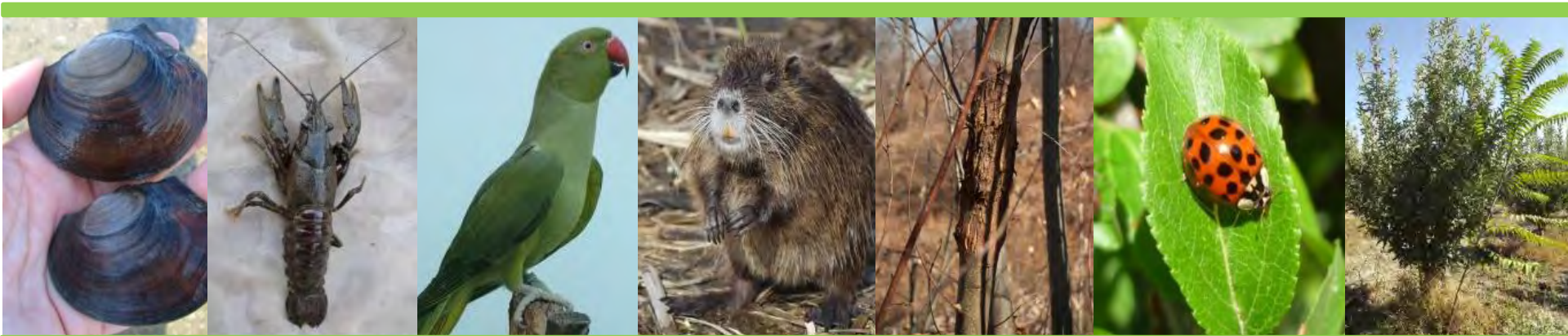


Pathways of biological invasions, Human factor. Climate change as a driver of biological invasions



Rumen Tomov

Outline

- Terminology
- Human factor
- International organizations
- Policy and legal context
- Pathway categorization
- General sources

Terminology

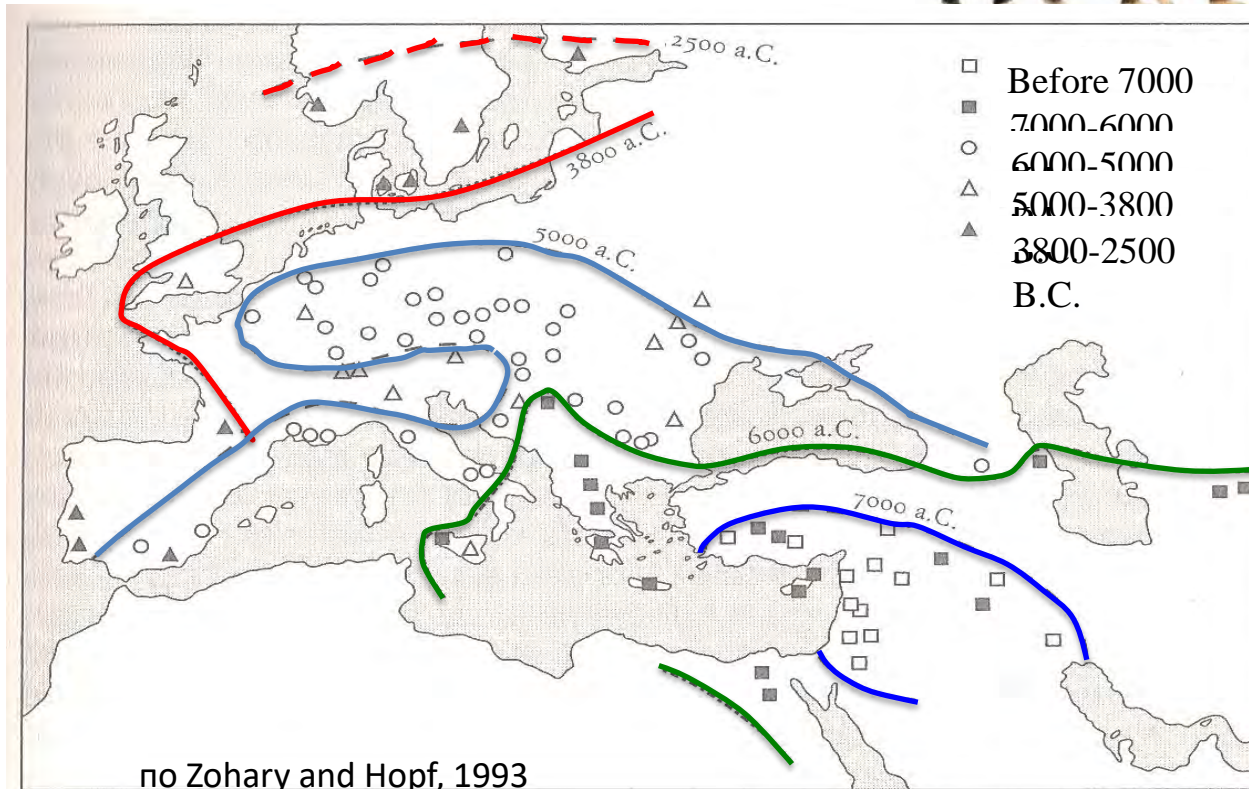
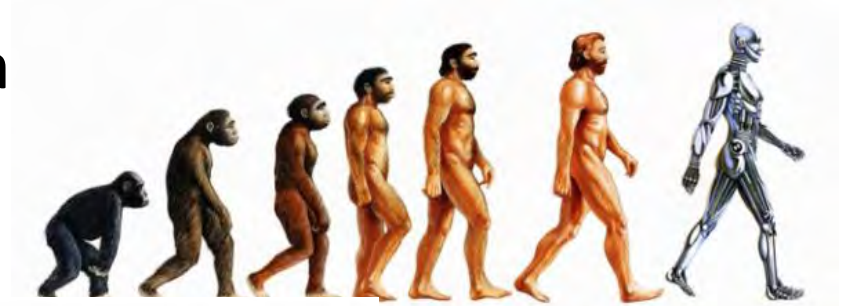
“pathway” means:

- the geographic route by which a species moves outside its natural range (past or present);
- the corridor of introduction (e.g. road, canal, tunnel); and/or
- the human activity that gives rise to an intentional or unintentional introduction.

OR 'pathways' means the routes and mechanisms of the introduction and spread of invasive alien species

Human factor

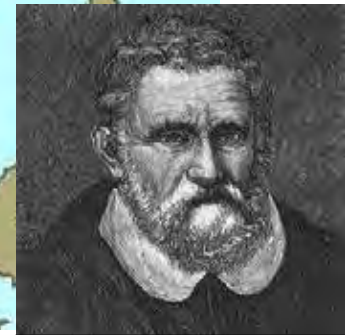
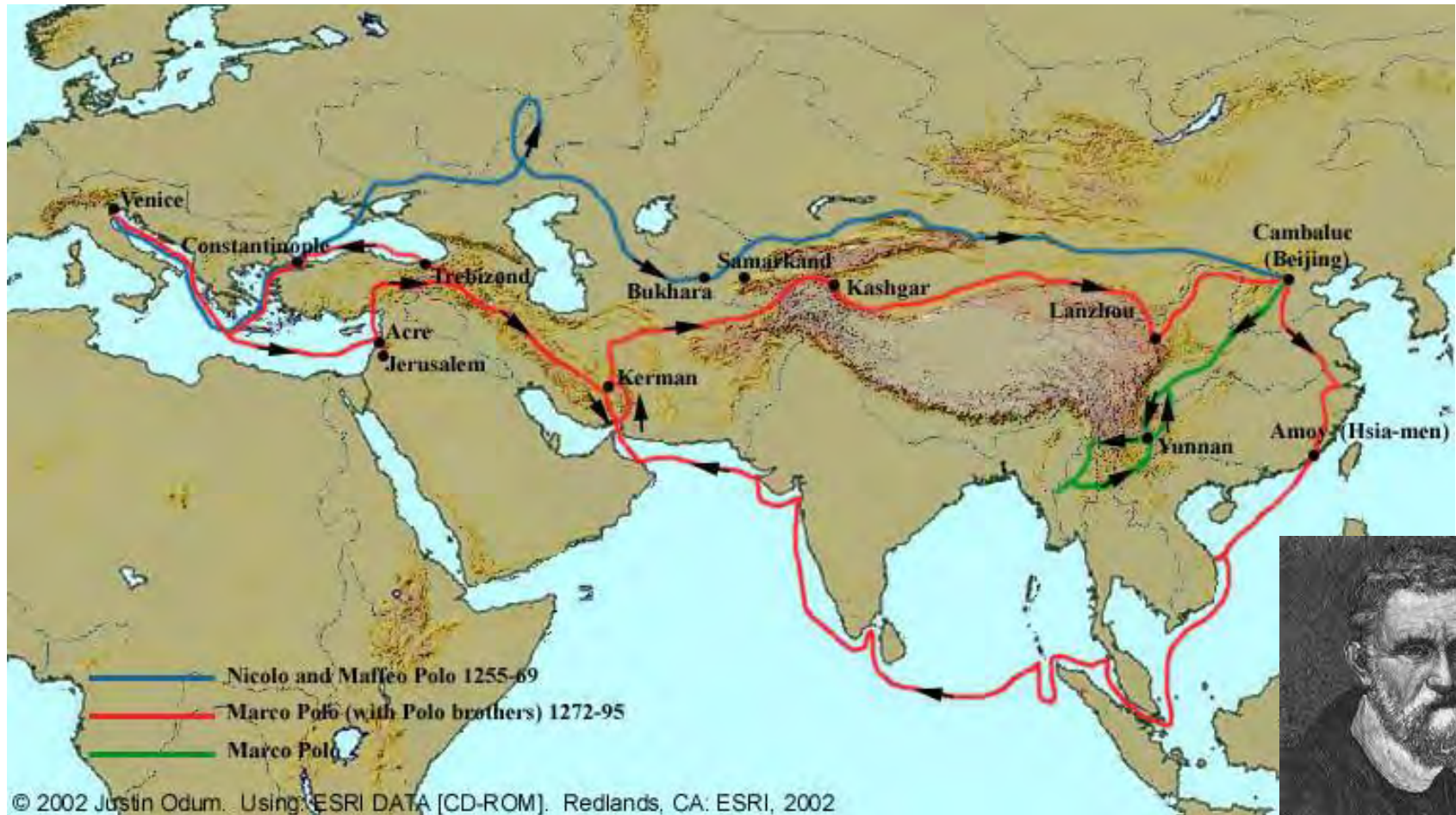
The beginning of the introduction of species beyond their natural range



large migrations

Human factor

- First intercontinental trips



Marco Polo

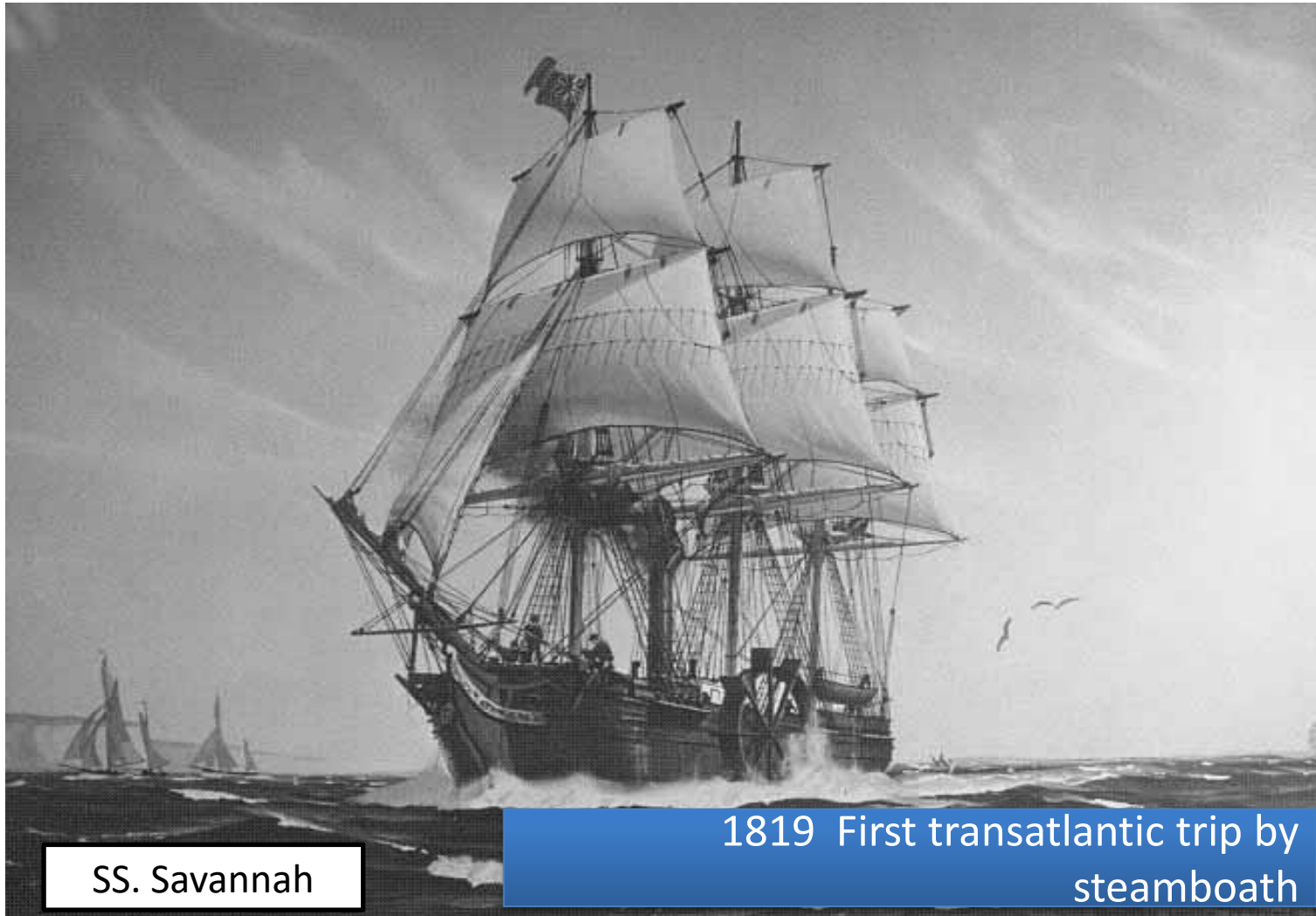
Human factor

- 1492 – America is discovered by Europeans



Christopher Columbus

Himan factor



SS. Savannah

1819 First transatlantic trip by
steamboath

Human factor

increased transport, trade, travel and tourism



Speed increasing

Volume increasing

Introduction

- Today the introduction of species beyond their natural range **is rising sharply**, due to increased transport, trade, travel and tourism and the unprecedented accessibility of goods resulting from **globalisation**.
- These activities **provide vectors and pathways** for live plants, animals and biological material to **cross biogeographical barriers** that would usually block their way.

Prevention

- It is well recognized that, **preventing introduction** of IAS is generally more cost-effective than measures taken following their introduction and establishment in a new location.
- Understanding the pathways by which organisms are moved internationally, as well implementation of enhanced pathway management measures, are **key approaches for reducing or eliminating the risks of introduction of IAS**

Pathway analysis

- Information on pathways is fundamental to alien-species risk assessments, management, monitoring, and surveillance.
- The identification of **priority pathways** and their management is a key action to prevent the introduction of new IAS into and within Europe (Genovesi and Shine 2004).

International organisations

- There are a number of international organisations and agreements recognising the need to adequately address IAS pathways through standards, guidelines, and recommendations
- The **International Plant Protection Convention (IPPC)**, and the **International Organization for Animal Health (OIE)**, are recognised as standard-setting bodies within the framework of the World Trade Organization Agreement on the Application of **Sanitary and Phytosanitary Measures (WTO-SPS Agreement)**.

POLICY AND LEGAL CONTEXT

- The importance of the threat of IAS and **relevant pathways** is reflected in a range of international, regional and national **laws and agreements**.
- The international agreements related to invasive alien species **are primarily stipulated in Article 8h of the 1992 Convention on Biological Diversity (CBD)**, which states *“Each contracting Party shall, as far as possible and as appropriate, **prevent the introduction of**, control or eradicate those alien species which threaten ecosystems, habitats or species”*.
- In 2002, at the 6th meeting of the Conference of the Parties to the CBD, a specific Decision VI.23 including relevant **Guiding Principles** to help Parties implement this requirement was adopted.

POLICY AND LEGAL CONTEXT

- The need to identify and manage IAS pathways is explicitly addressed, particularly in relation to the **Guiding principle 11**, on Unintentional introductions, according to which *“Common pathways leading to unintentional introductions need to be identified and appropriate provisions to minimize such introductions should be in place.*
- *Sectoral activities, such as fisheries, agriculture, forestry, horticulture, shipping (including the discharge of ballast waters), ground and air transportation, construction projects, landscaping, aquaculture including ornamental aquaculture, tourism, the pet industry and game-farming, are often pathways for unintentional introductions.*
- *Environmental impact assessment of such activities should address the risk of unintentional introduction of invasive alien species. Wherever appropriate, a risk analysis of the unintentional introduction of invasive alien species should be conducted for these pathways”.*

- At the 10th COP meeting a **Strategic Plan for Biodiversity** with **20 headline targets** for 2020 was set
- In this context, **Target 9 states:** *“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”.*
- This target highlights the **importance to ensure a special focus on the management of the introduction pathways of alien species**

A TOOLKIT
to facilitate Parties to
achieve Aichi Biodiversity
Target 9 on invasive alien
species
 (Prototype)

[GIASI Partnership](#)
[Secretariat of the](#)
[Convention on Biological](#)
[Diversity](#)





General sources



CBD



Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/18/9/Add.1
26 June 2014***

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE

Eighteenth meeting

Montreal, 23-28 June 2014

Item 5.2 of the provisional agenda*

**PATHWAYS OF INTRODUCTION OF INVASIVE SPECIES, THEIR PRIORITIZATION
AND MANAGEMENT**

General sources



CBD



Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/20/INF/5
6 April 2016

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE

Twentieth meeting

Montreal, Canada, 25-30 April 2016

Item 5 of the provisional agenda*

**PROGRESS TOWARD PATHWAYS PRIORITIZATION IN COMPLIANCE TO
AICHI TARGET 9**

Crossing Frontiers in Tackling Pathways of Biological Invasions

FRANZ ESSL, SVEN BACHER, TIM M. BLACKBURN, OLAF BOOY, GIUSEPPE BRUNDU, SARAH BRUNEL, ANA-CRISTINA CARDOSO, RENÉ ESCHEN, BELINDA GALLARDO, PIERO GENOVESI, QUENTIN GROOM, COLIN HARROWER, PHILIP MARC KENIS, INGOLF KÜHN, SABRINA KUMSCHICK, ANGELIKI COLETTE O'FLYNN, SHYAMA PAGAD, JAN PERGL, PETR PYŠEK, DAVID M. RICHARDSON, ALAIN ROQUES, HELEN E. ROY, RICCA HANNO SEEBENS, SONIA VANDERHOEVEN, MONTSERRAT VILÀ, AND JONATHAN M. JESCHKE

Journal of Applied Ecology



Journal of Applied Ecology 2015, 52, 1418–1424

doi: 10.1111/1365-2664.12470

POLICY DIRECTION

Invasion pathways at a crossroad: policy and research challenges for managing alien species introductions

Philip E. Hulme*

The Bio-Protection Research Centre, Lincoln University, PO Box 85084, Canterbury, New Zealand

Conservation Letters

A journal of the Society for Conservation Biology

Open Access

LETTER

Blurring Alien Introduction Pathways Risks Losing the Focus on Invasive Species Policy

Philip E. Hulme¹, Sven Bacher², Marc Kenis³, Ingolf Kühn^{4,5,6}, Jan Pergl⁷, Petr Pyšek^{7,8}, Alain Roques⁹, & Montserrat Vilà¹⁰

European Strategy on IAS

- in relation to the pathways and vectors, the *European Strategy on IAS* has explicitly identified the need to “Develop action plans to address specific problems identified e.g. for priority IAS, pathways and vectors, vulnerable sites, ecosystems, etc.”
- The aim is for Parties to “have specific strategies and action plans in place to address all aspects of IAS prevention and mitigation

The EU Regulation no. 1143/2014 on Invasive Alien Species

The new EU regulation on IAS includes some innovative pathways-related provisions, such as the provisions of art. 13, according to which:

- *"Member States shall, within 18 months of the adoption of the Union list carry out a **comprehensive analysis of the pathways of unintentional introduction** and spread of invasive alien species of Union concern"*
- *"Within three years of the adoption of the Union list, each Member State shall establish and implement **one single action plan or a set of action plans to address the priority pathways**".*

categorization of IAS pathways

- Major pathways will vary between countries and will **need to be well identified** in order to be effectively addressed
- Once the pathways for the introduction of invasive alien species have been identified and **prioritized**, actions will need to be taken to **prevent the risk** of new alien species becoming established.
-

categorization of IAS pathways

- A key reference tool for the categorization of IAS pathways is the CBD document UNEP/CBD/SBSTTA/18/9/Add.1 agreed to at the last COP12 (in view of the achievement of the Aichi Biodiversity Target 9).
- Common pathways were categorized by experts in six groups:
- **Release; Escape; Transport-Contaminants; Transport-Stowaway; Corridors; and Unaided** (natural dispersals).

RELEASE IN NATURE

- Biological control
- Erosion control/ dune stabilization (windbreaks, hedges, ...)
- Fishery in the wild (including game fishing)
- Hunting in the wild
- Landscape/flora/fauna “improvement” in the wild
- Introduction for conservation purposes
- Release in nature for use (other than above, e.g., fur, transport, medical use)
- Other intentional release

ESCAPE FROM CONFINEMENT

- Agriculture (including Biofuel feedstocks)
- Aquaculture / mariculture
- Botanical garden/zoo/aquaria (excluding domestic aquaria)
- Pet/aquarium/terrarium species (including live food for such species)
- Farmed animals (including animals left under limited control)
- Forestry (including reforestation)
- Fur farms
- Horticulture
- Ornamental purpose other than horticulture
- Research and ex-situ breeding (in facilities)
- Live food and live bait
- Other escape from confinement

TRANSPORT – CONTAMINANT

- Contaminant nursery material
- Contaminated bait
- Food contaminant (including of live food)
- Contaminant on animals (except parasites, species transported by host/vector)
- Parasites on animals (including species transported by host and vector)
- Contaminant on plants (except parasites, species transported by host/vector)
- Parasites on plants (including species transported by host and vector)
- Seed contaminant
- Timber trade
- Transportation of habitat material (soil, vegetation,...)

TRANSPORT - STOWAWAY

- Angling/fishing equipment
- Container/bulk
- Hitchhikers in or on airplane
- Hitchhikers on ship/boat (excluding ballast water and hull fouling)
- Machinery/equipment
- People and their luggage/equipment (in particular tourism)
- Organic packing material, in particular wood packaging
- **Ship/boat ballast water**
- Ship/boat hull fouling
- Vehicles (car, train, ...)
- Other means of transport

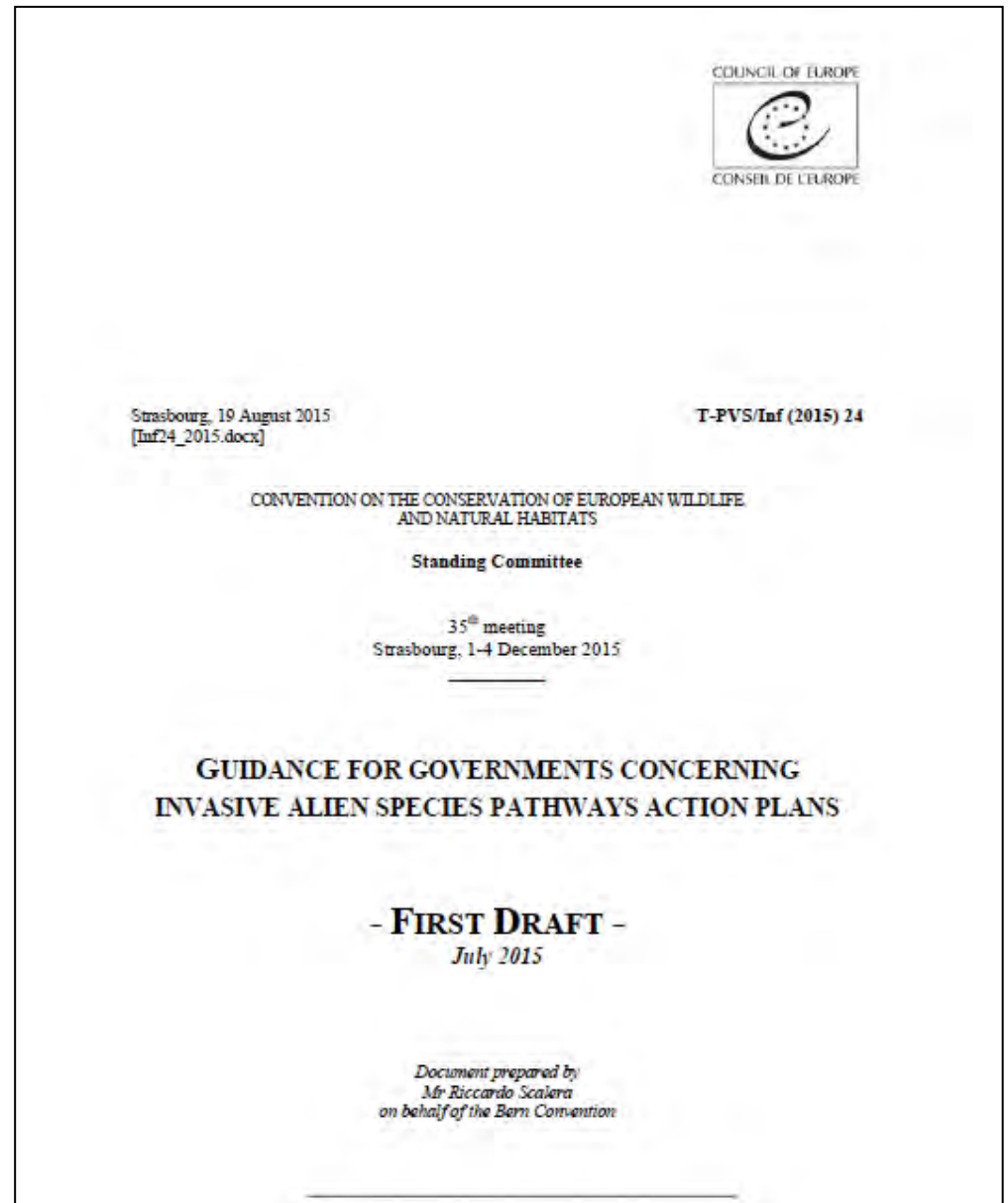
CORRIDOR

- Interconnected waterways/basins/seas
- Tunnels and land bridges

UNAIDED

- Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5

A key reference tool for the prioritization and management of pathways



priority pathways

- Given the evidence of **high incidences of introduction** of alien species and invasive species **through the escape pathway**, in particular through horticulture, measures to ensure confinement of alien species should be a high priority to implement, globally;
- **Transport-contaminants** appears **as the second most frequent pathway** of introduction. This pathway is associated with increasing human activities in international trade. Countries where the volume of import is large, particularly for agricultural and forestry products, and live bait and food, should prioritize the application of sanitary and phytosanitary measures to manage this pathway;
- **Transport-stowaway** is also associated with a **high frequency** of international trade, shipping and other human activities of moving vessels. Countries which receive large numbers of vessels in both terrestrial and aquatic environments may need to prioritize management of this pathway, particularly in port

Mistakes in intentional introductions

CANE TOAD (*BUFO MARINUS*)

Introduced in Australia as a biological control agent, The Cane toad is toxic for other predators and develops big populations.



HARMONIA AXYRIDIS



Underestimation of the risk

Lack of information about the potential negative impact



Trade with exotic species

Underestimation of the risk



- Import of plants



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Climate change and biological invasions

- A changing climate may **directly or indirectly influence** biological invasions by altering the likelihood of introduction or establishment, as well as modifying the geographic range, environmental impacts, economic costs or management of alien species.
- The strongest contemporary evidence for the potential role of climate change in the establishment of new alien species **is for terrestrial arthropods, as a result of their ectothermic physiology**, often high dispersal rate and their strong association with trade as well as commensal relationships with human environments.

(Hulme, 2016, DOI: 10.1111/brv.12282)

Climate change and biological invasions

- By contrast, **there is little empirical support for higher temperatures increasing the rate of alien plant establishment** due to the stronger effects of residence time and propagule pressure.
- In terms of invasive alien species that have known economic or biodiversity impacts, **the taxa that are likely to be the most responsive are plant pathogens and insect pests of agricultural crops.**

(Hulme, 2016, DOI: 10.1111/brv.12282)

Acknowledgements

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Thank you for your attention!