

United States Register of Introduced and Invasive Species

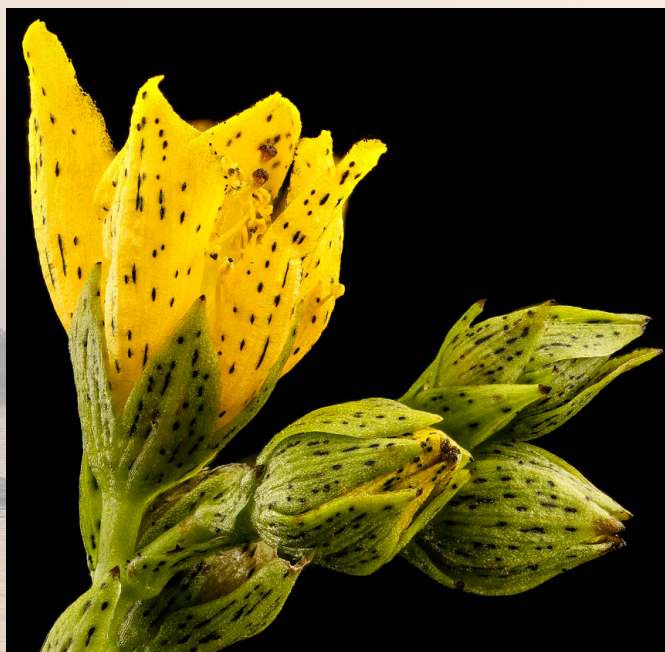
Introduction

Although natural disasters such as earthquakes and floods are commonly known to cause many billions of dollars in damages each year, the pervasive and insidious threat of invasive species is asserted to cost the United States more than \$120 billion, annually (Pimentel and others, 2005). An invasive species is an organism that is nonnative to a locality and that causes (or is likely to cause) harm (Executive Office of the President [EOP], 2016). An introduced species is one that is nonnative to an ecosystem and occurs there because of human activities that result in its intentional or unintentional escape, release, dissemination, or placement (EOP, 2016). Any introduced species that becomes established may eventually become invasive, so tracking them provides a baseline for effective modeling of species trends and interactions, geospatially, temporally, and economically.

The United States Register of Introduced and Invasive Species (US-RIIS) is unique, because it serves as a national register (Simpson and others, 2022) for all introduced and invasive species that are established within three localities of the United States: Alaska, Hawaii, and the lower 48 conterminous States (L48). Before becoming an invasive species that causes harm, a nonnative species must be both introduced and established in a locality. The US-RIIS has been created as a contribution to the Global Register of Introduced and Invasive Species (2021) Initiative and updates will be periodically submitted to the Global Biodiversity Information Facility ([GBIF], 2022). The GBIF network is an international biodiversity organization and data infrastructure funded by the world's governments that provides open access to data about life on Earth.

The US-RIIS can be used (1) to narrow down horizon scanning species lists that are used to assess the threat of invasive species not yet established (U.S. Department of the Interior, 2016), because names on the US-RIIS should not be on horizon scanning lists; (2) to create lists of introduced and established species for smaller areas within the United States by combining US-RIIS names with local species-occurrence data; and (3) to determine priorities for the control and mitigation of potentially invasive sleeper species (Sieg and others, 2010). Introduced sleeper species establish small populations that “* * * persist at low abundance for years or even decades—a period during which they often go undetected and have negligible effect—until they are triggered by an environmental factor to become highly abundant and disruptive” (Spear and others, 2021, p. 1).

The regional lists and the full list are each largely made up of *Insecta* (insects) and *Magnoliopsida* (flowering plants), and all other classes of species are combined in the category “all other classes.” (Simpson and others, 2022).



U.S. Geological Survey photograph by Helen Lowe Metzman, public domain.

Methods

The US-RIIS was compiled from more than 5,800 authoritative sources, was reviewed by (or based on input from) more than 30 invasive species scientists and continues to be updated. There are 14,700 records in the Version 2.0 full dataset, which includes 12,571 unique names (note that there are fewer names than records because a species may occur in more than one locality). To be included in the US-RIIS, a species must be nonnative everywhere in the locality and established (reproducing) anywhere in the locality. Species that are native anywhere in a locality are not included in that locality sublist.

Taxonomic and regional experts were consulted to create and review the US-RIIS, with each record being supported by an article, book, database, dissertation, ecological-risk screening, environmental assessment, fact sheet, handbook, pest-advisory alert, technical report, or website. Scientific names were standardized based on the Integrated Taxonomic Information System (2022) and the GBIF (2022).

The US-RIIS was designed to be compatible with country contributions to the Global Register of Introduced and Invasive Species (2021) Initiative, which compiles annotated and verified country-wise inventories of introduced and invasive species (2021). Each US-RIIS record has information on taxonomy, dates of introduction to the locality (where available; version 2.0 for 47 percent of its records), invasion status (invasive or introduced), whether the species has been introduced for biocontrol purposes, and citations for all the authoritative sources supporting the record. The US-RIIS significantly reorganized and expanded a preceding dataset called, “A Comprehensive List of Non-Native Species Established in Three Major Regions of the United States: Version 3.0” (Simpson and others, 2018), used by the US-RIIS.

Results

Several major differences have emerged among the three locality sublists of the US-RIIS. According to the United States Census Bureau (2021), the largest locality is the L48 (8,081,867 square kilometers [km²]), the second largest locality is Alaska (1,723,337 km²), and the smallest locality is Hawaii (28,313 km²). The largest locality (L48) has the largest number of introduced and established species, with 8,527. However, the smallest locality, Hawaii, has the second largest number of introduced and established species, with 5,628, while the much larger locality of Alaska has the third largest number of introduced and established species, with 545. Given the great range of locality size, it is important to consider average densities per 10,000 km² of introduced species occurring in each. The average density of introduced species in Hawaii is 1,988, which is almost 200 times the density of introduced species in the L48 and more than 650 times the density of introduced species in Alaska. The density of the introduced species in Alaska is three (fig.1 A–C). In Alaska, introduced and invasive species are largely *Magnoliopsida* (flowering plants), while in Hawaii they are largely *Insecta*

(insects), and in the L48, as well as in the combined localities of the US-RIIS, they are about equally divided between flowering plants and insects (table 1).

What’s the Difference? Introduced and Invasive Species

Introduced or nonnative species are those that arrive in a locality by direct or indirect human assistance (Devine, 1998). Some examples of pathways by which they can be introduced include the deliberate release of a biocontrol species (to control other undesirable species), hitchhiker species attached to any kind of vehicle (for example, boat, airplane, and car), escaped or released pets and their parasites, escaped cultivated plants and their parasites, species carried by human tourism, and species associated with shipped commodities or the commodities themselves (U.S. Department of Agriculture, 2021).

Labeling a species as introduced and established does not address its abundance or its effect on native species. All species included in the US-RIIS are introduced to and established somewhere within the locality. Species that are labeled as introduced and established in the US-RIIS may actually or eventually become invasive, may have no measurable effect on native species, or may be beneficial. In contrast, species that are labeled as invasive have been determined to have an actual or potential negative effect in the locality. It is important to note that although relative numbers in any given locality may vary somewhat, only a small number of introduced species become established, and a much smaller number of those ever become invasive and abundant (Jeschke and Pyšek, 2018). Figure 2 illustrates relations among different kinds of introduced species.

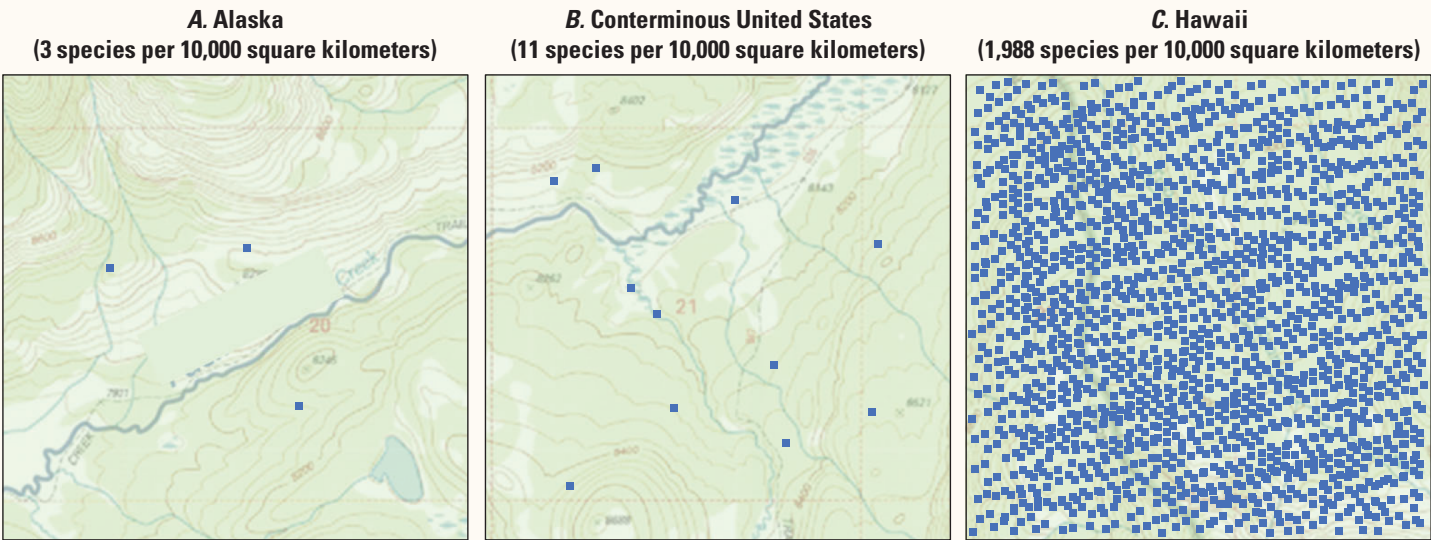


Figure 1. Comparative density of introduced and established species by locality (updated from Simpson and Eyler, 2018) in *A*, Alaska; *B*, conterminous (lower-48) United States; and *C*, Hawaii.

Table 1. Comparative taxonomic makeup of species included in lists of the United States Register of Introduced and Invasive Species (Simpson and others, 2022).

[No., number of species; L48, lower 48 conterminous United States; all other classes includes all other introduced species]

Class	Alaska (No. = 545)		Hawaii (No. = 5,628)		L48 (No. = 8,527)		Full list (No. = 14,700)	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Insecta	82	15	2,928	52	3,591	42	6,601	45
Magnoliopsida	379	70	1,443	26	3,873	45	5,695	39
All other classes	84	15	1,257	22	1,063	13	2,404	16

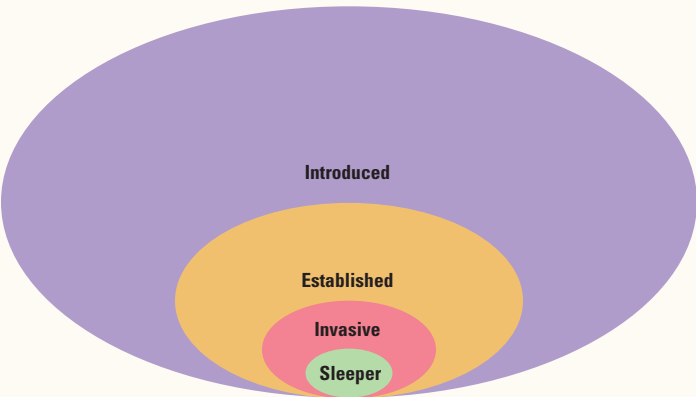
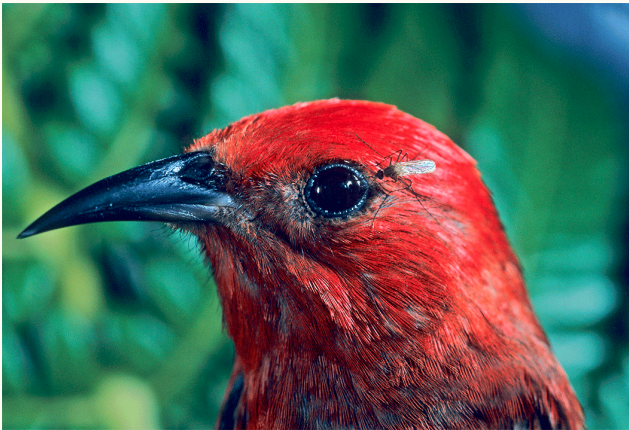


Figure 2. Venn diagram showing relations among different introduced species (established, invasive, and sleeper).

Sleeper Species

Although it is known and widely accepted that the majority of introduced and established species in a locality are harmless and that some are even beneficial (Jeschke and Pyšek, 2018), it is important to be watchful for the occurrence of sleeper species. These are introduced and established species that are eventually triggered by some environmental change to become harmful (Spear and others, 2021). A significant methodological strategy for the US-RIIS is to include all introduced and established species—regardless of their current or known potential effect—because any of these may eventually be revealed to have been a sleeper species.



U.S. Geological Survey photograph by Jack Jeffrey. High resolution version used with permission, jjphoto@hawaii.rr.com.

Biocontrol Species

Biocontrol species are ones that resources managers purposely introduce into an ecosystem as a strategy to control invasive species. Biocontrol species fulfill the criteria for inclusion on the US-RIIS when they are established and are nonnative to the entire locality. Occasionally, biocontrol species have become problematic and invasive (Stewart, 2005). Although comprehensive risk assessments that study potential collateral damage are required before biocontrol species can be approved for use in the United States, it is possible that more biocontrol species could become invasive in the future, by way of genetic mutations, environmental change, or undetected traits (Scoles and others, 2018).

How Can You Help?

We welcome all additions, corrections, and suggestions that could make the US-RIIS more accurate, useful, and complete. When you submit content for our consideration, please include an authoritative reference that supports your contribution.

For More Information

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