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Data collection and information sharing in plant health

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Abstracts

Presentations

Surveillance for invading plant pathogens: the use of epidemic models to quantify performance and optimise survey design

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There has been a significant increase in the number of invading plant pathogens in recent times, often associated with increases in global trade and travel. To effectively manage an invading pathogen population it is crucial that it is discovered at low incidence. This requires intensive early warning surveillance programs at substantial cost. However, large-scale surveillance surveys are expensive, often covering large geographic regions and stretching fiscal and manpower resources. Deciding how many sites to survey, how often and where is not trivial. There is a need for methods to support the design of surveillance programs that can quantify the expected performance of a given sampling plan. To quantify the probability of early warning necessitates a model-based approach which relates the spatial and temporal dynamics of invading pathogen populations with the dynamics and intensity of a surveillance system. We demonstrate how, for any given surveillance program, the incidence an epidemic will have reached when it is first detected can be estimated using a relatively simple rule of thumb. This provides a method to determine sampling resources to ensure enough resource is committed to have an acceptable chance to achieve early-detection, but not more than is necessary. We also show how stochastic epidemiological models and optimization techniques can be used to optimize surveillance programs to maximize performance and minimize costs involved. The methods show that the optimal spatial pattern of sampling resource deployment is often counter-intuitive; for example targeting the highest risk locations is not always the optimal course of action and in some circumstances it is more effective to spread resources evenly in space irrespective of risk. The methods have been used to inform national scale regulatory surveys for tree pathogens in the UK, as well as state and national scale surveys for invading citrus pathogens in Brazil and the US.

Survey planning in Lombardy region

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The survey conducted by the Regional Plant Protection Service is aimed at the knowledge of the pest status of its territory and to collect the data required by the format drawn up by DG Sanco.
Checks require:
1. a great effort in terms of planning and coordination with the bodies involved for various reasons in the problem;
2. the work in the field of many technicians who must be trained,
3. the collection and processing of data for reporting to the NPPO and European Commission.
10 years ago in Lombardy the survey was limited to 5 harmful species, in 2012 the monitoring involved 30 harmful organisms, in 2013 these were joined by 18 others.
The annual increase of the needs in terms of financial and human resources for the implementation of these controls requires the development of strategies that optimize the work. It is therefore necessary to carry out a careful planning to collect significant and representative data and optimize resources.
The format transmitted by DG SANCO are often difficult to interpret and do not indicate the procedure by which to collect data on the territory. The result is that often every region in Italy collects data in different ways and the same thing happens for the different Member States.
The planning of the survey should take into account several factors: type of crop, extension of cultivation, sources of risk, proximity to outbreaks, period and frequency of checks and especially the cost of each hectare or site controlled.
The organisation of the monitoring in 2013 has allowed us to take advantage of past experience and optimize all possible synergies with the local territory and obtained as a result a marked improvement in performance.

The French epidemiological surveillance network for plant health

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The French epidemiological surveillance network for plant health involves the main actors in plant protection: farmers and growers, technical institutes, cooperatives, wholesalers and chambers of agriculture and regional federations for the study of and protection against pests. The plot network built up includes more than 15000 plots distributed across the whole of French national territory. The plots are chosen to provide a representative sample of the climatic, agronomic and phytosanitary conditions in the various industry sectors.
Observations are scheduled for each monitored plot. The list of bioagressors for monitoring and notification is drawn up in advance for each type of crop. Observations must follow a calendar and a protocol predetermined and harmonised at national level. Additionally, the observers are tasked with notifying all crop pests, which includes emerging parasites, invasive species and regulated pests subject to quarantine or mandatory control measures.
The information collected at regional level is made public within 48 hours in the "Plant Health Bulletin". This resource is available free of charge from the regional directorates for food, agriculture and forests. Coverage of French national territory is complete, including overseas departments.
Plant Health Bulletins provide farmers and agricultural advisers with the information they need for the proper use of pest control resources, thereby limiting application of plant protection products to plots genuinely threatened by bioagressors. In particular, Bulletins indicate whether harmfulness thresholds have been reached.
At national level, this information is aggregated in a database that can be accessed by the partners and official departments and agencies responsible for risk management.

The EFSA PERSEUS Project: Plant health surveys for the EU territory: an analysis of data quality and methodologies and the resulting uncertainties for pest risk assessment

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Plant health surveys within the EU are conducted to get information about the occurrence and distribution of organisms harmful to plants. Requirements for such surveys are set-out in statutory obligations. However, the methodologies used to conduct the surveys are not defined in detail and therefore the quality of survey data is seen as a significant potential source of uncertainty and may influence the evaluation of the effectiveness and of management options. The project PERSEUS has examined the methodological aspects of these surveys to identify strengths and weaknesses. The current and emerging approaches employed for surveying plant health pests were identified in a first step through a systematic review of the literature (Work Package 1). In a second step, an inventory of specific surveys including approaches that were not publicly available was assembled through the development of questionnaires addressing all the relevant issues of conducting plant pest surveys, which were sent to all relevant competent bodies within the EU territory (Work Package 2). Following the literature search and the assembly of the inventory, the findings were reviewed with an emphasis on assessing the strengths and weaknesses of the methodologies evaluated and how this influences uncertainties in pest risk assessment and the evaluation of management options (Work package 3). The final step of the work described case studies in which selected species were examined in more detail and quantitative assessments were made of how surveys can be expected to perform. As a consequence of this the extent to which descriptions and reports of surveys provide enough information to allow their performance to be examined was assessed (Work Package 4). The project has generated datasheets for 283 pest species and detailed results with conclusions and recommendations are reported. In the presentation, the main findings are described.

Could the methodologies used for the collection of pesticide usage statistics also be used to monitor the incidence and spread of plant pests?

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This presentation will provide insight to the collection, management and sharing of data on the use of pesticides in the UK. Fera has over 30 years' experience gathering and managing this data and will outline some of the challenges faced in terms of data collection systems, data accuracy, databases, websites and other media, spatial and temporal timescales and sharing the information with a wider audience.

The Data are used by Government, in part to comply with EU Statistics Regulations, but also to formulate future policy on pesticide use and registration. An essential requirement of the surveys is to ensure that they are representative and statistically robust. In order to meet this requirement the sampling methodology must be sound and the uptake and collaboration in the surveys by farmers must be comprehensive and unbiased. Samples are based on national cropping statistics and selected to represent the range of size groups and geographical distribution of each cropping group.

The surveys are voluntary with an uptake rate for all surveys of over 90%. This ensures that data collected are valid and representative of each cropping group and geographical area.

The majority of surveys are made by personal visit and surveyor's interview farmers on a face to face basis. During the interview information on crop agronomy and reasons for use, such as target pest diseases and weeds, are collected. Information on these target species are presented within the publicly available published reports. During the interview many farmers raise their concerns over emerging pests and diseases. Although this information is currently anecdotal it could be collected on a more formal basis.

The ability to make good national estimates relies on the use of both good sampling methodologies and well-designed relational databases. These principles could equally well apply to surveillance and methodologies for pest surveys.

Remote monitoring of plant-related insects using web-based camera traps

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The importance of early detection of potentially threatening pests is increasing year by year; many efforts are focused on the interception of alien species entering in new habitats through commodities and packaging material shipped from all over the world. The same importance is the surveillance of invasive species already introduced in limited areas, in order to intercept and avoid the pest spreading. In this respect, the development of tools able to maximize the frequency of trap check in a short time with a minimum effort can be extremely helpful for increasing the efficiency of early detection. In this contribution we present a monitoring technique based on web-connected cameras coupled with insect traps. Cameras are able to take pictures of the trap content and send them through a GPRS connection to a dedicated web page. This allows the operator to remotely check the presence of potentially threatening insects and focus the field-work only to those traps showing target insects in it, avoiding the periodical checking of a complete trap-set, including empty ones. Furthermore, a high frequency of shoots allows a short time-span monitoring, increasing the efficiency of early detection and related control activities. The application of such technology can be useful also for other purposes, including studies of species with a flight activity restricted to short periods or moments of the day difficult to manage by human operators.

An SMS based system for monitoring of progressive development of plant diseases: A pilot initiative for surveillance of wheat rusts in Turkey

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Wheat is a major crop for food security and the rusts, namely stripe, stem and leaf rusts are among the major disease constraints causing significant losses to wheat crops in many countries. Due to their air-borne nature, management of wheat rusts requires integrated efforts including timely surveillance and responses in case of epidemics. Especially speedy communication and transfer of field data is very critical for timely response. Effective surveillance systems are not present in many of the developing countries in Near East, East and North Africa, and Central, West and South Asia which are vulnerable to wheat rust epidemics. This activity has been initiated to develop a rapid surveillance system for possible implementation in these countries. As an initial step the system has been installed in Central Anatolia region of Turkey. The system is composed of an SMS gateway tool, an operation unit and a network of extension officers in 30 districts of five provinces. Based on SMS reports of the districts, the system facilitates daily monitoring and mapping of the status of rust diseases and real time exchange of observations among the institutions. The system also generates alert messages transmitted to relevant authorities. Initial assessments indicate that the system successfully facilitates rapid exchange of information among extension offices in the districts, central operation unit, research institutes and relevant authorities at various levels. The system can serve as rapid communication tool to facilitate effective decision making and timely interventions in case of sudden epidemics. Additionally, it can assist research communities to design detailed scientific surveys in the most appropriate locations. The activity has been carried out in collaboration with the Ministry of Food Agriculture and Livestock of Turkey and supported by IFAD and the Italian Development Cooperation.

Monitoring air and rain for plant pathogens

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Many important diseases of crops are initiated by airborne spores, some of which can be dispersed effectively over continental scales, while others may spread only locally from introduced plant material. Many are fungal spores but bacteria can also become airborne and some may even influence weather by 'seeding' rain. Virus diseases may also be transported in infected pollen. Air sampling has been used previously to understand the seasonal timing and sources of spores of plant pathogens. In the past 15 years, DNA-based methods, like quantitative PCR provided new information about spores that previously could not be identified by microscopy or culturing. For farmers dealing with established but sporadic pathogens, inoculum-based disease forecasting has potential but is most effective if samples can be analyzed and results disseminated within hours. Hence, portable tests are increasingly attractive, including rapid isothermal DNA-based methods, lateral flow immunological kits and biosensors. DNA-based diagnostics can also provide useful information at the sub-species level, such as presence of fungicide resistance or changes in pathotype race structure. It is much harder to use air samplers to detect the arrival of rare, exotic spores but coordination of a sampling network within Europe and use of high volume samplers appears promising. Not only air but also rain should be sampled. Interpretation of results to identify spore thresholds presenting a risk, varies with location of the sampler and is not straight-forward due to the deposition and dilution of spores under different atmospheric conditions. Further work is required to investigate the spatial variability in spore numbers of established pathogens in air at different sites and how changes in numbers of airborne spores at particular heights above or distances away from crops are related to subsequent disease severity in order to optimize inoculum based disease forecasts. Similarly, the use of air trajectory forecasting could enhance any network used for surveillance of new pathogens. New remote sensing methods such as LIDAR, WIBS and UV spectrometers may have promise but are currently at an early stage of development and require specificity testing.

Scientometric approaches in data collection for plant health

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Scientometrics is a field of information science devoted to the quantitative study of patterns in the scientific literature. This contribution aims to present three main scientometric approaches that can help in the collection of data relevant to plant health. First, scientometric analyses can quantify the proportion of studies available in various databases on a set of plant pests and pathogens. For example, it has been shown that about 90% of the Web of Science publications on the exotic tree pathogens present in Switzerland are on just 20% of such pathogens, thus highlighting the knowledge gaps on many exotic tree diseases. Second, time-series of publication numbers can identify temporal trends in the literature relevant to plant health, as shown by a paper documenting an increasing proportion of studies mentioning fungi in the literature of the last two decades on agriculture, climate change, disease, food, forests and health. These trends can be then used to e.g. allocate resources based on quantitative evidence, rather than personal feelings. Third, comparative temporal studies can highlight which plant pests and pathogens are becoming increasingly studied. For instance, the number of studies on *Phytophthora ramorum*, the causal agent of Sudden Oak Death (unknown to science before 2001), has now caught up with the number of studies on *Cryphonectria parasitica*, a pathogen that has been causing chestnut blight for many decades. This approach can identify potential new plant health challenges for a certain region, by investigating which plant pests and pathogens are becoming increasingly mentioned in the literature of other regions with a similar climate. Although they have been rarely used in the context of plant and tree health, scientometric approaches have much potential in informing plant health authorities, funding bodies and researchers about regional patterns and temporal trends in data availability on plant pests and pathogens.

Learning from modeling pest introduction: what data is needed and is it available?

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Models to evaluate risks of pest invasion are becoming popular, because they add transparency and consistency to risk assessment. At the same time, models are also very data demanding; data which is often not available or not accessible. Yet, we can learn from these models since the parameters needed to feed the model are ideally variables that are available. In this talk we will present a generic model to predict the likelihood of pest introduction. This model predicts the likelihood of plant pest entry, including transfer to a new host, given the flow of non-edible plant products. We discuss i) the parameters that are needed to feed such a model, ii) how to include uncertainty of the parameters that are derived from currently available data, and iii) the sensitivity of the model outcomes to the uncertainty of those parameters. We conclude with an overview of parameters that are crucial for a reliable assessment of pest introduction, using insights from case-studies.

Physiologically based demographic models provide a guidance for identifying data needs and for guiding data collection in evidence-based pest risk assessment

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The regional pest status of a species (native or invasive) depends on many biotic (e.g., natural enemies) and abiotic (e.g., weather) factors that are difficult to separate and quantify on a geographic scale. However, the weather-driven biology of the species and of relevant interacting species in its food chain or web can be captured by a mechanistic description (i.e., a process-based model) and used for projecting its potential geographic distribution and relative abundance so as to gauge its regional pest status.

Physiologically based demographic models (PBDMs) in the context of a geographic information system (GIS) can help provide an appropriate level of mechanistic synthesis for capturing the complex interactions that underpin evidence-based pest risk assessment and decision making in plant health. PBDMs may include bottom-up effects of plant growth and development on herbivore dynamics and, in some cases, the top-down action of natural enemies. When driven by weather including climate change scenarios, PBDMs predict the phenology, age structure and abundance dynamics, and distribution of the interacting species across wide geographic areas.

PBDMs build on the idea that all organisms in all trophic levels are consumers with resource acquisition processes having similar shapes described by the same mathematical functions, and with analogous allocation priorities. This notion enables PBDMs to capture relevant ecosystem complexity using a modest number of measurable parameters. As the underlying functions are known, parameter estimation is easier – a significant advantage in case the required set of sound biological data is not available in full. This was the case for the highly destructive South American tomato leafminer (*Tuta absoluta*) that recently invaded the Mediterranean Basin. The PBDM modeling framework provided clear guidance for a collaborative effort by identifying data gaps in *T. absoluta* biology, and for guiding data collection.

Assessing the potential distribution of insect pests under current and future climatic conditions in European forests using host data

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In this study we propose a methodology for assessing forest vulnerability to insect pests at pan-European level. Two insect pests are used for testing and validating a methodology that could be extended to other forest insect pests. Our results highlight the strengths of the approach, facilitate information sharing with decision makers and discuss the limitations, including data availability of forests insect pests.

Forest insect pests represent a serious threat to European forests and their effects could be exacerbated by warmer climatic conditions. The methodology is illustrated in a pilot study case assessing two European forest pests: Large Pine Weevil (*Hylobius abietis*) and Horse Chestnut Leaf Miner (*Cameraria ohridella*). The proposed approach integrates information from different sources. Data of observed insect pests were collected from the Global Biodiversity Information Facility (GBIF)[1], climatic datasets (current climate and A1B scenario) were sourced from WorldClim[2] and the Research Program on Climate Change, Agriculture and Food Security (CCAFS)[3], and data of European host tree species under current and future climates were provided by EFDAC[4]. The approach is implemented in two steps. First, the potential habitat of the pests is computed using the machine learning algorithm of MAXENT[5] model. Data of observed presence of insect pests and a set of 19 bioclimatic covariates representing current and future climate conditions are input in MAXENT for producing maps of current and future habitat distribution of pests. In a second step the distribution of the corresponding host tree species, computed using the Constrained Spatial Multi-Frequency analysis (C-SMFA[6,7]), for each pest is integrated with the pest habitat distribution maps to estimate forest vulnerability under current and future climates. Future habitat suitability of host tree species is used instead of current distribution for assessing the potential distribution of pests under future climatic conditions.

[1] http://www.gbif.org/
[2] http://www.worldclim.org/
[3] http://www.ccafs-climate.org/
[4] http://forest.jrc.ec.europa.eu/efdac/
[5] http://dx.doi.org/10.1016/j.bbr.2011.03.031
[6] http://www.pestrisk.org/2012/BioforskFOKUS7-10_IPRMW-VI.pdf#page=22
[7] http://forest.jrc.ec.europa.eu/efdac/applications/metadata-catalog/?catalogue=EFDAC&keyword=SMFA

Inventory and review of quantitative models for spread of plant pests for use in pest risk assessment for the EU territory

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Robust modelling tools for predicting the spread and dispersal of plant pests are required for effective risk assessment of the impact of both novel and existing pests in the EU. The ongoing project OC/EFSA/PLH/2012/01 reviews the current state of the art in pest spread modelling to evaluate the fitness of alternative modelling strategies for various aspects of risk assessment.
We report on the first phase of this project – an extensive literature review to assess the scientific literature on plant pest spread modelling combined with a cluster analysis of the results of the search to identify groups of model strategies. Using systematic review methodology, we implemented robust and step-wise screening criteria. The final assessment yielded 468 scientific articles describing spatial models of pest spread or dispersal, within which 478 unique models are reported.
For clustering, 27 data fields describing each model's representation of time, space, the pest organism(s) and the host plant(s) were populated. Subsequently multi-variate statistical clustering of the data suggested partitioning the data into eight clusters, or model strategies.
We describe the differences among model clusters both in terms of the clustering data and for a number of other data fields characterising the ways in which the models are used. Clusters are significantly differentiated according to the functional and taxonomic groups of the pests and host plants and the ways in which the models were parameterised and analysed.
We reveal important deficiencies in current modelling, including a lack of multi-species models, lack of evolutionary models and under-representation of spread driven by multiple pest entry or introduction.
We describe how we envisage integrating this analysis in a Decision Support Tool for the assessment of the fitness of the model strategies for pest risk assessments. Such a tool will be of high importance for the EFSA Panel on Plant Health.

MARS JRC climate based crop and yield forecast system: resources and opportunities for pest risk assessment

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The Crop Growth Monitoring System is the core of the MARS Crop Yield Forecast System (MCYFS) currently used in forecasting activities in Europe. The role of CGMS is providing reliable and timely spatial information about crop status in Europe, which are used in different statistical procedures to produce a yield prevision. Among the four main components of MCYFS the first one is the meteorological infrastructure dedicated to the gathering and processing of meteorological data that produces agro-meteorological indicators for early alert warning and input to crop models. The second component is the crop growth modelling with the purpose of producing crop status indicators ingesting weather data and static data (crop parameters, soil information, and management practices) in crop modelling solutions. The remote sensing component provides biophysical indicators and derived parameters at temporal resolution of 10 or 30 days over the whole continental Europe. Finally the last component is the statistical methods for the evaluation of results, comparing them to historical yield, interpreting the relationships between crop indicators and crop yield, and assisting in yield forecasting.

The growth modelling simulations are run through the BioMA platform that embeds a set of models dedicated to biotic stresses such as generic model for soil borne or airborne diseases, maize mycotoxin, rice blast or insect pests (corn borer) models, but also abiotic stresses (frost kill, heat damages). Combined with the MARS meteorological database on European historical series of daily weather data at 25 x 25 grid resolution, these models have been used to provide support to EFSA for the preparation of scientific opinions and reports regarding the risk of *Phyllosticta citricarpa* and *Phytophthora fragariae* for the EU territory and the analysis of the Epidemiological Data of " Schmallenberg " virus.

Selection and organization of life-history data for PRA: a mechanistic perspective

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The type of data collected for pest characterization in pest risk analysis, their organization and depth of analysis are critical for the evaluation of the potential establishment and spread of a pest. A method for collection, selection and organization of biological data relevant to pest characterization will be presented. The method is based on the estimation of per capita biodemographic functions which describe the dependence of physiological responses on environmental variables. These biodemographic models are rate functions which describe development, mortality and fecundity rates as functions of abiotic and biotic variables. Because of its physiological importance, temperature is the most important an environmental variable for poikilotherm organisms. However, the dependence on other physical (e.g., relative humidity), chemical (e.g., pH), and biological (e.g., food availability) variables can be modeled easily as well. The advantages offered by biodemographic functions that will be discussed are: (i) the generality of the curves describing life history strategies (the same functional form can be used for different species), (ii) the added biological realism in describing physiological responses to environmental variables (e.g., non-linear responses to temperature), (iii) the mechanistic description of weather variation or climate change scenarios, (iv) the biological meaningfulness of the curves and their power to capture different phenomena (e.g., stress due to exposure at low and high temperatures), (v) the support for data collection, organization and sharing (e.g., priority setting in data collection, evaluation of uncertainties, management of sparse or incomplete data). A further advantage of biodemographic functions is that they can be directly embedded as components of mechanistic approaches to population dynamics as implemented in Physiologically-Based Demographic Models. This modelling approach is very efficient in generating scenarios of potential establishment and spread of invasive alien species considering variation in population phenology and density across wide geographic areas and at different levels of resolution.

Challenges of data collection in Pest Risk Analysis

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Pest risk analysis (PRA) requires data to be available in order to be performed satisfactorily. Missing, incomplete, inconsistent or conflicting data provide a major challenge in pest risk analysis worldwide and a key source of uncertainty. When carrying out PRAs, information may be required on the pest itself, the situation in its current area of distribution, the pathways of entry, the factors affecting its establishment, spread and impacts in the area under threat and the measures available for its management. Based on the recent experience with EPPO expert working groups for PRA the challenges of data collection will be presented and suggestions for improvement presented.

Express Pest Risk Analysis in Germany – sharing information about new emerging pests with the plant protection services and the public

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The Institute for National and International Plant Health of the Julius Kuehn-Institute (JKI) is conducting PRAs in the framework of a legally established systematic procedure to support decision making by the plant protection services of the German Federal States on measures regarding findings of new emerging plant pests in consignments, the field, protected cultivation or open landscape. An Express-PRA scheme had been developed by the JKI with inputs from the Food and Environment Research Agency (Fera), UK and the Dutch Plant Protection Service (PPS). After the development of the EPPO Express Scheme, in which also the JKI, Fera and the PPS were involved, this scheme is now applied in Germany. It covers all necessary information for the assessment of the related risks. In general, the Express-PRA is delivered within 2-3 days to the plant protection services, enabling quick action (e.g. rejection of a consignment), with a certain degree of uncertainty that is also depending on the information being accessible. Collecting information to assess the potential risks of these emerging pests can be difficult due to the lack of data. Frequently, new pests are found in consignments from Asia, in particular China, and in many cases, descriptions of these pests are only available in Chinese or even not described anywhere. Using information from related species and relying on expert judgment, based on longstanding experience with PRA in the JKI and in exchange with other scientists on national and international level, risks (including uncertainties) are estimated and management options provided. This information is shared with the plant protection services and the public via the website of the JKI, ensuring also that, in case there is a repeated finding, immediate action is possible. Express-PRAs are also translated into English and made available on the JKI website to share this information with other NPPOs.

Prioritizing pest risks and pest surveillance in the Netherlands

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An overview will be given of the Dutch pest surveillance program. In the EU, survey requirements are in place for some specific pest species. Besides surveys for these specific pests, the Netherlands also conduct surveys to determine the pest status (absence/presence) of various other EU-regulated pests but also more general surveys to detect any new pest which may be a threat to plant health in the Netherlands and Europe. Detection of infestations at an early stage will increase the chance of eradication. Every year, a new list of pests, locations, and commodity types is made to be included in the survey. EU-regulated pests with a relatively high probability of introduction or impact are more frequently included than other pests. Emerging risks not regulated (yet) but identified by an initial risk assessment (Quick scan) may also be included. Limitations of pest surveillance programs will be discussed.

Evaluation of evidence and its uncertainty in qualitative pest risk assessments

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Advancement of methods and strategies for pest surveillance and data collection, information sharing for PRA, and pest reporting are among work priorities for NAPPO. Regional NPPOs carry out similar activities as requirements of the SPS Agreement and the IPPC. Under these agreements, information sharing is an obligation and measures should be based on evidence. There is however, no specific guidance about quality of evidence or treatment of uncertainty.
Uncertainty in qualitative PRAs is largely dependent on quality and reliability of information. Guidelines for Plant Pest Risk Assessment of Imported Fruit and Vegetable Commodities (USDA, 2012) include a supplement on evaluation of evidence. The supplement establishes a framework for assessing the quality and reliability of scientific evidence for PRA without being overly prescriptive.
Reliability of evidence addresses the quality of information sources, the methodology used, and the degree of consensus regarding the data. Reliability is rated from low to high depending on the quality of publications. Examples are provided for each source category with assignments of possible ratings.
Applicability refers to pertinence of the information to a particular situation. The risk ratings generally should be based on evidence of the pest's behavior under conditions closely approaching those of the PRA area. Since such information is not always available, some extrapolation is necessary for making assumptions. Applicability of information is rated from low to high based on the degree of extrapolation of biological information and environmental conditions in the publication source to the actual scenario in PRA.
The rating for uncertainty associated with the quality of evidence is found in a matrix that combines ratings for applicability and reliability.
Based on the USDA's experience, NAPPO is proposing a similar framework as an appendix to the regional standard on Pest Risk Management, currently under development.

Managing data challenges for evidence-based policy making

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UK plant and tree species are facing threats from increasing numbers of pathogens as a result of the ever-growing volume of international trade. To assess the potential impact of increasing numbers and varieties of pests and diseases on the health of UK plants and trees under various policy scenarios, we need to have data readily available. This will enable us to prioritise risks, develop contingency plans, determine control strategies before a pest or disease arrives and to monitor the success of these strategies once the pest or disease has entered the UK. Large uncertainties resulting from a lack of information about pests and diseases may have a significant impact on policy decisions and the success of control strategies. Therefore uncertainties should be considered appropriately when deciding on control strategies. An understanding of the limitations of the available evidence may also direct further research.

The establishment of diseases such as phytophthora and chalara in the UK has highlighted the importance of access to robust evidence to inform policy decisions. It also resulted in the establishment of an Expert Taskforce to provide advice on how the UK should protect plants and trees from pests and diseases. The recommendations provided by the Expert Taskforce highlight the importance of having easy access to data to predict, monitor and control the spread of pests and pathogens as effectively as possible.

In this presentation, I will present strategy options for obtaining evidence for dealing with current and future pest and diseases. This will include an overview of the types of information that are needed as part of contingency planning for future threats to plants and trees in the UK, an outline of options for obtaining access to information from a wide range of sources and provide direction for managing situations when information is lacking.

Role of research to support plant health risk assessment at EFSA

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The European Food Safety Authority (EFSA) is the European Union reference body for risk assessment in the areas of food and feed safety, animal and plant health. EFSA's risk assessment is performed independently from risk management, by Panels of scientific experts. Plant health risk assessment at EFSA includes pest, commodity and environmental risk assessment and is based on scientific evidence from systematic search of scientific and technical literature as well as from laboratory and field research. EU research programmes, trans-national research networks, national and EFSA funded research contributions in supporting plant health risk assessment are presented and discussed, with key examples from EFSA funded projects. It is also shown how risk assessment uncertainties highlighting scientific knowledge gaps can orient research directions.

Citizen science and early detection: the example of first occurrences of the brown marmorated stink bug *Halyomorpha halys* in Italy

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The Brown Marmorated Stink Bug *Halyomorpha halys* (Heteroptera, Pentatomidae) was detected for the first time in Italy in September 2012 in Modena (Northern Italy) during an insect collection for educational purposes. Native to east Asia, *H. halys* is listed in the EPPO Alert list given its wide host range and extremely high potential as an invasive pest of many agricultural crops, as shown in other countries where it was introduced, such as the USA, where it has become a serious pest of many fruit, horticultural and ornamentals crops. Besides, it is also a nuisance pest for its tendency to mass-aggregate inside houses to overwinter. In Europe it was first reported in Liechtenstein and Switzerland, where, despite increasing numbers, it is not yet recorded as an agricultural pest. In Italy, a "citizen-science" type of monitoring system has been activated since May 2013 starting from the territory of first detection (Emilia Romagna region), which is potentially at serious risk due extended areas with high value fruit crops. Thanks to the involvement of University students, entomology amateurs and common citizens, a detailed map of the actual distribution of *H. halys* and useful information on its phenology were obtained, which will be used for monitoring and management programs in agricultural crops.

EPPO data collection and early warning

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Since its creation in 1951, EPPO has been given the task to collect and share information on regulated pests and pests which may present potential risks for the EPPO region. Throughout the years, information on regulated pests has been collected and circulated to EPPO member countries in various forms (datasheets, pictures, databases and websites). In particular, pest-specific information is circulated in the 'EPPO Reporting Service', which is a free monthly newsletter. Two main sources of information are used by the EPPO Secretariat when preparing the EPPO Reporting Service: the scientific literature and official pest reports sent by the National Plant Protection Organization (NPPOs). For many years, the main focus was put on organisms already listed in the EPPO A1/A2 Lists of pests recommended for regulation as quarantine pests. However in the 1990s, EPPO member countries clearly expressed the need for an early warning system, which would help them to identify potential risks, ideally before pest introduction or spread is taking place. In 1999, the EPPO Alert List was created and launched on the EPPO website. Its aim is two-fold: 1) achieve early warning, and 2) propose potential candidates for Pest Risk Analysis. The pests on the Alert List are selected by the EPPO Secretariat, mainly from the literature but also from suggestions of NPPOs. All pests on the Alert List are selected because they may present a phytosanitary risk for the EPPO region. The reasons for considering inclusion on the Alert List can be of various nature: pests which are new to science, new outbreaks, reports of spread, etc. The Alert List is reviewed critically every year by the EPPO Panel on Phytosanitary Measures, which can select candidates for PRA or delete pests for which no phytosanitary action is considered appropriate. The EPPO Alert List can be consulted on the EPPO website: http://www.eppo.int/QUARANTINE/Alert_List/alert_list.htm.

Development of an Early Warning System to anticipate emerging risks in Plant Health in the UK – *ex ante* assessment: proof of concept study

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The project aimed to develop and evaluate a systematic approach to empower effective response in the area of plant health in the UK. In particular, it addressed the stage of early identification of potential risks, and developed a framework to:

- Identify and characterise drivers of emerging risks in plant health – *"what do I need to take into account?* The identification and forecasting of these factors was crucial to enable finding data requirements, evidence gaps, and surveillance needs (e.g. how often, points of monitoring / inspection) as well as performing appropriate cost/benefit analyses (i.e. more frequent / less frequent monitoring, etc.).
- Evaluate types and sources of information required to address the identified drivers – "*knowns and unknowns of prerequisites of crises in plant health"?* Available sources of information required to address the identified drivers were identified and evaluated *via* expert judgment (qualitative and quantitative) inputs, and data monitoring and filtering approaches were customised and developed. It is expected that uncertainties (e.g. due to missing data; unknown or partially known dependencies among factors; variable patterns of data collection, e.g. among different countries; different terminologies applied; spatial and temporal (incl. forecasting) patterns, etc.) will be large, and the project will characterise these systematically.
- Employ the information acquired to decide upon the status of potential risks in plant health – *"should a particular risk be included in the UK plant risk register?"* This part focused on an all-inclusive evaluation of all available information (including recognised and characterised uncertainties) to decide whether a particular risk at a particular point in time should be included in the plant risk register. It was realised via an experts' workshop and included a number of stages, e. g. build-up of possible risk scenarios, structured dialogue, argumentation steps, etc.

Lessons learned from developing and implementing an early warning system to support U.S. safeguarding against exotic plant pests

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To protect United States agriculture and natural resources against the introduction and establishment of exotic plant pests, the United States Department of Agriculture's (USDA) Plant Protection and Quarantine (PPQ) carries out numerous safeguarding functions, which depend on current information about exotic plant pests. PestLens, a cooperative effort of PPQ and the Center for Integrated Pest Management at North Carolina State University, is a web-based early warning system that helps PPQ stay current on newly emerging pest information and provides a mechanism for documenting and coordinating safeguarding actions. PestLens gathers information from a wide range of sources, including several hundred scientific journals, web sites, e-mail groups, newsletters, and automated internet search queries; summarizes this information and provides relevant background knowledge; reports the information in a weekly e-mail notification; provides a conceptual framework for making and coordinating safeguarding decisions; and makes the original information, as well as resulting decisions and actions, accessible through a web-enabled database. PestLens is the result of several years of development and implementation of plant health data collection and information sharing methods, and the lessons learned from this process may provide valuable insight for those seeking to develop a similar system.

Early warning survey and detection design in an outbreak area: Pine Wood Nematode case study

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Early detection of infected trees after a PWN outbreak is a key issue that has to combine accuracy, cost effectiveness and environment regard. The goal of a survey Plan for early detection is in this case to guarantee that any possible infected tree is detected immediately and surgery eradication process is applied instead of massive clear-cutting procedures of doubtful usefulness. Combination of continuous visual surveys in the action flight radius of possible vectors, massive trapping with specific attractants, and an certain level of sampling in standing trees (symptomatic and asymptomatic), in addition to and adequate treatment of decaying trees can guarantee, if is adequately applied, the eradication of the outbreak in its beginning. The general schedule of the Plan is described, also it is discussed the validity of certain norms now applied (maximum size of the chips, radius of survey…).

Media monitoring for emerging plant health risk

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According to its founding regulation, the European Food Safety Authority (EFSA) has the mission to develop tools and methodologies to identify and characterise emerging risks in the field of food and feed safety. MedISys, that is part of the Europe Media Monitor (EMM) software, is a fully automatic public health surveillance system to monitor on human and animal infectious diseases, chemical, biological, radiological and nuclear threats, and food & feed contaminations. After a preliminary assessment of the usefulness of MedISys for the detection of (re-)emerging food/feed borne hazards, the JRC and EFSA designed an EFSA Tab menu on MedISys containing new sources and categories in the area of food and feed safety, animal health and plant health. Subsets of the EFSA categories developed in MedISys were further fine-tuned and evaluated showing a good potential of this tool particularly in the areas of GMOs and plant health. Currently, work continues beyond the preliminary experiment. New media sources are being identified, based on experts' input and Web search engines, and an ontology for existing and emerging plant health threats is being developed for key European crops. The ontology will include information about the pests, their names in different languages, the affected crops, the symptoms and the vectors, and will drive the generation of MedISys filters. The objective is to analyse and test approaches and strategies for the media monitoring and reporting of signals of (re)emerging plant health threats. The project plan and approaches are presented with examples of the application.

Pest reporting in the European Union

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The European Commission acts as the risk manager for the European Union (EU), and as part of this process, its Food and Veterinary Office (FVO) collects, analyses and reports on the wide range of pest reports received from the 28 Member States of the EU. These reports are also a key factor in the planning of the FVO's audits and controls in EU Member States and Third Countries.

This presentation provides an overview of the requirements for pest reporting in the EU and the methods currently in place for handling and dissemination of such reports.
There are three main categories of pest reports which Member States are required to submit, these relate to findings in trade(import and Intra-EU), pest presence and the outcome of specific surveillance programmes.
The majority of pest reports received (2,700 annually) are trade related, and the means of notifying, analysing and reporting on these is well established. Approximately 220 reports of pest presence are received annually, many of which relate to the outcome of mandatory surveillance programmes, of which there are currently 17; 13 concerning emergency measures for specific harmful organisms and four, the situation of specific potato pests with the EU. A brief overview of the reports of pest presence is provided.

Forthcoming changes to the EU plant health regime will introduce requirements for wider pest surveillance and co-financing to assist this, based on prior submission and approval of survey programmes and more extensive reporting. These will present new challenges and opportunities for pest reporting in the EU. The FVO is undertaking a desk study and new mini-series on new and emerging risks to plant health, including surveillance to determine best practice and assist in establishing guidelines, in advance of these changes.

EPPO pest reporting and databases

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EPPO member countries have to fulfil various reporting obligations which are defined in the International Plant Protection Convention (IPPC) and the EPPO Convention (as well as in the EU Directive 2000/29 for the EU Member States). Among these obligations, pest reporting is a key element, as this information may trigger phytosanitary actions or serve as a basis when designing plant health policies. As stated in the EPPO Convention, one of the functions of the Organization is to *'disseminate information by obtaining information from Member Governments on the existence, outbreak or spread of pests, and conveying such information to Member Governments…'*.
In practice, the National Plant Protection Organizations (NPPOs) of EPPO member countries report the following to the EPPO Secretariat:

- Introductions and outbreaks of regulated pests;
- Updates about the situation of regulated pests of other pests which may pose a risk;
- Emergence of new phytosanitary problems;
- Eradication of regulated pests.

The information received at the EPPO Secretariat is circulated in the 'EPPO Reporting Service' and stored in PQR. PQR is a database which contains information about host plants, geographical distributions (including pest status when specified by the NPPO) and categorization (quarantine status) of regulated pests. In order to harmonize pest reporting activities within the EPPO region, the EPPO Standard PM 1/5(1) *Format for pest reports* was adopted by the Council of EPPO in September 2011. This Standard was then used as a basis to develop a web-based interface facilitating the preparation and storage of pest reports within each NPPO, as well as data sharing with the EPPO Secretariat. This new interface was first released in July 2013. In the future, it is hoped that this system will allow pest reports to be shared with the IPPC Secretariat and eventually with the EU Commission via their respective computerized pest reporting systems (the EU system is still under development), as the ultimate goal is to avoid duplication of work for the NPPOs.

The right information to the right people at the right time – lessons from New Zealand's emerging risk system

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New Zealand's Ministry for Primary Industries (MPI) introduced an emerging risk system for plant (and animal) health in 2012. The MPI emerging risk system links with existing early warning and reporting systems for pest information. The focus of the system is to report in a way that results in action when it is needed. The main challenge is getting the right information to the right people at the right time – without information overload.

The MPI emerging risk system has been running for 18 months and has achieved some good results. Over this time we have learned some valuable lessons about how to target information reports in the most useful way. Most of these lessons are not about the design of the system, but about the human factors. These human factors are seldom documented but are important considerations for any pest reporting system. The main difficulty has been balancing the risk of information overload with the risk that people duplicate effort because they don't have enough information. Other challenges include: understanding the connections so that information flows effectively, ensuring that there are feedback loops in place, balancing the levels of effort in different parts of the system in the most efficient way, balancing emerging risk work against other priorities and demonstrating the benefits of the system.

Data collection, data sharing and pest reporting – tools used by the German Plant Protection Service

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Data collection and data sharing is an essential part of the work of the national plant protection service especially in countries with regional structures like Germany. Data transfer within Germany is regulated by the Plant Protection Act and the Plant Inspection Order completed by an Administrative Rule. In Germany, the Institute for National and International Plant Health of the Julius Kuehn Institute (JKI) is responsible inter alia for coordination of activities of the regional plant protection services, for provision of information for the regional services and for communication with other countries, authorities and organizations in the EU. Pest reporting is one of the responsibilities.
In this context, different kinds of data are collected and stored including data about the findings and spread of pests, surveillance, interceptions of consignments, import and export of plants, phytosanitary regulations and phytosanitary procedures. Some of the data are collected manually; others are fed online in the computer systems by various users. Locally stored databases need further communication tools to make the relevant data accessible for the regional services like alert letters.
Most of the data are stored electronically in databases and online applications. Due to data privacy protection most of the data collections are not freely accessible while some information e.g. about regulations and pest reporting is made public on the JKI website. The relevant authorities have some information directly available from online databases. An example is WAtSon that is used to store and communicate on new occurrences of pests within Germany.

Acquisition and management of information in plant-georeferenced geographic information system of Emilia-Romagna region, Italy

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Emilia-Romagna region uses a Geographical Information System, where since 1994 is operating a phytosanitary sector (FitoGis) which represents a basic tool to share all the phytosanitary information collected by nearly 50 users daily.
The database contains the georeferenced information (map coordinates and related description of the feature) of crops, forestry plants and amenity trees (locations, producing sites, phytosanitary conditions, measures taken or to be taken) and of more than 30 pests (mainly quarantine ones). The data, managed through the regional network, are also collected in the field with different GPS tools and are used to coordinate of more than 20 monitoring. A data important use regards also their spread by web to external users of the inter-active cartography (https://servizimoka.regione.emilia-romagna.it/mokaWeb92/applicazioni/fito01) regarding the spread of Sharka (PPV), *Pseudomonas syringae* pv. *actinidiae* (Psa), *Erwinia amylovora*, Flavescence dorée, Oriental chestnut gall wasp, Western corn rootworm, etc.
The integration with the regional geodatabase (roads, rivers, cadastre, etc) and with other geodata produced by other people (for instance public green of the municipalities) facilitates the daily phytosanitary monitoring activity of the PPS.
In the workshop, examples of the managed data and their practical use in FitoGis are shown such as the inspections of the fruit and ornamental nurseries (1169 covering 2233 ha), the control in 2012 of sharka (191 foci out of 1393 monitored sites) and fireblight (160 foci out of 1391 monitored sites) or other crops pests.

Facilitating information exchange on plant health through the Plantwise programme

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Plantwise is a global programme led by CABI that supports smallholder farmers in developing countries by providing actionable knowledge to protect their crops from pests and diseases (www.plantwise.org). Plant clinics are set up to provide direct contact between extension workers and farmers. At these clinics, not only is plant health information provided to the farmer but data are also collected on the pest problems seen. This information exchange is supported by a knowledge bank (www.plantwise.org/knowledgebank) that contains high quality plant health advice and facilitates the processing of the data acquired. The Plantwise team works with partners in each of the thirty-one Plantwise countries to assist in the collection of data by suggesting an appropriate infrastructure and by helping with process design. Training is also provided along with basic equipment and support tools, both online and offline. The aim is to have data passing smoothly through all the stages of collection, recording, transfer, digitisation, harmonisation, validation, analysis and sharing.

Plantwise also facilitates the in-country use of the data by the key stakeholders from across the plant health system. Workshops to review the incoming data are held that include researchers, phytosanitary officers, Ministry staff and extension workers who then become positively engaged and enthusiastic. As more data are analysed so it becomes clearer to all that the information provided delivers a crucial means to monitor and improve overall plant health processes and to inform in-country decision-making, e.g. on research or policy priorities. Data processing and analysis is now seen as a key Monitoring and Evaluation tool for Plantwise, both by CABI and in-country partners. Incentivising partners by showing the value of the data helps to overcome the considerable on-going challenges to the overall process, including trade sensitivities and the complications of data processing.

V2P2repository: a “place” to store, search and share data from research on plant-microorganism-virus interactions

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Managing large amount of data is a challenge for many research institutes. The problem is related not only to storage and preservation, but also, and mainly, to retrieving and making available the data. The difficulty is even higher when data are not homogeneous and not digitized. *V2P2repository* has been designed to face this challenge.

V2P2repository is an open source/open access platform for storing, accommodating, preserving and making accessible different types of data produced by scientific research in the field of plant-microrganisms-virus interactions.

The "repository" was chosen as the best storage technology for the platform needs, since it allows ingesting and handling of objects from different sources, metadata cataloguing and semantic relationships.

V2P2repository contains images from optical and electronic microscopy of plant disease symptoms, plant, fungal and insect tissues, plant viruses and insect vectors, all provided with detailed descriptions and all linked with relationships to the other objects of the repository such as virus and fungal strain collections, antibody list, protocols, publications… This structure will allow users to extensively search all the data, starting from different points and reaching different deepness of search.

The repository and its front-end are based on open source software and the project outcomes will be released as open access. Fedora (Flexible Extensible Digital Object Repository Architecture) Commons, chosen as framework for the repository, can support large amounts of data, OAI-PMH compliant, programmable operations of ingesting, semantic description of relationships between objects, expandable and customizable architectural models. According to ROAR (Registry of Open Access Repositories) *V2P2* will be one of the first repositories to use Fedora Commons not only for text and publication archives.

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EFSA data warehouse: data collection and data access at EFSA

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The availability of an EFSA data warehouse, a tool for easy access and query of the EFSA data, is the final objective of a long process of data collection and integration. In plant health, as in other data collection areas, data are essential for the support of EFSA risk assessment either in case data are coming from the monitoring and surveillance activities or from the literature.
Initially every data collection was designed to support the needs of a specific EFSA opinion. With time this organisation was perceived as insufficient since it did not allow reusing the data for further analyses inside the plant heath area and to compare results with other EFSA collected results (e.g. pesticides residues data, toxicological data).
Therefore the need of a "standard data model" arises to allow integrated data collection and analysis for a specific area and across multiple EFSA domains.
This is the pathway currently followed by EFSA for plant health, where based on the past experiences and on the current data collection needs (e.g. pests in apple, plants soil and growing media) a standard data model is defined and piloted.
A positive outcome of this pilot would result in the definition of this model in the EFSA data warehouse.

Posters

Development of a new open source research infrastructure network for agricultural data sharing

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Both the research community and industry agree on the benefits of digitizing, collecting and open sharing research data. The development of common practices and operating models for data sharing at a global level is, in fact, known to improve the efficiency of the knowledge production processes, as well as unlock new perspectives for the commercial use of research data. Nevertheless, data management and sharing may entail costs, in terms of time and infrastructure implementation, that not all the researchers are willing to take over. We are currently addressing the issue of infrastructure implementation by developing an open source/open access platform in the framework of a national project called "V2P2repository", meant to preserve and make accessible non-homogeneous research data, such as images, logs and notes, produced in the field of plant-microorganism interactions. We would like to expand this repository prototype in order to openly share data about our collection of plant viruses. Started in the 1960s, it counts so far nearly 1000 isolates, strains or accessions available in the form of lyophilized leaves or as infectious clones. Most of these samples are also associated to unintegrated epidemiological records, pictures of symptoms and electron micrographs.
The repository architecture will be based on open-source software frameworks: Fedora Commons and the Open Archives Initiative Protocol for Metadata Harvesting, as a storage backend, and Drupal CMS combined with Islandora, as a frontend. Relationships will be created following the AGROVOC ontology from FAO. Moreover, stakeholders from the research community and industry will be involved firstly in the customization of the consultation portals to address their different needs and key issues and, secondly, in the reliability tests of the infrastructure.
Finally, our repository could represent an operating model that may encourage and facilitate researchers in the process of data ingesting and sharing.

Q-bank: Comprehensive databases on quarantine plant pests and diseases

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Q-bank offers descriptions of well characterized regulated plants pests. It comprises ecological, morphological, physiological, and sequence data of items that are available in physical collections of plant pathogenic bacteria, fungi, insects, nematodes, phytoplasmas, viruses and viroids, and invasive plants.
Q-bank serves as an identification and detection reference database for phytosanitary organizations: national plant protection organizations, general inspection bodies, and private laboratories. The descriptions of the items in the databases are an indispensable tool to identify and detect harmful quarantine organisms.
Q-bank comprises data of properly documented species and strains present in collections from which items can be obtained for further studies or use as controls in identification and detection tests.
The entries in Q-bank are continuously updated by a team of curators with taxonomic, phytosanitary and diagnostic expertise from world-wide national plant protection organizations and institutes with connections to relevant phytosanitary collections. Where relevant, information is linking to other databases such as European and Mediterranean Plant Protection Organization (EPPO).

Di@gnoPlant and VigiPl@nt tools: field level diagnosis, surveillance and detection of plant diseases using smartphone applications

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The early and reliable identification of a disease and the detection of emergent pests have proven to be crucial steps in plant protection in order to reduce the use of pesticides and the extension of pathogens. To this aim, we have developed two applications for smartphones and tablets to help identify (Di@gnoPlant) and localize (VigiPl@nt) diseases in the field.
Di@gnoPlant answers two key questions in plant protection: What disease/pathogen causes the symptoms I see? And what control methods can I use? At the onset or discovery of disease symptoms on a crop, the user is able to identify diseases on a range of crops (grape, vegetables, tobacco…) via a smartphone or a tablet (Apple or Android), with the assistance of an image identification module. He can then obtain information on the characteristics of the identified disease/pathogen, by accessing the INRA e-Phytia website, which is organized into fact sheets that present the biology of the incriminated pest, the symptoms it causes and describe optimized protection methods.
Through the mobile Vigipl@nt application, users can report the presence/identification of pathogens or of emergent diseases and therefore contribute to a surveillance network. This involves making observations and taking pictures of the crop and symptoms, filling out a form on the smartphone or tablet. Dated and geotagged, the information is stored or transferred directly to the e-Phytia database. Pathogen/disease presence or impact maps can be displayed on the smartphone and can be developed to monitor the presence of one or more pathogens in a given production area. Further analysis tools of the accumulated reports are under development.
Di@gnoPlant et VigiPl@nt will be presented and can be tested.

Invasive plant species in agro-ecosystems in Greece: database development, information sharing and dissemination

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A database of most important invasive plant species in agro-ecosystems in Greece is being developed in close collaboration with stakeholders (Weed Science Society of Greece WSSG, academia, research institutes and private sector). The objective of such system is to build, continuously update, and efficiently communicate management strategies, cooperation and communication in all involved stakeholders. The list comprises of the most important species; 20 alien and 11 non-alien invasive weed species (present or potentially present) in the country. At a later stage, the EPPO guidelines regarding the prioritization process in order to identify which IAS have the highest priority for an EPPO PRA will be implemented. In this database, every entry will be represented by a string with all needed information (description, photos, countries of wide-spread presence, regional presence etc.). Dissemination will be accomplished through the internet, formation of working groups within the WSSG and stakeholder meetings.

Stepped-up surveillance for early detection of *Anoplophora chinensis* in Plantaregina district, a pest free area, specialised in full-size deciduous ornamental trees production

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The Plantaregina district area, a zone with many nurseries in Canneto sull'Oglio, extends for more than 50.000 ha between the provinces of Mantua and Cremona and hosts the biggest concentration of commercial nurseries in Lombardy. The area businesses specialize in the cultivation of full-size deciduous ornamental trees. Each year, almost 3 million plants of the species most vulnerable to *A. chinensis* are grown in open fields. To protect this district and ensure its economic well-being, the Plant Health Service has designed and applied a stepped-up surveillance system, in line with the FAO ISPM international standards 4, 6, 8.
The plan of reinforced surveillance includes the following steps:

1. planning
2. control of the urban green spaces
3. surveillance of the territory
4. control of high-risk points
5. control of high-risk fields.

The planning stage is of fundamental importance and is based on the preparation of the requisite cartography, to be used as an operational tool, and on involving the nursery operators in the district and others in the area so that they participate in the planned actions. The urban green spaces were inspected using the methods already utilized in the demarcated areas, but a new methodology was devised for the enhanced territorial surveillance, as there were no established guidelines to follow. We drew up a map with a buffer zone of 2 km radius around all the areas dedicated to nursery cultivation. We then superimposed a grid of 500m on each side, leading to the creation of 2,156 cells, subsequently classified based on the risk to plant health and identified by different colors. 1-4 key points were defined for each cell, depending on the risk to plant health. Using a GPS system, more than 3,450 key points were located and mapped out, for a total of 11,233 plants in all. In addition, 16 nurseries were classified as high risk sources, according to the types of plants they produced and the origin of their supplies. In these cases, in addition to controlling the plants being cultivated, a buffer zone with a radius of 100 m around the company headquarters was also controlled. Lastly, controls were conducted in fields containing the plant species considered most vulnerable, based on their age and origin.

Survey methodology and quality management of *Anoplophora chinensis* in Lombardy

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Monitoring the principal signs of infestation (frass, exit holes) attributable to *Anoplophora chinensis* is a fundamental aspect of the policies intended to contain and eventually eradicate this alien invasive species.
The activity is carried out according to EU decision 138/2012/CE. The demarcated area subject to checks is formed by an infested area (in which the presence of *Anoplophora chinensis* has been confirmed) and a buffer zone (including a radius of at least 2 km around the borders of the infested area). Within a radius of 500 m from the borders of the infested zone, all the plant species that host *Anoplophora chinensis* are checked, in public and private green areas; in the remaining 1500 m of radius, all the potential host plants in the public green areas and some of the ones in the private areas are checked, in order to monitor a representative portion of the entire area.
Based on the above indications and the discovery of infested plants, a geo-referenced set of maps is produced, showing the areas to be controlled, on which the monitoring activity is then based. The next stage involves communication and the furnishing of informative materials to all the municipalities and parks that lie within the areas indicated on the maps, in order to set up collaborative efforts including the municipal administrations, the local police and volunteers.
The fieldwork is organized using two-man teams which, following a theoretical and practical training course, are assigned to control a precise area. Each team disposes of: ID cards; geo-referenced maps of the area to be inspected; data collection cards; hand-held computer with GPS; paint and tape with official logos to mark the infested plants. The cards filled out in the field are then entered in Excel spread sheets, extrapolating the data of the single infested plants for subsequent treatment (epidemiological statistics, felling of the plants, re-qualification of the infested areas).

The application of UK Plant Health Information Warehouse

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The Plant Health Information Warehouse (PHIW) is an information system funded by the Department for Environment, Food & Rural Affairs (Defra) and developed and maintained by the Food and Environment Research Agency (Fera) to support the work of the UK Plant Health Service. The PHIW contains a core list of pests and diseases which each have a unique ID number. All information stored about these organisms is referenced by the appropriate unique ID, allowing a datasheet of all recorded relevant information to be generated for each organism. The datasheets include, but are not limited to, the status and distribution of the organism, as well as information on evaluations, recommendations and decisions such as Pest Risk Analyses and Policy decisions. The underlying pest and disease list and plant list also provide validation for other IT systems, and work is on-going to improve the efficiency with which these data are maintained by drawing upon further external data sources. Various initiatives are either planned or on-going which may be supported by the PHIW, including the development of a plant health risk register. These initiatives and the potential benefits of links with the PHIW will be considered.

Quarantine pests interceptions in solid wood packing materials held by International Agricultural Surveillance (VIGIAGRO) at the Port of Santos, Brazil, 2009-2010

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Agribusiness accounts for approximately 30 % of Brazil's gross domestic product (GDP). The Port of Santos is the largest seaport of Brazil, responsible for moving over 25% of all Brazilian foreign trade. With the continuous increase of imports, increases the risk of introduction of quarantine pests in the country. The solid wood packaging materials accompanying a large amount of imported cargo. Interceptions have been made of absent quarantine pests (A1) and present quarantine pests (A2) in Brazil. The registration and systematization of interceptions allow characterization, the taxonomy, the geographic origin, and the quantity for the International Agricultural Surveillance (VIGIAGRO) of the Agriculture Defense Department, of the Ministry of Agriculture, Livestock and Supply of Brazil, can direct their inspections at points of entry and apply phytosanitary measures, minimizing the risk of introducing pests. In this work, we considered only the interceptions quarantine pests officially identified, forwarded by inspectors of VIGIAGRO in the port of Santos, in the period from 2009 to 2010, totaling 19 quarantine pest interceptions, being 15 absent quarantine pests (A1) and 04 present quarantine pests (A2) as defined by the Brazilian legislation. Were analyzed and correlated with the categories of pests: the number, the geographic origin, and the taxonomy of species intercepted. All quarantine pest interceptions were of Coleoptera order, Bostrichidae family and *Sinoxylon* gender. All absent quarantine pests (A1) matches were intercepted coming from India, being the predominant species of *Sinoxylon anale* and only one interception of *Sinoxylon crassum*. The present quarantine pests (A2) were intercepted three originated from India and one of Vietnam, all species were *Sinoxylon conigerum*.

PQR the EPPO database on quarantine pests

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PQR (Plant Quarantine data Retrieval system) is a database which provides detailed information on the geographical distribution and host plants of quarantine pests. Search tools also allow the users to identify commodities which may act as pathways in international trade for the movement of pests and diseases. In recent years, the database has been extended to cover invasive alien plants. The latest version of PQR also includes world maps, pictures and active links to the EPPO Reporting Service (a monthly newsletter about new outbreaks, new pests etc.). Today, approximately 1600 world distributions are included in PQR.
PQR gives access to data on:

- all the pests of the EPPO A1 and A2 Lists (i.e. lists of pests recommended for regulation as quarantine pests) and the all pests listed in EU Plant Health Directive 2000/29
- pests and plants of the EPPO Alert List
- plants of the EPPO List of invasive alien plants
- many other quarantine pests and invasive plants of interest to other regions of the world (data obtained from FAO, CABI or from other Regional Plant Protection Organizations).

PQR can be downloaded free of charge from the EPPO website:
http://newpqr.eppo.int/download.php

EPPO codes: a general overview

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EPPO codes are computer codes which were developed for plants, pests and pathogens which are important in agriculture and plant protection. This harmonized coding system was created to facilitate the management of plant and pest names in computerized databases, as well as data exchange between IT systems. EPPO codes are built by using combinations of 5 and 6 letters for plant and pest names, respectively. The first 3 or 4 letters correspond to the genus name and the last 2 correspond to the species (e.g. *Bemisia tabaci* is coded BEMITA, *Solanum tuberosum* is coded SOLTU). One of the main principles is that a unique code is attributed to a single taxon and does not change over time (even if the preferred scientific name changes). The development of this coding system was initiated by BAYER in the 1970s. In 1997, BAYER transferred to EPPO the maintenance and development of the BAYER code system. During the 1990s/2000s, EPPO developed an interface called EPPT ('EPPO Plant Protection Thesaurus') facilitating access to codes and names, and developed a hierarchical system. In 2007, it was agreed to rename BAYER codes as EPPO codes, and the interface to consult the codes (EPPT) was made freely accessible on the Internet. Today, the database covers more than 61 500 species that are important in agriculture and plant protection.

- 30 500 plant species (cultivated, wild, weeds)
- 23 000 animal species (e.g. insects, mites, nematodes, rodents), biocontrol agents
- 8 000 microorganism species (e.g. bacteria, fungus, viruses, viroids and virus-like)

For each organism, the database provides:

- EPPO code
- Preferred scientific name and authority
- Synonyms and other scientific names
- Common names in different languages
- Elements of taxonomy

EPPO codes can be freely accessed via EPPT:
http://eppt.eppo.org

Testing two plant pest risk assessment schemes to support risk reduction decisions for the European Union: methodology used, data collection process and results obtained from application on a case study pest: *Acidovorax citrulli*

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Within the framework of EFSA-funded project Prima phacie, two existing qualitative plant pest risk assessment schemes were revised to better align with the EFSA plant health remit and support decisions regarding risk reduction options (RROs) for the EU. The two schemes, identified as methods '2b' and '4b' were based on EPPO and USDA schemes, respectively.
Information gathering and data assembly are a prerequisite for well informed risk assessment and evaluation of RROs. Systematic literature reviews (SLR) were conducted on aspects of the biology of example case study pests used to test the schemes. Data for SLR were obtained from literature via abstracting databases, internet search machines, EPPO information systems, European interceptions and country specific information from Member States via questionnaires. Data were compiled into pest datasheets and used as reference documents for each pest risk assessment.
Methods 2b and 4b describe risk elements (entry, establishment, spread, impact) using qualitative ordinal scales with five categories (very low, low, moderate, high, very high). Risk elements are combined using a Matrix model in Method 2b whereas a Bayesian Belief Network with conditional probability tables is used in Method 4b. Assessors testing 2b described uncertainty by selecting one from three prescribed uncertainty distributions, while Method 4b allowed full flexibility to express uncertainty within categories. Both methods were tested against five case study plant pests. For each pest, RROs were identified and their effectiveness was evaluated by comparing the risk assessment results with or without RROs in place.
As an example of the application of the above two methods, the results of assessing the risk of one of the case study pests: *Acidovorax citrulli*, a bacterium causing fruit blotch of cucurbits, together with the evaluation of relevant RROs are presented.

Ornamental pathways of entry of some pest species in Bulgaria: gaps in the data at national and international level

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During the period 1992 – 2012, data has been collected regarding the introduction and spread of important greenhouse pests on ornamentals in Bulgaria to support risk assessment. Special attention was paid to *Frankliniella occidentalis, Liriomyza trifolii, L. huidobriensis, Echinothrips americanus, Thrips palmi* and *Bemisia tabaci* due to their significant economic importance. The aim was to construct a national database, readily available for PRA experts. Now, a retrospective approach is used to analyze the process of data collection in order to summarize the encountered difficulties, both at national and EU level, to identify major gaps and ultimately find solutions to facilitate this type of research.
One of the major drawbacks in pathway analysis is the lack of sufficient specific information on trade of commodities which results in uncertainties regarding the conclusions of the assessment. Other problematic items are the intended use of commodities and the measures used to quantify planting material in trade. The present study outlines the main gaps in the data on EU ornamental trade, both internal and external, while focusing on Bulgaria as the risk assessment area. The process of data collection is reviewed comparatively with respect to two time periods: before and after the accession of Bulgaria to the EU. The databases used most widely in risk assessment are scrutinized (EUROSTAT, FAOSTAT, databases of NPPOs, trade organizations).
Another main problem in data collection on pest entry is the actual identity of the pests and hosts of concern. Due to the process of constant taxonomic revision, one and the same plant, pest or pathogen may appear under different names in the various informational sources. There is lack of coherence between Directive 2000/29/EC and the available databases. Furthermore, EUROPHYT sometimes reports pests to family or genus level which leads to more uncertainties in the review of interceptions.

Methodologies for data collection in Quarantine Service of the Russian Federation

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Data collection and information sharing in plant health are the most important parts of scientific work and pest risk assessment. For data collection are used scientific literature, online resources, computer programs, results of production activity of FSBO “All Russian Plant Quarantine Centre” (FSBO “VNIIKR”), scientific collaboration between experts of different institutions, participation in conferences, workshops and so on.

The most frequently using computer programs are PQR – EPPO database on quarantine pests, EPPO Plant Protection Thesaurus.

Online Resources: Website www.eppo.int is the most frequently used for conducting research, writing PRA, methods diagnostic and identifies pests, standards. We download EPPO pest-specific information, EPPO Standards on phytosanitary measures, PRAs conducted by EPPO Expert Working Groups

Website www.scoop.it allows to get and share new and interesting information on pests, diagnostic methods and other activities.

Some of our scientists are the members of the ResearchGate online-community (www.researchgate.net), where participants can exchange of publications, experience and information with other scientists, get answers to their questions.

www.cabi.org Invasive Species Compendium, Crop Protection Compendium.

www.agroatlas.ru The Russian-English Agricultural Atlas is the world’s most comprehensive source of information on the geographic distribution of plant-based agriculture in Russia and neighboring countries. The Atlas contains 1500 maps that illustrate the distribution of 100 crops, 560 wild crop relatives, 640 diseases, pests and weeds, and 200 environmental parameters. Additionally, the Atlas provides detailed biological descriptions, illustrations, metadata and reference lists.

www.ncbi.nlm.nih.gov We use this website to get access to biomedical and genomic information.

Information on phytosanitary condition of the territory of the Russian Federation, the spread of pests in country we get by inspections that are held annually by specialists of FGBU "VNIIKR."

In the process of data collection the most important are the availability and relevance of information.

The Crop Protection Compendium: information for pest risk analysis

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The CPC is a widely used, encyclopaedic knowledge resource with comprehensive coverage of more than 10,000 agricultural and forest pests. More than 2400 pests are included in the Compendium as detailed, fully referenced and peer reviewed datasheets compiled by more than 1000 experts. The datasheets are regularly updated, and supplementary bibliographic records (including full text articles) on pests are updated weekly. Real-time updating has decreased the time taken to respond to feedback on CPC content, particularly for pest distribution and host data. The information requirements of pest risk analysis (PRA) have been assigned high priority since the inception of the CPC and consultation with plant quarantine professionals across the world has greatly influenced the pest coverage, data presentation and functionality. Datasheets include sections on taxonomy, distribution, biology and ecology, movement and dispersal, identification, detection and inspection, phytosanitary risk, impacts and control. They are illustrated with colour images and distribution maps. Powerful database searches can be used to generate lists of pests which may be filtered using criteria such as country, host or plant part affected, with linkage to datasheets. From here information can be easily located and copied directly into PRAs. The CPC includes links to other phytosanitary information resources, including a PRA tool developed through the EU-funded PRATIQUE project, and can be used alongside these sources to develop PRAs. The CPC is one of a series of Compendia web resources published by CABI. Their development is funded and guided by international groups of stakeholders made up of government departments, development assistance organizations and private companies, and their sustainability is ensured by a combination of sales revenue and funding through partnerships. Although offered for sale in developed countries, the CPC is provided at low cost, or free via donors, to stakeholders in developing countries.

Sources of phytosanitary information in Russia

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There are several sources of information in Russia:
Website of the Ministry of Agriculture www.mcx.ru and Journal "Quarantine and Plant Protection"
Website of the Federal Service for Veterinary and Phytosanitary Surveillance www.fsvps.ru, websites of regional bodies and Journal " AgriSecurity"
Website of the All-Russian Plant Quarantine Centre www.vniikr.ru, websites of regional branches and Journal "Plant Health. Research and Practice"
Website of the Federal State Statistics Service www.gks.ru and Statistical yearbook
Website of the Federal State Custom Service www.customs.ru
Website of the Eurasian Commission www.eurasiancommission.org

The plant health challenge of detecting cryptic small arthropods: lessons from mite invasive to Europe

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Introductions of alien spider mites into Europe have increased 50% in the last 30 years and most of these mites have the status of pests. These introduced mites often have a tropical origin, but established easily in the Mediterranean Basin. Warmer climatic conditions as predicted by climate change may create new possibilities not only for invasive species to become established but also for more frequent pest outbreaks. Spider mites are minute and most of these alien species remained undetected until they established in the field, the detection being frequently associated to outbreaks. Detection of spider mites, as it is often the case for small cryptic arthropods, is difficult and incrementing detection power does not seem an easy task. Neither improving interception schemes, nor reducing the volume of trade of commodities associated to these species appears realistic means to prevent the arrival of new alien mites. Spider mite are often polyphagous and have a plethora of ways of entry and developing remote prevention strategies to entrance appears as the first approach to be implemented. The use of databases to identify new emerging risks, together with thorough certification and quarantine protocols at the origin of commodities susceptible to harbor mites are explored and discussed as approaches to prevent new entries and to improve plant health and food security.

The scheme of collecting, sharing and building information in planning surveys in the Hungarian plant health control system

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The poster presents the Hungarian plant health control system consisting of official inspections and surveillance and how the elements, such as information sources, dedicated record keeping and implementation by inspectorate and diagnostics are built on each other in order to operate the system.
The poster shows how survey planning, considering risk assessment is built in the scheme.

Import of deciduous wood chips from eastern North America – pathway-initiated risk characterization of relevant plant pests

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In Europe, the volume of imported wood chips is expected to increase to satisfy demand for energy production. Several companies have initiated import of deciduous wood chips from North America. The Panel of Plant Health of the Norwegian Scientific Committee for Food Safety has conducted a risk characterization of potential insect pests and pathogenic fungi which may be harmful to Norwegian forests. The selection is made primarily for the pathway wood chips. Ten insect species were ranked: *Agrilus anxius, A. planipennis, A. bilineatus, Chrysobothris femorata, A. horni, A. granulatus liragus, A. granulatus granulatus, Hylurgopinus rufipes, A. politus, Scolytus schevyerwi*. Four pathogenic fungi were ranked: *Ceratocystis fagacearum, Davidiella populorum, Phellinus spiculosus, P. everhartii*. The ranking is based on the likelihood of arriving with the pathway wood chips, the presence of susceptible hosts in Norway, the climate similarity between Norway and the area of origin, and the severity of damage they may cause in Norwegian forests. The ranking indicates in which order the species should undergo full risk assessment. *Agrilus anxius* has already been risk assessed for Norway. The commodity wood chips across tree species should be assessed due to the methods of harvesting and the high diversity of tree species in the area of origin.

Actinidia pollen is a pathway for the dissemination of *Pseudomonas syringae* pv. *actinidiae* and for the spread of the bacterial canker of kiwifruit

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The bacterial canker is the most destructive disease of cultivated *Actinidia* spp. Its causal agent is *Pseudomonas syringae* pv. *actinidiae*, a Gram negative bacterium. The organism has been listed as a regulated pest for the European Union (EU Implementing Decision of 5 December 2012) and has been included in the EPPO A2 list. A PRA was prepared by EPPO and a number of pathways for its introduction and spread have been recognized, namely plants for planting, tissue cultures and pollen. For the first two pathways the probability was rated as high, for pollen the probability was not assessed, since pollen transmission was not yet demonstrated. In order to evaluate the involvement of pollen in the transmission of the pathogen and spread of the disease an experimental kiwifruit orchard was planted very far (more than 100 km) from any area where *Actinidia* spp. are commercially cultivated. Artificial pollination was done with naturally contaminated pollen using both dusting and wet sprays, as commonly done by orchardists. Pollination with pollen free from Psa was done as control. During two years experiments in 2011-2013, pollen has been confirmed to disseminate Psa in kiwifruit orchards. During the first season, no disease symptom was ever observed on trees, although Psa was regularly detected and isolated on flowers, fruitlets and leaves from spring until midsummer. Detection was negative on fruits from August until harvesting (mid October). Psa was not detectable during wintertime on vines, both epiphytically and endophytically. During the second season, a number of trees developed necrotic leaf spots resembling those described for Psa infections, starting from June and July. From those lesions Psa was also detected and isolated in pure culture. Therefore, our experiments confirmed pollen as a pathway for the dissemination of Psa and the spread of the bacterial canker by Psa.

Using host data to model patterns and processes of tree pests across Europe

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Data availability is a major issue in parasitology. Usually we know much more about a host (in terms of ecology, distribution, biology, etc.) than we know about its parasites. When applied to host parasite systems, island biogeography provides a tentative workaround to this problem, suggesting that various pieces of information about parasites may be inferred from their hosts' features. However, this is unlikely to work unless symbiotic relationships are strong enough to justify the identification of a host as the main habitat for its parasites. For tree pests this is not always the case, also due to the fact that their ecology is often more close to that of phytophagous organisms than to that of true parasites. Yet, for many of them, we have very little information. Thus, using tree data to enlighten potential patterns and processes regulating distribution and dynamics of their pests is often our best bet. Still, despite its potential, this approach has not been given much consideration. Here we introduce a suite of web applications aimed at fulfill this gap, providing a flexible analytical framework that makes it possible to hypothesize spatial patterns and ecological processes of European tree pests using distributional data of their known hosts. The suite includes different modeling tools aimed at forecasting potential pest distributions and invasion routes under different assumptions. We discuss pros and cons of the approach, focusing on its possible applications in conservation biology and forest health management.

Regulation of weeds in Mexico

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Importation of crop seeds and other agricultural commodities increases the risk of introduction of alien weeds. In order to prevent the introduction of those weeds to its territory, Mexico issued in 2000 year, the standard "NOM-043-FITO-1999, Specifications to prevent the introduction of quarantine weeds into Mexico". 63 species are listed and procedures, such as inspection and take of samples are described in the standard. Under this regulation, samples of products are taken at point of entry, and send to an authorized laboratory to be analyzed. A new version of this standard will be released in 2014 for public comment.

The development of bacterial strain-, species-, clade- and genus-specific diagnostics using a genomics approach

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Our ability to undertake diagnostics for the detection and differentiation of plant pests and pathogens is an essential part of plant health. While there are a number of different methodologies available, those based on PCR have become standard for most applications. This includes both conventional PCR and quantitative realtime PCR (including Taqman with the use of internal probes). PCR primers specific to a particular genus or species are typically designed around a conserved gene or other sequence, e.g. rRNA or housekeeping genes. We have developed a new method for the design of specific primers and probes using comparative genomics, which is unbiased in terms of diagnostic gene choice. To date the method has been used to develop primers for the bacterial plant pathogen *Dickeya* but also for the human pathogen *E. coli*. In the case of *Dickeya*, species and strain specific primers were developed, and their specificity verified against multiple isolates from both within and outside the *Dickeya* genus. For *E. coli*, strain specific primers were developed for a human outbreak strain belonging to serotype O104:H4, which improved accuracy over contemporary primers that detect the serotype but not the outbreak strain. With an exponential increase in the availability of genome sequences and the ever reducing costs of obtaining them, sequencing the genomes of outbreak strains, whether for statutory testing or research, will soon become commonplace, allowing us to harness the power of genomics for the development of accurate diagnostics.

Measuring the overall phytosanitary situation: development of a plant health barometer

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The development of a plant health barometer, an instrument to measure the overall phytosanitary situation on a national level (Belgium) and on a yearly basis and to monitor its evolution over time, is described. The elaboration of a set of 13 plant health indicators (PHI's) as the basis for the plant health barometer is discussed. These indicators were weighted by experts - including scientists, policy makers and agro-industrial representatives - to determine their relative impact in the barometer. The result of the barometer is expressed as a comparison with the previous year. Based on the results of the 13 PHI's, it is concluded that the overall plant health in Belgium shows a positive evolution from 2007 until 2010 and a negative evolution from 2010 until 2012. The plant health barometer provides a helicopter view of the phytosanitary situation of plants and plant products in Belgium and is a tool to communicate in an intelligible, comprehensible manner on aspects of plant health to consumers and professional stakeholders in the plant production chain. Together with the food safety barometer and the animal health barometer, the plant health barometer is one of the 3 instruments to provide a bird's eye view on the overall status of the safety of the food chain in Belgium.

Slovenian experience in notification and publishing data on the occurrence and spread of organisms harmful to plants

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The Slovenian experience in interlinking the Plant Health legislative and information systems for improving the effectiveness of data gathering, decision making and sharing the awareness or decisions on measures implemented by the National Plant Protection Organization (NPPO) is presented. From among its principal national and international obligations, NPPO provides for the systematic collection of information obtained through the surveillance and field surveys for analysing pest status, for pest reporting and for adopting plant health measures, where appropriate. NPPO provides for the coordination and exchange of information between authorities, public researchers and extension services, and for reporting on any new potential quarantine organisms and regulated pests. The obligation of sharing important plant health information is laid down in national legislation, incorporating *inter alia* the ISPM 17 international standard. In Slovenia, any institution involved in plant health, including authorised laboratories, is committed to the rapid notification in writing or electronically of the NPPO of any pest emergence, calamity pest outbreaks or epiphytocia, reporting at least the data on the pest, locality, time, and circumstances, intensity of occurrence and plants affected. This obligation equally applies to the registered places of production and other growers. Using an on-line form, the general public is encouraged to notify occurrence of certain controlled plant pests via the Slovenian phytosanitary portal, where also results of field surveys and officially delimited regulated areas are accessible and viewable by the supporting geographical information system. Researchers are especially encouraged to use official data and consult the NPPO before publishing their first reports on plant pests for Slovenia. NPPO has provided for an efficient phytosanitary information system based on access to the most reliable databases used in Slovenia for registration purposes, land use and topography mapping, and other official needs, which in combination with the official sources of information at the EU and international levels enable an accurate pest status definition.

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