Collaboratively Managing Sudden Oak Death Using Tangible Geospatial Modeling[1]

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Abstract

Failure to build consensus amongst stakeholders has been a primary obstacle barring progress in developing and implementing strategies to manage sudden oak death (SOD). Consensus as to the goals of *in situ* management of SOD has rarely been reached, because stakeholders' visions of success vary widely and often compete with each other across the complex landscape of forest resources, ownership types, and overlapping jurisdiction in which this epidemic unfolds. Investments in research on the pathology of *P. ramorum* have yielded dynamic spread models identifying and ranking communities at risk. However, unresolved questions regarding the efficacy and costs of proposed management, as well as the degree and location of collective action needed to affect change, has worked against deploying management treatments. The lack of shared and articulated goals, uncertainty in effect, and misunderstanding as to the roles of individuals and institutions in controlling the disease has left much of the region vulnerable to ongoing forest loss.

We introduce Tangible Landscape, a participatory modeling tool designed to explore "wicked" socio-ecological natural resource dilemmas by providing a "smart" workbench for consensus and collaborative solution building. Tangible Landscape allows stakeholders and decision makers to gather around a geographically realistic model and explore scenarios with instant feedback as to impacts of their decisions. Coupling a scanner, a projector, and a GIS, Tangible Landscape 1) builds participant understanding of complex environmental systems and the models that simulate them using 3D visualizations; 2) allows participants to iteratively test personal management strategies by computationally "steering" simulation models using an intuitive, tangible interface; 3) provides data-driven, near real-time spatio-temporal projections of management outcomes including costs; and 4) promotes co-learning amongst participants who are also testing their own strategies.

We explored the potential of Tangible Landscape to develop a SOD management strategy for Upper Sonoma Valley, CA, an area hard-hit by the disease, using actors playing local stakeholders. This deployment uses a host-driven pathogen spread and host mortality simulation model derived from published SOD data and models. From the point of historical detection of SOD (2000) in the Valley, we challenged our role players to limit both the extent of spread and oak (*Quercus*) mortality by 2010 given limitations to the area they could treat. For this case, treatments were limited to culling of bay laurel (*U. californica*), and represented by placing props on a physical terrain model. The scanner reads these representations of effort, updates a combined GIS and disease simulation model, and provides the estimated cost of treatment per ha. The results are projected back onto the physical model and different management scenarios are compared in near real time.

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We found Tangible Landscape provided the degree of information density and realism needed for role players to 1) quickly learn the salient details of a complex epidemiological spread model 2) allow decision making to be geographically and contextually informed, 3) develop and test management alternatives, and 4) incorporate near-real time feedbacks into adaptive strategies. In all, Tangible Landscape constituted a powerful shared environment fostering co-learning and co-management among participants.