

Invasive Alien Species (IAS)

Environmental, economic and social impact

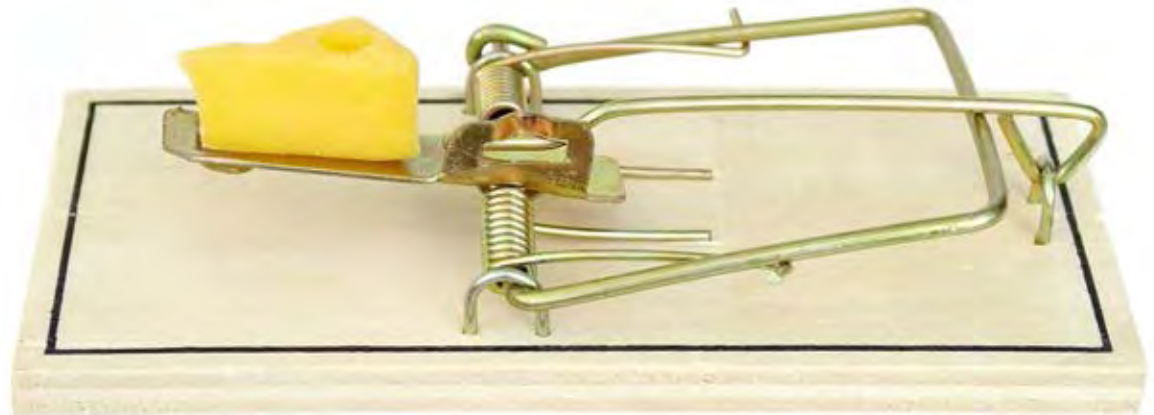
Introduction to Risk analysis. Part 2

Rumen Tomov



What is risk?

- What is risk?
- The **likelihood** that **something bad** will happen, and the **magnitude** of the associated consequences



Elements of risk

“Something bad” - Adverse event

- There **must be an adverse event** for there to be risk.
- Key is identifying hazards: something potentially harmful to a person's life, health, property, or the environment.

Elements of risk

- Risk=The **likelihood** that something bad will happen, and the magnitude of the associated consequences
 - **Likelihood - Probability of adverse event occurring**
 - If an adverse event cannot occur (zero likelihood), it cannot have an impact and therefore there is no risk.

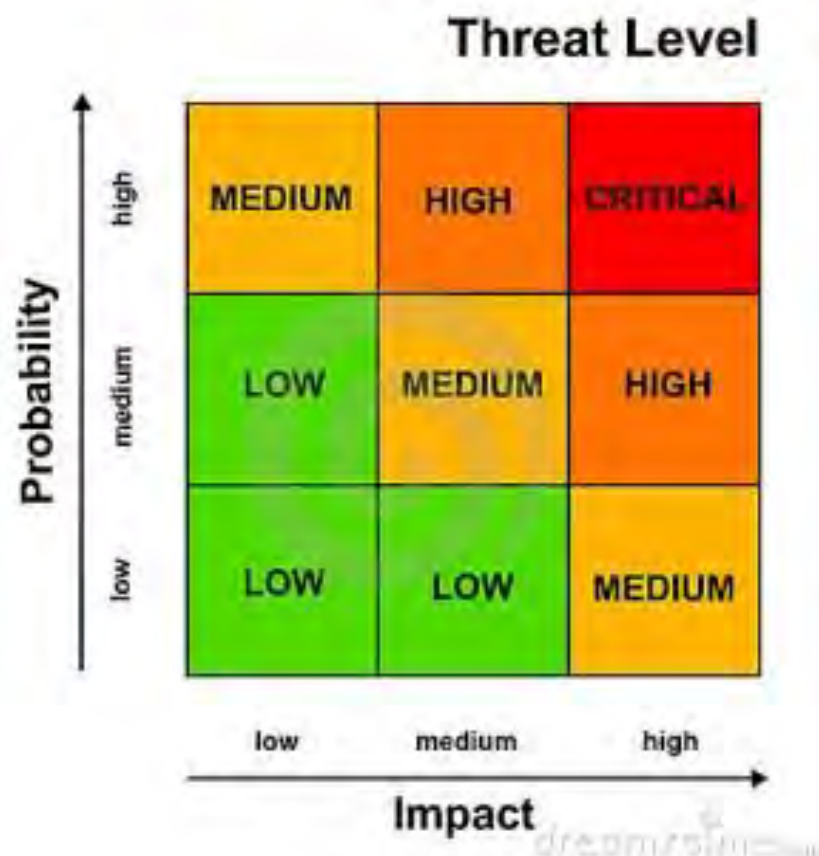
Elements of risk

- Risk=The likelihood that something bad will happen, and the magnitude of the associated **consequences**
 - Consequences - **Impact** that results from the adverse event being realized
 - If an event is likely to occur, but the event has no impact, then **there is no risk**.

Key messages

Therefore, we need to...

- Describe it: Risk Assessment
- Talk about it: Risk Communication
- Do something about it: Risk Management



What is Risk Analysis?

- A **systematic way** of gathering, recording, and evaluating information leading to recommendations for a position or action in response to an identified hazard

Why do Risk Analysis?

- Before you can manage something, you must be able **to measure how bad** it is.

Risk Analysis components

1: Define the scope

Clarify: Purpose, objectives, customer

Understand: Audience, intended use of the risk analysis

Define: Work specifications to meet the expectation for the project

What is the risk?

2. Risk Assessment

Identify hazard(s) and adverse event(s)
Estimate probability (likelihood)
Estimate consequences (magnitude of the impacts)

How do we talk about it?

Risk Communication

What should we do about it?

3. Risk Management

Identify options
Evaluate options
Recommend options



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What is Risk Analysis ?

Risk Communication

- (Should) occur throughout the entire (risk analysis) process
- Two-way
- Open, multiple exchanges of information and opinions that lead to better understanding and decisions
- Consulting
- Informing
- Explaining or justifying



World Trade Organisation (WTO)

- Responsible for establishing rules of trade between nations
- IPPC is the recognised international standard setting body for plant health under the WTO-SPS

WTO - SPS Agreement

Sanitary and Phytosanitary measures should be:

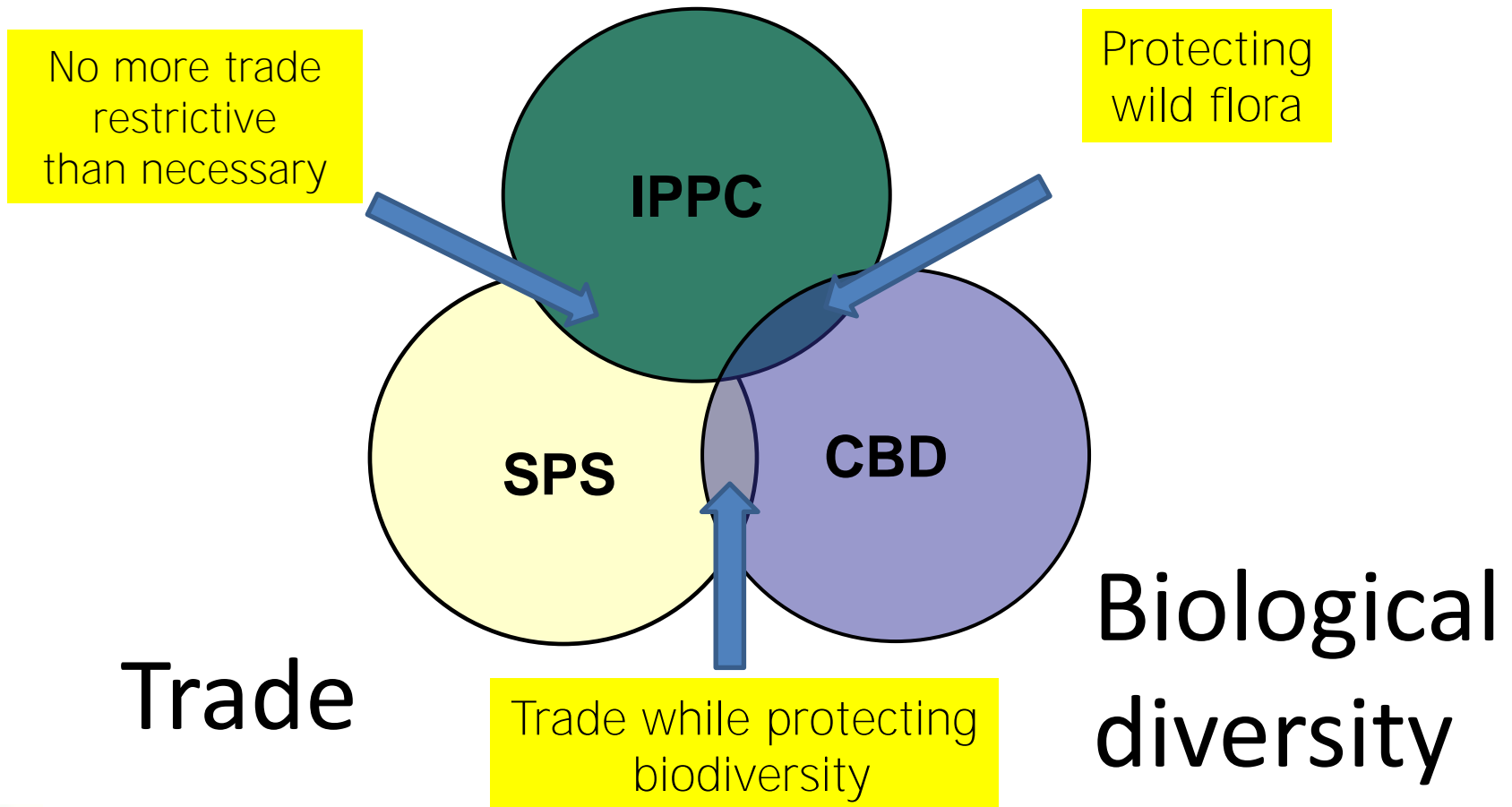
- consistent with international standards
- justified by scientific principles and evidence
- harmonised to the extent possible
- transparent / notified / non-discriminatory
- only as restrictive as necessary to meet the appropriate level of protection

Other international agreements

- Convention on Biological Diversity (CBD)
 - Protecting biodiversity
 - Protect from invasive alien species
- Cartagena Protocol on Biosafety
 - Genetically modified organisms

International regulatory framework

Plant protection



International Standards for Phytosanitary Measures (ISPMs)

ISPMs:

- provide guidance to member countries in implementing national programs and fulfilling requirements of the IPPC
- may be very general (e.g., Glossary, Principles etc.), or highly specific (e.g., phytosanitary treatments for regulated pests, solid wood packaging etc.)

- ISPM No. 2
 - *Framework for pest risk analysis, 2007*
- ISPM No. 3
 - *Guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms, 2005*
- ISPM No. 11
 - *Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms, 2004*
- ISPM No. 21
 - *Pest risk analysis for regulated non-quarantine pests, 2004*

ISPMs



**INTERNATIONAL STANDARDS FOR
PHYTOSANITARY MEASURES**

ISPM 2

FRAMEWORK FOR PEST RISK ANALYSIS

(2007)



**INTERNATIONAL STANDARDS FOR
PHYTOSANITARY MEASURES**

ISPM 11

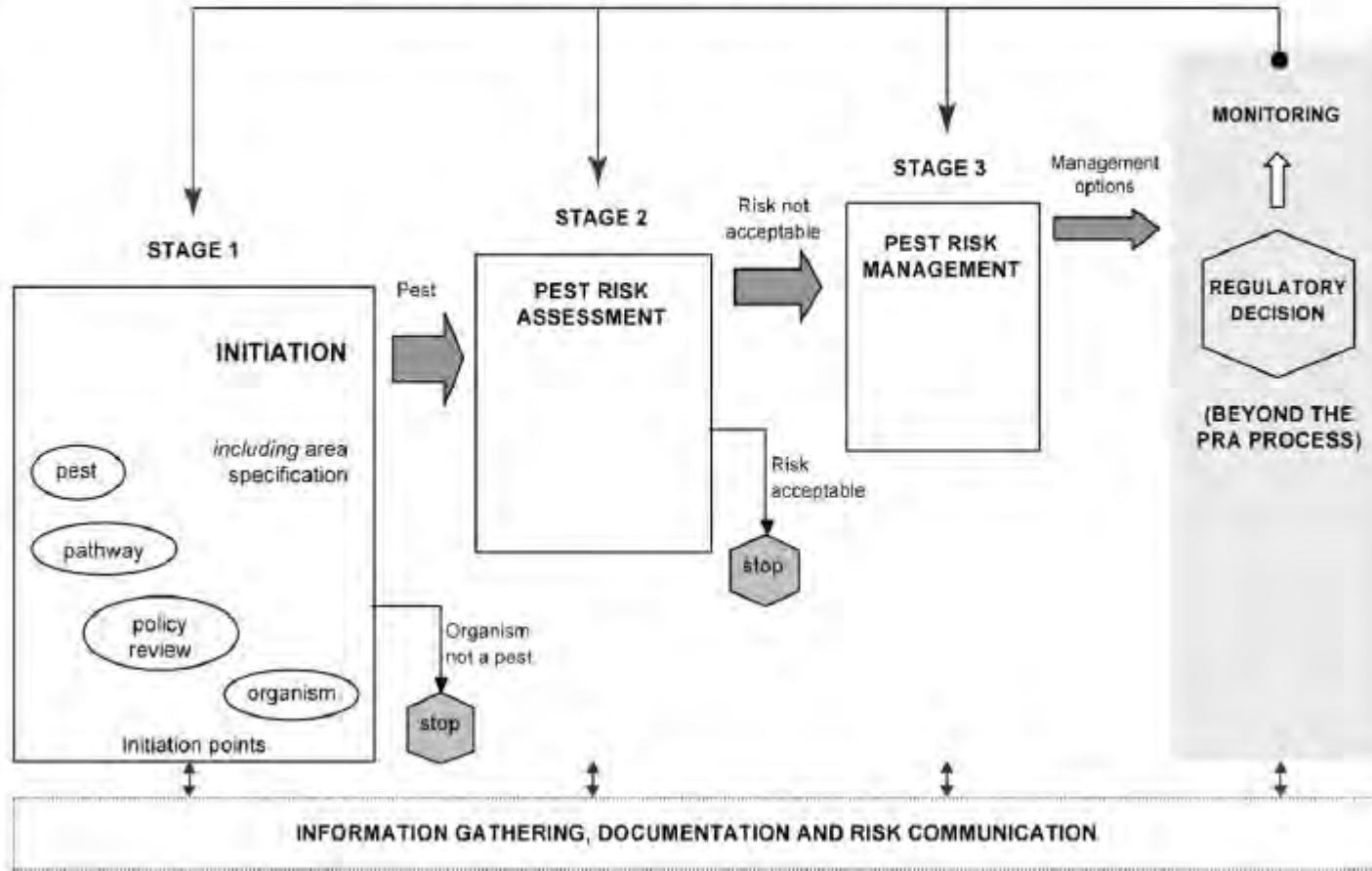
**PEST RISK ANALYSIS FOR QUARANTINE PESTS
INCLUDING ANALYSIS OF ENVIRONMENTAL
RISKS AND LIVING MODIFIED ORGANISMS**

(2004)

Pest risk analysis

ISPM 2-18

PEST RISK ANALYSIS FLOW CHART



APPENDIX 1: Pest risk analysis flow chart

This appendix is for reference purposes only and is not a prescriptive part of the standard.

ISPM 2

Framework for pest risk analysis - Appendix 1

ISPM 2

- The analysis evaluates:
 - the **probability of introduction and spread** of the pest
 - the **magnitude of potential economic consequences** in a defined area, using biological or other scientific and economic evidence.
- If the risk is deemed unacceptable, the analysis may continue by suggesting **management options** that can reduce the risk to an acceptable level. Subsequently, pest risk management options may be used to establish phytosanitary regulations.

ERA Risk assessment

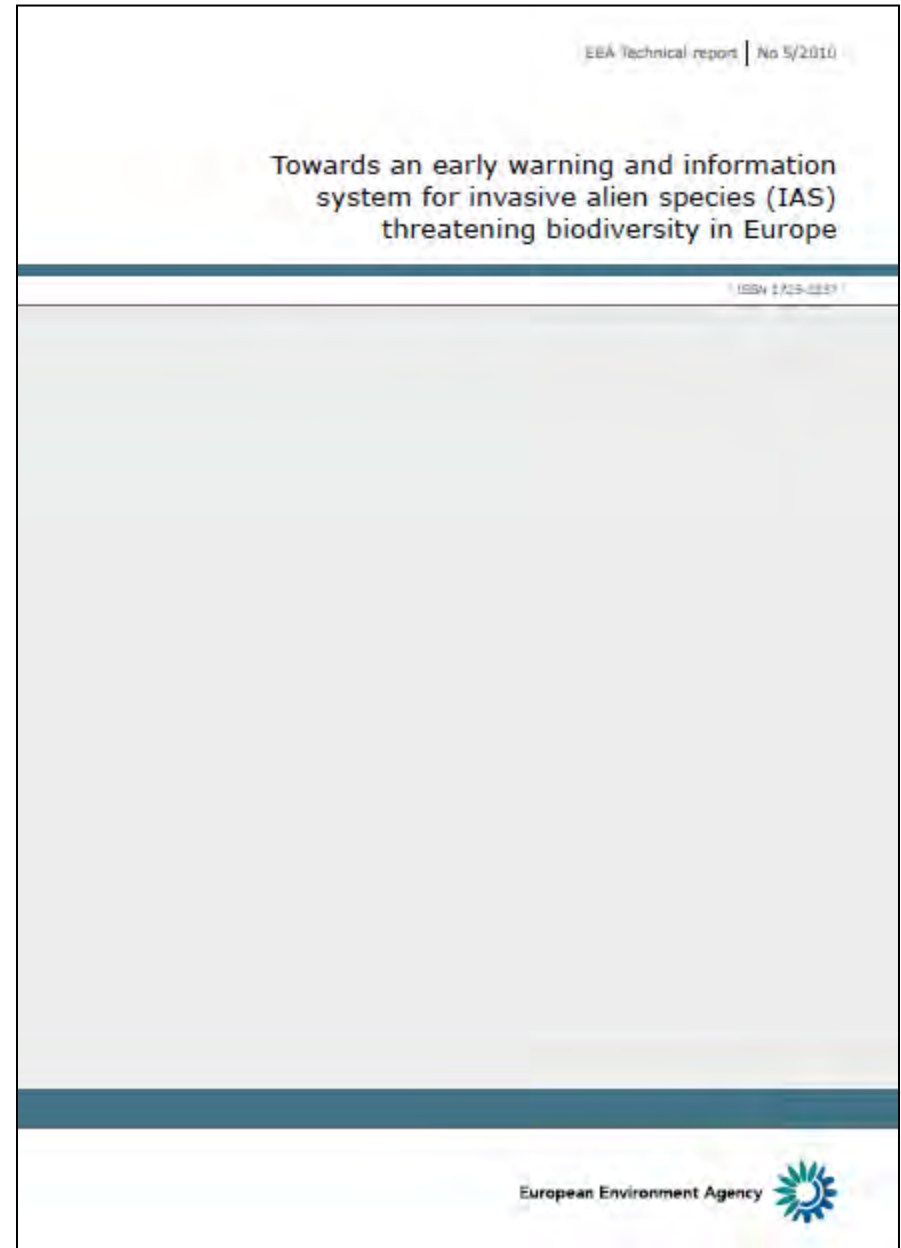
European Commission IAS strategy emphasise **prevention as the most cost-effective way**, hence highlighting the importance of:

- - **risk assessment tools** (Miller et al. 2006; Shine et al. 2010)
- - implementation of an early warning and information system (Hulme et al. 2009a, 2009b; Genovesi et al. 2010).

Such an **early warning system** should encompass elements for identifying **potential future IAS not yet present** and for **prioritising** alien species **already present** according to their impact (Randall et al. 2008).

What is early warning?

Basic document



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What is early warning?

Early warning and rapid response system (EWRR): a framework designed to respond to biological invasions through a coordinated system of:

- surveillance and monitoring activities; diagnosis of invading species;
- **assessment of risks;**
- circulation of information, including reporting to competent authorities;
- and identification and enforcement of appropriate responses.

ERA Risk assessment

- Risk assessment is the technical and objective process of **evaluating** biological or other scientific and economic **evidence to identify potentially invasive alien** species and **determine the level of invasion risk** associated with a species or pathway and specifically whether an alien species will become invasive.
- An effective and robust **risk assessment** method is seen as **an essential component of IAS management** (Shine, Kettunen et al. 2010) and a **fundamental element** of an early warning and information system in Europe (Genovesi, Scalera et al. 2010).

Approaches for developing the lists (prioritisation)

- The **risk assessment is a** fundamental element of an **early warning** and information system
- The risk assessment can be done at very **different levels of accuracy, depending on its objectives.**

For example,

- when deciding how to respond to a new incursion, **a quick screening of the risks connected to the introduced species is in general more than sufficient to identify the proper response;**
- when assessment is aimed at prioritising action or at supporting regulations of trade, **a full and comprehensive risk assessment is required**

Approaches for developing the lists (prioritisation)

McGeoch et al. 2015)

- **prioritization** - the process of ranking species, pathways, or sites
- **prioritization scheme** (or prioritization model) is any structured system that produces **a ranking or ordered set of risk categories.**

purposes of

- (1) determining their relative environmental (and sometimes also socio-economic) impacts (sensu Kumschick et al. 2012; Blackburn et al. 2014)
- (2) deciding on the relative priority of actions to effectively and efficiently prevent or mitigate the impact of invasive alien species

General literature sources

Final report
of the project

Invasive alien species –
framework for the identification of invasive alien species of EU concern
ENV.B.2/ETU/2013/0026



Lithobates (Rana) catesbeianus (Riccardo Scalera)

General literature sources

The report provides a **review of available IAS risk analysis protocols** and use this, coupled with expert opinion, to inform the development of **minimum standards** necessary to ensure effective risk assessment methods for the EU

Table 2.2: Short-list of attributes derived from the long-list extracted from the review of risk assessments through Tasks 1 and 2. Additional information and clarification on the agreed minimum standards are provided in Tables 3.4 and 3.5.

Risk assessment attribute
Includes species description
Documents information sources
Can be used for a broad range of taxa
Includes the likelihood of entry, establishment, spread and magnitude of impact
Includes description of (1) the actual and potential distribution; (2) the likelihood of spread; (3) the magnitude of impact
Has the capacity to include multiple pathways of entry and spread, both intentional and unintentional
Has the capacity to include multiple pathways of secondary spread, both intentional and unintentional
Can broadly assess environmental impact with respect to biodiversity and ecosystem patterns and processes
Broadly assesses environmental impact with respect to biodiversity and related ecosystem services
Includes status (endangered or protected) of species or habitat under threat
Has the capacity to consider future impacts due to environmental change
Broadly assesses socio-economic impact
Includes assessment of monetary cost of damage
Considers socio-economic benefits
Provides a summary of the different components of the assessment in a consistent and interpretable form
Includes measure of uncertainty
Can deal with lack of data
Unbiased and objectively assesses all species regardless of current status
Compliant with WTO standards
Includes quality assurance

General literature sources



**Invasive Alien Species -
Prioritising prevention efforts
through horizon scanning**
ENV.B.2/ETU/2014/0016
Final report

Horizon-scanning can be defined as a systematic examination of potential threats and opportunities, within a given context, and likely future developments which are at the margin of current thinking and planning.

Risk analysis and prioritisation
For invasive and non-native species in Ireland and Northern Ireland

Written by: John Kelly, Colette O'Flynn and Cathy Maguire
Date: March 2013
Status: Final

Biol Invasions
DOI 10.1007/s10530-015-1013-1

PERSPECTIVES AND PARADIGMS

Prioritizing species, pathways, and sites to achieve conservation targets for biological invasion

Melodie A. McGeoch · Piero Genovesi · Peter J. Bellingham ·
Mark J. Costello · Chris McGrannachan · Andy Sheppard

The CrossMark logo, which consists of a red square with a white 'C' inside a circle, followed by the text "CrossMark".

Approaches for developing the lists (prioritisation)

IAS horizon scanning methods

Horizon scanning for new invasive non-native species in England (Parrott et al. 2009)

Horizon scanning for invasive non-native plants in Great Britain (Thomas 2011)

Socio-economic factors amplify the invasion potential of 12 high-risk aquatic invasive species in Great Britain and Ireland (Gallardo, Aldridge 2013)

Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland (Kelly et al. 2013)

Targeting and Prioritisation for INS in the RINSE Project Area (Gallardo et al. 2013)

Horizon scanning for invasive alien species with the potential to threaten biodiversity in Great Britain (Roy et al. 2014a)

Horizon scanning for new invasive non-native species in the Netherlands (Matthews et al. 2014)

Alien invasive species – Pathway analysis and horizon scanning for countries in Northern Europe (NOBANIS 2015)

Approaches for developing the lists (prioritisation)

Prioritization within risk assessment protocols - Several existing risk assessment protocols have the capacity to assess species **not yet present** in the assessment area

- *The Weed Risk Assessment (Pheloung et al. 1999)*
- *Risk analysis of potential invasive plants in Spain (Andreu, Vilà 2010)*
- *The EPPO Prioritization Process (EPPO PP) for invasive alien plants (Brunel et al. 2010)*
- *Alien species in Norway: with the Norwegian Black List 2012 (Gederaas et al. 2013)*
- *Risk analysis of non-indigenous marine species, Ireland: including those expected in inland water (Minchin 2014)*
- *The Harmonia+ protocol (D'hondt et al. 2015)*
- *Sentinel plants (Roques et al. 2015)*
- *Assessment of risks to animal, plant and public health (EFSA 2014)*

General literature sources

G Model

JNC-25214; No. of Pages 12

ARTICLE IN PRESS

Journal for Nature Conservation xxx (2011) xxx–xxx



Contents lists available at ScienceDirect

Journal for Nature Conservation

Journal homepage: www.elsevier.de/jnc



Review of risk assessment systems of IAS in Europe and introducing the German–Austrian Black List Information System (GABLIS)

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ABSTRACT

We give a mini-review of existing European risk assessment procedures and present a newly developed and tested risk assessment tool for invasive alien species (IAS) in Germany and Austria, the “German–Austrian Black List Information System” (GABLIS). Based on the analysis of existing European national risk assessment systems, we analyse and discuss: the assessment criteria used; which impacts

General literature sources



EFSA Journal 2011;9(12):2460

SCIENTIFIC OPINION

Guidance on the environmental risk assessment of plant pests¹

EFSA Panel on Plant Health (PLH)^{2,3}

European Food Safety Authority (EFSA), Parma, Italy

Bulletin OEPP/EPPO Bulletin (2012) 42 (1), 21–27

ISSN 0250–8052. DOI: 10.1111/epp.2527

New protocols to assess the environmental impact of pests in the EPPO decision-support scheme for pest risk analysis*

M. Kenis¹, S. Bacher², R. H. A. Baker³, E. Branquart⁴, S. Brunel⁵, J. Holt⁶, P. E. Hulme⁷,
A. MacLeod³, J. Pergl⁸, F. Petter⁵, P. Pyšek^{8,9}, G. Schrader¹⁰, A. Sissons¹¹, U. Starfinger¹⁰
and U. Schaffner¹

General literature sources



Guidelines for environmental impact assessment and list classification of non-native organisms in Belgium.

*

Version 2.6 (07/12/2009)

1. Introduction

Harmonia is an information system on non-native invasive species in Belgium, which is developed at the initiative of scientists gathered within the Belgian Forum on Invasive Species (<http://ias.biodiversity.be>). This system aims at collecting standardised information on exotic species which are assumed to be detrimental to native biodiversity in Belgium. It aims to include a high diversity of taxonomic groups from terrestrial, freshwater and marine environments.

Species included in the system are allocated to different list categories based on a simplified environmental impact assessment protocol (ISEIA), and geographic distribution in Belgium (species invasion stage). Such categorisation offers a scientific background to prioritise actions to prevent introduction and mitigate the impact of invasive species, including the improvement of the legislative framework at the federal and the regional levels. This standard provides detailed instructions about the methodology used for this categorisation.

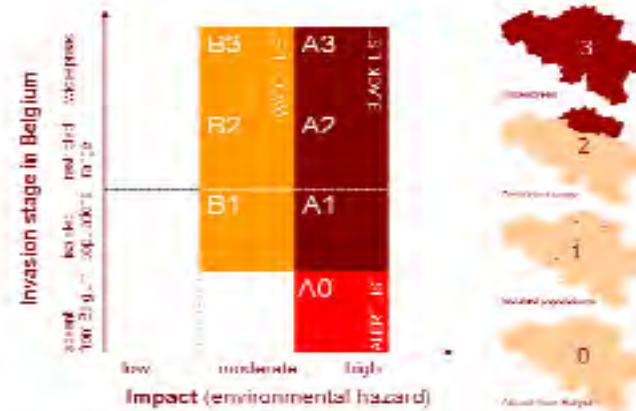


Figure 1 - List system proposed by the Belgian Forum on Invasive Species to identify organisms of most concern for preventive and mitigation actions.

4. Species screening

General literature sources

Biodivers Conserv (2013) 22:37–62
DOI 10.1007/s10531-012-0394-z

ORIGINAL PAPER

Generic ecological impact assessments of alien species in Norway: a semi-quantitative set of criteria

Hanno Sandvik · Bernt-Erik Sæther · Tomas Holmern ·
Jarle Tufto · Steinar Engen · Helen E. Roy

Received: 19 January 2012 / Accepted: 30 October 2012 / Published online: 18 November 2012
© Springer Science+Business Media Dordrecht 2012

Abstract The ecological impact assessment scheme that has been developed to classify alien species in Norway is presented. The underlying set of criteria enables a generic and semi-quantitative impact assessment of alien species. The criteria produce a classification

What are the **definitions** for existing lists (results of prioritization/ranking)

The outcome of prioritization is the allocation of species into different lists

- White list
- Grey list
- **Black list**
- **Alert list**
- **Watch list**
- Climate List
- Operation list
- Warning list
- Action list
- Management list

What are the **definitions** for existing lists (results of prioritization)

Black list

- **EEA:** a list of alien species that have been shown **through risk assessment** to pose risks to the environment, economy or human well being.
- **(Parrott et al. 2009):** **high** risk and present
- **ISEIA Belgium:** Species with **high** environmental risk
- **Essl et al. 2011:** negative impact **confirmed**, invasive
 - Black List–Warning List if the alien species is **not yet present** in the reference area,
 - Black List–Action List if the alien species **occurs only in a few** localities and eradication measures are available,
 - Black List–Management List if the alien species **occurs in a large area** and eradication measures are hardly feasible.
- **(Blackburn et al. 2014):** species that have a **measurable impacts** of concern

What are the **definitions** for existing lists (results of prioritization)

Alert list

- EPP0: species that **may present** a phytosanitary risk for the EPP0 region.
- **EEA Alert lists (alarm list)**: list of alien species **not yet present** in a territory or present only in a very limited range **that pose risks** to the invaded area, and for which it is recommended to apply particular surveillance and monitoring efforts in order to enhance prompt response in the case of arrival/expansion.
- **(Parrott et al. 2009)**: high risk and **absent**
- **(Gallardo et al. 2013)**: species **not yet present** in any of the RINSE project countries

What are the **definitions** for existing lists (results of prioritization)

Watch list

- **EEA**: a list of alien species **not yet present** in a territory — or present only in a limited range — that are **considered potentially to pose risks** to the invaded area and for which it is recommended to monitor arrival, expansion and impacts, and/or application of prevention measures.
- **ISEIA**: species with a **moderate environmental risk** on the basis of current knowledge
- **(Parrott et al. 2009)**: **medium risk** and **present or absent**

What are the **definitions** for existing lists (results of prioritization)

Climate List

- **(Parrott et al. 2009)**: high or medium risk and currently climatically constrained, but potentially supported by climate change
- **(Gallardo et al. 2013)**: species already present in at least one of the RINSE countries

White list

- **(Blackburn et al. 2014)**: species with a low risk of impact
- **Essl et al. 2011**: no negative impact

Grey list

- **(Blackburn et al. 2014)**: uncertain impact
- **Essl et al. 2011**:
 - Grey List–Watch -species with more confidence of being invasive
 - Grey List–Operation - species with lower confidence of being invasive

Environmental Impact

A pragmatic solution for comparing diverse environmental impacts was recently developed: the Environmental Impact Classification for Alien Taxa, or EICAT (Blackburn et al. 2014, Hawkins et al. 2015)

OPEN ACCESS Freely available online

PLOS BIOLOGY

Essay



A Unified Classification of Alien Species Based on the Magnitude of their Environmental Impacts

Tim M. Blackburn^{1,2,3*}, Franz Essl⁴, Thomas Evans⁵, Philip E. Hulme⁶, Jonathan M. Jeschke⁷, Ingolf Kühn^{8,9}, Sabrina Kumschick¹⁰, Zuzana Marková^{11,12}, Agata Mrugała¹², Wolfgang Nentwig¹³, Jan Pergl¹¹, Petr Pyšek^{11,12}, Wolfgang Rabitsch¹⁴, Anthony Ricciardi¹⁵, David M. Richardson¹⁰, Agnieszka Sendek⁸, Montserrat Vilà¹⁶, John R. U. Wilson^{10,17}, Marten Winter⁹, Piero Genovesi¹⁸, Sven Bacher¹⁹

Diversity and Distributions, (Diversity Distrib.) (2015) 21, 1360–1363



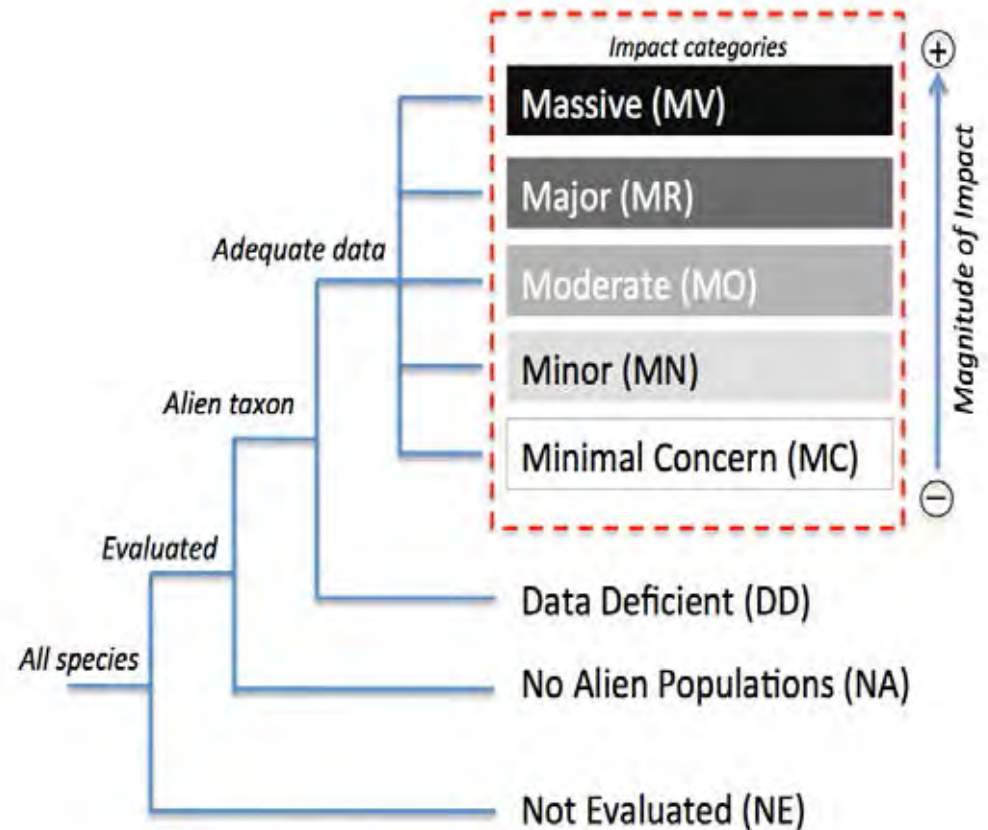
Framework and guidelines for implementing the proposed IUCN Environmental Impact Classification for Alien Taxa (EICAT)

Charlotte L. Hawkins¹, Sven Bacher², Franz Essl³, Philip E. Hulme⁴, Jonathan M. Jeschke^{5,6}, Ingolf Kühn^{7,8}, Sabrina Kumschick^{9,10}, Wolfgang Nentwig¹¹, Jan Pergl¹², Petr Pyšek^{12,13}, Wolfgang Rabitsch¹⁴, David M. Richardson⁹, Montserrat Vilà¹⁵, John R. U. Wilson^{9,10}, Piero Genovesi¹⁶ and Tim M. Blackburn^{1,17,18,*}



The EICAT

EICAT translates impacts caused through different mechanisms into five ranked categories of impact from **minimal to massive**;



The EICAT Impact Categories

The first five categories follow a sequential series of impact scenarios describing increasing levels of impact by alien taxa. The change in category reflects an increase in the order of **magnitude** of the particular impact so that a **new level of biological organization** is involved

- **Minimal Concern (MC)** - discernible impacts, but no effects on individual fitness of native species;
- **Minor (MN)** – fitness of individuals reduced, but no impact on populations;
- **Moderate (MO)** - changes to populations, but not to community composition;
- **Major (MR)** - community changes, which are reversible;
- **Massive (MV)** – irreversible community changes and extinctions.

The EICAT

EICAT is receiving increasing international support and has recently been adopted by the IUCN
(<https://portals.iucn.org/congress/motion/014>)

- The EICAT adopts parallel classification systems to capture both the maximum impact ever recorded and the current impact level caused by the alien taxon
- It must be stressed at the outset that EICAT scheme is not a risk assessment, and its output alone should not be used to assign the priority that should be attached to the control or management of any given alien species
- Thus, while it may be useful for ranking and prioritisation of management activities for established alien species within a country, the EICAT scheme should not be used alone to identify which alien species should be regulated
- Only the highest impact reported is considered for assessment purposes

**REGULATION (EU) No 1143/2014 OF THE EUROPEAN PARLIAMENT AND OF THE
COUNCIL
of 22 October 2014
on the prevention and management of the introduction and spread of invasive alien
species**

Article 4

List of invasive alien species of Union concern

3. Invasive alien species shall only be included on the Union list if they meet all of the following criteria:
- (a) they are found, based on available scientific evidence, to be alien to the territory of the Union excluding the outermost regions;
 - (b) they are found, based on available scientific evidence, to be capable of establishing a viable population and spreading in the environment under current conditions and in foreseeable climate change conditions in one biogeographical region shared by more than two Member States or one marine subregion excluding their outermost regions;
 - (c) they are, based on available scientific evidence, likely to have a significant adverse impact on biodiversity or the related ecosystem services, and may also have an adverse impact on human health or the economy;
 - (d) it is demonstrated by a risk assessment carried out pursuant to Article 5(1) that concerted action at Union level is required to prevent their introduction, establishment or spread;**
 - (e) it is likely that the inclusion on the Union list will effectively prevent, minimise or mitigate their adverse impact.

Article 5

Risk assessment / COMPLIANCE with the minimum standards

1. For the purposes of Article 4, a risk assessment shall be carried out in relation to the current and potential range of invasive alien species, having regard to the following elements:

- Probability of entry
- Probability of establishment
- Probability of spread
- Probability of impact
- **MINIMUM STANDARDS** *are in Italic*

Article 5

(a) a description of the species with its taxonomic identity, its history, and its natural and potential range; Information on the organism

- *1. Description (Taxonomy, invasion history, distribution range (native and introduced), geographic scope, socio-economic benefits)*

(b) a description of its reproduction and spread patterns and dynamics including an assessment of whether the environmental conditions necessary for its reproduction and spread exist;

- **Probability of establishment**
- **Probability of spread**

(c) a description of the potential pathways of introduction and spread of the species, both intentional and unintentional, including where relevant the commodities with which the species is generally associated;

- *4. Has the capacity to assess multiple pathways of entry and spread in the assessment, both intentional and unintentional*
- **Probability of entry**

Article 5

(d) a thorough assessment of the risk of introduction, establishment and spread in relevant biogeographical regions in current conditions and in foreseeable climate change conditions;

- *2. Includes the likelihood of entry, establishment, spread and magnitude of impact*
- *9. Includes possible effects of climate change in the foreseeable future*
- **Probability of establishment**
- **Probability of spread**

(e) a description of the current distribution of the species, including whether the species is already present in the Union or in neighbouring countries, and a projection of its likely future distribution; Information on the organism

- *3. Includes description of the actual and potential distribution, spread and magnitude of impact*

Article 5

(f) a description of the **adverse impact** on biodiversity and related ecosystem services, including on native species, protected sites, endangered habitats, as well as on human health, safety, and the economy including an assessment of the potential future impact having regard to available scientific knowledge;

- **Probability of impact**
- *5. Can broadly assess environmental impact with respect to biodiversity and ecosystem patterns and processes*
- *6. Can broadly assess environmental impact with respect to ecosystem services*
- *7. Broadly assesses adverse socio-economic impact*
- *8. Includes status (threatened or protected) of species or habitat under threat*

Article 5

(g) an assessment of the potential costs of damage;

(h) a description of the known uses for the species and social and economic benefits deriving from those uses
Information on the organism

- *10. Can be completed even when there is a lack of data or associated information*
- *11. Documents information sources*
- *12. Provides a summary of the different components of the assessment in a consistent and interpretable form and an overall summary*
- *13. Includes uncertainty*

Each section should include the confidence level (high, medium or low confidence), according to a documented methodology.

The scoring of confidence level and impact classification systems used should be referenced by including a link to the underlying publication.

- *14. Includes quality assurance*

Information on the quality assurance

- Author: name, title, affiliation, city, country
- Peer reviewer 1: name, title, affiliation, city, country
- Peer reviewer 2: name, title, affiliation, city, country
-
- The risk analysis should be subjected to quality assurance system, including at least:
 - The risk analysis should have been reviewed by at least two peer reviewers.
 - Each peer reviewer should have the relevant taxonomic expertise.
- The author and the peer reviewers could be working in the same country, but cannot be affiliated to the same scientific institution

Use for example:

- Harmonia+:
<http://ias.biodiversity.be/harmoniaplus>
- EPPO:
[https://www.eppo.int/QUARANTINE/Pest Risk Analysis/PRA intro.htm](https://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm)
- <http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1001850>, see text S1

Acknowledgements

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Thank you for your attention!



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