

Economic costs of invasive species in US

Type of organism	Losses and Damages [x 100 million]	Control costs [x 100 million]	Total costs [x 100 million]
Plants			
Forest insects	NA	85	85
Aquatic weeds	33	130	163
Miscellaneous	NA	2.6	2.6
Animals			
Wildlife (deer)	22,000	2,000	24,000
Northern Pacific salmon, gill net loss	NA	1,500	1,500
Materials			
Iron mines and tunnels	70	NA	70
Power pipes	400	1.3	401.3
Transportation	70	NA	70
Water			
Power	22,000	NA	22,000
Other water	27,000	NA	27,000
Other			
Fish	1,000	NA	1,000
Wildlife	300	NA	300
Medical and amphibians	1	4.3	5.3
Other non-animal	1,000	NA	1,000
Activities			
Recreation	400	NA	400
Forest management	1,000	NA	1,000
Other	NA	NA	0
Other water	11,000	11	11,011
Wildlife	NA	1,000	1,000
Forest	2,000	NA	2,000
Industry			
Power	NA	NA	0
Other	1,000	NA	1,000
Transport	300	NA	300
Recreation			
Other	21,000	NA	21,000
Other			
Other	NA	12	12
Power	2,000	NA	2,000
Other	NA	NA	0
Transport	3,000	NA	3,000
Other	NA	NA	0
All organisms			130,000
NA not available			

Biogeography Table 1. Estimated annual costs associated with some nonindigenous species introduced to the United States, in millions of dollars (see text for details and sources). Pimentel et al., 2000 Prof. J. Hicke

Invasive species example: Freshwater fish



Established Non-native Fish Species, 2000
 Number of Species
 0 1-10 11-20 21-30 31-40 41-50
 Data Source: U.S. Geological Survey. Coverage: lower 48 states only.
 The number and distribution of nonnative fish species in US watersheds, as well as other indicators of nonnative species, are reported in The State of the Nation's Ecosystems (The Heinz Center, 2002; www.heinzcenter.org/publications.htm). Recently proposed revisions to these indicators, encompassing plants, vertebrates, invertebrates, and pathogens for the six major US basins, will increase the consistency of reporting on nonnatives and improve comparability across regions and research and monitoring programs. Reprinted courtesy of The Heinz Center.
 Dybas, 2004
 Biogeography

Invasive species example: Lake trout

- Introduced into Yellowstone Lake in 1994 by angler
- Decline of native cutthroat trout
- Park Service removed 80,000 lake trout since 1995
- Problem not likely to go away; rather, in maintenance mode



Biogeography pond.dnr.cornell.edu 9 www.fs.fed.us/4/bsfr/recreation/webpics/fishWebpage Prof. J. Hicke

Invasive species example: Buffelgrass as a disrupter of Southwest desert ecosystems

- modifications to disturbance regimes
- elimination of native species
- control by
 - education
 - mechanical removal

<http://www.npr.org/templates/story/story.php?storyId=5295379>

Biogeography

10

Prof. J. Hicke

Invasive species example: Cheatgrass in the West

Consequences

- spreads by fire: promotion of fire => loss of native shrublands => loss of habitat for native animals
- weed in agricultural fields
- little or no nutritional value for cattle ("cheatgrass")

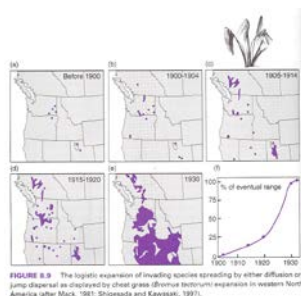


FIGURE 8.9 The logistic expansion of invading species spreading by either diffusion or jump dispersal as illustrated by cheat grass. (a) Cheat grass distribution before 1900. (b) Cheat grass distribution 1900-1904. (c) Cheat grass distribution 1905-1914. (d) Cheat grass distribution 1915-1920. (e) Cheat grass distribution 1920-1930. (f) Percentage of eventual range over time. (a) Mack, 1981; (b) Shipstead and Kawwassak, 1997.

Biogeography

11

Prof. J. Hicke

How are global change issues facilitating invasions?

Table 1. Possible general impacts of global change elements on the prevalence of invasive alien species^a

Element of global change	Prevalence of invaders ^b
Increased atmospheric CO ₂ concentration	+/-
Climate change	+
Increased nitrogen deposition	+
Altered disturbance regimes	+
Increased habitat fragmentation	+

^aAlthough these predictions are speculative, they are based on observations that are mentioned or cited in the text.

^bKey: +/-, might increase prevalence of some invaders and reduce prevalence of others; +, expected to increase prevalence of invaders in many affected regions.

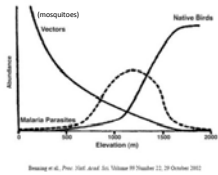
Dukes and Mooney, 1999

Biogeography

12

Prof. J. Hicke

Invasive species example: Malaria in Hawaiian Islands caused extinction in bird species



- 30 species of Hawaiian honeycreepers (*Drepanididae*)
 - endemic to Hawaiian islands
- on Oahu, 6 species extinct by 1900
 - declines in lower elevation species but not higher elevation
- tied to introduction of *Culex* mosquitoes in 1820s by Europeans
 - carriers of avian malaria
 - lack of evolution in presence of mosquitoes => lack of defense in honeycreepers
 - limited in elevation extent by temperature

Biogeography

13

Prof. J. Hicke

Climate change facilitates some invasions

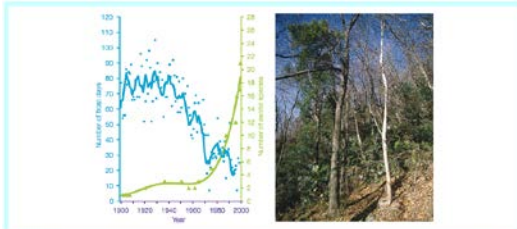


Figure 3 Vegetation shift from indigenous deciduous to exotic evergreen broad-leaved vegetation in southern Netherlands. The shrub layer is dominated by the growing number of grassland, exotic evergreen broad-leaved species (see illustration that appear to profit from milder winter conditions, indicated here by the decreasing number of days with frost on any the smoothed curve gives five year averages for the number of frost days per year)

Walther et al., 2002

Biogeography

14

Prof. J. Hicke
