

ECOLOGY

Will Threat of Biological Invasions Unite the European Union?

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Europe is the source of many of the world's worst invasive species, including Austrian pine (*Pinus nigra*), Norway maple (*Acer platanoides*), Spanish slug (*Arion lusitanicus*), German wasp (*Vespa germanica*), Scotch broom (*Cytisus scoparius*), and English starling (*Sturnus vulgaris*). However, the perspective of Europe as the source rather than recipient of invasive species is in urgent need of revision in light of the Delivering Alien Invasive Species Inventories for Europe (DAISIE) project (www.europe-aliens.org). This continent-wide assessment of the scale and impact of biological invasions reveals that Europe's maritime and land borders have been breached by >11,000 alien species. Over half of these are terrestrial plants. Aquatic and terrestrial invertebrates account for >30% of species, whereas only ~5% are vertebrates. Compared with estimates from little more than a decade ago, the new data on aliens identify more than five times as many bird species, a threefold increase in mammal species, and twice as many plants established in Europe (1). Europe is home to numerous species from other continents, e.g., Canada goose (*Branta canadensis*), American bullfrog (*Lithobates catesbeianus*), Argentine ant (*Linepithema humile*), Egyptian goose (*Alopochen aegyptiaca*), Indian strawberry (*Duchesnea indica*), Chinese mitten crab (*Eriocheir sinensis*), Japanese oyster (*Crassostrea gigas*), and New Zealand flatworm (*Arthurdendylus triangulatus*).

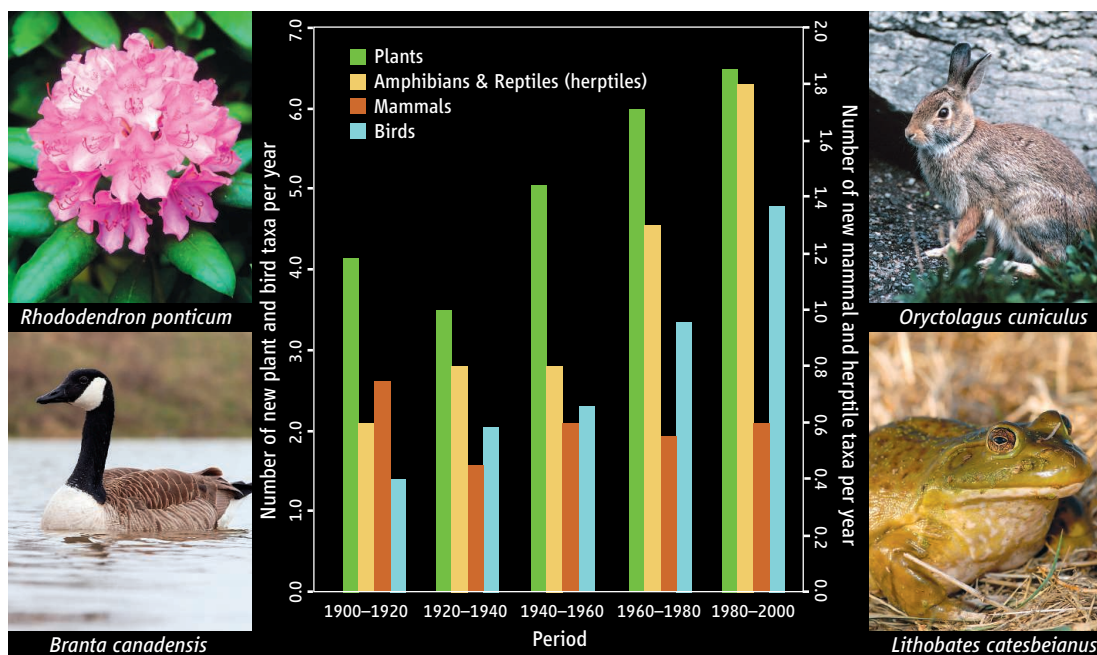
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Even the crudest estimate of total known monetary impact of alien species in Europe is close to €10 billion (about U.S. \$13 billion) annually (2). This figure is an underestimate, as potential economic and environmental impacts are unknown for almost 90% of the alien species found in Europe (3). Alien species predate, hybridize with, parasitize, and out-compete a wide range of native European taxa and,

New data on the extent of biological invasions pose major regulatory and political challenges to European institutions.

International Convention for the Control and Management of Ships' Ballast Water and Sediments. More recently, signatories to the CBD have agreed to achieve a significant reduction of the current rate of biodiversity loss by 2010, and this includes providing evidence of actions to reduce the number and cost of biological invasions (5). In response, Europe has committed itself to using the



Alien taxa newly recorded as established in Europe per annum (1).

as a result, reduce biodiversity, threaten endangered species, and alter ecosystems (4).

To date, the European Union's (EU's) response to the problems of alien species has been driven by commitments to international agreements such as the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) and the Convention on Biological Diversity (CBD). Yet these commitments have not always been supported by action. Under the CBD, EU member states rate implementation of Article 8h "to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" as a significantly lower priority than nations outside Europe (4) and only two EU states (France and Spain) have ratified the

cumulative number of alien species in its territory as one indicator of progress toward the 2010 goals (6). Yet, progress to date has been poor, with average annual rates of alien species establishment in Europe having progressively increased over the last century for many taxa (see figure, above).

Therefore, the European Commission has put forward a proposal to the European Council and Parliament for an EU strategy on invasive species (2). The strategy emphasizes prevention as the most cost-effective way forward and presents three new policy options: maximize the use of existing legal instruments; adapt existing legislation through specific amendments; or establish a comprehensive, dedicated legal framework to address biological invasions.

Current legislative efforts to prevent introduction of invasive alien species are most effective at targeting intentional releases or where liabilities can be readily determined, e.g., pests and pathogens on plant and animal products. However, recent introductions are increasingly unintentional (7). Major gaps exist in the binding international regulatory framework especially as relates to hull fouling, air transport, tourism, pets and aquarium and garden species, live bait and plant seeds, and interbasin water transfers and canals.

One way that existing legislation could be adapted is through establishment of a “blacklist” of species prohibited from import and sale in Europe that would prioritize those species that pose the most significant threats. The EU has adopted such an approach in its Council Directive 2000/29/EC to protect against introduction and spread of organisms harmful to plants or plant products. This directive could form the basis for blacklisting a wider range of invasive pests in terrestrial and aquatic environments. Yet pan-European bodies have failed to agree on the criteria for listing species. The European and Mediterranean Plant Protection Organisation (EPPO) has listed several invasive plants as pests requiring official regulation because of their perceived threat to ecosystems and recommends its member countries take measures to prevent their introduction or spread and to manage established populations (8). Nevertheless, when EPPO risk assessments for several invasive plant species were submitted to the European Food Safety Authority (EFSA), the request to list them as official pests in Council Directive 2000/29/EC was declined (9, 10). Although EFSA acknowledged that the species were probably invasive, further quantitative information on population dynamics, environmental drivers, introduction pathways, spatial distribution, and impacts was required. Yet, such additional data may not reduce the uncertainty in assessing risks. As a result, lengthy and costly steps are likely to be necessary to officially blacklist even a single species.

A further complication with blacklisting is that a significant proportion of alien species in Europe are native elsewhere on the continent—including half of all plants, a third of arthropods, and a quarter of the vertebrate species (1). A number of these European species include some of the worst aliens, e.g., Spanish slug, rabbit (*Oryctolagus cuniculus*), and rhododendron (*Rhododendron ponticum*). Blacklists may therefore need a regional or national focus. Several European countries have established their own national blacklists (2), but each uses different listing criteria based on qualitative expert opinion that do not match EFSA’s requirements and thus could be challenged.

Legally binding blacklists supported by quantitative risk assessment may assist in the prevention of future threats, but current lists are reactive and include many species already established, often quite widely, in Europe (8). Although only ~10% of aliens established in Europe are known to have an economic or environmental impact, this still implies that there are >1000 species requiring proactive management (3). Europe does not have a particularly good record in managing alien species, with only 34 species (primarily vertebrates) successfully eradicated from one or more regions (11). Limited resources have often resulted in a piecemeal approach targeting local management, rather than a coordinated international effort.

If Europe is serious about addressing biological invasions, and especially the 2010 target, then it should support establishment of an indicator that quantifies actual responses, e.g., number and cost of national management activities against invasive species (12). In contrast to prevention, the regulatory and technical tools addressing eradication, control, or management of invasive species remain poorly developed (13).

Many of the policy and legislative needs identified for Europe are equally relevant to the U.S.A. where the Ecological Society of America has called for establishing a federal center to manage biological invasions that would parallel centers set up to tackle the threat of human diseases (14). Likewise, a new agency, the European Centre for Invasive Species Management (ECISM), could be established similarly to the European Centre for Disease Prevention and Control (ECDC) (15). ECISM would have a mission to identify, assess, and communicate current and emerging threats to the economy and environment posed by invasive species. It would bring together different elements relating to biological invasions that are currently dispersed among various European bodies, such as the European Environment Agency (monitoring and indicators), EFSA (risk assessment), and within different Directorates-General of the European Commission (environment, transport, agriculture, maritime affairs, and so on).

ECISM would ensure a broader European perspective that better integrates regulatory, scientific, and public outreach initiatives, not only by addressing preventative measures, but also by rapid response and management. Responsibilities could include providing high-level scientific advice, building a Europe-wide surveillance system, monitoring emerging threats in Europe to support rapid response, coordinating the European networking of bodies operating in the field of biological inva-

sions, and communicating the scientific and technical outputs to stakeholders and the general public. ECISM would have no regulatory powers but would help develop new legislation addressing biological invasions.

Would such a proposal appeal to the Council of Europe and European Parliament? The need for coordinated action has been expressed at the highest political levels in Europe (2). Under the Czech Presidency of the EU, addressing the European Commission proposal for an EU strategy on invasive species is seen as a priority (16). Yet there are challenges. The cornerstone of the EU is the single market and the regulatory environment has been designed to remove technical barriers to the free movement of goods and people (17). Yet levels of invasion in European countries are highly correlated with national Gross Domestic Products and reflect levels of external trade and capital investment (18). Politicians may view additional legislation and regulation to address biological invasions as an impediment to economic growth. Tax-payers may similarly be resistant to additional costs, especially because only 2% of the European public feel biological invasions are important threats to biodiversity (19). Results from DAISIE may help better inform such opinions and highlight the scale of the problem in Europe. Costs of a specific agency such as ECISM, if run on a budget similar to ECDC’s, would amount to <0.5% of the annual cost of biological invasions in Europe but could bring much greater dividends to the European economy and environment.

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