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Invasive Alien Species

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Invasive Alien Species

Contents

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Invasive Alien Species: Risks, Impacts and Solutions

Invasive alien species (IAS) are a leading cause of biodiversity loss in Europe and across the globe. As plants or animals that are introduced, either accidentally or deliberately, into areas they would not otherwise have reached, IAS can cause substantial ecological damage, disrupting native ecosystems. This can lead to extinctions, loss of important ecosystem services and harm to human health. They can also result in significant economic losses; estimates indicate that IAS damage and control measures currently cost Europe at least €12 billion per year. In recognition of the serious and urgent nature of this threat, the EU Biodiversity Strategy to 2020[1] sets specific targets to tackle IAS. The strategy also includes the development of a dedicated legislative instrument focusing on early warning, rapid response and damage control, which was adopted on the 9th of September this year.

This Thematic Issue from Science for Environment Policy presents key pieces of research exploring risk assessments of IAS, surveillance methods, management practices and public perceptions of the problem.

The first article in this issue asks **'What are the impacts of invasive alien species?'**, presenting a study which reveals that beyond the immediate effects of IAS, more subtle changes can occur that affect an entire ecosystem. In the UK, for example, the predatory flatworm not only reduces numbers of native earthworms, but also increases waterlogging; in the absence of earthworms, the soil becomes less porous. This in turn affects conditions for plants and makes the habitat less suitable for moles. These diverse impacts must be carefully considered in risk assessments and management of IAS, the study's authors note.

Risk assessments are a particularly important aspect of IAS research, as they can help set priorities and support effective surveillance and rapid response. Limited resources mean it is not possible to control every species that is alien to Europe, therefore risk assessments are needed which help us identify the species that are most likely to have ecological and economic impacts.

'A new approach for evaluating alien species risk' sets out a framework for best practice, defining risk in relation to transport (which includes introduction), establishment, abundance, spread, and impact. This, say the researchers, aids understanding of how invasion processes are linked and promotes a more effective, integrative approach to IAS risk assessments. The article **'Socio-economic factors affect risk of alien species**

invasion' examines the best ways of predicting locations most at risk from invasion by alien aquatic species. The study summarised in this article shows that basing risk assessments on environmental factors, such as temperature, and omitting socio-economic factors, such as distance to the nearest port, could result in serious underestimations of the areas at risk.

The importance of human influence is also highlighted by the article **'Human population density explains alien species richness in protected areas'**. This study shows that across the wide range of different habitats encompassed by South African national parks, local human population is the only characteristic that consistently reflects IAS abundance.

Risks of invasion can change over time, as the article **'Mapping fish invasions in European freshwaters'** illustrates. Documenting pathways of fish invasion into Germany and Austria, the researchers demonstrated that although, in the past, the main driver of introductions has been commercial fisheries, the species currently showing the most rapid expansions have been introduced via trade in animals. The changing nature of IAS risk as a result of climate change is the focus of the article **'Endangered species' response to the dual threat of climate change and invasive species'**, which predicts that the invasive zebra mussel may benefit from climate change, negatively affecting native mussel populations.

Beyond the impacts and risks of IAS, this issue also explores how best to guard against future introductions and prevent the spread of newly introduced species. Good surveillance is particularly important and the

article **'Effective tools to predict spread and improve monitoring of invasive alien species'** considers how habitat suitability models can provide information for targeted sampling, providing much higher detection rates than random sampling.

Effective prevention can be achieved, however, as the article **'Risks of invasion of alien marine species driven by global shipping'** illustrates. This study examined the risks of invasion of marine species spread by transportation in ballast water, and shows that treating this water before it is discarded could reduce the risk by as much as 82%.

One key factor influencing the success of management and eradication of IAS are the perceptions of different stakeholders, from the public to conservation managers and scientists. **'Does the public's view of invasive alien species differ from the professionals'?'** explores differing attitudes to IAS, and indicates that the general public feel that human responsibility for introduction is a key factor in whether to eradicate species, often not explicitly discussed by scientists. The study's authors call for better communication, stressing that open discussion between scientists and the public could lead to a valuable increase in understanding of IAS.

The importance of an in-depth understanding of the risks of IAS is also highlighted in our last article, **'Conservation managers and public unaware of invasive alien species' true risks'**, detailing a UK survey which finds, worryingly, that regardless of the amount of scientific research on a species, both the public and conservation managers are unaware of the full risks posed by IAS.

In conclusion, IAS present a severe threat to global biodiversity. To meet this challenge, prevention of new introductions, early warning of invasions and rapid response to such threats must be guiding principles. An effective system of prioritisation is also needed, to focus limited resources on key threats. Furthermore, good communication between scientists, the public and conservation managers would increase the chances of success in vital prevention, eradication and management efforts.

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1.   http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm

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Theme(s): Biodiversity

What are the impacts of invasive alien species?

The impacts of invasive alien species (IAS) can take many different forms, from ecological to socio-economic. A new review investigates how to define and quantify 'impact' and discusses the most successful strategies to reduce invasion risk and prevent different impacts.

"The focus of invasion science has shifted [...] to cumulative impacts on ecosystems, revealing that the effects of an introduction can be many and varied."

Biological invasions can substantially degrade ecosystems and IAS are listed among the primary causes of global biodiversity loss. For example, among aquatic species introduced to six European countries, 69% have had detrimental ecological impacts.

However, defining and quantifying such impacts can be difficult. As a result, the focus of invasion science has recently shifted from impacts on particular species to cumulative impacts on ecosystems, revealing that the effects of an introduction can be many and varied. For example, the predatory flatworm, invasive to the UK, not only reduces numbers of native earthworms, affecting food supply for birds, but also means the soil becomes less porous, increasing waterlogging. This in turn affects conditions for plants and makes the habitat less suitable for moles.

Furthermore, beyond ecological consequences, economic and sociological factors must also be considered when the impact of IAS is evaluated. For example, when the Japanese tiger prawn became established as an invasive species in the Mediterranean, it was welcomed by local fishermen who benefited from the extra income. However, the invasion led to the extinction of a native species of prawn and therefore was regarded as harmful by conservationists. Similarly, while the invasion of pine trees throughout the southern hemisphere reduces the quality of litter (dead plant material on the forest floor) and depletes soil biodiversity, these fast-growing trees also support timber industries, benefiting local economies.

Management of impacts and risks must also be carefully considered. The Convention on Biological Diversity[1] states that prevention of invasive species is the priority response, followed by rapid eradication efforts if needed. Prevention measures can include intercepting species moving across borders. For example, the treatment of ballast water on ships can be used to kill marine organisms and prevent them from spreading to new regions.

If prevention fails, swift action greatly increases the likelihood of successful eradication, the authors of the review note. For example, an eradication effort in California to remove an invasive species of seaweed mounted within six months of invasion was successful in two years. In the Mediterranean, however, several years' delay in eradication efforts allowed the species to spread for thousands of kilometres along the coasts of many southern European countries and the species now cannot be removed with current technologies.

Good management strategies must also include good communication between scientists and the public to improve awareness of the impacts of invasive species on ecosystems, the authors conclude. In particular, increased awareness of the subtler impacts of invaders on the entire ecosystem is needed.

1. *http://www.cbd.int/convention/*

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Theme(s): Biodiversity, Risk assessment

A new approach for evaluating alien species risk

A new framework has been developed by researchers to provide guidance in evaluating alien species risk. Using an analysis of more than 300 risk assessment (RA) models, the researchers highlight that many fail to cover all of the components of alien species invasion and offer guidance on which elements to include in future risk assessments.

"Given limited resources, controlling all alien species is not only impractical, but also impossible. As such, policymakers and researchers have turned to a variety of risk assessment models."

Global trade offers many economic benefits, but it also brings increased opportunity for the accidental, or deliberate, spread of non-native plant and animal species. While many of these alien species are harmless, others can become invasive and cause serious damage. Invasive alien species are one of Europe's main drivers of biodiversity loss, and cause millions of euros worth of damage every year.

Given limited resources, controlling all alien species is not only impractical, but also impossible. As such, policymakers and researchers have turned to a variety of risk assessment models to identify invasive species likely to cause harm, both environmental and economic.

In this study, researchers reviewed and compared existing RA approaches, and integrated more than 300 different RA models to produce a new framework. They found two general types of RA approaches. Quantitative RA methods are used by academics and take a mathematical approach, often focusing on a single risk component, in many cases, species establishment. Qualitative and semi-quantitative approaches, used for policy development, have a more verbal basis and are usually based on expert opinion. These often deal with more than three different risk components but have a tendency to focus on impact.

The new framework defines risk in relation to each of the major stages in the invasion process: Transport (which includes introduction), Establishment, Abundance, Spread, and Impact (TEASI). Each of these stages is described in the study in mathematical form, yielding a quantitative RA structure.

The TEASI framework also allows the questions asked in qualitative and semi-quantitative methods to be described using equations, by considering them as special cases of quantitative models. It can therefore be described both mathematically and verbally. The researchers hope that this will allow for a more complete understanding, and practicality of use, in both policy and academia.

Its developers suggest that TEASI helps us understand how invasion processes are linked and promotes an integrative approach to alien species RA. However, the framework does not claim to be fully comprehensive, and instead provides an outline which serves as a starting point for future risk modelling work.

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Theme(s): Biodiversity, Risk assessment

Socio-economic factors affect risk of alien species invasion

Omitting socio-economic factors from invasive alien species (IAS) risk assessments could result in serious underestimations of the area at risk, new research suggests. Including factors such as population density and proximity to ports in risk assessments was found in this UK study to increase the size of the area predicted as suitable for invasion by up to six times.

"Research has shown that socio-economic factors are related to the number of IAS in a region, but despite their potential to improve predictions, they have not been used to predict invasion risk."

Species distribution models (SDM) are often used to predict areas most susceptible to colonisation by IAS. By considering environmental factors, such as climate and geology, which affect local water chemistry, SDM can be used to identify areas similar to the preferred habitat of the species. Other research has shown that socio-economic factors are related to the number of IAS in a region, but despite their potential to improve predictions, they have not been used to predict invasion risk.

This study evaluated how well environmental and socio-economic factors predicted the risk of invasion of 12 aquatic invasive alien species. These so-called 'dirty dozen' were chosen on the basis of the large potential ecological and economic impacts they would cause if they became widely established in Great Britain and Ireland. Some of these, such as the killer shrimp and the bloody red mysid, have already reached the UK but have yet to spread. Others, such as the Asian clam and the marmorkreb crayfish, have not yet arrived.

In order to model the risk of invasion in Great Britain and Ireland, the study used environmental data on the climate (e.g. temperature and rainfall) and geology (e.g. type of rock). The model also included four socio-economic factors. Firstly, the Global Human Influence Index, which groups relevant factors, such as population density, urban extent and roads into one measure. Secondly, to identify the specific effects of population density alone, this was also considered as a separate factor, and the third factor was land cover (e.g. forest, grassland, wetland, crops). Proximity to ports was the fourth socio-economic factor considered and was included as ports are the main entry point for aquatic invasive species.

The most important factor influencing the risk of invasion according to the model's results was minimum temperature, followed by proximity to ports. The inclusion of socio-economic factors resulted in an increase in areas at risk, compared to predictions that considered only environmental factors. In the case of the quagga mussel, the area considered suitable for invasion increased by six times, and for the Ponto-Caspian amphipod, it increased more than fourfold. The importance of these socio-economic factors is likely to be because they reflect possible routes of introduction, such as ports, roads, railways and the pet trade.

The maps produced by the study show that coastal, densely populated areas and those near transport routes are at most risk of invasion by the 'dirty dozen'. They also highlight which species are of particular concern in certain areas. The study's authors conclude that this approach provides a useful tool for preventing and controlling potential and existing invasions by helping prioritise areas and species.

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Theme(s): Biodiversity

Human population density explains alien species richness in protected areas

Protected areas near densely populated towns and cities have higher numbers of alien species than those in more isolated locations, research suggests. In a South African study, researchers examined a number of different environmental characteristics of national parks, and found that surrounding human population density best explained the number of alien species in each park.

"Local human population was the only characteristic that consistently reflected alien species abundance."

There are many different factors that might affect the numbers of alien species in an area, but these are often specific to the particular pathway of introduction. For example, rivers have been found to be an important pathway for alien species, but only for water-borne species. Few studies have attempted to identify general drivers of invasion which can be applied to a range of different species across both animals and plants.

In this study, researchers examined alien species in 19 national parks across South Africa. To identify common factors that are associated with high numbers of alien species, researchers examined several environmental characteristics of the parks. These included the age of the park, the number of years since new land was added to the park, park area, data availability (for example, how often the park is surveyed for invasive or alien species), surrounding human population density, number of roads, number of rivers and indigenous plant species richness.

Of the 813 species of alien animals and plants recorded across all national parks, 181 were known to have negative effects on biodiversity. The results of a statistical analysis showed that, in general, parks with high numbers of alien species were surrounded by dense human populations. Local human population was the only characteristic that consistently reflected alien species abundance.

Numbers of alien species were also high in parks with high data availability, as greater survey efforts led to detection of a greater number of species. This highlights the importance of surveillance, the researchers stress. Alien species, especially plants, which are not yet established enough to cause harm, are likely to be overlooked unless thorough, regular surveys are undertaken.

Overall, the researchers conclude that although there are many different pathways for alien species, and exact quantification may require species-specific data, surrounding human population density is the single factor that can predict the risk of alien species in protected areas. They suggest that mitigation strategies could include buffer zones, better monitoring, particularly along park boundaries, and effective coordination with all surrounding land owners.

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Theme(s): Biodiversity, Water

Mapping fish invasions in European freshwaters

Detailed analysis of the patterns of invasion of alien fish species in Austria and Germany has highlighted how drivers of invasion, such as the animal trade, can change over time. The researchers who conducted the analysis warn that climate change may be a key cause in changing invasion patterns in the future.

"… patterns of invasion are likely to change if temperatures rise under climate change."

The invasion of alien fish species is known to be a major threat to the biodiversity of freshwater ecosystems. In Europe, fish invasions have increased as a result of imports for commercial fisheries, accidental releases and a highly connected network of waterways. However, despite the economic and ecological importance of these invasions, data describing patterns of invasion in detail are rare.

For this study, records of alien fish species from 1981 to 2007 were collected from databases in Austria and Germany. In addition, climatic and environmental factors, such as temperature and river flow, that might influence alien fish invasion were assessed.

Fifteen alien fish species were considered as 'established' in both German and Austrian freshwaters, constituting 14 and 17% of freshwater fish in the two countries, respectively. The largest rivers in the region (the Danube and Rhine) have the highest numbers of invasive species and are both important waterways, acting as gateways for new invasions.

In both countries, six other alien species are present but not established, while the status of five alien species in Germany and three in Austria remain unknown. Until the 1980s, North America and Asia were the main sources of alien fish species, however, recently there have been more invasions from eastern Europe, partly reflecting the influence of the Danube-Main canal, which opened in 1992. This shows how the relative importance of invasion routes can change over time.

The results also highlighted the changing nature of the drivers of invasion.Using data from Austria, the researchers showed that the alien fish species which were introduced early via commercial fisheries, such as the rainbow and brook trout, were also the most widespread, found at 67% and 29% of sites respectively. However, they have shown no increase in spatial distribution in recent years. Conversly, fish such as the pumpkinseed sunfish and bighead goby introduced via the animal trade (e.g. via the pet trade, not including commercial fisheries) and through waterways (i.e. spreading into new areas via well-connected rivers or canals), have shown more recent increases in rates of spread.

The researchers warn that the patterns of invasion are also likely to change if temperatures rise under climate change. The amount of habitat suitable for coldwater species may fall, leading to declines, and increases in numbers of invasive species adapted to warm water may occur.

Possible mitigation methods include effective management, as well as raising awareness at both national and European levels. The study's authors note that several invasive fish show a preference for waterways that have been modified (often deepened and straightened) by humans. They therefore receommend restoring natural ecosystems by employing ecosystem-based management, as endorsed by the EU's Water Framework Directive[1].

1. *http://ec.europa.eu/environment/water/water-framework/*

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Theme(s): Biodiversity, Climate change and energy, Water

Endangered species response to the dual threat of climate change and invasive species

The joint threat posed by climate change and invasive alien species can have different effects on endangered native species, new research suggests. This European study predicts that the invasive zebra mussel may benefit from climate change, negatively affecting native mussel populations; but both invasive and native crayfish could suffer declines.

"Forecasting how both invasive and native species will respond to climate change is of vital importance to conservation management strategies."

Although climate change and invasive species are considered to be the two most important threats to biodiversity, their combined impacts have rarely been assessed, making it difficult to implement effective risk management and conservation measures.

This study evaluates the threat posed by climate change and two of the most harmful and widespread freshwater invasive species in Europe - the zebra mussel and the signal crayfish - on the distribution of two endangered freshwater species: the depressed river mussel and the white-clawed crayfish.

The signal crayfish, originally from North America, competes for habitat and resources with European white-clawed crayfish and carries a fungal disease responsible for drastic reductions of native crayfish populations in Western Europe. Similarly, the zebra mussel, invasive in much of Europe, frequently outcompetes the native depressed river mussel as a result of its faster growth and higher reproductive rates. Both alien species are included in the list of 100 worst invaders in Europe[1], while both of the native species are now on the IUCN Red List of Threatened Species[2].

In this study, funded by the EU FRESIS project[3], researchers used regional species distribution models (SDMs) to predict the impact of the expected climate in 2050 on the four species' ranges. Four contrasting future climate scenarios were used to account for the high uncertainty associated with such predictions.

The 2050 scenarios suggested that the invasive zebra mussel could strongly benefit from climate change's effects, with an increase of 15-20% in their range size, invading new areas in northeast Europe. In contrast, the native depressed river mussel was predicted to experience considerable loss of 14-36%. Furthermore, populations could decline even further as a result of a predicted increase in range overlap (up to 24%) with the faster growing zebra mussel population.

Conversely, negative effects of climatic changes for both species of crayfish were predicted, especially the invasive signal crayfish, which could suffer up to 32% decrease in range size. The overlap between the ranges of the two crayfishes was also expected to decrease by 13-16%.

Forecasting how both invasive and native species will respond to climate change is of vital importance to conservation management strategies. SDMs can assist in the management of endangered species over large spatial scales and long time periods by anticipating future changes in distribution and identifying potential refuge areas. However, the researchers note that changing climatic conditions create uncertainties in SDM predictions relating to species adaptation to future environments.

1. *See: DAISIE European Alien Invasive Species Gateway, http://www.europe-aliens.org/*
2. *See: www.iucnredlist.org*
3. *FRESIS (Freshwater invasive species in Europe: control, prevention and eradication) was supported by the European Commission under the Seventh Framework Programme. See: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=1136 0410&pid=2030&q=2D2FAA8BD56D7B091CE67BB014675D61&type=adv*

Effective tools to predict spread and improve monitoring of invasive alien species

Effective surveillance and risk analysis are key to preventing the ecological damage caused by invasive alien species (IAS). Habitat suitability models provide highly effective tools for predicting the spread of IAS and guiding monitoring strategies, new research suggests.

"Conservation managers currently face the challenge of determining where introductions of IAS are likely to occur, and how they will spread across the landscape."

Along with habitat loss, IAS are a serious threat to European biodiversity, displacing native species and causing the deterioration of many ecosystems. Conservation managers currently face the challenge of determining where introductions of IAS are likely to occur, and how they will spread across the landscape.

Habitat suitability models (HSMs) are mathematical tools for mapping the potential distribution of IAS, and facilitating risk analysis, monitoring and control. However, the ability of these models to prioritise monitoring efforts has not been tested in the field. Many sampling designs are costly, time-consuming and ineffective at detecting newly arriving species. This study had two main objectives. Firstly, to test if HSMs can be improved by using an 'iterative' sampling design; this uses observations to guide subsequent data collection and improve the original design. Secondly, to assess the ability of HSMs to predict the spread of IAS.

The researchers examined three plants invasive to the US. The spotted knapweed and the wild parsnip, invasive to Wisconsin, US, were examined using data on a state-wide scale. The salt cedar was analysed on a regional scale using data from 957 counties in the western US. These initial data provided a 30 m2 resolution within Wisconsin and 1 km2 resolution for western US, and were used to produce the first iteration and subsequently inform more targeted sampling. The model's success at species detection was then compared to other surveys conducted during the same season using non-targeted sampling.

Across all three species, researchers found that model performance at species detection increased by using the initial model results to inform more targeted sampling. In addition, HSMs were able to accurately predict the spread of IAS across the landscape, and the use of targeted sampling detected more species with less sampling effort than a non-targeted random approach.

This approach may help guide early detection, rapid response and containment of harmful IAS and even diseases at local and global scales. The reduction of already limited monitoring and control budgets makes development of tools such as HSM even more important for managers in future. However, the models are limited by sparse data across large geographical areas, and the study's authors stress that data sharing and regular data updates should be encouraged to provide valuable improvements in HSM performance.

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Theme(s): Biodiversity, Marine ecosystems, Risk assessment

Risks of invasion of alien marine species driven by global shipping

New research has identified global hot spots of invasion risk by marine species transported in the ballast water of shipping. Treating this water before discarding it could reduce the risk of invasions by as much as 82%, the researchers predict.

"Increased trade and transport at sea now means that many marine regions are being invaded by several new species every year."

The movement of marine organisms outside their natural ranges can have seriously damaging effects on native ecosystems. Increased trade and transport at sea now means that many marine regions are being invaded by several new species every year. Such biological invasions often occur as a result of the water taken on board as ballast to stabilise ships, which can contain aquatic species. When new cargo is loaded at ports along the ship's journey, the ballast water is pumped out and the organisms are released in the surrounding water.

Using an updated database on shipping traffic researchers have been able to analyse the volume, frequency, origin and destination of cargo ships around the world. The data, recorded during 2007 and 2008, represent movements of 67% of the global shipping fleet ships and the majority of large ships at sea. The resulting network included 32,511 ships, which made 2,892,523 voyages, calling at 1,469 ports. Ballast water discharge volumes were provided by the National Ballast Information Clearinghouse. The water temperature and salinity at each port were also recorded.

The results show that high invasion risks were concentrated in a small number of busy ports; the majority of ports were at low risk of receiving new organisms via ballast water. The hot spots are mainly located in South East Asia, the Middle East and the USA, with Singapore, the Suez Canal (Egypt), Hong Kong and the Panama Canal most likely to be invaded.

As well as shipping intensity, the water temperature and salinity of the original port from where the ballast water was taken also played an important role in invasion risk. The results predict that the greatest risk of new introductions occurs at distances of approximately 8,000-10,000 km between the source and recipient sites. Over longer distances, the organisms are less likely to survive the journey.

The researchers also investigated mitigation strategies, such as treating ballast water at each port, for example, with filters, chemicals or radiation. They estimated that if 'treatment effort' (the percentage of species eradicated by a single treatment) was 25%, invasion risk would be reduced by 56% . This rises to 82% if treatment effort reaches 50%.

The authors conclude that understanding invasion risks and developing successful mitigation strategies is especially important in the light of future global warming, which may open Arctic passages to shipping and therefore increase the risk of invasion into new areas by alien species.

Source: Seebens, H., Gastner, M.T. & Blasius, B. (2013). The risk of marine bioinvasion caused by global shipping. *Ecology Letters* 16: 782-790. DOI: 10.1111/ele.12111

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Theme(s): Biodiversity

Does the public's view of invasive alien species differ from the professionals'?

Key differences between public and professional opinions on invasive alien species (IAS) are highlighted by a recent UK study. Its authors recommend clearer, open discussion of the harm caused by IAS and human responsibility for their spread.

"Understanding public opinion regarding IAS is vital; in the past, public response to proposed IAS management has delayed action, occasionally even to the point where eradication is no longer possible."

Understanding public opinion regarding IAS is vital; in the past, public response to proposed IAS management has delayed action, occasionally even to the point where eradication is no longer possible. In this study, researchers explored the views of different groups of individuals from the north of the UK. These included the general public, conservation volunteers and professional ecologists, as well as interested professionals, such as forestry managers and anglers.

Using nine focus group sessions and three interviews, totalling 79 participants overall, the researchers identified recurring themes in discussions. In particular, the researchers explored how the perception of species attributes (e.g. 'harmfulness') was linked with attitudes towards both species and management strategies.

Five attributes of IAS were repeatedly mentioned by participants across all groups. These included: impact on the economy or character of a place; whether humans were intentionally involved in the introduction process; non-nativeness; controllability and attractiveness of the species.

The non-native nature of a species was emphasised more by ecologists than by the general public. Ecologists were also more likely to associate this attribute with human-led introduction and harm to the environment. In contrast, the public simply defined non-native as being from a different region.

There were also important differences between ecologists and the public in terms of strategies for controlling IAS, which were discussed in a general way by the public. Many suggested that trapping and culling are the most effective measures. However, ecologists and other interested professionals tended to discuss control for specific cases, highlighting the need for different approaches to fit the context.

Moral issues surrounding control were emphasised more by members of the public, who held a general view that if a process was natural, i.e. not caused by humans, we should not interfere.

The study's authors stress that these results cannot be assumed to reflect the views of the wider public, as only a relatively small number of people participated. However, they also suggest that there is no reason to believe that they should differ markedly from other opinions found in north-western Europe.

In conclusion, the authors recommend that factors that concern the public, such as harm caused by a species and human responsibility for IAS spread, should be communicated and addressed explicitly by conservationists. This would benefit not only communication between ecologists and the public, but also scientific debate.

Source: Selge, S., Fischer, A. & van der Wal, R. (2011). Public and professional views on invasive non-native species – A qualitative social scientific investigation. *Biological Conservation.* 144: 3089–3097. DOI: 10.1016/j.biocon.2011.09.014.

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Theme(s): Biodiversity

Conservation managers and public unaware of invasive alien species' true risks

Neither the public nor conservation managers are fully aware of the different risks posed by invasive alien species (IAS), new research suggests. A study examining perceptions of five invasive species in the UK shows that both conservation managers and the public regard some highly damaging species as 'low risk', and that their awareness does not increase with the amount of scientific research on the topic.

"Effective conservation management schemes to eradicate IAS must have a sound foundation in science."

Effective conservation management schemes to eradicate IAS must have a sound foundation in science. Public support can also be vital to the schemes' success, as ignoring public attitudes can result in their failure. However, there is little understanding as to what influences public or conservation managers' opinions and attitudes towards IAS.

In this study, researchers examined the views of the general public (187 individuals) and conservation managers (132 individuals) and related these views to media coverage and scientific research concerning IAS. Initially, the two groups were asked to complete a questionnaire which asked about their general views on the threats of IAS, their knowledge of specific IAS and how much of a threat they considered them to be. The five species included in the study were: grey squirrels, Japanese knotweed, harlequin ladybirds, topmouth gudgeons (a freshwater fish species) and signal crayfish.

In order to compare the participants' responses to media coverage of these species, the researchers recorded the number of 'hits' from three major internet search engines when searching for each species. The number of peer-reviewed scientific papers published was used to represent research output for each species. Finally, to compare perceptions of threat with actual threats posed by these IAS, the researchers assessed the risk of each species using an invasiveness scoring tool based on range, history, biology and ecology.

The results showed that public awareness of the IAS did not match the scores from the risk assessments. For example, public awareness of the grey squirrel was very high, but this species scored lowest on the risk assessment.

There was also no obvious relationship between the numbers of scientific papers published on a species and the public awareness or perceived threat. For instance, a large amount of research has been published on the signal crayfish, but public awareness was relatively low. Media coverage, however, did correlate well with public awareness, although it should be noted that this does not imply causation.

The results also revealed some surprising and concerning results regarding conservation managers' awareness and risk perception of IAS. As with the general public, awareness of the harlequin ladybird remained low despite the high research output. However, perceived risk did not match that of the risk assessments. For example, the topmouth gudgeon, which is identified among experts as being one of the most potentially damaging IAS in the UK today, was thought to have the least risk of the five species by conservation managers.

The study's authors warn that this lack of knowledge could result in ineffective conservation practices. They call for better communication between scientists, conservation managers and the general public, and recommend using a scientific basis for conservation prioritisation.

A selection of articles relevant to Invasive Alien Species from Science for Environment Policy's News Alert.

Choosing between established and innovative policy measures: controlling invasive species (April 2013)
Assessing the potential of new environmental management tools often brings an 'innovation dilemma': is it better to stick with what is known to work, or to implement new measures that are potentially more effective, but also more uncertain? Researchers have proposed an approach to deal with these dilemmas, and applied it to the case study of an invasive species programme in the US.

Invasive alien plants threaten Antarctic biodiversity (May 2012)
According to new research, several areas of the Antarctic are at considerable risk from the establishment of 'alien' plants accidentally carried by visitors to the region. The findings demonstrate that invasive species pose risks even in remote areas and that these risks are likely to increase as the climate changes.

Invasive alien slug could spread further with climate change (December 2012)
A recent study sheds light on why some alien species are more likely to become invasive than others. The research in Switzerland found that the alien Spanish slug is better able to survive under changing environmental conditions than the native Black slug, thanks to its robust 'Jack-of-all-trades' nature.

A new tool to help predict species invasiveness (June 2011)
There is a common assumption that plant species are more inclined to thrive in a non-native community than a native one, sometimes becoming 'invasive'. However, this behaviour is likely to be quite unusual and invasive alien plants are actually an important exception, according to a new study. Much can be learned from the population of a species 'at home' and should be included in official assessment criteria.

Data on alien species in need of standardisation (February 2012)
A new study has identified several differences between two major European databases on alien species, which could be communicating mixed messages for biodiversity policymakers. Researchers recommend creating a single pan-European database to address these differences.

Current economic activity leaves an alien species 'invasion debt' (February 2011)
Past economic activity is more likely to explain the current pattern of biological invasions across Europe than recent human activities, according to a new study. It can take several decades before a newly introduced species becomes established and spreads, which may mean that recent invasions caused by current economic activities could create an 'invasion debt' for future generations.

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