

Climate and Host Risk Map for Sudden Oak Death Risk (*Phytophthora ramorum*).

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A climate and host risk map was constructed for Sudden Oak Death (SOD) using the NAPPFast pest mapping system (Borchert and Magarey, 2005). The climatic map was based upon an infection model and 10-year daily climatic data. The model was constructed using a generic 'fill-in-the-blanks' template for creating models 'on the fly.' The model uses the daily combination of average temperature and total leaf wetness hours per day to estimate the number of days in each year suitable for infection.

In constructing our model, we assumed that *P. ramorum* would climatically be limited by temperature for growth and moisture requirements for zoospore infection. The temperature thresholds (minimum, optimum, maximum temperature) for *P. ramorum* infection were 3, 20, 28 C respectively (Werres et al., 2001; Orlikowski and Szkuta, 2002; Tooley et al., 2005). The moisture requirement of at least 12 hours, was estimated from data describing zoospore infection of *Umbellularia californica* leaves (Huberli et al., 2003). An infection model (Magarey et al., 2005) was used to estimate the number of days favorable for infection. It was considered that the climatic probability of at least 60 favorable days for infection might be a useful indicator of climatic risk (Smith, 2002). For each 10 km pixel, each day was assigned a value between 0 (unfavorable for infection) and 1 (favorable for infection) and these values were accumulated over the year. The resulting layer represents the probability of having a sum of at least 60 favorable days over the whole year. This layer was averaged with a susceptible host area layer based on the sum of 100% of the hardwood and 50% of the mixed forest density (USFS, 1991) to produce a relative risk map (Figure 1). A second modeling effort examined the implications of extreme low soil temperatures < - 25° C which are known to reduce survival of the pathogen: sporangia and chlamydospores in laboratory tests (DEFRA, 2004). This cold temperature exclusion zone reduced the northern extent of the disease (Figure 2). Snow cover may provide insulation that is not considered in the model. Additional cold temperature survival data is needed.

There are certain limitations associated with model output. The model is based on 10 km² data and consequently may not perform ideally in mountainous terrain. (It is hoped to upgrade to a 1 km² spatial resolution at some time in the future.) The model was compared with *P. ramorum* observations in the field (UC Berkeley 2005) (Figure 3). All *P. ramorum* observations appear in the most favorable 9 year band visualized by the infection model in California. Some scientists believe the model over-predicts in coastal California. This may be because the model does not account for sporulation and dispersal. Sporulation requires at least 24 hours of wetness. We hope to improve the model when more advanced model building tool kits come on-line.

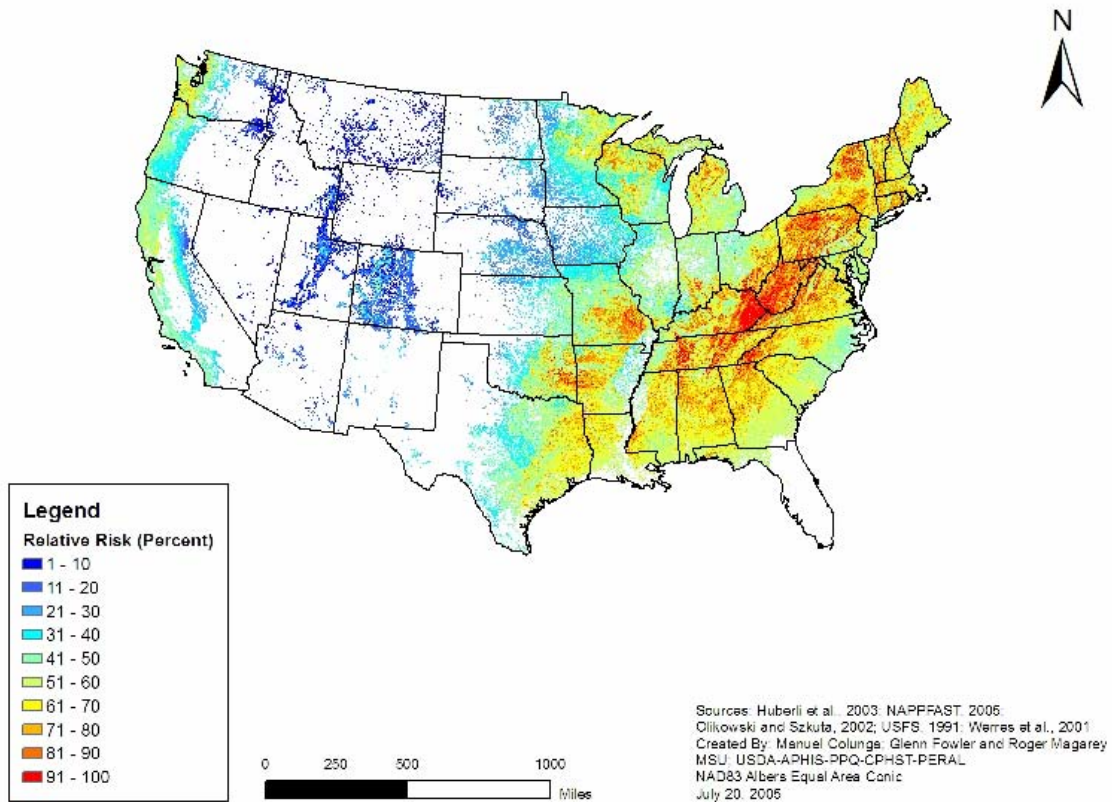


Figure 1. The probability of at least 60 favorable days for infection by *P. ramorum*. Map based on 10-year climatic data at a 10 km² resolution and includes forest density data (USFS, 1991).

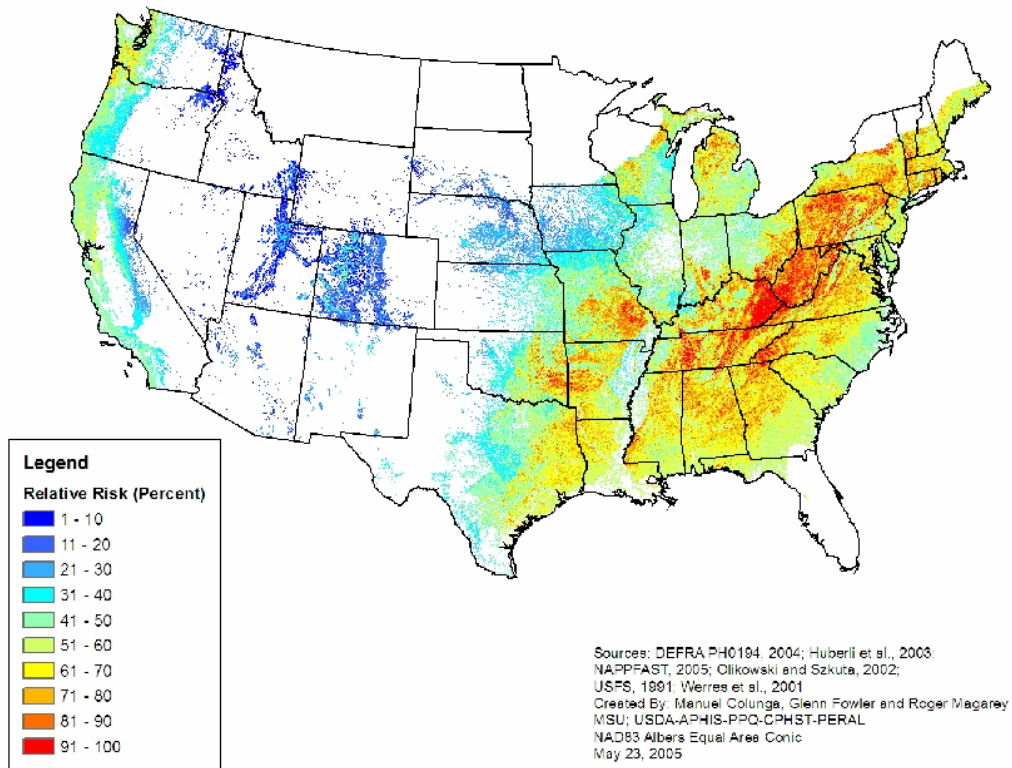


Figure 2. The probability of at least 60 favorable days for infection by *P. ramorum* and - 25 C soil temperature exclusion. Map based on 10-year climatic data at a 10 km² resolution and includes forest density data (USFS, 1991).

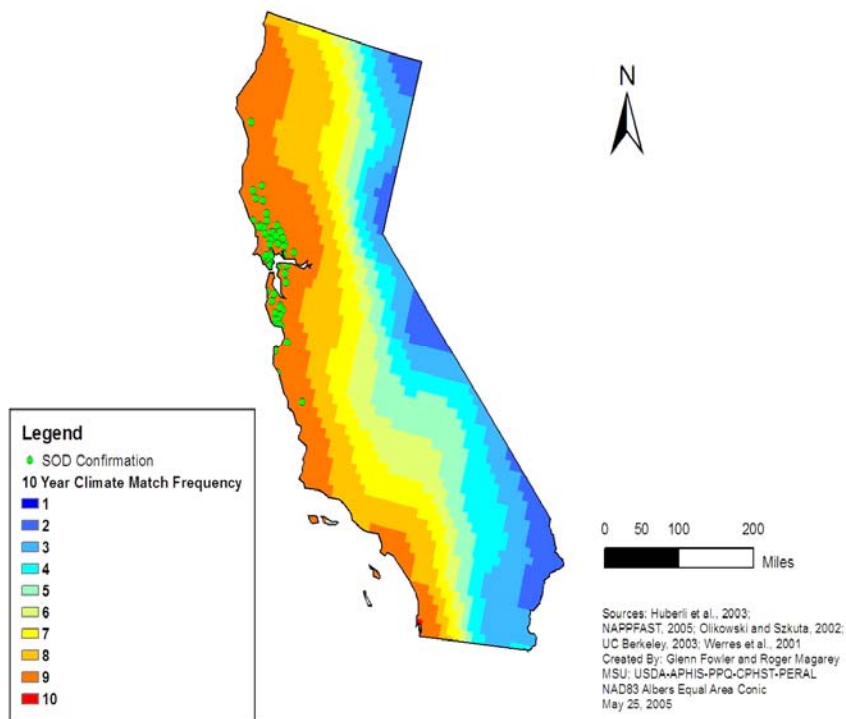


Figure 3. Comparison of sudden oak death observations compiled by UC Berkeley with predictions made by an infection model in NAPPFAST using ten year climate data.

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