

Chapter 4

Impacts of *Phytophthora lateralis* on Port-Orford-Cedar

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June 2001

Introduction

Much of the impetus to undertake a range-wide assessment of Port-Orford-cedar came from questions on the extent of infection caused by *Phytophthora lateralis*, and the impacts of the pathogen on Port-Orford-cedar as a species.

Extent of Infestation

Approximately nine percent of mapped Forest Service and Bureau of Land Management (BLM) Port-Orford-cedar land in Oregon and California is mapped as infested with *P. lateralis* and has dead and dying Port-Orford-cedar trees⁴ (figs. 4.1 and 4.2).



Figure 4.1—Port-Orford-cedar killed by *Phytophthora lateralis*. Note proximity to road and poorly drained spot where water has puddled.

⁴ GIS analysis designed by Kirk Casavan and Don Rose; conducted by Debra Kroeger; based on the Port-Orford-cedar Range-wide Geographic Information Systems Layer on Federal Lands.

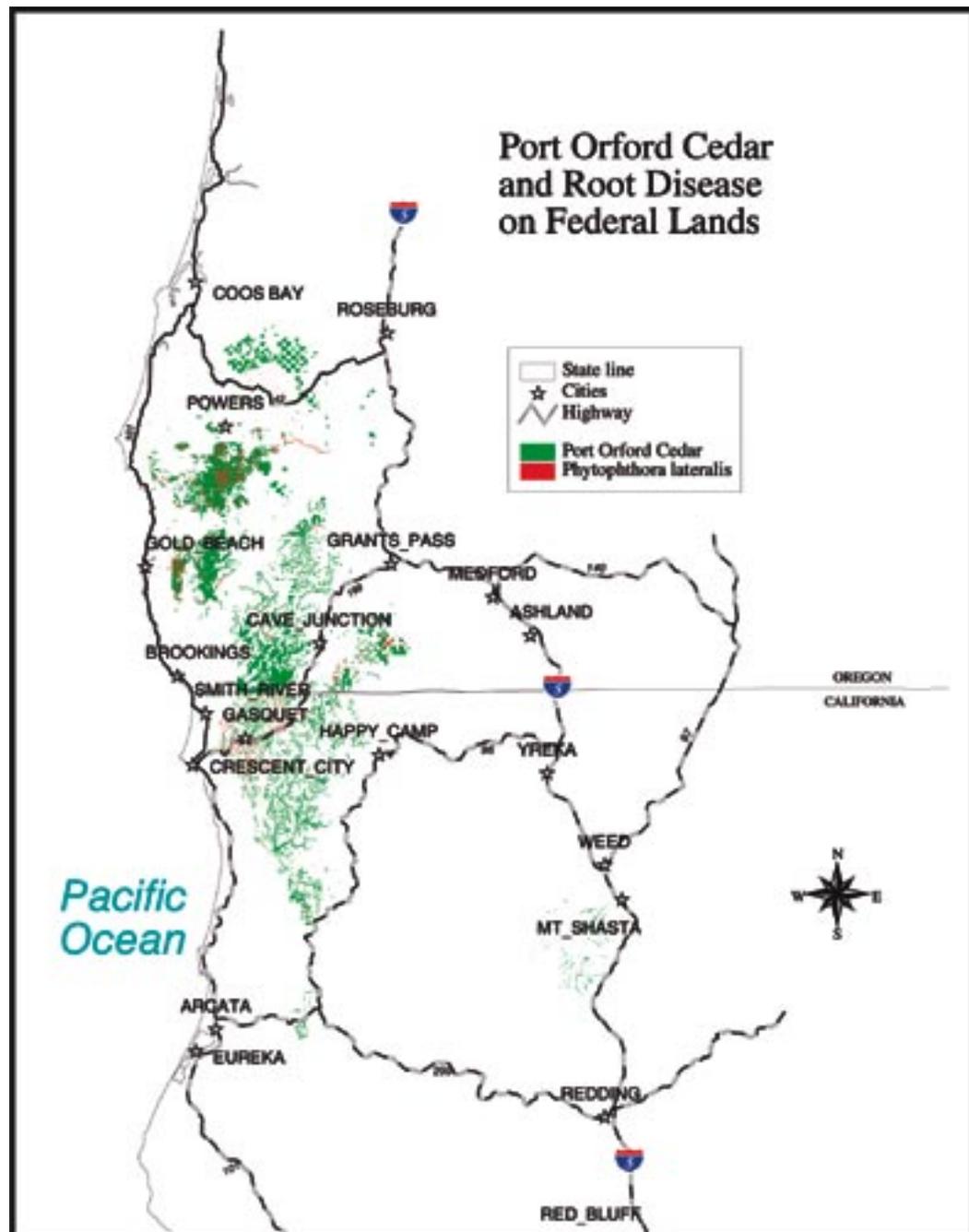


Figure 4.2—Healthy and infected Port-Orford-cedar on federal lands

An analysis⁵ from northern California, the most heavily infested area on federal lands, shows most of the infestation is in three, fifth-field watersheds. The South Fork Smith River is 37 percent infested, the Middle Fork Smith River, 34 percent infested, and the Lower Smith River is 21 percent infested. Within Oregon, the most infested area is in the Siskiyou Mountains ecoregion where the Williams Creek watershed is 15 percent infested.

⁵ GIS analysis designed by Kirk Casavan and Don Rose; conducted by Debra Kroeger; based on the Port-Orford-cedar Range-wide Geographic Information Systems Layer on Federal Lands.

Geographic Information System Mapping Methodologies

Mapping of *P. lateralis* infestations has been accomplished in a variety of ways. On the Siskiyou National Forest, roadside surveys were first conducted in 1964 and continue to today. Visual observations of the occurrence and estimated locations of dead Port-Orford-cedar were noted and entered into the Geographic Information System (GIS). In 2002, the Powers Ranger District of the Siskiyou National Forest also used photo interpretation and field verification to further refine District diseased and healthy Port-Orford-cedar locations. National Forests in California utilized ecological mapping techniques for estimating the occurrence of disease. The BLM, using roadside surveys and aerial photo interpretation, mapped Port-Orford-cedar root disease locales and compiled this information for Oregon into GIS by 1998. Since 1998, the Coos Bay, Medford and Roseburg Districts have made several subsequent updates, using these survey techniques as well as integrating current observations made from on-going data collection, such as from silvicultural stand exams and timber sale cruise data.

Mapping locations of healthy Port-Orford-cedar is more difficult because it is more difficult to see, both on the ground as well as in aerial photographs. The Forest Service and BLM have used general roadside surveys to estimate where healthy Port-Orford-cedar grows. The BLM defined the intersection of uninfested road segments with individual timber stands (based upon the Forest Operations Inventory) as the approximate mapped locations of healthy Port-Orford-cedar. National Forests in California performed field work involving ecological mapping to approximate the locales of healthy Port-Orford-cedar.

The resulting comparisons of diseased and healthy acres of Port-Orford-cedar produced the range-wide estimate of nine percent infestation of Port-Orford-cedar.

Location by Land Allocation

Infestation is not restricted to any land allocation (table 4.1).

Eighty percent of the range of Port-Orford-cedar on federal lands is in allocations that are unlikely to be harvested (administratively withdrawn, late successional reserve, and congressional withdrawals). Of particular interest, because of its ecological role, is the health of Port-Orford-cedar in riparian areas. Riparian areas, as defined by National

Table 4.1—Approximate percentages of acres in different federal land allocations over the range of Port-Orford-cedar and percentage of those acres inhabited by Port-Orford-cedar that are infested by *P. lateralis*

Allocation	Allocation Acres (percent)	Diseased Acres (percent)
Late Successional Reserve	58	9
Matrix/Riparian	19	8
Congresionally Withdrawn	17	6
Administratively Withdrawn	5	4
Adaptive Management Area	1	14

Forests and BLM Districts, make up about 40 percent of the area within the range of Port-Orford-cedar. Within these riparian areas, a relatively high percentage of the area, about 13 percent, is infested. Outside of the riparian areas, only 5 percent of the area is infested.

California Port-Orford-Cedar Plant Associations with More than 10 percent *P. lateralis* Infestation

An analysis from California shows, at least in the California portion of the range of Port-Orford-cedar, most of the infestation is in riparian areas (table 4.2). Seven plant associations have at least 10 percent of their area infested.

Rate of Spread

Rate of spread of *P. lateralis* over the range of Port-Orford-cedar has been highly variable from watershed to watershed. There is no determinable rate of spread which is applicable range-wide. In some drainages, the rate of spread has been relatively rapid.

Data were collected during the infestation of the Smith River drainage in California from 1980 through 1999 (figs. 4.3 through 4.6). In 1980, infestation was present at about nine small, isolated sites. Three years later, the sites had expanded in size and new sites were evident. With 10 additional years, the infestation was almost continuous along several waterways, and by 1999, the extent was quite broad. The pattern of spread in the Smith River drainage started slowly in the first three years, then accelerated. It appeared to be still spreading in 1999⁶.

In the Williams Creek watershed, in Oregon, a high rate of spread was recorded over three years. Of the 55 sites tested, 28 percent were infested in 1998, 33 percent in 1999, and 40 percent in 2000⁷.

Table 4.2—Port-Orford-cedar plant communities at risk (more than 10 percent infested by *P. lateralis*) in California (Jimerson et al. 1999)

Plant Association	Percent of Area Infested
Tanoak-Port-Orford-cedar-Coast Redwood/ Evergreen Huckleberry	54%
Tanoak-Port-Orford-cedar-California Bay/ Evergreen Huckleberry	27%
Tanoak-Port-Orford-cedar-White Alder -Riparian	22%
Tanoak-Port-Orford-cedar/ Evergreen Huckleberry-Western Azalea	17%
Port-Orford-cedar-Western White Pine / Labrador Tea/ California Pitcher Plant	15%
Port-Orford-cedar-Western White Pine / Western Azalea-Dwarf Tanbark-Labrador Tea	12%
Port-Orford-cedar/ Salal	11%

⁶ Rose, Donald L. 1999. Personal communication. Former Port-Orford-cedar Program Manager, USDA Forest Service, Siskiyou National Forest, Grants Pass, OR. Currently environmental coordinator, Bonneville Power Administration, 905 NE 11th Avenue, Portland, OR 97232.

⁷ Betlejewski, Frank. 2001. Personal communication. Port-Orford-cedar Program Manager, USDA Forest Service, Southwest Oregon Forest Insect and Disease Service Center, 2606 Old Stage Road, Central Point, OR 97502.

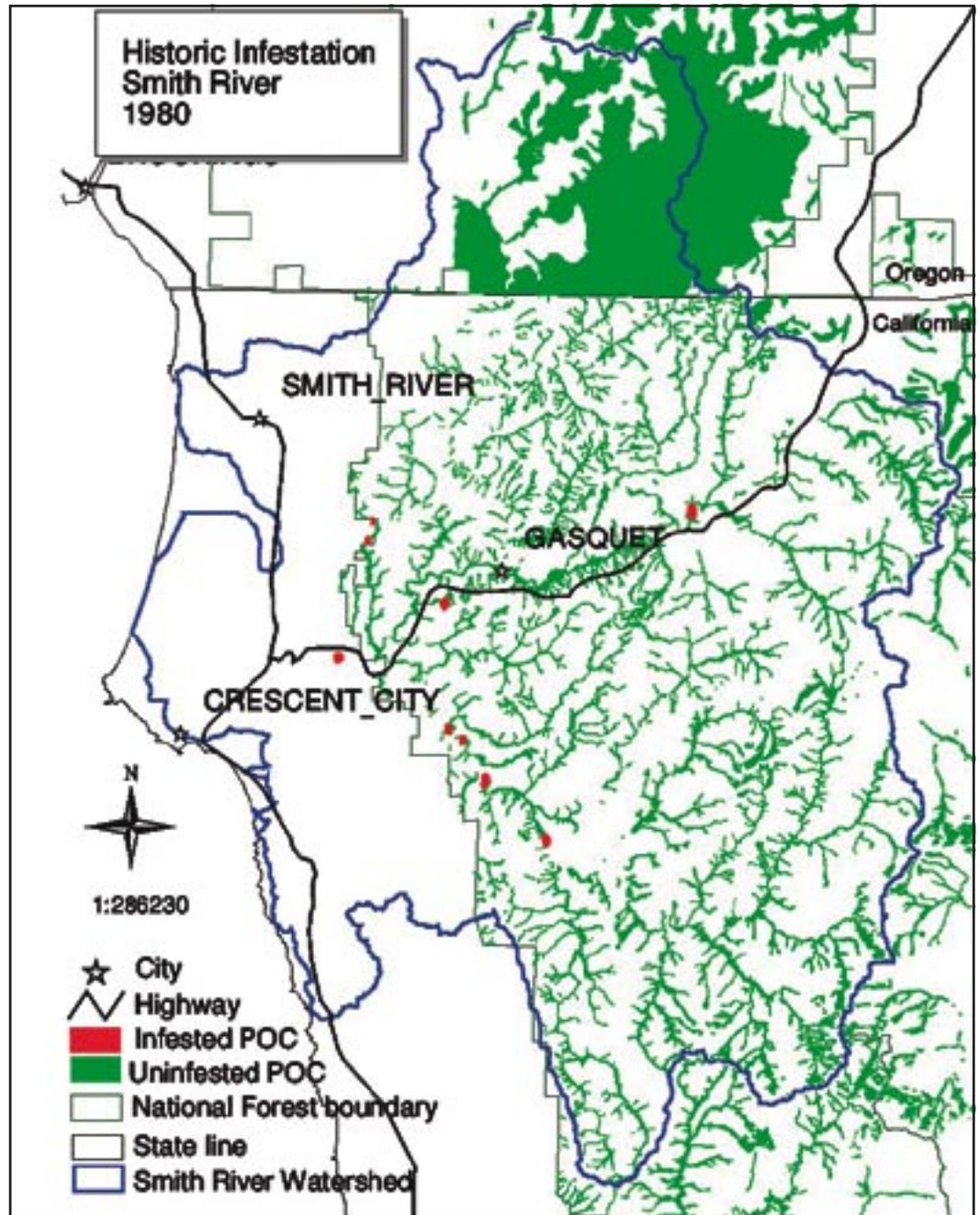


Figure 4.3—*Phytophthora lateralis* infestation, Smith River 1980

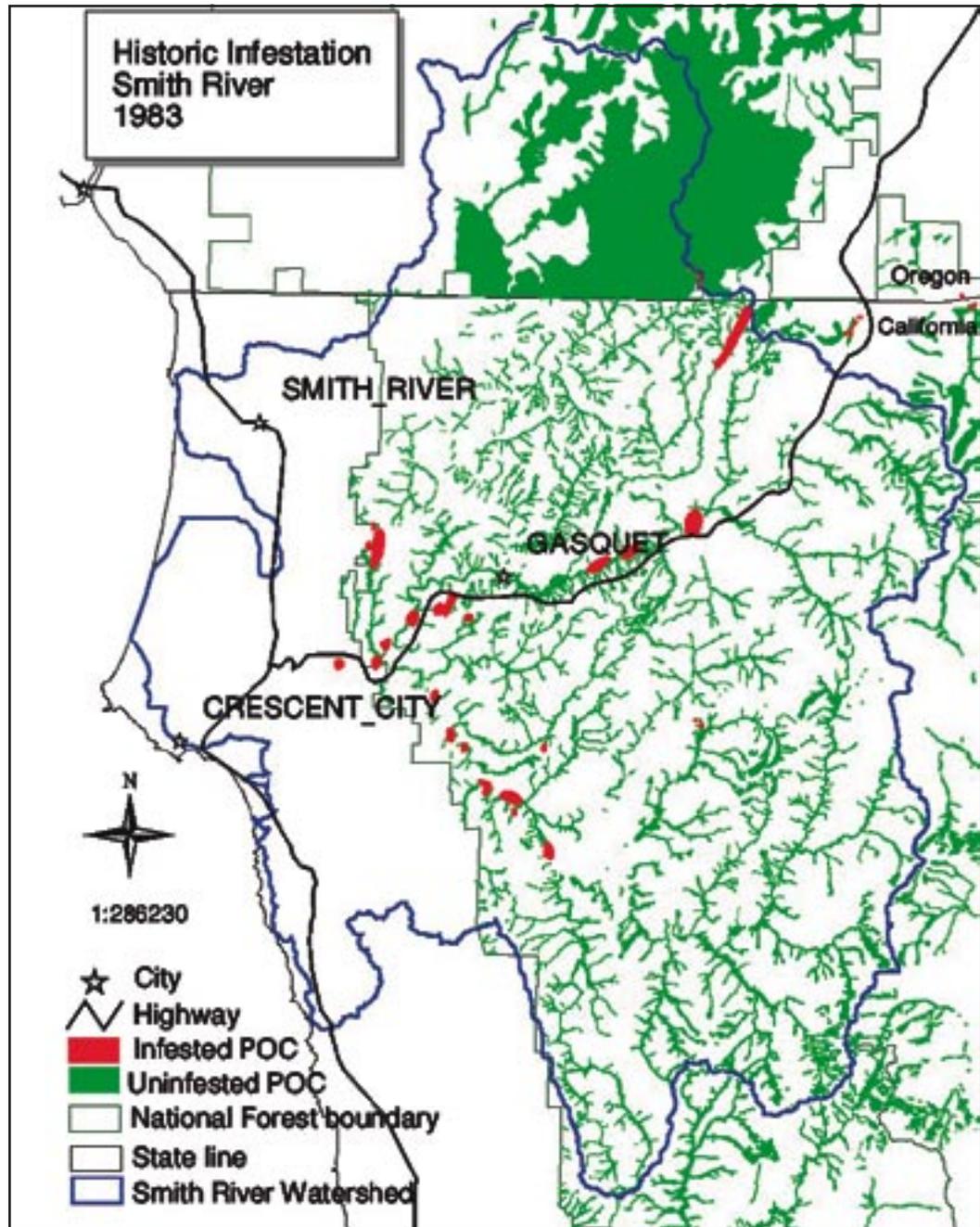


Figure 4.4—*Phytophthora lateralis* infestation, Smith River 1983

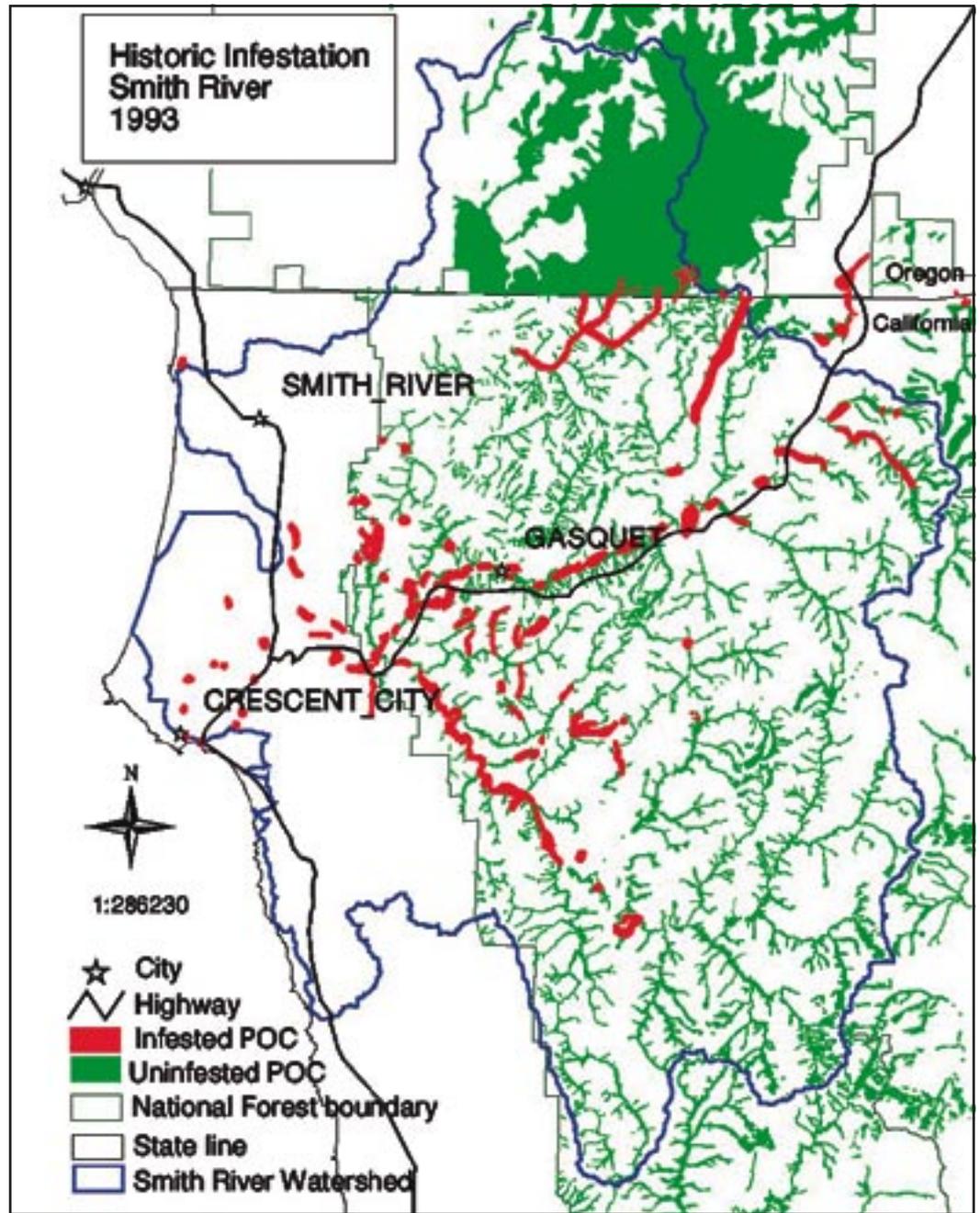


Figure 4.5—*Phytophthora lateralis* infestation, Smith River 1993

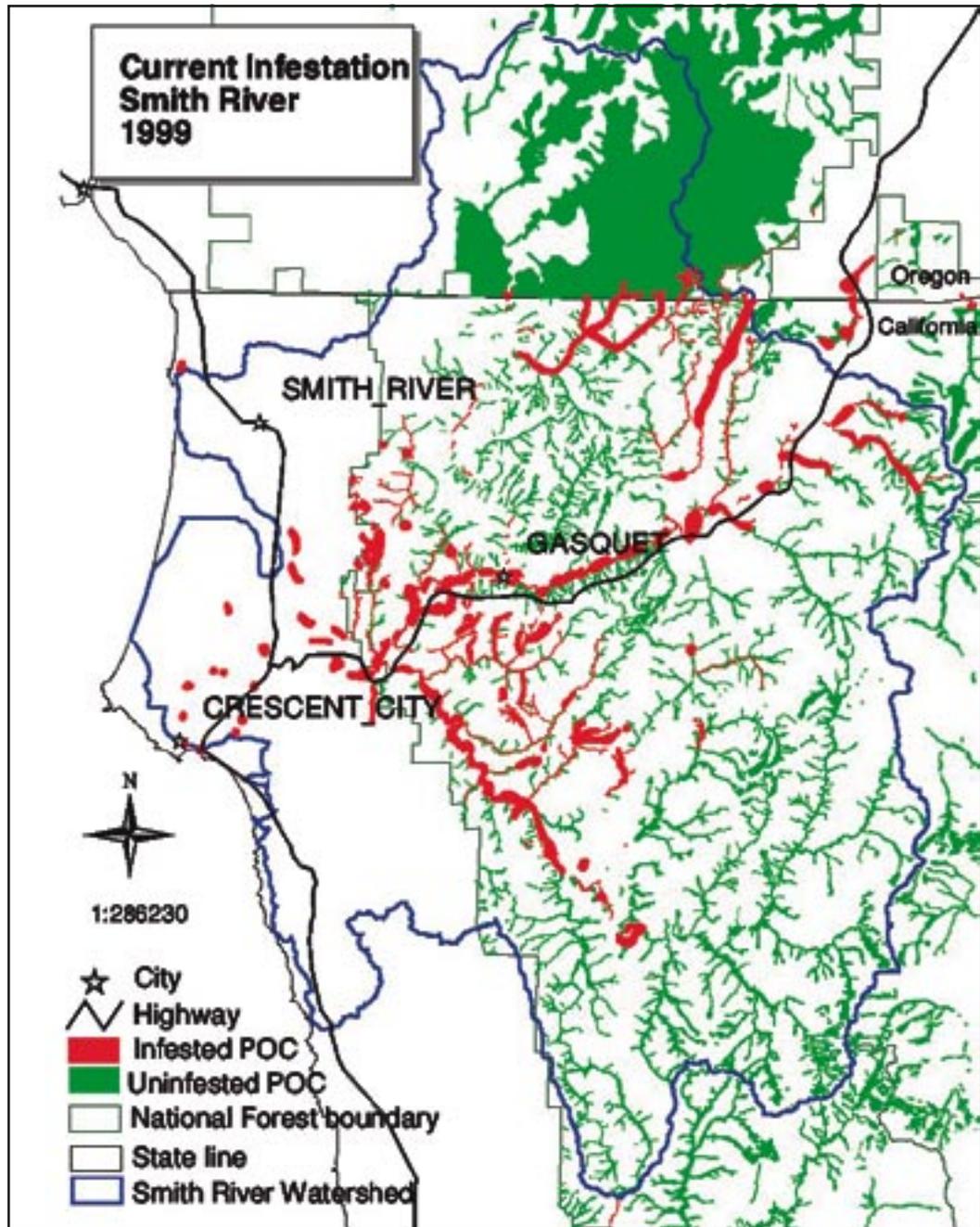


Figure 4.6—*Phytophthora lateralis* infestation, Smith River 1999

Status of Infestation Relative to Roads

In California, most of the infested areas are in the northern part of the Six Rivers National Forest (fig. 4.7). Most of the infestations are in roaded areas. A few infestations are in areas that are roadless or behind barriers. The disjunct populations of Port-Orford-cedar on the Shasta-Trinity National Forest are unprotected, yet uninfested. Some nearby private lands along the Sacramento River are infested.

On the Siskiyou National Forest, most of the infested area is roaded (fig. 4.8). Only a small amount of infestation is present in areas greater than 500 feet from a road or behind a barrier.

On a smaller landscape scale, the Elk Creek watershed map shows the infestations clearly associated with roaded areas and rivers or streams (fig. 4.9).

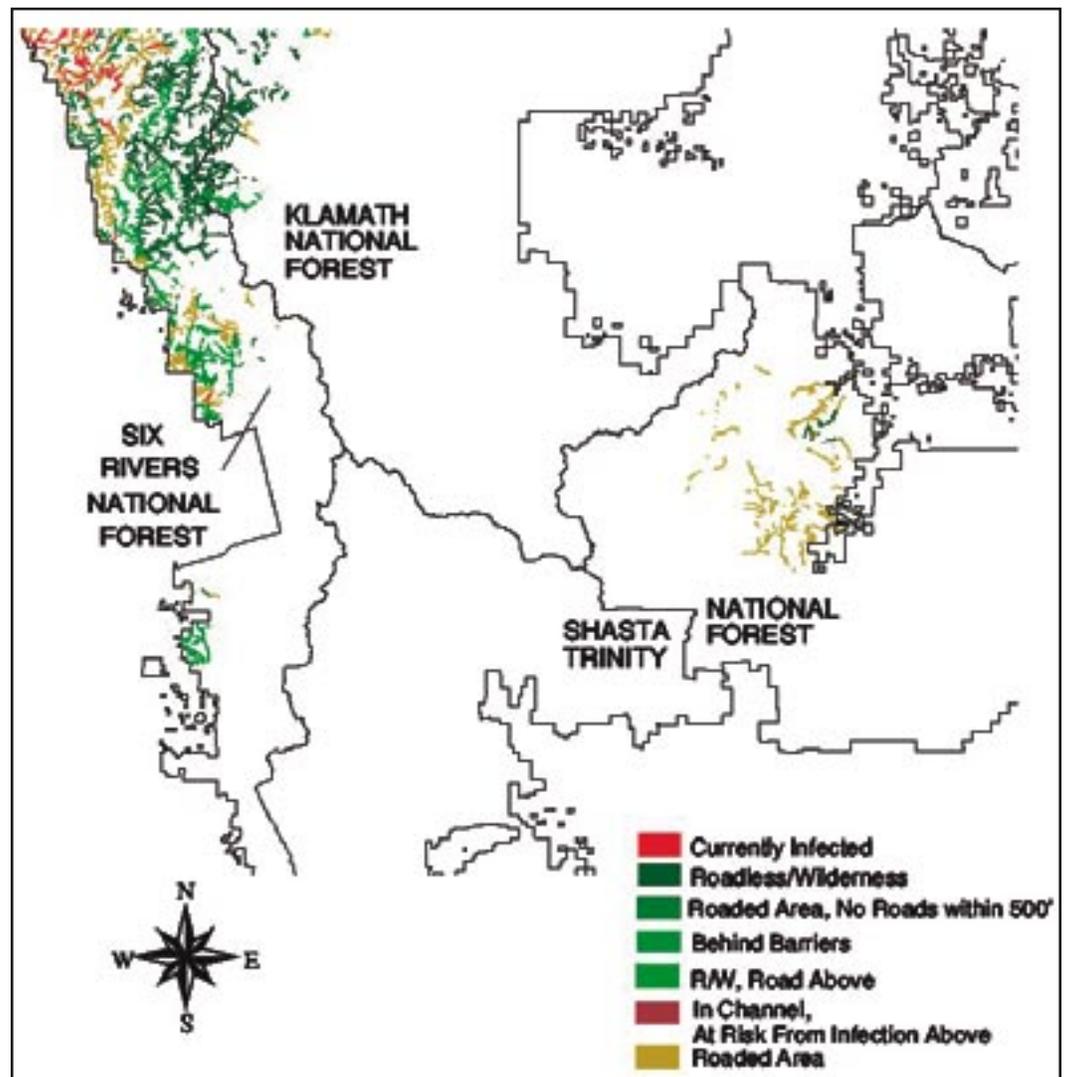


Figure 4.7—Condition of Port-Orford-cedar in National Forests in California relative to factors that influence disease spread, 2001

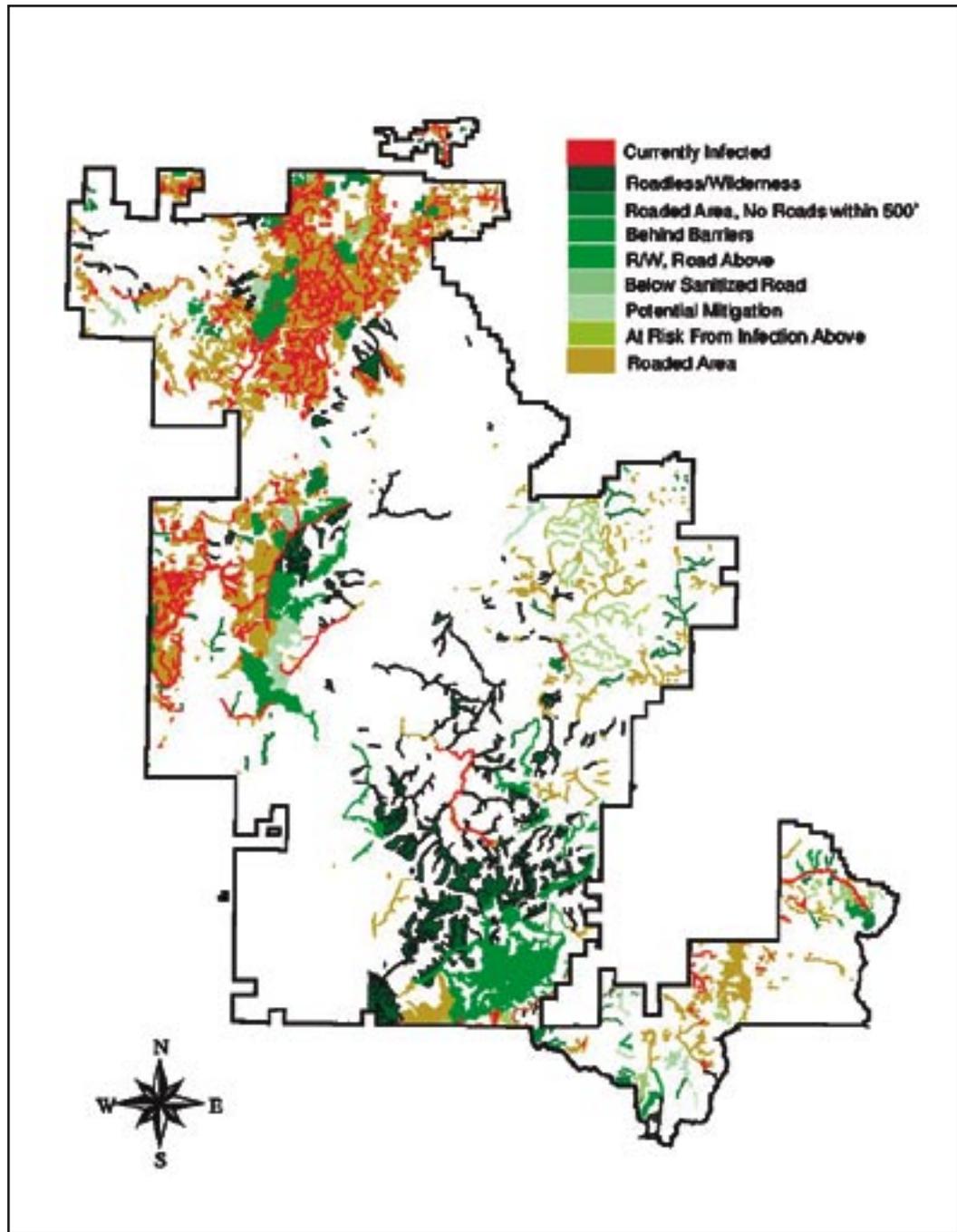


Figure 4.8—Condition of Port-Orford-cedar in the Siskiyou National Forest relative to factors that influence disease spread, 2001

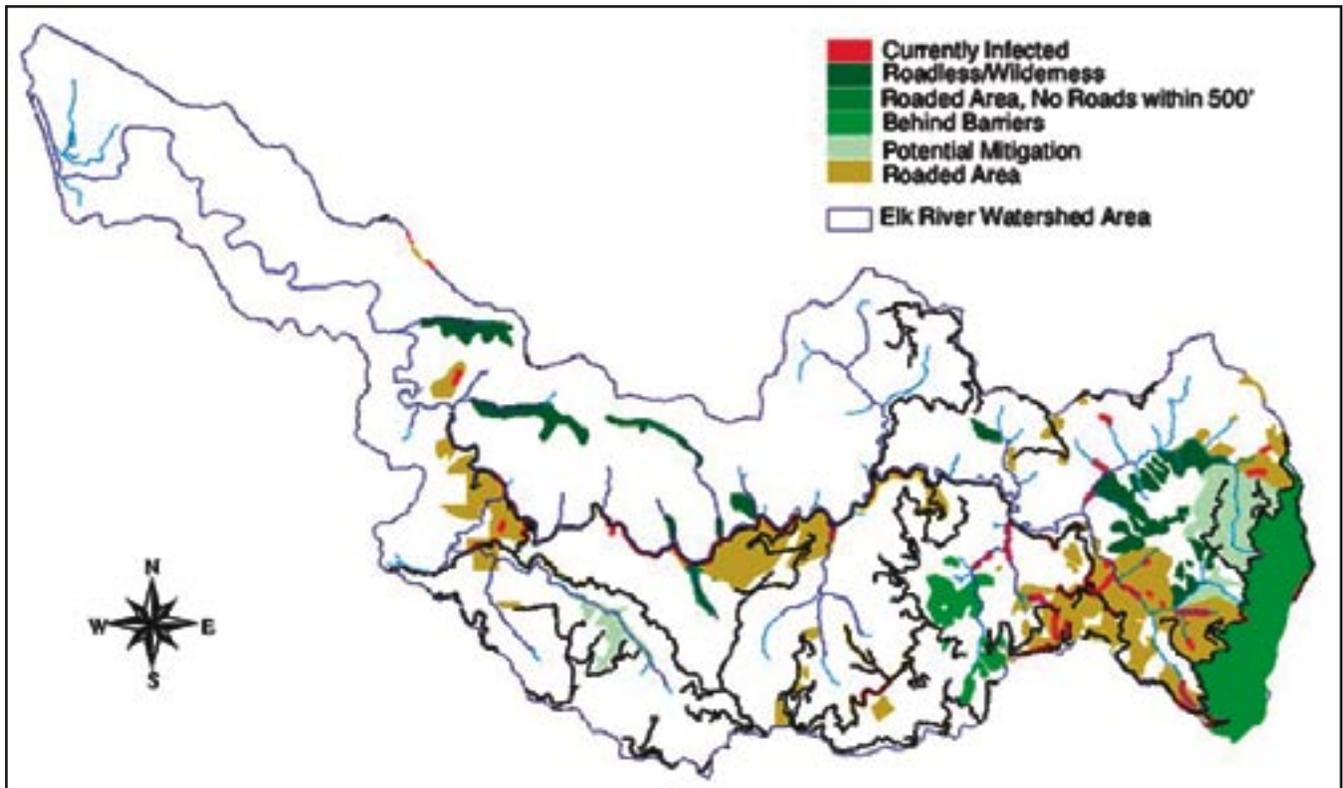


Figure 4.9—Condition of Port-Orford-cedar in the Elk River Watershed, Siskiyou National Forest, relative to factors that influence disease spread, 2001

Landscape Level Impacts of Port-Orford-Cedar Root Disease

Results of several surveys demonstrate the kinds of impacts that *P. lateralis* can have across a landscape:

Coquille River Falls Research National Area

Data from three inventory surveys done in 1958, 1986, and 1999 in the Research Natural Area (RNA), with the goal of documenting the long-term effects of more than 45 years of chronic infestation, suggest that the overall amount of infestation has remained more or less constant since 1958 (Goheen et al. 1986b, Hansen 2000). Many Port-Orford-cedar have survived in the RNA, though nearly all close to streams or other wet areas are dead. In general, live Port-Orford-cedar is either upslope from water or in the headwaters above the road locations.

Powers Roads

Surveys conducted along road sections that were infested since at least 1958 on the Powers Ranger District, Siskiyou National Forest, and in adjacent areas demonstrated that substantial numbers of Port-Orford-cedar survived even though inoculum levels in certain places along the roads obviously remained high. Disease-caused mortality continued to occur, and there was progressive disease spread downslope (Goheen et al. 1986a, Hansen 1993).

Smith River Watershed

P. lateralis spread within a watershed is shown in the historical mapping of the Smith River drainage in California. The first occurrence of the pathogen in the Smith River drainage is thought to have been in the early 1960s. These first observed disease centers were small and confined to the lower Smith River in and around Crescent City⁸. A map with periodic updates of pathogen spread was maintained beginning in 1980. New mortality of Port-Orford-cedar was mapped in 1983, 1984, 1986, 1987, 1989, and 1998. These infested areas were hand drawn on District maps and are rough estimates of sizes and locations of the infestations. The maps provide a dramatic example of how rapidly the pathogen can spread within and between drainages (figs. 4.3 through 4.6). The pathogen spread from nine small confined areas in 1980 to more than 16 percent of the watershed 20 years later. Pathogen spread appears greater in the mid- to late 1980s. The rapid spread may have resulted from a rise in inoculum, causing a classic epidemic curve, or an increase in the intensity of mapping efforts during this time. The latter culminated in the mapping of all stands with at least 10 percent crown cover of Port-Orford-cedar in 1998. The mapping in 1980 through 1989 delineated the occurrence of dead Port-Orford-cedar and included areas with widely scattered or clumpy distribution. In 1998, there was a total of 3,174 acres that had some level of disease-caused mortality within the Smith River drainage.

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⁸ Wells, Ken. 1996. Personal communication. Retired. Timber Management Assistant, U.S. Department of Agriculture, Forest Service, Region 5.