Biological invasions: species on the move

Helen E. Roy envisions a future where the threat of invasive alien species is reduced for the benefit of people and the environment globally.

Understanding the distribution of species is both fascinating and important for informing conservation action. Some species are retracting in range while others are expanding. Changes in species distribution are known to be driven by climate change and land and sea use change. Climate change can create opportunities for some species, while for others it leads to habitat changes – shifting from being suitable to becoming unfavourable.

One of the most dramatic ways in which species are moving is through the process of biological invasion, whereby a species is transported by human activity from its native range to a region within which it would not naturally occur. The involvement of human activity in moving a species – intentional or not – is the defining feature of non-native (also known as alien) species and distinguishes them from those that may have dispersed naturally, perhaps because of climate change.

THE THREAT OF INVASIVE ALIEN SPECIES

Introductions of non-native species are increasing at unprecedented rates globally. The recently published Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) *Thematic Assessment on Invasive Alien Species and their Control* report estimated that there are 200 new species being introduced to new areas globally every year.[1] Some non-native species establish, spread and adversely affect biodiversity and ecosystems; this subset is termed invasive alien (non-native) species.

Invasive non-native species are costly to the environment and adversely affect people. It is estimated that such species cost over US$423 billion a year globally, which is

a considerable underestimate because many of the costs are hard to capture.[1] Invasive non-native species may also have adverse effects on our quality of life. Indeed, some may affect human health, such as non-native plants that produce copious amounts of allergenic pollen, or jellyfish that may have painful stings. Perhaps most notable are insects such as mosquitoes, which are vectors for introducing diseases to new regions of the world. It is perhaps unsurprising that one of the headline messages from the IPBES report is that invasive non-native species are 'contributing to the unparalleled degree of deterioration of the biosphere upon which humanity depends'.[1]

BIODIVERSITY LOSS DRIVER INTERACTIONS

The five major drivers of biodiversity loss – which include invasive species, climate change, and land and sea use change – are known to interact with one another. Some invasive alien species are only able to establish because the land has been degraded or the climate has changed in their favour. As an example, some invasive insects, such as ants, are benefitting from the warming climate in some regions and predictions indicate that more will do so in the future. More wildfires are a consequence of increased temperatures but also of an increase in fuel provided by flammable invasive plants. The IPBES report that 'climate change interacting with land- and sea-use change is predicted to profoundly shape and amplify the future threat from invasive alien species'.[1]

WE CAN MANAGE BIOLOGICAL INVASIONS

There are various approaches to controlling non-native species and managing biological invasions. Preventing their transport and introduction is the most effective way, achievable by implementing biosecurity measures. Everyone can make a difference. There are numerous campaigns – such as Check, Clean, Dry, and Be Plant Wise – that guide people in taking responsibility for reducing the threat of invasive non-native species.[2,3] In parallel, businesses can develop management plans to ensure their activities do not lead to their intentional or unintentional introduction.

Even after a species has become established within a new region there are options for its control. There are examples of successful eradications of invasive

▲ **Figure 1. Thriving seabird populations on Anguilla.**

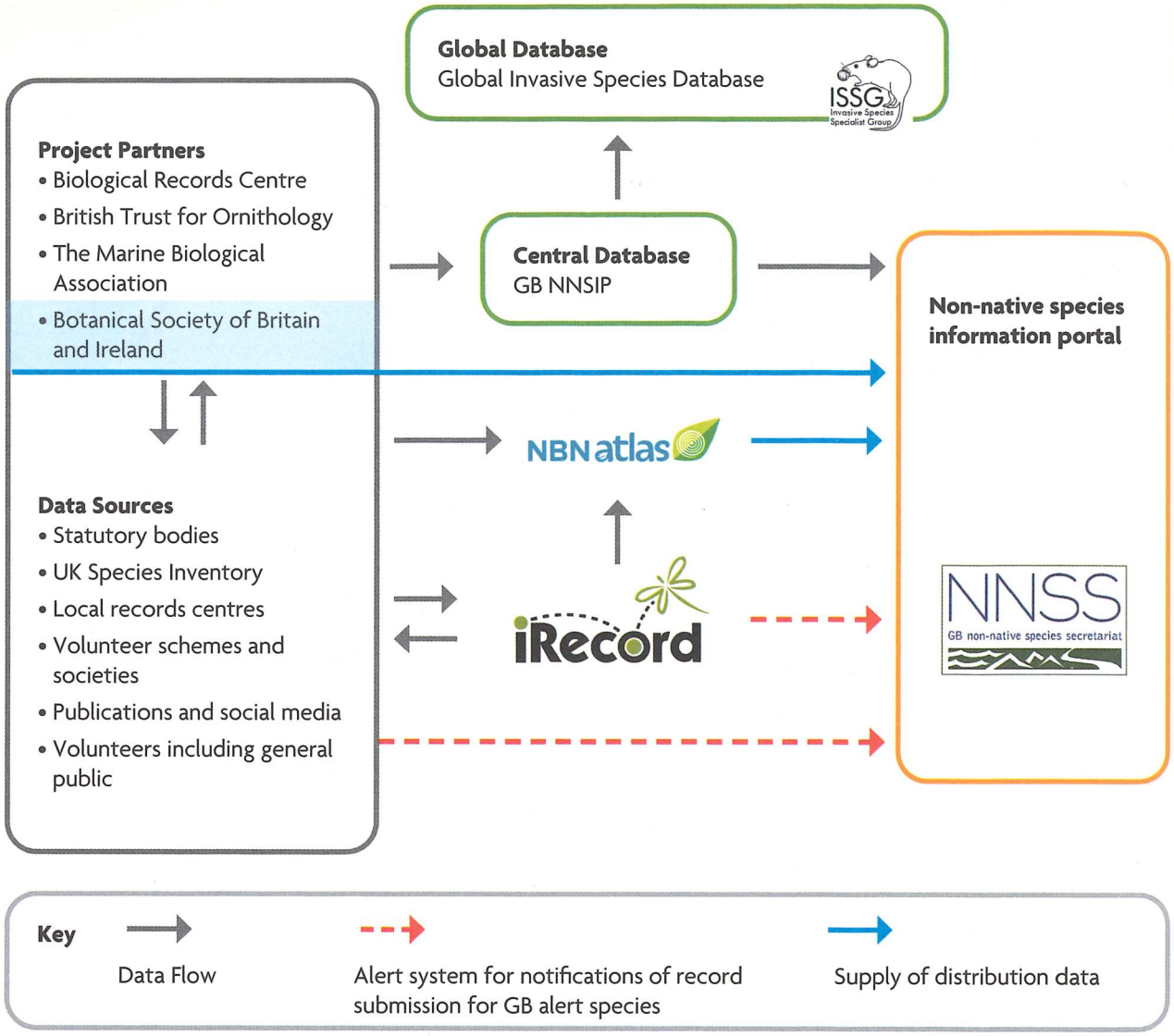
non-native species. For example, rats have been eradicated from many islands around the world. Rats pose a threat to human health and have also decimated some globally important seabird populations. Following their eradication, remaining seabird populations thrive, while there are also noticeable benefits for plant communities (see **Figure 1**).

NON-NATIVE SPECIES IN BRITAIN

There are over 2,000 non-native species within Britain, with plants being the most numerous. The Defra-funded GB Non-native Species Information Portal compiles information on all non-native species while also providing an online alert system for people to report sightings of species of concern.[4] One such species is the Asian hornet (*Vespa velutina*). This was introduced to France several decades ago and spread rapidly. The Asian hornet is a predator of insects and poses a particular threat to pollinating insects. Worker hornets visit flowers and trees to collect nectar for carbohydrate, but they also gather high-protein food, such as honeybees (*Apis mellifera*), hoverflies and other insects, to feed to their larvae. Asian hornets produce large nests comprising thousands of workers; it is estimated that a single worker can take about 25–30 honeybees back to the nest each day, making them a major threat to beekeeping and wild pollinating insects.

In 2012, Defra funded a study to predict which invasive non-native species could arrive, establish and impact biodiversity and ecosystems within the next 10 years.[5] Unsurprisingly the arrival of the Asian hornet was considered a high risk. In 2016, the first record of one was received and rapid action ensured the nest was found and removed, leading to its eradication. All Asian hornet workers return to their nest at night and so night-time nest removal is an effective management approach. Every year since, there have been a few sightings; last year saw unprecedented numbers of reports, but the National Bee Unit has so far managed to eliminate them. In the coming year it will be important to sustain this response and people are requested to report any sightings of concern through the alert system. The bright yellow legs are characteristic of this insect.

Citizen science is proving an important component of managing biological invasions, increasing information availability while engaging people and raising



▲ **GB Non-native Species Information Portal for information compilation and sharing. (Source: UK Centre for Ecology & Hydrology)**

awareness of the major and growing threat of invasive non-native species. Indeed, collaborations among stakeholders and governments to ensure equitable access to knowledge is critical to underpinning effective action.

INVASIVE SPECIES IN OVERSEAS TERRITORIES

The 14 UK Overseas Territories (UKOTs) are home to many unique and, in some cases, endemic species. Concerningly, invasive non-native species pose a major threat to these globally important ecosystems. Furthermore, they are also a threat to food and water security. For example, myna birds (*Acridotheres tristis*) are found on a number of UKOTs and feed on fruit and crops. New Zealand flax (*Phormium tenax*) is adversely altering the flow of water within the cloud forest of St Helena. However, the ongoing initiatives to manage biological invasions on UKOTs are inspiring, including approaches to biosecurity (actions to minimise the risk of invasive non-native species such as inspections of cargo and cleaning of equipment), management and conservation, but there is a need to share information to support action and inform decision-making.

An ongoing Darwin Plus project is compiling inventories of non-native species for all UKOTs following a similar format to the GB Non-native Species Information Portal.[6] Collaborations with partners in UKOTs is increasing the information available and supporting initiatives to predict which invasive non-native species might be on

the horizon, enabling communities to strengthen their biosecurity measures.

PROGRESS TOWARDS MEETING GLOBAL TARGETS

The Kunming–Montreal Global Biodiversity Framework agreement to halt and reverse biodiversity loss set a series of targets, of which Target 6 is ambitious. This target aims to tackle the impacts of invasive species and reduce their rate of introduction and establishment by at least 50 per cent by 2030.[7] Current predictions, based on a business-as-usual scenario, suggest that the number of non-native species will continue to increase at an unprecedented rate. Therefore, there is a need for immediate action to reduce the introduction and establishment of non-native species while simultaneously addressing climate change and land and sea use change.

Addressing the threat of biological invasions will strengthen the effectiveness of policies designed to respond to other drivers of biodiversity loss. Integrated approaches to managing environmental change, acknowledging the interactions between invasive alien species and other drivers, can support the alignment of policies leading to mutually beneficial outcomes.[1] Indeed, policy planning that reflects the interconnectedness of biodiversity loss drivers may have multiple benefits for people and nature and will certainly minimise the risk of any unintended consequences of our actions, whereby efforts to solve one problem may exacerbate the magnitude of others and may even have multiple benefits.

In conclusion, invasive non-native species are a major and growing threat, but there are effective solutions to addressing the problem. Raising awareness of the magnitude of the threat they pose is vital and ensuring the engagement of stakeholders in management strategies is critical to success. Providing adequate resourcing alongside cross-border and cross-sector collaborations will be important to achieve the much-needed ambitious progress towards meeting Target 6. Ultimately, managing biological invasions will have long-lasting benefits for people and nature. ES

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