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EUROPEAN CODE OF CONDUCT ON INTERNATIONAL TRAVEL AND INVASIVE ALIEN SPECIES

*Document prepared by
Mr Riccardo Scalera*

on behalf of the Bern Convention

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SUMMARY

The present document aims at providing guidance on voluntary measures to be adopted to prevent further intentional or unintentional introductions through international travels. Many evidences exist about the contribution of this pathway to the spread of invasive alien species. Preventing such introductions is possible provided that sound biosecurity measures are in place, along with actions aimed at raising awareness on the issue of IAS spread and their impact, including the related pathogens and diseases. The Code of conduct on international travels is thus addressed to a very wide variety of audience, from travel/tourism operators and relevant staff, to travellers, tourists, scientists and people in general. The support of national authorities in implementing the code is pivotal to ensure the effectiveness of the measures envisaged.

INTRODUCTION

Invasive alien species (IAS) are considered the second greatest threat to biodiversity globally, second only to habitat loss and fragmentation (MA 2005). The results of a review by Genovesi *et al.* (2015) show that 1 out of 5 threatened species in Europe is directly affected by IAS. In particular 145 “critically endangered” species, 112 “endangered” species and 128 “vulnerable” species are affected by IAS. Animals are usually more impacted than plants, with fish being particularly affected by this threat: 35 “critically endangered” species belonging to this taxonomic group, along with 27 “endangered” and 48 “vulnerable” species, are impacted by IAS. IAS are not only one of the first causes of extinctions (Clavero & Garcia-Berthou 2005), in fact they also severely affect the ecosystem services we depend upon (Vilà *et al.* 2010) and can have an adverse impact on human life and health. The economic consequences of biological invasions are also impressive. In Europe alone the overall losses due to this threat are exceeding 12 billion euro/year according to the best available data (Kettunen *et al.* 2009).

The pressure of IAS is expected to be steadily increasing over the next decade if significant actions are not implemented (CBD Secretariat, 2014). In Europe for example there are evidences showing that the number of IAS is constantly increasing, with a rate of 76% in the 1970-2007 period (Butchart *et al.* 2010). To adequately address this problem, a number of tools were developed in Europe over the years, starting from the European Strategy on IAS adopted in 2003 by the Bern Convention (Genovesi & Shine 2004). Following this fundamental milestone, several countries have been working on a dedicated policy on the issue.

In recent years, IAS pathways have been receiving a growing attention by the Bern Convention, which has been developing a number of guidance documents aimed at the sound management of specific pathways and vectors. The codes of conduct developed so far by the Bern Convention cover several activities linked with invasive alien plants and animals, namely pets (including ornamental fish), zoological gardens and aquaria, botanical gardens, forestry, horticulture, hunting, recreational fishing and recreational boating. The Bern Convention has been also working on a “Guidance for governments concerning invasive alien species pathways action plans” and on “Guidelines for protected areas management and IAS”. All these codes (developed with the support of the dedicated Group of Experts on Invasive Alien Species and in some cases with the direct contribution of relevant stakeholders) are intended to mobilise a number of professionals that are linked to trade, exhibition, or sale of wild plants and animals (plus hunters, anglers and managers of protected areas) in the hope that, because of their genuine interest in conservation, they will be good allies in fighting IAS introduction and spread. Such voluntary tools have also been formally endorsed by all Parties of the Bern Convention through specific resolutions. The development of codes of conduct or similar “incitative” voluntary instruments - which are not intended to be prescriptive - is thus receiving greater attention in the effort to tackle the threats from IAS, from both governments and relevant stakeholders.

The work done within the scope of the Bern Convention fits well with the legal provisions to be implemented by most of its Parties, particularly the EU and its Member States following the adoption and entry into force of the Regulation No 1143/2014 adopted by the European Union (herewith referred to as the EU Regulation on IAS). The sound implementation of such advanced legislation, followed by the Commission implementation Regulations No. 2016/1141 and No. 2017/1263 adopting respectively a list of IAS of Union concern and a first update, requires a number of additional support

tools to be urgently developed. A fundamental aspect is the strong focus on prevention, whose importance as a key management option is widely recognised and unanimously acknowledged, even beyond the scope of this legal tool. In this context the identification and management of the pathways by which alien species are introduced and spread is considered the most effective way of preventing species invasions (Anderson *et al.* 2015). In fact, one of the key provisions of the EU regulation on IAS, i.e. art. 13, specifically requires Member States to develop action plans for the management of pathways (taking into account the relevant codes of conduct, as appropriate) within fixed deadlines.

SCOPE AND AIM

The main objective of the present code of conduct is to provide guidance on voluntary measures to be adopted to prevent further intentional or unintentional introductions of IAS, including the related pathogens and diseases, by international travellers. The focus is therefore on transnational travels, e.g. on the movement of travellers and tourists between different countries and regions. More in detail, a particular attention is paid to travels toward “sensitive sites”, which in this document refer to ecologically vulnerable islands, pristine habitats and other isolated ecosystems such as lakes, mountain areas, protected areas, nature reserves, wilderness areas, isolated forests, inshore marine ecosystems, etc. which may have evolved in isolation and may therefore be less resilient to novel threats. However, since also introductions under the form of small scale translocations can represent a threat to the local biodiversity, the present code may also apply to all kind of movements of people and associated luggage/equipment/means of transport.

International travels are recognised as a potential pathway of IAS in Europe by a number of comprehensive studies. The results of the systematic review made by Anderson *et al.* (2015), on the role of tourism and recreation in the spread of alien species, provide quantitative evidence in support of the hypothesis that these are key pathways at the global level. This highlights the need for widespread biosecurity interventions to prevent the inadvertent introduction of IAS as the tourism and outdoor recreation sectors grow. Also Hulme (2015) stressed that although some tourists might attempt to deliberately smuggle live animals and plants that could subsequently escape, or import commodities that could contain contaminants (e.g. wood products), most visitors are unaware of the risk they pose in unintentionally introducing stowaways. In fact tourists may inadvertently facilitate the introduction of stowaways on their clothing, footwear and equipment (e.g. tents, fishing tackle, etc.). It is therefore important to promote a greater awareness on the issue, and to start working together with the tourism and transport sector in a synergistic manner, e.g. by sharing priorities and policies, thus forming a powerful ally to conservation agencies and institutions (Anderson *et al.* 2015). This clearly justifies the need of robust codes of practice for tourism operators that aim to prevent the introduction and movement of IAS (Hulme 2015).

Travellers are not a close, strictly defined group, and other categories of audience can be assimilated, including tourists, scientists, ship and aircraft crews, militaries, etc. along with all relevant support personnel (see Chown *et al.* 2012, Andreone *et al.* 2016). Therefore the code is addressed to a very wide variety of operators involved in the travel/tourism sector and industry, including travel/transport agencies and companies dealing with transport or movement of people and/or living organisms, professional associations for tourism/travel, tour operators, flight and boat operators, ship and aircraft crews, customs and quarantine services, militaries, protected area managers, scientists, importers and exporters of goods (as well as of living organisms), wildlife trade personnel, other government departments/agencies responsible for tourism, travel, transport, and infrastructures (hence property owners and managers of accommodation facilities for travellers) including from both the public and private sector. Such a wide audience represents a major constraint for the identification of specific measures to prevent introductions of alien species through international travels. Therefore, considering also the highly context dependent character of the risk posed by different types of travels, the best practices suggested in the code need to be tailored appropriately according to each specific situations.

Key activities pertaining to the tourist sector, such eco-tourism, hunting, fishing and several recreational activities etc. are also addressed. However some stakeholders and relevant activities have already dedicated codes of conduct developed for the pathways they are related to (see relevant section below).

Like other similar codes of conduct, also the present one is addressed to all the fifty countries and the European Union, which by signing up to the Bern Convention committed to implement appropriate measures to guarantee the conservation of biodiversity - and particularly the protection of wild fauna and flora in Europe – including by mitigating the problems related to the spread of IAS.

This document is also aimed at the achievement of Aichi Target 9 of the Strategic Plan for biodiversity 2011-2020, adopted during the tenth meeting of the Conference of the Parties of the Convention on Biological Diversity (CBD COP10, which took place in Nagoya, Aichi Prefecture, Japan, in October 2010). In particular Aichi Target 9 states that “*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*”. The same target inspired task 5 of the EU Biodiversity Strategy (see the Communication of the European Commission “Our life insurance, our natural capital: an EU biodiversity strategy to 2020” (COM (2011) 244 final).

The framework of actions to implement this code of conduct is voluntary and depends on there being a high level of self-regulation by travel/tourism operators and their staff, as well as business partners, tourist and travellers. In this context, the support of the relevant authorities is key to ensure that appropriate measures are established to facilitate the implementation of the code. Likewise other codes of conduct, also the present one is aimed at creating strong social norms and contributing to change people attitude toward the target problem.

INTERNATIONAL TOURISM AND TRAVELS AS PATHWAYS FOR IAS

International trade, tourism, shipping, ballast water, construction projects, ground and air transport, are some of the key sectors related to international travels, and among the key target ones for which the Guidelines for the Prevention of Biodiversity Loss Caused by Alien Species drafted by the ISSG IUCN/SSC (2000) suggest a selection of recommended actions to reduce the likelihood of unintentional introductions.

According to the CBD unified system proposed to categorize introduction pathways (UNEP/CBD/SBSTTA/18/9/Add.1) international travels correspond to the specific category “People and their luggage/equipment (in particular tourism)”. Therefore the focus of the CBD document is on the stowaway pathway, and is aimed at reducing the risks from transport vectors.

The need to consider focusing on a new dedicated travellers/tourism industry code of conduct that implements policies and practices to reduce the relevant biosecurity risks, is supported by a large body of literature on the subject. For example a recent analysis of policy challenges for pathways management (Hulme 2015), particularly in relation to specific case of IAS that may be introduced unintentionally attached to transport vectors, highlighted the relatively little progress in managing another major route by which stowaway alien species are being moved around the globe: tourism.

Tourism - a form of trade where people travel to the resource instead of vice versa - can facilitate the spread of IAS, as pointed out by McNeely *et al.* (2001) according to whom: “*With some 650 million people crossing international borders as tourists every year, the opportunities for them to serve as vectors for IAS is profound and increasing. They can intentionally carry living plants that eventually become invasive. They can return home with fruits and other living plant materials that carry with them potentially invasive insects that can have profound influences on agriculture. They can also carry parasites and diseases between countries. While much of the responsibility for addressing tourism-related issues of IAS will rest with the customs and quarantine offices in the destination countries, tourism-related agencies (both public and private) need to become more aware of the role that tourists play as vectors of IAS, and take measures to educate their staff, and ultimately the tourists themselves, on the hazards of the spread of such species*”.

Tourism and outdoor recreation involve the frequent congregation of people, vehicles and vessels from geographically diverse areas. They are therefore perceived to be major pathways for the movement of alien species, and ones that will become increasingly important with the continued growth of these sectors, particularly nature-based tourism, i.e. wildlife viewing and outdoor recreation, often centred around protected areas and national parks (Anderson *et al.* 2015). This is not surprising, as a fundamental consequence of the dynamic nature of invasions is that the importance of different pathways may change over time (Hulme 2015). On this regard, the data on future trends reported by

Anderson *et al.* (2015) are quite impressive: internationally, tourist arrivals are expected to grow from one billion to 18 billion by 2030. Although it might appear that each individual tourist might pose a trivial risk, it is evident that the overall global movement of material along with tourist and travellers is substantial (Hulme, 2015). Additionally, as pointed out by Hulme (2015) while the number of tourist arrivals world-wide has more than doubled since 1990, it is in emerging economies in Africa, Asia and South America where the rate of growth has been highest and these regions may be less well prepared to face new risks from IAS. Hulme (2015) also emphasised how tourist motives are changing with increasing interest in ecotourism, recreational activities (e.g. golf, fishing), agritourism (e.g. winery visits) and visits (including camping) to national parks and reserves. This change in behaviour poses an increased risk of introductions into areas that have up until recently been relatively free of IAS.

In general, despite the recognised importance of tourism as a major pathway for the spread of IAS (Anderson *et al.* 2015), and the evidence that this type of economic driver will accelerate alien species introductions (Hulme, 2015), studies specifically dedicated to the subject are still rare and scattered.

A first attempt to assess the relationship between tourism related activities and the introduction of IAS at the global level was made by Anderson *et al.* (2015) who conducted a systematic review and meta-analysis to determine the impact of tourism and outdoor recreation on IAS in terrestrial, marine and freshwater environments. The study by Anderson *et al.* (2015) allowed to confirm that the abundance and richness of IAS are significantly higher in sites where tourist activities take place than in control sites. The patterns observed were consistent across terrestrial, freshwater and marine environments, as well as across a variety of vectors (e.g. horses, hikers, yachts) and across a range of taxonomic groups (Anderson *et al.* 2015).

As reported by Anderson *et al.* (2015), most of the existing research on the subject focuses on protected areas and national parks where transport vectors are often restricted. Therefore in this context one of the few pathways by which alien species can be introduced is represented by recreational activities. Examples are hiking and horse-riding, which as revealed by previous studies, can act as vectors for the dispersal of alien seeds as well as pathogens, such as *Phytophthora ramorum*, the causative agent of sudden oak death. Also McNeely *et al.* (2001) pointed out that tourists unwittingly introduce alien plants into national parks, where they degrade protected ecosystems and drive up management costs.

The potential for transported soil to harbour and spread IAS is also widely recognized. According to a study undertaken by McNeill *et al.* (2011) the soil removed from footwear being carried in the baggage of international travellers arriving in New Zealand by flight, hosted a wide range of viable organisms that may often include potential IAS, among which bacteria, fungi, nematodes and seeds, as well as several live arthropods. Hulme (2015) stressed how significant the importance of the tourist pathways can be compared to other routes by which stowaways might be introduced. In fact the survivorship of stowaways in soil through the tourist pathways is higher than other routes (such as shipping containers).

Similarly Ware *et al.* (2011) published a study which demonstrates that people arriving in Svalbard pose an identifiable hazard to the local environment through the introduction of (invasive) alien plant seeds that are capable of germination even under current climatic conditions (26% of the seeds collected within the study germinated under test conditions). The authors emphasised how up to 300,000 seeds could potentially be carried to Svalbard on the footgear of unsuspecting travellers. The results of the study by Ware *et al.* (2011) confirmed therefore that modern aviation, as the means by which tourism has achieved its rapid increase, has the potential to increase the pressure of plant species introduction to highly visited cold climate regions and isolated islands globally. It means that increased travel activities and expected temperature increases might alter the ecosystem in Svalbard, as well as in any other islands and isolated regions worldwide experiencing similar increases in human traffic.

This evidence is confirmed by other studies focusing on IAS in high elevation habitats characterised by cold environments, where species are directly introduced from one mountain area to another (Alexander and Kueffer 2016, Kueffer *et al.* 2013) as a consequence of the transport by hikers and tourists (Pickering and Mount 2010). More in general the tourist-assisted transport of alien species

to remote habitats such as islands, or isolated ecosystems could have serious consequences (Anderson *et al.* 2015). This is because as nature-based tourism continues to grow in popularity, the species living in these environments have often evolved in isolation and may therefore be less resilient to novel threats.

IAS are spread by travellers also intentionally. The case of the Italian wall lizard (*Podarcis sicula*), introduced in South California in 1994 (Kirschbaum & Pauly 2016), and the European common wall lizard (*Podarcis muralis*) introduced in Cincinnati, Ohio (USA) circa 1950 (Deichsel & Gist 2001), are both linked to releases by tourist returning from a journey to Italy, respectively from Sicily and from Lake Como area in northern Italy, where the animals were caught in the wild. Similarly, the origin of the common chameleon (*Chamaeleo chamaeleon*) in southern Italy was recently confirmed by Andreone *et al.* (2016) who established that the species, which is alien to Italy, was introduced either accidentally or intentionally by an Italian soldier who brought it to Italy from Lebanon, where he was in service in 1982 and where he used to keep a small group of chameleons in captivity as pets. Also travelling scientists seem to play a peculiar role as vectors: according to a study by Chown *et al.* (2012) focusing on a continent-wide risk assessment for the establishment of IAS in Antarctica, scientists carry greater propagule loads than tourists, although annual tourist numbers are much higher than those of scientists (thus tempering these differences in propagule load).

However, the actual contribution of the international travel/tourism pathway to the introduction of alien species is not always straightforward. Assigning the entry or spread of alien species to specific pathways may be subject to various levels of uncertainty, and while in some cases there is excellent evidence supporting the global significance of some pathways (e.g. ballast waters and pet trade), for some areas/pathways there are important gaps (e.g. the only available may be based on expert assumption rather than evidences) or in some cases the exact pathway responsible for a particular introduction may be simply unknown (Essl *et al.* 2015).

Furthermore, disentangling the actual contribution of travellers in the spread of IAS compared to other pathways may not be an easy task, and there is always a risk of misreporting. For example, in the small island of Montecristo, in the integral nature reserve of the Tuscan Archipelago National Park (Central Italy), Torrini *et al.* (2016) found an alien nematode *Osccheius tipulae*, phylogenetically close to others from South America. The assessment of possible pathways showed that rather than the recent soil from tourist foot traffic, the nematode could be arrived as a consequence of the import of plants and associated insects, isopods, or snails before phytosanitary restrictions (other hypothesis rejected as highly improbable, included the possibility of dispersion through wind and birds). This shows the high level of uncertainty which often characterises the retrospective approach in assigning a species and which may have negative management implications (see also Hulme 2015).

Additional impacts of international travels

International travels and tourism can potentially act as a vector of IAS in several ways, including in synergy with other socio-economic factors. For example, in Antarctica there is a growing concern that the rapidly growing scope and extent of tourist (and scientific) activities, along with the combination of accelerating climate changes will lead to substantial environmental degradation (see Chown *et al.* 2012) associated with the introduction and spread of IAS.

On this regard, as emphasised by Anderson *et al.* (2015), the congregation of large numbers of people, vehicles and vessels from geographically diverse areas not only provides a regular supply of alien propagules, but can act as forms of habitat disturbance, facilitating further species invasion through common recreational activities such as hiking, mountain biking and off-road driving. According to Anderson *et al.* (2015) tourist infrastructure, including the building of footpaths and lodges, and the planting of IAS in hotel gardens and ski resorts (i.e. namely in some Mediterranean Islands and in Kosciusko National Park in Australia) have also been associated with the intentional introduction of IAS. Similarly Alexander & Kueffer (2016) highlight the fact that IAS are known to be directly introduced in mountain habitats as ornamentals planted intentionally in tourist facilities at high elevation, for example for the restoration of ski runs (McDougall *et al.* 2011, Kueffer *et al.* 2013). Also Brundu (2013) points out that almost half of all plant introductions to Mediterranean islands stem from the increasing popularity of gardens and landscaping associated with tourist developments and housing and gardens.

Tourist can indirectly facilitate the introduction of IAS and/or contribute to their spread. For example, in the Galapagos islands, Stevenson (2001) stressed that as a result of increased human populations, the development on these islands for fishing and tourism has created a situation in which greater numbers of IAS are being introduced in the archipelago, at the expense of the native ecosystem. Also in Namibia, as a consequence of the obvious success of eco-tourism in the country, the Ministry of Environment and Tourism has received a growing number of applications from landowners to import alien and potentially invasive species (Bethune *et al.* 2004). For example, according to the information reported by Bethune *et al.* (2004) Namibian white rhino were extinct by the late 1880 and non-Namibian white rhino (*Ceraotherium simum*) stock, from Natal have been introduced into Namibian parks and private conservancies. Even though the Ministry of Environment and Tourism policy does not favour the introduction of alien species (especially into proclaimed conservation areas), an exception was made in this case due to the high tourist value of the species. There are very few places where tourists can see black and white rhino side by side. Also, non-Namibian common impala (*Aepycerus melampus*) have been imported and introduced to many commercial farms. The indigenous black-faced impala (a distinct morpho-type, and a high-value trophy animal of high economic value) has been allowed to interbreed with common impala. This has reduced both the conservation and the economic value of populations of genetically compromised black-faced impala. Also in the case of wild horses, although there is no question as to the alien nature of the species, it is felt that the tourist interest (which adds value to the target region) overrides any conservation concerns, challenging the policy of the Ministry of Environment and Tourism to eliminate IAS from proclaimed conservation areas. Unfortunately this is a real problem for the world's poorest countries which fall within biodiversity hotspots and rely on nature-tourism income; the introduction and subsequent impacts of IAS into these areas could therefore have serious economic, as well as ecological, implications (Anderson *et al.* 2015).

Similarly in Europe, the case of the spread of the greater rhea (*Rhea americana*), introduced in Germany in 2000 (Korthals A. & F. Philipp, 2010) after a number of individuals broke free from a private enclosure, shows how the negative economic impact (e.g. damage to crops) is eventually offset by the benefit of being a tourist attraction¹, with obvious management implications.

A short overview of other pathways strictly related to international travels

International travels as a pathway for IAS are strictly related to several other pathways, including all those listed within the CBD pathways categorisation system² as “Transport-stowaway” other than “People and their luggage/equipment (in particular tourism)”, namely:

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

Hulme (2015), in relation to IAS that may be introduced unintentionally attached to transport vectors, pointed out that most efforts in regulating this pathway addressed the role of shipping, and particularly on the Ballast Water Management Convention and guidelines for the management of biofouling developed by the International Maritime Organization. Also Occhipinti-Ambrogi *et al.* (2011) emphasised the role of shipping and small boating (either with ballast waters or translocation of hull fouling organisms) as a major pathway for the introduction of IAS. For example, as pointed out by Anderson *et al.* (2015), recreational boats have been a major vector for the spread of the zebra

¹ <http://www.10000birds.com/greater-rheas-germanys-new-big-bird.htm>

² UNEP/CBD/SBSTTA/18/9/Add.1 “Pathways of introduction of invasive species, their prioritization and management” (see details in the following Policy section)

mussel *Dreissena polymorpha* and invasive alien macrophytes between lakes and rivers within Europe, the USA and New Zealand. Additionally, yachts have been responsible for introducing alien bivalves, algae, ascidians and bryozoan in marine environments, e.g. into ports in Australasia and the Caribbean.

However, the exact role of each means of transport should deserve a dedicated study, because the actual impact and management implications may be not obvious. For example, humans and their vehicles are considered important vectors for transporting plant propagules over large distances to new areas, e.g. in the Australian Alps (Kueffer *et al.* 2013). Nevertheless according to the result of a study by Lonsdale and Lane (1994) on tourist vehicles as vectors of weed seeds (in Kakadu National Park, Northern Australia) it is recommended that resources are best spent on detecting and eradicating existing weed infestations, rather than on attempting to prevent this form of seed movement, given the low density of weed seeds found on tourist cars.

The peculiarity of each single category would require a specific code of conduct to be developed *ad hoc*. In some cases they have been already developed by the Bern Convention (see details in the following Policy section), while in others the policy and legislation measures are already well developed, e.g. in the case of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Ballast Water Management Convention). The latter is one of the most substantial measures introduced to regulate an introduction pathway related to travels on environmental grounds. This convention - adopted only in 2004 and ratified in 2016 - aims at reducing the impact of IAS introduced as stowaways in the marine environment, by regulating the treatment of ballast water.

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 objective of this section is not to provide a comprehensive listing of such policy and legislation, but only a brief overview of the most pertinent tools available at the European level.

The Convention on Biological Diversity

The international agreements related to IAS 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*”. The CBD Articles are legally binding to Parties, thus they are expected to translate Article 8h into the national legislation. In 2002, at the 6th meeting of the CoP to the CBD, a specific Decision VI/23 was adopted. This Decision contains Guiding Principles in its annex to help Parties implement this requirement, and Parties, other Governments and relevant organizations were urged to promote and implement the Guiding Principles. This Decision also urges Parties, other governments and relevant organizations to develop IAS strategies and action plans at national and regional level and to promote and implement the CBD Guiding Principles. 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:

“All States should have in place provisions to address unintentional introductions (or intentional introductions that have become established and invasive). These could include statutory and regulatory measures and establishment or strengthening of institutions and agencies with appropriate responsibilities. Operational resources should be sufficient to allow for rapid and effective action”.

Additionally: “*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 out (Aichi Biodiversity Targets). The mission of the Strategic Plan is to *"take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication. To ensure this, pressures on biodiversity are reduced, ecosystems are restored, biological resources are sustainably used and benefits arising out of utilization of genetic resources are shared in a fair and equitable manner; adequate financial resources are provided, capacities are enhanced, biodiversity issues and values mainstreamed, appropriate policies are effectively implemented, and decision-making is based on sound science and the precautionary approach."*

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 key reference tool for the categorisation of IAS pathways is the CBD document UNEP/CBD/SBSTTA/18/9/Add.1 "Pathways of introduction of invasive species, their prioritization and management" agreed to at the last COP 12 (in view of the achievement of the Aichi Biodiversity Target 9). In short, the CBD pathways categorisation distinguishes intentional and/or unintentional introductions, and the introduction mechanism as either the importation of a commodity, the arrival of a transport vector, the establishment of an anthropogenic dispersal corridor, or the natural spread from a region where the species is itself alien. These mechanisms can further be divided into six main groups: Release; Escape; Transport-Contaminants; Transport-Stowaway; Corridors; and Unaided (natural dispersals). The importance of this document lies on the key assumption that for ensuring a consistent and effective prioritisation of IAS pathways and the identification of the most appropriate measures for their management, a standard categorisation system to identify such pathways is required. A common terminology for pathways is crucial also to enable comparison of data across countries and over time. Furthermore it could also facilitate the assessment of the risks posed by pathways.

The use of a standard pathway categorization has been explicitly encouraged at the 12th CBD COP held at Pyeongchang (Republic of Korea, 6-17 October 2014) with its Decision XII/17 "Invasive alien species: review of work and considerations for future work" addressed to all CBD Parties. In particular the COP *"Calls upon Parties and invites other Governments, when developing or updating and implementing their national or regional invasive alien species strategies, to consider, on a voluntary basis and in conjunction with the items listed in decision VI/23" "Making use of the categorization of pathways of introduction of invasive alien species, considerations for their prioritization and the overview of available tools for their management as contained in the note by the Executive Secretary on pathways of introduction of invasive species, their prioritization and management"*.

The Bern Convention

In 2003 a specific strategy to deal with IAS at the European level (Genovesi and Shine 2004) was adopted by the Council of Europe to provide guidance to all fifty countries and the European Union (EU) which signed up to the Bern Convention, and thus committed to promoting national conservation policies, considering the impact of planning and development on the natural environment, promoting education and information on conservation, and coordinating research. The European Strategy on IAS – as it will be called hereafter - is aimed at providing guidance to help Bern Convention Parties in their efforts to identify and prioritise key actions to be implemented at the national and regional level. The identification of priority pathways and their management is indeed a key action to prevent the introduction of new IAS into and within Europe. It also supports the implementation of early warning and rapid response systems to detect new incursions.

More in detail, for *"Strengthening national policy, legal and institutional frameworks"* 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". In fact the European Strategy on IAS also highlights the need for "*Subregional co-operation*" at the European level according to which Parties should "*Promote dialogue between countries, sectors and key institutions in the same subregion, where not already established, to harmonise strategic direction and develop common approaches to shared IAS pathways and problems*" (Genovesi and Shine 2004).

The European Strategy on IAS is only one of the main outputs developed through the support of the specialised Group of Experts on Invasive Alien Species, established in 1992 by the Standing Committee to the Bern Convention. In fact, in addition to regularly monitor the implementation of the IAS Strategy, since 2009 the Group has focussed its work on the identification and prioritisation of pathways, and started preparing targeted codes of conduct to address these. So far the Standing Committee has endorsed codes of conduct on IAS and activities such as horticulture, zoos and aquaria, botanic gardens, hunting, pets, recreational fishing and recreational boating. Other codes are under development, including on plantation forestry. These codes of conduct are useful tools for increasing awareness on the IAS impact and federating the efforts of a wide range of stakeholders (including the business sector) through voluntary, sound and specific measures.

The following recommendations refer to the codes formally adopted by the Standing Committee to the Bern Convention:

- Recommendation No.188 (2016) on the European Code of Conduct on Recreational Boating and Invasive Alien Species;
- Recommendation No. 170 (2014) on the European Code of Conduct on Recreational Fishing and Invasive Alien Species;
- Recommendation No. 166 (2013) on the European Code of Conduct on Hunting and Invasive Alien Species;
- Recommendation No. 161 (2012) on the European Code of Conduct for Zoological Gardens and Aquaria on Invasive Alien Species;
- Recommendation No. 160 (2012) on the European Code of Conduct for Botanic Gardens on Invasive Alien Species;
- Recommendation No. 154 (2011) on the European Code of Conduct on Pets and Invasive Alien Species;
- Recommendation No. 134 (2008) on the European Code of Conduct on Horticulture and Invasive Alien Plants.

Other recommendations, although not related to a code of conduct, are worth being mentioned for the importance on the topic targeted by this document:

- Recommendation No. 179 (2015) on action to promote and complement the implementation of EU Regulation 1143/2014 on invasive alien species;
- Recommendation No. 167 (2013) on the European Guidelines on Protected Areas and Invasive Alien Species.

The value of such tools is widely recognised by a number of other international organisations.

In relation to international travels as a pathway, the European Strategy recognises that IAS are a cross-cutting issue concerning many social, economic and environmental interests (including also trade, health, agriculture, forestry, water resource management, infrastructure development, horticulture, aquaculture). Thus, in relation to "Early detection and rapid response", a key action recommended to Parties to ensure the establishment of comprehensive and cost-effective surveillance procedures in place, is to set up an Early Warning System and organise regular surveillance of high risk areas, such as:

- main entry points for commercial/tourist arrivals (airports, ports, harbours, open moorings, train stations) and areas frequently visited by tourists;

- highly disturbed areas (land clearance, construction, storm damage) and areas where disturbance is regularly occurring (roads, railways etc.).

More in detail, the European Strategy on IAS invites to co-operate with tourist operators and airport/port authorities to develop a code of conduct to minimise the movement of potentially invasive species in biological material by tourists and travellers. Other appropriate actions for trade and transport pathways and vectors, suggested within the European Strategy on IAS, include support to the International Civil Aviation Organisation's work to assess IAS risks associated with civil aviation pathways and develop common measures to minimise such risks, as well as improve the control and monitoring of import and movement of plants including seed and plant products and other related articles by National Plant Protection Organisations. For this reason, a code of conduct dedicated specifically to international travels is considered a crucial step to (pro)actively raise awareness among tourist and travellers, and involve the relevant stakeholders (i.e. professional associations for tourism/travel) in the framework of actions aimed at preventing or mitigating the threats posed by biological invasions at the relevant levels.

As a side note, a recent achievement of the Bern Convention was the finalisation of a guidance document on how to draft management plans and action plans for IAS pathways (Scalera and Genovesi 2016) addressed to governments and national authorities from across Europe and beyond. This document aims at providing a general framework of what a comprehensive action plan for managing IAS pathways should look like, including detailed instructions on contents, as well as examples of best practices. The objective was to develop a practical tool for both the authorities and relevant experts who have to draft such management/action plans and the administrators who have the responsibility to validate and implement them. Ideally, the guidance document on how to draft management/action plans for IAS pathways should be used in association with the present code of conduct and all the others developed by the Bern Convention, in order to ensure their sound implementation at the required administrative level.

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

By building on the European Strategy on IAS, some Parties have been developing their own national strategies, including the related legal and technical implementation tools. In this context, also the EU has recently adopted a dedicated legislation. The EU Regulation on IAS No. 1143/2014 is actually one of the greatest achievements in line with the ambitious Communication from the Commission "Our life insurance, our natural capital: an EU biodiversity strategy to 2020" (COM(2011) 244) adopted by the EC in 2011 to halt the loss of biodiversity and ecosystem services in the EU by 2020. The "EU Biodiversity Strategy to 2020" contains six main targets, and 20 actions to help the EU to reach this goal. In fact "*this strategy proposes filling this gap with a dedicated EU legislative instrument which could tackle outstanding challenges relating inter alia to IAS pathways, early detection and response and containment and management of IAS*". In particular, the regulation fits well with Target 5, according to which "*By 2020, Invasive Alien Species 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*".

The EU Regulation on IAS entered into force on 1st January 2015. This Regulation is based on the CBD Guiding Principles of prevention, prioritisation and coordination and seeks to address the problem of IAS in a comprehensive manner. The objective is to protect native biodiversity and ecosystem services, as well as to minimise and mitigate the human health or economic impacts that these species can have. The core of the system is an open list of IAS of Union concern for which a general ban from the EU, including introduction, transport, trade, keeping, breeding and release into the environment, is established (but the regulation also provides for a system of authorisations and permits to allow certain activities based on IAS). Not only article 7 (restrictions) applies, but also all other obligations, notification and rapid eradication or management.

The list, which currently includes 48 species (and 1 species with delayed entry into force), is based on risk assessments which satisfy certain conditions set out under Article 5(1) of the Regulation (e.g. see also Roy *et al.* 2014). Other IAS are expected to be added in the near future, and further species are being risk assessed to verify whether they will qualify for discussion and successive inclusion in the list. The decision process basically relies on a Committee composed by representatives

from Member States, and a “Scientific Forum” composed of representatives of the scientific community nominated by the Member States with the role of providing advice. The Scientific Forum meets once or more times a year and provides an opinion on each risk assessment, amongst other tasks.

Member States shall establish within 18 months a surveillance system for IAS of Union concern, and will be obliged to notify new incursions, and to immediately apply eradication (within 3 months after alert notification), when feasible and not disproportionately costly. Additionally, within 18 months Member States shall have in place effective management measures for IAS of Union concern that are widespread in their territory. Effective structures for official controls (border controls, goods entry points) should be already fully functioning.

The 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*" and "*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*". The contribution of codes of conduct on this regard is explicitly foreseen in the same article, according to which: "*Action plans shall include timetables for action and shall describe the measures to be adopted and, as appropriate, voluntary actions and codes of good practice, to address the priority pathways and to prevent the unintentional introduction and spread of invasive alien species into or within the Union*", and a special attention to international travel is paid, as it is recognised that action plans shall include measures to "*minimise contamination of goods, commodities, vehicles and equipment by specimens of invasive alien species, including measures to tackle transportation of invasive alien species from third countries*".

To this regard, see also art. 11 on IAS of regional concern and invasive alien species native to another part of the Union territory, and art. 22 on co-operation and coordination in relation to species of Member States concern. As pointed out by Essl *et al.* (2015) the near-abolition of border inspections between EU countries will be a major challenge for regulating these pathways. Nevertheless, the Regulation represents a significant improvement in the coordination, implementation, and consistency of pathway management across the EU.

Furthermore, the EU Regulation on IAS foresees that all risk assessments for the identification of the species of Union concern include a description of the main pathways (art. 5). To be noticed that the list of IAS of Union concern does not cover IAS that are native to some parts of the Union but invasive to others, but the Regulation provides Member States with the possibility to develop lists of IAS of Member State concern, applying stringent measures to regulate them (see art. 23). The Regulation allows Member State to identify, from their national list of IAS of Member State concern, species native or alien to the Union that require enhanced regional co-operation. Such regional co-operation may be facilitated by the EC.

Other relevant “mild” obligations are also foreseen for Member States, including the requirement to enhance co-operation at the international scale. For example, Member States shall make every effort to ensure coordination with other concerned States, when practical and appropriate, and shall endeavour to co-operate with third countries. Additionally, Member States should ensure coordination and co-operation for what concerns action plans on pathways, exchange of best practices on management, and public awareness programs. Effective communication and engagement of the society are indeed key elements for an effective implementation of the regulation.

THE RATIONALE FOR A CODE

In order to meet international conservation commitments, countries are required to identify, prioritise and manage pathways to prevent the spread of IAS, including those related to international travels.

The European Strategy on IAS (Genovesi & Shine 2004) suggests to promote the implementation and further development of standards, codes of conduct and best practices to minimise identified risks, in co-operation with international standard-setting organisations and relevant sectorial organisations, as appropriate. Voluntary codes of conduct and best practices are thus considered as fundamental

flexible “implementation” tools which could be scaled up with support from public bodies, industry federations, user groups and/or NGOs as appropriate, with the aim of ensuring responsible, proactive policies, and applying these in a coherent manner across Europe (Shine *et al.* 2010).

This is consistent to the Guidelines for the Prevention of Biodiversity Loss Caused by Alien Species drafted by the ISSG IUCN/SSC (2000) which stress the need to develop collaborative industry guidelines and codes of conduct to minimise or eliminate unintentional introductions, particularly those due to international and national trade and tourism routes.

Also according to “A Global Strategy on Invasive Alien Species” (McNeely *et al.* 2001) new and innovative strategies and actions must be developed in co-operation with the trade, travel, tourism and transport sectors to prevent inadvertent introductions. Other areas essential to address are awareness raising, legislation, information, management, education and training. Voluntary tools such as codes of conduct can thus be a valid instrument to (pro)actively address pathways with the purpose to prevent either intentional or unintentional introductions, and ensure more effective enforcement of policy and legislation. Codes of conduct can also support the development and adoption of harmonised standards at the national and regional level for preventive measures in practical operations in the target sector, as well as the required cross-sectorial coordination and co-operation.

Pathways related to international travels and tourism have already received some attention, particularly in specific regions, such as Southern Ocean Islands, Antarctica, New Zealand, the Galapagos islands, Saint Lucia, etc. Hence, several policy and legislation tools exist, whose provisions have inspired the recommendations listed in the present document. There are also a number of works discussing the existing policy and legislation measures, whose considerations and conclusions have been taken into account in the present work, so to ensure an effective and long-lasting value to the biosecurity measures proposed. A selection of such works is discussed in this section.

As stressed by Anderson *et al.* (2015) reducing unintentional introductions through the tourism pathway will require effective prediction, surveillance, awareness-raising and control, and will rely on international co-operation. The ISSG IUCN/SSC Guidelines (2000) as well as the document drafted by McNeely *et al.* (2001) suggest a selection of points to be included in national strategies and plans to reduce the likelihood of unintentional introductions, including in relation to international travels.

Shaw (2013) reports many details on how tourist activities are regulated in Southern Ocean Islands through permits and observers where tourism occurs. For example, tour operators are required to ensure that tourists clean their boots prior to disembarking tourist vessels and no food products are permitted ashore. Furthermore, people travelling to most of the islands are not permitted to take outdoor clothing that has been utilised in other areas, and most programmes provide their personnel with new or clean boots and outer clothing. Shaw (2013) also points out that these biosecurity principles are shared between countries, particularly in remote islands, and have broader applicability to protected areas more generally. This is definitely supported by the other examples reported below.

Stringent management measures including the adoption of a biosecurity policy at entry points are in place in New Zealand (see the country’s Biosecurity Act³) and are available for Antarctic tour operators (see IAATO Guidelines for Visitors to the Antarctic⁴). The focus of such measures is on seeds via footwear in particular (Ware *et al.* 2011). In Antarctica, for example, a way to substantially reduce propagule loads includes inspections of tourist footwear and luggage on arrival (Lee & Chown 2009). This method seems effective when dealing with pristine habitats (Anderson *et al.* 2015). However educating travellers of the need to clean footwear and personal equipment of seeds and contaminants may not be effective without being accompanied by regular inspections at entry points. As Lee & Chown (2009) pointed out, some change in the inspection and issuing procedures for expeditioner luggage along with some relatively inexpensive changes in cargo operations, would probably be required to further reduce propagule loads (such procedures would apply as much to the tourist industry as they do to science logistics, at least in terms of expeditioners). In the Galapagos Islands, where alien mosquitos had been frequently introduced through aircrafts and cargo boats

³ <http://www.mpi.govt.nz>

⁴ <http://iaato.org/visitor-guidelines>

(Bataille *et al.* 2009), disinfection protocols have been implemented for inter-island aeroplanes and boats to prevent the introduction of mosquito-borne diseases: a serious risk factor for the archipelago's endemic fauna.

The way that the tourism pathway is managed in New Zealand is discussed by Hulme (2015). Here, incoming passengers are screened and those in possession of outdoor equipment or footwear have their luggage inspected and even cleaned. This is a costly and time-consuming process, which relies on a combination of honest declarations by passengers on arrival and financial penalties for non-compliance. It imposes delays at the border and for this reason is considered unpopular with visitors, airport authorities and tourism operators.

In Santa Lucia, the prevention efforts linked to the travellers/tourist pathway, is implemented through a series of complementary actions following the Voluntary Code of Conduct for Saint Lucia's Tourism Sector, which provides some relevant indications directed at several groups of stakeholders (Krauss & Lao 2013). Also Krauss & Lao (2013) stressed the importance to start preventative measures against IAS with informed business practices.

Awareness raising initiatives to improve the biosecurity practices are considered an essential element of prevention also in this context (Meyerson & Pyšek 2013). Such initiatives have been developed in a number of sectors, including for recreational water users (Anderson *et al.* 2014) and airline passengers (Wittenberg & Cock 2001). Otherwise in Europe, some guidance for visitors to national parks and protected areas have been already developed (Monaco & Genovesi 2014, Anderson *et al.* 2015), as a way of reducing alien plant introduction by hikers and horse riders, as well as visitors taking part in recreational activities (e.g. motor boating, diving, snorkelling) in marine reserves.

Example of complementary measures aimed at supporting the prevention efforts

Given the positive correlation detected between visitor numbers and number of introduced species (Usher 1988), most likely due to associated infrastructures like lodges and roads (Foxcroft *et al.* 2013), it has been suggested that tourism may represent a threat for invasions of nature reserves and protected areas. This is obviously an issue of growing concern, as ecotourism is promoted as a prime, low impact source of revenue in many parts of the world (see also Lonsdale 1999; Foxcroft *et al.* 2014). Also Meyerson & Pyšek (2013) stress the importance of tourist camps and staff villages as source areas of invasive plant propagules. However, the income generated by tourist (Anderson *et al.* 2015) could provide an important source of revenue to fund management initiatives to prevent and mitigate the impacts of IAS.

Hulme (2015) pointed out that given the amount of the income generated by global tourism, imposing a tourist levy to recover costs of inspection would increase the financial viability of such interventions but would still be unpopular with tourists or tourism operators. Yet, despite resistance from the national tourism and airline industries, the New Zealand government has recently taken the decision to impose a biosecurity levy on incoming and departing air passengers which will meet the full costs of passenger border clearance. Improved tools to profile high-risk passengers (based on their origin and reasons for travel) combined with more effective technologies to screen luggage (e.g. X-rays, detection of volatiles) will speed processing times at ports of entry. Such investment can in turn increase the potential for eco-tourism in the long term (Anderson *et al.* 2015). Stakeholders should be the first ones to be shown how sustainable behaviour in ecotourism destination is financially beneficial, so they are motivated to be leading by example (Krauss & Lao 2013).

In Namibia, for instance (Bethune *et al.* 2004), the Ministry of Environment and Tourism, the tourist industry and the Namibian Professional Hunting Association (NAPHA), have recently agreed to market Namibia's indigenous species to eco-tourists and hunters. In this regard, alien species are actively discouraged, and some are banned. The two Namibian snake parks, in Swakopmund and at Makuti Lodge outside Etosha, only display indigenous species. This is a policy instituted in tandem to shape the quality of the environmental experience an eco-tourist can expect, rather than a strictly IAS issue, but it obviously has value in this regard as well. The marketing of "clean" eco-tourism, as opposed to "artificial", makes good economic sense in Namibia. In a social sense these policies encourage Namibians to be aware and proud of indigenous species and to be cautious of alien species. The loss of genetic integrity of Namibia's indigenous species is perhaps the biggest threat, and this is

protected by the Constitution and by international conventions on biodiversity. Currently the Ministry of Environment and Tourism is spending time and resources on this particular issue of dealing with alien strains of game animals from South Africa.

Always in Namibia (see Bethune *et al.* 2004), applications for introductions are dealt with on a case by case basis (several leading to court action), and the following has become obvious: current legislation is inadequate, enforcement is not uniform due to manpower problems, policy on the subject is neither formal nor clear within the Ministry of Environment, and Tourism and public awareness is lacking even within the wildlife sector. Namibia would like to market its eco-tourism industry based on indigenous wildlife. The discerning eco-tourist is aware of viewing alien species in unnatural surroundings, besides which Namibia cannot compete with South Africa on exotic animal safari experiences. Self-regulating codes of conduct can be the way to promote strong social norms and change people behaviour. In this regard, the NAPHA has taken up this issue in its policy on the import and translocation of game. The association proudly promotes the use of indigenous species as Namibian products and takes care not to contaminate Namibian game through the introduction of animals from outside the country or from different geographical areas.

It is clear that raising awareness on the issue is key to achieve long term results. Information and communication campaign should be specifically planned to address the specific audience, with the appropriate media. The use of modern communication means such as the social networks can be a valuable tool. In the Canary islands, for example, the Facebook page of an organization promoting climbing activities, Escalada Sostenible Tenerife, on July 5th, 2017, circulated a post focusing on the impact of the crimson fountaingrass (*Pennisetum setaceum*) and relevant good practices for climbers to prevent the spread of this invasive alien plant (Juan Luis Rodríguez Luengo, pers. comm. 2017). Similar initiatives show the importance of involving stakeholders and ensuring their proactive support and collaboration in the prevention effort aimed at the conservation of natural resources, including at managing the problem of alien species.

Toward an improved knowledge on the travellers and tourist pathway

The best available knowledge is a fundamental component of any policy and legislation, therefore to assess the validity of the measures suggested by the present code of conduct, all involved actors (including tourist, travellers, stakeholders and authorities) should be requested to provide some feedback. Interviews and questionnaires should be developed for this purpose. As nature-based tourism and outdoor recreation (hereafter grouped under “recreation” for simplicity) often take place in relatively pristine habitats, biodiversity hotspots and in developing countries which rely upon tourist income, it is vital to better understand the invasion pathway represented by tourist activities, so that it can be effectively managed (Anderson *et al.* 2015). For example, in the Galapagos islands, the conventional approaches attempted to date have shown and continue to show limited success (Stevenson 2001).

Conversely, similar studies and researches may also be useful to support the implementation of specific measures. For example, the travellers who participated to a study by Ware *et al.* (2011) aimed at assessing the viability of the seeds embedded in the soil off the soles of the shoes, filled out a questionnaire about when they had last cleaned their shoes, whether the shoes had been in use in the three previous months and if so, in what type of environment, forest, alpine or city. The objective was to collect information on whether in the near future, travellers to Svalbard may be required to pass through a cleaning process before they can leave Longyearbyen airport and walk out onto Svalbard soil.

According to Banks *et al.* (2015) more people and goods are moving further and more frequently via many different trade and transport networks under current trends of globalisation. These networks can play a major role in the unintended introduction of exotic species to new locations. With the continuing rise in global trade, more research attention is being focused on the role of networks in the spread of invasive species. This represents an emerging field of research in invasion science and the substantial knowledge being generated within other disciplines can provide ecologists with new tools with which to study invasions. For the first time, Banks *et al.* (2015) have synthesised studies from several perspectives, approaches and disciplines to derive the fundamental characteristics of network

topology determining the likelihood of spread of organisms via trade and transport networks. These characteristics can be used to identify critical points of vulnerability within these networks and enable the development of more effective strategies to prevent invasions.

The (fundamental) role of Member State's authorities

Like any other code of conduct aimed at the prevention from unintentional introduction and further spread of IAS, this is a voluntary tool whose implementation depends on the willingness of both travellers and the relevant stakeholders. Nevertheless, some support is needed from national authorities to improve the overall legal framework needed to ensure a proper implementation of management biosecurity measures, in particular at entry points. For example, national authorities should ensure that appropriate quarantine protocols and border control regulations and facilities are put in place and allocated the required resources, to prevent the introduction of alien species through certain types of activities. To this aim, it is important to verify that the inspection and interception capabilities needed to intercept the unintentional introduction of alien species, through border control legislation and procedures, are adequately ensured by qualified staff, specifically trained.

Eventually, all relevant policy and legislation measures should be enforced as required. For example, to reduce the problems of IAS arising from ballast water discharges and hull fouling, appropriate initiatives according to the guidelines and rules set within the Ballast Water Management Convention should be implemented. National authorities should consider ensuring the full enforcement of all relevant legal provisions including appropriate fines, penalties or other sanctions to apply to those responsible for unintentional introductions through negligence and bad practice, which in turn may be used to fund management initiatives to prevent and mitigate the impacts of IAS. To this purpose it is fundamental to guarantee that appropriate levels of monitoring and control are established.

As a side measure, economic incentives that may assist the introduction of IAS (e.g. introductions aimed at increasing game opportunities, or ornamental plants in tourist infrastructures) should be eliminated, and the transport of construction material duly regulated (in relation to the risk of spread of IAS). This also applies to any large engineering projects for which specific environmental impact assessment should be carried out, taking into account the risk associated with unintentional introductions of IAS (i.e. for canals, tunnels and roads that cross biogeographical zones, that might mix previously separated flora and fauna and disturb local biological diversity).

National authorities should also help identify the full range of relevant international trade authorities and industry associations (e.g. airport authorities and tourism operators including organizers, guides, dive instructors, boat operators), to be addressed to achieve the goal of significantly reducing the risk that travel and tourism will facilitate the introduction and spread of IAS. In this context, activities to promote co-operation within each country among the relevant sectors should be envisaged and coordinated as appropriate. To help ensure that all players understand the importance and benefits of preventing biological invasions, also in terms of the economic and aesthetic benefits, a pivotal contribution is the implementation of sound information campaigns aimed at raising awareness among the key stakeholders, as well as among tourists and travellers (e.g. at both origin and destination airports, or through dedicated in-flight announcements). To this aim, national authorities should ensure that national legislation applicable to introductions of alien species, both intentional and unintentional, is known and understood, not only by the citizens and institutions of the country concerned, but also by foreigners importing goods and services as well as by travellers and tourists (IUCN 2000).

CODE OF CONDUCT

The main objective of the present code of conduct is to provide guidance on voluntary measures to be adopted to prevent further intentional or unintentional introductions of IAS, including the related pathogens and diseases, by travellers and tourists moving between different countries and regions. More in detail, a particular attention is paid to travels toward "sensitive sites", which in this document refer to ecologically vulnerable islands, pristine habitats and other isolated ecosystems such as lakes, mountain areas, protected areas, nature reserves, wilderness areas, isolated forests, inshore marine ecosystems, etc. which may have evolved in isolation and may therefore be less resilient to novel

threats. However, since also introductions under the form of small scale translocations can represent a threat to the local biodiversity, the present code may also apply to all kind of movements of people and associated luggage/equipment/means of transport.

The code is addressed to all **operators involved in the travel/tourism sector and industry**, including travel/transport agencies and companies dealing with transport or movement of people and/or living organisms, professional associations for tourism/travel, tour operators, flight and boat operators, ship and aircraft crews, customs and quarantine services, militaries, protected area managers, scientists, importers and exporters of goods (as well as of living organisms), wildlife trade personnel, other government departments/agencies responsible for tourism, travel, transport, and infrastructures (hence property owners and managers of accommodation facilities for travellers) including from both the public and private sector. Such a wide audience represents a major constraint for the identification of specific measures to prevent introductions of alien species through international travels. Therefore, considering also the highly context dependent character of the risk posed by different types of travels, the best practices suggested below need to be tailored appropriately according to each specific situations.

Key activities pertaining to the tourist sector, such eco-tourism, hunting, fishing and several recreational activities etc. are also addressed (please note that some stakeholders and relevant activities have already dedicated codes of conduct developed for the pathways they are related to, see relevant section above).

On the basis of the information discussed in the present document, the following five key groups of recommendations have been identified for travel/tourism operators and their staff in Europe, as well as business partners, travellers and tourists:

- 1) Adopt effective preventative measures to avoid unintentional introduction and spread of IAS to and from the sites visited by travellers;
- 2) Adopt effective measures to ensure that no intentional introductions of alien species are carried out to and from the sites visited by travellers;
- 3) Proactively engage with relevant authorities to support measures aimed at preventing the introduction of IAS (including in relation to IAS monitoring and surveillance);
- 4) Adopt best practices for supporting biodiversity conservation measures to reduce the impact of tourism/travels related activities to the environment, particularly in relation to habitat disturbance and degradation;
- 5) Ensure adequate support to awareness raising and outreach activities focusing on IAS and their impacts.

Details on each group of key recommendations are provided below. Please notice that some measures require adequate support and assistance from national and local authorities.

1) Adopt effective preventative measures to avoid unintentional introduction and spread of IAS to and from the sites visited by travellers

- Be aware of all relevant regulations concerning the movement of wildlife across countries and regions, and get familiar with this code of conduct along with any other relevant guidance document aimed at preventing the introduction and spread of IAS as a consequence of travel/tourism related activities (e.g. including from strictly related pathways, such as eco-tourism, hunting, fishing and other recreational activities). Invite staff members, clients, business partners, travellers and tourists to do the same.
- Prevent transport of alien species assisted by travel/tourism related activities, particularly to “sensitive sites”. For example, when reaching a “sensitive site”, be sure that the relevant means of transport are not providing alien species with the opportunity to spread and colonise new areas (e.g. boat operators should secure boats on sandy landing places free from the presence of alien species, boats should not be tethered to support on the islands themselves, as ropes can serve as rat ladders). Consider the development and enforcement of specific protocols (e.g. on disinfection and quarantine), including liaising with the relevant authorities on this regard, as appropriate.

- Identify appropriate measures to prevent the spread of IAS (such as mice and rats at boat departure points) by eliminating litter and hiding spaces. Consider that litter discarded in the environment (e.g. organic waste, such seeds) can give rise to alien plants.
- Identify and establish appropriate measures to ensure that as far as possible goods, luggage, boxes, bags, clothes or any other items to be transported are free of alien species. Inspections of travellers and tourist luggage and equipment (e.g. on muddy boots or palm frond hats), should always be considered particularly before visiting “sensitive sites”.
- Identify appropriate measures to remove from the relevant means of transport any alien species, such as mice and rats, but also other animals and plants (including seeds or fragments) found during every travel, in particular at the departure point (e.g. before embarking).
- Ensure that clients are put in a condition to select conscientious staff from the relevant travel/tourism operators, who observe the present code. Allow clients to personally screen the means of transport used to travel to “sensitive sites” for signs of garbage and hitchhikers, such as mice and rats.
- Establish appropriate measures to refrain from transporting any construction material, such as timber, rocks, or sand to “sensitive sites” without prior as far as possible check of the presence of alien species as contaminant or stowaway.

2) Adopt effective measures to ensure that no intentional introductions of alien species are carried out to and from the sites visited by travellers

- Ensure that all people involved in the travel/tourism sector and industry (e.g. fisher folks, boat owners and captains) take appropriate measures to eliminate the risk of introducing alien species intentionally to new sites.
- Be vigilant of travellers and tourists visiting “sensitive sites” as they may deliberately smuggle live animals and plants that could subsequently escape, or may be harbouring alien organisms and consequently contribute to their introduction and spread.
- Report any suspicious behaviour in relation to the (un)intentional release of alien species promptly to authorities.
- Ensure that any project or initiative aimed at promoting tourism activities does not entail the introduction of alien species. For example, be sure that only native plant species are planted on tourist location and infrastructures, including on beaches, along trails, at meeting and view points, and adjacent to any other ecologically sensitive sites.

3) Proactively engage with relevant authorities to support measures aimed at preventing the introduction of IAS (including in relation to IAS monitoring and surveillance)

- Verify with the relevant authorities whether it is appropriate to allow travellers and tourists to take any pets or livestock to “sensitive sites”.
- If possible and appropriate, ensure the necessary stakeholder support to the development of a site management plan, particularly in relation to surveillance and prevention measures focusing on IAS.
- Respect and comply with management plans once they have been established, and support their regular updating as appropriate, e.g. by providing feedback to the relevant authorities.
- Participate in early warning systems by reporting sightings of alien animals and plants to the relevant authorities. Such observations could include dead animals or the partial remains of dead animals, signs of presence, animals and plants you would not expect to see there, tampering with bait stations or signage, or wild fires.
- Collaborate with authorities in routine monitoring, stock-taking and identifying potential invasive risk factors on either public or private property to facilitate Early Detection and Rapid Response (EDRR).

- Work towards sustainable finance mechanisms, e.g. by charging travellers and tourists a fee or asking for voluntary donations that are fed back into relevant conservation actions, i.e. to raise awareness, employ wardens and guides, implement surveillance and prevention measures, and carry out restoration initiatives.

4) Adopt best practices for supporting biodiversity conservation measures to reduce the impact of tourism/travels related activities to the environment, particularly in relation to habitat disturbance and degradation

- Avoid any activity which may result in (further) habitat disturbance and degradation, particularly in “sensitive sites”, because they may contribute to increase the vulnerability of the environment, also in relation to the spread of alien species, and may drive up management costs.
- Be observant and responsible by regularly monitoring the sites of tourist interest and, where possible, also natural habitats for signs of alien species and other potentially damaging man-made alterations (e.g. garbage, makeshift construction, signs of fire or hunting).
- Actively join and participate in clean-up initiatives, e.g. the removal of alien species, and restoration programmes.
- On sites where IAS control activities are taking place, do not interfere with any equipment/infrastructure present in the area (e.g. rat sentinel bait stations, etc.)

5) Ensure adequate support to awareness raising and outreach activities focusing on IAS and their impacts

- Ensure that people is aware of the risk they pose in unintentionally introducing alien species as contaminants or stowaways (raising awareness of how much human travel contributes to alien invasive problems can improve behaviour and be cost-effective).
- Proactively promote the adoption of the code of conduct among colleagues and business partners. Brief travellers and tourists on the code of conduct.
- Provide information and details on recommended actions to all travellers and tourists, preferably prior to the start of any journeys.
- Consider the development of questionnaires to assess the validity and effectiveness of the measures implemented to prevent the introduction of IAS.
- Consider planning information and communication campaigns appropriately tailored to specific target audiences. This could envisage the placement of information boards or flyers in airports, harbours, railways station, as well as border stations, travel offices, tourist locations and infrastructures, visitor centres of protected areas, including on beaches, along trails, at meeting and view points, and adjacent to any other ecologically sensitive sites, etc. Consider also the realisation of audio-video material to be circulated through the appropriate media, including through the use of social networks.
- Assist financially, as far as possible, with the production of educational materials, including on-site signage and tree labels, and organization of events or field trips.
- Display and distribute educational information material that is being made available by technical agencies.
- Host events and presentations on environmental education for employees, guests and community members.
- Consult experts to determine what species are invasive or show invasive potential when in doubt; refer others to experts you know.
- Ensure travels are well organized and informative, i.e. the tour guides must be properly trained and equipped with education materials provided by technical experts. Include the issue of alien species and travels into relevant school curricula, e.g. for travel/tourist operators, hotel/recreational resorts managers etc.

- Pass knowledge to employees, local residents (starting with school children), visitors, fishermen, drivers, community residents etc., so that they shall be better informed about native flora and fauna as well as the risk presented by alien species (which they can further disseminate by acting as multipliers).
- Make the public aware of the unique experience being offered by native species in each target areas, but also of their vulnerability to the key factors threatening biodiversity, including those linked to the presence of alien species, etc.
- Ensure wider (international and regional) co-operation among different travel/tourism operators to exchange experiences with IAS management, identify cost-effective solutions, raise awareness on the impact caused by the introduction and spread of IAS.
- Consider the following examples of recommendations for tourists and travellers (along with the general public) in relation to the problem of alien species introduced and spread through international travel:
 - Be aware of existing rules comply with them.
 - Do not introduce any plants or animals into “sensitive sites” within the travel destination, along the travel and back home.
 - In order to prevent the introduction of alien species, along with the related pathogens and disease, carefully wash boots and clean all equipment including clothes, bags, tripods, tents and walking sticks before bringing them to the travel destination and back home. Pay particular attention to boot treads, velcro fastenings and pockets which could contain soil or seeds. Vehicles and aircraft should also be cleaned.
 - The transfer of species and disease between locations along the travel tour is also a concern. Ensure all clothing and equipment is cleaned before moving between sites.
 - Avoid any activity which may result in (further) habitat disturbance and degradation because they may contribute to increase the vulnerability of the environment, also in relation to the spread of alien species (e.g. respect the environment, do not damage/remove any plants or animals from the sites interested by the travel, do not collect or take away biological or geological specimens as a souvenir, do not dispose of litter or garbage on land, do not disturb or pollute lakes or streams never stray from the tour, etc.)

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