Climate Change

ISEFOR

At a glance

Title: Increasing Sustainability of European Forests

Instrument: Collaborative project FP7

Total Cost: €3995536

EC Contribution: €2973181

Duration: 36 months

Start Date: 01/09/2010

Consortium: 16 partners from 11 countries, including Russia

Project Coordinator: University of Aberdeen Scotland UK

Project Web Site: http://www.isefor.com/

Key Words: Forest health; climate change; security; agriculture

The challenge

Rapid climate change, increased global trade in plants for planting and increased pathogen fitness threaten the vitality of European forests.

Project Objectives

To identify the alien pests and pathogens and quantify the plant trade pathways that most threaten European forests. To provide the plant health surveillance community with diagnostic and predictive tools that will assist in mitigating threats from alien invasive forest pathogens and pests.

Methodology

Current information on pests and pathogens known as potentially invasive and the host taxa of these organisms will be collated and analysed to define the types of threats and update a database of invasive forest pathogens (IFPs).

State-of-the-art techniques, in particular using next generation sequencing, will be developed and evaluated for the rapid detection and diagnosis of invasive alien pests and pathogens. Participating laboratories will focus on pests in their area of expertise e.g. *Phytophthora* spp., *Hymenoscyphus pseudoalbidus,* Coleoptera and Lepidoptera, *Ceratocystis platani*, and *Fusarium circinatum*.

Data on plant nursery trade in Europe will be analysed as a pathway for the dispersal of alien pests. Plants traded and sentinel plants in nurseries in China will be sampled to identify and assess emerging pest and pathogen risks from the plants-for-planting pathway.

Cellular automaton (CA) modelling software will be developed to accurately predict spread and impacts of the alien pests and pathogens that have been identified as threats with climate change through the fundamental research of ISEFOR.

Expected Results

Over 40 papers in peer-reviewed journals have been published detailing research and results from ISEFOR. This note gives only a sample of the vast amount of new knowledge generated.

There has been an exponential increase in invasive forest pathogens (IFPs) over the last 40-years. Countries with a higher human impact, wider range of environments, or international trade host more IFPs. The new European Database of 123 IFPs is available on the ISEFOR website and lists species, host range, disease, impact and other factors. The DAISIE inventory of alien invasive species for Europe was reviewed and updated for arthropods.

Various sampling and DNA isolation methods were developed and tested to address the technical challenges of identifying alien invasive species that are in environments in low abundance. This included characterisation of *Phytophthora* communities in forest soils in Poland and Italy, airborne trapping in Swedish forests, Italian urban streets and detecting species associated with insects in France and migratory birds in the UK. Isolations from ten birds yielded 3,345 distinct eukaryotic species of which 135 were identified as plant pathogens, implicating migratory birds as a pathway.

Traditional morphological methods of species diagnosis combined with DNA barcoding indentified 31 potential pest invaders (mostly coleopterans, lepidopterans and a few heteropterans) from sampling sentinel European trees planted in China and surveys in Siberia and the Russian Far East. Sampling from *Acer palmatum, Buxus microphylla Fraxinus chinensis, Ilex cornuta* and *Zelkova schneideriana* trees commonly imported from China into Europe continues.

Netherlands and Italy are the main importers of live plants into Europe comprising 98% of over four billion plants imported each year. Most of the imported live plants come from Africa 81.3%, followed by Asia 11.5% and North America 4.6%. Woody plants form about a quarter of the live plants imported. There is considerable trade of imported plants between countries within Europe.

CA models are developed for nine species causing serious damage with documented environmental requirements that are sensitive to climate change, these are: *Bursaphelenchus xylophilus*, *Hymenoscyphus pseudoalbidus (Chalara fraxinea)*, *Dendroctonus ponderosae*, *Leptoglossus occidentalis*, *Agrilus planipennis*, *Dendrolimus sibiricus*, *Phytophthora alni*, *Fusarium circinatum* and *Dothistroma septosporum*. Initial runs predicted well for the spread of Ash Dieback and Pinewood nematode. Model parameters are refined through an iterative process with forest health experts.

'Biogeographical patterns and determinants of invasion by forest pathogens in Europe' New Phytologist 2013 197 238-350

'Inventory of terrestrial alien arthropod predators and parasites established in Europe' BioControl 2011 10.1007/s10526-011-9355-9

'Pyrosequencing of environmental soil samples reveals biodiversity of the Phytophthora resident community in chestnut forests' Microbiology Ecology 2013 10.1111/1574-6941.12132

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