Prioritisation of Invasive Alien Plants

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Presentation outlines

1. Why is important to set priorities?
2. How can we set priorities?
3. The EPPO Method
4. Some applications of the EPPO Method
5. News

Brundu & van Valkenburg 2012
1. Why is important to set priorities?
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Figure 2c. Brine spraying. Brundu & van Valkenburg 2012
Target 9

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

*Cfr* -https://www.cbd.int/sp/targets/rationale/target-9/

In decision X/2, the tenth meeting of the Conference of the Parties, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, adopted a revised and updated *Strategic Plan for Biodiversity*, including the Aichi Biodiversity Targets, for the 2011-2020 period.

Brundu & van Valkenburg 2012
EU biodiversity strategy to 2020

Target 5: Help combat Invasive Alien Species

By 2020, Invasive Alien Species (IAS) and their pathways are identified and prioritised, priority species are controlled or eradicated, and pathways are managed to prevent the introduction and establishment of new IAS.

-http://biodiversity.europa.eu/policy/eu-biodiversity-strategy-

Brundu & van Valkenburg 2012
Target 5 Combat Invasive Alien Species

By 2020, Invasive Alien Species (IAS) and their pathways are identified and prioritised, priority species are controlled or eradicated, and pathways are managed to prevent the introduction and establishment of new IAS.

Action 15 Strengthen the EU Plant and Animal Health Regimes

15) The Commission will integrate additional biodiversity concerns into the Plant and Animal Health Regimes by 2012.

Action 16 Establish a dedicated legislative instrument on Invasive Alien Species

16) The Commission will fill policy gaps in combating IAS by developing a dedicated legislative instrument by 2012.
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By 2020, **invasive** alien species and **pathways** are identified and **prioritized**, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Brundu & van Valkenburg 2012
There is an ongoing debate and research on most of the main concepts in invasion biology and management, such as on invasiveness, impacts, risk analysis, prioritization, pathways …….. etc.
Naturalization and invasion of alien plants: concepts and definitions

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Alien plants in checklists and floras: towards better communication between taxonomists and ecologists

Petr Pyšek1, David M. Richardson2, Marcel Rejmánek3, Grady L. Webster4, Mark Williamson5 & Jan Kirschner1

Invasive plants3

Naturalized plants that produce reproductive offspring, often in very large numbers, at considerable distances from parent plants (approximate scales: > 100 m; < 50 years for taxa spreading by seeds and other propagules; > 6 m/3 years for taxa spreading by roots, rhizomes, stolons, or creeping stems), and thus have the potential to spread over a considerable area.

A proposed unified framework for biological invasions

Tim M. Blackburn1,2, Petr Pyšek3,4, Sven Bacher5, James T. Carlton6, Richard P. Duncan7, Vojtěch Jarošík4,3, John R.U. Wilson8,9 and David M. Richardson8

An alien approach to invasive species: objectivity and society in invasion biology

Brendon M. H. Larson

Subjectivity and flexibility in invasion terminology: too much of a good thing?

Robert I. Colautti · David M. Richardson
A neutral terminology to define ‘invasive’ species

Robert I. Colautti* and Hugh J. MacIsaac

DOI 10.1007/s10530-006-9034-4

The invasiveness of an introduced species does not predict its impact

Anthony Ricciardi · Jill Cohen

DOI 10.1007/s10530-007-9209-7

In search of a real definition of the biological invasion phenomenon itself

Loïc Valéry · Hervé Fritz · Jean-Claude Lefeuivre · Daniel Simberloff
Consistent accuracy of the Australian weed risk assessment system across varied geographies

Doria R. Gordon, Daphne A. Onderdonk, Alison M. Fox and Randall K. Stocker

Application and evaluation of classification trees for screening unwanted plants

PETER CALEY AND PETRA M. KUHNNERT

Risk Assessment for Invasive Species

Mark C. Andersen, Heather Adams, Bruce Hope, and Mark Powell

A Risk-Assessment System for Screening Out Invasive Pest Plants from Hawaii and Other Pacific Islands

CURTIS C. DAehler, JULIE S. DENsLOW, SHAHIN ANSARI, AND HUang-CHI KUO

The Invasive Species Assessment Protocol: A Tool for Creating Regional and National Lists of Invasive Nonnative Plants that Negatively Impact Biodiversity

John M. Randall, Larry E. Morse, Nancy Bento, Ron Hiebert, Stephanie Lu, and Terri Killeffer

Screening new plant introductions for potential invasiveness: a test of impacts for the United States

Doria R. Gordon & Crysta A. Gantz

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2 Department of Botany, University of Florida, P.O. Box 118526, Gainesville, Florida 32611, USA
Measuring IMPACTS

\[ I = R \times A \times E \]  (Parker et al., 1999)

\[ I = A \times F \times C \]  (Ricciardi, 2003)

\[ I = F_t \times F_e \times F_s \times E \]  (Lockwood et al., 2007)
Impact assessment revisited: improving the theoretical basis for management of invasive alien species

Jan Thiele · Johannes Kollmann · Bo Markussen · Annette Otte

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Abstract The theoretical underpinnings of the assessment of invasive alien species impacts need to be improved. At present most approaches are unreliable to quantify impact at regional scales and do not allow for comparison of different invasive species. There are four basic problems that need to be addressed: (1) Some impacted ecosystem traits are spatially not additive; (2) invader effects may increase non-linearly with abundance or there may be effect thresholds impairing estimates of linear impact models; (3) the abundance and impact of alien species will often co-vary with environmental variation; and (4) the total invaded range is an inappropriate measure for quantifying regional impact because the habitat area available for invasion can vary markedly among invasive species. Mathematical models and empirical data using an invasive alien plant species (Heteroecium mantegazzianum) indicate that ignoring these issues leads to impact estimates almost an order of magnitude from the real value. Thus, we propose a habitat-sensitive formula for regional impact assessment that is unaffected by non-linearity. Furthermore, we make some statistical suggestions on how to assess invader effects properly and we discuss the quantification of the invaded range. These improvements are crucial for impact assessment with the overall aim of prioritizing management of invasive species.

Keywords Biological invasion · Ecological impact · Heteroecium mantegazzianum · Invaded range · Non-native species · Quantification of regional impacts

Introduction

The impact of invasive alien species on ecosystem traits presents one of the major challenges of applied ecological research. Currently, scientists are trying to improve the theoretical basis for assessing the consequences of biological invasions (e.g. Reaser et al. 2007). Rigorous impact assessment is of vital
Impacts of biological invasions: what’s what and the way forward

Daniel Simberloff¹, Jean-Louis Martin², Piero Genovesi³, Virginie Maris², David A. Wardle⁴, James Aronson²,⁵, Franck Courchamp⁶, Bella Galil⁷, Emili García-Berthou⁸, Michel Pascal⁹, Petr Pyšek¹⁰,¹¹, Ronaldo Sousa¹²,¹³, Eric Tabacchi¹⁴ and Montserrat Vila¹⁵*

A range of impacts: difficult to evaluate, uncertain, delayed, and pervasive

Difficult to evaluate

An ecological impact consists of any significant change in an ecological pattern or process [16]. Much popular literature and some scientific literature becloud invasion impacts and responses of species, communities, and ecosystems in two ways. First is the practice of designating native species as ‘good’ and introduced species as ‘bad.’ Species are neither and, furthermore, invasion pertains to the population level, not the species level. Different stakeholders can view an introduced population as ‘harmful’ or ‘useful’ [17]. When the Japanese tiger prawn Marsupe-
**Invasiveness** *(Invasion status, Invasive behaviour, Invasive success etc.)* & **Impacts** can be considered as a (non linear) function of different variables (or processes), at least of the following ones:

(1) Definitions under concern *(species, habitat, impact etc.)* including legislation framework;

(2) Taxon under assessment *(population variability, invasiveness traits etc.)*;

(3) Habitat *(habitat invasibility, habitat conservation value etc.)*;

(4) Geographical location;

(5) Time *(invasion stages, date of introduction etc.)*;

(6) Invaded range & rate of spread;

(7) Introduction pathway;

(8) Assessment methods and reference scale.

Brundu & van Valkenburg 2012
TOTAL ALIEN FLORA

NATURALIZED ALIEN FLORA

INVASIVE ALIENS

Brundu & van Valkenburg 2012
International – National Legislation

Agriculture, Forestry, Horticultural industry – trade, economical impacts

Conservation of natural habitats and landscapes, nature protection

Management activities, eradication, containment, control

Human health and ecosystem’s services

Stakeholder’s perception
Representation of the invasiveness concept in a 3D space
Invasiveness concept in a 2D space (Impact x Spread)

Brundu & van Valkenburg 2012
Exotic Plants

 Serious Threat
Hard to Control

 Serious Threat
Easy to Control

 Lesser Threat
Hard to Control

 Lesser Threat
Easy to Control

Significance of Impact

Feasability of Control

(Hiebert and Stubbendieck 1993; Heibert 2001)
BOX 1

Schematic classification of the main criteria in use for prioritizing or ranking pathways

In the lack of a common agreed method for (pathways) risk assessment, several approaches are actually in use, with different levels of integration or overlapping:

1. **Biogeographical** approach. As is possible to distinguish between IAS alien to Europe and IAS alien in Europe, pathways responsible for the introduction or species alien to Europe could be considered a priority in comparison to those that promote the spread of a species alien in Europe, i.e. not considered alien in some countries, or already established in part of the EU;

2. **“Ecological”** approach (propagule pressure, number, frequency, spatial extent, probability of establishment). From this point of view, pathways responsible for higher propagule pressures should be considered a priority;

3. **Taxonomical** approach (species-specific approach, invasive alien species or main tax. groups involved/transported). According to this approach, all the pathways related to the introduction of a given species (or group of species), should be considered a priority (sometimes also when a risk assessment is not yet available for all the species in that group);

4. **Impacts’** approach (ecosystems, habitats or species affected/invaded/degraded – economical costs, etc.). According to this approach are priority pathways those responsible for the introduction of species that can or could have negative impacts. There is not an agreed methodology for assessing impacts, therefore, different types of impacts may be considered and assessed in different ways. Additionally, the evaluation may change in accordance to the type of habitat, land use, ecosystem etc., that might be affected;

5. **Management** approach (pathways not already covered by other EU legislation, possibility to regulate/detect/inspect). From this point of view, priorities pathways are those that could be regulated or mitigated in some way. Concerning legislation tools, some pathways are already dealt with by a series of other EU legislations (plant, animal health, aquaculture etc.), while others are not addressed, and therefore could be considered a priority for legislation action. Additionally, after an eradication intervention, the pathways that could be responsible for a reintroduction of the eradicated taxa could be considered a priority for management.

Brundu et al., 2011
1. Why is important to set priorities?
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EPPO and Pest Risk Analysis

One of EPPO’s main priorities is to prevent the introduction of dangerous pests (bacteria, fungi, insects, plants, viruses...) from other parts of the world, and to limit their spread within the region should they be introduced. In recent years, trade networks have expanded and diversified, increasing the risks of introducing pests to new geographical areas. Measures adopted by countries to protect their territories from these introductions should be technically justified and an International Standard for Phytosanitary Measures (ISPM) on Pest Risk Analysis (ISPM no. 11) has been developed in the International Plant Protection Convention (IPPC) framework. Since the 1990s, the following developments have taken place within EPPO:

- EPPO has developed a decision-support scheme for Pest Risk Analysis and a computer program (CAPRA) to assist pest risk analysts in running the decision-support scheme - read more >>
- A Panel on PRA development has been created - read more >>
- Expert Working Groups (EWGs) are now being convened to conduct PRAs on specific pests - read more >>

**EPPO Standards and CAPRA**

- PM 5/3(5) Decision-support scheme for quarantine pests - version 2011 | Russian
  (warning: the 2011 version has not yet been translated into French, so for the moment this is a translation of the 2009 version: French)
Role of EPPO in the development of regional Standards on PRA

The EPPO Panel on PRA has been involved in developing schemes for pest risk assessment and pest risk management. Now that international standards have been adopted (ISPM 11 on Pest Risk Analysis for Quarantine Pests and its supplement), these international standards are the international reference for the SPS framework which would be the basis in case of disputes.

EPPO member countries considered that the EPPO Standards should be adapted to this new situation but favoured to maintain the EPPO schemes on pest risk assessment and pest risk management as they had an added value compared to ISPM no. 11 on pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms in particular with a presentation in a logical sequence of questions addressing all the elements mentioned in this ISPM (although excluding GMO issues). In addition, as Risk Analyses also have to be performed on invasive alien plants, EPPO standards have been adopted to cover such pests.

The EPPO Schemes on pest risk assessment and pest risk management have now been replaced by an EPPO decision-support scheme (combining pest risk assessment and pest risk management) which is available on the EPPO website and revised by the Panel on PRA development on an annual basis.

The computerized version of the EPPO Decision-support scheme is now available and can be downloaded from this website.
PRAs conducted by EPPO Expert Working Groups

Since 2006, EPPO organizes meetings of Experts Working Groups which are conducting PRAs on specific pests following the EPPO Decision-support scheme and its computerized version CAPRA (see above). The conclusions resulting from these PRAs are addressed to the EPPO member countries only (the area potentially at risk that is considered during these PRAs is the EPPO region, not the other parts of the world).

- Finalized PRAs

<table>
<thead>
<tr>
<th>Pest</th>
<th>PRA Documents</th>
<th>Data sheets</th>
<th>Final decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insects and mites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agrilus anxius</td>
<td>PRA (11-16987)</td>
<td>PRA rep (11-16988)</td>
<td>Final DS</td>
</tr>
<tr>
<td>Aulacaspis yasumatsulii</td>
<td>PRA (09-14021)</td>
<td>PRA rep (09-14022)</td>
<td>-</td>
</tr>
<tr>
<td>Bactrocera invadens</td>
<td>PRA (10-16193)</td>
<td>PRA rep (10-16192)</td>
<td>-</td>
</tr>
<tr>
<td>Dioctidia frumenti</td>
<td>PRA (11-16940)</td>
<td>PRA rep (11-16939)</td>
<td>Draft DS (10-15162)</td>
</tr>
<tr>
<td>Drosophila suzukii</td>
<td>PRA (11-17189)</td>
<td>PRA rep (11-17190)</td>
<td>-</td>
</tr>
<tr>
<td>Epithrix spp.</td>
<td>PRA (11-17790)</td>
<td>PRA rep (11-17791)</td>
<td>-</td>
</tr>
<tr>
<td>Megalasticus mutatus</td>
<td>PRA (07-13322)</td>
<td>PRA rep (07-13358)</td>
<td>Final DS</td>
</tr>
<tr>
<td>Metanius hemipterus</td>
<td>PRA (08-15273)</td>
<td>PRA rep (08-15446)</td>
<td>Draft DS (09-15171)</td>
</tr>
<tr>
<td>Raphidina indica</td>
<td>PRA (08-14672)</td>
<td>PRA rep (09-15197)</td>
<td>-</td>
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<tr>
<td>Soperda candida</td>
<td>PRA (11-16980)</td>
<td>PRA rep (10-16044)</td>
<td>-</td>
</tr>
<tr>
<td>Tetranychus evansi</td>
<td>PRA (08-14559)</td>
<td>PRA rep (08-14562)</td>
<td>Draft DS (07-13374)</td>
</tr>
<tr>
<td>Nematodes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bursaphelenchus xyophilus</td>
<td>PRA (09-15449)</td>
<td>PRA rep (09-15450)</td>
<td>Final DS</td>
</tr>
<tr>
<td>Meloidogyne enterolobii</td>
<td>PRA (10-16243)</td>
<td>PRA rep (10-16245)</td>
<td>-</td>
</tr>
<tr>
<td>Fungi (and fungus-like)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phytophthora lateralis</td>
<td>PRA (06-12730)</td>
<td>PRA rep (06-12731)</td>
<td>Final DS</td>
</tr>
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</table>
### Invasive plants

<table>
<thead>
<tr>
<th>Invasive plants</th>
<th>PRA (date)</th>
<th>PRA rep (date)</th>
<th>Final DS</th>
<th>A2</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eichhornia crassipes</td>
<td>PRA (08-14407)</td>
<td>PRA rep (08-14408)</td>
<td>Final DS</td>
<td>A2</td>
<td>2008</td>
</tr>
<tr>
<td>Ludwigia grandiflora</td>
<td>PRA (11-16827)</td>
<td>PRA rep (11-17142)</td>
<td>Final DS</td>
<td>A2</td>
<td>2011</td>
</tr>
<tr>
<td>Ludwigia peploides</td>
<td>PRA (11-16828)</td>
<td>PRA rep (11-17143)</td>
<td>Final DS</td>
<td>A2</td>
<td>2011</td>
</tr>
<tr>
<td>Hydrocotyle ranunculoides</td>
<td>PRA (09-15108)</td>
<td>PRA rep (09-15161)</td>
<td>Final DS</td>
<td>A2</td>
<td>2005</td>
</tr>
<tr>
<td>Lysichiton americanus</td>
<td>PRA (09-15078)</td>
<td>PRA rep (09-15077)</td>
<td>Final DS</td>
<td>A2</td>
<td>2005 but deleted in 2009</td>
</tr>
</tbody>
</table>

- **PRAs which are under development or planned in the near future**

#### Pest

<table>
<thead>
<tr>
<th>Insects and mites</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apriona spp.</td>
<td>EWG planned in 2011 - PRA (NL) - <a href="#">Extracts of Panel reports</a></td>
</tr>
<tr>
<td>Keiferia lycopersicella</td>
<td>EWG met in September 2011 - PRA under development</td>
</tr>
<tr>
<td>Thaumatothilia leucotreta</td>
<td>EWG planned in 2011 - PRA (NL) - <a href="#">Extracts of Panel reports</a></td>
</tr>
</tbody>
</table>

#### Fungi and fungus-like
European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

National regulatory control systems
Systèmes de lutte nationaux réglementaires

Eichhornia crassipes

Identity
Scientific names Eichhornia crassipes (Griseb.)
Synonyms: E. microstachys (Griseb.)
Habitat: South America, Brazil, Argentina, Uruguay, Paraguay, Bolivia, Peru, Chile, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Argentina, Uruguay, Paraguay, Bolivia, Peru, Chile, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana

Common names: Eichhornia crassipes

Notes on taxonomy and nomenclature
Eichhornia crassipes is in the Pontederiaceae family, which is taxonomically controversial.

Specific scope
This standard describes the procedures for control of Eichhornia crassipes.

The plant is also recorded as invasive in Spain and Portugal.

Data sheets on quarantine pests
Fiches informatives sur les organismes de quarantaine

Eichhornia crassipes
Fig 4: Potential distribution of *Eichhornia crassipes* in the EPPO region.
1. Initiation
2.1 Pest categorization
2.2 Probability of entry
2.3 Probability of Establishment
2.4 Probability of spread
2.5 Conclusions on introduction and spread
2.6 Economic consequences
2.7 Uncertainty and PRA conclusions
3. PR Management

**Ludwigia peploides qualifies as a QUARANTINE PEST**

EPPO PRA (France) **Ludwigia peploides**

http://www.legifrance.gouv.fr/
The EPPO prioritization process for invasive alien plants

S. Brunel¹, E. Branquart², G. Fried³, J. van Valkenburg⁴, G. Brundu⁵, U. Starfinger⁶, S. Buholzer⁷, A. Uludag⁸, M. Joseffson⁹ and R. Baker¹⁰

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²Belgian Biodiversity Platform, Centre de recherche de la Nature, des Fôrets et du Bois, Avenue Marechal Juin 23, B-5030 Gembloux, Belgium
³LNPV, Station de Montpellier, Campus International, Avenue de l'Observatoire, 34095 Montpellier, France
⁴Plant Protection Service, Geertjesweg 15, P.O. Box 1, 2300 GA Leiden, The Netherlands
⁵Regione Autonoma della Sardegna, Assessorato alla Polizia di Stato Generale, Via Biasi n. 7, 09131 Cagliari, Italy
⁶Julius Kühn Institut (JKI), Federal Research Centre for Plant Protection and Postharvest Biology, 11/12, 38104 Braunschweig, Germany
⁷Agroscope Reckenholz- Tänikon Research Station, CH-8032 Zürich, Switzerland
⁸EEA, Kongens Nytorv 6, 1050 Copenhagen, Denmark
⁹Swedish Environmental Protection Agency, Stockholm, Sweden
¹⁰Food and Environment Research Agency, Salisbury, UK

This process is designed (i) to produce a list of invasive alien plants that are established or could potentially establish in the EPPO region and (ii) to determine which of these have the highest priority for an EPPO Pest Risk Analysis (PRA).

The highest priority for performing PRA is given to species that satisfy one or more of the following:

- are spreading rapidly (or are known to have a capacity to spread rapidly)
- are capable of causing major economic and environmental impacts.
- are moved from country to country primarily by human activities
- still have a significant area suitable for further spread and can still be eradicated or contained

It should be kept in mind that the process is designed to perform rapid assessments, and to provide structured and traceable information on species. It does not in any way provide a substitute for a PRA.
The EPPO prioritization process for IAP

General principles

The EPPO process is designed:

• A. to produce a reference list of IAP that are established or could potentially establish in the EPPO region.

• B. to determine which Invasive Alien Plants (IAP) have the highest priority for an EPPO pest risk analysis (= quick screening tool to identify potential quarantine organisms);

Brunel et al. (2010) Article freely available on request
A. Criteria to produce lists of invasive alien plants

A.1 Is the plant species known to be alien in all or significant part of the area under assessment?

A.2 Is the plant species established in at least a part of the area under assessment?

A.3 Is the plant known to be invasive outside the area under assessment?

A.4 Based on ecoclimatic conditions, could the species establish in the area under assessment?

A.5 How high is the spread potential of the plant?

A.6 How high is the potential negative impact of the plant on native species, habitats and ecosystems in the endangered area under assessment?

A.7 How high is the potential negative impact of the species on agriculture, horticulture and forestry in the endangered area under assessment?

A.8 Does the species have additional impacts in the endangered area under assessment?

The highest score to one of the 3 questions should be taken, but additional impacts (Q A.8) cannot be taken as the highest impact on their own.
A. Criteria to produce lists of invasive alien plants

Spread capacity of the plant under assessment
Natural dispersion + unintentional human assistance

Assessed through a combination of plant life-history traits and field dispersion data.

<table>
<thead>
<tr>
<th>Category</th>
<th>Dispersion distances</th>
<th>Dispersion agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt; a few meters/year</td>
<td>-</td>
</tr>
<tr>
<td>Medium</td>
<td>&lt; 200 meters/year</td>
<td>wind but heavy diaspores, ants</td>
</tr>
<tr>
<td>High</td>
<td>&gt;&gt; 500 meters/year</td>
<td>wind, water, vertebrates, unintentional human activities</td>
</tr>
</tbody>
</table>
### A. Criteria to produce lists of invasive alien plants

#### Environmental impact

**Dominance & colonization of semi-natural habitats**

**Difficulty in assessing environmental impacts, use of a proxy =**

- Plant species dominance, ability to make large, dense and persistent populations (cover > 80%) in semi-natural habitats.
- There is an exception for alien species hybridizing.
- Habitats invaded should be recorded.

<table>
<thead>
<tr>
<th>Category</th>
<th>Behaviour and habitat invaded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>does not form dense persistent populations and rarely colonizes habitats of conservation value</td>
</tr>
<tr>
<td>Medium</td>
<td>forms dense persistent populations only in modified habitats or occurs in habitats of conservation value but does not form dense persistent populations</td>
</tr>
<tr>
<td>High</td>
<td>forms dense persistent populations and in habitats of conservation value or is able to hybridize with native plants</td>
</tr>
</tbody>
</table>
A. Criteria to produce lists of invasive alien plants

**Agricultural impact**
**Dominance & colonization of semi-natural habitats**

The impact on agriculture of a plant can change according to the relative importance of crop types where it has negative impacts and to the available method of control (including the authorized herbicides). The situations should be listed.

<table>
<thead>
<tr>
<th>Category</th>
<th>Behaviour and habitat invaded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>no yield or other economic losses are reported, the species is either sporadic in the crop or when it is frequent or abundant, it is a weak competitor</td>
</tr>
<tr>
<td>Medium</td>
<td>yield or other economic losses are reported, but only occur in particular conditions</td>
</tr>
<tr>
<td>High</td>
<td>the species can be dominant in a crop with regular management and is often very abundant</td>
</tr>
</tbody>
</table>
A. Criteria to produce lists of invasive alien plants

Invasiveness categories
Combination of spread and impact

<table>
<thead>
<tr>
<th>Impact (highest impact recorded)</th>
<th>Spread capacity</th>
<th>Invasiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High (list of IAP)</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td>Medium (observ. list)</td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>Low (minor concern)</td>
</tr>
</tbody>
</table>

Brundu & van Valkenburg 2012
To identify (potential) invasive alien plants for which a regional PRA should be performed:

- EPPO standard PM3/67 and national measures PM9
  - No

  (B.1) Is the plant species internationally traded or are there other existing or potential international pathways?
    - Yes, list the pathway(s)
    - No
    - (B.2) Is the risk of introduction by these international pathways identified to be superior to natural spread?
      - Yes
      - (B.3) Does the plant species still have a significant area suitable for further spread in the EPPO region?
        - Small
          - Not a priority for PRA
        - Medium
          - Lower priority for PRA
        - Large
          - Priority for PRA
The software is constructed with independent modules corresponding to the different sections of the PRA scheme.

It is possible to work on each module independently allowing the preparation of the PRA to be split between different experts.
Bayesian Network Software GeNie embedded in CAPRA

EPPO Prioritization Process for Invasive Alien Plants

Brundu & van Valkenburg 2012
1. Why is important to set priorities?
2. How can we set priorities?
3. The EPPO Method
4. **Some applications of the EPPO Method**
5. *News*
In France: > 370 species assessed
EPPO pp similar to Weber & Gut

Guillaume Fried (FR)

⇒ 40 major invasive species widespread in (almost) all regions of France

⇒ 77 regional invasive species restricted to one region

- Atlantic area (Brittany):
  Rhododendron ponticum,
  Polygonum polystachyum,
  …

- Mediterranean area:
  Acacia dealbata,
  Lonicera japonica
  Senecio angulatus

- Continental area:
  Bunias orientalis,
  Rudbeckia laciniata
Ecology of plant invasions in Mediterranean island ecosystems: invasivity, invisibility and threats to plant community in the Tuscan Archipelago

Lorenzo Lazzaro
Dipartimento di Biologia Evoluzionistica "Ugo Foscolo" - Laboratorio di Biologia

Biological invasions are often resulting in a significant loss in biodiversity, altering structure and function of invaded ecosystems and causing a substantial economic impact. The effects of invasion have to be expected higher on island ecosystems. Mediterranean island type ecosystems constitute a hot spot of biodiversity so the evaluation of alien and invasive plants can be considered one of the major aim for conservation and management purpose.

Aim of our study focuses on the plant invasions in the Tuscan Archipelago following three different points of view. Firstly we investigate the potential invasivity of alien plant introduced in the Archipelago using some of major Weed Risk Assessment with the aim to find the species with a higher probability of becoming a problem in the future. In the second phase we will search the areas at greatest risk of invasion according to the concepts of Ecological Predictive Models to measure the local invasivity. In this second part we will compare the distribution area of the invasive species with that of species and habitat that need conservation efforts in the Archipelago. Finally we will study the effects of the most dangerous invasive plants by looking at the changes caused in vascular plants and lichen communities.

We show only preliminary data as all the work is at his early stage and all the lines of research started with this PhD project.

WEED RISK ASSESSMENT

Risk assessment schemes are based on predictions which attempt to identify species that have not yet been introduced to a region but have a high likelihood of become invasive. Weed risk assessment procedures are developed and used not exploring the accumulated knowledge on invasive taxa, characteristics of invaded habitats and information on invasiveness of species elsewhere.

We tested the EPPO Invasiveness Process for Invasive Alien Plants, applied and reformulated for the Mediterranean basin and climate. For all of the alien species in the Tuscan Archipelago, with a result of 167 alien species, we took the procedure step by step answering for each species the questions from A.1 to A.9 (see Fig. 1). The gathering of the accumulated information took a time ranging from half an hour to two hours. Results are shown on Fig. 3.8.

In the second part of the EPPO process we select species for which an EPPO Pest Risk Analysis (PRA) is needed. The EPPO PRA is a long and expensive procedure of gathering information about the species. At the end it brings a decision on the management measures for that species.

PREDICTIVE ECOLOGICAL MODELLING

To realize the potential area of distributions we used climatic, topographic and anthropogenic factors, combined with spatial autocorrelation, associated with most common invasive species occurrence to detect other areas that possess similar characteristics and thus present major risk of being invaded. The first results are shown in a map (Fig. 4) that reports the local probability of invasion (invasivity) in the Elba Island. Factors associated with human population density (settlements and roadsides) resulted the more related with invasive species presence and thus the most important in predicting the risk of invasion (Fig. 5). From geographical point of view the higher risk is predicted in coast lines too, which present a high value for conservation and are seriously threatened from invasive alien species.

THREATS TO COMMUNITIES

Presence of invasive species have been chosen to directly affect several components of the diversity of plant communities, such as species richness, species composition, number of functional groups and functional composition. The higher problems can also affect directly and/or indirectly species and habitat worth of conservation. To investigate the effects on the diversity we choose to study the vascular plant and lichen communities in three cases of study in which four of the most dangerous invasive species in the Elba Island.

- **Acacia dealbata and A. pyramidalis** in dense pure stand in the Capoliveri area (SE of the island) (Box 1).
- Pure stands of *Robinia pseudoacacia* on the slopes of M. Capanne (NW of the island), replacing native evergreen oak forests (Box 2).
- *Carpobrotus aff. acinaciformis* is a succulent plant which seriously threaten plant coastal communities with endemic Limonium sp.pl. (Box 3).

BOX 1. Distribution and surface of *Acacia dealbata* and *Acacia pyramidalis* stands in the SW of Elba Island.

BOX 2. Areas invaded by *Robinia pseudoacacia* on North slopes of M. Capanne. The picture shows a large area where the original evergreen oak forest has been replaced by a *Robinia* pure stand.

BOX 3. Distribution of *C. aff. acinaciformis* in three islands of tuscan Archipelago (Elba, Gorgona and Giglio). Images show the case of Dianamare’s old airport.

Brundu & van Valkenburg 2012
Emerging invasive alien plants for the Mediterranean Basin

S. Brunei, G. Schrader, G. Brundu and G. Fried

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2Julius Kuehn-Institute, Institute for National and International Plant Health, Braunschweig (Germany)
3Corpo Foresile e di Vigilanza Ambienle della Regione Autonoma della Sardegna, Direzione Generale, Cagliari (Italy)
4LNPV Station de Montpellier, Montpellier (France)

Table 2: Results of the prioritization process for the emerging species, species to be observed in the Mediterranean basin, including known occurrence in EPPPO countries, evaluation of spread, environmental impact, impact on agriculture and forestry and the overall uncertainty for the assessment of the species, according to the EPPPO prioritization process.

<table>
<thead>
<tr>
<th>Species</th>
<th>Known occurrence</th>
<th>Spread</th>
<th>Impact on the environment</th>
<th>Impact on agriculture and forestry</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternandrus philocereus (Asteraceae)</td>
<td>FR, IT</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Amaranthaceae</td>
<td>FR, IT</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Anisomeles laetus (Asteraceae)</td>
<td>AT, BE, CZ, DK, FR, DE, FI, HR, IT, NL, NO, LU, PT, TT, RO, RU, SK, CH, GO, UA, HR, DE, FR, PT, ES, GB</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Baccharis halimoides (Asteraceae)</td>
<td>ES, FR, IT, PT, TR</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Carduus tenuiflorus (Asteraceae)</td>
<td>ES, FR, IT, PT, TR</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Euphorbia cyparissias (Euphorbiaceae)</td>
<td>ES, IT, NL, NO, PT</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Fallopia uliginosa (Nelumbonaceae)</td>
<td>DE, DK, HU, ES, IT, SI</td>
<td>High</td>
<td>High</td>
<td>No information</td>
<td>High</td>
</tr>
<tr>
<td>Inula arvensis (Persicaceae)</td>
<td>FR, IT, ES</td>
<td>High</td>
<td>High</td>
<td>No information</td>
<td>Low</td>
</tr>
<tr>
<td>Isatis tinctoria (Cauliflorae)</td>
<td>FR, IT, ES, FR, IT, SL, TR</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Ludwigia prostrata s.l. (Hydrocharitaceae)</td>
<td>FR, DE, ES, FR, IT, SL, TR</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Oenothera stricta (Hydrocharitaceae)</td>
<td>FR, IT, ES</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Nasturtium officinale (Papaveraceae)</td>
<td>FR, IT, ES</td>
<td>High</td>
<td>High</td>
<td>No information</td>
<td>Medium</td>
</tr>
<tr>
<td>Plantago major (Plantaginaceae)</td>
<td>ES</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Salvia melitensis (Labiatae)</td>
<td>IT</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Solanum stramoniiflorum (Solanaceae)</td>
<td>CY, ES, FR, GR, HR, IT, MA, RS, TR</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Species to be observed in the Mediterranean basin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aeluropus gibbsii (Lamiaceae)</td>
<td>CH, FR, GB</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Armoza sericea (Apoxynaceae)</td>
<td>ES, FR (Corsica), GR, IL, IT, PT</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Delairea odorata (Asteraceae)</td>
<td>FR, IT, IL, HR, PT (incl. Azores, Madeira, ES incl. Canary Islands)</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Dcerris caroliniana (Cucurbitaceae)</td>
<td>BE, FR, IT, NL, MA, GB</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Heliopsis helianthoides (Asteraceae)</td>
<td>ES, FR, IT</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Nasturtium officinale (Papaveraceae)</td>
<td>ES, FR, IT</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>N. tenuicastanum (Asteraceae)</td>
<td>FR (Corsica), IT, Sicily, Sardinia</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Verbena officinalis (Asteraceae)</td>
<td>DE, ES, FR, MA, GB</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Species of less concern in the Mediterranean basin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternandrus philocereus (Asteraceae)</td>
<td>ES</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Eichhornia azura (Pontederiaceae)</td>
<td>/</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>
1. Why is important to set priorities?
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EPPO training on the prioritization process to be held at the EPPO headquarters (Paris, France) on 2013-03-11/15
Thank you