



# Visualizing Forest Fire Regrowth

Comparing the average NDVI of the Sheep-Sugar fire and She-Lightning fire to the current Carr fire NDVI.

April 23, 2021

## FIRE? Why?

Forest fires are an unavoidable fact of life for those living in Northern California. Changes in temperatures and precipitation patterns have increased the severity and size of fires. One notable fire was the Carr fire that occurred in the summer of 2018. This fire was heavily monitored as it was close to the city of Redding. Over 1,000 buildings were destroyed and 8 lives lost. However, the land recovers and new life grows where the old forests burned. Because fires are so common to Northern California, the cycle of regrowth can

be seen in areas similar to the Carr fire. Comparing the current regrowth in the Carr fire scar to previous fires would help estimate if the recovery was on par with previous fires or was occurring at a different rate.



Fig 1. Map of fires used and major cities

## The Fires Used

The Sheep-Sugar fire of 1999 and the Shu Lightning fire of 2008 were chosen to compare with the Carr fire because of their close proximity to the Carr fire. This will provide a comparison for the expected NDVI changes that the Carr area would experience in the future

## NDVI

NDVI, or normalized difference vegetation index, measures

the health of vegetation by comparing the near-infrared and red bands. If a plant is healthy and photosynthesizing, it will reflect more near-infrared light and absorb more red light. A higher NDVI value would imply healthier vegetation than a lower value.

$$\text{NDVI} = \frac{(\text{NIR} - \text{Red})}{(\text{NIR} + \text{Red})}$$

Fig 2

From 1997-2020, the average NDVI of each burn scar, Sheep-Sugar, Shu Lightning, and Carr, in the month of May was measured and recorded.

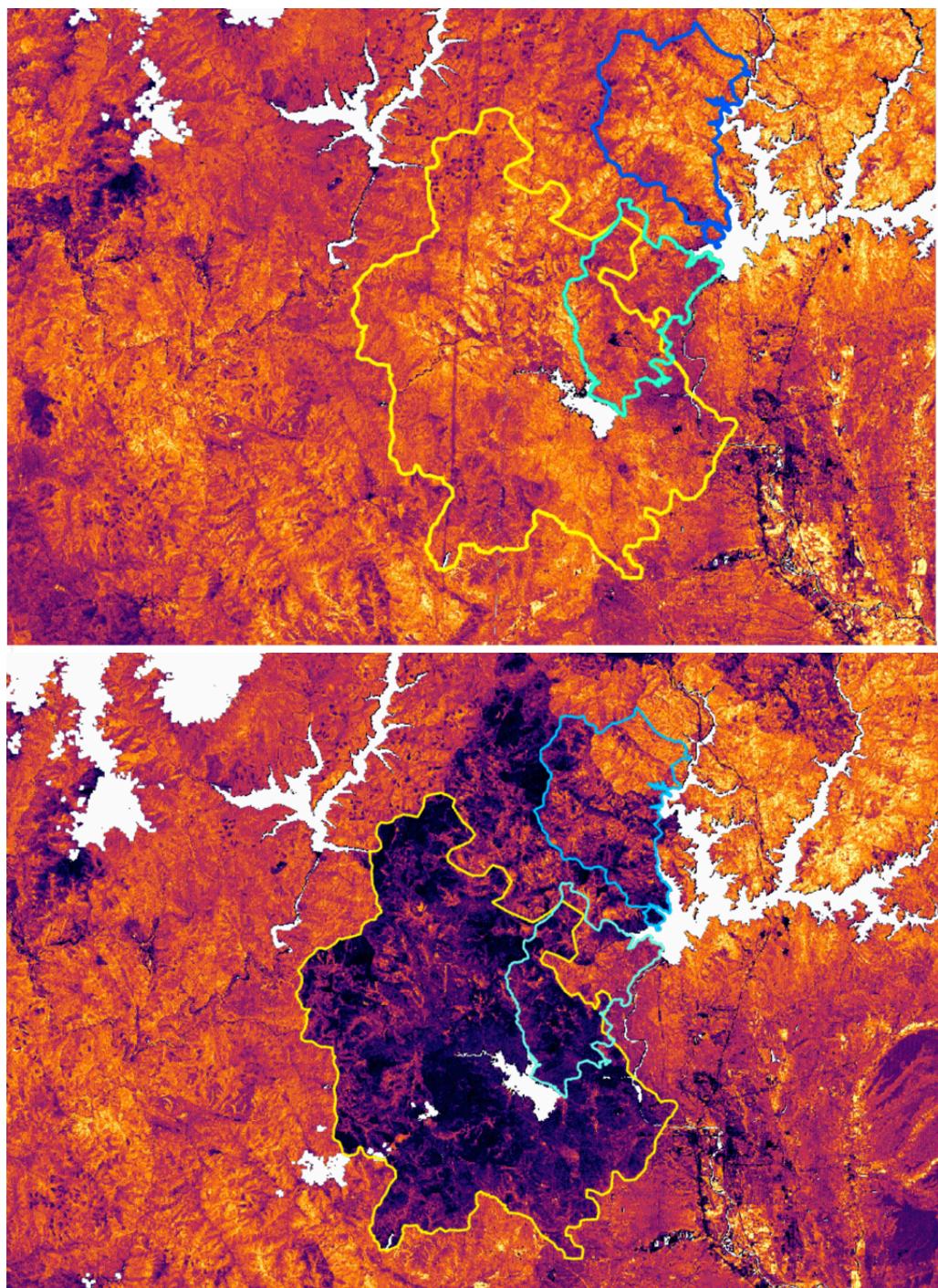
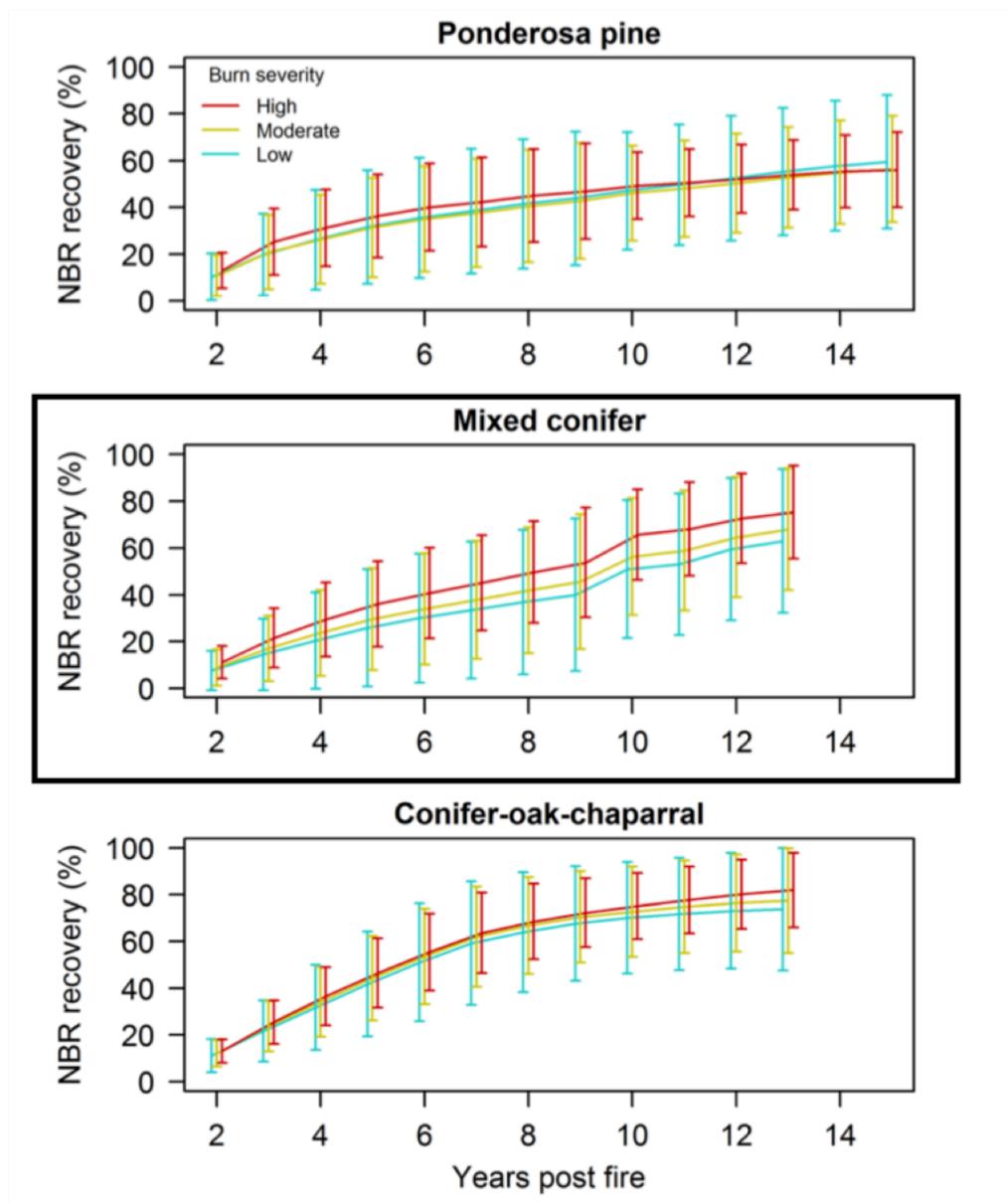


Fig 3. 2018(right), 2019(left). Light colors correlate to high NDVI and dark colors to low NDVI

The example above illustrates the dramatic imagery differences before and after a forest fire. The lighter colors in the Carr fire (yellow) shift to darker purples in the year after.

## Previous Studies



Bright et al. Fire Ecology (2019)  
15:8 <https://doi.org/10.1186/s42408-018-0021-9>

The majority of forests in the area surrounding Redding would be classified as mixed conifer. A previous study by Bright et al. in 2019 calculated regrowth in forests using NBR, which is similar to NDVI but uses SWIR. SWIR reflects strongly on burned ground, so NBR measures the loss of burns rather

than the growth of vegetation. Nevertheless, Bright et al. found that mixed conifer forests, including the most intense burns, could reach 90% of their pre-fire NBR in 12 years. This bodes well for areas affected by the Carr fire.

## Results

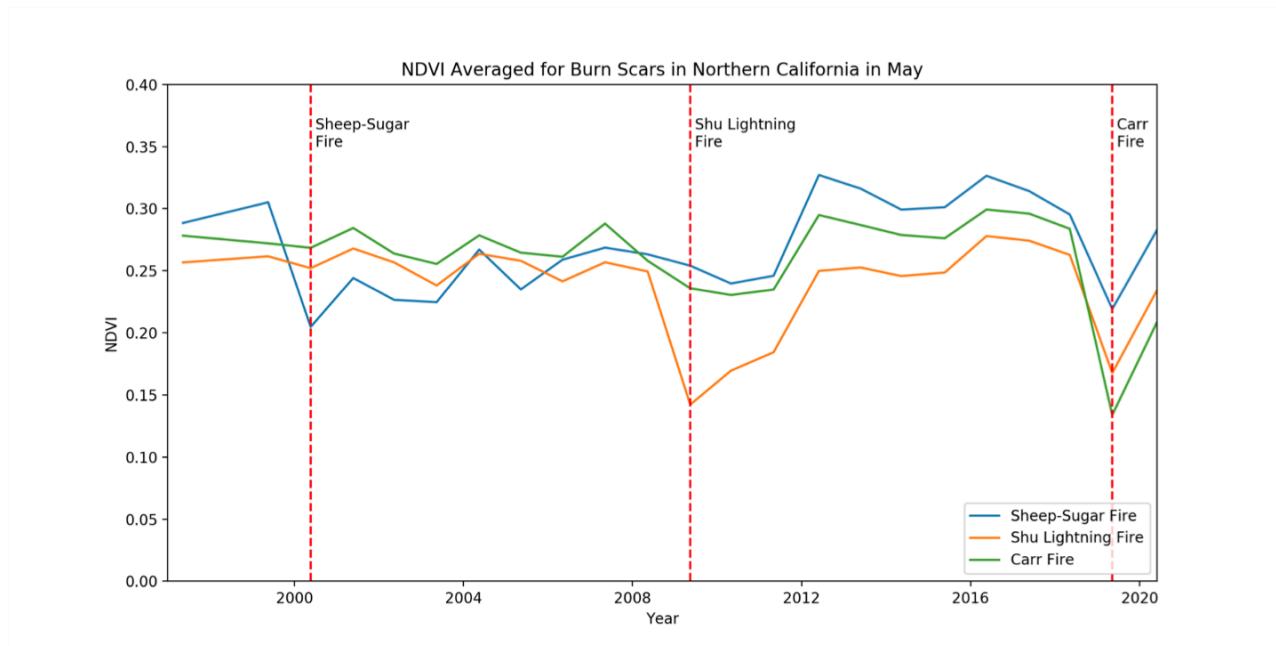


Fig 4

## What does it mean?

From figure 4, several patterns in NDVI after fires can be seen. Each fire area dropped average NDVI by at least 0.1 the year after the fire. The Sheep-Sugar fire had recovered its original NDVI in 12 years, while the Shu Lightning fire only took 6 years. The Carr fire dipped from 0.28 in 2018 to 0.14 in 2019. Although drastic, the NDVI in 2020 was already 0.20, indicating that the Carr fire could return to a normal NDVI in 6-12 years. This return to pre-fire NDVI does not necessarily

mean that the forest has recovered. NDVI only measures the amount of photosynthesis and does not account for the type of vegetation. The majority of growth seen after a fire would be herbaceous vegetation and not the trees that once ruled the forest. This initial increase is known as a 'flash of green'. Taller vegetation will then grow vertically over the course of many years. Hopefully, the Carr area will recover to its pre-fire NDVI by 2030.