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Thomas Fire Supervised Classification

Project Summary

Landsat 8 imagery was used to show the changes in vegetation land-cover before and after a large wildfire. The Thomas Fire started December 4, 2017 and was declared 100% contained on January 12, 2018 by the U.S. Forest Service. Landsat 8 imagery from October 22, 2017 and January 26, 2018 was chosen do to the lack of cloud cover present in both images. Supervised land-cover classification was performed on both images and zonal statistics were obtained based upon those classifications to quantatively show the relative changes in vegetative land-cover.

Purpose

The purpose of this project was to obtain further experience and understanding of Supervised Land-cover classification by examining the changes land-cover incurred by a wild fire. It was known that the fire primarily burned a large region of the Los Padres National Forest and for this reason it was thought that land-cover classifications would be a relatively straightforward affair. It was my hope that I would be able to produce reasonable land-cover classifications for both pre and post event images, and that the resulting statistics would reflect the obvious changes in vegetation apparent in the post event image.

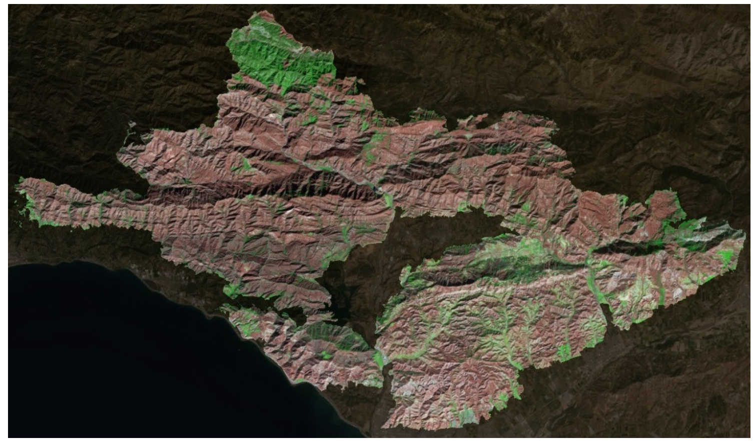
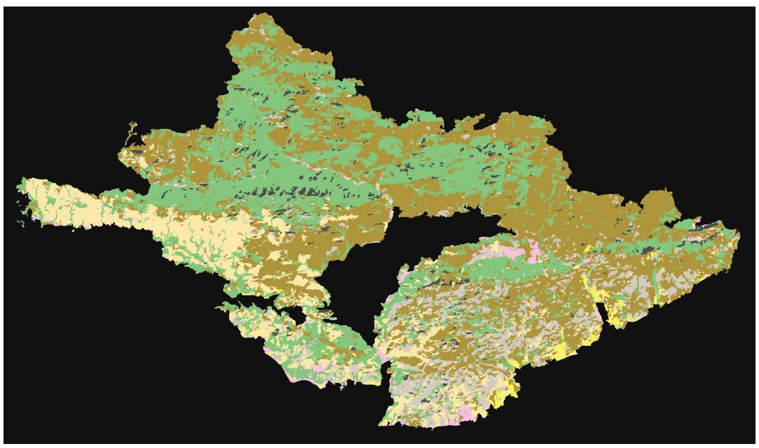
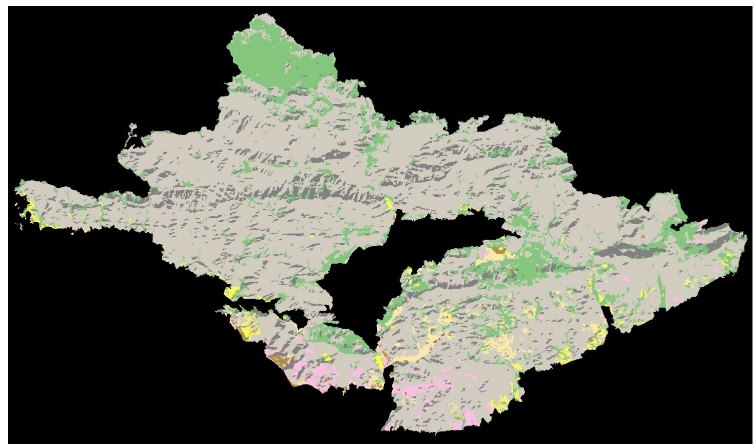
Description

Landsat 8 imagery was acquired using USGS Earth Explorer. California Fire incident boundaries were obtained from CAL FIRE FRAP (Fire and Resource Assessment Program). The boundary for Thomas Fire was located, exported into the file geodatabase and was then used to clip the Landsat 8 imagery. Both images were examined using different band combinations before the segmented images were produced from a 754 shortwave infrared band combination. The segmented images were then processed through Supervised Classifications with many iterations performed on the training sites. Zonal statistics were obtained and used to calculate the area of each land-cover class.

Difficulties encountered

I had some difficulty with utilizing the “Select by Segment Picker” option of the Training Samples Manager. There is a bug with “select by segment picker” where instead of selecting segments the user is only able to bring up the identify popup. I eventually found a workaround where adding or removing a layer from the map Contents would allow for the Select by Segment Picker tool to work as intended. This difficulty with the Training Samples Manager also made creating the training sites much more laborious as segments had to be Selected by Polygon. This led me to creating broad polygons which did not yield satisfactory results, and it was only when I succeeded in getting the Segment Picker tool to work correctly that I was able to generate a satisfactory Image Classification.

I also experienced some difficulty with the package creator as I found that on certain machines it would not successfully package projects with the ‘save history items’ option chosen. This caused me to misplace training sites. I overcame this obstacle with careful file management, but I did not figure out what caused this error or how to fix it.

Discussion

The classification of both images went well once I figured out how to get the Segment Picker tool working. When compared to the vegetation patterns shown in shortwave infrared (band combination 754) I feel the classification of the pre-event image (left) is reasonably accurate. The mountainous region on the far west portion of the fire boundaries clearly have a concentration of vegetation in the ravines. The large mountainous regions in the southeastern portion of the fire boundary is also appropriately categorized as barren with small pockets of vegetation littering the area. All of these details are clearly present in the Classified image and therefore serve to give it some credibility.

The post-event image output also appears to be reasonably accurate. The patches of forest remaining in the north and the eastern sections of the fire boundary make the classification seem plausible. However, there are also patches of Developed land-cover that were not in the previous image. When these areas were investigated further the ESRI Imagery does show that there are dirt roads and several buildings scattered about in these remote areas. It is obvious that they were classified as barren in the pre-event classification, but it is not known why they were picked up by the post-event image training sensors. Perhaps they simply showed up better in the post-event image as all the vegetation had been removed from the area. Or perhaps I simply did a better job choosing training sites (with the Segment Picker tool) on the second image. Regardless of the reason why there are differing Developed regions I feel that these differences can be disregarded because the analysis intended to be carried out is regarding the changes in vegetation between the two images. Developed land-cover and barren land-cover both are not involved in the vegetation changes under scrutiny, and so I feel that these differences can be viewed as inconsequential background noise.

	% total acres	
	Before	After
Shadow	2.34%	10.73%
Developed	1.58%	1.41%
Barren	9.41%	68.66%
Forest*	32.25%	15.13%
Shrubland*	40.65%	0.77%
Herbaceous*	12.35%	1.92%
Planted/Cultivated*	1.42%	1.39%
Vegetation*	86.66%	19.21%

The zonal statistics reflect what the classified images clearly demonstrate; there was a massive increase in Barren land-cover from the fire. According to my analysis the Shrublands were devastated by the fire. I feel this was to be expected as Shrubland seemed to occur where the average water content was restricted, like in mountainous areas with high slope where water would run off instead of entering the soil. Herbaceous areas decreased significantly as well, but the not the same extent as Shrubland. This could be the result of herbaceous areas growing back relatively quickly compared to the other vegetation types. The Forest land-cover seemed to fared the best among the vegetative classes; and this is clearly visible in the imagery with a large section of forest in the north being unaffected by the fire as well as a few pockets of forest in the eastern part of the boundary also remaining unaffected. It bears mentioning that this region had been experiencing drought conditions for at least 9 months before the fire, so all vegetation types lacking deep-dwelling root structures would have been experiencing significant stress from drought and would therefore be very susceptible to being consumed by the fire.

The zonal statistics also show that there was a substantial increase in the amount of shadow present in the image. This was partially due to the fact that the before image had its shadow content suppressed as I was able to perceive the tops of a canopy of trees in the shadows whilst assigning training sites. There was also a notable increase in the size and darkness of the shadows of the after image which I believe was caused by the image being captured less than 30 days from the winter solstice – the day when the sun is at its lowest daily maximum elevation. But regardless of the reason why shadows are more prevalent, I feel that these areas are a source of definite uncertainty, as these places would otherwise belong to any of the other classifications.

Overall I find that the results were not surprising. It was known that the Thomas Fire predominately burned areas of the Los Padres National Forest, so the fact that the zonal statistics demonstrate a 67.45% conversion from a vegetative class to barren was only slightly unexpected insomuch that I had anticipated a more dramatic conversion rate. The uncertainty introduced by the higher prevalence of Shadows could also help to explain why the final statistics weren't more dramatic.