The Development and Application of Dynamic, Geospatial *P. ramorum* Spread Models for Oregon

Devon Gaydos, Anna Petrasova, Chris M. Jones and **Ross K. Meentemeyer**, North Carolina State University, Center for Geospatial Analytics, Raleigh, NC; dagaydos@ncsu.edu; **Richard C. Cobb,** California Polytechnic State University, Department of Natural Resources and Environmental Science, San Luis Obispo, CA

Dynamic geospatial simulations are valuable assets for exploring how an invasive pest or pathogen is likely to spread given a range of possible scenarios. In particular, they are powerful for conducting computational experiments to assess how management affects spread, as large-scale management experiments may be impractical or unethical. Further, models can be used to generate no-management "control" comparisons, which do not exist with observed datasets. Geospatial simulations such as these have been developed to examine *Phytophthora ramorum* spread and impacts in California (Meentemeyer et al. 2011, Cunniffe et al. 2016). Yet, models had not been developed for Oregon, where sudden oak death continues to pose a significant economic and environmental threat.

In collaboration with experts from Oregon State University, Oregon Department of Forestry, and the U.S. Forest Service, we have updated these *P. ramorum* models to reflect epidemiological conditions in Oregon. Most notably, evidence suggests that tanoak disproportionately affects disease patterns in Oregon (Hansen et al. 2005), so the model was updated to reflect a single-host tanoak system which accounts for disease-induced mortality. Model development is complicated by the presence of two disease strains (NA1 and EU1) and years of intensive management which can obscure natural spread patterns. By simulating both the disease spread and management simultaneously, we were able to parameterize the model for both strains. Using these derived parameters, we generated a hypothetical no-management scenario for 2001-2017 to evaluate how effective Oregon's landscape-scale management efforts were at reducing pathogen spread.

Further, to increase the interactivity and usability of this model, we have linked it with a decision-support system called Tangible Landscape (Tonini et al. 2017). This innovative modeling tool allows users to intuitively guide models, regardless of prior experience with code or geospatial software. We present questionnaire results from a modeling workshop with Oregon stakeholders that highlight this tool's potential to engage stakeholders in sudden oak death management and decision-making.

References

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