Forest Research Institute
Center of Excellence PROFOREST
for Protection of Forest Resources in Central Europe

Possible limitation of decline phenomena in broadleaved stands

Edited by
Tomasz Oszako and Steve Woodward

This publication has been carried out with the financial support of the Commission of the European Communities, specific RTD programme “Quality of Life and Management of Living Resources, Key Action 1-Health Food and Environment, QLK1-CT-2002-30315 / PROFOREST: Protection of forest resources in Central Europe. It does not necessarily reflect its views and in no way anticipates the Commission’s future policy in this area.

Warsaw 2006

Reviewers:
François Lefort (University of Applied Sciences in Lullier, Switzerland)
Jacek Stocki (General Directorate of the State Forests in Warsaw, Poland)

ISBN 83-87647-56-X

Instytut Badawczy Leśnictwa
00-973 Warszawa, ul. Bitwy Warszawskiej 1920 Roku nr 3, phone [+48 22] 822 32 01
e-mail: Wydawnictwa_IBL@ibles.waw.pl; edition 330 copies

CONTENTS

Preface

This book focuses on developing state-of-the-art methods for detecting the vitality status of broad-leaved stands and their potential pests and pathogens in Europe. Species in the genus *Phytophthora* are responsible for some of the most damaging and dramatic diseases in forest ecosystems around the world, spectacular examples being Jarrah dieback in Western Australia, which is leading to serious decline in the status of *Eucalyptus marginata*-dominated forests there (and in other states of Australia), dieback of Port-Orford Cedar in Oregon State, North America caused by *P. lateralis*, and the recently emerged sudden oak death (SOD) in California and Oregon, caused by *P. ramorum*. Each of these organisms is present in Europe, and their spread may lead to further problems in forest ecosystems on this continent, where environmental conditions favour the pathogens. A further recently emerged complex of pathogens, known collectively as *P. alni*, is devastating riparian alder stands all over Europe, and has spread extremely rapidly since it was first recognised in the UK in the early-mid 1990s. Spread of these organisms is probably via contaminated soils and on the roots of plants from affected nurseries.

State-of-the-Art technologies for rapid and accurate detection of *Phytophthora* spp. require inputs from molecular biologists with experience in techniques including the polymerase chain reaction (PCR), real-time (quantitative) PCR, sequencing and microarray methods. To date, the forestry and horticulture sectors in Central Europe have had little access to these methods. In order to improve the situation, therefore, the conference "Possible limitation of dieback in broadleaved stands through silvicultural and protective measures" focused on the decline problem of deciduous tree species was held in Puszczykowo (Poland) in November 2005. This was made possible by funding from European Commission within the PROFOREST Centre of Excellence ("Protection of Forest Resources in Central Europe") with cooperation with General Directorate of the State Forests and Polish Phytopathological Society. Forestry is a large industry in Central Europe, and is also highly important for conservation of biodiversity, for landscape, and for water catchments. Improved detection and quantitation methods for highly damaging pathogens will therefore have significant societal benefits, over and above the scientific and technological issues described above.

Inadequate methods for detecting potentially devastating plant pathogens have, in the past, lead to the inadvertent intercontinental spread of several plant disease epidemics. Notable examples are Dutch elm disease, white pine blister rust and chestnut blight. Delays in identifying and in interpreting the biology of the causal agents for each of these diseases reduced our capacities to prevent the problems spreading rapidly and causing devastating losses to host trees, and to the ecosystems in which these trees dominated.

Despite the application of modern technologies to plant pathology, such threats still take us unawares, as amply illustrated by the damage caused to many tree species by the sudden emergence of *Phytopthora ramorum* in California in the last 10 years. Pathogens in the Oomycetes, including *Phytophthora* spp., form a unique branch of the eukaryotes. These pathogens cause some of the most devastating plant diseases known, with estimated annual losses world-wide to agriculture and horticulture crops of some US$10 billion. In forests, the damage can be greater than the simple timber losses, with massive effects on biodiversity, landscape management and water quality.

Inadequacies in identification of threatening pathogens, therefore, can have enormous consequences on forests as ecosystems and as productive units. The development of rapid and reliable identification protocols and technologies for *Phytophthora* diseases is of particular

importance in this respect. Although serological test kits are available for a limited number of these organisms, the accuracy of such systems is doubtful, particularly for emerging threats. Microarray technology is increasingly used to assess diversity in the genome, gene expression and genotyping. The technology has the capacity to combine species identification, speciation, typing and detection of virulence factors in single tests.

Scientific outputs of the conference are: (1) showing accurate, rapid identification of *Phytophthora* spp. in soils taken from forests and from forest nurseries; (2) quantitation of the pathogens; and (3) estimates of relative amounts of pathogens present in soils of different origins within the overall soil microbiota.

The outcomes of the discussion led Conference participants to formulate the following conclusions:

Nurseries:

1. As the water used in irrigation should be free of pathogens, especially *Phytophthora* spp., it is recommended that sources (reservoirs, pipelines, etc.) be monitored, and the water from them treated as necessary.

2. The practice of gathering alder seeds from water should be abandoned.

3. Reafforestation work should utilize saplings demonstrably free of *Phytophthora* spp. To this end, testing procedures must be developed and units of the State Forests authorised to conduct them.

4. Should *Phytophthora* spp. be shown to be present in the soil, every effort should be made to avoid the transfer of infected material on equipment (which should be decontaminated).

5. Soil pH should be monitored, since too high a value favours the development of pathogens.

6. The procedures by which to register, for forestry use, agents found effective against *Phytophthora* spp. in the garden (like *Aliette* and *Mildex*) should be launched.

Forest stands:

1. When there is an outbreak of honey fungus, reconnaissance and the removal of infected trees should both have been carried out by the end of April in a given year.

2. On the basis that trees in the ”resignation” stage are to be removed, the definition of this point will require more precise definition for different species of forest tree.

3. Means of assessing levels of damage in stands should be diversified to include the criterion of vitality.

4. A preference should be shown for methods of growing oak that use nurse crops and transitional stands.

5. The occurrence of *Phytophthora* spp. in soil should be assessed prior to restocking and renewal, with the subsequent species composition being adjusted in line with the results of this assessment.

6. The compaction and liming of soil should be avoided.

7. Where they have become prevalent, populations of defoliating insects should be limited, in both valuable seed stands and other production stands.

Overall conclusions. There is a need for broadly-based, interdisciplinary research into the disease complex involved in the decline and dieback of broadleaved stands, most especially in respect of tree nurseries.

Greater efforts should also be made in extension services to adapt scientific research to the requirements of forestry practice.

Tomasz Oszako and Steve Woodward