

Overview of USDA Forest Service Management Goals and Information Needs for Vegetation Structure and Function

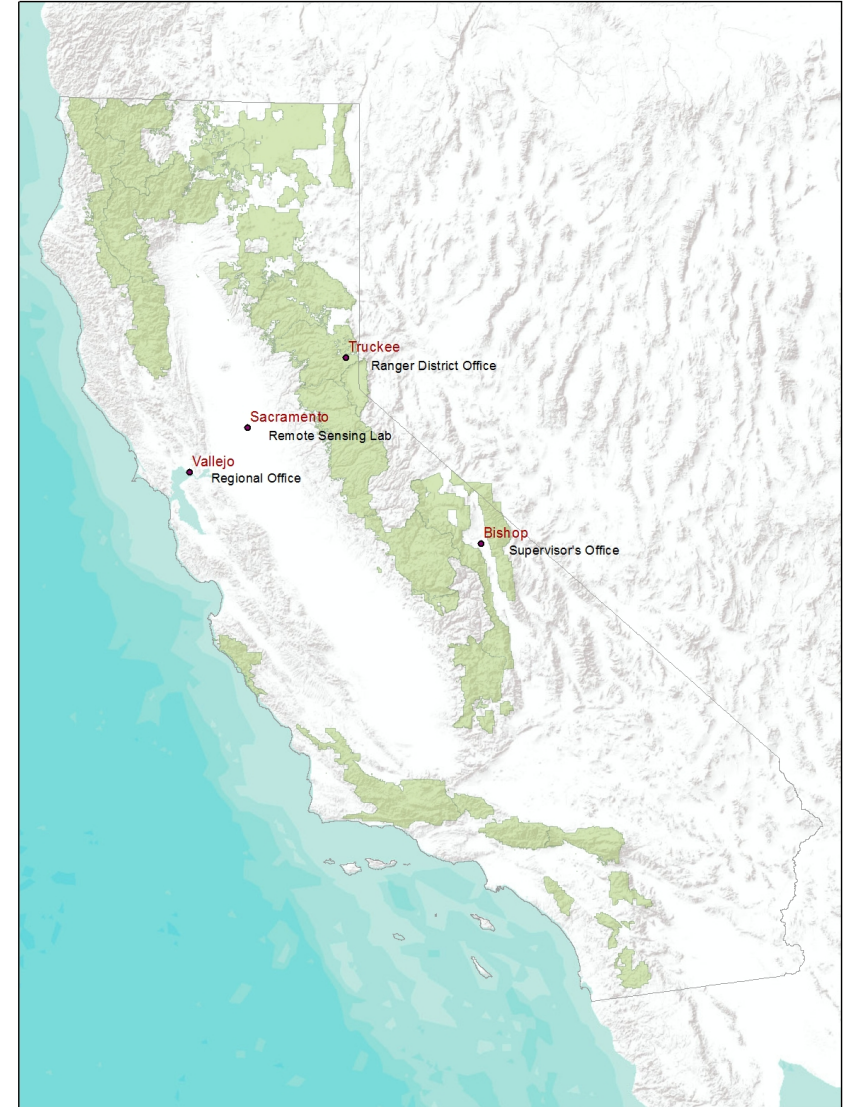
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Pacific Southwest Region (Region 5) Remote Sensing Laboratory

Which branch(es) within the USDA Forest Service do you represent?

- The R5 Remote Sensing Laboratory falls under the National Forest System branch of the USDA-FS.
- We work collaboratively with ecosystem planning, ecosystem management, fire and aviation management, and forest health staffs.
- Some RSL staff are strategically located on NFs to foster better communication with resource specialists.



How does your work contribute to USFS management goals and objectives? And what are these goals and objectives?

- **National Priorities**

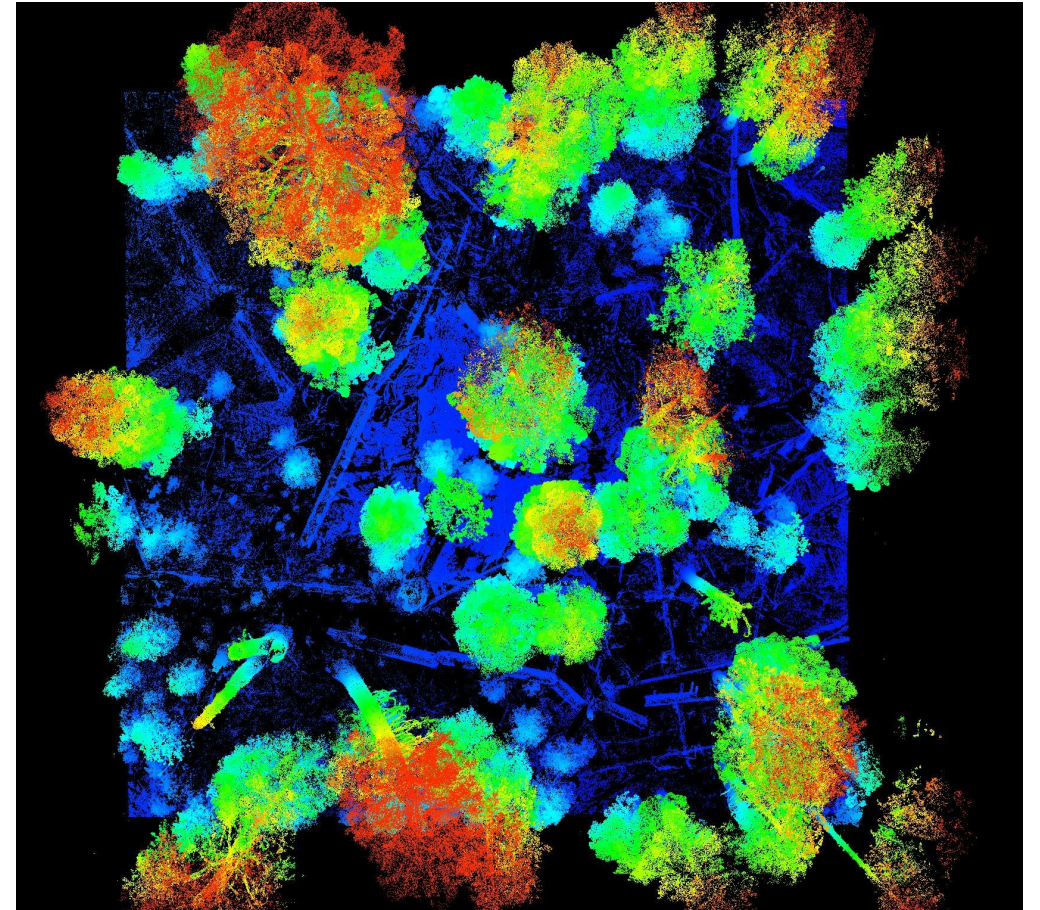
- Improving the condition of forests and grasslands.

- **Regional Strategic Priorities**

- Ecological restoration
 - Increase forest resilience through treatments and wildfire
 - Restore at least 50% of accessible, degraded forest meadows
 - Decrease occurrence of uncharacteristically severe wildfires
 - Reforest after wildfire
 - Ensure practices are grounded in concern for biodiversity and ecological process
 - Leadership Intent document:
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5351674.pdf

How does your work contribute to USFS management goals and objectives? And what are these goals and objectives?

- **Mapping and monitoring of forest resources to meet Agency and Region Priorities**
 - Develop tools and products for assessing vegetation structure and function, as well as for monitoring species and forest types of ecological or cultural importance
- **Provide advanced analytical support**
 - Translation/integration of analytics into the planning process (NEPA) and existing FS & collaborator workflows



Terrestrial Laser Scanner plot on the Plumas National Forest, California
Source: NASA CMS project (Title: Three dimensional change detection of aboveground biomass; PI Jonathan Greenberg)

Which resource area(s) are you responsible for?

Describe your area(s) of responsibility or expertise

- Responsible for:
 - Enhanced forest inventory
 - Data collection, compilation, and analysis of forest inventory intensification data
 - Existing Vegetation Mapping
 - Mapping program started in 1990, through an MOU with CAL FIRE and S&PF
 - Forest, shrub and grasslands monitoring
 - A new addition to the RSL's portfolio in response to a rapidly changing landscape
 - Forest structure
 - ALS, TLS, stand metric imputation
 - Smoke emissions modeling
 - Shared position between RSL and FAM

Diverse Team Environment

- Due to the complexity of each program area, we primarily work in teams and across multiple teams
- The RSL team has a diverse background
 - Ecology (plant, forest, fire, ecophysiology)
 - Forestry
 - Geology
 - Computer Science
 - Mathematics
 - Statistics
 - Geospatial Sciences
 - Scientific programming
- Diverse combination of backgrounds and skills allows for advanced analytics and product development

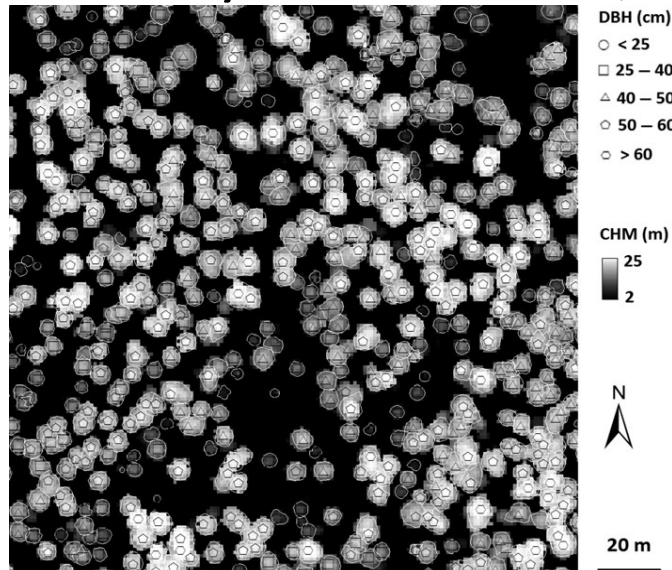
Forest inventory	Forest, Shrubland, & Meadow Monitoring	Forest structure	EVeg Mapping
Kama Kennedy Compilation, analysis, and contract admin.	Carlos Ramirez Concept development and analysis	Carlos Ramirez Applications development and analysis	Jeff Mallory Image processing, map attribution, editing, and QA/QC
Marcus McElhanev Inventory tools programming	Alex Koltunov Concept development, algorithm programming and analysis	Shengli Huang Algorithm programming and production	Rodney Hart Image processing, map attribution, editing, and QA/QC
Rodney Hart Field inspections, QA/QC	Michele Slaton Applications development and analysis	Marcus McElhanev FVS programming	Laura Young Map attribution, editing, and QA/QC
Laura Young Field inspections, QA/QC	Tanya Kohler Applications development and analysis	Kirk Evans LiDAR processing and algorithm development	Carol Clark Map finalization and metadata
Lee Tarnay Smoke Emissions	Nathan Amboy, Carol Clark, and Kirk Evans High-performance computing, virtual machine, and server support		

How do you use Vegetation Structure and Function data/information/tool(s) to support your management decision(s)?

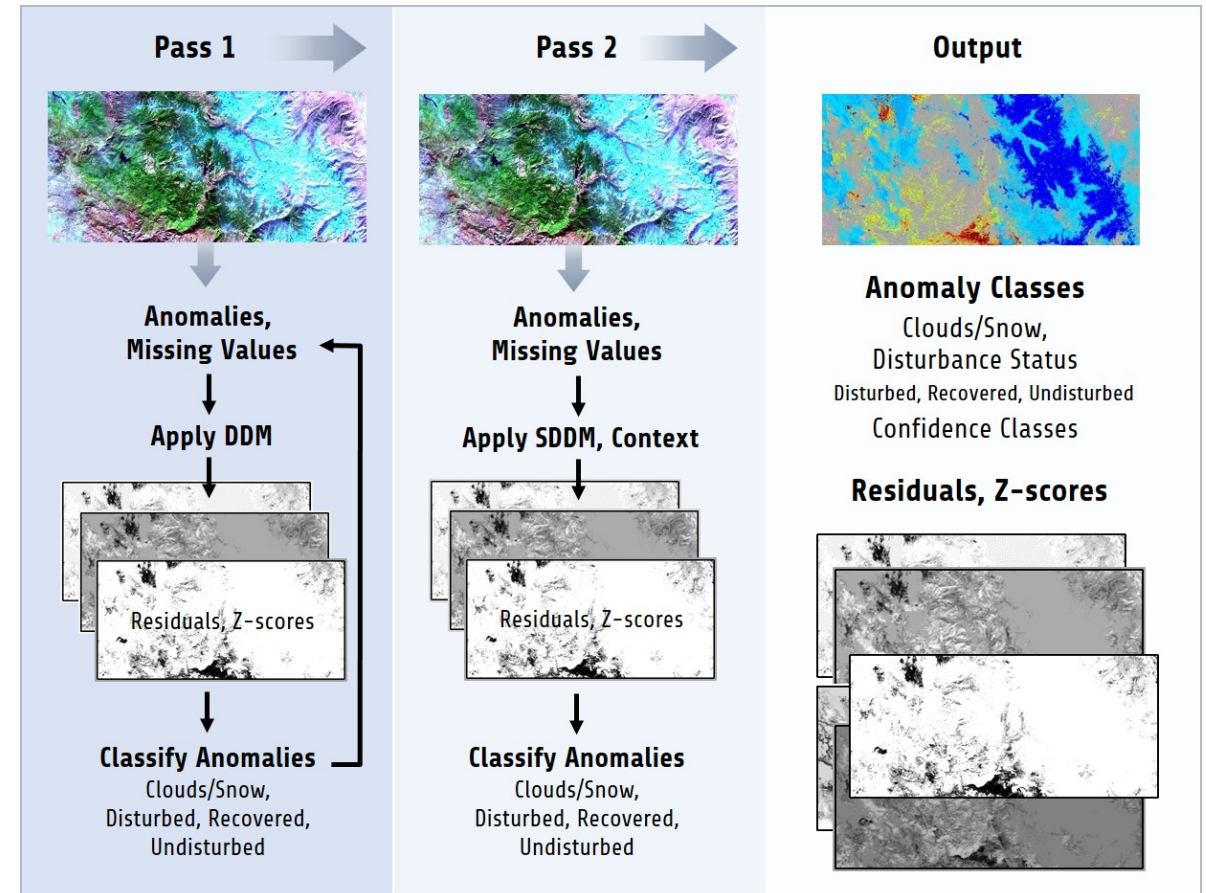
- We work directly with vegetation managers/silviculturists and wildlife biologists to integrate new RSL-developed products into their workflows and analyses to support regional priorities.
- Examples:
 - Vegetation management project planning
 - Timber production
 - Habitat suitability modeling
 - Fire risk assessment
 - Estimate current and projected carbon stocks
 - Ecological restoration prioritization

What is your primary source of Vegetation Structure and Function data/information/tool(s)?

- Landsat
- ALS
- TLS
- Ground-based sampling
- Secondary sources: SAR, IS



F3 Modeling Framework LITIDA module



Ecosystem Disturbance and Recovery Tracker-Anomaly Detection and Classification

How are remote sensing data used in your management decision(s)?

If so, describe the type of data and applications > Examples on next slides.

What are your spatial resolution and latency requirements?

- 1-m with a latency of 1 year
- 30-m with a latency of 2 weeks

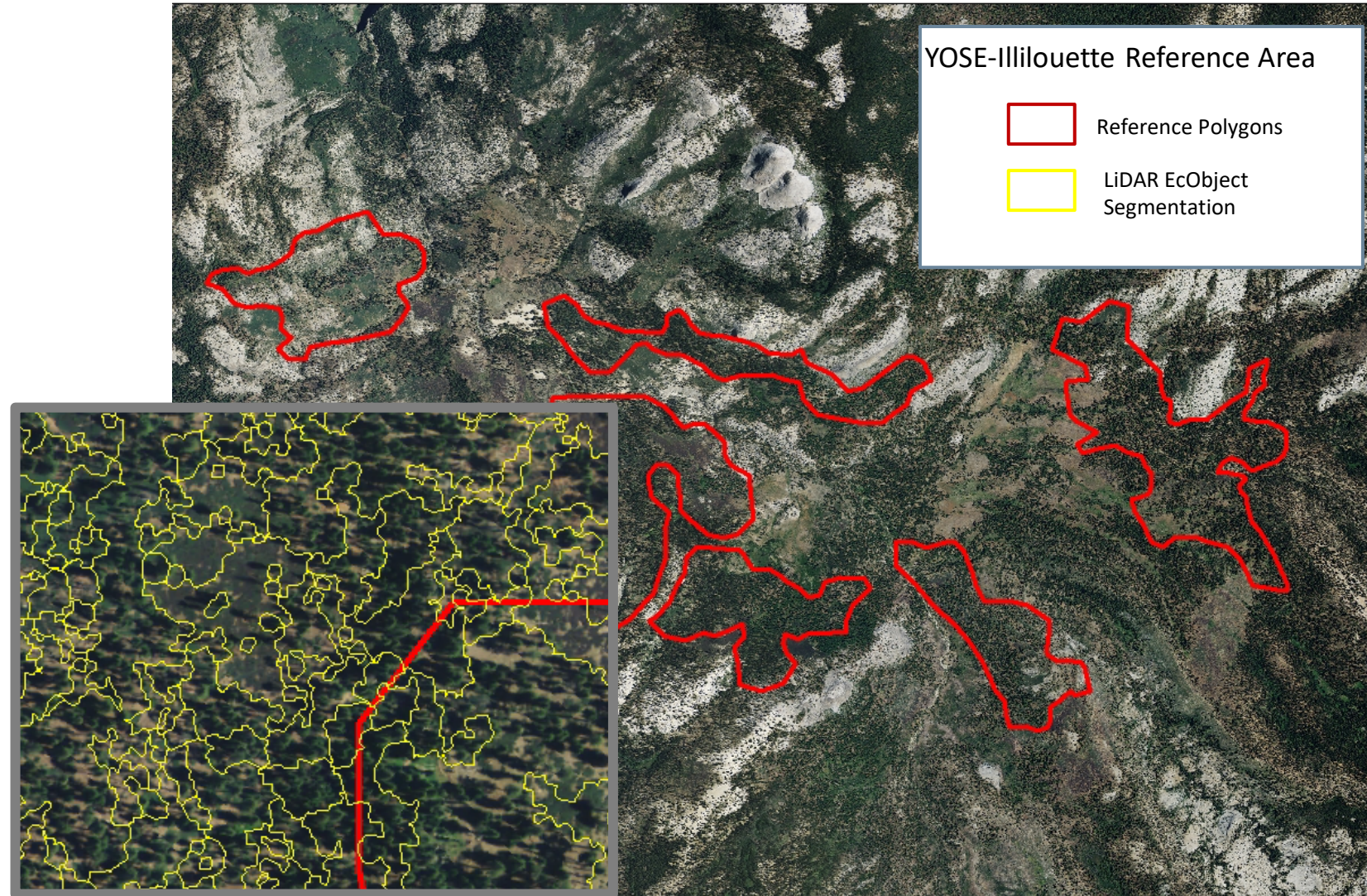
What is your organization's capability for integrating in remote sensing data?

- High. Forest staff are becoming more aware of RSL products, and gaining skills to work with them.

How are remote sensing data used in your management decision(s)?

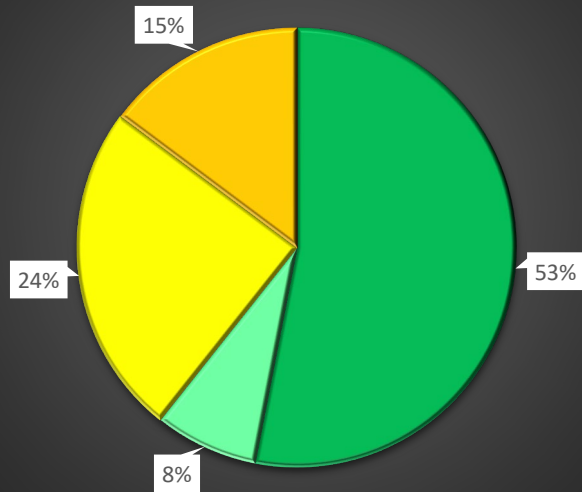
Example 1.

- High-resolution data, such as ALS, provides us with the ability to quantify patch and gap distributions at multiple scales.
- It also facilitates comparisons against contemporary reference conditions, such as those found in YOSE and SEKI NPs, CA and Sierra San Pedro Martir, Mexico

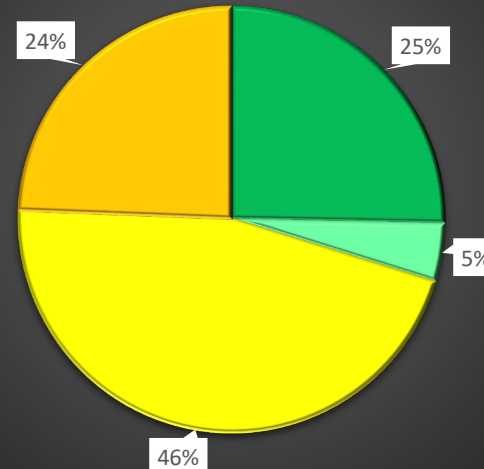


Illilouette Basin – Horizontal Structure

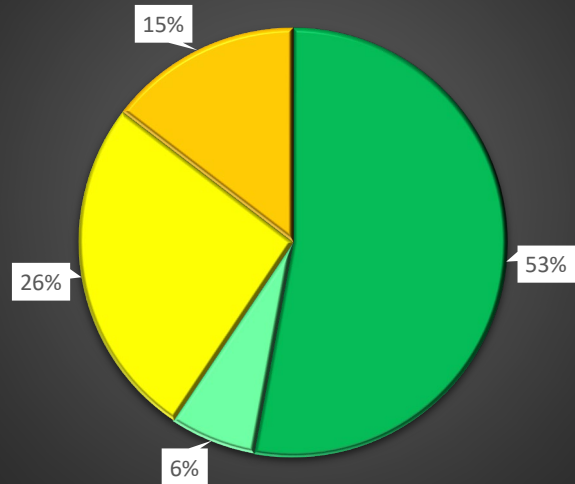
Drainage Bottoms



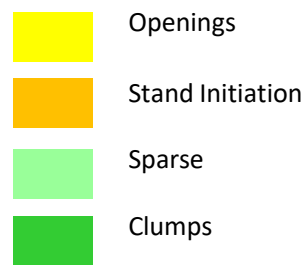
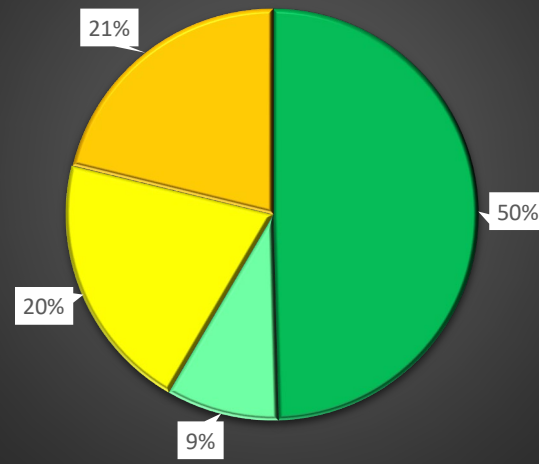
Ridge Tops



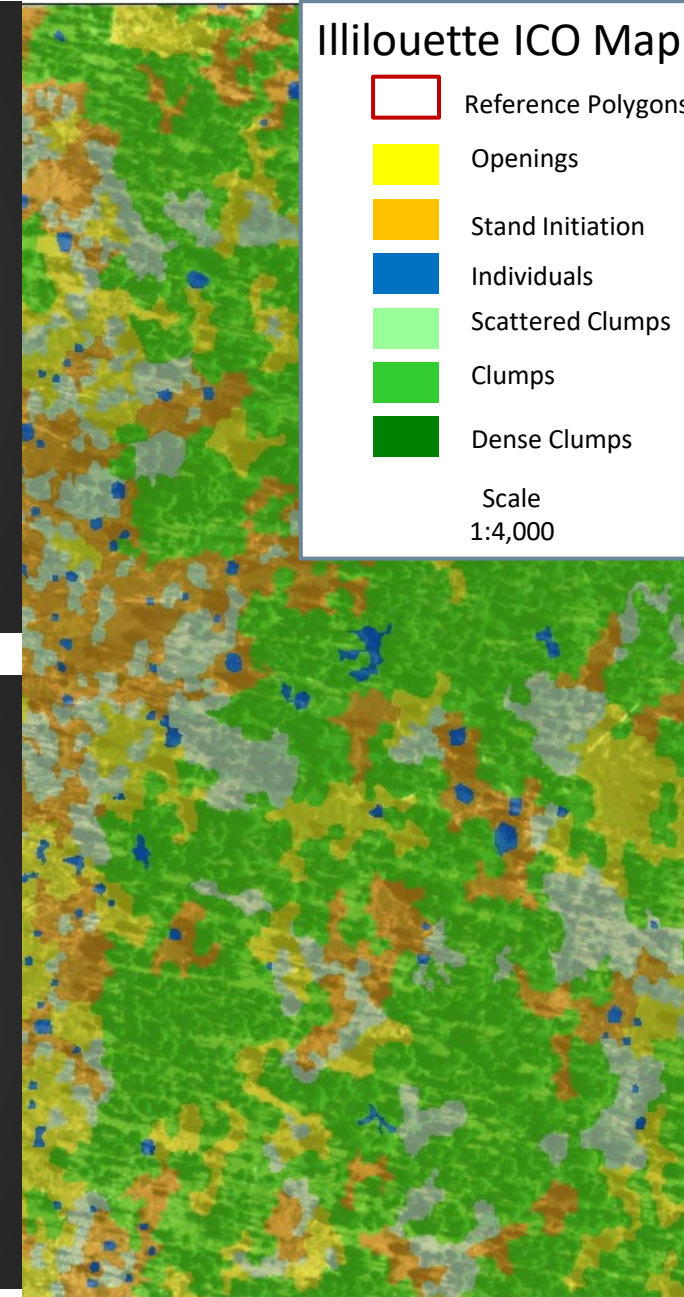
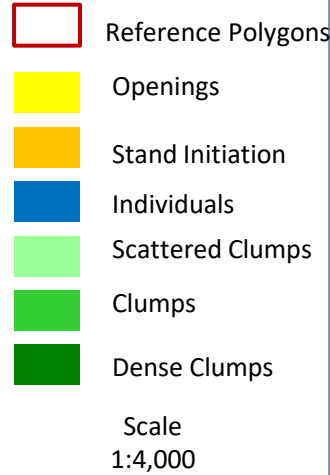
South West Facing



North East Facing



Illilouette ICO Map



Lake Tahoe Basin - Horizontal Structure Assessment

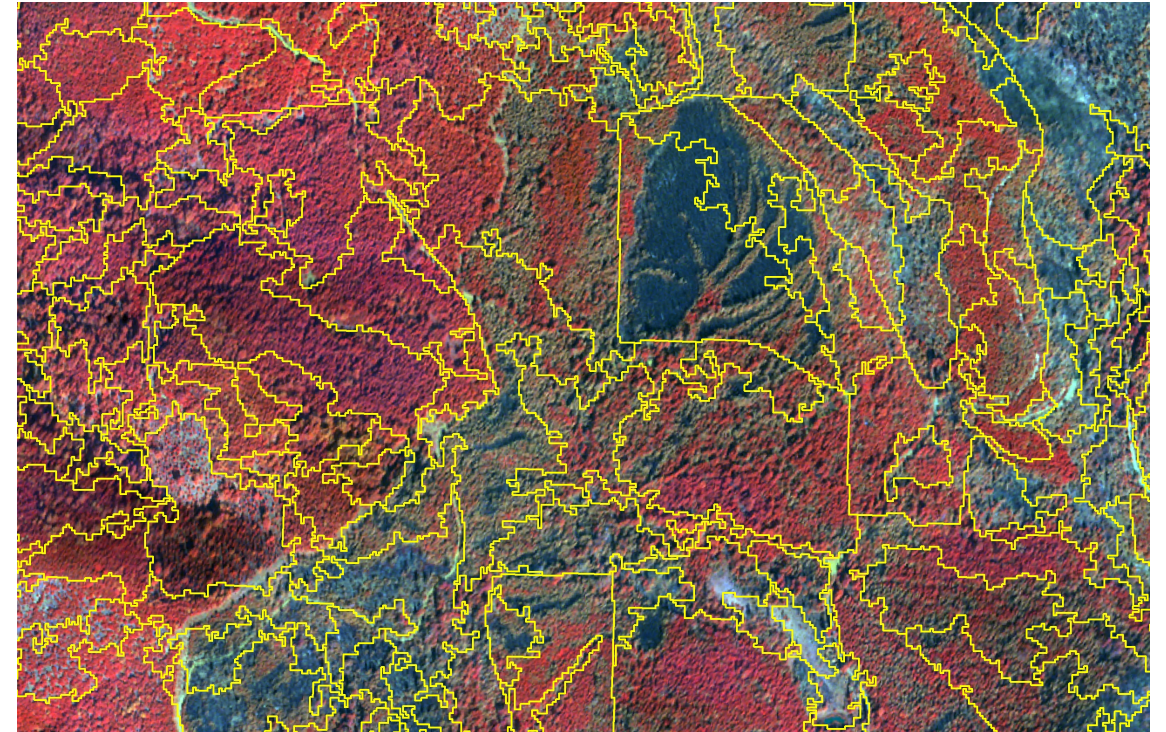
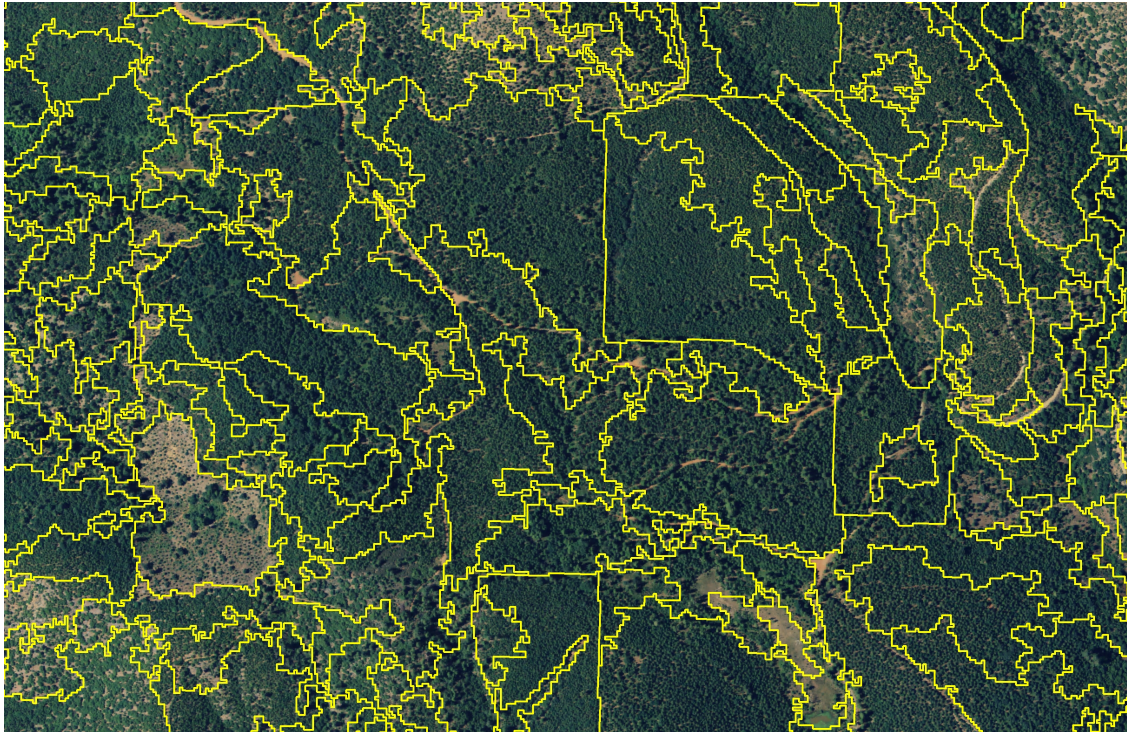
Landscape Position	Openings	Stand Initiation	Sparse	Clumps	Individuals
Drainage Bottoms	8%	12%	4%	76%	3.5 TPA
	0.55 acre	0.37 acre	0.14 acre	0.52 acre *	N/A
Ridge Tops	11%	16%	6%	67%	3.0 TPA
	0.70 acre	0.55 acre	0.15 acre	0.57 acre *	N/A
South West Facing	5%	11%	5%	79%	2.3 TPA
	0.46 acre	0.38 acres	0.14 acre	0.48 acre *	N/A
North East Facing	2%	8%	8%	82%	2.7 TPA
	0.36 acre	0.31 acre	0.16 acre	0.50 acre *	N/A

<div></div> over represented	<div></div> near resiliency envelope	<div></div> under represented	<div></div> within resiliency envelope
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How are remote sensing data used in your management decision(s)?

Example 2.

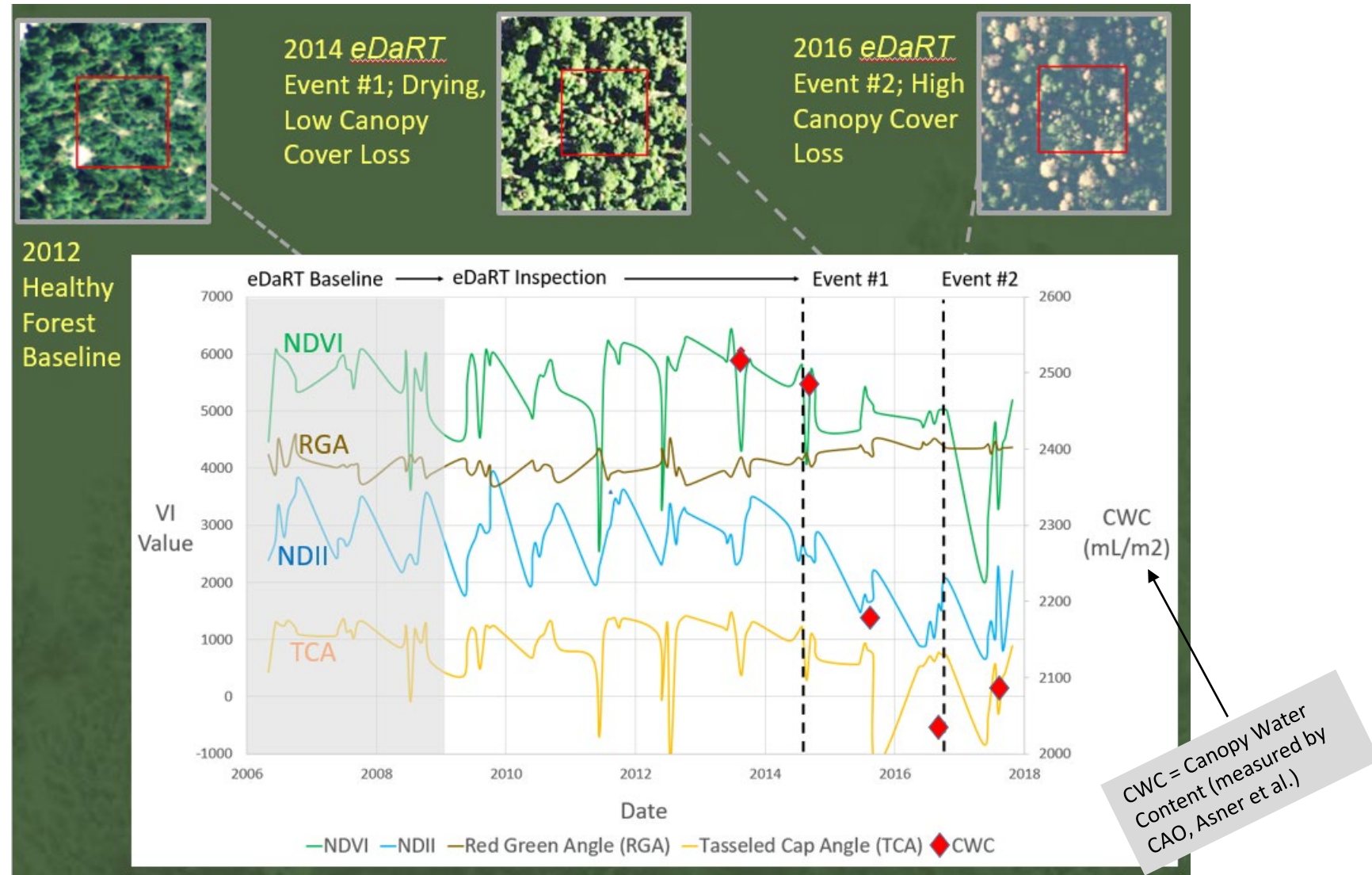
- High-resolution imagery facilitates updates to Existing Vegetation, which is relied upon in Land Management Plans to set goals and objectives for harvest and restoration.
- eVeg polygons over pre-fire (2012) imagery.
- eVeg polygons over post-fire (2013) imagery.
- Red = live, healthy vegetation



How are remote sensing data used in your management decision(s)?

Example 3.

- High-temporal resolution of Landsat allows for rapid detection of change. LA County recently used RSL outputs to target drought-stressed live oaks for early treatment.



What are top 3 critical information gaps/technological challenges that you believe remote sensing data could help to address?

- Monitoring changes in forest structure
 - a model-based approach is the closest we have to operational monitoring, however more direct structure measurements would be beneficial due to the variability in structure and composition throughout CA
- Changing disturbance regimes
 - restoration activities could be better targeted, with an increased pace & scale, by updating the current vector-based approach to mapping harvest, forest mortality, and other disturbance types
- Biophysical monitoring
 - soil moisture, canopy moisture, carbon flux, smoke and pollutant emissions, surface temperature

What [is the 4th] critical information gap/technological challenge that you believe remote sensing data could help to address?

- Detecting change in species and life-form composition
 - Trees invading shrublands and meadows, shrubland and hardwood conversion to invasive grasses, mixed conifer conversion to oaks.
 - How can eVeg and classifications like Calveg and NVCS keep up with newly emerging conditions?

