

Mapping Hardwood Mortality for the Early Detection of *P. ramorum*: an Assessment of Aerial Surveys and Object-Oriented Image Analysis¹

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Abstract

Effective monitoring and identification of areas of hardwood mortality is a critical component in the management of sudden oak death (SOD). From 2001 to 2005, aerial surveys covering 13.5 million acres in California were conducted to map and monitor hardwood mortality for the early detection of *Phytophthora ramorum*, the pathogen responsible for SOD. To assess the spatial accuracy of the aerial detection survey (ADS) program data, we used a mortality stem map generated from aerial photo interpretation (Meentemeyer and others 2007) within the Big Sur ecoregion of California. Although results suggest that the aerial surveys may be under-representing the extent of hardwood mortality in the study area, the ADS program has been successful in detecting infestations of *P. ramorum* in California. An additional analysis explored the use of object-oriented classification for mapping hardwood mortality. Results of this analysis indicate that object-oriented image analysis has the potential for mapping hardwood mortality and can complement the ADS program.

Key words: *Phytophthora ramorum*, sudden oak death, aerial surveys, mortality, object-oriented image analysis.

Aerial Detection Surveys (ADS) and Aerial Photo Interpretation

Hardwood mortality was mapped from fixed-wing aircraft using a digital sketch mapping system. From 2001 to 2005, within the Big Sur ecoregion, a total of 9,550 ha with hardwood mortality were mapped. Using high resolution (0.33 m) digital aerial photographs, Meentemeyer and others (2007) digitized point locations of all visible dead trees within a 794 km² area of the Big Sur ecoregion. The digitized point locations include all mortality up to 2005.

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Aerial Survey Data Assessment

Using the digitized point locations of dead trees as a reference data set, we assessed the spatial accuracy of the aerial survey data within the Big Sur ecoregion study area. Results suggest that the aerial surveys in this region are under-representing the extent of hardwood mortality in the Big Sur ecoregion (52 percent of the digitized points fell within the ADS polygons) (fig. 1).



Figure 1—Detail showing ADS mapped mortality polygons and Meentemeyer and others (2007) digitized point locations of dead trees.

Object-Oriented Image Analysis

Using the same set of digital aerial photos, four small areas of a single photo were selected to test the ability of object-oriented image analysis to identify single dead trees on the landscape. An initial test run was performed using eCognition 4.3 Professional. Using the digitized point locations of dead trees from Meentemeyer and others (2007), the object-oriented classified mortality map was spatially overlaid onto the digitized point map to calculate the percent overlap (fig. 2). The object oriented classification captured 71 percent of the mapped stems in the sample area.

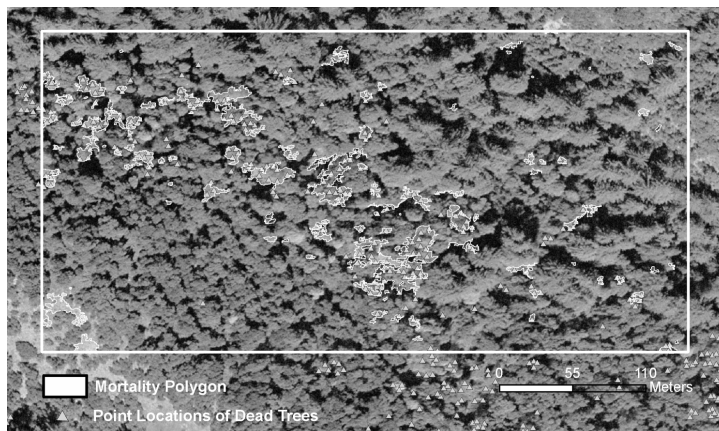


Figure 2—Detail showing object-oriented mortality polygons and digitized point locations of dead trees.

Conclusions

The primary advantage of the aerial detection surveys is that they cover a wide area in a short period of time for a relatively low cost. A disadvantage of the ADS data is a loss of resolution in the data as a result of the scale of the program.

Object-oriented classification has the potential to complement the ADS program, especially in analyzing areas of concern identified by the aerial surveys. Further work is required to explore applying object-oriented image analysis with field data for validation.

Literature Cited

Meentemeyer, R.K.; Rank, N.E.; Shoemaker, D.A.; Oneal, C.B.; Rizzo, D.M. 2007. Quantification of sudden oak death tree mortality in the Big Sur ecoregion of California. *Biol. Invasions*. DOI 10.1007/s10530-007-9199-5.