

**USDA Forest Service, Pacific Southwest Research Station,
Sudden Oak Death/*Phytophthora ramorum* Research
2002 to 2010**

Episodic abiotic stress and ramorum blight in nursery ornamentals: impacts on symptom expression and chemical management of *Phytophthora ramorum* in Rhododendron- Richard Bostock, UC Davis- \$67,245 (To be conducted at the National Ornamentals Research Site at Dominican University of California) (2010)

Origin of reproductively isolated lineages in *Phytophthora ramorum* and other globally invasive Phytophthoras. Clive Brasier, UK Forest Research- \$11,520 (2010)

Evaluation of bark/wood mulches for suppressing the spread of *Phytophthora ramorum*. Gary Chastagner, Washington State University, Puyallup - \$39,086 (2010)

Inoculum thresholds, sporulation and tissue colonization associated with infection of western hemlock, larch, and Douglas-fir by *Phytophthora ramorum*. Gary Chastagner, Washington State University, Puyallup - \$24,868 (2010)

Research in support of sudden oak death containment and management in Western tanoak forests. Everett Hansen, Oregon State University; Alan Kanskie, Oregon Department of Forestry and Ellen Michaels Goheen, USDA Forest Service, Forest Health Protection, Central Point, OR- \$73,880 (2010)

Forest Health Research, Education and Outreach. David Lewis and Janice Alexander, University of California Cooperative Extension, Marin County- \$69,042 (2010)

Building public awareness of Sudden Oak Death, *Phytophthora ramorum*. Frank Lowenstein, The Nature Conservancy- \$50,188 (2010)

Molecular Diagnostics of *Phytophthora* spp. from Natural Ecosystems. Frank N. Martin and Guillaume Bilodeau, USDA Agricultural Research Service, Salinas and Steve Oak, USDA Forest Service, Forest Health Protection, Asheville, NC- \$36,660 (2010)

Re-measurement and analysis of long-term impacts of *Phytophthora ramorum* in mixed oak woodlands. R.K. Meentemeyer, University of North Carolina, Charlotte; N.E. Rank and J. Hall Cushman, Sonoma State University; David Rizzo, UC Davis- \$76,540 (2010, for two years).

Efficacy of Sudden Oak Death adaptive management in Humboldt County. David Rizzo, UC Davis and Yana Valachovic, UC Cooperative Extension Humboldt and Del Norte Counties- \$37,800 (2010)

Identifying insect pollinators to tanoak flowers in forests impacted by *Phytophthora ramorum*. Jessica Wright, USDA Forest Service, PSW Research- \$2,920 (2010)

Comparative sporulation of *Phytophthora ramorum* on larch (*Larix*) and other key sporulating hosts, and the impact on Douglas-fir and Port Orford Cedar in the field. Joan Webber, UK Forest Research- \$55,424 (2010)

Accelerated breakdown of leaf litter naturally infected by *Phytophthora ramorum* and *P.kernoviae* as a method of disease management. Joan Webber and Sandra Denman, UK Forest Research - \$19,000; and Anna Maria Vettrano, University of Tuscia- \$21,000 (2010)

Ecology of *Phytophthora* spp. in watercourses: implications for the spread and management of Sudden Oak Death and other diseases. Kamyar Aram, Elizabeth Fichtner and David Rizzo, University of California Davis – \$88,200 (2008, 2009, 2010)

Sporulation of *P. ramorum* on trees and shrubs in western Washington forests. Gary Chastagner, Washington State University - \$120,980 (2008, 2009, 2010)

Epidemiology of *Phytophthora ramorum* and *Phytophthora kernoviae* in the UK. Elizabeth Fichtner and David Rizzo, University of California Davis; Joan Webber, UK Forestry Research - \$29,689 (2008, 2009)

Studying the epidemiology of *Phytophthora ramorum* in the air, soil and water, using a combination of intensive surveys and population genetic analyses. Matteo Garbelotto, University of California Berkeley - \$162,800 (2008 -2009)

Managing *Phytophthora ramorum* in tanoak forests. Everett Hansen, Oregon State University - \$181,016 (2008, 2009)

Studies on the latency period of *Phytophthora ramorum*. Marko Riedel, Stefan Wagner and Sabine Werres, Julius Kuehn Institute, Federal Centre for Cultivated Plants, Germany - \$82,160 (2008, 2009, 2010)

Inoculum thresholds necessary for infection of selected host species. Paul W. Tooley, USDA Agricultural Res. Serv., Ft. Detrick, MD - \$79,555 (2008, 2009)

Testing bark and wood of conifers for susceptibility to natural inoculum of *P. ramorum* and *P. kernoviae*. Clive M. Brasier and Anna Brown, Forest Research Agency, United Kingdom - \$110,692 (2008, 2009)

Investigating inoculum behaviour, infection and disease expression in relation to temperature and inoculum density of two aerial Phytophthoras (*P. ramorum* and *P. kernoviae*) on detached foliage. Sandra Denman and Joan Webber, Forest Research Agency, United Kingdom - \$53,585 (2007, 2008, 2009, 2010)

Variation in Tanoak's Resistance to *Phytophthora ramorum*. Matteo Garbelotto and Katy Hayden, University of California Berkeley; Jessica Wright, USDA Forest Service, Pacific Southwest Research Station; Richard Dodd, University of California Berkeley; Richard Sniezko,

USDA Forest Service, Pacific Northwest Region, Dorena Tree Improvement Center - \$311,428 (2008, 2009, 2010)

Monitoring migration, population structure and evolution of the Sudden Oak Death pathogen *Phytophthora ramorum* in North America. N.J. Grunwald, USDA Agricultural Research Service, Corvallis; E. M. Hansen, Oregon State University - \$397,728 (2006, 2007, 2008, 2009, 2010)

Epidemiology of *Phytophthora ramorum* in tanoak forests. Everett Hansen, Oregon State University - \$757,880 (2004 - 2010)

The role of elicitors in the pathogenesis and biology of *Phytophthora ramorum*, Daniel Manter, USDA Agricultural Research Service – Fort Collins; Everett Hansen, and Jennifer Parke, Oregon State University - \$321,207 (2007, 2008, 2009, 2010)

Sudden Oak Death Information Synthesis and Delivery. Douglas McCreary, University of California Berkeley - \$277,809 (2007, 2008, 2009, 2010)

Management of *Phytophthora ramorum* in tanoak and oak stands. Matteo Garbelotto, University of California Berkeley; Ted Swiecki, Phytosphere Research ; Yana Valachovic, UC Cooperative Extension – Humboldt and Del Norte Counties - \$405,728, (2006, 2007, 2008, 2009, 2010)

Non-market economic impacts of Sudden Oak Death/*Phytophthora ramorum*, Jeffrey Englin, University of Nevada-Reno - \$68,000 (2007, 2009)

Detecting and monitoring *Phytophthora ramorum* and other species of *Phytophthora* in forest streams in the Eastern USA. S. N. Jeffers and Jaesoon Hwang. Clemson University - \$247,780 (2006, 2007, 2009, 2010)

Global Forest Phytophthora Website. Jennifer Parke, Oregon State University - \$77,455 (2009, 2010)

Southern California Oak Mortality: Biology, Management, and Impact of the Goldspotted Oak Borer with an Emphasis on Solarization Treatment of Infested Firewood. Mary-Louise Flint, UC-Davis - \$75,517; Steve Seybold, USDA-FS, PSW - \$5,000 (2009, 2010)

Adaptive management of *Phytophthora ramorum* in the Big Sur Ecoregion: links between sudden oak death and fire, David Rizzo, UC-Davis - \$188,765 and Ross Meentemeyer, University of North Carolina Charlotte - \$126,364 (2009, 2010)

Development of a risk model for Sudden Oak Death in Oregon. Alan Kanaskie, Oregon Department of Forestry; Ross Meentemeyer, University of North Carolina – Charlotte - \$30,000 (2008)

Landscape-scale management of *P. ramorum*: linkages to conservation goals for the Garcia River Forest. David Rizzo, University of California Davis; Ross Meentemeyer, University of North Carolina – Charlotte - \$142,390 (2008)

Effect of environmental conditions on sporulation of *P. ramorum*. Steve Tjosvold, UC Cooperative Extension, Santa Cruz and Monterey Counties - \$40,000 (2008)

Understanding the long-term fire risks in tanoak forests affected by Sudden Oak Death. Yana Valachovic, Chris Lee UC Cooperative Extension, Humboldt and Del Norte Counties; Morgan Varner, Humboldt State University - \$53,597 (2008)

Systemic spread, asymptomatic infection, and infection potential of soilborne propagules in the disease cycle of *Phytophthora ramorum*. Jennifer Parke, Everett Hansen, and Barbara Lachenbruch, Oregon State University – \$89,880 (2007, 2008)

Optimization of management strategies for sudden oak death using epidemiological models and GIS technologies. C.A. Gilligan, University of Cambridge, D.M. Rizzo, UC-Davis - \$185,515 and Ross Meentemeyer, University of North Carolina - \$76,500 (2006, 2007)

Economic Impact Assessment for Sudden Oak Death/*Phytophthora ramorum* Tom Holmes, USDA Forest Service, Southern Research Station - \$100,000 (2007, 2008)

Protecting true oak habitats from *Phytophthora ramorum* at the Garcia River Forest, Mendocino County, Jeanette Howard, The Nature Conservancy, San Francisco - \$52,000 (2007)

Effects of clone size and structure of tanoak on spread of sudden oak death disease in California forests - Richard Dodd. UC-Berkeley - \$96,000 (2006, 2007, 2008)

Long-Term Study of Disease Dynamics and Forest Impacts Caused by *Phytophthora ramorum* in Northern California. J. H. Cushman, N. E. Rank, Sonoma State University and R.K. Meentemeyer, University of North Carolina, Charlotte - \$107,388 (2006, 2007, 2008)

Importance of Water-Runoff in Spreading Inoculum and Supporting New Infections of *Phytophthora ramorum* in Nursery and Landscape Conditions - Steve Tjosvold, UC Cooperative Extension - \$114,144 (2007, 2008)

Eradication of *Phytophthora ramorum* from contaminated sites - J. D. MacDonald, UC-Davis - \$20,905 (2005, 2006) Jointly funded with USDA-Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine

Zoospore infection of bark, host specificity and field resistance to bark infecting Phytophthoras. Clive M. Brasier and Anna Brown. Forest Research Agency, United Kingdom - \$29,975 (2005)

Acorn composition following tree application of phosphanate. Alyson Mitchell and Tedmund J. Swiecki. University of California Davis and Phytosphere Research, California - \$10,000 (2005)

Factors influencing *Phytophthora ramorum* infection in Christmas tree plantations. Gary Chastagner. Washington State University - \$108,237 (2005, 2006, 2007)

Enhanced plant-mediated and microbe-induced suppression of *Phytophthora ramorum* through application of specific amendments and foliar treatments. Michael Cohen. Sonoma State University - \$29,805 (2005, 2006)

Phenotypic and genotypic comparisons between nursery and wild populations of *Phytophthora ramorum*. Matteo Garbelotto, University of California Berkeley and Niklaus J. Grunwald, USDA Agricultural Research Service, Corvallis - \$163,966 (2005, 2006)

Evaluating the sporicidal efficacy of yellow-cedar heartwood toward *Phytophthora ramorum* spores in the litter and soil; Rick G. Kelsey. USDA Forest Service, Pacific Northwest Research Station - \$17,600 (2004)

Systemic spread, asymptomatic infection, and infection potential of soilborne propagules in the disease cycle of *Phytophthora ramorum*; Jennifer Parke, Jeff Stone and Everett Hansen. Oregon State University - \$433,951 (2005, 2006, 2007)

Determining the efficacy of a systems approach for producing nursery stock free of plant pathogenic *Phytophthora* species; Jennifer Parke, Oregon State University, and Niklaus J. Grunwald, USDA Agricultural Research Service, Corvallis - \$150,000 (2005)

Adaptive management of *Phytophthora ramorum* in the Big Sur Ecoregion; David Rizzo Matteo Garbelotto, University of California Davis - \$437,113 (2005, 2006, 2007, 2008)

Biological and ecophysiological factors mitigating in planta survival of *Phytophthora ramorum* in California bay laurel. David Rizzo and Elizabeth Fichtner, UC Davis and Daniel Huberli, UC Berkeley - \$140,000 (2005, 2006)

Seasonal symptom expression, detection, and potential for infectivity of *Phytophthora ramorum* on rhododendron and camellia; Steve Tjosvold. University of California Cooperative Extension, Santa Cruz Co. and Cheryl Blomquist, California Department of Food and Agriculture - \$98,669 (2005, 2006)

Dissecting the population genetics of *Phytophthora ramorum* using a high density SNP Chip; Brett Tyler and others. Virginia Polytechnic Institute and State University - \$100,631 (2005)

In vivo study of host-*Phytophthora ramorum*-interaction, using green fluorescent protein (GFP); Sabine Werres et al. Federal Biological Research Centre for Agriculture and Forestry (BBA), Germany - \$66,560 (2005, 2006)

Screening northern red oak (*Quercus rubra* L.) for geographic as well as individual tree variation for resistant to the Sudden Oak Death pathogen *Phytophthora ramorum*. Thomas L. Kubisiak and Dana C. Nelson. USDA Forest Service, Southern Research Station - \$46,512 (2004)

Predicting the effects of Sudden Oak Death on small vertebrates in high risk oak woodlands in San Luis Obispo County. William Tietje. Cooperative Extension, University of California Berkeley - \$17,876 (2004)

Management of *Phytophthora ramorum* on Christmas trees and conifer nursery stock. Gary Chastagner and Everett Hansen. Cooperative Extension, Washington State University - \$59,221 (2004)

Vertebrates as dispersal agents of *Phytophthora ramorum*, the pathogen that causes Sudden Oak Death. J. Hall Cushman & Ross K. Meentemeyer. Sonoma State University - \$78,577 (2004)

Evaluation of the potential of commercial firewood and densified fuelwood products as low risk resource utilization alternatives for sudden oak death-disease wood. John R. Shelly. Cooperative Extension, University of California Berkeley - \$44,000 (2004)

Phytophthora species associated with potential *Phytophthora ramorum* sites in the central and eastern United States; Yilmaz Balci, West Virginia University - \$50,000 (2004)

Sampling Cankers on oaks and Associated Eastern species for *Phytophthora* species and other organisms. Yilmaz Balci, West Virginia University - \$69,930 (2005, 2006)

Movement of *Phytophthora ramorum* among *Camellia* spp in a nursery setting; Sibdas Ghosh. Dominican University of California - \$54,523 (2004)

Sporulation, survival, distribution, and detection of soilborne inoculum of *Phytophthora ramorum* in forest ecosystems. David Rizzo and Elizabeth Fichtner. University of California Davis. - \$118,000 (2005, 2006)

Understanding the disease cycle of *Phytophthora ramorum* in California oak and tanoak woodlands: Inoculum production, infection thresholds, and summer survival. Jennifer M. Davidson. University of Hawaii - \$78,800 (2004)

Biology, Epidemiology, and Behavior of *P. ramorum*; Matteo Garbelotto, University of California Berkeley - \$145,000 (2004)

Is *Phytophthora ramorum* in Mexico? Dionicio Alvarado-Rosales. Instituto Fitosanidad, Montecillo, MX - \$52,500 (2004)

Infectivity and survival of *P. ramorum* in recirculation water. H. Beltz, T. Brand, D. Seipp, S. Wagner, and S. Werres, Chamber of Agriculture, Department of Horticulture, Bad Zwischenahn, Germany - \$40,462 (2003-2004)

Influence of land-use history and vertebrates on the occurrence and spread of *Phytophthora ramorum*. J. Hall Cushman, and R. Meentemeyer, California State University, Sonoma, CA - \$156,448 (2003-2004)

Development of DNA aptamers for field detection of *Phytophthora ramorum*. S. Doyle, Joint Genome Institute, Department of Energy/University of California, Berkeley -\$205,458 (2003, 2004)

Phytophthora ramorum in eastern United States forest: Sampling for presence and determining baseline *Phytophthora* species occurrence. Kurt Gottschalk, William MacDonald, Jennifer Juzwik, and R. Long, USDA Forest Service, Northeastern Experiment Station, Morgantown, WV - \$88,000 (2004)

Predicting Geographic Susceptibility and National Epidemic Development Patterns for Sudden Oak Death. William Hargrove, Oak Ridge National Laboratory, Oak Ridge, Tennessee - \$72,266 (2004)

Modeling potential spread of *P. ramorum* in the conterminous United States: effects of different models on modeled risk. Maggi Kelly, University of California, Berkeley - \$29,786 (2004)

Evaluating the role of host and non-host defensive chemicals on the pathogenicity and spore viability of *Phytophthora ramorum*. Rick Kelsey and Daniel Manter, USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR - \$125,000 (2004, 2005)

Molecular diagnosis of *Phytophthora* spp., SOD as a case study. Frank Martin. USDA-Agriculture Research Service, Salinas, CA - \$71,611 (2004)

Role of the Foliar Microbial Community in the Epidemiology of Sudden Oak Death. John Andrews, University of Wisconsin, Madison, WI - \$40,082 (2004)

The ecology and control of *Phytophthora ramorum* in nurseries. Jim MacDonald and R. Bostock, University of California, Davis, CA - \$50,000 (2003)

Survival and dissemination of *Phytophthora ramorum* in soil and potting media. Jennifer Parke and Robert Linderman, Oregon State University, Corvallis, OR - \$162,620 (2003, 2004)

Histopathology and PCR in situ visualization of *Phytophthora ramorum* within plant tissues. Jeff Stone and Lori Winton. Oregon State University, Corvallis, OR - \$82,404 (2003)

The effect of soil inoculum concentration, presence of inoculum in irrigation water, irrigation method, and plant disease incidence on the epidemiology of *Phytophthora ramorum* affecting containerized Rhododendron. Steve Tjosvold, University of California, Cooperative Extension, Santa Cruz and Monterey Counties - \$50,583 (2003)

Determination of population structure, phylogenetic placement, species state of *Phytophthora ramorum* and development of a quick and accurate diagnostic methodology, Matteo Garbelotto, UC Berkeley - \$446,770 (2002, 2003, 2004)

Studies on treatment for prevention, management, and sanitation of Sudden Oak Death disease, with a particular emphasis on chemical treatments and composting Matteo Garbelotto, UC Berkeley - \$152,000 (2002, 2003)

Detection and identification of decay and pathogen fungi directly from wood: A novel approach for the assessment of decay and disease in trees affected by Sudden Oak Death Matteo Garbelotto, UC Berkeley - \$40,107 (2002)

Identifying Sudden Oak Death resistant genotypes to susceptible species in coastal oak woodlands, Dr. Richard Dodd, UC-Berkeley - \$135,922 (2002, 2003)

Continuation of Intensive Research Plot Monitoring Across the Range of Sudden Oak Death, N. Maggi Kelly, UC- Berkeley - \$51,542 (2002)

Interactions of bark and ambrosia beetles with *Phytophthora ramorum* in coast live oaks and their role in tree failure, Richard Standiford, David Wood, Andrew Storer, Pavel Svihra, and Tjosvold, UC-Berkeley – \$104,468 (2002, 2003, 2004)

Ecological impacts of Sudden Oak Death on coast live oak and tanoak/redwood ecosystems
Barbara Allen-Diaz, Donald Dahlsten, Kevin O'Hara, Scott Stephens, William Tietje \$534,734, for 3 years (2002, 2003, 2004)

Studies to determine mechanisms of survival, spread, population structure, and other biological characteristics of *Phytophthora ramorum*, David Rizzo, UC-Davis - \$398,770 (2002, 2003, 2004)

Epidemiology, biology, and impact of *Phytophthora ramorum* in the Sierra Nevada, David Rizzo, UC-Davis - \$210,000 (2002, 2003, 2004)

Disease progression and sporulation potential of *Phytophthora ramorum* on non-oak hosts, David Rizzo, UC-Davis - \$210,000 (2002, 2003, 2004)

Utilization and disposal of *Phytophthora ramorum* infected oak and coordination of the PSW Sudden Oak Death research program: An effort to retard the spread of Sudden Oak Death Syndrome in the coastal habitat of California, Frank Beall and John Shelly, University of California, Forest Products Laboratory - \$216,000 (2002, 2003, 2004)

Evaluation of fungicides for the control of *Phytophthora ramorum* infecting containerized plants, Steve Tjosvold ,University of California Cooperative Extension, Watsonville, CA – \$36,135 (2002, 2003)

The effect of Sudden Oak Death on mortality, long term growth, and economic viability of coast live oak in three California counties, Norman Pillsbury, California State University-San Luis Obispo, CA - \$52,000 (2002, 2003, 2004)

A cytological and histological study of *Lithocarpus* and *Quercus* spp. infected with *Phytophthora ramorum*, Edwin R. Florance, Lewis and Clark College, Portland, OR - \$20,000 (2002)

Evaluation of water stress and other risk factors for *Phytophthora ramorum* canker in coast live oak and tanoak, Tedmud J. Swiecki, Phytosphere Research, Vacaville, CA- \$33,924 (2002)

Phytophthora ramorum (Sudden Oak Death) in coast live oak and tanoak: Factors affecting disease risk, disease progression, and failure potential - Tedmud J. Swiecki - \$308,401 (2002 to 2009)

Relationship between tree failure potential and *Phytophthora ramorum* canker (Sudden Oak Death), Tedmud J. Swiecki- \$50,000 (2002)

Field evaluation to study a method of potential transmission of Sudden Oak Death (*Phytophthora ramorum*) by birds, C. J. Ralph, Pacific Southwest Research Station, Erick S. Jules, Humboldt State University, Arcata, CA - \$74,000 (2002, 2003)

USDA-FS, Post doc. position. Develop the necessary protocols for testing laboratory susceptibility and field infection rates of SOD on various species of oaks, both those native to California and those found elsewhere in the United States. Stationed with David Rizzo, University of California, Davis - \$70,000 (2002)

A study to determine the role of vertebrate vectors (birds and small mammals) in spreading *Phytophthora ramorum*, Keyt Fischer, Steve Zack, Wildlife Conservation Society, Cheryl Blomquist, California Department of Food and Agriculture - \$45,000 (2002)

Comparative aggressiveness of European and U.S. isolates of *Phytophthora ramorum* on *Quercus rubra*, Clive Brasier, Forest Research Agency; Sabine Werres, Federal Biological Research Center for Agriculture and Forestry, Willem A. Man and R. P. Baayen, Dutch Plant Protection Service, Wageningen, Netherlands. - \$75,468 (2002, 2004)

Incoming funds. The Midpeninsula Regional Open Space District is providing \$60,000 over 3 years in research funds for Variation in Tanoak's Resistance to *Phytophthora ramorum*, Cindy Roessler (2007, 2008, 2009)

Incoming funds. The San Francisco Public Utilities Commission (SFPUC). An experimental management project to protect against the sudden oak death pathogen on the SFPUC Peninsula Watershed” - \$192,000 (2008, 2009)