ISSN 1554-5792

hortResources

horticultural network of New England

March-April 2005, Vol. 13, No. 2

Phytophthora ramorum: Epidemic

Messing with Mother Nature

President Bush's proposed FY 2006 budget "zeroes out" federal funding for the USDA Nursery Floral Research Initiative. Craig Regelbrugge (cregelbrugge@anla.org) American Nursery & Landscape Association Senior Director of Government Relations, says, "The president's budget cuts total agricultural programs by 9.6%, and zeroes out all congressional earmarks. So it's up to the Congress to decide what to restore. For our industry, it will be important to fight to keep our $6 million in base funding for the Initiative, which is doing cutting-edge research in environmental management, emergency situations like **Phytophthora ramorum**, and emerging issues like invasive plants." —Weekly NMPRO e-mail for Feb. 22, 2005

by Elizabeth F. Cole, M.D.

The cataclysmic tsunami of December 2004 made the connections between us and our planet dramatically visible. Globalization is the decompartmentalizing of global pieces, which include both tectonic plates and atoms. As microbes, plants, animals, and humans are translocated, each tries to accommodate to the changes and thereby causes other changes...

Emerging Epidemics

When a plant or animal is first exposed to a pathogen with which it has not co-evolved in time and place, an epidemic may result. Many of the original populations die because they have neither antibodies nor heritable natural defenses; in other words, the individuals susceptible to this new threat have not been culled out by previous exposure. Survivors may then coexist with newly dominant competitors. Dependents of the afflicted host will survive in relation to their own adaptability. Decomposers will thrive on the remains, renewing the soil. Thus landscapes and populations evolve.

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About HortResources

HortResources is a non-profit network of horticultural enthusiasts in the Northeast and beyond who serve as resources to one another. Members include individuals, businesses, and non-profit institutions. The *HortResources Newsletter* appears six times yearly. The *HortResources Calendar*, available at *hortresources.org*, is the most complete horticultural calendar of events available for New England. Membership starts in January but all back issues are free on line to members.

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Human responses include preventatives of infection (such as vaccines), treatments, and quickly established quarantines. These may reestablish the status quo. However, each is hard to develop, finance, and administer. Immediate and potential harm (even into the remote future) to the environment must also be considered.

A success story. SARS (Severe Acute Respiratory Syndrome) is an example of a lethal human epidemic successfully managed by quarantine.

A doctor from Toronto had visited a remote Chinese village where he ate infected meat. His hosts were apparently immune to the disease, being generations removed from local introduction, but the doctor took ill as he returned to Canada and infected twelve co-travelers from five different countries. Fortunately, he was alert to the unusual qualities of his pneumonia-like illness, realizing that it was due to a coronavirus and not treatable by ordinary means. Before he died, he imparted this information to hospital authorities and international health organizations were immediately alerted.

Antibiotics and immunization proved not effective. Genetic methods of diagnosis had to be instituted. Methods of avoiding exposure during treatment had to be taught to care givers. Tracing the contacts of the doctor and his co-travelers was an essential element of containment. Trace-backs led to 23,103 persons, all of whom had to be quarantined until proven not infected. 225 people were found to be actively infected. Before the end of the epidemic, 8000 people, some on every continent, had been infected and 800 died.

The extraordinary cooperation of international health organizations brought an end to the SARS epidemic in just four months. The total costs world-wide are not known but the cost of quarantine and the effect on tourism was $260 million (Canadian) to Toronto and $1.13 billion (Canadian) to the Ontario provincial government.

Dead forest at Big Sur in Monterey County, California. Photo by Susan Frankel, USDA Forest Svce.

Sudden Oak Death (SOD)

Phytophthora ramorum is a relatively new epidemic. It was first identified in California in 1995, when large numbers of tanoaks began dying in Marin and Santa Cruz counties. At that time, the unknown culprit was thought to kill its hosts quickly, hence the name "Sudden Oak Death." By the summer of 2000, it was discovered that SOD was caused by a previously unidentified Phytophthora species, officially named Phytophthora ramorum in April 2001.

In North America, *P. ramorum* is still called Sudden Oak Death when it is present in oaks. When it attacks horticultural plants, such as rhododendrons, it is called *ramorum* blight. *P. ramorum* has been found where climatic conditions are mild and moist. It can live in soil, water, and plants, and can spread to other susceptible plants. Further inland in California, where the climate is warmer and drier, the pathogen has not been found despite the presence of vast forests of susceptible oaks. However, *P. ramorum* has the potential to cause significant forest and landscape loss wherever its climate requirements are met.

The virulence of *P. ramorum* indicates that it is an exotic pathogen, not a co-evolutionary organism. No one knows where it came from. There is no known cure.

North America

Some scientists theorize that P. ramorum was introduced at least several years prior to its recognition in 1995 and that the prolonged wet weather in California in the early 1990's facilitated its spread. Within five years, P. ramorum had killed tens of thousands of coast live oaks, California black oaks, Shreve's oaks, and tanoaks along California's central coast. Yet, some susceptible tree species avoided infection, hinting that genetic diversity may yet prove the source of regeneration.

Today *P. ramorum* can be found in California forests from Monterey County to Humboldt County, and in nearby Curry County in Oregon. In isolated sites, as in Oregon, eradication and close subsequent surveillance are being carried out in hope of containment.

Signs of infection in bole hosts. Weeping bole cankers, found above ground level, often at breast height, are characteristic signs of infection in susceptible forest oaks and tanoaks. A brilliant observation was made, and confirmed by simulation, that the oozing cankers tended to occur where rainwater splashed or was washed down the bole from neighboring foliar hosts, such as tanoak (the only known foliar and bole host) and California bay laurel (*Umbellularia californica*). It is now believed that the cankers show up approximately six months to two years after the pathogen has entered the tree. *P. ramorum* enters through the bark without a sign. As it girdles the trunk and cuts off the tree's circulatory system, cankers and browning foliage appear.

Quercus rubra, Northern red oak

Bark and ambrosia beetles and *Hypoxylon* fungus galls may also be signs of infection. These opportunistic organisms are secondary invaders, attacking weakened trees. They often hasten a tree's death by further compromising its structural integrity. Creating an abundance of dead limbs and trees, SOD has greatly increased the amount of fire fuel in infested forests, as well as created hazardous conditions for people and property, by structurally compromising the trees.

Nursery infections in western U.S. Once *P. ramorum* was identified as the pathogen, nurseries in infested areas were thoroughly inspected, both as possible sources of infection and because they were exposed to forest infections. In 2001, one nursery in Santa Cruz County was found to have *P. ramorum* on rhododendron. The source of this sole nursery infection has not been determined.

Signs of infection in other species. Attention that had been riveted on oaks next turned to other species in infested areas, especially those showing leaf spots and twig cankers. Some were found to support abundant reservoirs of inoculum, available to be carried to other susceptible plants.

P. ramorum hosts include plants as diverse as the mighty coast redwood and Douglas fir and forest floor-hugging ferns. At last count, 68 plants were known to be susceptible but, as research continues, the list continues to expand. For a list of hosts, go to http://www.aphis.usda.gov/ppq/ispm/pramorum.

Water monitoring is being conducted in many areas of California, with infection often found in streams and rivers in infested forests. Rhododendron leaves, highly susceptible to *P. ramorum*, are set as bait into waterways in porous bags. This has proven an effective tool in monitoring forests for the presence of the pathogen.

The pathogen. *P. ramorum* is in the genus *Phytophthora*, which includes more than sixty other known species. In Latin, *Phytophthora* means "plant destroyer." The genus has caused enormous damage to forests and agriculture throughout the world, causing Port Orford cedar loss in Northern California and Southern Oregon, jarrah dieback in Australia, potato blight in Ireland, and citrus and chocolate crop damage, to name only a few.

Although *Phytophthora* are often referred to as fungi, they are ancient oomycete (water molds) in the 6th Kingdom, *Stramenopiles*. Close relatives include brown algae and kelp. All are inhabitants of cool, wet climates and have in common mycelia and three kinds of spores: flagellated spores that swim; spores that survive harsh, dry conditions; and mating spores.

Mutations are common. Using new genetic techniques, it was discovered that the European and the North American *P. ramorum* strains are related, but not identical. Varying in only a small segment of the genome, European and American types may have the potential to mate and reproduce, causing concern that their offspring might be most virulent form yet.

In August 2003, before the initiation in the U.S. of the *P. ramorum* quarantine, plants from a nursery in Oregon and its sister nursery in Washington were found infected with both the North American *P. ramorum* A2 mating type, and the European *P. ramorum* A1 mating type. This was the first report of the European A1 mating type in the United States. It was also the first time both mating types were found in close proximity to one another in the U.S. The European strain likely came from British Columbia and the American strain likely came from the US.

In 2003, *P. ramorum* was found on *Camellia* and *Rhododendron* in several nurseries in British Columbia, Washington, Oregon, and California. The source remains unknown; most nurseries were too removed from forests to have been infected by them. In March 2004, Monrovia Nursery, and Specialty Plants, Inc., a web-based retailer, were found to have *P. ramorum*-infected camellias. Shipments of host plants from these nurseries were immediately stopped, but not before infected plants had been sent throughout the U.S. to nurseries and private individuals. Through trace-forward surveys, it was found that enormous numbers of *P. ramorum*-susceptible hosts were also shipped nationwide. Subsequently, following the USDA APHIS Confirmed Nursery Protocol, millions of plants were destroyed at great financial loss. In January 2005, USDA APHIS implemented an Emergency Order mandating annual inspections for all Washington, Oregon, and California nurseries shipping stock interstate (including non-host plants).

Eradication is not easily accomplished. In January 2005, re-inspection of Monrovia Nursery identified new, limited *P. ramorum* infection on camellias.The plants were destroyed per the USDA Confirmed Nursery Protocol. Today USDA APHIS, the Canadian Food Inspection Agency (CFIA), and state departments of agriculture cooperate to contain nursery *P. ramorum* outbreaks through quarantine.

Inspection procedures. In the United States, the USDA Animal and Plant Health Inspection Service (APHIS) is charged with interstate regulation of pathogens, including development of eradication protocols and overseeing nursery inspections of plants, water, and soil. Nursery perimeters are inspected by the USDA Forest Service, while state agriculture departments oversee intrastate trade.

Per the Confirmed Nursery Protocol, all susceptible plants within the infected contiguous block are destroyed and all plants within a 10-meter buffer zone are quarantined and held for a period to determine whether or not they are infected; if they prove to be *P. ramorum*-free after the quarantine period, they may be shipped. All plants beyond the 10 meters are inspected for symptoms. Soil in contact with infected plants is also destroyed and all equipment used in the process is sterilized.

As part of a U.S.-wide effort to locate *P. ramorum*-positive nursery stock, USDA APHIS conducted 3,095 nursery inspections in 2004, taking 50,820 samples from plants, water, and soil. Additionally, the USDA FS *P. ramorum* National Wildland Survey sampled 681 nursery perimeter locations in 34 states. Of the 3,207 samples submitted, all were negative for *P. ramorum*.

Regulations continue to evolve as the science evolves, so check with the APHIS website for regulatory updates (Confirmed Nursery Protocols, USDA/APHIS).

In 2004, 292,450 *P. ramorum*-susceptible plants, not necessarily infected, were shipped from Monrovia Nursery to 8,450 U.S. nurseries in 39 states. 171 nurseries tested in 20 states had infected plants. Over 200 customers in Massachusetts alone received mail order plants directly (Massachusetts Nursery & Landscape Association, www.mnla.com). 5,540 host plants went to four Canadian provinces in 330 shipments. Trace-forwards from Hines Nursery in Oregon disclosed infection in Maryland.

The cost to U.S. taxpayers to eradicate the pathogen from the infested nurseries was over $20 million.

Europe

In 2002, a single infected viburnum was found in a nursery in Sussex, England. Nursery and forestry agencies were mobilized, quarantines followed, and over 1500 sites in Britain's forests were combed for infection. None were found. However, infected nursery stock was found in over 370 nurseries and garden centers. These plants were quarantined or destroyed.

The U.K., the Netherlands, and Germany have brisk nursery trades. Before *P. ramorum* quarantines were set, widespread dissemination of the pathogen through European countries had occurred via nursery shipments. To date, the pathogen has been found in more than 400 nurseries in at least 13 other countries, including Germany, Spain, France, Poland, Belgium, Sweden, Switzerland, Norway, Slovenia, and Italy.

Forest infections in Europe. Until recently, the disease was limited to nurseries, gardens, and their perimeters. Britain and the Netherlands are now reporting forest tree mortality. In England, infected species are limited to a very few sites in Cornwall where holm oak (*Quercus ilex*) and sweet chestnut (*Castanea sativa*) had foliar infections, while bleeding cankers were found on four other species: turkey oak (*Quercus cerris*), beech (*Fagus sylvatica*), horse chestnut (*Aesculus hippocastanum*), and Planetree maple (*Acer pseudoplatanus*). The Netherlands has lost small numbers of native red oaks.

Unfortunately, the first *P. ramorum*-positive Planetree maple (*Acer pseudoplatanus*) was just confirmed in May 2005 at one of the *P. ramorum*-infested woodland sites in Cornwall. Four other trees in close proximity appear to be symptomatic: *Fagus sylvatica, Cornus, Acer laevigatum,* and *Pieris*.

A. pseudoplatanus joins six others (see COMTF February 2005 report) that are pending addition to the USDA APHIS host and associated host list.

Phytophthora kernoviae. In November 2003, another previously unknown species of *Phytophthora* was found in Cornwall, in southwest Britain, within the *P. ramorum*-quarantined area, on rhododendrons [the species was not named by U. K. Department for Environment, Food, and Rural Affairs (DEFRA)], thirty beeches (*Fagus sylvatica*), and two English oaks (*Quercus robur*). It was called *Phytophthora kernoviae* after Cornwall's ancient name by discoverers Clive Brasier and colleagues at the U. K. Forestry Commission Forest Research Agency. Signs of *P. kernoviae* are shown on the Forestry Commission website: www.forestry.gov.uk.

Nine hosts are known for *P. kernoviae* and other sites of infestation have been found. Updated information is available at http://www.defra.gov.uk/planth/kernovii/kernqa.pdf.

Laboratory tests and observations suggest that *P. kernoviae* is more aggressive than *P. ramorum*, with rhododendrons succumbing in as little as a few weeks. *Magnolia* and *Liriodendron* are also affected.

Infected plants are being destroyed. Removing all *Rhododendron*, is under consideration, including destruction of the roots to prevent re-growth. No effective chemical treatments have been found but burning would be preferred over fungicides, which might suppress symptoms without eliminating infection. Grants to landowners may be available towards the cost of clearing woodland sites.

P. kernoviae is being taken very seriously. DEFRA (http://www.defra.gov.uk/planth/ph.htm) Plant Health and Seeds Inspectorate has drafted a plan for containing and eradicating the pathogen, including: maintenance of a disease-free buffer zone; restriction of susceptible plants and plant parts to the zone unless determined to be disease-free; decontamination precautions for high-risk activities such as hedge trimming; and access restrictions. The boundaries of the "disease management zone" have not yet been set.

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NEWS FLASH!!

Horticultural Research Institute, the research division of ANLA, awarded $220,000 for 18 research projects and 4 scholarships. A high priority is developing *Phytophthora* diagnostic methods. Other priorities are evaluating bioplastic nursery containers, a multi-state survey of nursery laborers, and a study by the University of Connecticut to DNA fingerprint *Berberis thunbergii* and *Euonymus alata* to determine the origins of invasive populations. —Weekly NMPRO e-mail for Apr. 12, 2005

Oregon's Department of Agriculture inspected 901 nurseries for *Phytophthora ramorum*, about 45% of the 2,012 Oregon facilities that must be inspected by June 30 to meet state and federal requirements. Officials have detected the pathogen at two facilities — a Marion County wholesale nursery and a Washington County retail nursery. All SOD-susceptible plants at these facilities were immediately put on hold. —Weekly NMPRO e-mail for Apr. 05, 2005

MORE ON INVASIVE PESTS, p. 14

Diagnostic and Scientific Tools

Observation

Each species of plant has its own *P. ramorum*-specific symptoms, which can include leaf blight, twig and stem cankers, and weeping trunk cankers. Making identification more difficult, lesions from other diseases or injury often closely mimic those of *P. ramorum*. For photos by species, see: http://www.massnrc.org/pests/pestFAQsheets/suddenoakdeath.html and www.suddenoakdeath.org.

Observation also includes flyovers to identify forest areas with mortality. These are followed by ground-check surveys and sampling in areas identified as possibly impacted by *P. ramorum*. Go to www.suddenoakdeath.org for a map and the most up-to-date information.

Laboratory Studies

Laboratories approved by USDA APHIS for *P. ramorum*-positive testing use the following three tests for diagnosis:

1. Culture on special agar containing deterrents for extraneous bacterial and fungal growth.
2. ELISA (Enzyme-Linked Immunosorbent Assay), a genetic test used to distinguish the genera *Phytophthora*; ELISA does not disclose the species of *Phytophthora* so, if ELISA confirms the presence of a *Phytophthora*, either culturing or nested PCR testing (below) are done for specific pathogen identification.
3. Nested PCR (Polymerase Chain Reaction), another genetic test, identifies *Phytophthora* by species. It is the most sophisticated of the three tests used for confirmation. Strict avoidance of contamination within the lab is required.

Koch's postulates. Koch's postulates are a time-consuming series of tests, the universal standard for proof that one species is susceptible to an organism or pathogen.

In the case of *P. ramorum*, samples are taken from the lesions of infected plants, which are then cultured, analyzed and identified. Then they are used to inoculate new samples of the originally infected species. A new sample is then taken, cultured, and compared to the original. A match confirms the causal relationship between the pathogen and the host.

Laboratory inoculation studies assist in predicting the susceptibility of potential hosts in nature. They also aid in predicting the type of lesions for which to look in a genus or species not currently infected in nature.

A *P. ramorum*-associated host is a plant that is strongly suspected to be a host but the scientific proof has not yet been established. Some hosts are not on the "associated" list for long, while others are difficult to culture from and remain on the list indefinitely. Plants are also classified as associated hosts if they are found to be *P. ramorum*-susceptible in the laboratory, even though they have never been found naturally infected. At this stage, associated plants and host plants are under the same regulations.

The Future

While there has never been a confirmed case of P. ramorum in the east coast forests of North America, many P. ramorum-regulated plants grow there. Additionally, genetic and susceptibility tests indicate that others are potentially susceptible. The lists of host and associated host plants are frequently updated at USDA APHIS: http://www.aphis.usda.gov/ppq/ispm/pramorum/.

Garden plants. Because customers cannot be traced forward from retail nurseries, it is important for anyone purchasing plants or receiving plants or cuttings as gifts to be familiar with *P. ramorum* host and associated-host symptoms. When looking for infection, pay particular attention to host plants purchased since the 2004 nursery outbreak; check the symptoms posted at www.suddenoakdeath.org. Get positive identification through government-approved agencies. There are many look-alike diseases that are NOT *P. ramorum*, making laboratory testing necessary to determine what is causing symptoms. Inspectors will dispose of infected soil, plants, or pots.

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USDA/APHIS Hosts and Plants Associated with *Phytophthora ramorum*

Lists are constantly updated at: http://www.aphis.usda.gov/ppq/ispm/sod.

31Proven Hosts for *Phytophthora ramorum*

Host plants are naturally infected plants added upon documentation, review and acceptance of traditional Koch's postulates. Some are regulated in part (such as redwood and Douglas fir); others are regulated in their entirety (such as tanoak and western star flower). Details on regulated plants and articles are at http://www.aphis.usda.gov/ppq/ispm/sod via links to "*Phytophthora ramorum* 7 CFR 301.92" and "Recent Modifications to *Phytophthora ramorum* Regulations."

Scientific Name, Common Name

Acer macrophyllum Bigleaf maple
Aesculus californica California buckeye
Arbutus menziesii Madrone
Arctostaphylos manzanita Manzanita
Calluna vulgaris Scotch heather
Camellia spp. Camellia - all species, hybrids and cultivars
Hamamelis virginiana Witch hazel
Heteromeles arbutifolia Toyon
Lithocarpus densiflorus Tanoak
Lonicera hispidula California honeysuckle
Maianthemum racemosa (=*Smilacina racemosum*) False Solomon's seal
Photinia fraseri Red tip photinia
Pieris formosa Himalaya pieris
Pieris formosa x japonica Pieris 'Forest Flame', forest flame andromeda
Pieris floribunda x *japonica* Pieris 'Brouwer's Beauty', Brouwer's beauty andromeda
Pieris japonica Japanese pieris
Pseudotsuga menziesii var. *menziesii* Douglas fir
Quercus agrifolia Coast live oak
Quercus chrysolepis Canyon live oak
Quercus kelloggii California black oak
Quercus parvula var. *shrevei* Shreve's oak
Rhamnus californica California coffeeberry
Rhododendron spp. Rhododendron (including azalea) – all species, hybrids and cultivars
Rosa gymnocarpa Wood rose
Sequoia sempervirens Coast redwood
Trientalis latifolia Western starflower
Umbellularia californica California bay laurel, pepperwood, Oregon myrtle
Vaccinium ovatum Evergreen huckleberry
Viburnum x bodnantense Bodnant viburnum
Viburnum plicatum var. *tomentosum* Doublefile viburnum
Viburnum tinus Laurustinus

37 Plants Associated with *Phytophthora ramorum*

Associated plants are those found naturally infected and from which *P. ramorum* has been cultured and/or detected using PCR (Polymerase Chain Reaction). For each of these, traditional Koch's postulates have not yet been completed or documented and reviewed. They are regulated only as nursery stock.

Scientific Name, Common Name, Date & Source of Report

Abies grandis Grand fir – June 03 (1)*
Aesculus hippocastanum Horse chestnut – Dec 03 (3)
Arbutus unedo Strawberry tree – Dec 02 (7)
Clintonia andrewsiana Andrew's clintonia bead lily – May 04 (5)
Castanea sativa Sweet chestnut – Feb 04 (3)
Corylus cornuta California hazelnut – Dec 02 (5)
Drimys winteri Winter's bark – July 04 (3)
Dryopteris arguta California wood fern – May 04 (5)
Fagus sylvatica European beech – Dec 03 (3)
Fraxinus excelsior European ash – Dec 04 (3)
Kalmia latifolia Mountain laurel – Fall 02 (3)
Laurus nobilis Bay laurel – July 04 (3)
Leucothoe fontanesiana Drooping leucothoe - Oct 03 (3)
Nothofagus obliqua Roble beech – Dec 04 (3)
Pieris formosa var. *forrestii* Chinese Pieris – Oct 03 (3)
Pieris formosa var. *forrestii* x *Pieris japonica* Pieris – Oct 03 (3)
Pittosporum undulatum Victorian box – Dec 02 (6)
Pyracantha koidzumii Formosa firethorn – Apr 04 (9)
Quercus cerris European turkey oak - Feb 04 (3)
Quercus falcata Southern red oak – Nov 03 (3)
Quercus ilex Holm oak – Dec 03 (3)
Quercus rubra Northern red oak – Nov 03 (8)
Rhamnus purshiana Cascara – Dec 02 (4)
Rubus spectabilis Salmonberry – Dec 02 (4)
Salix caprea Goat willow – July 04 (3)
Syringa vulgaris Lilac – 2003 (3) updated Oct 03
Taxus baccata European yew – Aug 03 (3)
Taxus brevifolia Pacific yew – May 03 (5)
Toxicodendron diversilobum Poison oak – Dec 02 (4)
Viburnum davidii David viburnum - Oct 03 (3)
Viburnum farreri (=*V. fragrans*) Fragrant viburnum – Oct 03 (3)
Viburnum lantana Wayfaringtree viburnum – Oct 03 (3)
Viburnum opulus European cranberrybush viburnum – Oct 03 (3)
Viburnum x *burkwoodii* Burkwood viburnum – Oct 03 (3)
Viburnum x *carlcephalum* x *V. utile* viburnum – Oct 03 (3)
Viburnum x *pragense* Prague viburnum – Oct 03 (3)
Viburnum x *rhytidophylloides* Alleghany or willowood viburnum Sept 04 (2)

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Prevention. Control of this epidemic, wherever it may appear, rests on containment through education: recognition of the signs of the disease in each affected species; practicing sanitary methods in forests, nurseries and gardens; early detection and appropriate reporting; testing to confirm diagnosis; local eradication wherever possible; and compliance with regulations. See specific management instructions, photos, and more on the COMTF website (California Oak Mortality Task Force) at www.suddenoakdeath.org and PRED (*Phytophthora ramorum* Educate to Detect) at http://www.ncpmc.org/sod/pred_program.doc.

Because *P. ramorum* infects soil and water, need to practice sanitary methods to avoid spreading it. Wear disposable shoe covers or clean off shoes, pet's paws, and car and bike tires on site. Also, disinfect tools and other equipment on site. Avoid visiting areas known to be infested during wet months. And, above all else, be sure to leave all plant material and soil at the site.

It is best to acquire plants from a certified *P. ramorum*-free nursery. Some state agricultural agencies will supply the names of nurseries that have had infections or those that have been inspected and certified; some states, however, have non-disclosure policies.

The public can provide important assistance to specialists by learning host and associated host plants and signs of infection. Photos of plant lesions are shown on the USDA website at www.ncpmc.org/sod/images.html.

To a large extent, control of this epidemic is in the hands of the nursery industry. It may seem draconian to suggest that inter-nursery trade be halted, but it would be prudent. If all plants for sale were grown on site from seed or tissue culture and if hybridization were halted, the movement of pathogens would be dramatically slowed and the torrential flow of plants with altered genes and uncertain resistance levels would be shut off.

A call to arms. A human adult requires all the oxygen supplied yearly by the leaves of two mature trees but trees are being lost increasingly to development, fire, logging, pollution, and infection. The loss of trees also leads to loss of water, decreased soil retention, and climate change.

We need the commitment of professionals and lay people to protecting the environment. We need to continue funding the scientists who are researching *P. ramorum* and to hold government agencies to the highest standards.

Above all, we should not look for quick solutions to problems through the use of chemical treatments. Even those that have proven successful must not be allowed to poison our planet and its other inhabitants.

Change is a part of the life cycle of the Earth. Patience, good practices, and assimilation will see our gardens and our forests through this latest change.

With gratitude for the help and patience of Fran Gustman, HortResources Editor; Susan Frankel, USDA Forest Service, plant pathologist; and Katie Palmieri, COMTF Public Information Officer.
—EFC

Elizabeth F. Cole is the founder of HortResourcesn (originally known as New England Horticultural Resources Network), and served five years as president. Now back in her home state of California, she has been active in water conservation and ecology, a member of the Management Committee of the California Oak Mortality Task Force and Chairman of Trees and Views Committee of the City of Sausalito. Her autobiography can be found in *HRN* November-December 2003. Reach her at ecolemd@rcn.com.

References, p. 10.

REFERENCES

Photographs
•www.ncipm.org/sod
•www.suddenoakdeath.org

PRED (*Phytophthora ramorum*: Educate to Detect).
•For slideshow, go to www.suddenoakdeath.org; then "PRED National Training Materials for Master Gardeners."
•For a free CD of "*Phytophthora ramorum*: Educate to Detect," provide your home address to Susan Osterbur at Saosterb@uiuc.edu.

United States
•Planning for Epidemics: The Lesions of SARS. RA Weinstein, New England Journal of Medicine 350:23, June 3, 2004
•*Phytophthora ramorum* sp. *nov* (a new pathogen) on Rhododendron and Viburnum, Werres S., R. Marwitz, W. A. Man in It Veld, A. W. De Cock, P. J. M. Bonants, M. De Weerdt, K. Themann, E. Ilieva, and R. P. Baayen, *Mycological Research* 105(10); 11555-1165m 2001. *Phytophthora ramorum* is formally named.
• Official Regulatory Protocol for Nurseries Containing Plants Infected with *Phytophthora ramorum* (Sudden Oak Death) Confirmed. Nursery Protocol of 15 October 2004. Version 6.0 revised Jan 2005 http://www.aphis.usda.gov/ppq/ispm/sod/pdf_files/federalorder-12-21-04final.pdf
•Sudden Oak Death: Invasive Species http://invasivespecies.gov/profiles/sod.shtml
•The Relentless Spread of Sudden Oak Death: Tracking a Mysterious Killer. Elizabeth F. Cole, MD. http://www.coastalconservancy.ca.gov/coast%26ocean/winter2002/pages/one.htm

California
• California Oak Mortality Task Force http://www.suddenoakdeath.org/
•Sudden Oak Death Science Symposium: The State of Our Knowledge. Basic science presented. http//danr.ucop.edu/ihrmp/sodsymp/summary.html
•http://danr.ucop.edu/ihrmp/sodsymp/present.html Wonderful old and state-of-the art abstracts
•Preventing Exotic Pathogen Threats to Forests: A Sideways Scientific Look. Clive Brasier http://danr.ucop.edu/ihrmp/sodsymp/paper/paper35.html. Also papers 32, 22, 8, 12, and 15.

U.S. Agricultural
•USDA/ARS: http://www.ars.usda.gov/research
•USDA/ARS Horticultural Crops Research Laboratory: http://www.ars-grin.gov/ars/PacWest/Corvallis/hcrl/hcrl.html
•ARS Home Site: http://www.ars.usda.gov/main/main.htm
•Sudden Oak Death in Small Fruit and Nursery Crops: Evaluating the Potential for Disease, Detection, and Control (Corvallis, OR), 2003: http://www.ars.usda.gov/research/projects/projects.htm?accn_no=405192

United Kingdom
•Native Oaks Succumb to New Disease, Countryside magazine: http://www.nfucountryside.org.U. K. /news-rural-1258.htm
•The Hunt for Tree Killers, Great Britain Forestry Commission: http://www.forestry.gov.U. K. /forestry/infd-67xjyn

Ireland •http://www.dardni.gov.U. K. /pa2003/pa030080.htm

Quercus rubra, red oak

MEMBER NEWS

Members are invited to submit items for Member News.

HORTRESOURCES EVENT

The next **Society Row** sale will be held Saturday, May 21, 10 AM - 3 PM, at the Waltham Field Station, 240 Beaver St., Waltham.

Click on hortresources.org, Coming Up at HortResources, for directions to the Waltham Field Station and for news of other events.

RENEWALS DUE

If you haven't yet paid for your **HortResources' 2005 membership**, please send in your dues. A membership form is available at hortresources.org on the home page and on p. 15 of this newsletter. To receive hard copies of the newsletter, send $25 over the cost of membership, to Janis Porter, Membership Chair. Links to a personal or business web site from our web site are now available for $35 for a year of advertising!

ISSN 1554-5792 has been assigned to the *HortResources Newsletter* by the Library of Congress and appears near the top edge of the cover. An ISSN is the equivalent of the ISBN on books. Our newsletter can now appear in national directories of serials, which will bring it to many more people's attention.

Sally Williams, editor of Garden Literature Index at EBSCO Publishing, an on-line database of books and periodicals about horticulture, and first editor of this newsletter, took it upon herself to obtain the ISSN for *HortResources Newsletter.* Sally was recently a judge for the 2005 Garden Writers Association Media Awards.

Ruah Donnelly's second guide to buying plants is out: *The Adventurous Gardener: Where to Buy the Best Plants in New York and New Jersey* (The Horticultural Press, March 2005). The book provides a description of some 120 growing establishments and includes driving directions, business hours, web sites, catalog and mail-order info, and nearby attractions. Ruah's first book, *The Adventurous Gardener: Where to Buy the Best Plants in New England* won an award from the Garden Writers Association. I, for one, am looking forward to this new book for my jaunts further afield! —Sally Williams

New England Wild Flower Society announced that Gwen Stauffer has succeeded David DeKing (who headed the society for 10 years) as Executive Director. Stauffer served previously as executive director of Gardens at Callaway Gardens in Georgia.

The Massachusetts Horticultural Society's new executive director is Thomas Herrera-Mishler, formerly executive director of Airlie Gardens in Wilmington, NC. Eight people have held the position of MHS executive director; prior to 1933, MassHort's leadership was volunteer.

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ALL MEMBERS

Please go to Preferences Logout on the home page of hortresources.org. Fill in or update your address, phone number, and ESPECIALLY the PARAGRAPH at the bottom of the page, which tells the other members about you. If you are a professional member, this is free advertising of the services that you provide!

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RENEWALS

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Elizabeth Cole
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Lucille Dressler
Daisy Schnepel
Bruce Wenning

Non-profit

New England Unit/Herb Society

CONTRIBUTIONS

Thank you!

Elizabeth Cole $75

People, Places, and Plants Television Show left the air at the end of March. The show, hosted by New England gardening journalists Roger Swain and Paul Tukey, had been nominated for an Emmy in 2004. It was near or at the top of its time slot in ratings in New England in Boston and Portland and had been picked up by cable outlets across the country.

"Producing a weekly show is the most demanding thing we've ever undertaken in ten years at our company," said Tukey, who founded *People, Places, and Plants* gardening magazine in 1995. "We're enormously proud of the show and the audience we were able to generate. We're sorry to disappoint that audience, but from a personal and professional standpoint, I needed to focus on family and our core business, which is the magazine. My son's final Little League season is about to begin, and I'm looking forward to being at all the games this year."

"It has been a wonderful show with a wonderful message," Swain said. "I am proud to have my name attached to this body of work. We'll be happy to make more shows together when and if the time comes."

A major sponsor of the show was **Pride's Corner Farm** of Lebanon, Connecticut.

Readers are aware that the magazine had suffered financially since March 2004, when the Portland Flower Show lost money. The Flower Show is being run now by the Maine Nursery and Landscape Association, which had sponsored it until 2002. However, the magazine itself continues to be produced, covering a wide range of gardening topics in New England and New York.

Judith Tankard's newest book, *Gardens of the Arts and Crafts Movement* was recently published. She has been giving talks and doing book-signings since, including an April benefit for the Sargent House Museum in Gloucester. Her home was featured in the *Boston Globe Magazine* on January 16.

Graham Rice received his fifth award for garden writing in April. The Garden Writers Association awarded him the Bronze Award of Achievement for "Bambi, or Buzz Saw?," which appeared in *Notes from the Forest*, the newsletter of the Lacawac Sanctuary, a 500-acre nature preserve in northeast Pennsylvania. Rice has received four previous awards in the United States and in Britain, including Book of the Year in Britain for *Hardy Perennials*. He is at work as Editor-in-Chief of a major encyclopedia of perennials for the Royal Horticultural Society and the American Horticultural Society. The winning article is at

CUTTINGS

http://www.grahamrice.com/lacawac/bambi.html.

Patrick Chassee is new curator of landscapes at the Isabella Stewart Gardener Museum in Boston.

Earth Day. Friday, April 22, 2005, was the 35th anniversary of Earth Day. It has been celebrated every April 22 since 1970 when it was organized by Gaylord Nelson, former U.S. senator from Wisconsin. "Caring for the Earth begins at home with each of us long before it can ascend to a national and global attitude," says Nelson in *Beyond Earth Day, Fulfilling the Promise*.

Nelson tells the story of how Earth Day came to exist. He says, "At a conference in Seattle in September 1969, I announced that in the spring of 1970 there would be a nationwide grassroots demonstration on behalf of the environment and invited everyone to participate. The wire services carried the story from coast to coast. The response was electric... Telegrams, letters, and telephone inquiries poured in from all across the country. The American people finally had a forum to express its concern about what was happening to the land, rivers, lakes, and air — and they did so with spectacular exuberance..."

He believes that "Earth Day worked because of the spontaneous response at the grassroots level. We [he and his staff] had neither the time nor resources to organize 20 million demonstrators and the thousands of schools and local communities that participated. That was the remarkable thing about Earth Day. It organized itself." (http://earthday.envirolink.org/history.html)

The Earth Day Network is an alliance of 5,000 groups in 184 countries working to promote a healthy, sustainable environment.

A competing Earth Day group has celebrated the vernal equinox on March 21 since 1970. The day is celebrated by the United Nations with the ringing of the Peace Bell.

Sara Stein, acclaimed author of *Noah's Garden: Restoring the Ecology of Our Own Backyards* (Houghton Mifflin, 1993) and other books about landscaping with native plants, died of lung cancer on February 25, at her home in Maine. She was 69. A memorial fund has been established by her family to support the Vinalhaven Public Library Native Garden in her home town.

Continued p. 14.

Cuttings continued from p. 12.

Orchids. Sally Muspratt writes, "Sincere thanks for recommending the orchid workshop [this winter, held by the Indoor Gardeners Plant Society]. Frank Coppolino is a lovely, modest, knowledgeable person and I thoroughly enjoyed his talk.

"It was clear that the orchid I'd been given a year ago was not one of the kinds he specialized in. So when I came home I went to the web and by luck and Google found http://www.orquideas.com/index.html, which is an incredibly good web site on cymbidiums. Excellent text, excellent photographs — take a look."

Bamboo. http://www.earthcare.com.au/bamboo.htm This site makes identifications quite straight forward as to genus, covering *Bambusa, Dendrocalamus, Gigantochloa, Guadua, Melocanna, Nastus, Phyllostachys, Schizostachyum, Thyrsostachys* and one plant easily confused with a bamboo. There are also notes on growing bamboos, slide shows, and recipes available. —BOTLINX@lists.ou.edu, March 23, 2005

Planting depth impacts perennial performance. Researchers at Cornell University found that planting depth is a major factor in the performance of bare-root perennials. Planting bare-root crowns at or slightly above the soil surface results in much better growth and performance compared to when crowns are planted below the soil surface. Those planted more deeply typically grow much more slowly and with less vigor. A printable, pictorial guide is available at the university's FlowerBulb Research Program Web site. —GMPRO greEn-MAIL, for April 05, 2005

Cutting propagation. Michigan State University researchers Roberto Lopez and Erik Runkle report controlling light levels during cutting propagation is critical to ensure proper rooting. High light levels can cause the cuttings to become stressed and wilted, which can delay rooting. Low light levels can also delay rooting and increase propagation time.

Optimum light levels vary for the stage of root development. From cutting stick to callus formation, the light level should be 600-1,000 footcandles and be indirect or diffuse. Once roots are initiated (5-12 days), the light level can be increased to 1,000-2,500 footcandles, but still diffused. Once cuttings are well rooted (10-16 days), the light level can be increased to 2,500-4,000 footcandles, to acclimate plants to the post-propagation environment. —GMPRO greEn-MAIL, for April 05, 2005

Scotts Co. is now The Scotts Miracle-Gro Co. —The Weekly Dirt, for 05 Apr., 2005

North American Fruit Explorers (NAFEX) http://www.nafex.org/. North American Fruit Explorers is a 3000+ member organization devoted to aiding and encouraging fruit exploration. Hidden in a link called "NAFEX Fruit and Nut Interest Groups" is reasonably extensive information on figs and kiwi, less on a handful of other fruits. Membership is $13 and includes the quarterly journal, *Pomona* (only the table of contents is currently online). The society takes off where yesterday's Home Orchard Society leaves off. —BOTLINX@lists.ou.edu, January 18, 2005

INVASIVE PESTS

•**Emerald ash borer.** U.S. Forest Service and Michigan State University scientists have found wasps that may help against emerald ash borer. The wasps are members of the genus *Balcha*, which feed on emerald ash borer larvae, and *Pediobius*, which attack the eggs. —Weekly NMPRO e-mail for Apr. 05, 2005

Emerald ash borer was found for the first time in Northwest Ohio's Hancock County in felled ash logs near Van Buren, near an existing eradication zone in North Baltimore. To date, infestations have been found in Ohio's Defiance, Franklin, Fulton, Hancock, Henry, Lucas and Wood counties. The pest is considered eradicated in Franklin County. — Weekly NMPRO e-mail for Apr. 12, 2005

•**Hemlock woolly adelgid.** Eastern and Carolina hemlock are under siege by the hemlock woolly adelgid, a native of Japan, first observed in the United States in Connecticut in 1985. Studies are in progress at the University of Connecticut's Experimental Station by Mark S. McClure and Carole A. S-J Cheah, which involve introducing the tiny ladybug, *Adelges tsugae,* an insect native to Japan. The ladybug is the size of a poppy seed and jet black. It actively explore s branches for adelgids and moves off to find better locations when supplies are low. Adelgids have been measured at 88% fewer on branches on which there is *Adelges tsugae*.

•**Honey locust knot.** A new disease, *Gleditsia triacanthos*, causes gall-like swellings at branch nodes, distorts young shoots, defoliates and can kill adult trees in two years. The disease was first discovered in Ohio in 2000 and has since been found in MI, MD, KY, IL, IN and IA. It is believed to be a bacterial disorder related to *pseudomonas*. —bonello.2@osu.edu

Photo by Fran Gustman

Central Park's Gates

Fran Gustman

Whether or not Christo's Gates installation in Central Park in Manhattan is a great artistic success, the party certainly was. Hard-boiled New Yorkers and tourists thronged to the park and mingled happily to see it. Created by French artist Christo, known for huge, ephemeral landscape art, the show was scheduled for a brief two weeks in February. The artist and his business manager and wife Jeanne-Claude engineered the fund-raising themselves to the tune of $21 million and donated all merchandising rights to Nurture New York's Nature and The Central Park Conservancy.

The bright saffron was welcomed by the color-starved populace on the cold day that my husband and I visited, along with family and friends. With the sun behind the rectangles of material, they shone like warm gold. The 7,500 vinyl hangings on their 16-foot posts outlined the shapes of the hills as they followed the pathways of the park. To put them up, not a branch in Central Park was disturbed, not a hole dug. The materials themselves were recycled at the end of the show.

Is it art? Opinions ranged from praise to mild suggestions for improvement. One viewer admired the simple, Japanese-like black metal bases that supported the posts, over which, despite the well-filled pathways, no one was observed to trip. Another felt that the saffron evoked the robes of the hari-krishnas of the sixties and seemed dated; she wondered if the color had been chosen when the project was first proposed, 26 years ago. Another observer felt that the pleated material was reminiscent of shower curtains. Other viewers suggested that alterations in the color from post to post would have been welcome or perhaps variations in the height of the posts. An artist commented that she had enjoyed others of Christo's other installations more.

Although the first reaction of my husband Sandy was "What's the big deal?," he found himself becoming more appreciative as he spent more time in the park. His final evaluation was that the event was exciting, even magical, and impressive in its extent. Our daughter Cara, now a graduate student in Manhattan, praised The Gates for bringing people into the park to see a part of New York that is integral to the lives of New Yorkers, in contrast with tourist attractions like Times Square or the Ritz Carlton Hotel.

Olmsted. The designer of Central Park, Frederick Law Olmsted, would have been pleased to see his park so well used. Olmsted and his firm created parks, suburban enclaves, and the campuses of prestigious colleges across the United States. In Boston, from 1878 to 1896, Olmsted linked the Boston park system into the Emerald Necklace, starting with Boston Common and ending at Franklin Park. He designed six of the green "jewels" of the necklace: the Back Bay Fens, The Riverway, Olmsted Park, Jamaica Park, the Arnold Arboretum, and Franklin Park.

An inspiration. For me, the Gates will linger in my mind's eye. Central Park was a joyful community those weeks in February, overflowing with representatives of the world of all ages.

Perhaps the event will serve as an inspiration to the parks of New England. Certainly it will be missed in Manhattan.

The angel of the Bethesda Fountain. Photo Fran Gustman

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