Prescribed burning and forest structure changes in San Juan National Forest

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Background

1800

Native Americans implement small scale burning

The San Juan National Forest thrives as a non-homogenous open forest with trees of all ages.

1830-1880

Europeans colonize Colorado

Europeans force Native Americans out and small scale prescribe burning stops. A dense, homogenous, even-aged forest begins to grow.

2000-present

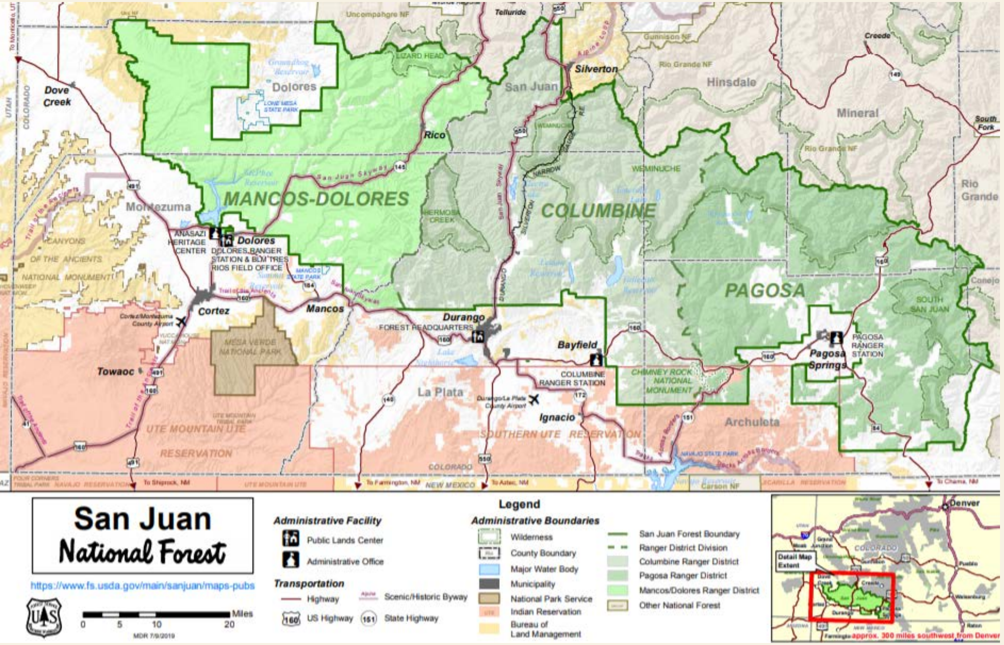
USDA implements prescribed burning project in San Juan National Forest

Dolores Prescribed Fire Pine Ecosystem Restoration project aims to restore the forest to its structure of the early 1800s.

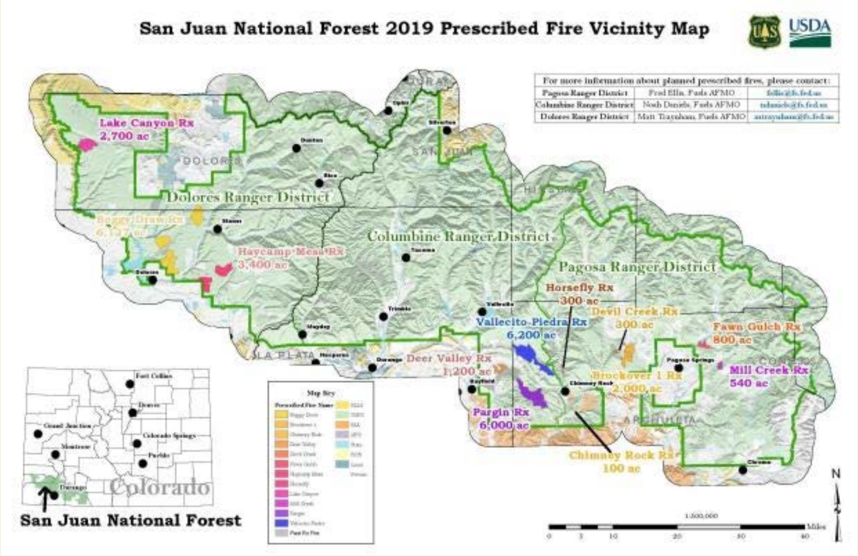
Research Question

How has the forest structure of the Dolores Ranger District in the San Juan National Forest changed due to prescribed burns?

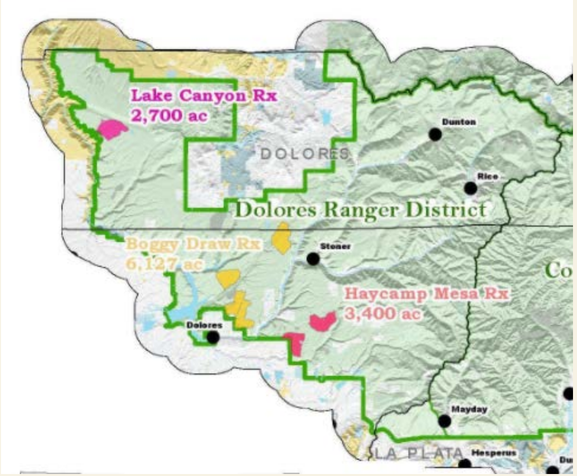
Location



San Juan National Forest
https://www.fs.usda.gov/main/sanjuan/maps-pubs
Legend
Administrative Facility
Public Lands Center
Administrative Office
Transportation
Highway
Scenic/Historic Byway
US Highway
State Highway
Administrative Boundaries
Wilderness
County Boundary
Major Water Body
Municipality
National Park Service
Indian Reservation
Bureau of Land Management
San Juan Forest Boundary
Ranger District Division
Columbine Ranger District
Pagosa Ranger District
Mancos/Dolores Ranger District
Other National Forest
Miles
MDR 7/9/2019
MANCOS-DOLORES
COLUMBINE
PAGOSA
Dolores
San Juan
Hinsdale
Mineral
Montezuma
La Plata
Archuleta
Dove Creek
Rico
Silverton
Cortez
Mancos
Durango
Bayfield
Pagosa Springs
Towaoc
Ignacio
FOREST HEADQUARTERS
COLUMBINE RANGER STATION
PAGOSA RANGER STATION
DOLORES RANGER STATION & BLM TRES RIOS FIELD OFFICE
ANASAZI HERITAGE CENTER
MESA VERDE NATIONAL PARK
CHIMNEY ROCK NATIONAL MONUMENT
UTE MOUNTAIN UTE RESERVATION
SOUTHERN UTE RESERVATION
Denver
approx. 300 miles southwest from Denver



San Juan National Forest 2019 Prescribed Fire Vicinity Map
USDA
Lake Canyon Rx 2,700 ac
Dolores Ranger District
Boggy Draw Rx 6,127 ac
Haycamp Mesa Rx 3,400 ac
Columbine Ranger District
Pagosa Ranger District
Horsefly Rx 300 ac
Devil Creek Rx 300 ac
Fawn Gulch Rx 800 ac
Vallecito-Piedra Rx 6,200 ac
Deer Valley Rx 1,200 ac
Brockover 1 Rx 2,000 ac
Mill Creek Rx 540 ac
Pargin Rx 6,000 ac
Chimney Rock Rx 100 ac
Colorado
San Juan National Forest
Map Key

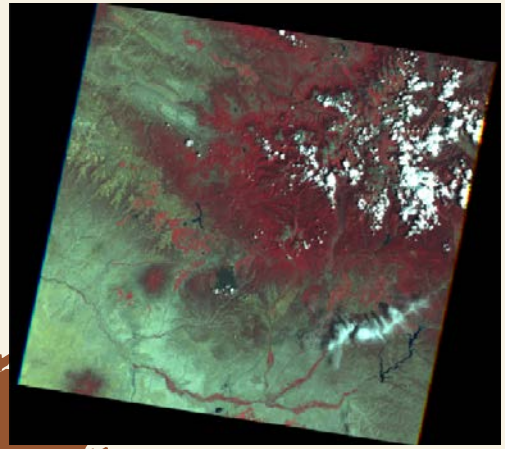


Lake Canyon Rx 2,700 ac
DOLORES
Dunton
Rico
Dolores Ranger District
Boggy Draw Rx 6,127 ac
Stoner
Haycamp Mesa Rx 3,400 ac
Dolores
Mayday
LA PLATA
Hesperus

Methods - gathering images

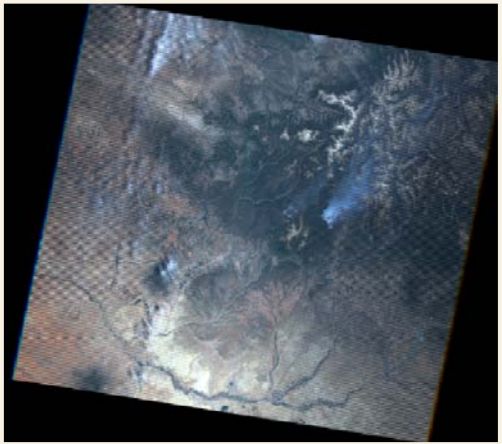
2000 - pre burn

July 26, 2000



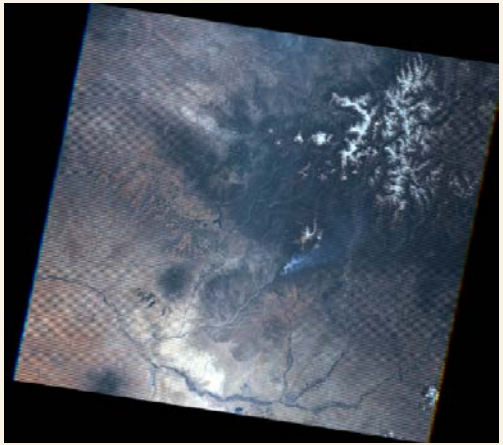
2018 - first burn

June 10, 2018
June 26, 2018
August 13, 2018

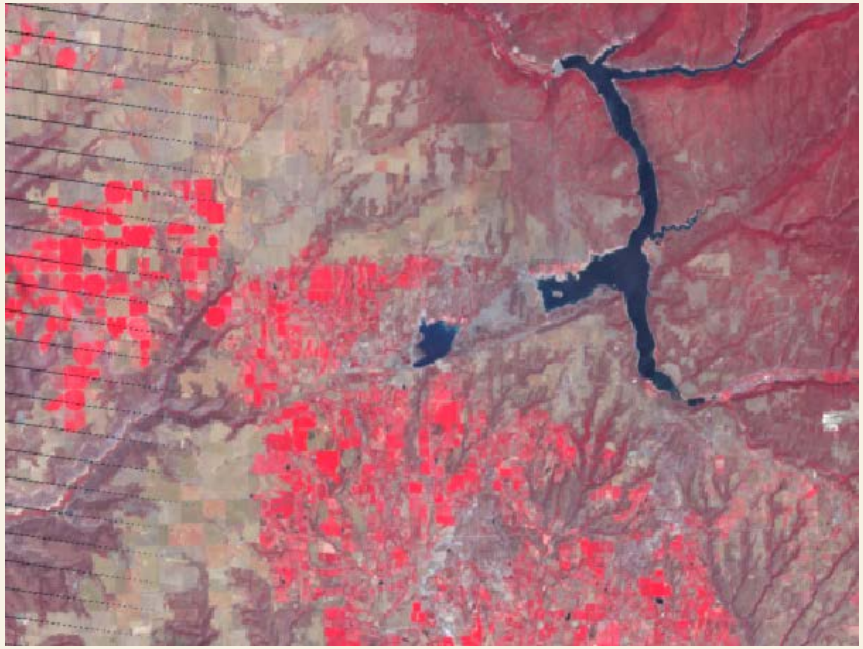


2020 - post initial burn

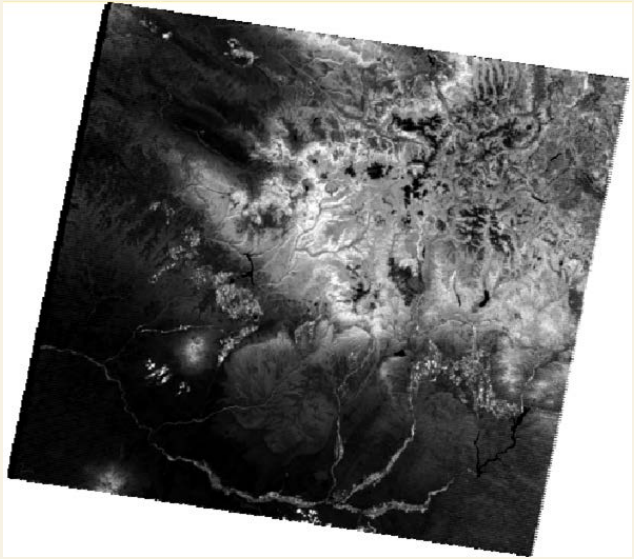
June 15, 2020
July 1, 2020
August 18, 2020

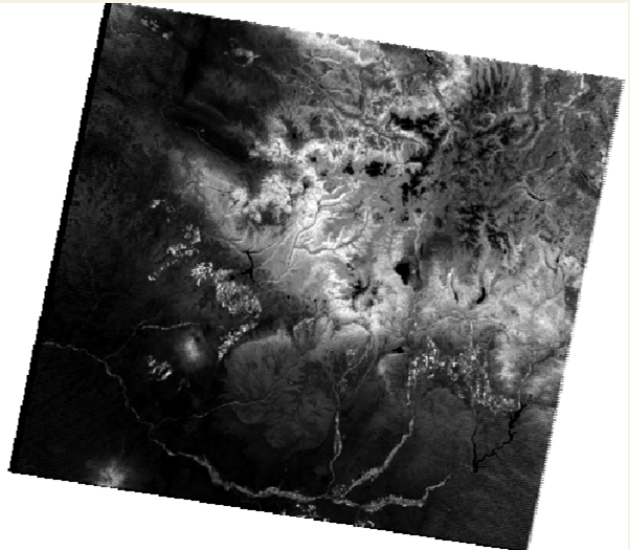


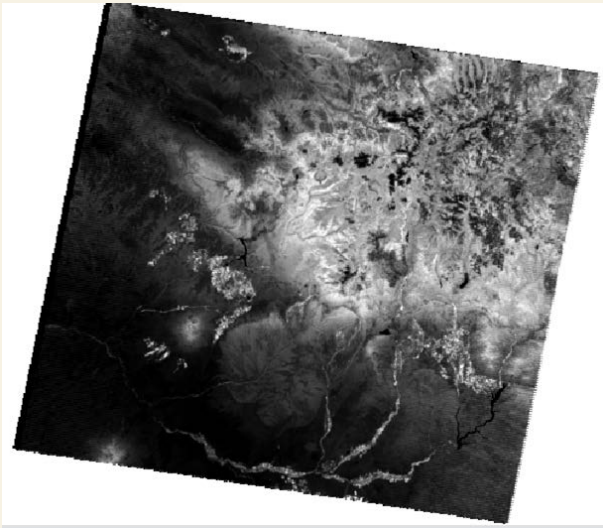
Methods- focal analysis



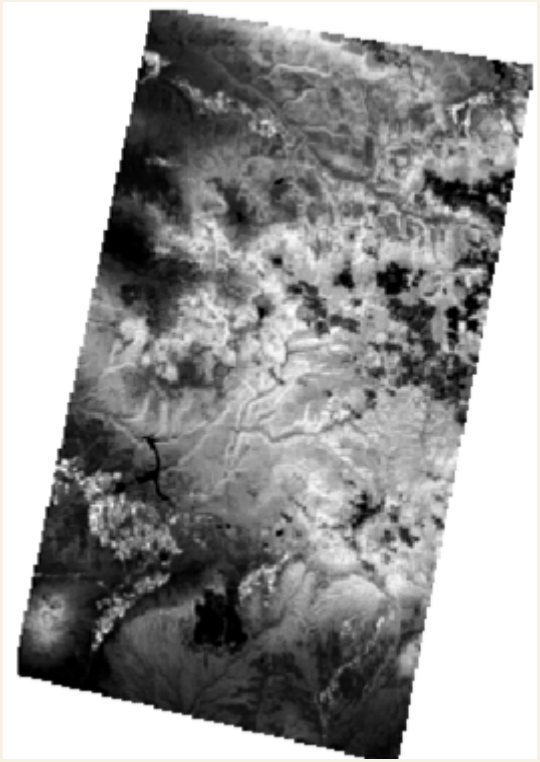
Methods- NDVI of focal analysis output images

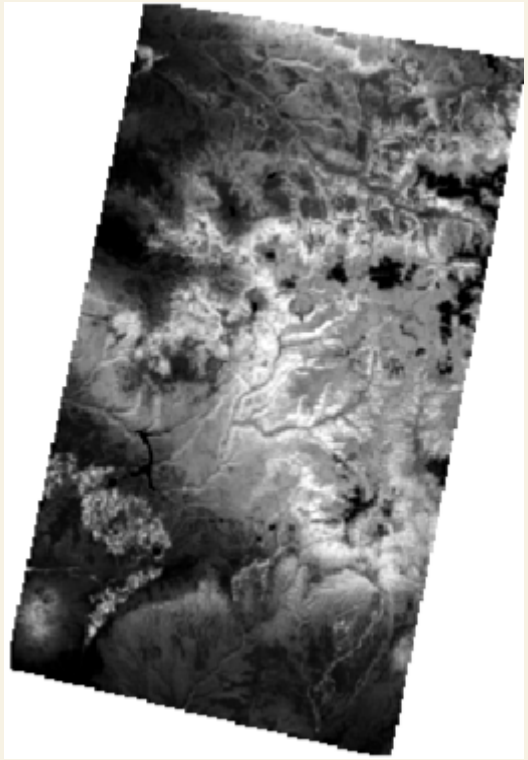


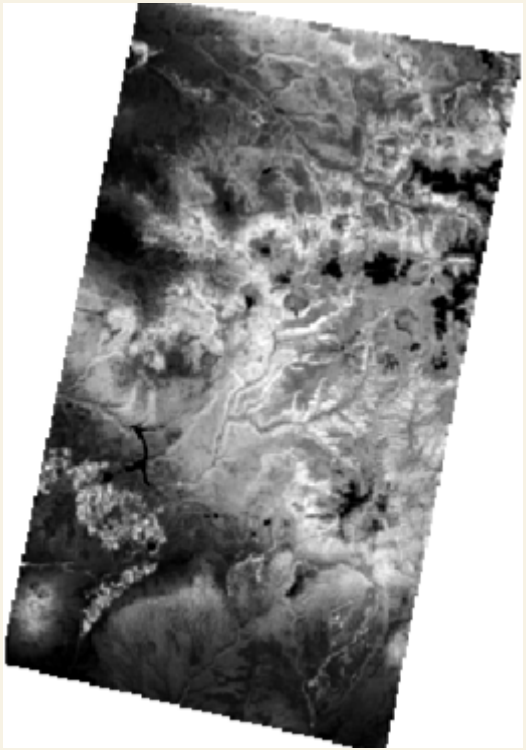




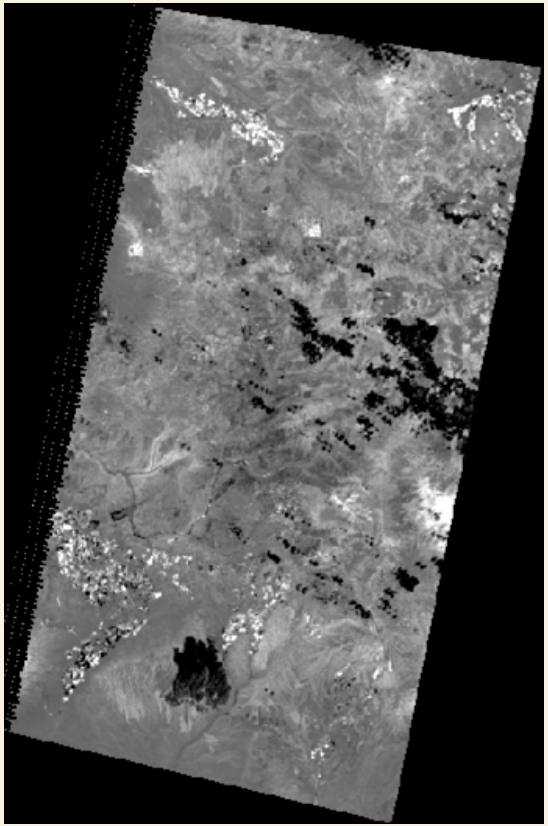
Methods - average NDVI and AOI

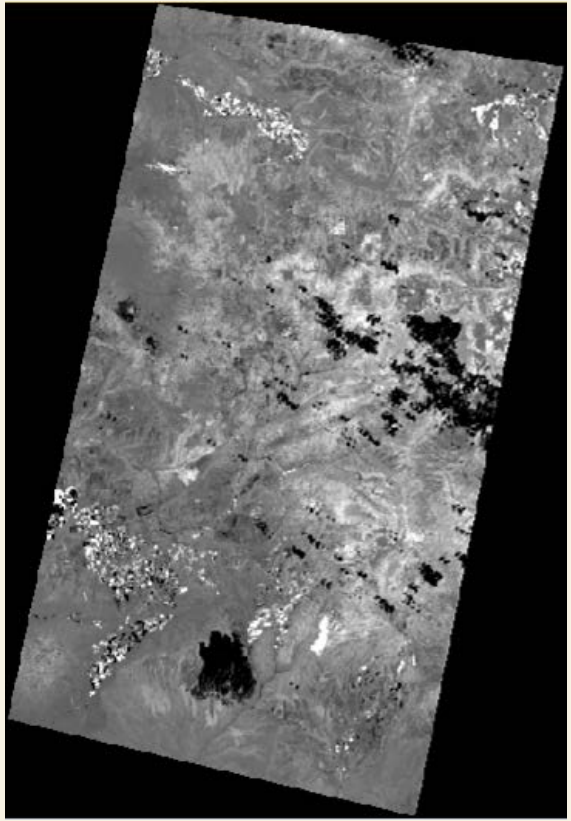


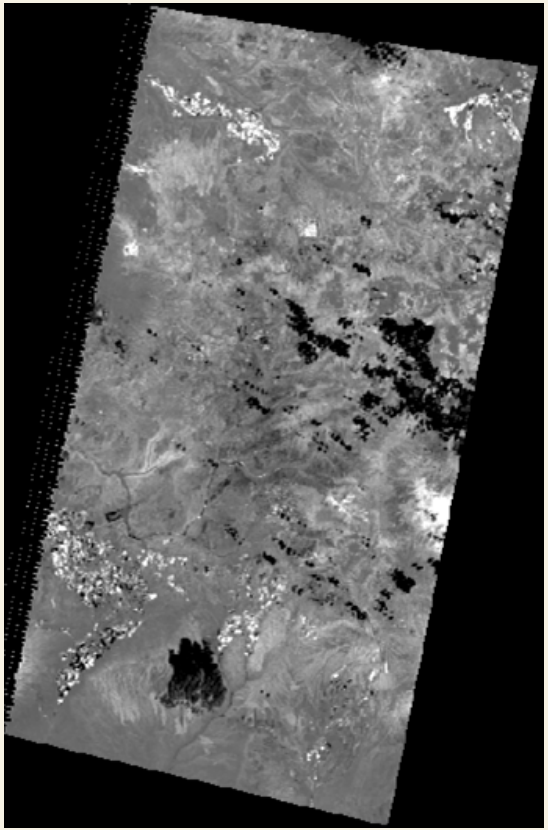




Methods - image difference





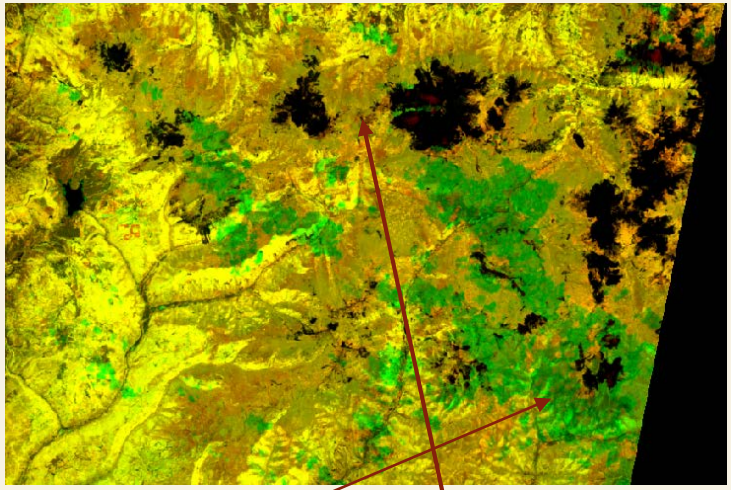


Results- layer stacking

2000-2018 image difference output + layer stacking.

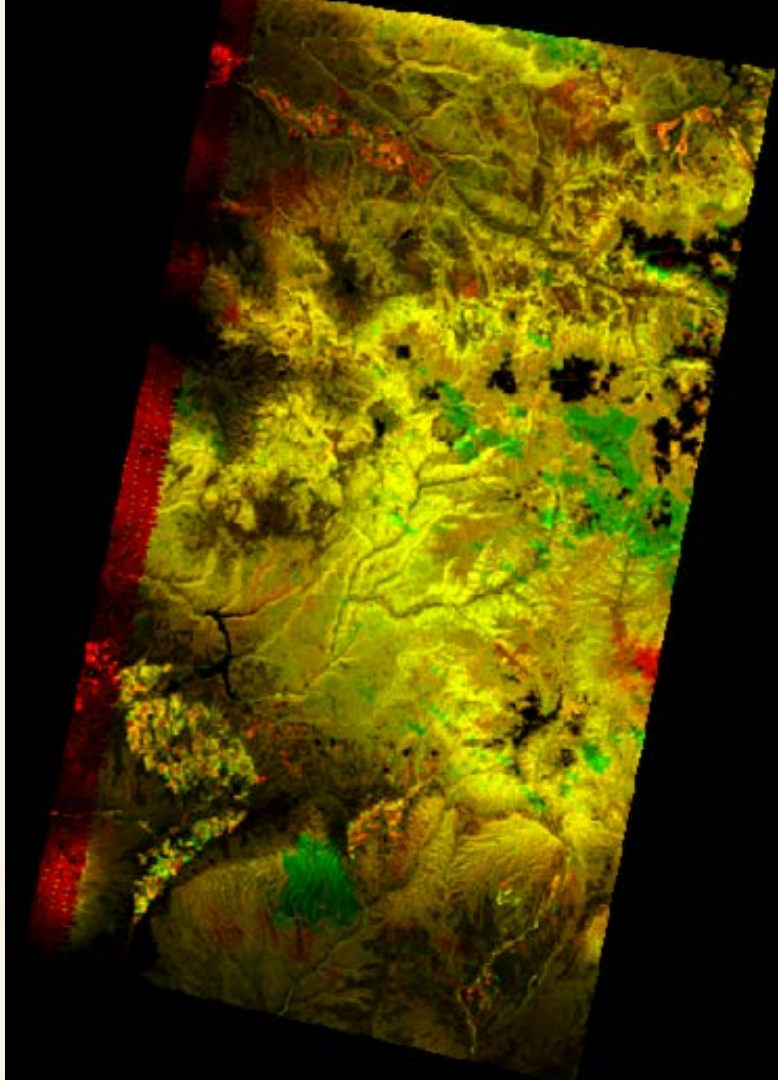
The 2000 NDVI cropped layer was assigned to red.

The 2018 NDVI cropped layer was assigned to green.

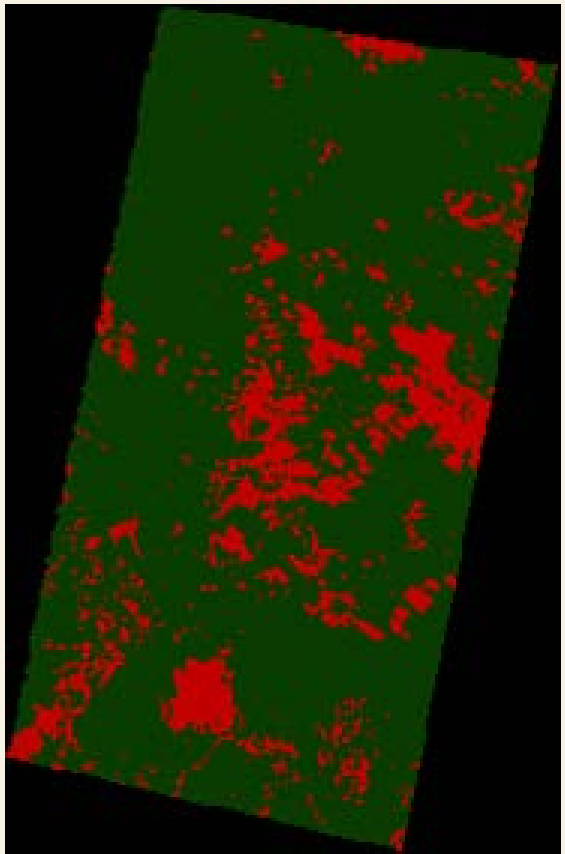


NDVI changed from -0.23 to 0.15 in this area

NDVI changed from 0.17 to 0.12 in this area



Results - negative and positive changes in ArcMap



2000-2018 image difference output.

Red spaces are areas between -0.9 and 0.

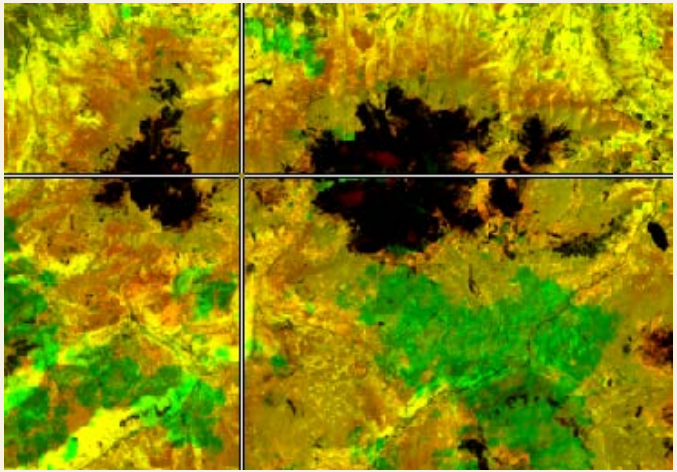
Green spaces are areas between 0 and 1.

Results - layer stacking

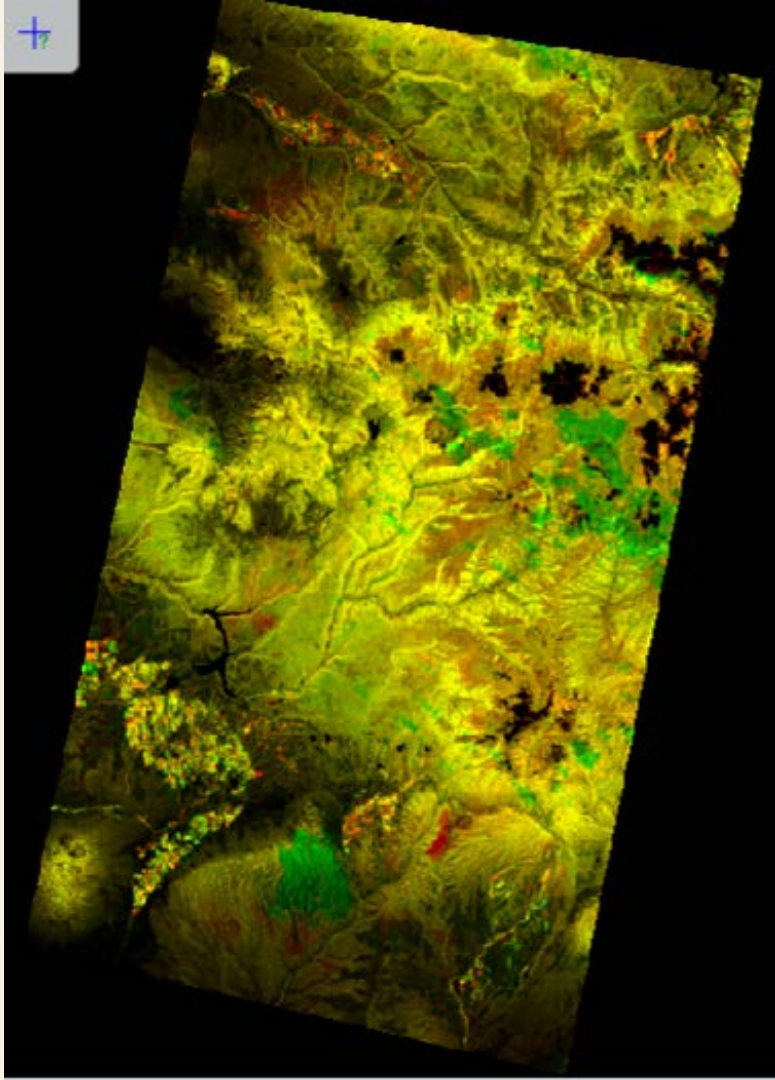
2000-2020 image difference output + layer stacking.

The 2000 NDVI cropped layer was assigned to red.

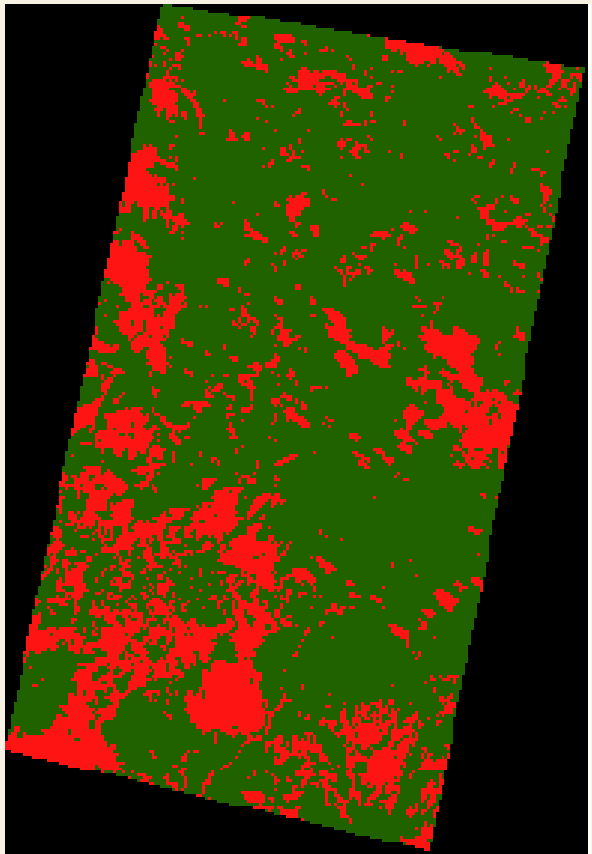
The 2020 NDVI cropped layer was assigned to green.



At the cross hairs the NDVI difference value is 0.14 which is a significant change in NDVI and indicates that there is less dense forest growing in 2020 than 2000.



Results - negative and positive changes in ArcMap



2000-2020 image difference output.

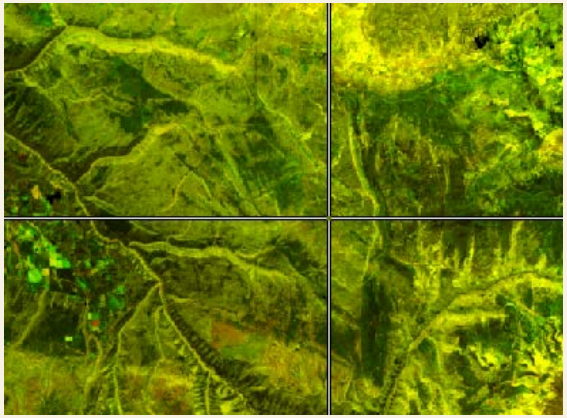
Red spaces are areas between -0.9 and 0.

Green spaces are areas between 0 and 1.

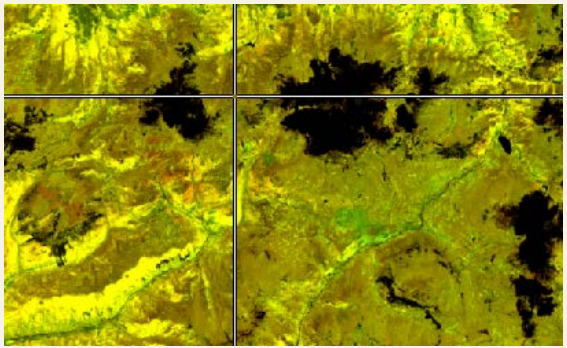
Results- layer stacking

2018-2020 image difference output + layer stacking.

The 2018 NDVI cropped layer was assigned to red.

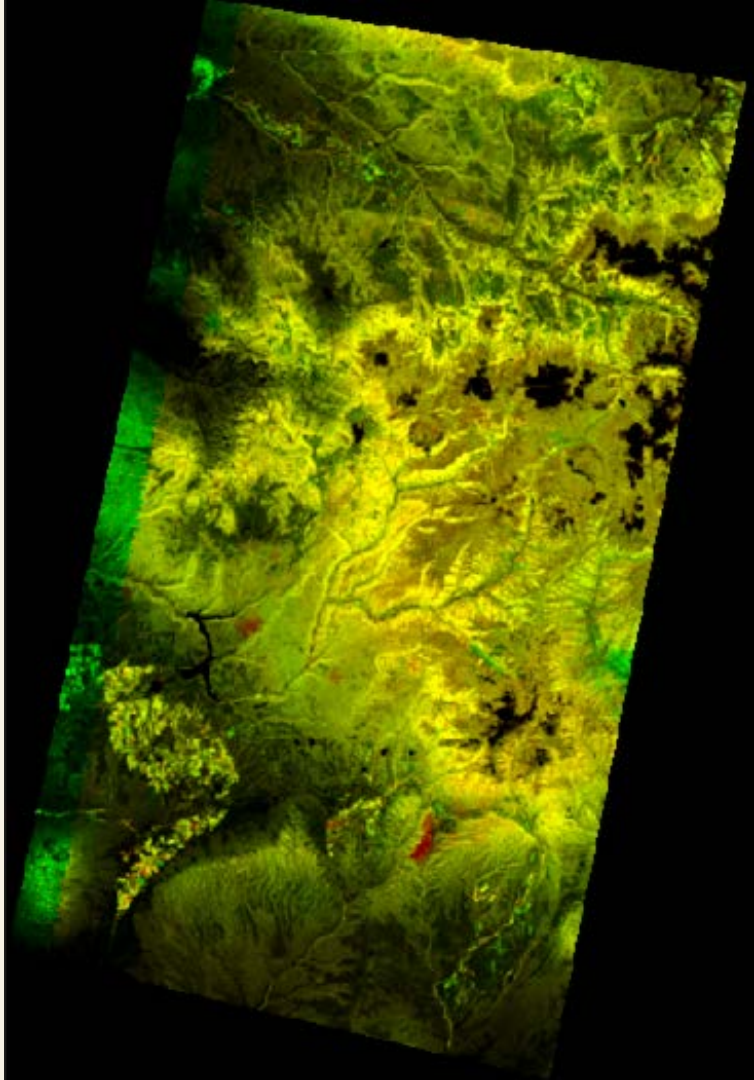


The 2020 NDVI cropped layer was assigned to green.

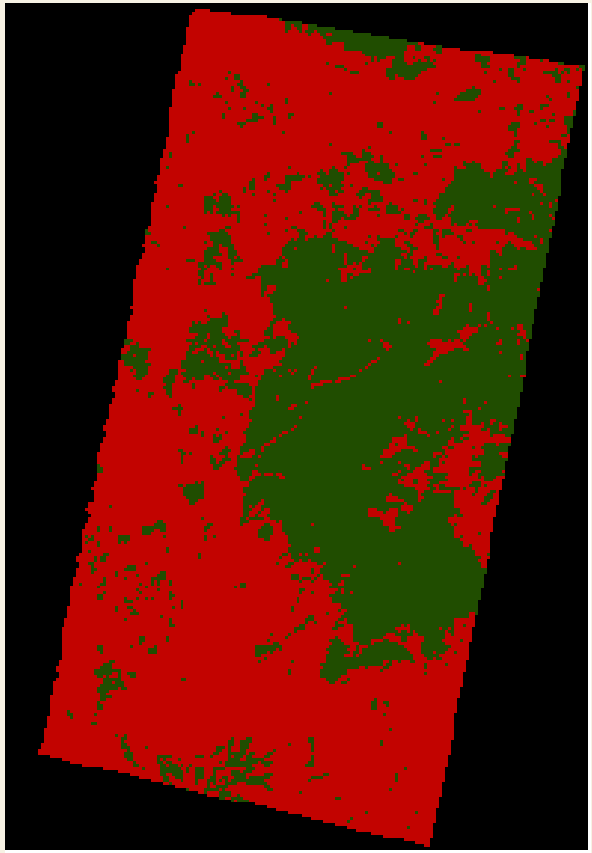


At the cross hairs the NDVI difference value is -0.05 indicating forest growth between 2018 and 2020.

At the crosshairs the NDVI difference value is 0.09 indicating a less dense forest in 2020 than 2018.



Results - negative and positive changes in ArcMap



2018-2020 image difference output.

Red spaces are areas between -0.9 and 0.

Green spaces are areas between 0 and 1.

Complications to the project

1. Only one image was used for the 2000 NDVI analysis
1. Clouds covered a section of the forest in the one 2000 image
1. Striping from Landsat 7 made it impossible to analyze the entire Dolores Ranger District

Discussion

To summarize:

Pre burn compared to first burn year

2000 and 2018: significant areas with lower NDVI values in 2018 than 2000 indicating less dense forest coverage.

Pre burn compared to present

2000 and 2020: significant areas with lower NDVI values in 2020 than 2000 indicating less dense forest coverage but there is a slight increase in the number of areas seeing higher NDVI values in 2020 than 2000 indicating forest growth in certain spaces.

First burn year compared to present

2018 and 2020: significant areas with higher NDVI values in 2020 than 2018 indicating a more dense vegetation coverage in 2020.

Why do we not see a decrease in NDVI from 2018 (first burn year) to 2020? How does this compare to the overall trend seen between 2000 (pre burn) to 2020?

Bibliography

Adaptivesilviculture.org. (n.d.). San Juan National FOREST, CO: Adaptive SILVICULTURE for climate change. Retrieved April 07, 2021, from https://www.adaptivesilviculture.org/project-site/san-juan-national-forest

InciWeb developed and maintained by USDA Forest Service, F. (n.d.). San Juan National Forest prescribed FIRE PROGRAM. Retrieved May 04, 2021, from https://inciweb.nwcg.gov/incident/map/6288/34/91087

USGS. (2016, December 22). Climate impacts on forests. Retrieved April 07, 2021, from https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-forests_.html#:~:text=Climate%20change%20could%20alter%20the,the%20distribution%20of%20tree%20species.&text=In%20other%20cases%2C%20existing%20species,their%20range%20or%20die%20out.

USGS. (n.d.). Resource management. Retrieved April 07, 2021, from https://www.fs.usda.gov/detailfull/sanjuan/landmanagement/resourcemanagement/?cid=fseprd647665&width=full

USGS. (2017, May). *Dolores prescribed fire pine ecosystem restoration project* [Scholarly project]. In *United States Department of Agriculture*. Retrieved April 07, 2021, from https://www.fs.usda.gov/project/?project=51633)

USGS. (n.d.). Retrieved April 07, 2021, from USGS.