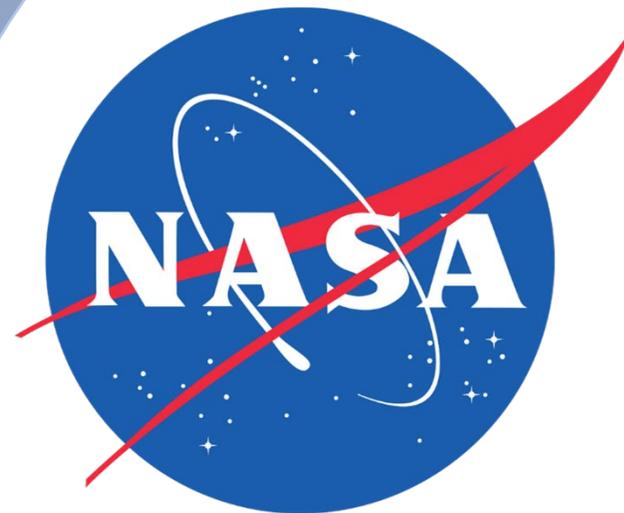




AEOIP Spring Workshop

March 22-24, 2022

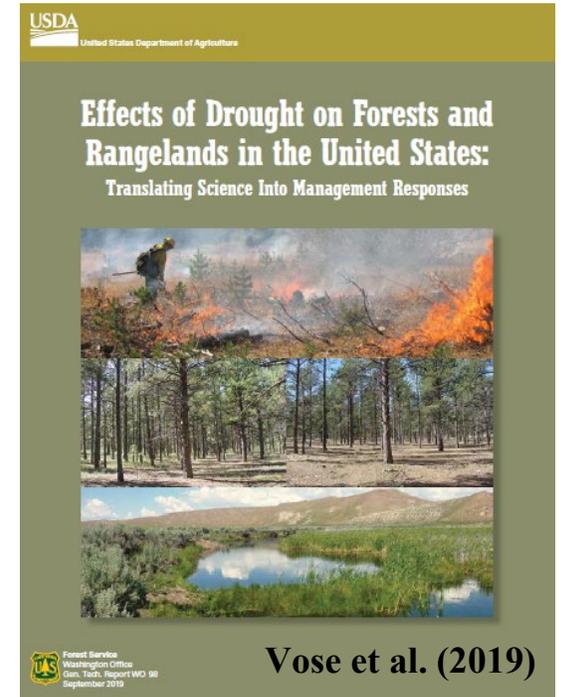
Using dynamic remote sensing for early detection of forest stress in the Sierra Nevada Mountains. (2020 Pitch)



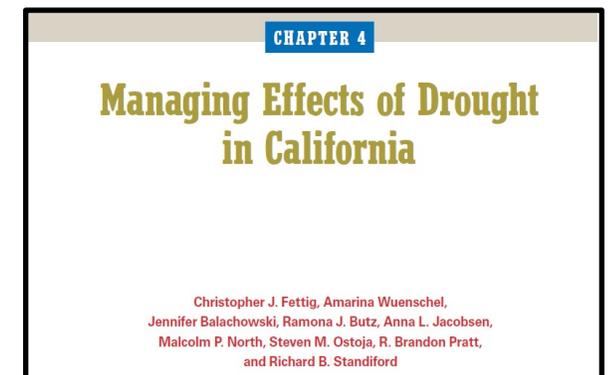


Dynamic remote-sensing of forest stress can inform both drought management and climate change adaptation strategies

- Drought and climate change assessments identify management strategies that can be supported by EO data.
- Partnerships and tool development are needed if these datasets are going to inform decision making.



Vose et al. (2019)



Christopher J. Fettig, Amarina Wuenschel,
Jennifer Balachowski, Ramona J. Butz, Anna L. Jacobsen,
Malcolm P. North, Steven M. Ostoja, R. Brandon Pratt,
and Richard B. Standiford

SIERRA NEVADA RECREATION AND INFRASTRUCTURE
VULNERABILITY ASSESSMENT AND ADAPTATION STRATEGY PARTNERSHIP

Climate Change Vulnerability and Adaptation
for Infrastructure and Recreation in the Sierra
Nevada
Halofsky et al. (in press)

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

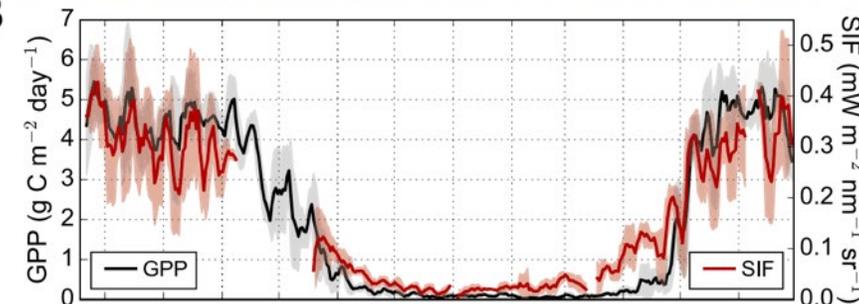
Because SIF data are now available from space, we can use it to detect:

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

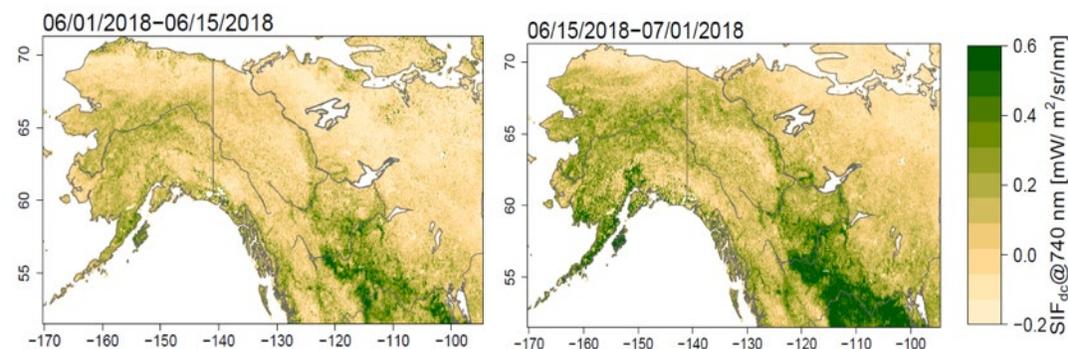
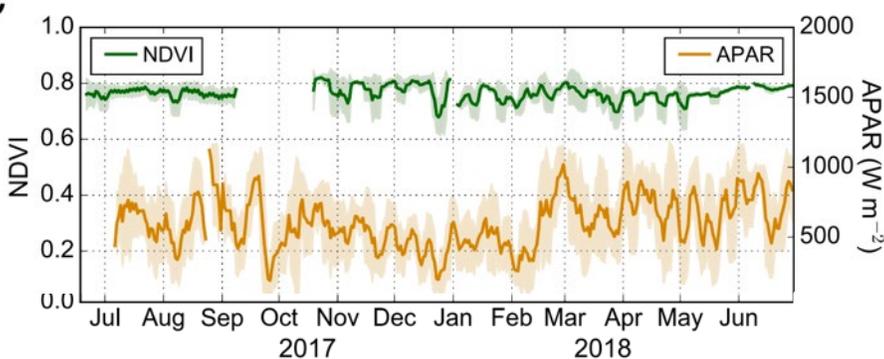
A



B



C



What EO data does your idea utilize?

1) A 'downscaled SIF' product for CONUS

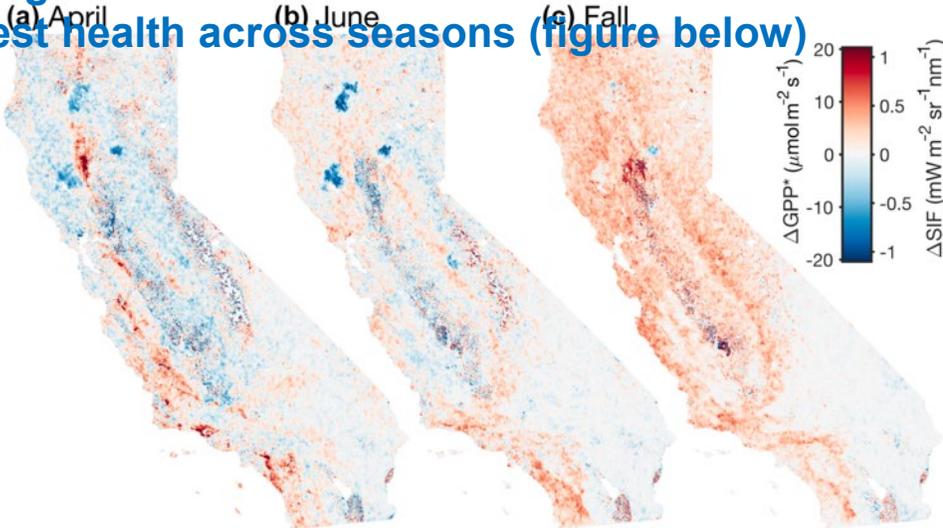
- Includes TROPOMI SIF, OCO-2 SIF, and MODIS VIs
- Increased sensitivity to canopy photosynthesis (Fig. right)

2) Evapotranspiration from ECOSTRESS and Landsat ET

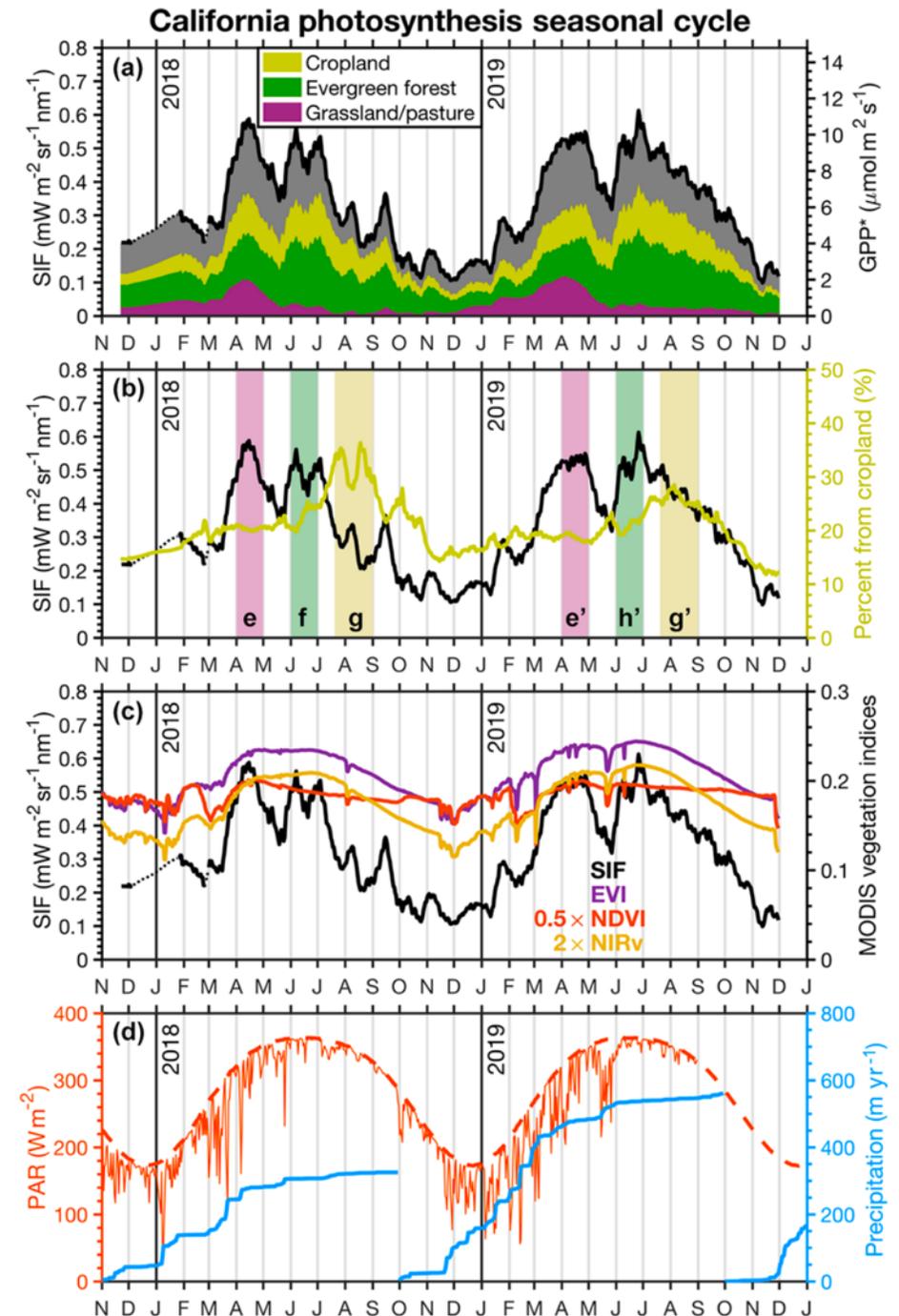
- Permit mapping of Water-Use Efficiency

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*



The pitch remains a pitch... but new opportunities emerge!

Job Title: Regional Analyst (started Jan 2022)

Organization: USFS Intermountain Region Information Management

1-sentence bio: Forest ecologist who previously worked with OSC for four years



Primary research areas/land management issues/EO application:

Analyses to support resource inventory/condition, land management planning, and monitoring.

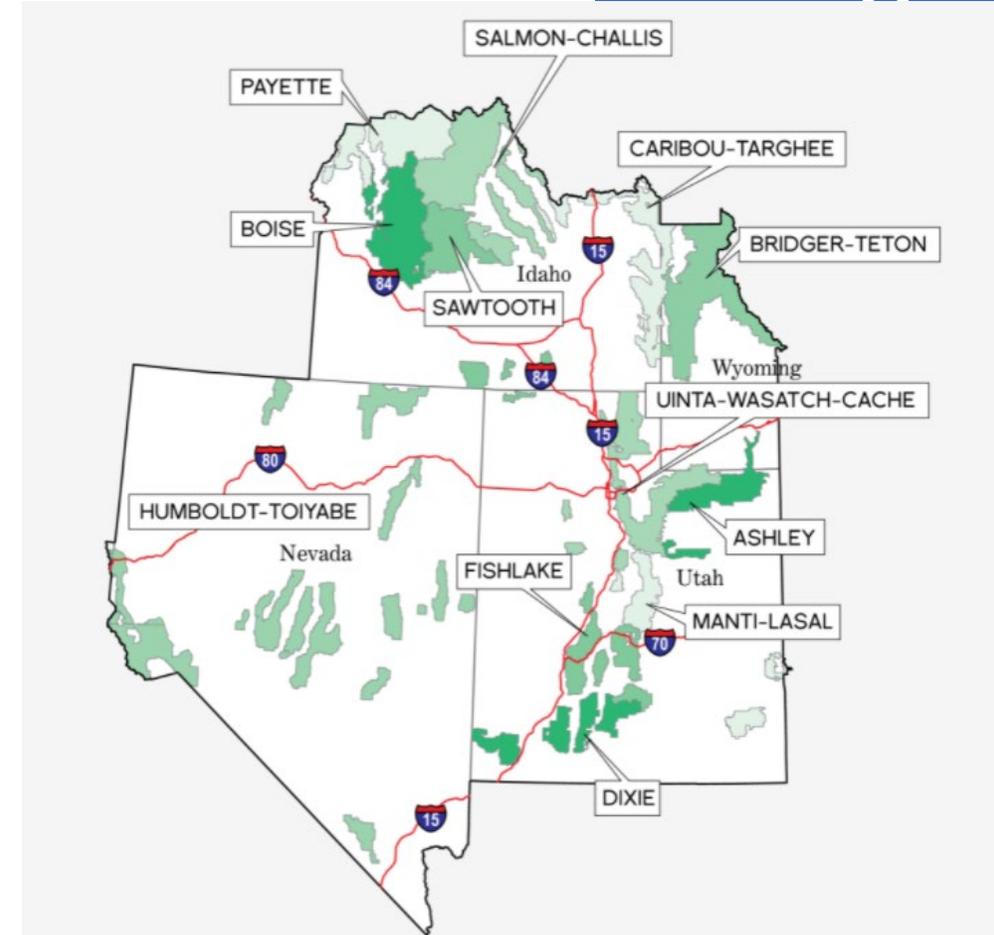
Using remotely-sensed data to support monitoring, project implementation, and ecosystem modelling

Current team members:

USFS analysts, scientists, R4 FS regional AND unit staff

National USFS climate change, monitoring, and analyst networks

New collaborators?



Challenges and opportunities in the Intermountain Region

- **Scale of EO datasets.** Demand for both fine-resolution products to support project-level work AND datasets that cover multiple forests and support consistent analysis/monitoring
 - **Timing mismatch** between analysis and land management priorities (e.g. plan revision schedules, new agency priorities). Stars have to align
 - **Lots of EO data options**, but what's the right choice? Questions, manager needs, and appropriate data applications can be articulated more clearly.
 - **Complex and diverse forest ecosystems** can make interpretation of EO data difficult (particularly when datasets are new and/or numerous)
-
- R4 has established **successful partnerships** with RMRS to collect and analyze LiDAR data across Shared Stewardship priority landscapes.
 - **Shared funding** support from USGS to support R4 data collection efforts
 - **Maintaining connections** with broader networks, planning groups, and SMEs to keep up to date on new data, analysis approaches, and needs at both WO and Forest levels
 - **Flexibility to try new analyses** to support Regional needs and priorities



Feedback to AEOIP

- *Open exchange of ideas and opportunities to engage with networks is great (2020 pitch in pocket). Follow through from both managers and data providers to support application is crucial.*
- *Consider manager needs across spatial and temporal scales to identify opportunities (e.g. ask what needs to be measured this year at the project scale vs in the next five years across multiple forests? What agency priorities are you trying to address?)*
- *Keep up the conversation. Lots of movement with FS staff so you never know who might be joining the discussion for the first time.*
- *How to foster stronger partnerships with universities, states, other agencies to support follow through?*



Thank You!

