# Pagami Creek Wildfire

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**FNRM 3262**

## Introduction

On August 18, 2011 a strike of lightning hit about 13 miles east of Ely, Minnesota and triggered a wildfire that lasted almost a month. The fire smoldered for a few days like many other lightning fires, but then some extenuating circumstances - low humidity and strong winds – allowed the fire to spread over 130 acres. Extreme winds over the next few weeks caused the fire to spread over 93,000 acres (Forest Service, 2012).

The impact the wildfire was widespread. Smoke from the fire spread as far as Eastern Europe and was spotted over Russia and Ukraine. Several homes were threatened, but fortunately no human lives were lost (Gabbert, 2011).

The objective of this project is to use aerial imagery to show the extent of the Pagami Creek Wildfire, as well as measure the damage that the fire created. Environmental impacts will also be measured, in the form of carbon dioxide emissions.

## Data Sources and Methods

The first step was to pinpoint the area of the fire. Using Google maps I was able to find the coordinates of the fire. Then using the USGS's Earth Explorer, I downloaded two images from those coordinates, one from May 15th, 2011, before the fire took place, and the other from October 6th, 2011, after the fire had run its course. Both images were Landsat 4 TM. After stacking all of the layers for each of these images to create a workable Imagine file, I ran a supervised classification on each image. The first image from before the burn had three classes: water, vegetation, and dead vegetation. The second image from after the burn had four classes: water, vegetation, dead vegetation, and burn.

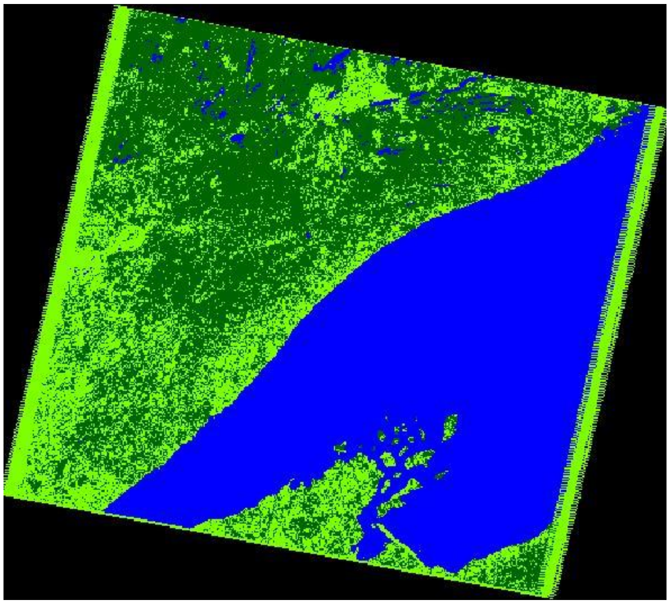
After creating a summary by zone report for the classified Landsat images, I discovered that much of the vegetation from the "before" image in May had turned to water in the "after" image in October. One explanation for this is that shoreline receded during the hotter months. A more likely explanation is that during the summer months, the Landsat sensor only penetrated the top layer or two of the tree canopy, so when the leaves fell from the trees in the fall, more of the lakes were exposed for the sensor to detect. Because the burn area was in such a small area of the Landsat image, I decided to create an Area of Interest to make a smaller map in order to eliminate areas of the image that were not beneficial or relevant to my analysis.

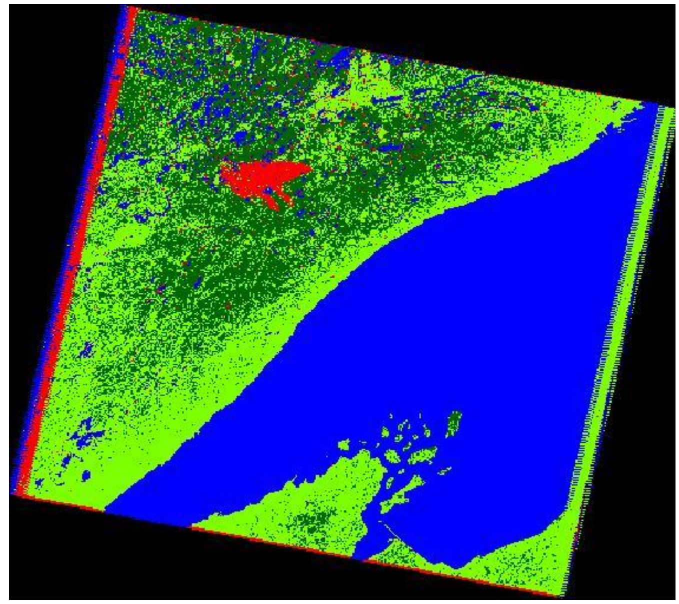
I then quantified the results by finding the total area of the wildfire, and by calculating the carbon dioxide emissions based on values from a study done by the US Forest Service.

## Results

I had success with the classification of the two images, the burn area is clearly visible in the image on the left (in red), the October Landsat image. However, one unexpected result was that much of the vegetated area from the May Landsat image turned to water (as discussed in the methods section). The most likely explanation – that the Landsat sensor could not penetrate the tree canopy during summer months – would account for the discrepancy.

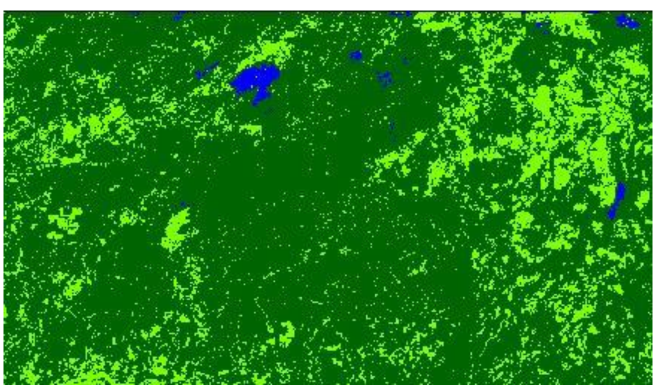
Pictured below are the classified Landsat images, as well as the area of interest for each of the images. The area of interest is where the summary report and the image difference analyses were done.

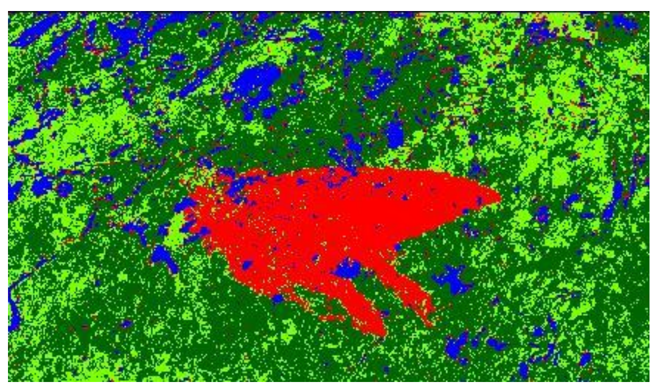




May 2011 – before the fire October 2011 – after the fire (in red)

In each image, blue is water, dark green is vegetation, and light green is dead vegetation. In the October image, the red area is where the fire occurred. As stated above, there was a lot of unnecessary area in the image, so I created an area of interest:





May 2011 – area of interest October 2011 – area of interest (fire in red)

In the “image difference” layer, as was expected, it was very easy to see the areas that had the most differences between the May and the October images.

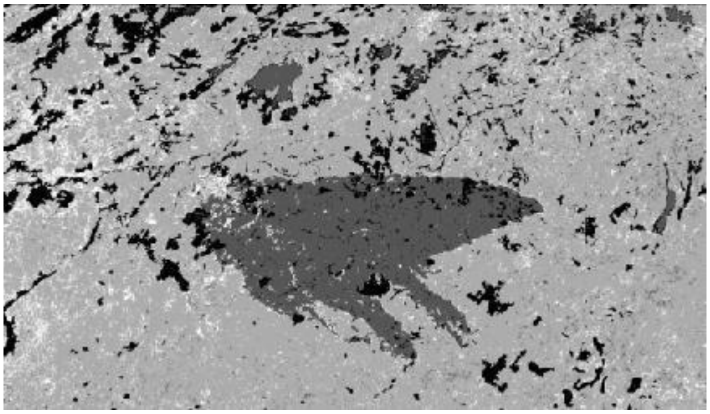


Image difference image

The area of the fire is very clearly highlighted, as are the areas where vegetation changed to water.

**Summary Report Matrix**

| **COUNT** | | To | | | | |
|---|---|---|---|---|---|---|
| **From** | | Water | Burn | Vegetation | Dead Veg | **TOTAL** |
| | Water | 25151 | 34 | 0 | 0 | 25185 |
| | Vegetation | 252747 | 383555 | 5.93E+10 | 271291 | 59256907593 |
| | Dead Vegetation | 1465 | 33189 | 50870 | 426043 | 511567 |
| | **TOTAL** | 279363 | 416778 | 59256050870 | 697334 | **59257444345** |
| **IN HECTARES** | | **To** | | | | |
| **From** | | Water | Burn | Vegetation | Dead Veg | **TOTAL** |
| | Water | 2263.59 | 3.06 | 0 | 0 | 2266.65 |
| | Vegetation | 22747.2 | 34519.9 | 1.43E+05 | 24416.2 | 225013.3 |
| | Dead Vegetation | 131.85 | 2987.01 | 4578.3 | 38343.9 | 46041.06 |
| | **TOTAL** | 25142.64 | 37509.97 | 147908.3 | 62760.1 | **273321.01 ha** |

## Discussion

My results showed that there were a total of 37,509.97 hectares that were ultimately converted to burn. This work is very important because early detection and monitoring of wildfires using technologies such as remote sensing can help us to better control and prevent them. The lightning strike that triggered this particular fire was not an unusual occurrence; on the contrary, strikes like these happen almost daily, but most of them don’t start extreme, widespread fires because of forest conditions. In this situation, high winds and dry conditions made a perfect situation for the fire to spread to this huge area of more than 90,000 acres.

If we use remote sensing technologies to watch for fires such as these to catch them early, we may be able to prevent millions of dollars in damage, as well as prevent many tons of carbon dioxide emissions. According to a study done by the US Forest Service, in the lower 48 states, there are on average 41.0 megagrams of carbon released per hectare of wildfire (NWCG, 2011). For the Pagami Creek wildfire, that translates to 1,695,254.2 tons of carbon released into the atmosphere from this single event. Over time, these fires could become a major contributor to climate change and carbon emissions in the atmosphere. Catching these events early could not only stop these emissions from entering the air, but could also save the photosynthesizers that convert the carbon to oxygen.

## Works Cited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