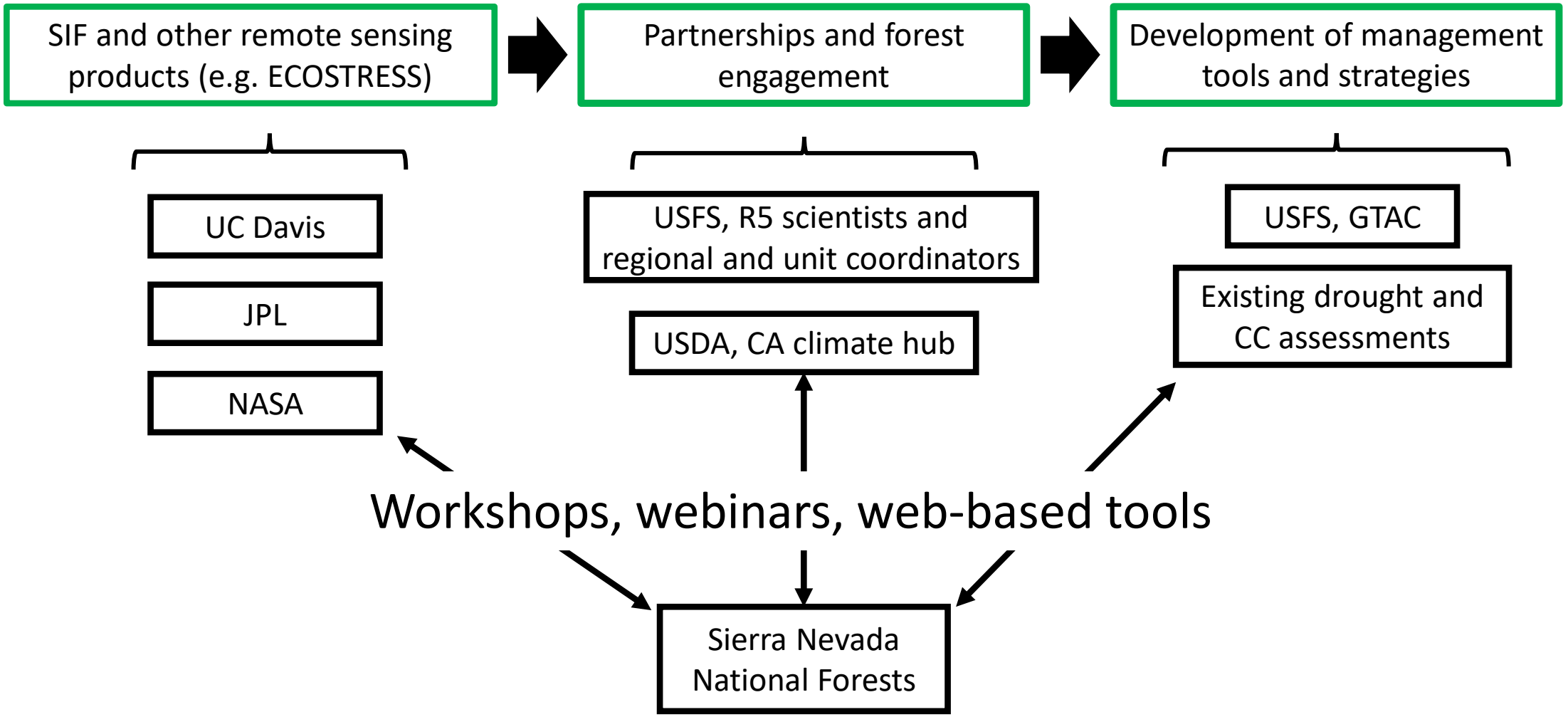


Vose et al. (2019)



Outcomes / Societal Benefits

Expanding existing scientist-manager partnerships to rapidly assess and manage forest stress



Issue(s) being addressed

Solar-induced fluorescence (SIF) is a small 'glow' of light emitted during plant photosynthesis

SIF shows close correspondence to canopy photosynthesis

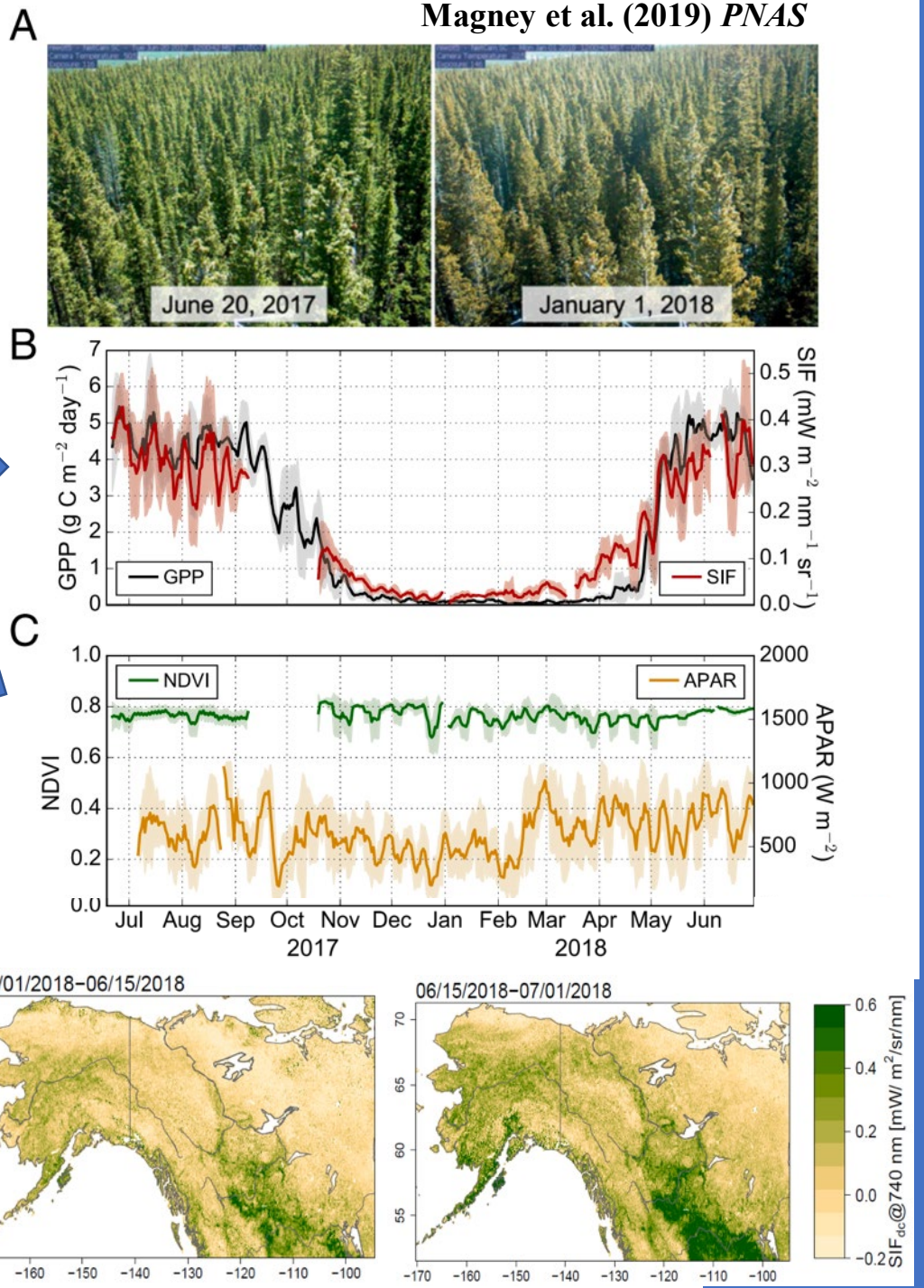
Unlike traditional 'greenness' indices (NDVI) which have challenges in evergreen systems

This allows us to detect rapid changes in tree photosynthesis, prior to any visible change

Because SIF data are now available from space, we can use it to detect:

1) Instantaneous changes in forest health
2) Impacts of drought (↓photosynthesis)
3) Spatiotemporal patterns of Carbon uptake
   - Strong relationships between GPP and SIF (Fig. B)

Magney et al. (2019) *PNAS*



Issues Addressed

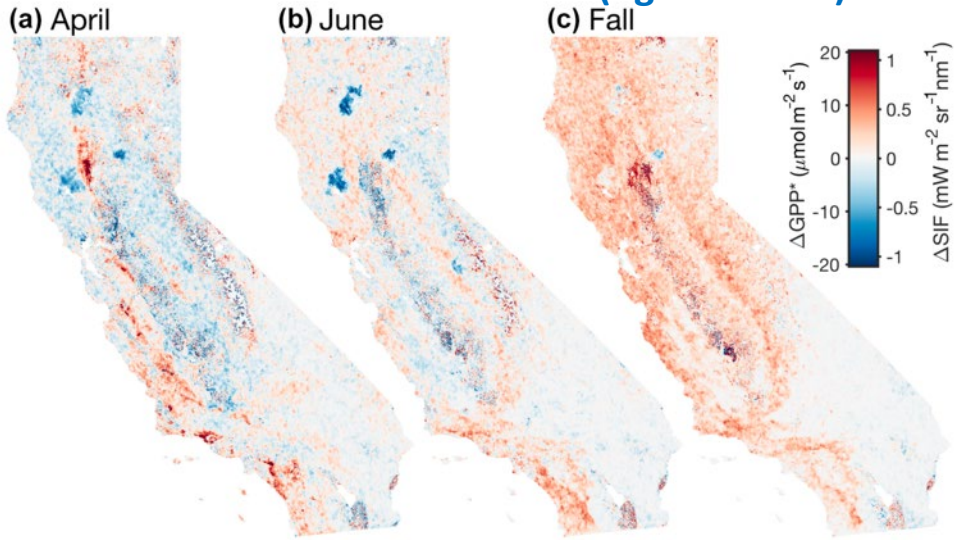
What EO data does your idea utilize?

1) **A 'downscaled SIF' product for CONUS**
   - Includes TROPOMI SIF, OCO-2 SIF, and MODIS VIs
   - Increased sensitivity to canopy photosynthesis (Fig. right)

2) **Evapotranspiration from ECOSTRESS and Landsat ET**
   - Permit mapping of Water-Use Efficiency

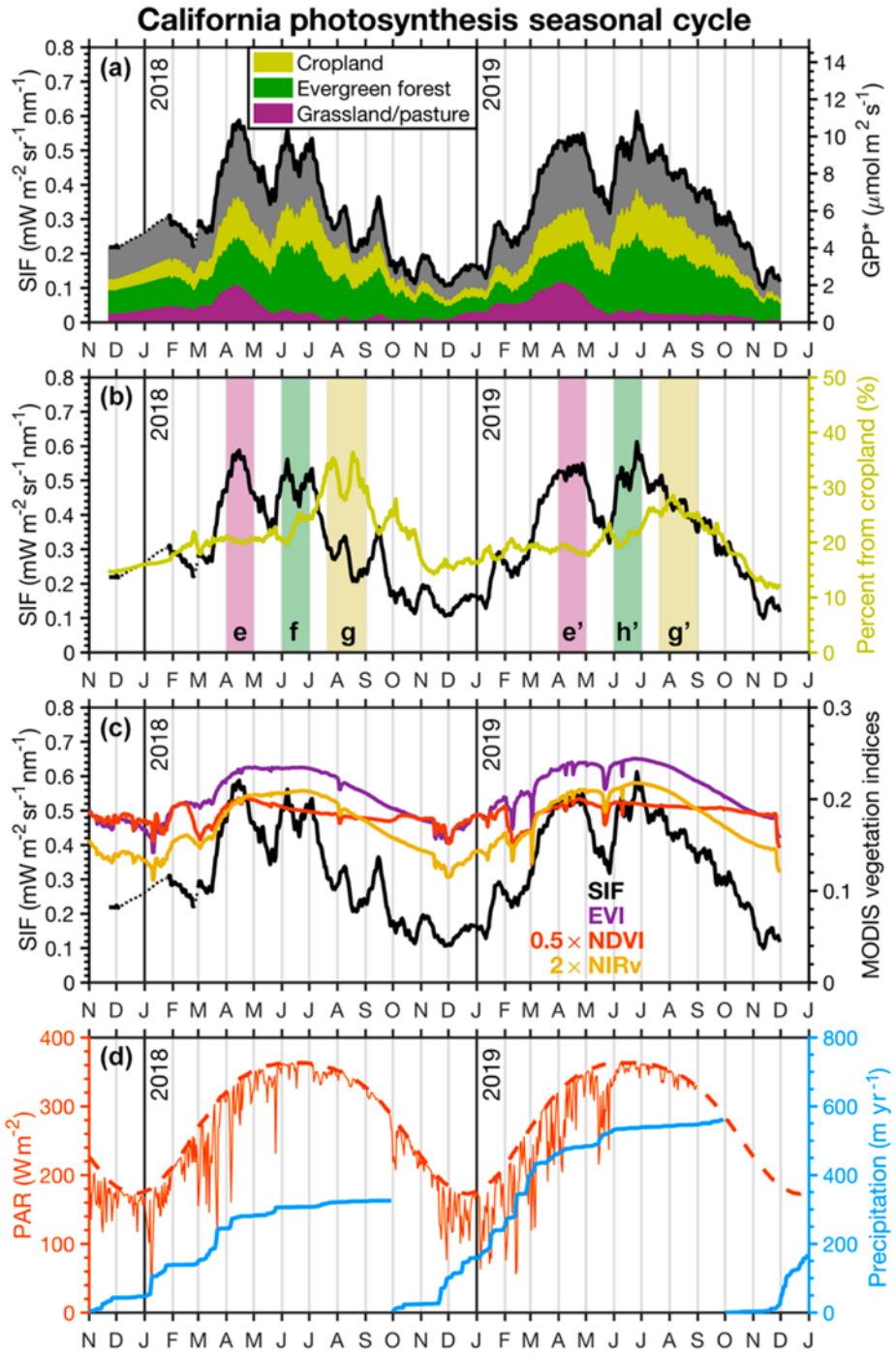
Ultimately, the combination of these two data sources will enable mapping of rapid changes in evapotranspiration and photosynthesis, with a sub-weekly resolution at 500 x 500m

Permitting research into the drivers of differences in forest health across seasons (figure below)



Blue = ↑ GPP in 2018 **Red = ↑GPP in 2019**

Turner, Kohler, Magney (2020) ***Biogeosciences***



Earth Observation Tools

Thank You!