



**European Cooperation
in the field of Scientific
and Technical Research
- COST -**

Brussels, 15 May 2014

COST 037/14

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action FP1401: A global network of nurseries as early warning system against alien tree pests (Global Warning)

Delegations will find attached the Memorandum of Understanding for COST Action FP1401 as approved by the COST Committee of Senior Officials (CSO) at its 190th meeting on 14 May 2014.

MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as
COST Action FP1401
A GLOBAL NETWORK OF NURSERIES AS EARLY WARNING SYSTEM AGAINST
ALIEN TREE PESTS (GLOBAL WARNING)

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 4114/13 “COST Action Management” and document COST 4112/13 “Rules for Participation in and Implementation of COST Activities” , or in any new document amending or replacing them, the contents of which the Parties are fully aware of.
2. The main objective of the Action is to create lists of the tree species that should be targeted using sentinel nurseries, develop standardised protocols to collect data required for risk assessments, and work with NPPOs towards a regulatory basis for the use of the data.
3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 96 million in 2014 prices.
4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.
5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of section 2. *Changes to a COST Action* in the document COST 4114/13.

A. ABSTRACT AND KEYWORDS

The international trade in live plants is a major pathway for the introduction of invasive tree pests and pathogens, resulting in environmental and economic damage. Many recently introduced pests and diseases were not known to be harmful, or unknown to science, and were not regulated before they invaded, indicating that the current system to identify harmful species does not provide sufficient protection from invasions by alien pests and pathogens. A novel way of identifying potentially harmful organisms for regulation is by monitoring European trees planted in regions that export plants to Europe. The Action will 1) establish a global network of scientists and regulators in countries where sentinel nurseries could be established from seed or where there are botanical gardens or arboreta with exotic trees, 2) develop common protocols for the monitoring and identification of pests and 3) explore ways to regulate the establishment of such nurseries and the use of data collected through them. This Action will also bring together detailed information about the international trade in trees and the environmental value of native trees in Europe. The Action will produce written, electronic and workshop outputs, as well as at least five short-term scientific missions per year.

Keywords: Potentially invasive alien species, forest pests and pathogens, international trade in live plants, pest and commodity risk analysis, early warning system

B. BACKGROUND**B.1 General background**

Alien tree pests and diseases cause significant environmental and economic damage in many parts of the world (Kenis and Branco 2010; Williams et al. 2010; Aukema et al. 2011). Since the mid-20th century, the number of alien invertebrate pests and pathogens of trees and other woody plants in Europe has increased markedly and the introduction of many of these species has been traced back to the global trade in live plants (Kenis et al. 2007; Santini et al. 2013). The volume of the live plant trade has increased enormously in recent decades. There has been a shift in the origin of the plants, with now five times more coming from China than fifteen years ago, when the annual import value was low whereas it is now similar to imports from North America, which was already a major source of live plants and historically an important source of tree pests and diseases (Eschen et al. 2014). The increase in import volume from sources with which there is little experience coincides with a heightened risk of importing harmful organisms.

Most countries regulate organisms based on their actual or potential economic and environmental damage, established through Pest Risk Analysis (PRA). Consequently, only few, known species are regulated, but there is little overlap between the identity of regulated and established species. In fact, many, if not most of the established pests and diseases were not known to be harmful in the region of origin, or were unknown to science prior to causing serious damage, and hence were not regulated before they invaded (Kenis et al. 2007). This problem indicates that the current system to identify and regulate potentially harmful species is too weak to protect the environment and the economy from damage by invasive alien species (IAS). An early warning system that identifies potentially invasive tree pests and diseases in the exporting country would allow PRA to be carried out and measures to be stipulated and taken in the exporting country to reduce the level of contamination.

Many countries carry out a risk analysis on pathways of introduction or commodities (e.g. plant genera, species or varieties from a specific origin) before issuing import permits for the commodity. In Europe, by contrast, risk analyses are carried out to inform decisions on the regulation of individual pests and are focused on known species. PRA and pathway risk analysis requires, amongst other information, data on pest-host associations. Usually, however, the quantity and quality of information about organisms associated with plant species is restricted to known, damaging pests associated with the plant species in the region of origin, but this is not sufficient to assess whether these pests and pathogens will be a threat to the environment in the importing country. Moreover, potentially harmful pests may not be recognised during risk analysis because they do not cause serious damage on co-evolved hosts in the region of origin. When they encounter new hosts without a shared evolutionary history, the new host plants can be extremely vulnerable to attack compared with the native hosts in the region of origin. An example is the recent invasion by the non-European pathogen *Hymenoscyphus pseudoalbidus* on European *Fraxinus*. Whether host jumps will occur after introduction of IAS and to what extent the environment will be damaged are almost impossible to predict. An early-warning system based on European trees in regions that export live plants to European countries will provide an assessment of the vulnerability of these species to pests and diseases from the exporting country before they arrive in Europe.

B.2 Current state of knowledge

European countries import large numbers of live plants in a wide variety of genera and from a large number of countries worldwide. The past decade has seen a strong increase in the value (and hence the volume) of live plant imports into Europe from East Asia, China in particular (Eschen et al.

2014), but there is little detailed information on live plant imports available (e.g. Dehnen-Schmutz et al. 2010). For example, data on plant family or genus are available from only a few European Union countries (EPPO 2012), but the annual and seasonal variations in the species composition, volume and/or origin of the imported plants are unknown. Collating knowledge about the live plant trade and importance of native trees in Europe will improve PRA and reduce risk.

However, improved knowledge about the identity of imported plants and their origin alone does not suffice for PRA, since the damage potential of the majority of alien pests and pathogens that are currently invasive in Europe was unknown prior to their introduction in Europe. Several promising approaches to assess the potential attack by previously unknown harmful alien species on native trees have recently been investigated. Surveys of European tree species in botanical gardens and arboreta in Russia and East Asia have identified many insects native to that part of the world attacking these trees (Tomoshevich et al. 2013). Similarly, work in sentinel nurseries established in China revealed that a large number of native insects and pathogens, several of which were previously unknown to science, attacked five Asian woody plant species commonly exported to Europe. These studies illustrate that additional information required for accurate PRA and commodity risk assessment can be obtained by carrying out targeted surveys in the region where plants are produced for export to Europe. Moreover, this work has identified several harmful species on non-European tree species that have since been introduced into Europe and that do damage (e.g. the box tree moth). The research also identified European tree species under attack from pests and diseases, which indicates the level of risk inherent to importing live plants from those regions.

B.3 Reasons for the Action

There is a great need for an early warning system for tree pests and diseases because of the increasing volume of trade in live plants and the vast diversity of pathways; thus, a large number of unknown harmful organisms may arrive. Most research on alien tree pests and diseases in Europe is focused on quantifying the spread and impact, or on measures to mitigate impacts of established organisms. Little research has been concerned with the establishment of early warning systems for the prediction of new, potentially harmful organisms that enable regulation and prevention of the arrival of these organisms. One of the most relevant of such studies, the establishment and monitoring of European tree species in sentinel nurseries in China as part of the FP7 project PRATIQUE, provided interesting and novel information about the vulnerability of European trees to pests and diseases native to the two regions where the nurseries were established and from where

many trees are exported to Europe. Unfortunately, these nurseries have been destroyed and the Chinese government no longer allows import of live trees from Europe for this purpose. In a subsequent study, part of the FP7 project ISEFOR, trees of Chinese species that are commonly exported to Europe were monitored in two sentinel nurseries in China. The results of this study also illustrate that these plants can carry harmful organisms that are not yet present in Europe, are hard to detect during phytosanitary inspections, and are often unknown as harmful. Hence, the results of monitoring sentinel nurseries will allow more adequate PRA and regulation of harmful organisms or pathways. A major difference between the two previous studies is, however, that the second study does not provide information about the likelihood of attack of European tree species. This is highly relevant information to be included in PRAs and the use of European tree species in sentinel nurseries that act as early warning systems for tree pests and diseases for Europe is preferable to the use of native tree species in the exporting country.

Seeds generally are of lower phytosanitary risk than live plants, for example because of the smaller chance of introducing harmful organisms and endophytic microorganisms with them, and their import is less restricted. Hence, to overcome restrictions on the import of live plants, at least for some genera and countries, for the establishment of sentinel nurseries with exotic tree species any future nurseries should be established from seed. This Action will establish a global network of scientists and regulators in countries where sentinel nurseries with trees grown from seed can be established or where there are botanical gardens, arboreta or other plantations with foreign tree species. This scheme is necessary and innovative, as no similar initiative, with a large number of interested parties exists. This Action, therefore, will open the way to the establishment of a wider network than any other early warning system for tree pests and diseases, both because of the involvement of more interested parties and because of the innovative approach of using seeds to establish sentinel nurseries. In addition, the Action will establish common protocols for the monitoring and identification of pests, and explore ways to regulate the establishment of such nurseries as well as the use of data collected through them. The Action will also investigate the potential of establishing sentinel nurseries with European tree species in areas where pests or diseases that are placed on the EPPO A2 list are present, as an early warning system to determine the vulnerability of these tree species to the newly established harmful organisms. The outcomes of this Action will enable the future establishment of a more robust early warning system for alien tree pests and diseases for the involved countries, which will have a high degree of reciprocity.

B.4 Complementarity with other research programmes

Several research programmes have addressed the introducing of harmful organisms through international trade, early warning systems and analysis of trade-associated risks through PRA and assessment of the socio-environmental impacts of alien invasive species. For example:

- PRATIQUE analysed and proposed improvements to pest risk analysis techniques in the European Union through (amongst other things) modules focussing on existing PRA methods, the gaps in existing methods, models for spread and impact, and management techniques.
- FORTHREATS evaluated whether the introduction of alien pathogens into Europe can be prevented and how disease outbreaks can be controlled or contained. The project partners also compiled information on non-native pathogens, including fungi, oomycetes, bacteria and viruses.
- Q-BOL developed identification tools based on DNA barcoding for the identification of quarantine organisms.
- ISEFOR defined the threats to European forest ecosystems, based on current knowledge of the pest and pathogens known as potentially invasive, and the host plants attacked by these organisms. Techniques for the identification and detection of pests and diseases were developed and the European nursery trade critically assessed. A new sentinel nursery was established in China during ISEFOR, but prohibition of the import of European trees meant that only Chinese species were planted.
- COST Action Alien Challenge (TD1209) works on a European information system for invasive alien species, including an early warning system, but most information in existing databases pertains to known pests or pests that are established in Europe.
- COST Action PERMIT (FP1002) focuses on reducing threats from exotic pests through promoting enhanced pathway management. The main focus of PERMIT is on live plants as these are the most important pathway for the introduction of pests and diseases into Europe.

This Action is complementary to, and extends the EUPHRESKO project "Establishing the basis for an International Plant Sentinel Network (IPSN) as an early-warning system for future pest threats", which addresses sentinel trees as early warning systems. The EUPHRESKO project focuses on existing arboreta in botanical gardens and on the development of an online information exchange portal and a platform to provide diagnostic support. An innovative aspect of this Action is the exploration of seeds as the basis for the establishment of sentinel nurseries. This Action will also

extend the project through the involvement of a much larger number of countries and partners, by providing information that allows identification of the most important or most vulnerable European species to be monitored, as well as looking at the potential for establishment of nurseries. The monitoring of often relatively few established trees in botanic gardens and young, more numerous trees in nurseries both have advantages and disadvantages and these projects therefore complement each other well.

In addition to interactions with EU research projects and other Actions, this Action will interact with and complement the work of regional plant protection organisations, such as EPPO, NAPPO and APPPC, and the NPPOs of EU Member States, as well as the International Plant Protection Convention (IPPC) of the FAO, the International Forest Quarantine Research Group (IFQRG) under the IPPC and working parties of the International Union of Forest Research Organisations (IUFRO), in particular Division 7.03.12 "Alien invasive species and international trade".

C. OBJECTIVES AND BENEFITS

C.1 Aim

The aims of the Action are to 1) establish a network of scientists and regulators in countries where sentinel nurseries with trees grown from seed could be established or where there are botanical gardens, arboreta or other plantations with foreign tree species, 2) suggest common protocols for the monitoring and identification of pests and 3) explore ways to regulate the establishment of such nurseries as well as the use of data collected through them.

C.2 Objectives

To achieve these aims, the Action will develop a network of researchers and representatives of NPPOs, in particular PRA specialists. Because of the variety of targeted organisms and the diversity of methods and tools required for the monitoring and taxonomic identification of IAS on trees, the development of protocols will involve ecologists, taxonomists and molecular biologists, including both entomologists and pathologists. The involvement of both researchers with experience in monitoring the occurrence and impact of IAS and officials who carry out PRA based on the information generated by researchers and who can allow the import and use of seeds for scientific purposes, as well as the use of potentially sensitive data gathered in such plantings, will contribute significantly to the development of an effective network of nurseries as early warning systems against alien tree pests. A COST Action with such interdisciplinary, integrative and highly

international character seems the most appropriate approach to streamline the development of an effective early warning system that relies on international collaboration and exchange of information between researchers and the regulatory community.

Effective early warning systems, and thus PRA, require knowledge of 1) the harmful organisms that are associated with imported plants in the exporting country, and 2) the potential implication of attack on native species by harmful organisms in the importing country.

These important requirements are often unfulfilled. In part, because plant health regulations are based on regulated organisms (ca. 200 taxa in the EU), little information is available about other organisms associated with the imported plants and these other organisms may or may not appear harmful in the exporting country. Moreover, no collated information about the economic and environmental importance and the vulnerability of native tree species in Europe is readily available, making an assessment of the potential impacts of attack by new IAS more difficult and time-consuming.

The Action therefore has three main Objectives:

- 1) **to create lists of the most important or vulnerable native tree species that should be targeted using sentinel nurseries.** Outcome: decision support for the planting design of sentinel nurseries and support for PRA experts for the assessment of potential impacts of new harmful organisms that could be introduced through trade;
- 2) **to develop standardised monitoring protocols to collect data required for preparing appropriate and reliable risk assessments.** Outcome: harmonised nursery design, data collection and identification for a range of organisms based on direct observation and symptoms, as well as morphological and molecular techniques;
- 3) **to work with representatives of NPPOs towards a regulatory basis for the use of the data collected in sentinel nurseries.** Outcome: streamlined exchange of knowledge between researchers and NPPOs about the presence of potentially harmful organisms, based on national and international standards.

C.3 How networking within the Action will yield the objectives?

For an early warning system against alien tree pests and diseases to work, collaboration between researchers with different expertise and PRA experts is vital. In particular in the context of alien tree pests and diseases and international trade, international cooperation and networking is paramount and a COST Action provides the ideal platform to develop and expand such networks. Because of the need for information input from all EU countries and near-neighbour states into the

first objective and the scattered availability of the information about native tree species, which may include data on trade, geographic distribution, use, economic value, pest and disease attack, ecosystem function, etc. that will be collected, it is expected that the delivery of this objective will result in the involvement of a wide range of experts and sources.

The design of nurseries, as well as the development of standardised protocols for the monitoring and identification of tree pests and diseases is by definition a collaborative task that will draw on experts of various disciplines and from different countries. Only collaboration and inclusion of a wide range of experts can ensure that monitoring and identification protocols can be widely applied and that the results of the monitoring and identification satisfy the requirements of PRA experts. The involvement of non-COST and reciprocal countries in this COST Action and established links of participating experts with countries outside Europe will make the necessary intercontinental collaboration possible.

This COST Action will bring together researchers and representatives of NPPOs, i.e. producers and users of the information required for PRA. The combination of stakeholders is essential for the development of an effective early warning system, because this will ensure that the results obtained in sentinel nurseries will provide the information required by NPPOs. Moreover, given the potentially sensitive nature of the results (for example, if regulated organisms are recorded for the first time in a country) it is important that this information is first presented to the NPPO of that country before it is transmitted to researchers in another country, but it is also important that the information is exchanged rapidly with potential importing countries as the information is required for accurate PRAs.

The MC meetings, training schools, short-term scientific missions (STSMs) and the international conference will all stimulate networking and collaboration between the participating experts. This process will lead to joint scientific publications, and the identification and pursuance of new research opportunities. The involvement of scientists and representatives of NPPOs will lead to integration of interdisciplinary expertise about ecology, risk assessment and regulations, as well as exchange of experience and dissemination of the outcomes.

C.4 Potential impact of the Action

This Action will prepare the framework for seed-derived sentinel nurseries as an early warning system for tree pests and diseases through the development of worldwide, standardised monitoring and identification protocols for pests and pathogens, detailed information on intercontinental trade in live trees (and other woody plants) and the ecological and socio-economic importance of native

tree species in Europe. At present, the interactions between invasion biologists and the regulatory community are limited, resulting in poor understanding of the phytosanitary and regulatory reality by researchers. This Action will result in more, direct interaction and, consequently, a better understanding of the requirements of, and more effective provision of information to the regulatory community. This is important, as in Europe much of the research on biological invasions is primarily focused on describing the distribution and impact of (established) alien tree pests and diseases and less on early warning against new alien species or measures to minimise the risks posed by such species.

PRA and lists of regulated pests often depend on information about the impact of harmful organisms on co-evolved hosts in the region of origin, which does not reflect the potential impact in the introduced range. The available information is often incomplete and scattered. The development of tools to overcome this shortcoming in the information availability, on a global scale and through interactions between entomologists, pathologists, molecular biologists and regulators, makes this Action highly innovative. The direct interactions with PRA experts, but also scientific publications, training schools, the Action website and the final conference will ensure effective transfer and dissemination of knowledge elaborated during the Action. This Action will also lead to an international discussion on the regulation of imports of exotic seed material for phytosanitary purposes and the benefits of sentinel nurseries with species from different origins will be reciprocal.

C.5 Target groups/end users

The Action will bring direct benefits to a wide range of researchers and the phytosanitary community (NPPOs, PRA experts, policy and decision makers), which will be ensured through consultation and involvement of these groups and end users in the MC meetings, Working Groups and the training schools.

Researchers will benefit from increased interaction with the regulatory community, which will lead to improved understanding of phytosanitary regulations. Better understanding of phytosanitary regulations can lead to more focused research on prediction and prevention, as well as early detection of new invasions by tree pests and diseases and mitigation of impacts.

NPPOs and RPPOs will benefit from harmonised monitoring and identification protocols, as this will lead to more complete and more consistent information about potential new alien tree pests and diseases. Consultation and involvement of both researchers and the phytosanitary community during the development of these protocols will ensure the delivery of outcomes that are relevant for these end users.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

Early warning systems that can identify tree pests and diseases before they arrive in Europe are urgently needed in order to be able to carry out risk analyses (PRA) on these species, their hosts and the pathways through which they may arrive. The development of the framework for the establishment of an international network of sentinel nurseries, based on plants grown from seed, is an innovative way of creating such an early warning system. However, other important information required for comprehensive PRAs is still lacking. For example, detailed trade data that would allow quantification of pathways (i.e. for any given year the number of plants of a genus imported from a non-European country), and hence the potential arrival rate of the pests and diseases, or the value of native tree species are paramount to PRA, but no single, comprehensive database containing such information exists. A database of such information would make it easier, faster and more cost-effective to carry out PRAs. This Action will collate the additional information that is required for taking the environmental and socio-economic values of native European trees into account when carrying out PRA. This information is also highly relevant for the selection of tree species to be planted in sentinel nurseries or that will be monitored in arboreta and botanic gardens. This Action will collate and update a detailed database of imports of live trees and shrubs into COST countries that can be consulted by PRA experts when the need arises.

It is expected that the monitoring of pests and diseases in sentinel nurseries, botanical gardens or arboreta with exotic trees will primarily be carried out by local researchers in order to save costs by reducing travel expenses. It is important that monitoring of tree pests and diseases is done using the same protocols in all countries, that the methodology is appropriate for the detection and identification of a wide range of organisms and that the results are adequate for prioritisation of pests and diseases for PRA. Consensus is therefore required on the methods to be used, on the development of common protocols for the monitoring and identification of pests and on the use of data collected through these processes. Participants in this Action will suggest standardised monitoring and identification methods. Depending on which species are found, the results of monitoring of exotic trees may prove sensitive because of the potential economic implications. It is important that this is acknowledged by researchers and PRA experts. The participants of the Action will explore ways to regulate the establishment of such nurseries and the use of collected data. From the beginning of the Action, there will be a strong focus on the establishment of collaboration between researchers and representatives from NPPOs in COST countries and elsewhere. PRA

requires early warning of stakeholders about pests and diseases associated with tree species in exporting countries and those that may also attack native tree species in the importing country. Such international and interdisciplinary work requires a broad consortium, such as can be established through a COST Action. In this manner, the design of the early warning system and the information collected through monitoring of these sentinel nurseries and collated in databases can meet the needs of PRA experts and the wider phytosanitary community. Interactions between researchers and NPPO representatives of COST and non-COST countries will lead to optimal conditions for data exchange. An inventory of regulations in the participating countries regarding the import conditions for tree seeds for planting and the possibilities for the use of trees grown from such seed to be used in establishing nurseries as part of an early warning system for phytosanitary purposes will be made. In addition, experience with the implementation of such regulations and with open-field experiments involving exotic plant species will be collated, to inform decisions about the implementation of an early-warning system based on sentinel nurseries.

D.2 Scientific work plan methods and means

The scientific programme of the project will focus on seven tasks, organised in three working groups (WGs). The task of dissemination of the activities and outcomes of the Action (also see I.H.) is coordinated in a fourth WG. It is anticipated that WG1 and WG2 in particular will interact and exchange information in a complementary manner.

WG1 : Prioritisation of tree species for sentinel nurseries

The choice of trees to plant in sentinel nurseries or monitor in arboreta or botanical gardens may depend on the identity of the species that are imported into Europe, the origin, season and volume of those imports, or the likelihood that these or related species provide a pathway for pests or diseases that attack native European trees. In addition, the environmental or socio-economic value of the native tree species may also be a reason to monitor that particular, or related species more or less intensively.

The information required for decisions about inclusion of tree species in an early warning system, or for use in PRA, is not readily available. Measures and measurements of ecological importance of individual tree species are rare and the socio-economic value of trees, even if known for some individual species or countries, cannot be found in a single database. In this WG two databases will be constructed that bring together detailed data on the international trade (i.e. European imports) in live trees for as many countries and years as possible and quantitative measures for the importance

of native trees in Europe. The information in these databases will be valuable not only for the selection of tree species for an early warning system, but also for prioritisation of pathways for risk analysis.

Tasks:

- T.1. Characterise intercontinental trade in tree species
- T.2. Characterise the importance of native tree species

Deliverables:

- D.1. Database of genus-level intercontinental trade in live trees
- D.2. Database of environmental importance of European tree species

WG2: Standardised monitoring protocols for pests and diseases of sentinel trees

Techniques used for monitoring of trees in the exporting country, whether in sentinel nurseries, botanical gardens or arboreta, and their execution in a standardised manner, as well as the methods used for the detection and identification of pests and diseases are decisive factors determining the usefulness of early warning systems. However, it is also essential that the results of the monitoring efforts provide the information required by experts to prioritise and carry out PRA. The experts from the phytosanitary community and the researchers in this WG will make an inventory of the information required and available for PRA and pathway risk analysis, also drawing on, and interacting with experts from WG1. In order to select the most appropriate monitoring and identification protocols, experts in this WG will collate an overview of available techniques, for a range of organism types. Based on real and hypothetical examples, including some where host jumps have occurred, the WG will explore ways to prioritise tree pests and diseases for PRA and will suggest preferred methods for prioritisation.

Tasks:

- T.3. Identify data requirements for pathway risk analysis
- T.4. Collate identification tools and monitoring techniques for tree pests and diseases
- T.5. Propose prioritisation methods for tree pests and diseases for risk analysis

Deliverable:

- D.3. Proposals for a standardised design of sentinel nurseries, protocols for monitoring and identification of tree pests and diseases and a method to prioritise tree pests and diseases found in sentinel nurseries for risk analysis

WG3: Regulation of sentinel nurseries and the collation of results for use in PRA

Regulations of the countries where sentinel nurseries could be established affect whether it is

possible to import seed (as opposed to the less preferred option of using seeds available from sources within the country), the quantity that can be imported, and whether treatments and other phytosanitary measures that must be applied. These possibilities and restrictions vary between countries and special regulations or conditions for scientific purposes may apply. An overview of import regulations for seeds for planting, including the rules for outside planting of trees grown from these seeds, will be made for as many countries as possible. This should facilitate the selection of locations for and preparation of future sentinel nurseries, which will be of reciprocal benefit, as non-COST countries will be able to use this information for the implementation of sentinel nurseries in locations and with species that are most relevant to them. Experiences of NPPOs and importers with the import of seeds and planting of exotic tree species will be collected through interviews with the relevant stakeholders.

The collected data may be sensitive and it is important that these sensitivities are taken into account when designing and implementing an early warning system based on sentinel nurseries. Ways to deal with the collected monitoring data, to ensure that the NPPO of the country is always informed, and how the data can be made available to importing countries will be explored.

Tasks:

T.6. Identify and analyse national legislation on the import of seeds of exotic tree species and their use for scientific purposes in open-field situations

T.7. Collate experiences with the implementation of such legislation and open-field experiments

Deliverable:

D.4. Database of national legislation for import of seeds of exotic tree species for scientific purposes

WG4: Dissemination

The outcomes of the Action will be presented to stakeholders, including the research and phytosanitary communities, the live plant industry and the general public. A dedicated, open-access Action website will be established at the outset and newsletters and other dissemination activities added promptly. Further dissemination will be through scientific publications and oral/poster presentations at conferences and more informal meetings, interactions with the NPPOs of participating countries (representatives other than those involved in the Action), and articles in appropriate trade journals. An international workshop or conference, including proceedings, will be organised in the last year of the Action. The dissemination activities are described in more detail in section I.H.

Deliverables:

D.5. International workshop/conference

D.6. Project website

E. ORGANISATION

E.1 Coordination and organisation

The Action will be managed and coordinated by the Management Committee (MC), in accordance with the Rules and Regulations for COST Actions. The day-to-day organisation will be overseen by a Steering Group (SG) composed of the Action Chair, Vice-Chair, the WG leaders and co-leaders and the STSM manager. The SG members will be nominated and elected during the first meeting of the Action. One MC meeting and up to two additional meetings of the WGs will be held each year. The SG will oversee the planning and delivery of the Action and regular contact for the management of the Action will be kept through e-mail, phone and other means as appropriate. The SG will be responsible for monitoring and evaluating achievements, as well as stimulating the productive and cost-effective use of COST opportunities. Progress of the Action, outputs and proceedings of meetings will be made available on the open-access Action website.

Milestones

The progress in the Action will be measured against the following Milestones:

Milestone	Task	Month
M.1.1.	Kick-off meeting	0
M.1.2.	First MC meeting	1
M.5.1.	Project website launched	2
M.3.1.	Data requirements for pathway risk analysis	6
M.1.3.	Workshop on risk analysis techniques, target identification and data requirements	25
M.3.2.	Collation of monitoring and identification techniques	30
M.1.4.	Training school on detection, monitoring and identification techniques	33
M.3.3.	Proposition for prioritisation methods for tree pests and diseases for risk analysis	42
M.4.2.	Report on foreign experiences with legislation on import of seeds for scientific purposes and open-field experiments with such seeds	45
M.3.4.	Standardised design for sentinel nurseries, monitoring of pests and diseases and prioritisation for risk analysis	45
M.4.1.	Analysis of national legislations concerning the import of seeds for	45

	planting for scientific purposes	
M.5.2.	International conference/workshop	46
M.2.1.	Database on international trade in live trees	48
M.2.2.	Database on environmental importance of European tree species	48
M.5.3.	Conference proceedings published	48

Networking

This Action will provide plenty of opportunities for networking during meetings, STSMs and in WGs, which will involve researchers, PRA experts and stakeholders. WGs will include experts from different scientific disciplines and COST countries, as well as members of the phytosanitary community. Because there is limited interaction between the research and phytosanitary communities, it is likely that many, new collaborations will develop during this Action and that there will be feedback between the research and phytosanitary communities. The WG leader will coordinate the WG and will be responsible for liaison with the MC, SG and other WGs.

Capacity building and networking by early-stage researchers will be stimulated through STSMs and the Training Schools. The Action will fund 5-10 STSMs per year and will encourage early-stage researchers to participate fully. As the Action includes non-COST countries, reciprocal STSM will also be possible.

Interactions with related COST Actions, particularly PERMIT (FP1002) and Alien Challenge (TD1209), and research projects in Europe, the US and elsewhere will be established. It is anticipated that reciprocal STSMs will be important for this Action.

E.2 Working Groups

The work on the Tasks will be organised in four Working Groups, each of which will focus on specific tasks (see Section D.2.):

- WG1 Prioritisation of tree species for sentinel nurseries (tasks 1 & 2),
- WG2 Standardised monitoring protocols for pests and diseases of sentinel trees (tasks 3, 4 & 5),
- WG3 Regulation of sentinel nurseries and the collation of results for use in PRA (tasks 6 & 7), and

- WG4 Dissemination.

The SG will allocate WG membership of experts to encourage the establishment of new contacts between researchers and PRA experts and will oversee progress, exchange of information between WGs and identify relevant end-users and information needs and resources.

E.3 Liaison and interaction with other research programmes

Through their work in ongoing COST Actions, and EU research projects (e.g. FP7, EUPHRESKO (ERA-NET)), the participants combined bring together a wide range of professional contacts in various disciplines, including biology, taxonomy, development of detection and identification tools, pest risk analysis, regulation, policy.

In addition, the participants are already involved in international and global organisations that work to address specifically the risks associated with the trade in live plants and possible mitigation measures, such as the IPPC, EPPO, the Standing Committee on Plant Health of the EU, IUFRO and IFQRG.

The participants in the Action have many international contacts in non-COST countries and experience working in non-COST countries, including important exporting countries, such as China or Kenya.

E.4 Gender balance and involvement of early-stage researchers

The Action will promote the active involvement of, and transfer of knowledge to early-stage researchers, in particular, but not exclusively, through STSMs and training schools that will allow early-stage researchers to participate in the scientific work of the Action, gain knowledge on monitoring and identification techniques for both pests and pathogens and build professional networks. The interdisciplinary nature of the Action and the involvement of both researchers and members of the phytosanitary community will enable early-stage researchers to gain experience in a variety of topics and research fields. The studies carried out during each STSM will be presented at the following MC meetings and a summary report will be made available on the Action website.

F. TIMETABLE

The Action will have a duration of four years. The tasks within each Working Group are expected

to be carried out for the whole duration of the Action, as will the dissemination activities. A kick-off meeting will be held shortly after approval of the Action and a MC meeting will be held in the first three months after the Action starts. Training schools will be organised in the second and third year of the Action and the final year will see an international conference.

	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4												
Task 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Task 2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Task 3	X	X														
Task 4			X	X	X	X	X	X	X	X						
Task 5							X	X	X	X	X	X	X	X	X	X
Task 6	X	X	X	X	X	X	X	X								
Task 7					X	X	X	X	X	X	X	X	X	X	X	X
STSMs		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Training school							X				X					
MC meeting	X						X				X					X
International conference																X
Website start, updates	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dissemination activities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, BA, BE, BG, CH, DE, DK, EL, ES, FI, FR, HR, HU, IE, IS, IT, MK, NL, PL, RS, SE, SK, TR, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 96 Million € for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

H.1 Who?

A dedicated WG will oversee and coordinate the dissemination activities. The main reason for

having a separate WG for dissemination is to ensure that as wide a range of stakeholders as possible is informed about the progress and outcomes of the Action.

The beneficiaries of the Action are researchers, the phytosanitary community, the horticultural and forestry industries and the general public through fewer damaging organisms entering Europe.

Researchers include the participating scientists, universities, early-stage researchers, other research frameworks such as COST Actions, and national and international research projects. These will be informed about the progress made in the Action through training schools, peer-reviewed publications, presentations at workshops and conferences, and the final international conference of this Action.

The phytosanitary community, which includes representatives of NPPOs and RPPOs, such as PRA experts and policy makers, will benefit from the outputs of the WGs, which will be of direct use to PRA experts, but also policy makers. This group of stakeholders will be informed directly through involvement in the Action, presentations to audiences in NPPOs and publications in specialist journals.

The horticultural and forestry industries will benefit from this Action as a result of improved PRA and phytosanitary measures that are aimed at avoiding the introduction of pests and diseases through the live plant trade. The industries will be informed about the Action and its outcomes through the Action website, downloadable information leaflets and articles in trade journals.

The general public needs to be aware of the risks of the live plant trade and the possibilities to reduce those risks. Through the Action website, press releases and downloadable information leaflets, the Action will provide this information.

H.2 What?

Website – an open-access website will be launched at the beginning of the Action and will be updated at least four times a year. The site will provide information about the Action, the background and updates on the progress and outcomes of the Action. Information leaflets for stakeholders, as well as summary reports of STSMs will be put onto the website.

Downloadable information – in order to reach a wide public with general information, information leaflets on the background of biological invasions, this Action and its progress will be developed in English and other languages and put onto the Action website.

Training – Early-stage researchers will participate in training schools and STSMs within the frame of this Action, thus providing opportunities to learn about and contribute to the outcomes of the Action.

Peer-reviewed publications – The Action will produce peer-reviewed publications aimed at both the scientific research community and the phytosanitary community. COST will be acknowledged in all publications resulting from the Action.

H.3 How?

A Working Group specifically for dissemination activities (WG4) is an integral part of the Action and the MC will oversee the progress of dissemination activities. In the final year, the Action will organise an international conference or workshop on the implementation of a global network of sentinel nurseries and the use of monitoring results of such networks, in arboreta or botanical gardens to improve phytosanitary safety and risk analysis, the proceedings of which will be published. A training school on identification of tree pests and pathogens for early-stage researchers will be organised. An open-access website will be developed early in the Action, for coordination, advertising of progress made in the WGs and dissemination of information and outcomes.