The Impact of Conservation Practices on Post Wildfire Recovery

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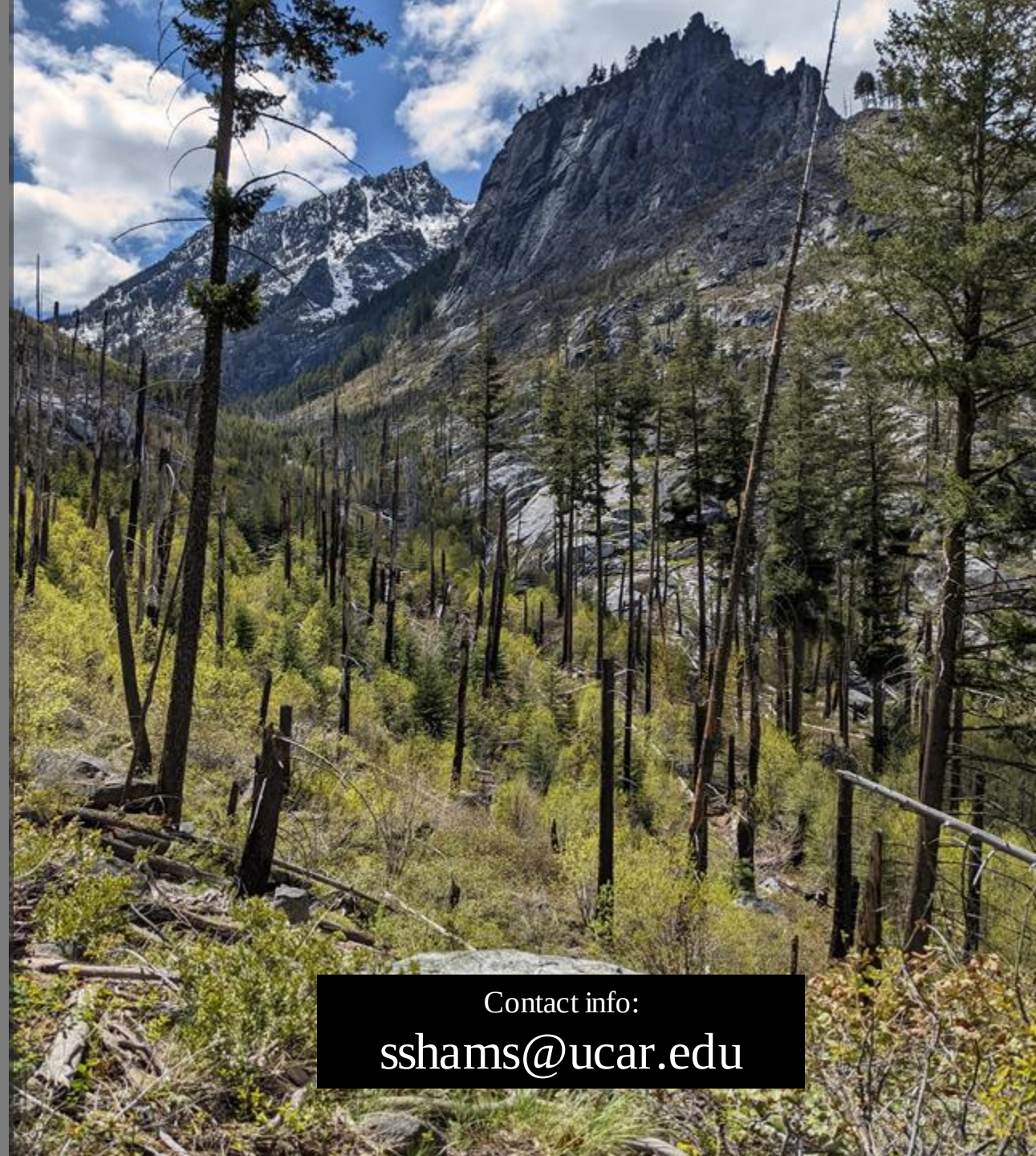
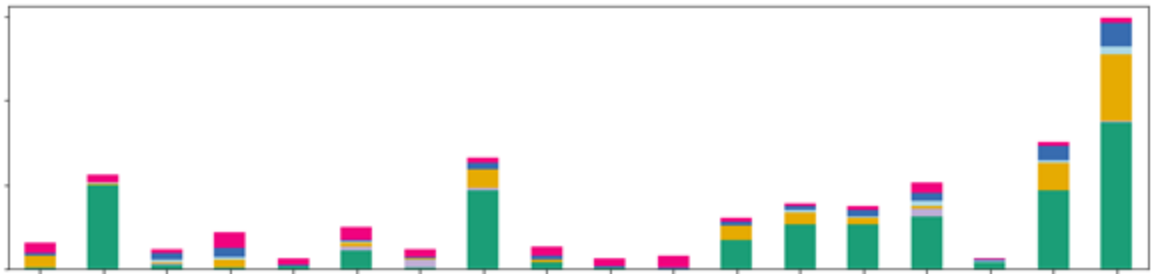
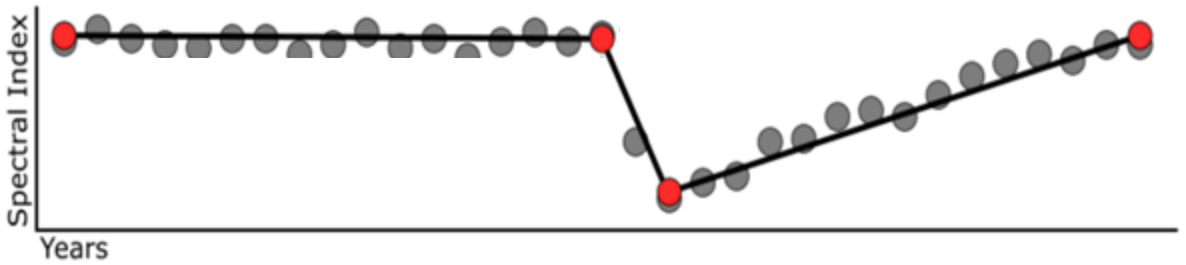


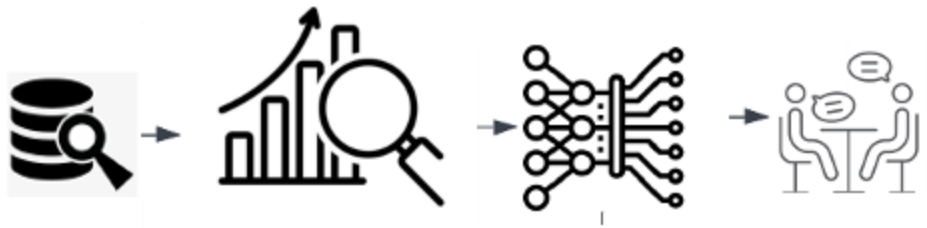
Outline



Project overview, Datasets and methods



Recovery diagnostics and recovery simulations



Conclusion, takeaways

Conservation Status

USA Protected Areas Database (PAD) provides conservation categories in terms of long-term protection of biodiversity called Gap Analysis Project (GAP).

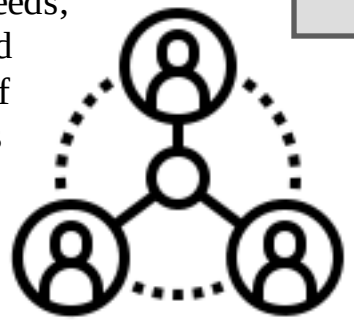
- GAP Status 1 : Areas managed for biodiversity where natural **disturbances are allowed** to proceed
- GAP Status 2 - Areas managed for biodiversity where natural **disturbance is suppressed**
- GAP Status 3 - Areas protected from land cover conversion but subject to **extractive uses** such as logging and mining
- GAP Status 4 - Areas with **no** known mandate for protection

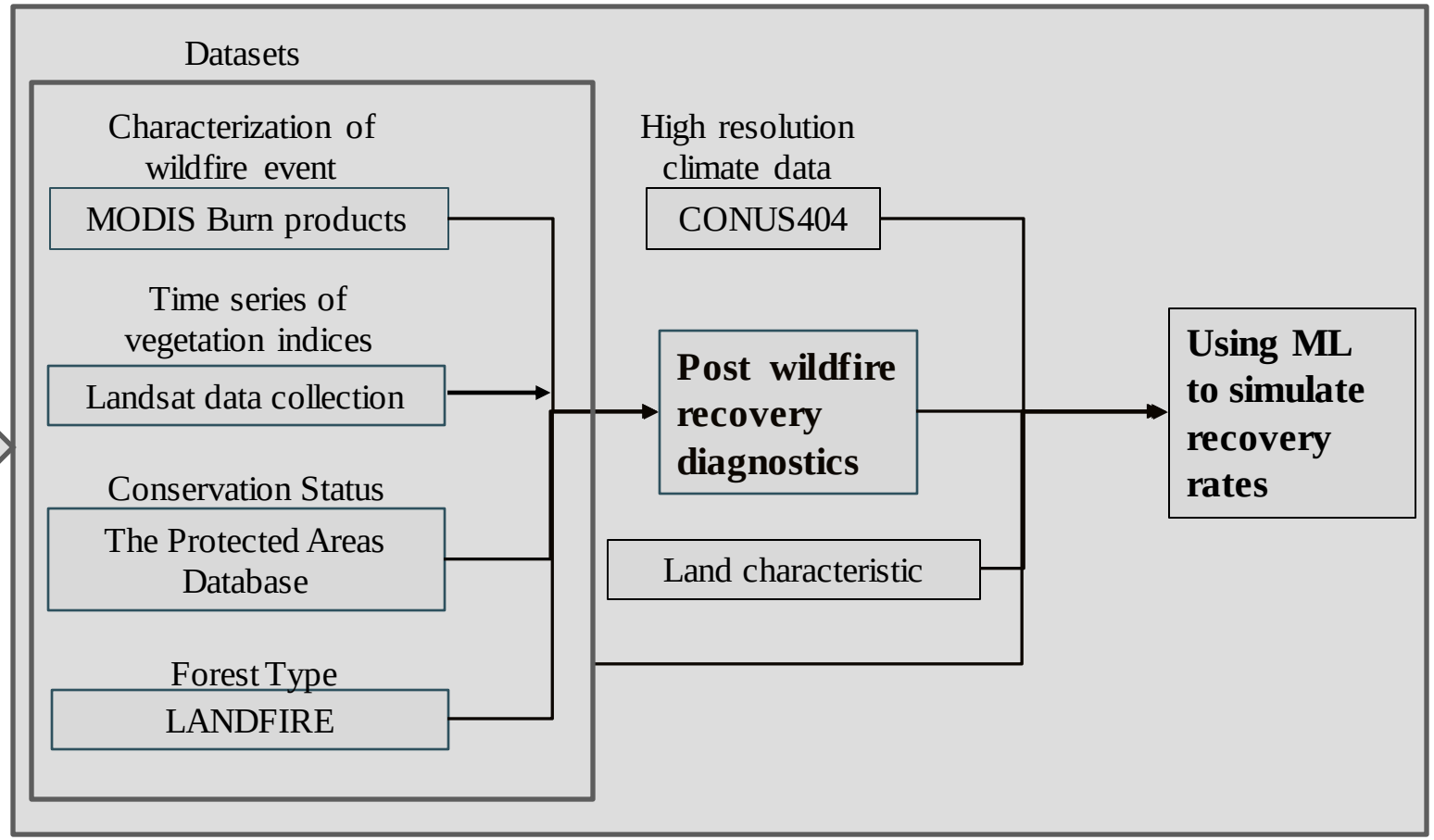
Project overview

Can we quantify the impact of conservation activities on post-wildfire recovery using remote sensing data?

Can we simulate the post-wildfire recovery rates?

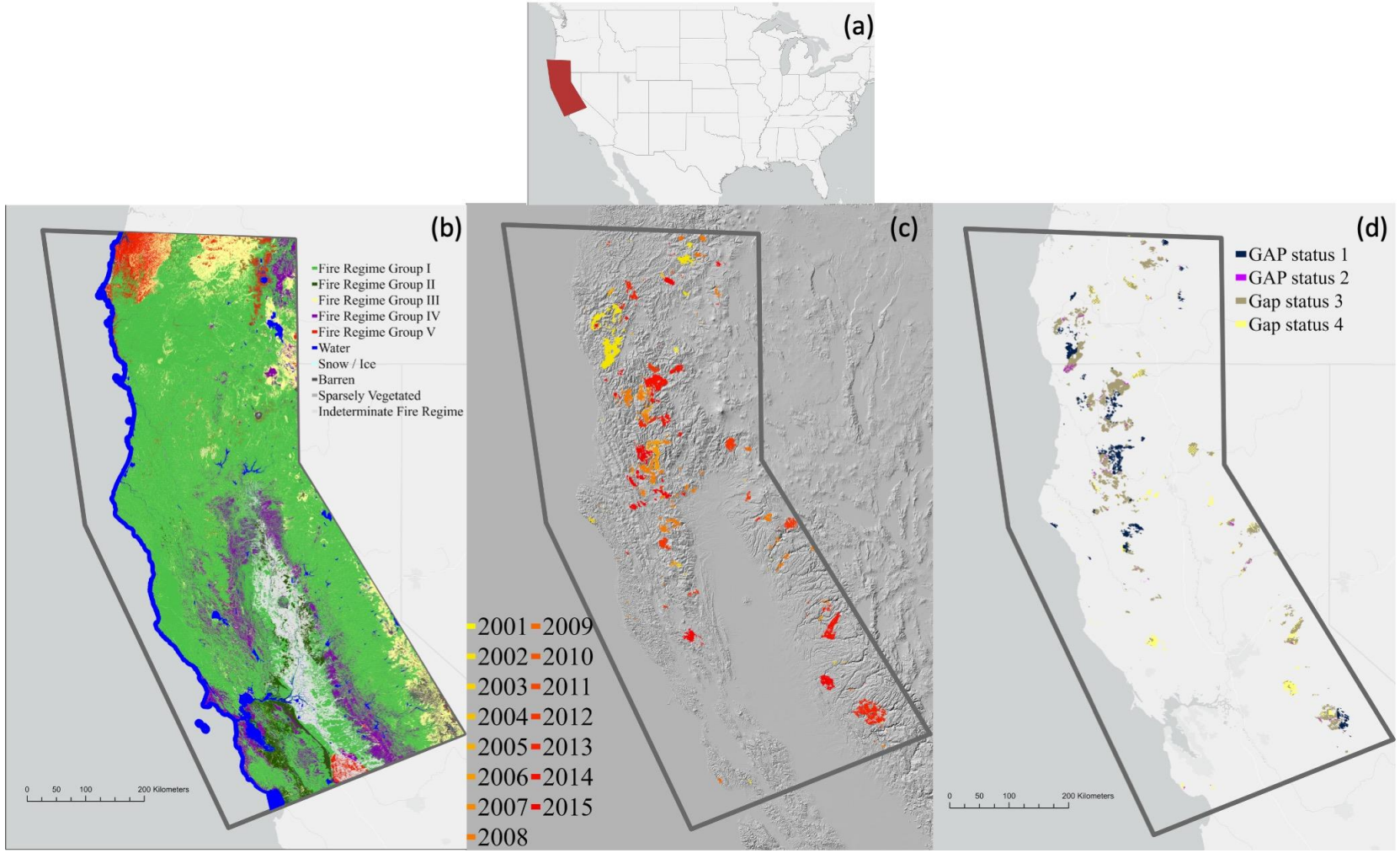
Determine the needs, priorities, and challenges of stakeholders





Study Area

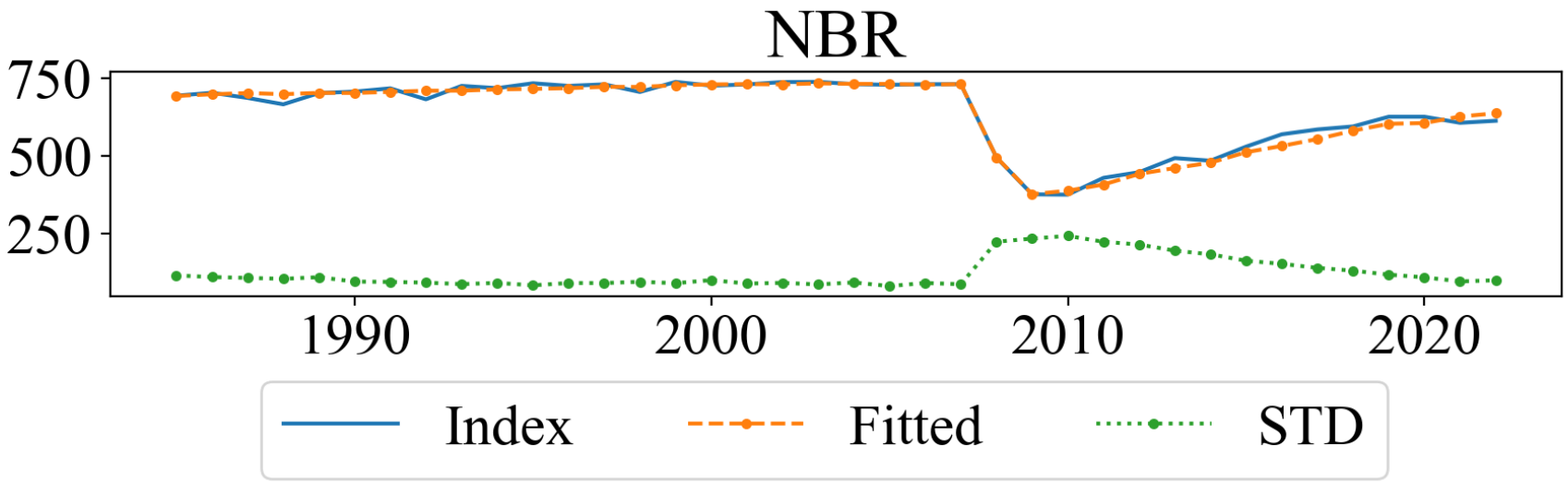
- Dominated by conifer and evergreen forested area.
- Dominated by fire regime group 1 (mix severity, interval less than 35)
- Diverse set of management and conservation status



Recovery Diagnostics

$$\text{Normalized burn index (NBR)} = \frac{NIR - SWIR}{NIR + SWIR}$$

dNBR=NBR (Pre wildfire)-NBR (post wildfire)

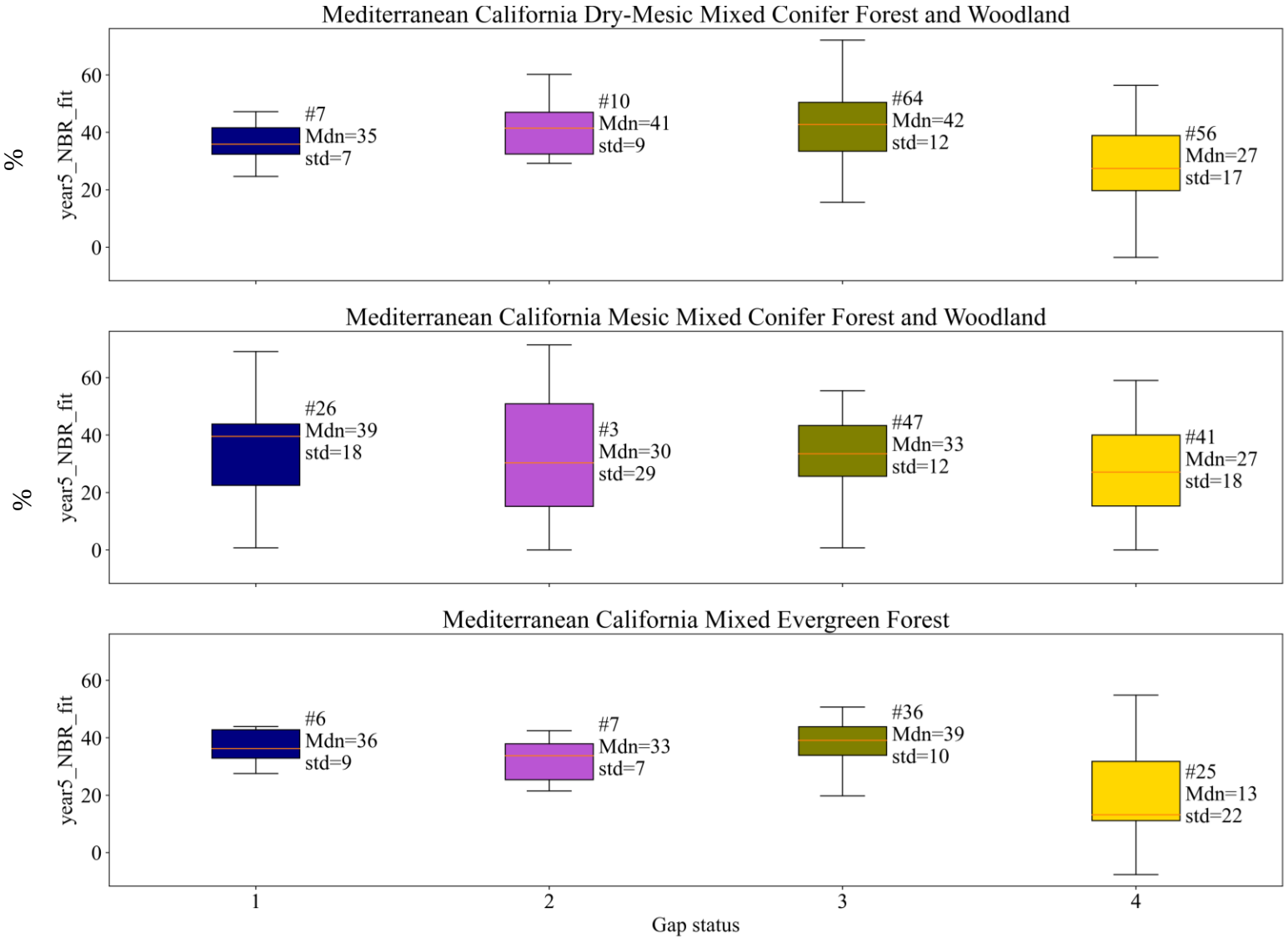


$$\text{Percent NBR Recovery} = \frac{NBR_{n'+5} - NBR_{n'}}{dNBR} * 100$$

- Where n' is the year that has the minimum of NBR between year of the wildfire (n) or the following year (n+1).
- The advantage of this ratio is normalizing each wildfire event based on its *dNBR*, which corresponds to the wildfire intensity.

Recovery based on conservation status and forest type

- Recovery is more lingering in unmanaged areas
- Forest type influence the impact of conservation activities on recovery
  - Large variabilities in recovery of Mesic mixed conifer



Driving factors of post wildfire recovery

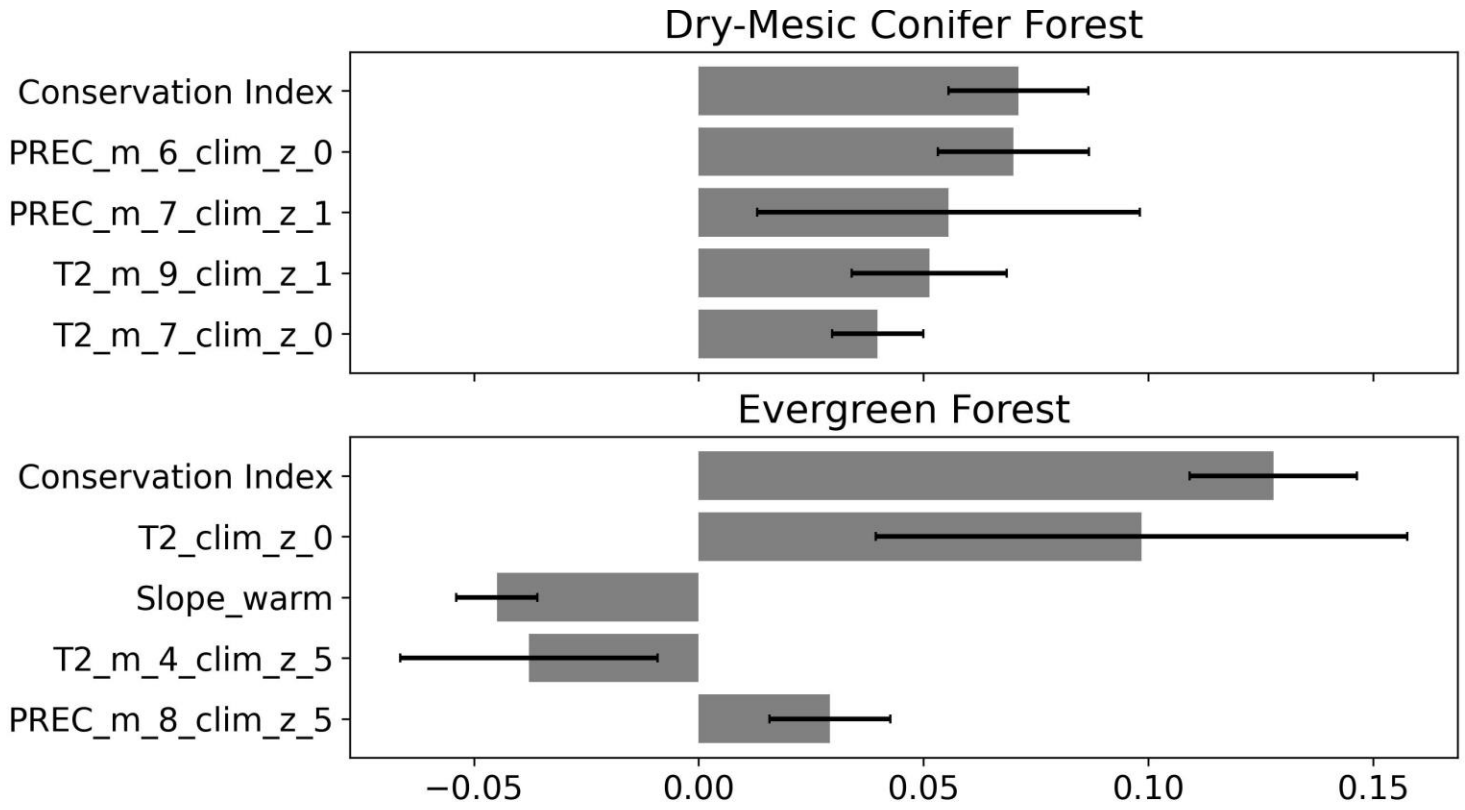
Can we simulate the post wildfire recovery using ML?

The list of all predictors

Predictors used in RF simulation	predictor	Explanations
Conservation index	Conservation Stat	We reordered Gap Status to have more sequential meaning (as shown in Table 1)
Burn scar/fire characteristics	Area (km2)	The total area of wildfire polygon
	f_duration	The duration of wildfire
	dNBR	Delta NBR as a measure of fire severity
	f_NBR	The low NBR value after wildfire
	std_f_NBR	Max NBR std after wildfire (between n, n+1)
Pre-fire vegetation status	pre_f_NBR	NBR value for the year prior to the wildfire
	std_pre_f_NBR	mean std NBR for 5 years pre wildfire
Landform	physiographical characteristics (the % coverage)	
	peak_ridge_cliff	peak_ridge_warm, peak_ridge, peak_ridge_cool, mountain_divide, cliff
	flat	upper_slope_flat, lower_slope_flat
	valleys	valley,valley_narrow
	warm_slope	upper_slope_warm, lower_slope_warm
	cool_slope	upper_slope_cool, lower_slope_cool
	neutral_slope	upper_slope, lower_slope
Climate variable	The anomalies of n, n+1, n+5 is used for each predictor for annual as well as monthly data (total 3*13*2= 78 predictors)	
	T2	2-meter temperature
	Prec	Total precipitation

Random Forest Results

- For climate predictor, the monthly variables : “m”_ “ the number of the months”,
- Anomaly of climatology variables have Clim_z_ with either 0, 1, and 5 which represent the wildfire year, the following year, and 5 years following the wildfire.



100 ensemble runs of random selection of validation vs training data. Differences are estimated as the observed 5-year percent NBR recovery minus predicted by the model.

Summary: the preliminary results motivate further investigation

We studied moderate to highly severe burned forest larger than 1 km in subset of California and Oregon

- The importance of conservation planning in post-wildfire recovery.
  - More lingering recovery in areas with no known mandate for protection
- The intensity of the impact of conservation status varies for different forest types
  - the importance of management intervention in post wildfire recovery and having priority plans.
- RF is able to reasonably simulate moderate recovery rates
- Incorporation of an automated framework of detecting burn areas (MODIS) and tracking vegetation indexes (Landsat), in combination with publicly available conservation status, could be used to track the impact of interventions across the world.

Questions?

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Table 1. GAP status and their characteristics.

GAP status	Long-term protection of biodiversity	Extractive usage	Descriptive name	Conservation index
1	✓		Disturbance Allowed	1
2	✓		Disturbance Suppressed	3
3	✓	✓	Excitative	2
4			No protection mandate	0

Random Forest Results

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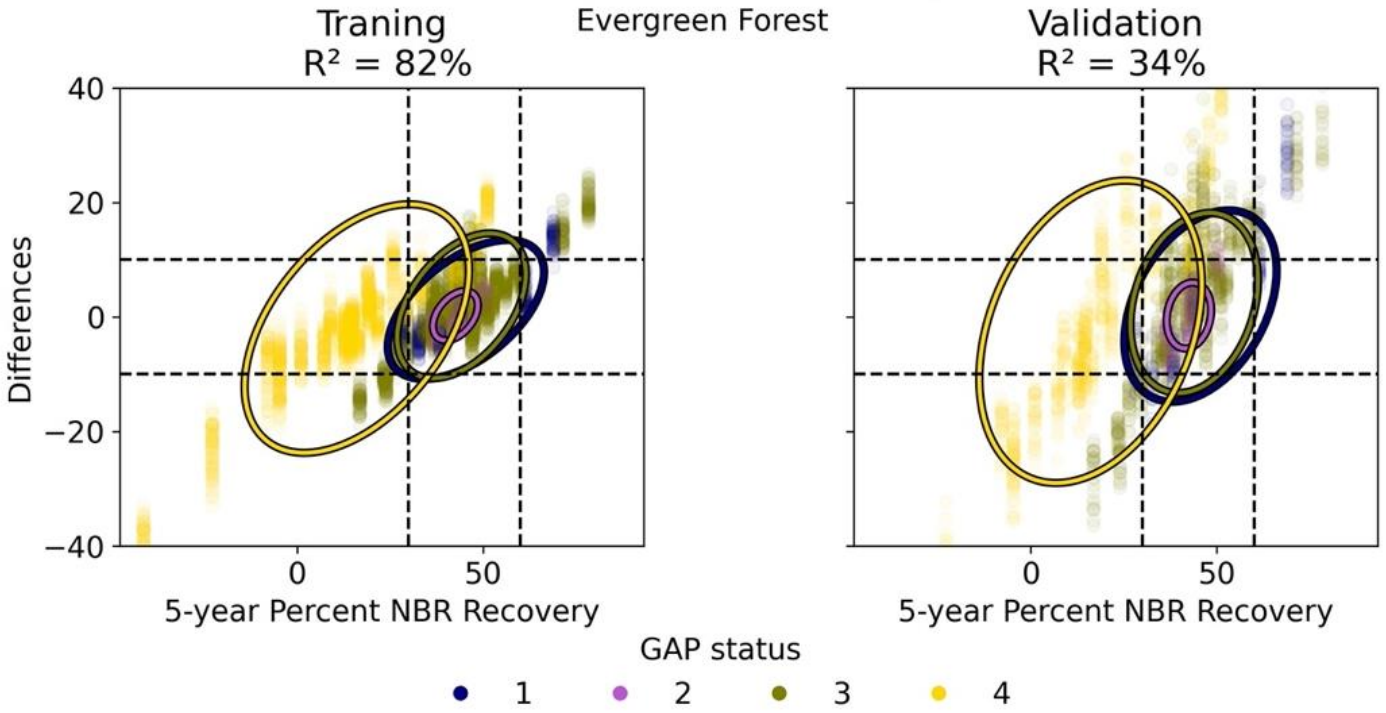

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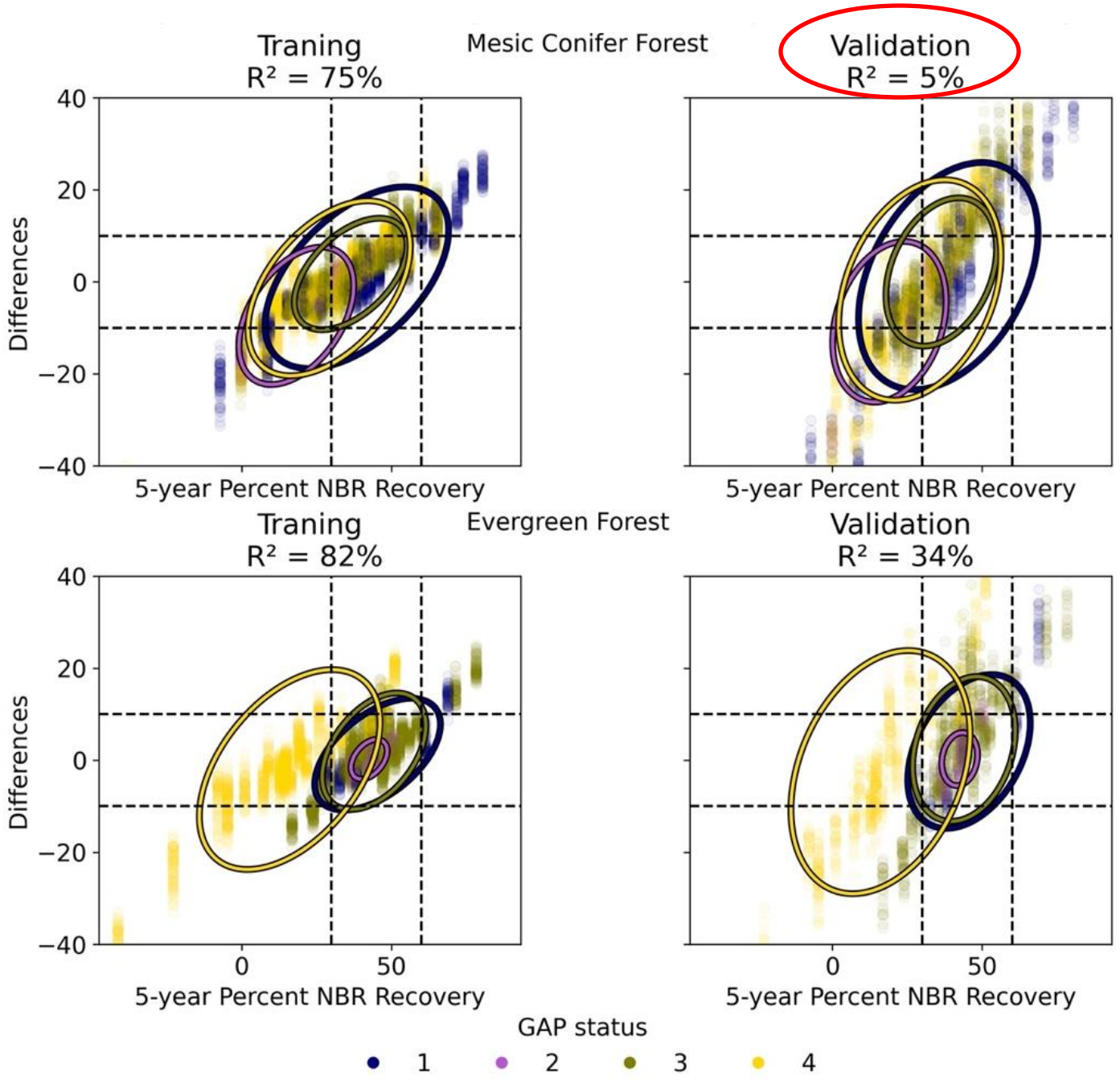
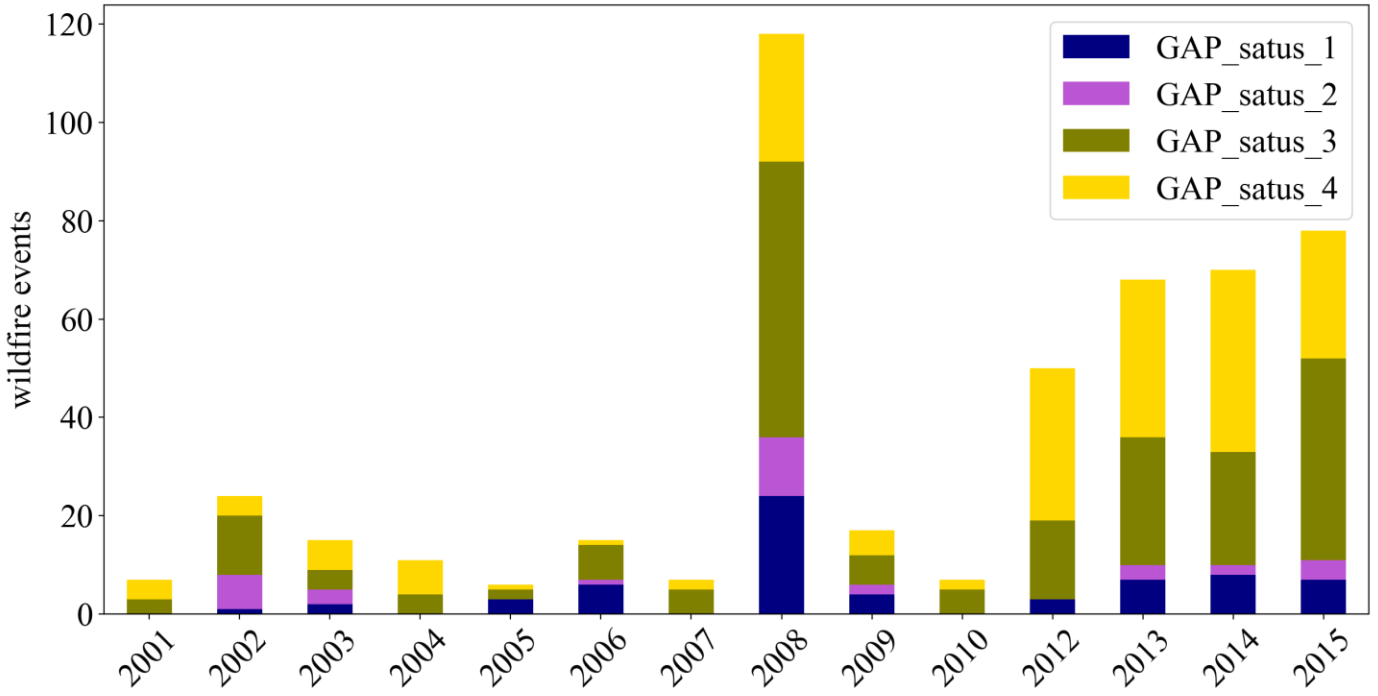


Low R^2 thus we did not discuss the premutation predictors of Mesic conifer

Focusing on Wildfires In Forested Area (Burn Area Larger Than 1 Km)



The aggregated annual burned area of needleleaf forest where each fire event is larger than 1km in the study area, coverage of each GAP status for each year is shown by color coding for each bar

Creating Annual Time Series of Vegetation Indices