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in Science and Technology  
- COST -**

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**Secretariat**

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**COST 4138/10**

**MEMORANDUM OF UNDERSTANDING**

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Subject : Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action FP1002: Pathway Evaluation and pest Risk Management In Transport - PERMIT

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Delegations will find attached the Memorandum of Understanding for COST Action FP1002 as approved by the COST Committee of Senior Officials (CSO) at its 178th meeting on 25 May 2010

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## MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

### COST Action FP1002

#### PATHWAY EVALUATION AND PEST RISK MANAGEMENT IN TRANSPORT - PERMIT

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 4159/10 “Rules and Procedures for Implementing COST Actions”, or in any new document amending or replacing it, the contents of which the Parties are fully aware of.
2. The aim of the Action is to reduce the potential threats to forests from pests of phytosanitary concern through promoting *enhanced pathway management*. The Action will synthesise information towards a *manage once, remove many* pest reduction strategy.
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 92 million in 2010 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 Chapter V of the document referred to in Point 1 above.

## **A. ABSTRACT AND KEYWORDS**

Movements of Invasive Alien Species (IAS) globally by trade and human movement present severe and increasing risks of transfer of plant pests (principally invertebrates and plant pathogens) globally. Climate change adds further opportunities for pest establishment and impact, both by providing increased survival and growth opportunities for pests and, through environmental stresses, making trees more vulnerable to those pests. In relation to ecosystem services and their longevity, forests are particularly vulnerable to IAS. In particular, multiple PATHWAYS for transfer of pests internationally are poorly characterised, leading to increasing transfer and establishment of new damaging organisms. The COST Action PERMIT addresses this shortfall in knowledge and practice and will focus on reducing threats from exotic pests through promoting ENHANCED PATHWAY MANAGEMENT. The general approach will be through analysis and shared experiences of the principal pathways for movement of forest pests. This will lead to an appraisal of potential generic procedures that could be applied to pathway management, ultimately leading to a “manage once, remove many” Systems Approach to maximise pest reduction and to influence future phytosanitary policy. It will deliver hard copy, electronic and workshop outputs and exchange of experiences through at least 4 Short Term Scientific Missions per year.

**Keywords:** Invasive Alien Species, Forest Pests, Biosecurity, Pathway Management, Climate Change

## **B. BACKGROUND**

### **B.1 General background**

The introduction of species beyond their natural ranges has risen dramatically and at an accelerating rate over the past 50 years, due to increased transport, trade, travel and tourism on a global scale. Such PATHWAYS provide opportunities for transport of species across bio-geographic barriers that would otherwise prevent their movement. Europe is a major trading block having many contiguous Member States (MS), shared borders and internal free trade arrangements. Invasive Alien Species (IAS) may easily reach neighbouring MS or ecologically different parts of the same country, thus presenting major biosecurity risks.

IAS are species introduced outside their natural habitats where they may invade, establish, out-compete native species and disrupt ecosystem services. Biological invasions operate globally and are considered to be the second cause of biodiversity loss after direct habitat destruction. They are predicted to become the major engines of adverse ecological change in the future because of their increased spread and establishment. In addition to threats to biodiversity and ecosystem services, the direct costs of IAS in relation to crop and amenity losses are immense. Therefore, the planning of more effective strategies to deal with biological invasions is a global conservation and socio-economic priority, requiring improved actions at national and international levels based on proactive rather than reactive approaches. Fundamental to maintaining biosecurity is improving our understanding of the pathways by which pests are moved internationally and, arising from this improved knowledge, development and implementation of enhanced pathway management to reduce or eliminate pest risks. Fundamentally, keeping pests out is far more effective than attempting to eradicate or contain them after they have established in a new location.

The basis for developing improved methods for reducing pest movement along pathways is the sharing of knowledge, its synthesis through use of international expertise and, as key outputs, the development of new proposals and decision support for ENHANCED PATHWAY MANAGEMENT. Such a knowledge-based initiative is ideally delivered through the EU COST Action process, where the emphasis is on developing and enhancing networks and by building and synergising capacity between existing and new research groups. Since the problem to be addressed in the current proposal is global in context, the ability to include countries outside the normal COST membership is fundamental and will add value and geographic scale to the outputs. Through the exchange of information and associated Short Term Scientific Missions (STSMs), strengths and weaknesses in knowledge will be identified, which will lead to precise identification of research needs that can be addressed through ongoing or new research topics generated by the COST partners. Synthesis of state-of-the-art knowledge, including identification of gaps in that knowledge, will be provided by hard-copy, electronic and workshop outputs from the COST Action.

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The basis for developing improved methods for reducing pest movement along pathways is the sharing of knowledge, its synthesis through use of international expertise and, as key outputs, the development of new proposals and decision support for ENHANCED PATHWAY MANAGEMENT. Such a knowledge-based initiative is ideally delivered through the EU COST Action process, where the emphasis is on developing and enhancing networks and by building and synergising capacity between existing and new research groups. Since the problem to be addressed in the current proposal is global in context, the ability to include countries outside the normal COST membership is fundamental and will add value and geographic scale to the outputs. Through the exchange of information and associated Short Term Scientific Missions (STSMs), strengths and weaknesses in knowledge will be identified, which will lead to precise identification of research needs that can be addressed through ongoing or new research topics generated by the COST partners. Synthesis of state-of-the-art knowledge, including identification of gaps in that knowledge, will be provided by hard-copy, electronic and workshop outputs from the COST Action.

## B.2 Current state of knowledge

At the core of phytosanitary process in dealing with biosecurity risks to forests worldwide is Pest Risk Analysis (PRA). Not surprisingly, PRA focuses on named organisms and the commodities with which they are associated. The International Plant Protection Convention (IPPC) provides a process that Regional Plant Protection Organisations (RPPOs) adapt for their own use. The European and Mediterranean Plant Protection Organisation (EPPO) scheme tends to be used regionally and at national levels in the EU and the remainder of the EPPO countries. Considerable emphasis is placed on evaluating the pathways for movement of named pests and, for each pathway, the mitigation measures that can be applied to reduce or eliminate the pests from that pathway. Depending on the state of knowledge, this process can provide a high level of security against threats from the named pest. However, while having great strengths in delivering a focused pest-specific approach, traditional PRA also has major weaknesses because it can miss many organisms that may be associated with the same pathways.

In practice, PRAs tend to be retrospective and triggered by the appearance of a pest outside its home range and which is already causing problems in a new location. Thus, many pests that are, or have been, the subject of research within the EU and COST countries are focus species for PRA activity and reflect the arrival of new organisms rather than anticipation of their possible arrival. Key illustrative examples of current concern include:

- Pine wood nematode, *Bursaphelenchus xylophilus*, which is causing extensive tree mortality in Portugal and is subject to eradication action in Spain. This has been the subject of several European Framework Programme projects, including RISKBURS, PHRAME and related projects such as PORTCHECK, QBOL and COST Action 872 (Exploiting genomics to understand plant-nematode interactions).
- *Phytophthora ramorum*, cause of Sudden Oak Death syndrome is an invasive pathogen of uncertain origin in California and Europe. A recently completed EU FP6 project (RAPRA) has studied this organism in detail and provided up to date PRA conclusions. The COST Action FP0801 “Established and Emerging Phytophthora: Increasing Threats to Woodland and Forest Ecosystems in Europe” extends the outcomes of RAPRA and the EU Coordination Action FORTHREATS.

The arrival of these pests and their subsequent establishment in Europe also represents failures of the process of prevention that is core to management of phytosanitary risks. Since many pests are moved and then establish globally without having been previously included in PRA activity, they provide compelling evidence that many more organisms are moving along particular pathways than are recognised in phytosanitary listing and regulation globally. Thus, there are many examples of the destruction of large forest areas, entire ecosystems, and even threats to tree species through the spread or change in risk patterns of forest pests and pathogens. Some of these are linked to climate change and range expansion, potentially linked to trade, while others are entirely associated with unrecognised movement along global movement pathways:

- Emerald ash borer (*Agrilus planipennis*); exotic, tree-killing beetle from China spreading through parts of the USA, Canada and Russia.
- The platypodid beetle *Megaplatypus mutatus*, a native of South America, which has established in Italy and was not recognised as a problem prior to arrival.
- Establishment of Asian longhorn beetle (*Anoplophora glabripennis*) in North America triggered PRAs and the passing of phytosanitary regulations in the EU. The species, along with its close relative the citrus longhorn beetle *A. chinensis*, has established or is under eradication in several EU member states.
- Mountain pine beetle (*Dendroctonus ponderosae*) causing devastation in British Columbia; a native bark beetle that has increased its range related to changing climate.
- White pine blister rust (*Cronartium ribicola*) introduced into North America from Asia via Europe in the early 1900s has caused huge losses to five-needle pines.
- Asian and European gypsy moth (*Lymantria dispar*). European strain established and causing damage in USA and Canada with further incursions by the Asian strain.

These, and many other examples of interceptions of IAS, indicate that knowledge of the range of pests that are associated with and move globally on a wide range of pathways is inadequate. Thus the current proposal focuses on the potential impacts of IAS on forests and woodlands worldwide, emphasising their prevention and early detection and management, particularly since impacts may take many years to manifest themselves. Internationally, forests make vital contributions to economies, the conservation of biodiversity, environmental protection and to global carbon and water cycles. They also play a key role in strategies for offsetting CO<sub>2</sub> emissions and as potential sources of bio-energy. These benefits are increasingly at risk from biosecurity threats arising from growth in international trade and tourism and also from changing climates. However, in the vast majority of cases, pests can only move globally if they are provided with suitable pathways. Understanding and managing the multiplicity of pests that are associated with different pathways is the core activity of the current proposed COST Action.

### **B.3 Reasons for the Action**

Although there are a range of EU and international projects and research initiatives related to specific phytosanitary threats (as indicated in B. 2), there is surprisingly little coordinated action or exchange of experiences and information on the biological and physical attributes of pathways for movement of pests globally. Some initiatives have commenced (e.g. the IUFRO Alien Invasive Species and International Trade Unit has a small working group on Plants for Planting as a Pathway) but they tend not to have a funding basis that allows frequent and structured interaction with relevant scientists, practitioners and stakeholders. COST is an ideal vehicle to provide this structured network to enhance knowledge exchange, sharing and synthesis.



PERMIT will focus on reducing the potential threats from exotic pests through promoting ENHANCED PATHWAY MANAGEMENT. It will do this through inter-related and sequential objectives. The general approach will be through analysis and shared experiences of the principal pathways for movement of forest and woodland pests, leading to an appraisal of potential generic procedures that could be applied to pathway management ultimately leading to a “manage once, remove many” approach to maximise pest reduction. PERMIT recognises that the nature of international trade is evolving and increasing in scale. For example, in recent years, the demand for, and delivery of, live Plants for Planting including ornamental and forest/woodland trees has increased enormously (the value of all trade in imported live plants to the EU Member States was €1,434 Billion in 2007). This relatively new, high risk, pathway adds to those, such as wood products, wood packaging, etc, already recognised as presenting phytosanitary risks. Each pathway has a biological ‘carrying capacity’ that reflects the range of pests that could be associated with the pathway at origin. When combined with predictions that, because of climate change, many pests will increase in severity and in their capacity to exploit host plants in new locations, the need for increased knowledge exchange and analysis is fundamental to anticipating new problems and for early development of solutions to combat any increased threats.

PERMIT will, therefore, provide an interdisciplinary and interactive forum based around scientists, phytosanitary authorities, wider stakeholders and end-users from a range of COST and non-COST countries. It will provide a structured means of addressing the wider biological characteristics of pathways of global pest movement and will recommend generic processes for maximal pathway risk reduction, thus extending beyond, but complementary to, the current list-based emphasis in phytosanitary procedures. Further benefits will arise from:

- Enhanced protection of the European forest and woodland estate leading to increased financial and amenity values.
- Improved and more secure flow of goods internationally, supporting global trade, whilst contributing to reduced phytosanitary risk.

## **B.4 Complementarity with other research programmes**

There are several EU research programmes, either completed or still in progress, that have components relevant to PERMIT. Some are listed below.

### **EU Framework Programme**

PHRAME – Plant Health Risk And Monitoring Evaluation: Development of improved pest risk analysis techniques for quarantine organisms using pinewood nematode, *Bursaphelenchus xylophilus*, in Portugal as a model (FP5 – completed)

RAPRA – Risk Analysis for Phytophthora Ramorum (FP6 – completed)

DAISIE - Delivering Alien Invasive Species Inventories for Europe (FP6 – completed, but active database and website)

PRATIQUE – Enhancements of Pest Risk Analysis Techniques (FP7 - ongoing)

QBOL – Quarantine Barcoding Of Life (FP7 - ongoing)

ISEFOR – Increasing Sustainability of European Forests: Modelling for Security Against Invasive Pests and Pathogens under Climate Change (FP7 – new, at contract stage)

### **Interreg**

REINFFORCE – REsource INFrastructures for monitoring, adapting and protecting European Atlantic FORests under Changing climate (Interreg IVC -ongoing)

FUTUREforest – How trees and woodlands can adapt to the effects of climate change and provide opportunities for mitigation (Interreg IVC - ongoing).

### **COST Actions**

FP0703 - Expected Climate Change and Options for European Silviculture (ECHOES) (ongoing)

FP0801 – Established and Emerging Phytophthora: Increasing Threats to Woodland and Forest Ecosystems in Europe (ongoing)

872 - Exploiting genomics to understand plant-nematode interactions (ongoing)

Although there are areas of overlap with all the above programmes, the unique feature of PERMIT is its emphasis on the pest carrying capacities of different pathways and, through synthesis of this knowledge, the development of recommendations for generic pathway management, ideally through the concept of “manage once, remove many”. There are, however, considerable benefits to be gained from interaction with the listed EU projects and with others that will be brought in by the wide international coverage of the PERMIT COST Action.

## **C. OBJECTIVES AND BENEFITS**

### **C.1 Main/primary objectives**

The main objective of the Action is, through enhanced knowledge gathering, sharing and synthesis, to reduce the potential threats to forests from pests of phytosanitary concern through promoting ENHANCED PATHWAY MANAGEMENT. The COST Action will achieve this through a series of inter-related and sequential objectives. It will employ analysis and shared experiences of the principal pathways for movement of forest pests, leading to an appraisal of potential generic procedures that could be applied to pathway management, ultimately leading to a “manage once, remove many” approach to maximise pest reduction.

### **C.2 Secondary objectives**

To achieve the primary objective the Action will use two broad secondary objectives:

Objective 1: Quantification of pathway risk. This objective will identify high risk pathways through quantifying the volumes of goods or other materials moved along each pathway, the type of goods/materials moved and the organisms vectored by these pathways. This will allow quantification of risks associated with individual pathways so that Objective 2 can focus on the highest impact pathways.

Objective 2: Pathway risk mitigation. This objective will focus on communication to end users of risks associated with specific pathways, and will ultimately develop a decision support system that can be used by regulatory agencies to identify and mitigate the risks posed by individual pathways. The ultimate goal is a “manage once, remove many” approach that mitigates risk from multiple organisms, not all of which will be pre-classified as hazardous to the receiving country or region. Dissemination and interactive sharing of the findings from the Action will be through a dedicated website, a series of workshops (some linked to the regular meetings of the Action) and, ultimately, a Decision Support Tool available as hard copy and electronic platforms.

### **C.3 How will the objectives be achieved?**

The objectives will be achieved through both literature searches and shared expertise and experiences of the COST participants, particularly bringing in expertise and knowledge of the biological and ecological interactions between pests and potential pathways. Arising from this synthesis, research needs and gaps will be identified and, where possible, these will be addressed immediately either through adaptation of existing research programmes or through application for new funding streams.

Specifically:

- Working Groups will address the 7 principal Tasks to be carried out within the Action. Interaction between the Working Groups and national and international research programmes and with Regional Plant Protection Organisations will guide the precise directions of work and provide interactive evaluation of progress.
- Arising from the Working Group deliberations, at least 4 Short Term Scientific Missions (STSMs) per year will be organised to enhance shared experiences and to address in more detail specific topics identified for further analysis.
- Knowledge transfer, delivery of decision support systems and their testing by end-users will be achieved through electronic (principally the PERMIT website), hard-copy and verbal means. The latter will be by workshops and demonstration events.
- Management of the project will be through an agreed timetable developed by the Management Committee and maintained by the Coordinator using suitable project management software. This will ensure that deliverables are identified and milestones for their achievement kept under constant review.

#### **C.4 Benefits of the Action**

The EU, through Council Directive 2000/29/EC, provides mechanisms for “protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community”. The Directive is essentially a listing of all the potentially harmful pests already identified by the EU Member States and by the Standing Committee on Plant Health and links these pests to particular pathways. Similar list-based approaches have been adopted globally and there are many similarities and overlaps in procedures by different countries, trading groups and RPPOs, all of whom link to both the IPPC and the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement).

The Action will contribute to the ongoing development of improved phytosanitary measures in EU and global contexts, particularly since the contributors to the Action include countries external to COST. By focussing on the component of phytosanitary risk that, by definition, provides clear opportunities for international transfer of pests, the Action is also well placed to quantify those risks generically and, thereby, to consider generic methods for their reduction – “manage once, remove many”.

COST, therefore, is the ideal platform for this particular proposal. It facilitates networking at a truly international scale and has the added benefit of considerable flexibility in inclusion of additional partners during the course of the Action and in developing young scientists and exchange of experiences through STSMs.

#### **C.5 Target groups/end users**

Results from this Action will be of interest to a wide range of end-users:

- The results will be directly relevant and applicable to the EU Standing Committee on Plant Health in relation to the continuing development and refinement of Directive 2000/29/EC.

- Regional Plant Protection Organisations (contributors to the Action reside in EPPO, IAPSC, NAPPO and PPPO regions of the world) globally will also benefit. In particular, several members of the EPPO Forest Quarantine Panel will be involved in this COST Action.
- In the wider context of forest and woodland protection from invasive pests and, therefore, in downstream benefits of maintaining and improving ecosystem health, end-users also include forest and woodland managers, wood-processing industries and the wider public for amenity and human health benefits.

## **D. SCIENTIFIC PROGRAMME**

### **D.1 Scientific focus**

Movements of Invasive Alien Species internationally and, particularly, pests of phytosanitary concern, are regarded as one of the major causes of habitat and biodiversity losses in a changing world. The focus of the Action will be a coordinated and structured assessment of the key element in movement of forest pests worldwide – **the pathways on which pests move**. It will bring science and practical experience together to describe the functional basis of a given pathway as a conduit for pest movement. PERMIT includes expertise in pest biology and ecology, on the structural basis of pathways associated with particular pest biologies and on the potential generic processes that can be applied to maximise pest freedom on each identified pathway. By focussing broadly on biological and physical associations between pests and their pathways, the range of pests (both known and not yet described) and potential measures to minimise generic phytosanitary risks will be described and quantified. This will provide a decision support system for phytosanitary authorities and practitioners in facing the every increasing risks posed by pests in a changing world.

## **D.2 Scientific work plan methods and means**

The Action work plan will be based around 7 primary tasks, supported by 4 main Working Groups, although there will be full interaction between them in developing knowledge on pathways and solutions for their management.

### **Working Group 1**

#### **Task 1: Pathway characterisation**

Currently recognised phytosanitary pathways will be analysed in relation to their potential to be colonised by pests in their countries of origin and, subsequently, their capacity to ‘deliver’ pests to new locations. The analysis will be focused on the structural and biological carrying capacities of the pathways and related to types of pests and their generic biological characteristics that determine whether they are likely to be associated with particular pathways at origin.

#### ***Targets:***

- T 1.1*** Identify, by expert knowledge and analysis of RPPO and NPPO experiences globally, the known and potential pathways that provide conduits for movement of pests between locations.
- T 1.2*** Carry out biological and ecological analyses of the pest-carrying characteristics of key pathways and characterise each in relation to the types of pest organism that could be associated with the pathway.

#### ***Milestones:***

- M 1.1*** Production of comprehensive listing of known and potential pathways for international movement of forest pests
- M 1.2*** Summarise key pest-carrying characteristics of pest-pathway associations

## **Task 2: Evidence of movement of pests along pathways**

There is currently only fragmented information on the degree of movement of pests along key pathways. Information on movements of forest pests globally will be gathered by direct interaction with National and Regional Plant Protection Organisations and by analysis of wider scientific literature on pest associations with identified pathways. By broadening to include general scientific information, inferences on potential and actual pest colonisation of pathways can be used to address generic pathway risks and potential management regimes. The evidence base will include pest interception data as well as pest establishment information. Particular emphasis in the European context will be use of the DAISIE database, augmented by a number of other international data sources.

### ***Targets:***

- T 2.1** Using existing data sources and by structured interaction with NPPOs and RPPOs, construct an evidence database on known organism movement along key pathways.
- T 2.2** By analysis of the database, produce a classification of pathway risk according to biological carrying capacities and demonstrated abilities of pest organisms to move along given pathways.

### ***Milestones:***

- M 2.2** Produce and maintain evidence database on pest movements along key pathways.
- M 2.3** Provide pathway risk classification in relation to pathway carrying capacity and pest associations

## **Task 3: Trade patterns in relation to movement along pathways**

Analysis of trends and volumes of movement along identified pathways will be used to estimate their extent and speed of movement. It will include traded goods and also the inadvertent movement of pests by individuals carrying personal goods. The analysis will provide information on the level of knowledge of stakeholders involved in pathway movements. This will be the basis for improved education and knowledge transfer in Task 5.



### ***Targets:***

- T 3.1*** In parallel with, but mainly based on the outcome of Task 2, quantify the relative risk contributions of different pathways on a regional and temporal basis.
- T 3.2*** By questionnaire and direct discussion with key actors involved in pathway initiation and delivery, determine the level of knowledge of the phytosanitary consequences of pest movement along the pathways.
- T 3.3*** Cross reference and analyse connections between the outcomes of targets 3.1 and 3.2 to refine risk categorisation of identified pathways.

### ***Milestones:***

- M 3.1*** Provide a quantitative evaluation of the risks from all pathways identified in the COST Action.
- M 3.2*** Provide a structured summary of the knowledge-gathering exercise on phytosanitary consequences of pest movements along named pathways.
- M 3.3*** Provide risk categorisation of identified pathways as a basis for Tasks 4-6.

## **Working Group 2**

**Task 4:** Analysis and development of generic risk mitigation measures to reduce pest movements along pathways

Detailed information on pathways and their pest carrying capacities will be used to assess risk reduction strategies. This will include current measures that are generally pest-specific, and new generic measures that will address management of pests with particular biological attributes and associations with given pathways. The purpose will be to propose single or multiple measures to deliver a “manage once, remove many” approach to ensure freedom from pests for named pathways.

## ***Targets***

- T 4.1*** Direct pest reduction measures, such as heat treatment, fumigation, irradiation, etc. will be assessed and ranked according to efficacy and practicality for particular pathways.
- T 4.2*** Indirect measures to minimise the association of pests with pathways at their origins will be assessed in relation to the range of pests, their biological characteristics and the management of the pathway from its initiation. This analysis will include evidence gathering on feasibility, practicality and efficacy of measures such as place of production freedom, seasonal restrictions, inspection regimes, pre-testing, etc.
- T 4.3*** Combinations of direct and indirect methods of pest reduction will be assessed and compared for efficacy using evidence from NPPOs and RPPOs, exporters and forest and woodland managers in relation to potential to ensure generic freedom from pests identified by Working Group 1. A particular focus will be extrapolation of information on survival and development of pests based on detailed analysis of pest management regimes in the wider nursery, woodland and forest management contexts.

## ***Milestones:***

- M 4.1*** Produce evidence-based rankings of the efficacies of direct pest reduction measures applicable to identified pathways.
- M 4.2*** Produce evidence-based synthesis of potential and actual indirect pest reduction measures applicable to minimising associations of pests with pathways at their origins.
- M 4.3*** Produce a critically assessed synthesis of total pest management options applicable to pathway risk reduction.

### **Working Group 3**

**Task 5:** Education and dissemination of information for pathway risk awareness and risk reduction  
Information will be collated and used as a basis for improved education and dissemination of information on pathway risk awareness. This will address both the reasons for trade along given pathways and the level of knowledge on risks of movement of pests for each pathway. While being comprehensive, particular focus will be on more intractable pathways such as Plants for Planting and personal movement of goods that could pose phytosanitary risks. The Working Group charged with carrying out this task will include socio-economic expertise so that appropriate techniques of data gathering and analysis can be applied to the information gathered.

#### ***Targets:***

**T 5.1** Through interaction with NPPOs, RPPOs, producers (nurseries, exporters, etc.), forest managers, traders, trade organisations, transport organisations, the wider public, etc., the level of awareness of phytosanitary risk for a range of pathways will be assessed.

**T 5.2** Knowledge from Task 5.1 will be used to assess data from Working Groups 1 and 2 in relation to success or failure of current processes for given pathways. This will provide focus on which pathways require increased effort to maximise pest reduction. A key question will be whether failures of process are due to inadequate measures or to lack of knowledge/awareness of the wider phytosanitary risks posed by particular pathways.

#### ***Milestones:***

**M 5.1** Report on phytosanitary awareness in a wide range of actors and stakeholders.

**M 5.2** Produce a critical evaluation and analysis of the roles of education and awareness in the success or failure of pest management strategies to ensure pathway freedom from phytosanitary risks.

## **Working Group 4**

### **Task 6: Identification of research and data gathering needs**

The COST Action will employ structured data gathering and analysis to identify knowledge gaps and research needs on a pathway by pathway basis. By concentrating on generic risks and risk mitigation measures, PERMIT will provide a basis for development of novel risk reduction measures of value to the EC and internationally.

#### ***Targets:***

- T 6.1** By interaction with Working Groups 1-3 and the wider ‘phytosanitary community’, assess the capacities of phytosanitary measures to reduce risks from a range of pathways generically.
- T 6.2** Compare the outcome of Task 6.1 with current practices for phytosanitary risk reduction and carry out a ‘gaps analysis’ to identify where there is either a shortfall in quality of measures being applied to reduce risks or where there are major gaps in practice that require substantial research and development effort to deliver new phytosanitary solutions.
- T 6.3** Where capacity exists, commence or facilitate collaborative research to test new generic risk reduction measures. If this is not possible directly through existing funding, consider joint applications for new funding based on identified research gaps.

#### ***Milestones:***

- M 6.1** Provide a report on the findings of Working Group 4 with emphasis on the capacity of existing phytosanitary measures to provide acceptable risk reduction for both known and unknown pests moving along pathways.
- M 6.2** Make recommendations for specific areas of research to address gaps in phytosanitary measures for given pathways.
- M 6.3** Develop the capacity to facilitate new research to address the research gaps identified in T6.3 and, as appropriate, develop new funding bids involving appropriate expertise internationally.

## **Interaction between Management Committee and all participants**

**Task 7:** Production of electronic and hard-copy synthesis of the findings as a basis for a Decision Support System for pathway risk recognition and management.

The key outcomes of PERMIT will be to produce electronic and hard-copy syntheses arising from data gathering, analysis and development of risk mitigation strategies for important pathways. This will form the basis for a novel Decision Support System for risk recognition and risk management for given pathways. Although there will be limited capacity to carry out verification studies within PERMIT itself, it is anticipated that parallel research and interactions between partners will allow direct testing and refinement of proposed risk mitigation measures (see T6.3). In this way, PERMIT will be interactive, involving data gathering and analysis as its core measures but with linkage to ongoing or new research into improved pathway management for enhanced phytosanitary safety. At least four SHORT TERM SCIENTIFIC MISSIONS (STSMs) per year will be organised. There will also be interim WORKSHOPS and a final dissemination INTERNATIONAL CONFERENCE to deliver, debate and refine the key outcomes of the Action.

### ***Targets:***

- T 7.1** Meetings of the Management Committee will coordinate the Action and consider applications for STSMs.
- T 7.2** In parallel to 7.1, meetings of the Working Groups will be held to share information and to evolve work directions and plan outputs.
- T 7.3** Prepare and maintain the PERMIT website, including progress reports and electronic outputs.
- T 7.4** Synthesise the findings of the Working Groups and develop a Decision Support System for risk recognition and risk management on a pathway by pathway basis.
- T 7.5** Organise and oversee at least 4 STSMs per annum, with particular emphasis on post-graduate and post-doctoral scientists.

- T 7.6** Organise Workshops to disseminate and provoke wider discussion on findings from the Action. It is anticipated that there will be one per year for years 2-4.
- T 7.7** Organise an International Conference to be held in the final year to publicise the work of the Action and to involve stakeholders from a wide range of disciplines, particularly those involved in phytosanitary policy and practice. The papers and discussion outcomes will be published in a major Proceedings volume.

**Milestones:**

- M 7.1** Hold meetings of the Management Committee twice per year.
- M 7.2** Hold meetings of the Working Groups and COST participants twice per year in conjunction with the MC meetings.
- M 7.3** Carry out publicity measures, particularly through the Action website and associated electronic documentation.
- M 7.4** Deliver a draft Decision Support System in Year 2 and continue to refine until the final deliverable of the Action.
- M 7.5** In conjunction with the MC meetings, organise at least 4 STSMs per annum.
- M 7.6** For years 2-4, organise an annual workshop to disseminate ongoing findings and to provide interaction with key stakeholders.
- M 7.7** In the final year, organise an International Conference to disseminate the findings of the Action and publish the findings in a major Proceedings volume.

**E. ORGANISATION**

**E.1 Coordination and organisation**

This COST Action will be coordinated through the Management Committee (MC), set up in accordance with the provisions in “Rules and Procedures for Implementing COST Actions” – COST 270/07. Membership of the MC, including the Chair, Vice-Chair, Working Group Leaders and STSM Manager, will be formally nominated and elected at the kick-off meeting of the Action.

A Steering Group, including the MC Chair, Vice-Chair, Working Group Leaders and STSM Manager will be responsible for oversight of the planning and execution of the Action, including liaison with local organisers in each country hosting meetings of the Action.

Communication both within the Action and for the benefit of external parties will be mainly through the Action website, supported by email, telephone and, as appropriate, video conferencing.

A specific committee will be established to organise the Action Conference and to organise and edit the Proceedings from the Conference.

Working Groups will include relevant expertise and be drawn from COST member countries and, where appropriate, other countries. Working Groups will elect a leader who will be a member of the MC and provide reports and ensure liaison within and between Working Groups.

The Action Targets and Milestones have been outlined in section D. 2.

## **E.2 Working Groups**

As indicated in Section D. 2., the Action will establish four Working Groups to address a series of inter-related Tasks:

### **WG1: Pathway characterisation linked to pest movements and trade patterns**

This WG will address Tasks 1-3 in which a range of pathways known to be significant for pest movement internationally will be characterised and linked to evidence of successful pest movement along those pathways. The WG will provide a synthesis of the finding that will underpin work by the other Working Groups.

## **WG2: Development of generic risk mitigation measures to reduce pest movements along pathways**

The key task of this WG will be to assess the efficacy of existing and potential risk mitigation measures that can be applied to pathways under an overall strategy of ‘manage once, remove many’, which accounts for both known and unknown organisms associated with the pathways.

## **WG3: Analysis of the level of education and awareness of risks associated with different pathways**

This WG will address whether the efficacy of pest reduction measures applied to pathways is compromised in any way by poor education and awareness of the risks associated with those pathways. Such knowledge will be a critical component of assessing the causes of failures of process that might be gathered from the other Working Groups.

## **WG4: Identification of research and data gathering needs**

Identification of knowledge gaps and research needs on a pathway by pathway basis will be the main activity of this WG. It will both identify research needs and also facilitate the carrying out or initiation of the research needed to deliver the main aim of Enhanced Pathway Management.

### **E.3 Liaison and interaction with other research programmes**

There are many research initiatives and programmes dealing with the general area of phytosanitary risk and movement of Invasive Alien Species internationally. Those of particular relevance to this COST Action are outlined in Section B.4 (Complementarity with Other Research Programmes). Early liaison and interaction with the ongoing programmes listed in B.4, especially EU Framework Programmes DAISIE and FORTHREATS (database analysis), PRATIQUE, ISEFOR and COST Actions FP0703 – Expected Climate Change and Options for European Silviculture, FP0801 – Established and Emerging Phytophthora: Increasing Threats to Woodland and Forest Ecosystems in Europe. Additional benefits will be gained from the EU Marie Curie programme TRANZFOR which provides for extended exchange visits between some of the COST countries, Australia and New Zealand.



Experts from other research initiatives will be invited to the workshops organised within the current Action so that interactions can be fostered and maintained to the benefit of all parties concerned.

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

This COST Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its MC agendas. The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas.

The Action will particularly support the development of early-stage researchers so that the experience of the different research groups can be shared and passed to the next generation of researchers. Thus, the encouragement and delivery of STSMs will be a priority item providing specific research focus but also ensuring that the gender balance of the early-stage researchers is appropriate and particularly facilitates involvement by female researchers.

The election of female members to the Management Committee will also be given high priority and, as indicated, will be an agenda item for all meetings.

## F. TIMETABLE

The Action will run for four years as indicated in the Table, which shows the timings and milestones for the planned work.

Activity	Year 1			Year 2			Year 3			Year 4					
MC & SG Meetings	X		X		X		X		X		X			X	
STSMs		X	X	X	X	X	X	X	X	X	X	X	X	X	
WG1			X		X		X		X		X		X		
WG2			X		X		X		X		X		X		
WG3			X		X		X		X		X		X		
WG4			X		X		X		X		X		X		
WG5			X		X		X		X		X		X		
Workshops			X		X		X		X		X		X		
International Conference														x	
Publication of Proceedings														X	
Web site set up & upkeep		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: Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, United Kingdom. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 92 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.

In addition, the following non-COST countries have expressed their interest to participate: Australia, Canada, China, New Zealand, Russia, USA and South Africa.

## **H. DISSEMINATION PLAN**

### **H.1 Who?**

PERMIT will provide data, syntheses and recommendations of relevance to a wide range of stakeholders with interest or responsibility for forest and ecosystem health in the context of phytosanitary risks. The target audiences will, therefore, include:

- Plant Health and quarantine policy makers and regulators at local, regional, national, COST country and international levels. Thus, NPPOs and RPPOs will be primary targets for interaction and dissemination.
- Nursery, woodland, forest and land managers with responsibility for tree production and care and who are involved in any way with pathways capable of moving pests from place to place.
- Scientists and researchers involved in phytosanitary risks.
- The general public, both as travellers and as drivers for pathways involving traded goods.

### **H.2 What?**

A number of dissemination mechanisms will be employed to delivery the outcomes of the Action:

- Action website which will be regularly updated and which will contain information on the Action and its contributors and downloadable PDF files of its main findings.
- Annual Workshops to report on findings and to provide dialogue and debate to contribute to work directions and analyses for following phases of the Action.
- Participation of Action staff in national and international conferences and workshops, with emphasis on publicising the outcomes of PERMIT.
- Publication of articles in peer-reviewed journals and conference proceedings.

- An International Conference at the end of the Action to report on main findings and to encourage take-up of the pathway risk decision support system.
- Electronic Proceedings arising from the final Conference which will be available as a downloadable PDF file. If a publisher can be found, consideration will be given to hard copy publication of the proceedings.

### **H.3 How?**

The Management Committee will consider progress and ensure that summaries and significant findings will be made available through the various mechanisms outlined in H.2. The MC will also review dissemination plans at its regular meetings and develop appropriate mechanisms of dissemination dependent on the outputs concerned.

Therefore, outputs will generally be delivered through the Action website in the form of PDF files for download. Augmenting this underlying dissemination route, other means of presentation such as general conference presentations, Workshop findings, the Decision Support System, peer reviewed papers and the International Conference Proceedings will be published as PDF files, subject to copyright permissions.