EUROPEAN SCIENCE FOUNDATION
SETTING SCIENCE AGENDAS FOR EUROPE

Exploratory Workshop Scheme

Standing Committee for Life, Earth and Environmental Sciences (LESC)

ESF Exploratory Workshop on

RISK ASSESSMENT ANALYSIS: METHODS AND APPLICATIONS FOR EVALUATING BIOLOGICAL INVASIONS

Girona (Catalonia, Spain), 17-20 April 2011

Convened by:
Núria Roura-Pascual, Daniel Sol, Ingolf Kühn and Wolfgang Rabitsch

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SCIENTIFIC REPORT

Co-sponsored by

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1. Executive summary

The workshop was held at the Science and Technology Park of the University of Girona over two days and a half. It was organized by Núria Roura-Pascual (University of Girona and Forest Sciences Center of Catalonia, Catalonia, Spain), Daniel Sol (Centre for Ecological Research and Forestry Applications/Spanish National Research Council, Catalonia, Spain), Ingolf Kühn (Helmholtz Centre for Environmental Research-UFZ, Germany) and Wolfgang Rabitsch (Environmental Agency Austria, Austria). The organization received support from the Department of Environmental Sciences and the Office of Research and Technology Transfer of the University of Girona. In addition to the European Science Foundation (ESF), the workshop was partly funded by the Agency for Management of University and Research Grants (AGAUR) of the Department of Economy and Knowledge of the Government of Catalonia. This agency contributed to cover part of the travel expenses of the participants from countries outside Europe.

The workshop brought together a total of 21 participants from 12 countries (Australia, Austria, Canada, Czech Republic, Finland, France, Germany, Italy, South Africa, Spain, Switzerland and United Kingdom). We initially expected to have the presence of two additional attendees (Dr. Wanda Born and Dr. Philip Hulme), but they could not finally attend the workshop due to unforeseeable personal reasons. The background of the participants was quite diverse, but can broadly be classified into two main groups: those working in academia (mostly interested in the development of methodologies for risk analysis) and those working in applied fields with a wider experience in performing risk analyses for management purposes). The general atmosphere of the workshop was ideal for the success of the workshop, since all the attendees participated in the discussions in a very constructive and friendly manner. The breaks and the meals facilitated the interactions amongst the participants and therefore the flow of information around the discussion topics. The venue of the workshop, as well as the hotel were most of the participants were accommodated, greatly contributed to these positive synergies and the emergence of new ideas and collaborations.

The main topics of discussion were twofold: (1) the development of risk analysis protocols and (2) the application of risk analyses to prevention, control and eradication of biological invasions. We dedicated a day to each topic, while the last half day was dedicated to the general discussion of the workshop and the follow-up activities. The first two days were divided in two parts: the morning part was dedicated to 30-minutes presentations about to the topic under discussion, while in the afternoon the participants were randomly divided in two groups to discuss around a specific topic. We run two parallel sessions instead of one to encourage the participation of all the attendees, i.e. to facilitate discussions and to accelerate the emergence of new ideas. The decision proved to be good, since the discussions were fluent and each group developed a different set of ideas. The conclusions derived from each group were presented to the rest of participants the following day.

During the first day we agreed that besides the multiple advances in the field of risk analyses, there are still constraints that limit the development of efficient and helpful protocols. These limitations relate to: (i) the lack of knowledge on the factors influencing the different stages of the invasions process, (ii) the lack of data available to produce more objective quantifications of the risks posed by some exotic species, and (iii) the various sources of uncertainty influencing the results of risk analyses. In addition to these limitations,

the incorporation of economic costs into the protocols for risk analyses emerged as crucial to provide more realistic approximations. While these limitations can affect any risk assessment protocol, during the second day we examined the particularities that affect the implementation of risk analyses at the European level. There was agreement that the different circumstances of each country - in terms of the invasive species present and their capacity to respond effectively to these invasions as well as differing legislations and administrative organisations - were the main constraints to the establishment of a common strategy for the development and application of risk analyses. To propose and guide the development of such a strategy, it is thus necessary to identify the idiosyncracies of each country and therefore understand the similarities/differences amongst them in terms of invasive alien management.

Through the discussion of these topics we accomplished the research objectives of the workshop, which were the identification of the gaps of knowledge in the development of risk analyses regarding biological invasions and the elaboration of a strategy for the implementation of risk analyses in Europe. We identified three key aspects that should guide future scientific investigations: (1) the development of a common framework for the comparision of risk analyses that take into account the different sources of uncertainty; (2) the use of economic “rate of return” frameworks to examine the cost-benefit balance of risk management actions to provide a series of guidelines for the implementation of risk analyses considering different budgetary scenarios; and finally (3) the revision and evaluation of the policies and actions regarding the management of biological invasions implemented in the different European countries. Each of these key themes will be examined and discussed in a scientific paper to be submitted to an international peer-reviewed journal (see supplementary data for the manuscript outlines).

Overall, we consider the workshop a success. The research objectives were partially met; “partially” because they were updated based on the information provided during the presentations and the discussion groups (for example, instead of providing a strategy for the implementation of risk analyses at the European level we agreed to review the policies and practices undertaken in each country). Additionally, we also gained a series of additional benefits/outcomes through the interactions of the different participants. We have now identified a first core of scientists with whom we have established a network of researchers working on risk analyses. The skills and interests of the group are broad, but at the same time focused enough to allow exchanges around the management of biological invasions and the application of risk analyses. Although we have not set up a specific framework for the elaboration of a more formal endeavour (such as the submission of an European project or the constitution of a ESF Research Networking Programme), we have agreed in the way to work from now on and fixed deadlines to cooperate in the development of the key themes highlighted in the previous paragraph.

2. Scientific content of the event

The original objectives of the workshop were: (i) the identification of the gaps of knowledge and challenges to address in the development of risk analyses regarding biological invasions, and (ii) the proposal of a strategy for the implementation of such tools in the management of alien species at the European level. To achieve these objectives we divided

the workshop in two main sessions: the first session was dedicated to the devepment of risk analyses, while the second one to the application of risk analysis for managing biological invasions. We dedicated a day to each session, with the mornings composed of various 30-minutes presentations around the question under study and the afternoons to the discussion groups. The participants were randomly splitted in two groups, to facilitate discussions and to allow more ideas/perspectives to emerge. The results of the discussions were presented to the rest of the participants the first hour of the next day. The last half day of the workshop was dedicated to the general discussion and the establishment of collaborations between the participants.

Monday 18 April

The first hour of the workshop was dedicated to the presentation of the workshop and the European Science Foundation, followed by a brief self-presentation of the participants to better know each other and promote the interactions during the following sessions.

The discussion topic of the day was the development of methodologies for risk analyses. The aim was to examine the state of the art of risk analyses and to identify the gaps of knowledge in the methods and the drivers determining invasions. The first talk of the morning was presented by Mark A. Burgman, which has a long-standing experience in risk analyses as a researcher and director of the Australian Centre of Excellence for Risk Analysis. He presented the fundamentals of risk analyses, emphasizing the different types and levels of uncertainty and how this has been addressed in different approaches. The next talk was given by Jaakko O. Heikkilä, who is a senior researcher at the MTT Agrifood Research Finland, Economic Research Unit. He presented a review of studies employing risk assessment analyses to identify alien plant species, highlighting the emerging strength and weaknesses of the different methodological approaches. The third presenter was David M. Richardson, the deputy director of the Centre for Invasion Biology. Due to his long-standing experience in plant invasions, his presentation dealt with the drivers (both related to the traits of species and features of the environment) responsible for the introduction, establishment and spread of invasive alien plants. Multiple studies have investigated the drivers of plants invasions in the last years, but current research are moving towards more general models with a wide applicability. Focusing now in vertebrates, Daniel Sol from the Centre for Ecological Research and Forestry Applications (Spanish National Research Council) talked about the features that make a species a successful invader. There are many features that have been proposed to define successful invader, yet for vertebrates the most firmly supported are ecological generalism and behavioural plasticity. The following talk was given by Sven Bacher from the University of Fribourg. He presented a scheme for the prioritization of management actions based on the ecologic, economic and societal impacts of invasive species caused to the environment. The project was funded by the ministries of Environment and Agriculture of the Swiss government, and the scheme resulted from a tigthed collaboration between scientists and managers. Finally, Brian Leung from McGill University discussed about the need to integrate economics into risk analyses to make them more realistic and help managers weight the different management alternatives. He illustrated his points with the case study of the zebra mussel in North America.

The afternoon session was dedicated to the discussion around a specific question: “where do uncertainties in risk analyses come from?”. We decided to focus the discussion on this

topic as it is the most important and controversional issue to be solved. As indicated above, the discussion was run in two parallel groups.

One group identified and detailed the different types of uncertainty (model uncertainty, parameters uncertainty and observational error) at the different stages of the invasion process (introduction, establishment, spread and impact). There was some controversy on the best way to proceed, given the different participants' backgrounds ranging from a mathematical perspective to those more inclined to use expert judgement. Instead of becoming a major problem, this controversy made them realize that a major challenge in risk analyses is to develop a common framework in which to compare risk analysis protocols. In the course of the discussion, the question raised whether uncertainties in predicting the fate of introductions can be reduced if we use better methods/approaches. Then the group discussed how uncertainty can be quantified and proposed that a hierarchical Bayesian framework serve best, even in cases where there are limited data. Understanding the relationship between propagule pressure and invasion success was suggested to be the most critical step to reduce the levels of uncertainty inherent to the invasion process. A concept of a hierarchical Bayesian framework was sketchet which accounts for quantifiable uncertainties and where later steps in the invasions process would build on the previous steps.

The other group decided that before addressing the issue of uncertainties, it was necessary to ask how risk assessments can help mitigating the impact of invaders. The conclusion was that risk analyses can offer an important tool along all steps of an invasion, that is for preventing entrance, establishment, spread and impact of invaders in the light of trade-offs and economic limitations. Risk analyses may guide decisions in (1) allowing import of non-indigenous species either with no or few conditions or with stringent conditions (e.g. black-while-lists), (2) developing monitoring programmes and contingency plans for early warning and rapid responses to avoid establishment and spread of introduced species, and (3) prioritizing to control or eradicate a potentially dangerous non-indigenous species. RAs also may help influence political decisions by informing the public about the economic and ecologic risk of releasing exotic species. The group also discussed whether or not it is possible to built accurate RAs, concluding that this is possible provided that the risk analysis (1) is logic (transitive, associative) and probabilistic (not arbitrary), (2) allows an intuitive interpretation of risks (i.e. is science-based, consistent with data, comparable and repeatable), (3) incorporates economic costs and benefits, (4) considers most invasion stages, (5) take into account species-environment interactions, and (6) is designed to consider uncertainties explicitly. We identified three main sources of uncertainties: (1) lack of knowledge, (2) natural variation associated with environmental, demographic and genetic stochasticity, and (3) terminology or linguistic issues (misunderstandings, even when using probabilistic approaches). As the second has no solution and the third should be relatively easy to deal with, we focused on the first source of stochasticity. Here we distinguished uncertainties arising during the risk analysis development (methodology) from those arising from a lack of knowledge on the organism (biological and environmental unknowns). There was agreement that the first level of uncertainty depends on the purpose of the risk analysis (entrance, establishment, spread, impact) and that we need to accept from the beginning that the information is imperfect. But what level of uncertainty is acceptable? Again it depends on the purpose of the risk analysis and becomes less important when used as prioritization. Here there was some controversy in the discussion over quantitative vs. qualitative risk

analysis approaches, although we agreed that in qualitative systems uncertaintities are more difficult to incorporate, and that statistical approaches should minimise the uncertainty of subjectively assigning weights to different questions and avoid the tendency to be over confident on things we know the least. To asses the degree of uncertainty in a risk analysis one can use independent validation or sensitive analyses (e.g. to test how sensible are the outcomes to each question). The second source of uncertainity (biological and environmental unknowns) comes from the lack of knowledge about the organism. This raises the question of whether we canpredict the risk of organisms for which there is no information on the factors that influence establishment, spread and/or impact.

Tuesday 19 April

The first hour of the morning was dedicated to present the results of the afternoon sessions of the previous day and to highlight the most interesting themes for posterior analyses. We agreed on the importance of uncertainty in building accurate risk analyses for biological invasions and the need to provide a common framework for identifying/describing these different types of uncertainty. We decided to write up a review article on this topic.

The discussion topic of the second day was the application of risk analyses in the prevention and control of biological invasions. The first presenter was Piero Genovesi from the Institute for Environmental Protection and Research, who has a long-standing experience in the management of biological invasions and the difficult process of implementation at political leels. After showing the different policies available at the European level concerning invasive species, he presented the framework of the forthcoming EU strategy on invasive alien species and the various working groups currently dedicated to prevention, early warning and rapid response, and eradication, control and restoration of invasive alien species. His talk highlighted several challenges faced by the development of risk analyses in EU (such as the adequacy/reliability of risk anlayses, climate change and large scale “assisted migrations”) and the need (due to the main alien species already known to occur in Europe) for different RA-systems (quick screening versus detailed risk analyses). This was also acknowledged by the European Plant Protection Organization, which currently develops “compact Pest Risk Assessments” (for quick screening) made of their regular but time- and labour-consuming Pest Risk Assessments. The exact nature of the forthcoming EU strategy is still under debate and the results of the workshop (if delivered within one or two years) may be influential and helpful to the European Commission and the political process. The following presenter was Franz Essl from the Environmental Agency Austria. He presented the risk analysis scheme developed for Germany and Austria (GABLIS) and how this scheme (basically a black list approach) can be used to prioritize management actions. The system currently is – although legally not binding – used in Germany. There are, however, a series of challenges (such as the integration of impacts across time and space, the time lags caused by socio-economic activities, the differences between the realized and fundamental niche of species, and the non-standardizable “expert knowledge” judgements for risk assessment) that need to be considered to increase the predictive capacity and to decrease the level of uncertainty of risk analyses. The next talk was conducted by Françoise Petter from the European Plant Protection Organization (EPPO). She presented the tools available for Pest Risk Assessments to avoid the entrance and expansion of invasive alien organisms (bacteria, viruses, fungi, arthropods) that harm plants of economic interest. She stressed several aspects (such as degree of uncertainty and length of the protocol) that should be considered

in the future application of risk analyses and additional activities at the EPPO (such as promoting Code of Conducts for Horticulture and including invasive alien plants species that are ecological harmful in Pest Risk Assessments under a broadened legal plant protection framework). After the EPPO overview, Stephan Gollasch head of the private enterprise GoConsult focused on the management of invasive alien species in ballast waters. He presented the characteristics and limitations of risk analyses under the perspective of the IMO Ballast Water Management Convention, followed by an introduction of the application or risk assessment to the Baltic Sea. He identified the major gaps of knowledge and several guidelines to undertake in future practices. The last talk of the morning was given by Katharina Dehnen-Schmutz from the University of Warwick. She presented the problem of ornamental plants in UK and how the introduction of exotic plants species is regulated, using a species as an example to emphasize the different possibilities available to their regulation.

The discussions during the afternoon session were related to the development of a strategy for the implementation of risk analyses at the European level. The participants were again split in two groups and discussed different aspects separately.

One group - after a brief discussion on the possibility to develop a European strategy for risk analysis - concluded that this currently is under development at the European level by the European Comission and that it would be more efficient to narrow down the discussion to a few specific topics. By conducting a brainstorming process where the opinion of policy-makers was considered to be of high relevance, the participants agreed to pursue an avenue from risk analyses to risk management. The latter could be tangled by economic methods optimizing the rate of return among several eradication programs. The particulars of such an approach, especially data availability, definition and quantification of key terms such as “risk”, “discounting”, “costs” and “success” were topics that merited to be examined in detail.

The other group discussed possible gaps towards a Strategey for risk analyses of invasive alien species in Europe. The group agreed that existing systems should be improved and further developed (e.g. animal and plant health sectors, Aquaculture Directive, Pet trade regulation, etc.), and that new systems are needed to fill existing gaps. Gaps were identified at different levels (e.g. environments, taxa, pathways, countries). The group also agreed that a broader set of RA-tools is necessary to get hold of the many alien species in a short time: a pre-screening or quick screening tool (“compact RA”) and an in-depth analysis for selected species (“detailed RA”). Different approaches (including an exit-strategy) are needed for proper response at different stages of the invasion process (“fit for purpose”). At the political level, cooperation of RA between neighbouring countries or regions should be strengthened and the existing lack of implementation and execution of legislation reduced. The group then discussed the aims and scope of a publication targeting this political level of RA and decided to start with a descriptive analysis of the coverage of policy instruments related to risk analyses (taxa, environments, pathways, early warning and rapid response, contingency plans, prioritization for management actions and/or RA, IAS-monitoring programmes, obligatory eradication actions, legal status, etc) across European countries and compare this with existing data of numbers of IAS (taken from the DAISIE-database). With spatial autocorrelation statistics and considering confounding factors (e.g. wealth of countries, length of common borders) a map of consistencies or inconsistencies may emerge that can be useful for European decision-makers where gaps need to be closed or where to focus future efforts. Depending on the availability of data (which need to be checked) a temporal

analysis of the effects of policy instruments in European countries may be done for selected invasion steps and taxa. The group finally discussed the need for a central depository or platform of existing European RA-Systems, including description of methods, assessments, and list of experts. The possibility of a “Virtual Lab on IAS” to be developed within LIFEWATCH (http://www.lifewatch.eu/) was briefly touched.

Wednesday 20 April

As we did on Tuesday, the first hour of the day was dedicated to bring together the ideas emerged during the afternoon discussions of the previous day. All the participants agreed that the themes identified by the two groups should be examined in more detail and therefore be developed in further collaborative efforts.

The rest of the morning was dedicated to agree on the ideas emerged during the two discussion sessions, and to decide the way to move forward. We identified the main themes, as well as the leaders to develop them. The leaders had the responsibility to write a manuscript outline to distribute amongst the participants. In this way, the participants will have the opportunity to commit themselves to the development of the different themes depending on their affinities and experience. The idea is to produce a scientific paper from each theme, as well as to maintain the collaboration amongst the participants through this informal research network.

3. Assessment of the results, contribution to the future direction of the field, outcome

The various presentations and discussion groups made evident that, even though the multiple advances in the development and application of risk analyses, there is still a lot to do at the European level. The most relevant issues that emerged during the discussion were the following ones:

- The dichotomy between qualitative and quantitative approaches for risk analyses is still a problem. The selection of the methodological approach depends on the quality and availability of the data, but there is still an important debate on which method is more appropriate. It seems that qualitative approaches are being used because of their simplicity, while quantitative ones are used when appropriate data is available. In any case, it is important to emphasize that the link between these two approaches is still not clear, and that this confusion creates problems when it comes to unify the two approximations.
- Different types of uncertainties can affect risk analyses. To develop reliable protocols and produce well-grounded decisions for managing biological invasions, it is thus necessary to examine carefully the different types of uncertainties and to develop tests to identify/quantify them (were possible). Clear guidelines on how to identify and include uncertainties in risk analysis should be developed.
- The lack of a common framework to describe and compare different protocols for risk analyses is a major impediment for the development of a strategy regarding the implementation of risk analyses in Europe. Even though risk analyses need to be adjusted to the peculiarities of each case study (such as the stage of the invasion process under study, group of species, uncertainties in data, etc), it is important to

contextualize them in a broader framework to understand what each protocol is evaluating and which degree of confidence can be associated to the final results. This is important not only for the applicability of the model, but also to create a common understanding and terminology between researchers, managers, stake-holders and decision-makers regarding risk analyses.

- The economic costs derived from the introduction/expansion of exotic species and the actions required to control/eradicate them need to be incorporated into risk analysis schemes. Decisions are taken and funds allocated based on a trade-off between the status of the biological invasions and the budget available over time. Therefore, it is necessary to include the cost associated with different management strategies (or no-strategies) into risk analyses to spend the budget in the most efficient way. In addition, economic analyses may be useful in assessing when to stop taking actions (exit-strategies)
- A strategy for the development and application of risk analyses at the European level is necessary to manage biological invasions efficiently. Species are not constrained to a specific admistrative region, therefore countries need to set a common playground in which to set priorities for action and unify efforts. Besides the numerous difficulties to produce such a common strategy (due to different priorities, management capacities, policies and regulations, etc.), it is important to know the policies available and practices undertaken at each European country regarding the control of biological invasions. Identifying the circumstances present in each country will permit to establish a series of guidelines to propose a European strategy for the development and implementation of risk analyses.

In addition to these issues, we also discussed a series of other topics related with the development and implementation of risk analyses. However, here we only present those themes that set the bases for the post-workshop collaborations in the form of developing and writing scientific papers. The first three topics (bullet points) will be discussed together in a single paper; the idea behind this study is to produce a general framework for the comparison of risk analyses. The last two topics will be discussed in two separate papers, one examining the literature and data available on the economic costs of different eradication programmes and one reviewing the policies available in terms of biological invasions at the European level. As mentioned in the previous sections, we assigned a leader to each topic (namely Brian Leung, Ingolf Kühn and Wolfgang Rabitsch), but different participants will be invited to join the different groups depending on their affinities. We expect to continue the collaborations through the development of these various products. (See Supplementary data for manuscript outlines).

We decided not to submit a proposal for an ESF Research Networking Programe or a European project at this stage, but we agreed that it would be worth to perform a follow-up workshop to examine the progress made and address additional questions in two years time. We preferred to first set an informal network of experts and after achieving the proposed research outputs to establish a more formal collaboration. Nevertheless, the general feeling amongst the participants was that the workshop was a success and we intend to consolidate our cooperations.

4. Final programme

Sunday 17 April 2011

Afternoon	*Arrival*
20:00	*Get-together, social event, informal (Hotel Peninsular)*

Monday 18 June 2011

09.00-09.30	**Inaugural Address and Presentation of the European Science Foundation (ESF)** Núria Roura-Pascual (University of Girona, Girona, Catalonia, Spain)
09.30-10.00	Presentation of the Participants
10.00-13.30	**SESSION 1 (presentations): Building Risk Analyses**
10.00-10.30	**Presentation 1** "Fundamentals of risk analyses" Mark A. Burgman (Australian Centre of Excellence for Risk Analysis, Melbourne, Australia)
10.30-11.0	**Presentation 2** "Practices, strengths and weaknesses of risk ranking: results from a review" Jaakko O. Heikkilä (MTT, Helsinki, Finland)
11.00-11.30	*Coffee / Tea Break*
11.30-12.00	**Presentation 3** "Drivers of plant invasions – emerging ideas & implications for risk assessment" David M. Richardson (Centre for Invasion Biology, Stellenbosch, South Africa)
12.00-12.30	**Presentation 4** "Factors driving invasions in vertebrates" Daniel Sol (Centre for Ecological Research and Applied Forestries Faculty/Spanish National Research Council, Barcelona, Catalonia, Spain)
12.30-13.00	**Presentation 5** "How to quantify and compare impacts across species: the case of vertebrates" Sven Bacher (Department of Biology, Ecology and Evolution Unit, University of Fribourg, Fribourg, Switzerland)
13.00-13.30	**Presentation 6** "Bioeconomic risk analyses" Brian Leung (McGill University, Montreal, Canada)
13.30-14.30	*Lunch*
14.30-18.00	**SESSION 1 (discussion): Building Risk Analyses**
14.30-16.00	**Discussion** "Development of risk analyses"
16.00-16.30	*Coffee / tea break*
16.30-18.00	**Discussion** "Development of risk analyses"
21.00	*Dinner*

Tuesday 19 April 2011

09.00-10.00	**Workshop updates** Daniel Sol (Centre for Ecological Research and Applied Forestries Faculty, Barcelona, Spain)
10.00-13.00	**SESSION 2 (presentations): Applying Risk Analyses**

10.00-10.30	**Presentation 1** “Implementation of the risk analyses in the European policies on invasive alien species” Piero Genovesi (Institute for Environmental Protection and Research, Rome, Italy)
10.30-11.00	*Coffee / Tea Break*
11.00-11.30	**Presentation 2** “Analysis of risk assessment systems in Europe: status quo, lessons learned and some challenges?” Franz Essl (Environmental Agency Austria, Wien, Austria)
11.30-12.00	**Presentation 3** “Risk analysis for plant pests in Europe” Françoise Petter (European Plant Protection Organization, Paris, France)
12.00-12.30	**Presentation 4** “Risk assessment from the IMO Ballast Water Management Convention perspective” Stephan Gollasch (GoConsult, Hamburg, Germany)
12.30-13.00	**Presentation 5** “How can we manage the invasion risk of ornamental garden plants?” Katharina Dehnen-Schmutz (University of Warwick, Warwick, United Kingdom)
13.00-14.30	*Lunch*
14.30-18.00	**SESSION 2 (discussion): Applying Risk Analyses**
14.30-16.00	**Discussion** “Strategy for risk assessments of alien species in Europe”
16.00-16.30	*Coffee / tea break*
16.30-18.00	**Discussion** “Strategy for risk assessments of alien species in Europe”
21.00	*Dinner*

Wednesday 20 April 2011

09.00-10.00	**Workshop updates** Ingolf Kühn (Helmholtz Centre for Environmental Research, Halle, Germany)
10.00-14.30	**SESSION 3: General conclusions**
10.00-10.30	**General discussion**
10.30-11.00	*Coffee / Tea Break*
11.00-12.30	**Follow-up activities/networking/collaborations**
12.30-13.00	**Closing Address** Wolfgang Rabitsch (Environmental Agency Austria, Wien, Austria)
13.00-14.30	*Lunch*
14.30	*End of Workshop and departure*

5. Final list of participants

Núria Roura-Pascual (University of Girona, Catalonia, Spain)
Daniel Sol (Centre for Ecological Research and Forestry Applications/Spanish National Research Council, Catalonia, Spain)
Ingolf Kühn (Helmholtz Centre for Environmental Research – UFZ, Germany)
Wolfgang Rabitsch (Environmental Agency Austria, Austria)
Sven Bacher (University of Fribourg, Switzerland)
Lluís Brotons (Tecnologic Forestry Center of Catalonia, Catalonia, Spain)
Mark A. Burgman (Australian Centre of Excellence for Risk Analysis, University of Melbourne, Australia)
Miguel Clavero (Estación Biológica de Doñana, Spain)
Katharina Dehnen-Schmutz (University of Warwick, United Kingdom)
Alana den Breeyen (Stellenbosch University, South Africa)
Franz Essl (Environmental Agency Austria, Austria)
Piero Genovesi (Institute for Environmental Protection and Research, Italy)
Stephan Gollasch (GoConsult, Germany)
Jaakko O. Heikkilä (MTT, Finland)
Brian Leung (McGill University, Canada)
Niall P. Moore (Agriculture and Environment Ministries, United Kingdom)
Jan Pergl (Academy of Sciences of the Czech Republic, Czech Republic)
Françoise Petter (European Plant Protection Organization, France)
David M. Richardson (Centre for Invasion Biology, South Africa)
Mark van Kleunen (University of Konstanz, Germany)
Montserrat Vilà (Estación Biológica de Doñana, Spain)

6. Statistical information on participants

Age:

<40 years = 10
40-50 years = 8
>50 years = 3

Countries of origin:

Australia = 1
Austria = 2
Canada = 1
Czech Republic = 1
Finland = 1
France = 1
Italy = 1
Germany = 3
South Africa = 2
Spain = 5
Switzerland = 1
United Kingdom = 2

Sex:

Female = 5
Male = 16