THE EXPLOSIVE TRUTH
Using Remote Sensing to Analyze the Environmental Effects of the 2011 Eruption of the Puyehue-Cordón Caulle Volcanic Complex

BACKGROUND & PROJECT GOALS
The 2011 eruption of the Puyehue-Cordón Caulle Volcanic Complex (PCCVC; Figure 1) is widely considered to be the worst volcanic eruption of the twenty-first century. Earthquakes rocked the surrounding area for several months prior to the eruption, and the ash cloud itself from the eruption rose to above 12 km in height and 5 km in width. The ash plume itself moved primarily to the east, effecting farming towns on the Argentinian steppe greatly. The nearby farming village of Pueyhue, Chile, however, was also dramatically affected by the violence of the eruption (Bignami et. al., 2013).

Examining the environmental effects of the 2011 eruption can help us understand how this volcano could do damage in the near, or distant, future. That is why this project was undertaken.

RESULTS & DISCUSSION

The two biggest changes were the decrease in forest area and also the shifting of many Crop 1 fields to Crop 2 fields, which suggests that there was a fallowing of the crop fields. In order to calculate the area that was affected by the eruption, the class statistics of each image were used to compute the amount of pixels that changed. This number was converted into kilometers (Table 1).

Table 1. Various areas affected by the eruption, depending on the Change Detection method

<table>
<thead>
<tr>
<th>Change Detection</th>
<th>Area Affected (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band 4 (image chg.)</td>
<td>221.76</td>
</tr>
<tr>
<td>Band 7 (image chg.)</td>
<td>239.02</td>
</tr>
<tr>
<td>NDVI (image chg.)</td>
<td>330.39</td>
</tr>
<tr>
<td>Thematic Change</td>
<td>328.77</td>
</tr>
</tbody>
</table>

The eruption caused a significant loss in crops which not only affected the amount of food available to citizens of Pueyhue, but it also caused the birth rate to drop from 60% to 10-30%, and caused the death of 225,000 sheep and 60,000 goats (Wilson et. al., 2012). The eruption would also have led to the loss of habitat and death of Vesula spp. (invasive wasps), Vultur gryphus (Andean condor), and Campephilus magellanicus (native woodpecker). The Andean condor is already an endangered species, so this loss of habitat would have put the species even more at risk.

This project must be continued in order to accurately determine how the vegetation has been changing since the end of the eruption. It could be growing back now that it has been three years since the eruption ended, but this is impossible to tell unless we look at the years of 2016 and 2017 to model a vegetation growth rate. The project did, however, successfully show how Remote Sensing can be used to assess the

REFERENCES

