Socioecología y Biología de la Conservación

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Coordinadores

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UNIDAD I: Fundamentos Conceptuales de la Conservación Biológica

Clase 2

Amenazas Primarias a la Biodiversidad

Tema 1: Degradación y Pérdida de Hábitats

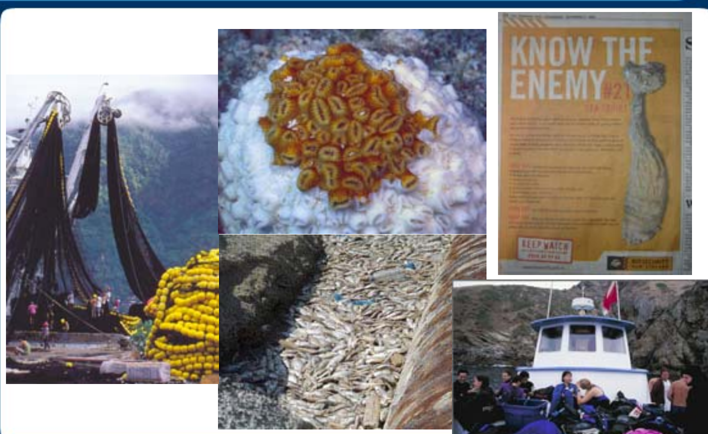
Tema 2: Fragmentación de Hábitats

Tema 3: Sobre-explotación

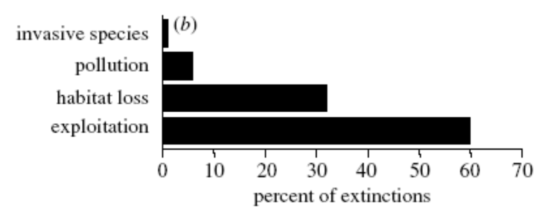
Tema 4: Especies Invasoras

Tema 5: Cambio Climático.

Amenazas

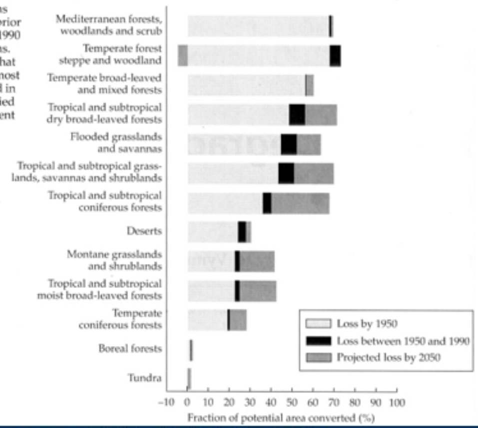


Factores que explican la pérdida de biodiversidad marina



Transformación de hábitats en ambientes terrestres

Figure 6.1 Habitat transformation has been more extensive in some biomes prior to 1950, and losses between 1950 and 1990 have particularly affected tropical areas. Trends in habitat conversion suggest that 50% or more of the original extent of most biomes will have been greatly reduced in value for biodiversity by 2050. (Modified from Millennium Ecosystem Assessment 2005b.)



Formas de degradación de hábitats

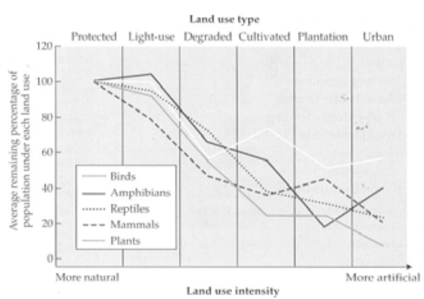
TABLE 6.1 *Forms of Habitat Degradation*

Agriculture	**Infrastructure development**
Crops	**Industry**
Shifting agriculture	**Human settlement**
Small-holder farming	Small-scale
Agro-industry farming	Villages to towns
Wood plantations	Suburban-urban sprawl
Small-scale	Urban areas
Large-scale	**Land, air, water transportation**
Nontimber plantations	**Dams**
Small-scale	**Tourism/recreation**
Large-scale	**Telecommunications and power lines**
Livestock	
Nomadic	**Pollution**
Small-holder	**Atmospheric pollution**
Agro-industry	Global warming/oceanic warming
Abandonment post-agricultural use	Acid precipitation
Marine aquaculture	Ozone hole effects
Freshwater aquaculture	Smog
	Land pollution
Extraction	Agricultural chemicals
Mining	Household chemicals
Small-scale	Commercial/industrial chemicals
Gold-mining	Light pollution
Strip-mining	**Water pollution**
Fisheries	Agricultural chemicals
Subsistence	Household chemicals
Artisinal/small-scale	Commercial/industrial chemicals
Large-scale/industrial	Thermal pollution
Wood	Oil slicks
Small-scale subsistence	Sediment
Selective logging	Sewage (nitrogen and phosphorus)
Clear-cutting	Agricultural fertilizers
Nonwoody vegetation collection	Solid waste
Coral removal	Noise pollution
Groundwater extraction	
	Biotic changes
Fires	Invasive nonnative species
War/civil unrest	Change in native species dynamics

Source: Modified from IUCN Red List threat categories, IUCN 2004.

Uso del suelo y biodiversidad

Figure 6.2 Effect of increasing land use intensity on the fraction of species in vertebrate taxa and plants that remain compared with the inferred population sizes from the pre-colonial period in southern Africa. Protected areas are expected to represent the most natural condition, and average population sizes under each type of use are scaled in relation to this category, which is designated as 100%. Light-use areas are those where use is sustainable (e.g., light grazing). Degraded areas are those where use exceeds productive capacity of the land. Cultivated areas are both croplands and planted pastures. Plantations are nonnative monocultures. Urban are built-up areas and high impact mining regions. Taxa respond differently to this gradient of use, but all decline as use becomes more intense. Light-use and urban areas have increased numbers of ponds relative to natural conditions, and therefore support larger amphibian populations. (Modified from Scholes and Biggs 2004.)



Vegetación natural remanente (USA)

Figure 6.3 Natural vegetation has been degraded extensively in the U.S. A comparison of land cover shown in 1992 satellite images with potential natural vegetation based on regional climate and soils indicates substantive change in 58% of the natural vegetation. (Modified from Stein et al. 2000.)

Cambio en el uso del suelo (en 30 años)

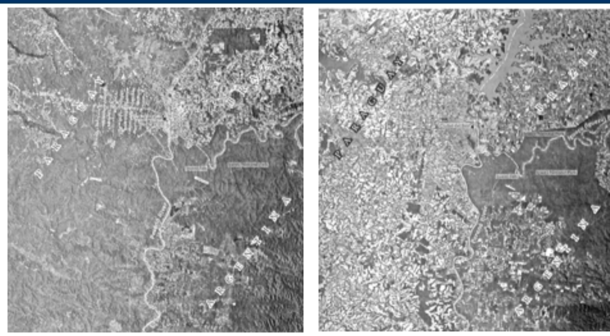


Figure 6.4 Land cover change in the past 30 years has been dramatic in the Iguazú, the Paraná River region where the boundaries of Paraguay, Brazil, and Argentina meet. Since the first image was captured via satellite in 1973 (A), the Itaipú Dam, the world's largest hydroelectric project, was built, inundating a huge area (B). Extensive agricultural development was promoted in Paraguay, beginning just before the 1970s (note road leading from the Ciudad del Este in (A) and the "herring-bone" pattern of initial settlement and forest clearing), and has resulted in nearly total conversion of forest to soybeans fields. The large reserves in Argentina and Brazil surrounding the Iguazú Falls protect the last remnants of these forests. (Images from Division of Early Warning and Assessment, UN Environment Programme 2004.)

Cambio en el Mar de Aral

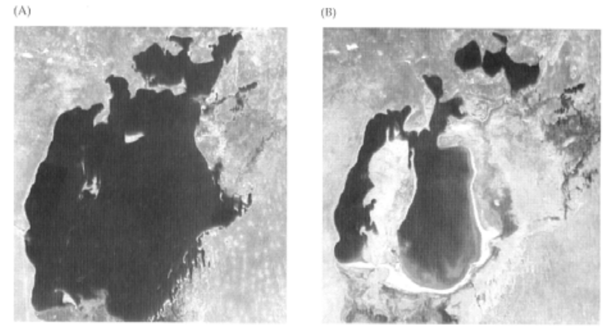


Figure 6.6 The Aral Sea shrank to 40% of its original volume within a decade following its use for irrigation. It also became so salty that its commercial fisheries entirely collapsed by 1984. Further water withdrawals broke the sea into separate areas, and it is expected that the southern Aral Sea will disappear entirely within 15 years. (Satellite images courtesy of the UN Environment Programme 2004.)

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Pérdida histórica de humedales (USA)

Figure 6.7 Historical loss of wetlands by State in the U.S., 1780s–1980s. Numbers in each state represent wetland loss in thousands of ha. (Modified from Revenga et al. 2000.)

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Reemplazo de manglares por aquacultura (Honduras)

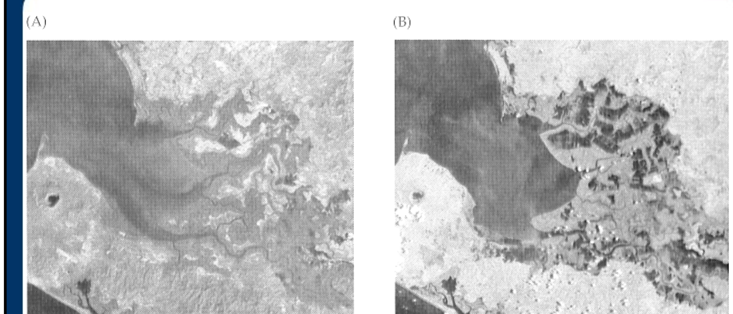

Figure 6.8 Mangrove forests have been replaced in many areas by aquaculture. This pair of satellite images shows mangrove forests in the Gulf of Fonseca, Honduras in 1987 (A), and their loss to roughly 775 km^2 of shrimp ponds in 2000 (B). (Images courtesy of the UN Environment Programme 2003.)

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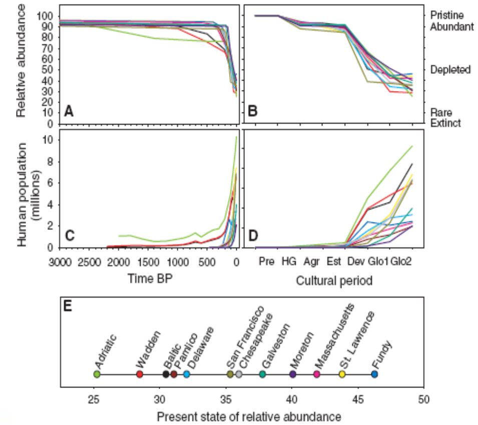
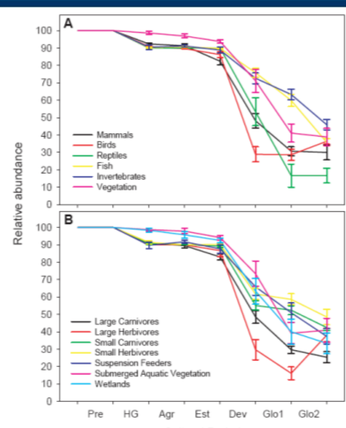
Degradación de estuarios y mares costeros

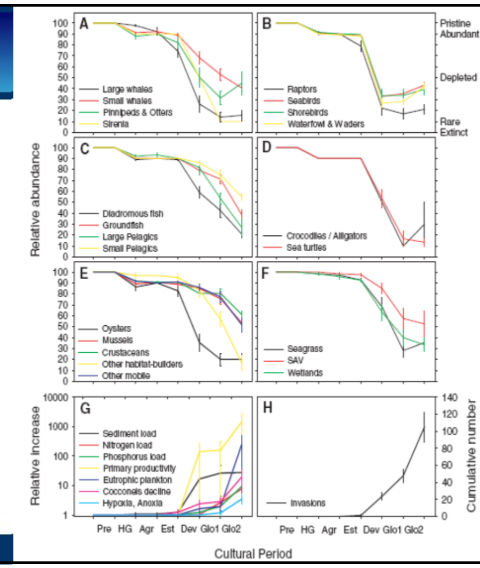
System	Lat.	Long.	Size (km^2)	SpR (fish)	PP ($mg\ C \cdot m^{-2} d^{-1}$)	Origin (years $\times 10^3$ B.P.)	Impact (years)	Human population Growth (x-fold)	Total ($\times 10^6$)	Density (km^{-2})
W. Baltic Sea	55 N	16 E	390,077	156	1,804	7.0–9.0	1,000	4	84.94	230
Wadden Sea	54 N	8 E	13,500	189	1,067	7.5	1,000	26	6.50	699
N. Adriatic Sea	44 N	14 E	160,000	606	385	8.0	2,500	21	103.00	746
S. Gulf St. Lawrence	47 N	63 W	65,000	197	1,044	6.4–14.5	240	135	7.41	114
Outer Bay of Fundy	45 N	67 W	148	197	1,044	7.0–15.0	240	18	0.03	260
Massachusetts Bay	42 N	71 W	768	645	1,124	6.3–12.0	320	156	2.50	5,230
Delaware Bay	38 N	75 W	2,070	645	1,124	7.0–8.0	240	95	3.33	2,693
Chesapeake Bay	37 N	76 W	6,974	645	1,124	7.4–8.2	240	19	6.93	1,004
Pamlico Sound	35 N	76 W	4,680	1,170	564	7.2–8.2	300	144	0.22	43
Galveston Bay	29 N	95 W	1,456	972	417	7.7–8.2	180	2,659	3.99	4,482
San Francisco Bay	38 N	123 W	838	803	501	8.5–9.3	180	4,533	6.80	8,200
Moreton Bay	27 S	153 E	1,600	1,239	441	6.5	150	710	2.20	1,375

Cambios en las abundancias relativas y población humana asociadas a estuarios

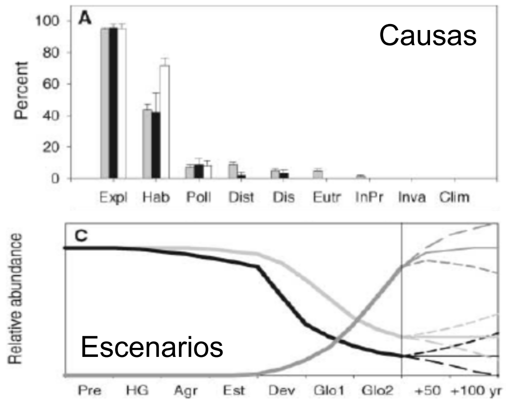


Cambio en las abundancias de grupos taxonómicos durante los periodos culturales





Causas de la pérdida de biodiversidad y potenciales escenarios



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Impactos de la deforestación (tierra) y pesca de arrastre (fondo marino)

TABLE 6.2 *A Comparison of the Impacts of Forest Clear-Cutting and Trawling of the Seabed*

Impact	Clear-cutting	Bottom trawling
Effects on substratum	Exposes soils to erosion and compresses them	Overturns, moves, and buries boulders and cobbles, homogenizes sediments, eliminates existing microtopography, leaves long-lasting grooves
Effects on roots of infauna	Stimulates, then eliminates saprotrophs that decay roots	Crushes and buries some infauna; exposes others, thus stimulating scavenger populations
Effects on emergent biogenic structures and structure formers	Removes or burns snags, down logs, and most structure-forming species aboveground	Removes, damages, or displaces most structure-forming species above sediment-water interface
Effects on associated species	Eliminates most late-successional species and encourages pioneer species	Eliminates most late-successional species and encourages pioneer species
Effects on biogeochemistry	Releases large pulse of carbon to atmosphere by removing and oxidizing accumulated organic material; eliminates nitrogen fixation by arboreal lichens	Releases large pulse of carbon to water column and atmosphere by removing and oxidizing accumulated organic material; increases oxygen demand
Recovery to original structure	Decades to centuries	Years to centuries
Typical return time	40–200 years	40 days–10 years
Area covered per year globally	~0.1 million km^2 (net forest and woodland loss)	~14.8 million km^2
Latitudinal range	Subpolar to tropical	Subpolar to tropical
Ownership of areas where it occurs	Private and public	Public
Published scientific studies	Many	Few
Public consciousness	Substantial	Very little
Legal status	Activity increasingly modified to lessen impacts or not allowed in favor of alternative logging methods and preservation	Activity not allowed in few areas

Source: Modified from Watling and Norse 1998.

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Aves amenazadas por distintas formas de degradación de hábitat

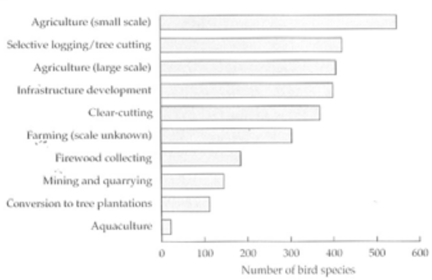

Figure 6.9 Bird species that are threatened by habitat degradation and loss are primarily affected by forms of agriculture, logging, and other tree-clearing, and by infrastructure development. (Modified from Birdlife International 2004.)

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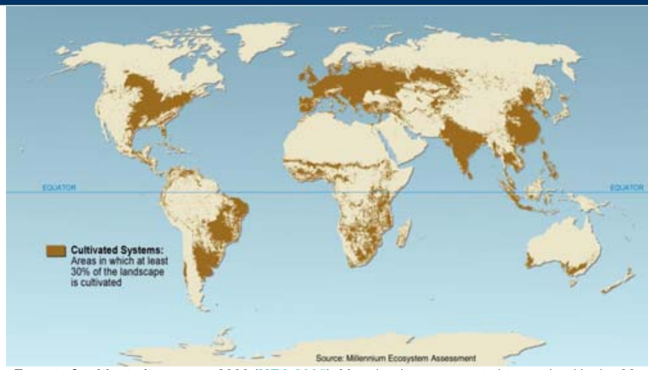
Sistemas cultivados en el mundo



Extent of cultivated systems, 2000 (MEA 2005). More land was converted to cropland in the 30 years after 1950 than in the 150 years between 1700 and 1850. Cultivated systems (areas where at least 30% of the landscape is in croplands,shifting cultivation, confined livestock production, or freshwater aquaculture) now cover one quarter of Earth's terrestrial surface.

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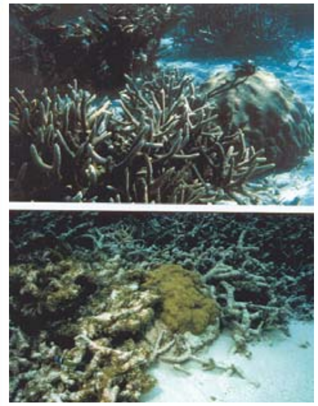
Superficies de tierras degradadas

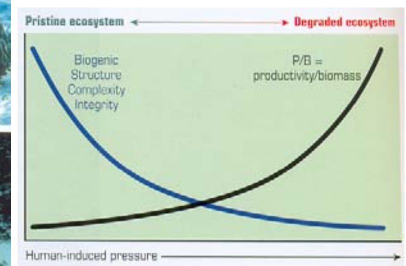
TABLE 6.3 *Extent of Land Degradation by Several Causes*

Degradation extent	Cause
680	Overgrazing: Losses are most severe in Africa and Asia where pasturelands have become overgrazed. About 20% of the world's pastures are degraded.
580	Deforestation: Large-scale logging and clearance for agriculture and urban use. 220 million ha of tropical forest were destroyed between 1975–1990, mainly for pasture and cropland.
550	Agricultural mismanagement: Soil erosion has reached 25,000 million tonnes annually. Salinization and waterlogging affect about 40 million ha annually.
137	Fuelwood consumption: Woodfuel is the primary source of energy in many developing countries, and represents a substantial form of degradation to forests and woodlands.
19.5	Urbanization and industry: Urban growth, road construction, mining, and industry create complete habitat loss. Useful agricultural land is often lost as well.

Note: Degradation extent is given in millions of hectares.
Source: UN Environmental Programme 2002.

Degradación de ecosistemas bentónicos





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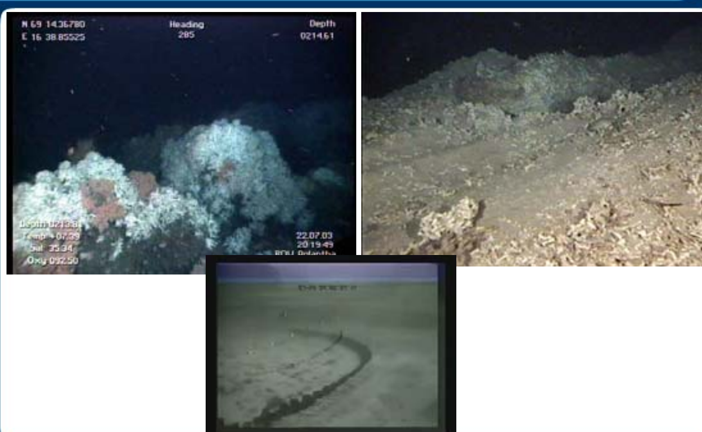
Daños de la pesca de Arrastre



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Concentración de ozono (P.N. Yosemite, CA, USA)

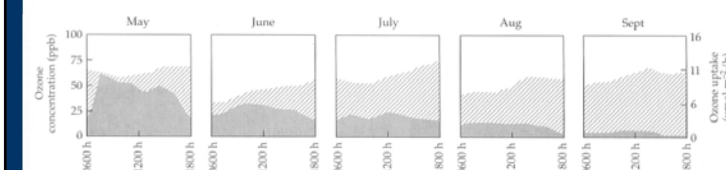

Figure A Ozone concentration (hatched area) plotted with ozone uptake (solid areas) for Yosemite National Park, CA, showing increasing decoupling of concentration and uptake over the season. Individual panels present 1 day of measurements taken every 2 hours from 0600 to 1800 hours PST in each month during the growing season. (Modified from Panek and Ustin

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Contaminación por plástico: León marino de California

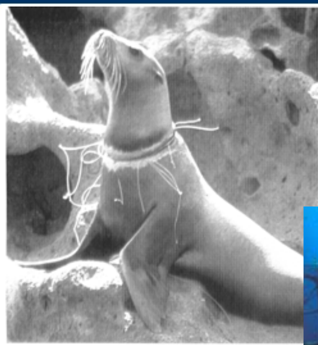
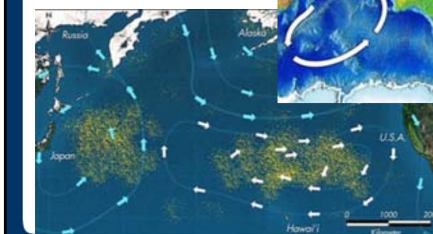


Figure 6.12 Entanglement in plastic debris can cause deep wounds and restrict feeding, as seen here for this California sea lion (*Zalophus californianus*). (Photograph © Hal Beral/ Visuals Unlimited.).

Pesca fantasma

La isla de plástico en el océano Los 5 giros



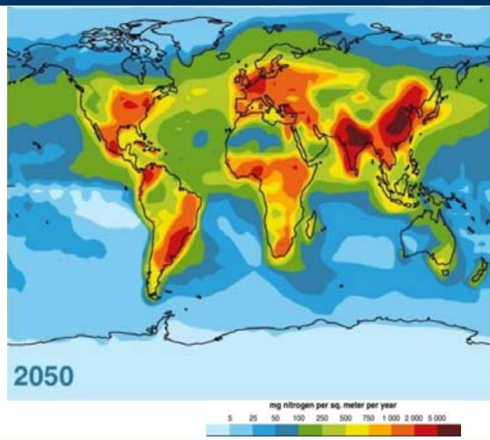
Contaminación por petróleo

Figure 6.13 The *Exxon Valdez* oil spill contaminated over 1900 km of shoreline in Alaska, from its origin in Prince William Sound (PWS), along the Kenai Peninsula (KP) to the Alaska Peninsula (AP) and Kodiak Island (KI). (Modified from Peterson et al. 2003).

Depositación de nitrógeno

Figure 6.14 The amount of nitrogen deposited in the world's major watersheds has increased tremendously from predisturbance levels to the mid-1990s. (Modified from Millennium Ecosystem Assessment 2005b.)

Depositación de nitrógeno en el tiempo (1860, 1990, 2050)



MEA 2005

Riqueza de especies versus depositación de nitrógeno

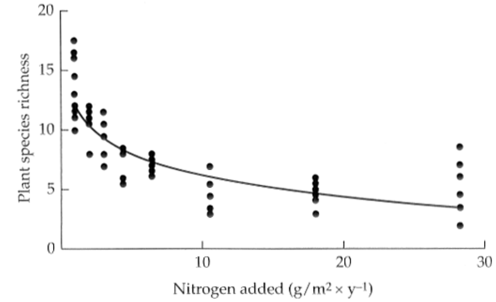
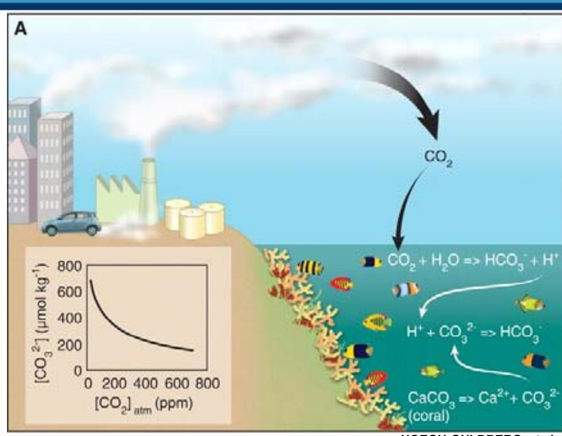


Figure 6.15 Plant species richness declines along a nitrogen gradient in a prairie ecosystem at Cedar Creek, Minnesota. (*x*-axis is the rate of nitrogen addition plus 1). Each point represents the average of data collected in 1995 and 1996. (Modified from Haddad et al. 2000.)

Acidificación de los océanos



HOEGH-GULDBERG et al, 2007

Zonas hipóxicas (muertas)

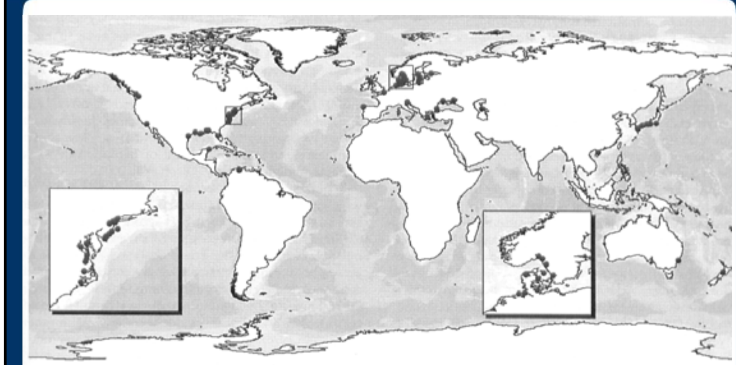


Figure 6.16 World distribution of hypoxic or "dead zones" is correlated to position of watersheds that have greatly enhanced nitrogen inputs, and to major cities. (Modified from Burke et al. 2000.)

Hotspots de biodiversidad

Figure 6.17 Biodiversity hotspots are the most immediately threatened regions with the greatest richness of plant species on Earth. Hotspots (dark gray) are priority regions for conservation efforts. Major tropical wilderness areas (light gray) are also a conservation priority by CI. (Courtesy of Conservation International.)

Protección según bioma

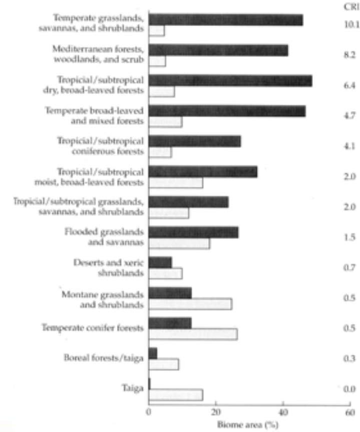


Figure 6.18 Protected areas provide better coverage of some biomes (e.g., temperate conifer forests) than of others (Mediterranean habitats), particularly relative to the proportion of total habitat area has been converted to human uses. The Conservation Risk Index (CRI; dark gray) is the ratio of the percent habitat converted to percent habitat protected (light gray). (Modified from Hoekstra et al. 2005.)

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Ecoregiones en crisis

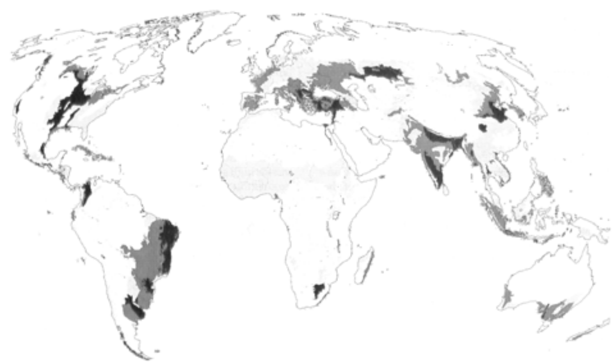

Figure 6.19 Distribution of the 305 crisis ecoregions that are at-risk of elimination due to habitat conversion. Vulnerable ecoregions are in light gray, endangered ecoregions in medium gray, and critically endangered ecoregions in black. (Modified from Hoekstra et al. 2005.)

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Pérdida de habitat por cambio en el uso del suelo

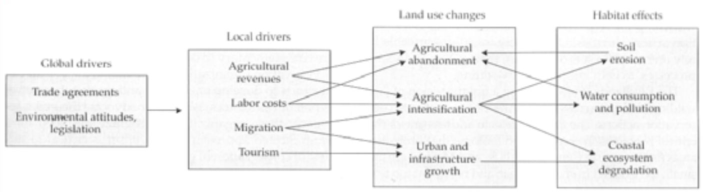

Figure 6.20 An example of how habitat degradation caused by land use change is based on economic and social drivers of land use decisions. (Modified from Millennium Ecosystem Assessment 2005a.)

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Valor económico para ecosistemas manejados en forma sustentable

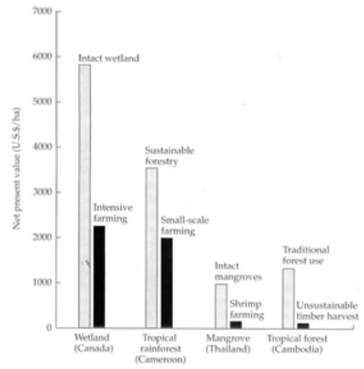

Figure 6.21 Economic value (net present value) from managing ecosystems in sustainable ways (gray bars) is higher than for unsustainable uses of that same ecosystem type (black bars). (Modified from Balmford et al. 2002.)

Flora de sotobosque en matorrales no cultivados y cultivados

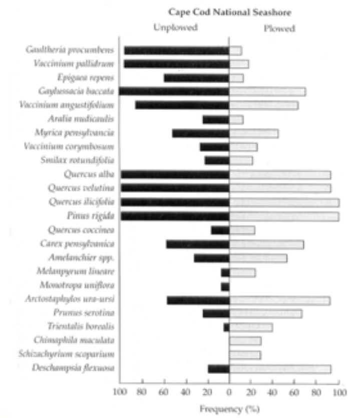

Figure A The understory flora of woodlands that had once been cultivated for agriculture (plowed) differs from that found in sites that had always been woodlots (unplowed) in the Cape Cod National Seashore, MA. In this region, as in much of New England, lands were cleared of trees to make way for agriculture, plowed, and beginning in the nineteenth century, abandoned and allowed to reforest. Both plowed and unplowed sites have been forested and managed since the late nineteenth century, yet a century after their use, the flora clearly differs. There are three groups of species represented, (1) species (especially ericaceous shrubs) that are more abundant in former woodlots that were eliminated by agriculture and have failed to reestablish, (2) weedy species that established well in agricultral sites and persisted there, but that are incapable of establishing widely in intact forest areas, and (3) species that are excellent dispersers and establish readily in any site. (Modified from Foster et al. 2003.)

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Re-conversión de praderas a matorrales / bosque

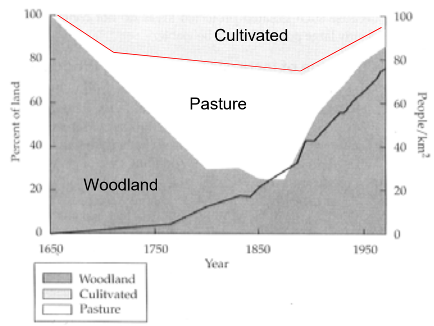

Figure B Beginning in the mid-1600s, the landscapes of New England were largely converted to pasture and croplands, but with the industrial revolution were abandoned and reforested until the present day. Population density (black line) increased over the same period, as people moved to cities from the countryside. (Modified from Foster 2002.)

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Leer

Groom MJ, GK Meffe y CR Carroll. 2006. Principles of Conservation Biology. Third Edition. Sinauer Associates, Inc., Sunderland, Massachusetts. Capítulo 6: Habitat Degradation and Loss

Ver también: www.sinauer.com/groom

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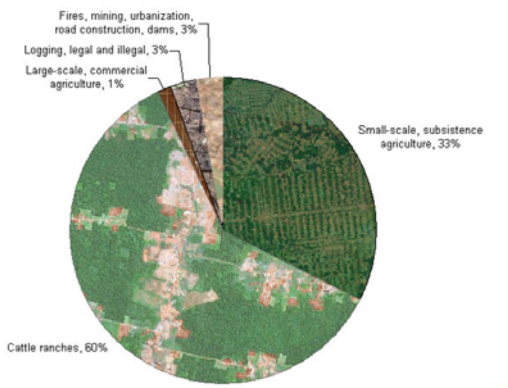
Transformación de hábitats

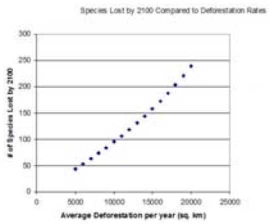
The golden headed lion tamarin (*Leontopithecus chrysomelas*) is endemic to the Atlantic Forest of eastern Brazil, one of the most threatened ecosystems in the world.

Causas de la deforestación en el Amazonas



Deforestación y extinciones

Figure A A fragmented landscape seen in the study plots of the Biological Dynamics for Forest Fragments project near Manaus, Brazil. (Photograph © Mark Moffett/Minden Pictures.)



Distribución de la vegetación en una ladera de exposición oeste

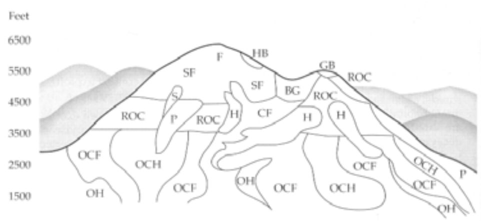


Figure 7.2 Topographic distribution of vegetation on an idealized west-facing slope on the Great Smoky Mountains National Park. Vegetation types: BG, beech gap; CF, cove forest; F, Fraser fir; GB, grassy bald; H, hemlock; HB, heath bald; OCF, chestnut oak–chestnut; OCH, chestnut oak–chestnut heath; OH, oak–hickory; P, pine forest and heath; ROC, red oak–chestnut oak; S, spruce; SF, spruce–fir. (From Whittaker 1956.)

Fragmentación

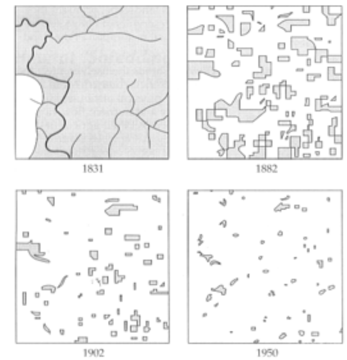


Figure 7.1 Changes in a wooded area of Cadiz Township, Green County, Wisconsin, during the period of European settlement. Shaded area represents the amount of land in forest in each year. (From Curtis 1956.)

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Efecto del Fuego

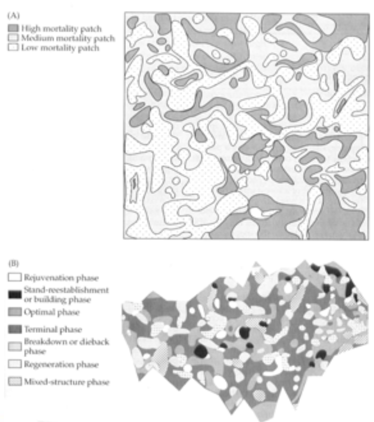

Figure 7.3 (A) Fire mortality patches from 1800 to 1900 in the Cook-Quentin study area, Willamette National Forest, Oregon. Scale is about 10 km from left to right. (B) Stand development phases in a 1 km wide section of virgin forest in Yugoslavia. Patches average about 0.5 ha in size. Phases represent stages in a continuous cycle of forest dieback and recovery. (A, from Morrison and Swanson 1990; B, from Mueller-Dombois 1987.)

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Formación de claros y fragmentación

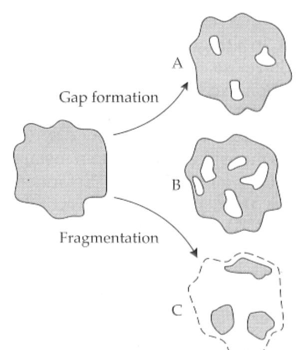

Figure 7.4 A fragmentation sequence begins with gap formation of perforation of the landscape A. Gaps become bigger or more numerous (landscape B) until the landscape matrix shifts from forest to anthropogenic habitat (landscape C). (From Wiens 1989.)

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Fragmentación a escala fina

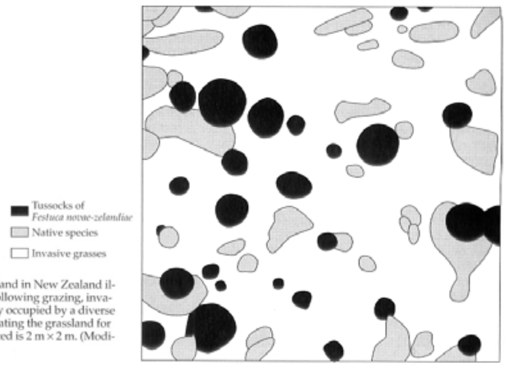


Figure 7.5 This short-tussock grassland in New Zealand illustrates fine-scale fragmentation. Following grazing, invasive grasses filled the spaces normally occupied by a diverse suite of native species, thus fragmentating the grassland for plant and animal species. Area depicted is 2 m × 2 m. (Modified from Lord and Norton 1990.)

Probabilidad de encuentro y tamaño del parche

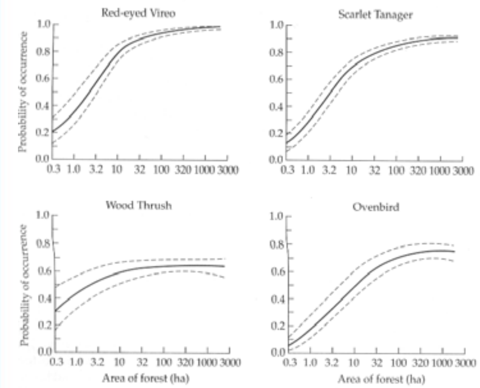


Figure 7.6 Probability of four species of common forest interior Neotropical migrant birds nesting in United States mid-Atlantic forests of various sizes, based on point counts. Dotted lines indicate 95% confidence intervals. (From Robbins et al. 1989.)

Cambio en la riqueza de especies

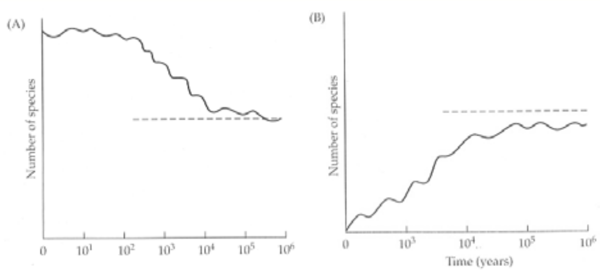


Figure 7.7 Predicted species richness over time for land-bridge islands (A) and oceanic islands (B). Land-bridge islands were once part of a large land area and contained more species than they could retain after their isolation by rising sea level; the decline in species richness after isolation is known as "relaxation." Oceanic islands, often of volcanic origin, are slowly colonized by long-distance dispersal, so species richness builds gradually to an equilibrium level (dashed line). (From Harris 1984.)

Constelación de parches separados

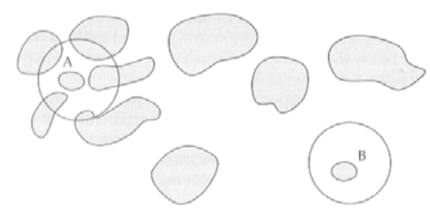


Figure 7.8 A constellation of separate habitat patches may be critical to the survival of individuals or populations. If a species requires resources in the shaded habitat patches, site A will be preferable to site B. Although no single patch is large enough by itself to support a population, the close grouping of patches in site A provides sufficient resources within the accessible part of the landscape (circle). In contrast, site B consists of one small, isolated patch and will not support a population. If human activities create impenetrable barriers to movement between the patches in site A, that site will no longer be superior to site B. (From Dunning et al. 1992.)

Combinación de hábitats

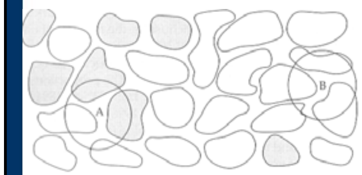


Figure 7.9 Many animals require a suite of different habitats or resources to meet life history needs. If a species requires nonsubstitutable resources found in two habitat types (shaded and open), regions of the landscape where the two habitats are in close proximity (site A) will support larger populations than regions where one habitat type is rare (site B). However, as in the example on Figure 7.8, barriers between habitat patches will destroy any advantage of site A. (From Dunning et al. 1992.)

Las barreras naturales o artificiales son comunes en muchos paisajes

Predación de nidos versos borde del bosque

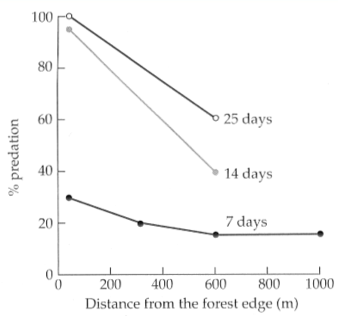


Figure 7.11 Percent of experimental nests (quail eggs) preyed upon as a function of distance from forest edge. Nests at the edge of forest are all consumed within 14 days, and even those 600 m away from the forest edge show high rates of predation after 25 days. (From Wilcove et al. 1986.)

Forma y tamaño del parche

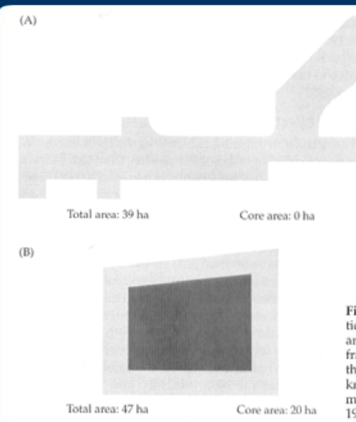


Figure 7.12 A comparison of breeding success of fragmentation-sensitive birds in two forest fragments with similar total areas but vastly different core areas (forest interior). (A) A fragment that is entirely edge habitat (light). (B) A fragment that contains 20 ha of core habitat (dark region). Of 16 species known to be sensitive to fragmentation, none bred in the fragment in (A), and 6 bred in fragment in (B). (From Temple 1986.)

Barreras antrópicas para el movimiento de animales

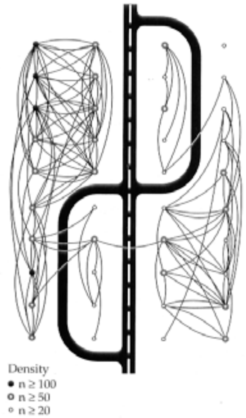
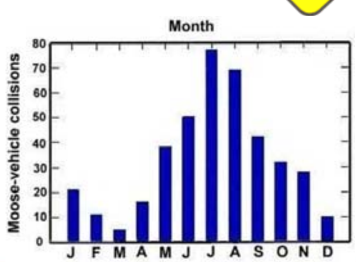


Figure 7.13 Roads can be significant barriers to the movement of small vertebrates and invertebrates. In this example, populations of the forest-dwelling carabid beetle *Abax ater* were almost completely divided by a road and even by parking loops. Lines represent movements of marked beetles between capture and recapture points. (Modified from Mader 1984.)

Colisiones con vida silvestre

Figure 7.14 Florida panthers are highly endangered. Automobile collisions are the single largest source of mortality for this species, a situation that is made worse as more people move to south Florida. Efforts to reduce this mortality include posting of caution signs in areas where panthers frequently cross roads. (Photograph © Painet, Inc.)

Colisiones con vida silvestre



Animales sueltos (ciervo)

Tasa de extinción versus tamaño de la población

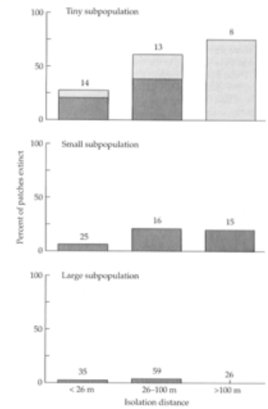


Figure 7.15 Extinction rates were highest in small, isolated patches (subpopulations) of the annual plant *Clarkia concinna* (Onagraceae). White portions of bar denote patches, in which individuals had no, or low, reproductive success, and dark gray portions denote patches that experienced a catastrophe (e.g., a flood); sample sizes are above bars. (From Groom 1998.)

Tamaño de la isla versus diversidad

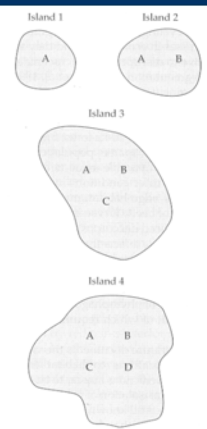


Figure 7.16 Hypothetical nested subset distribution of species on islands of different sizes. The letters A through D represent different species. Species are added in a predictable sequence with increasing island size and number of habitats. The largest island contains all four species. (From Cutler 1991.)

Conectividad entre fragmentos

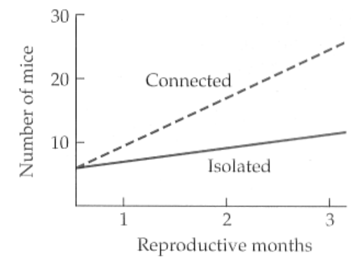


Figure 7.17 Isolated woodlots in a fragmented landscape are predicted by simulation models to have lower rates of population growth than woodlots connected by fencerow corridors. These predictions were verified by studies of white-footed mice in southern Ontario. (From Merriam 1991, based on Fahrig and Merriam 1985.)

Subdivisión del territorio (incremento de casas y caminos en el tiempo)

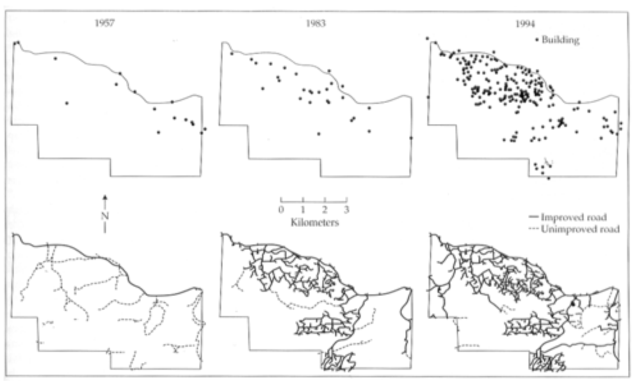


Figure A A former ranch in Colorado that has been subdivided into ranchettes. The upper maps show the increase in the number of houses over time; the lower maps show the increase in roads built to access the homes.

Densidad de aves versus distancia desde casas rurales

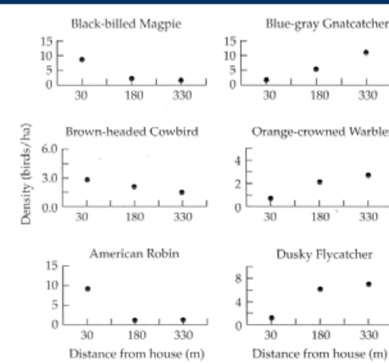


Figure B Densities of songbirds with increasing distances (30 m, 180 m, and 330 m) from rural ranchettes. Note that generalist species (left column) are more abundant close to homes while specialist species (right column) are more common farther from homes.

Densidad de aves en tres usos de suelo diferentes

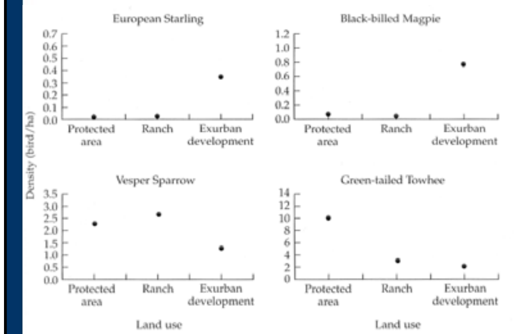


Figure C Densities of songbirds on three different land uses in the American West: protected areas, ranches, and ranchette developments. Several generalist species were more common on lands devoted to exurban development than on protected areas and ranches. Also some species, such as Vesper Sparrows, occurred in higher densities on protected areas and ranches than on ranchettes.

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Fragmentación en las principales cuencas de ríos en el mundo

Figure A Degree of fragmentation of major river basins of the world. Of the 227 large river basins assessed by Dynesius and Nilsson (1994) and Nilsson et al. (2000), 37% are strongly affected by fragmentation and altered flows, 23% are moderately affected, and 40% are unaffected. Strongly affected systems include those with less than one quarter of their main channel left without dams, where the largest tributary has at least one dam, as well as rivers whose annual flow patterns have changed substantially. Sub-basins of the Amazon, Orinono, and Congo are unaffected, although each of these major rivers has some sub-basins that are affected by fragmentation. The Yangtze River in China, which currently is classified as moderately affected, will become strongly affected once the Three Gorges Dam is completed.

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Degradación biológica aguas arriba de represas

TABLE A *Examples of Upstream Biological Degradation Caused by Dams and Human Activity*

Downstream human activities	Upstream biological legacies
Urbanization; dams and impoundments; gravel mining; channelization	Genetic isolation; population-level changes: "source" of native species "sink" for nonnative species; ecosystem-level changes: primary production, nutrient cycling, decomposition

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Tamaño de la Isla y densidad de animales y árboles (Venezuela)

TABLE A *Counts of Selected Species on Lago Guri Islands and Mainland*

	Island Class													
	Small, far				Small, near				Medium			Large	
Mammals	Col	Igu	Mie	Tri	Bum	Pal	Per	Roc	Cor	Lom	Pan	DM	TF
Dasypus spp.	0	+[a]	0	0	0	0	1	0	2	1	1	1	+
Rodent, small	2	1	0	1	4	6	6	+	2	1	7	1	1
Reptiles													
Ameiva ameiva	0	5	24	6	11	3	5	8	1	0	4	2	1
Geochelone carbonería	0	1	0	1	1	0	1	2	0	2	2	1	0
Amphibians													
Bufo marinus	2	0	1	0	1	0	2	0	0	+	0	1	0
Dendrobates leuco	10	3	4	6	11	0	0	7	1	10	3	2	0
Invertebrates													
Atta spp. (colonies)	3	5	1	0	6	1	1	2	2	2	1	0	0
Tarantula spp.	8	3	20	9	2	0	6	7	5	9	10	9	6

Note: Data normalized to 1 ha.
[a] + is recorded on landmass, but not on formal census.

TABLE B *Number of Small and Large Saplings in Sample Plots on Lago Guri Landmasses*

	Landmass					
	Small ($n^a = 6$)		Medium ($n = 4$)		Large ($n = 2$)	
Sapling size	Exposed	Protected	Exposed	Protected	Exposed	Protected
Small	69	67	119	165	166	155
Large	131	155	173	193	139	101

[a] n = Number of saplings sampled.

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Densidad de árboles en el tiempo, lago Guri, Venezuela

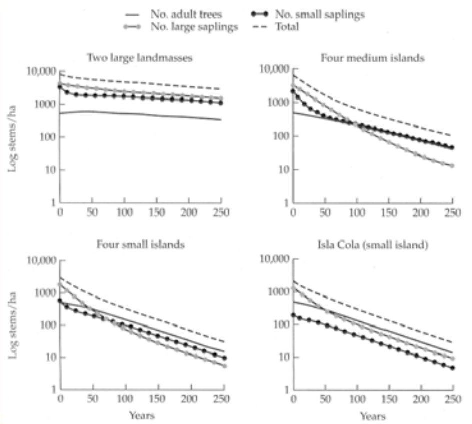


Figure A Dramatic declines in total density of trees (as well as of adult, large sapling, and small sapling stage classes) are predicted on medium and small islands in Lago Guri given current survival and recruitement rates. In contrast, trees on large landmasses are predicted to decline only slightly.

Leer

Groom MJ, GK Meffe y CR Carroll. 2006. Principles of Conservation Biology. Third Edition. Sinauer Associates, Inc., Sunderland, Massachusetts. Capítulo 7: Habitat Fragmentation

Ver también: www.sinauer.com/groom

UNIDAD I: Fundamentos Conceptuales de la Conservación Biológica

Clase 2

Amenazas Primarias a la Biodiversidad

Tema 1: Degradación y Pérdida de Hábitats

Tema 2: Fragmentación de Hábitats

Tema 3: Sobre-explotación

Tema 4: Especies Invasoras

Tema 5: Cambio Climático.

Productividad versus tamaño árbol

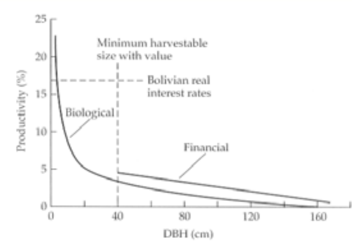


Figure 8.1 Productivity of Bolivian mahogany trees as a function of size expressed as tree diameter at breast height (DBH). Financial productivity is equivalent to size increments combined with a 1% real increase in price. Trees equal to or smaller than 40 cm in DBH have no commercial value, but at this size they increase at 5% in value per year. To maximize their profits, loggers should fell trees at a size when the financial productivity drops below the prevailing interest rate, which in Bolivia was 17% in 1989–1994. The discrepancy between the interest rates and tree growth rate provides a strong incentive to overexploit. (Modified from Gullison 1998.)

Cacería en bosques tropicales

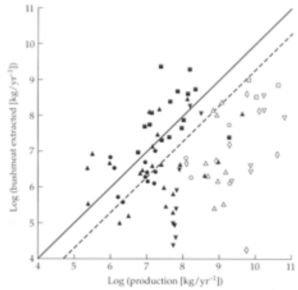


Figure 8.2 Hunting rates are unsustainably high across large tracts of tropical forests as seen in the relationship between total extraction and total production of game meat throughout the Congo and Amazon basin (solid and open symbols, respectively) by mammalian taxa. The solid line indicates where extraction equals production; the dashed line indicates exploitation levels at 20% of production, considered to be sustainable for long-lived taxa. Taxon symbols are as follows: ungulates (squares), primates (triangles), carnivores (circles), rodents (inverse triangles), and other taxa (diamonds). (Modified from Fa et al. 2002.)

Colecta de nueces versus tamaño del árbol (Brazil)

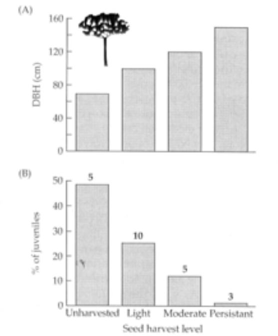


Figure 8.3 Relationships between historical levels of Brazil nut collection and mean tree size, expressed in terms of DBH, cm (A); and percentage of juvenile trees (B) in different populations. Numbers above bars indicate the number of populations studied throughout the Brazilian, Bolivian, and Peruvian Amazon. (Modified from Peres et al. 2003.)

Densidad versus intensidad de pesca

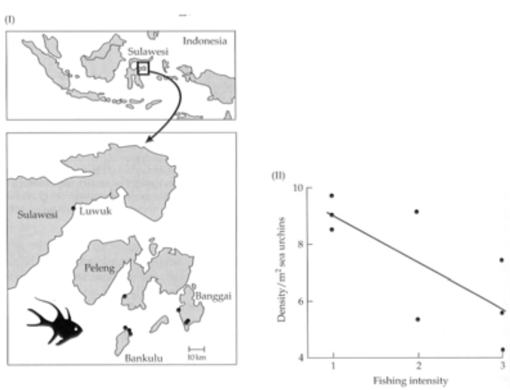
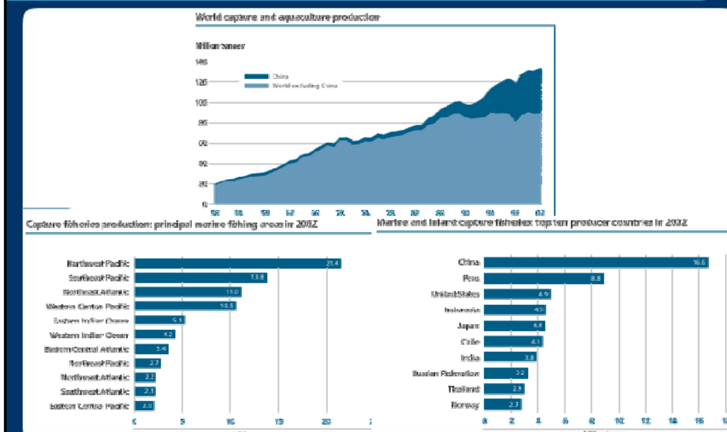
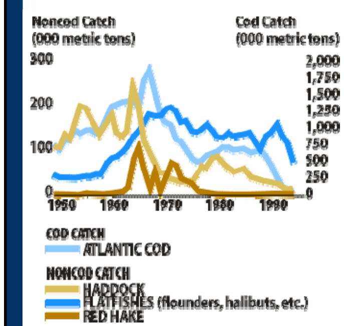


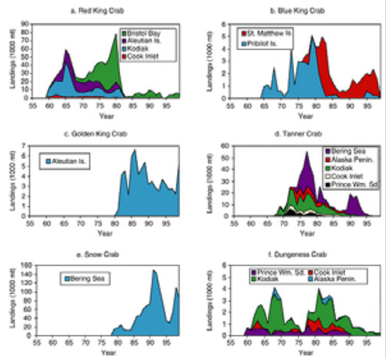
Figure A (I) Map of the Banggai Archipelago of Indonesia, showing study sites as black circles. The Banggai cardinalfish is pictured in the lower left corner. (II) Correlation between Banggai cardinalfish density and the intensity of fishing at eight separate sites in the Banggai Archipelago near Sulawesi, Indonesia. Because the cardinalfish is associated with sea urchins, their density is expressed per m^2 of sea urchins on the sea bed. Intensity of fishing was estimated from interviews with local people. Banggai cardinalfish are caught by nets only, so reductions in density are solely related to fishing pressure, not to reef destruction (Modified from Kolm and Berglund 2003.)

Pesquería global (capturas y acuacultura)



Sobrepesca





Orange Roughy

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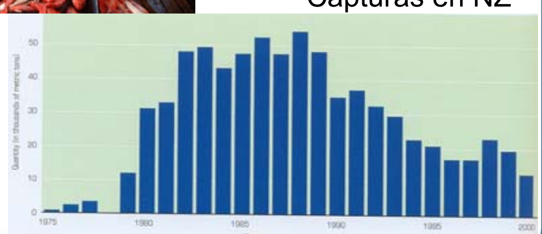
Orange Roughy

Capturas en NZ



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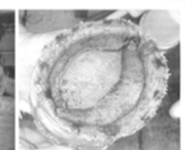
Pesca incidental ?

Figure 8.5 Chinese bahaba (*Bahaba taipingensis*) caught as an incidental by-catch by a trawler west of Hong Kong. (Photograph courtesy of Cheng Tai-sing.)

Figure 8.7 Mekong giant catfish, *Pangasianodon gigas*, from the Mekong River. (Photograph courtesy of Zeb Hogan.)



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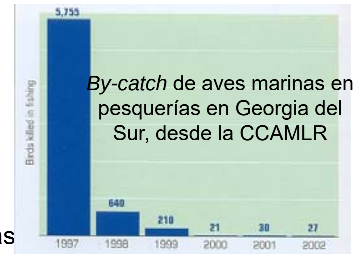
Soluciones concretas



By-catch de aves marinas en pesquerías en Georgia del Sur, desde la CCAMLR

CCAMLR: Convention for the Conservation of Antarctic Marine Living Resources

- ✓ Conciencia mundial
- ✓ Soluciones prácticas
- ✓ Restricciones a las pesquerías
- ✓ MPAs
- ✓ Convenciones internacionales
- ✓ Conciencia de usuarios tradicionales (e.g. Port-Cros, Maoris)

Soluciones concretas

- ✓ Conciencia mundial
- ✓ Soluciones prácticas
- ✓ Restricciones a las pesquerías
- ✓ MPAs
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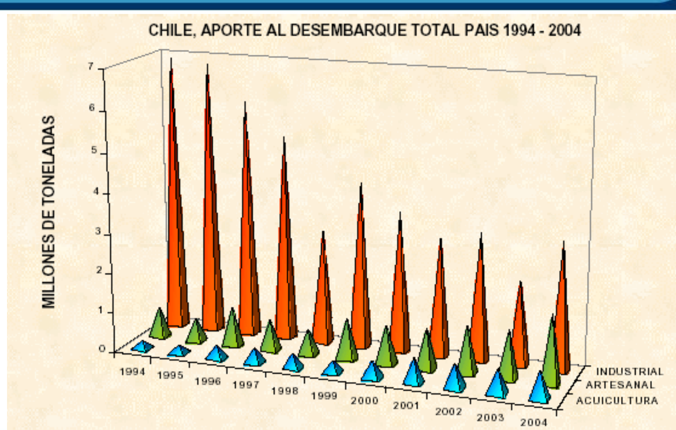
- ✓ Conciencia de usuarios tradicionales (e.g. Port-Cros, Maoris)

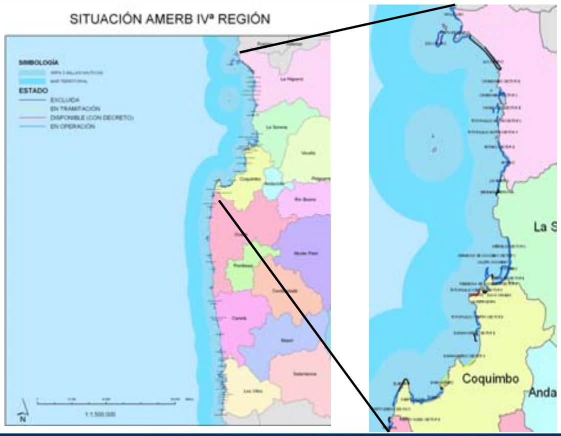
Capturas en Chile



Vedas vigentes en Chile

- Anchoveta
- Algas Pardas
- Caracol
- Camarón Nailon
- Centolla
- Especies Salmónidas
- Especies Ícticas Nativas
- Erizo
- Huepo
- Langosta de Archipielago de Juan Fernández
- Langosta de Isla de Pascua
- Raya
- Langostino Amarillo
- Langostino Colorado
- Lobo Marino Común
- Locate
- Loco
- Luga Roja
- Macha
- Mamíferos Aves y Reptiles
- Merluza del Sur
- Ostión del Sur
- Orange Roughy

AMERBs



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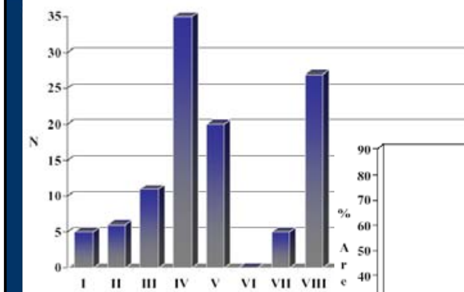
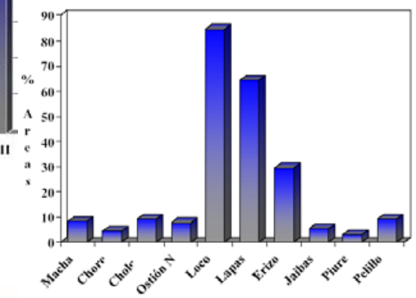
AMERBs





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Reproducción y Mortalidad denso-dependiente

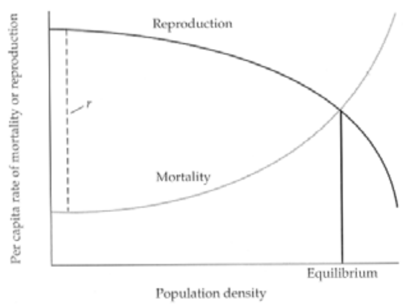

Figure 8.8 Density dependence stems from relationships between population density and per capita rates of birth and death. The difference between these at a small population size is the intrinsic rate of natural increase, r, and the density at which these rates are balanced is the equilibrium population size.

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Crecimiento logístico de una población

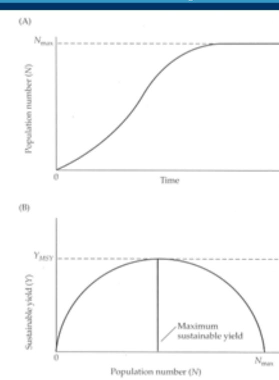

Figure 8.9 (A) Logistic population growth of a population up to a maximum population size, N_{max}. (B) Sustainable yield, Y (surplus production) against population size for the logistic case shown in (A). The maximum sustainable yield (Y_{MSY}) occurs at 50% of the maximum population size.

The simplest way to ask about the ability of a population to compensate for elevated mortality is to start with the logistic model, which gives the number of individuals at time t as:

$$N_t = \frac{N_{max}}{1+\left(\frac{N_{max}}{N_0}-1\right)e^{-rt}} \quad [8.1]$$

Here N_{max} is the maximum population size (Figure 8.9A). This is often called the "carrying capacity," or equilibrium population size.

The growth rate of this population before exploitation can be considered its surplus production, $g(N)$, and is given as:

$$g(N) = rN\left(1-\frac{N}{N_{max}}\right) \quad [8.2]$$

If the population in Figure 8.9A is being exploited at a steady rate, then its rate of change per unit time, dN/dt will be the difference between its surplus production and the yield, Y, for a given level of exploitation:

$$\frac{dN}{dt} = rN\left(1-\frac{N}{N_{max}}\right)-Y \quad [8.3]$$

The population's surplus production is the yield that can be removed sustainably. We can plot this property against different population sizes (Figure 8.9B).

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Tortugas conocidas y proyectadas

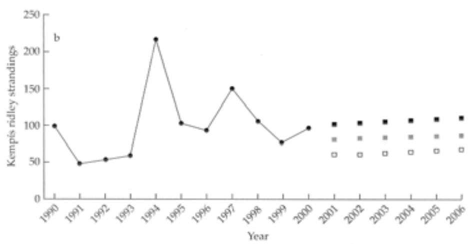

Figure 8.14 Projected annual strandings for Kemp's ridley sea turtles based on three potential levels of compliance by shrimpers in using turtle excluder devices in their nets. Black squares = compliance at 2000 levels, gray squares = 50% improved compliance over 2000 levels, and open squares = full compliance. Fluctuations in strandings reflects variation in compliance and sea turtle abundance in areas where shrimp fisheries are most active. (Modified from Lewison et al. 2003.)

Corta selectiva y daño residual

Figure A Selective logging typical involves cutting a few valuable species, and extracting them via skidders or draft animals. (Photograph by M. Pinard).

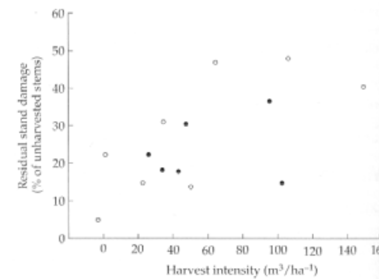

Figure B Variability in harvest intensities (m^3/ha^{-1}) and incidental damage to the residual stand (percentage of unharvested trees) across the tropics. Open symbols are areas in which harvesting was planned and controlled; closed symbols are areas in which harvesting was carried out in a conventional way (typical for the region, generally with little planning and control over operations). (Modified from Pinard et al. 2005.)

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FSC Forest Stewardship Council

http://www.fsc.org/pc.html

Overview of the FSC Principles and Criteria

Principle 1.
Compliance with all applicable laws and international treaties

Principle 2.
Demonstrated and uncontested, clearly defined, long–term land tenure and use rights

Principle 3.
Recognition and respect of indigenous peoples' rights

Principle 4.
Maintenance or enhancement of long-term social and economic well-being of forest workers and local communities and respect of worker's rights in compliance with International Labour Organisation (ILO) conventions

Principle 5.
Equitable use and sharing of benefits derived from the forest

Principle 6.
Reduction of environmental impact of logging activities and maintenance of the ecological functions and integrity of the forest

Principle 7.
Appropriate and continuously updated management plan

Principle 8.
Appropriate monitoring and assessment activities to assess the condition of the forest, management activities and their social and environmental impacts

Principle 9.
Maintenance of High Conservation Value Forests (HCVFs) defined as environmental and social values that are considered to be of outstanding significance or critical importance

Principle 10.
In addition to compliance with all of the above, plantations must contribute to reduce the pressures on and promote the restoration and conservation of natural forests.

- Prohibit conversion of forests or any other natural habitat
- Respect of international workers rights
- Prohibition of use of hazardous chemicals
- Respect of Human Rights with particular attention to indigenous peoples
- No corruption – follow all applicable laws
- Identification and appropriate management of areas that need special protection (e.g. cultural or sacred sites, habitat of endangered animals or plants)

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Leer

Groom MJ, GK Meffe y CR Carroll. 2006. Principles of Conservation Biology. Third Edition. Sinauer Associates, Inc., Sunderland, Massachusetts. Capítulo 8: Overexploitation

Ver también: www.sinauer.com/groom

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UNIDAD I: Fundamentos Conceptuales de la Conservación Biológica

Clase 2

Amenazas Primarias a la Biodiversidad

Tema 1: Degradación y Pérdida de Hábitats

Tema 2: Fragmentación de Hábitats

Tema 3: Sobre-explotación

Tema 4: Especies Invasoras

Tema 5: Cambio Climático.

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Terminología de especies invasoras

TABLE 9.1 *Introduced Species Terminology*

Cryptogenic	Applies to species whose status—native or nonnative—cannot readily be determined; commonly used for species whose cosmopolitan distributions or unclear taxonomy make their geographic origins uncertain
Indigenous	Synonymous to native
Introduced	Refers to a species that has been released outside its native range; synonymous with nonnative, nonindigenous
Introduction	The release of escape of a nonnative species
Invasion	The establishment and spread of an introduced species
Invader	An introduced species
Native	Describes species that evolved in a region
Nonindigenous	Synonymous with introduced, nonnative
Reintroduced	Refers to intentionally released individuals of a native species that was locally endangered or extinct

Note: The terms adventive, alien, exotic, invasive, naturalized, nuisance, pest, and weedy are also used to refer to introduced species, but are either loosely defined, applied to both native and nonnative species, or are rich with non-scientific connotations. The terms introduced, non-native, or nonindigenous are therefore more clear when referring to species outside their native ranges.

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Vectores de transporte de organismos marinos mediados por humanos

Ocean-Going Ships, Exploratory Petroleum Platforms, Dry Docks
- Fouling organisms (hulls, sea chests, seawater pipes, ballast tanks)
- Attached and entangled organisms (on anchors, anchor chains, fish nets, and traps)
- Planktonic/nektonic organisms (ballast water, live wells)
- Benthic organisms (in ballast sediment)

Canals
- Movement of species through sea-level canals
- Movement of species through lock canals

Mariculture (Aquaculture)
- Open sea ranching (escape of fisheries stock, and associated diseases and pathogens, from enclosures)

Live Seafood Industry
- Intra- or international transport of living organisms said to be intended for human consumption, but often finding their way into the open sea

Saltwater Aquarium Industry
- Intentional release of species into the wild by the public
- Accidental release of species into the wild by the public
- Release of organisms associated with transport media (such as water)

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Vectores de transporte de organismos marinos mediados por humanos

Saltwater Bait Industry
- Intentional release of species into the wild by the public
- Accidental release of species into the wild by the public
- Release of organisms associated with transport media (the packing material such as algae)

Marine and Maritime Plant Community Restoration
- Seagrass transplantation
- Marsh and wetland grass transplantation
- Dune grass transplantation

Conservation Efforts
- Intentional release of threatened, endangered, or depleted species into new regions where they did not occur previously (introductions) or into regions from which they have been extirpated (these are properly called reestablishments, not reintroductions)

Scientific Research
- Intentional release of experimental organisms
- Accidental release of organisms (as by failure of a seawater effluent control system, or as organisms attached to scientific equipment)

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Invasiones en la bahía de San Francisco

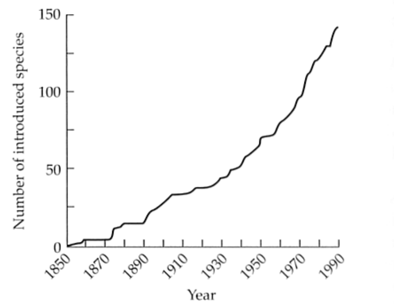

Figure 9.1 Accumulation of established estuarine and marine invaders in San Francisco Bay, California, over 140 years (records with uncertain collection dates and records resulting from specialized sampling for invaders have been excluded). (Modified from Cohen and Carlton 1998.)

Culebras invasoras y corte de energía eléctrica en Guan

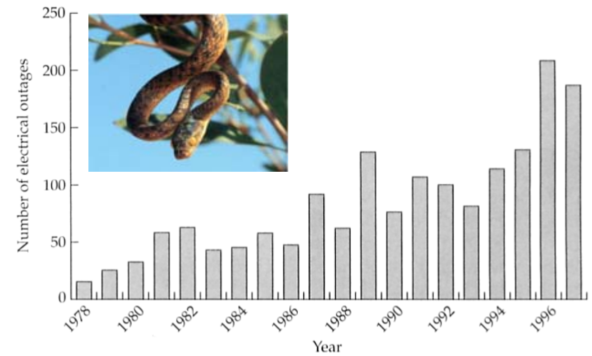

Figure 9.2 Annual electrical outages caused by the invading brown tree snake on Guam. (Modified from Fritts 2002.)

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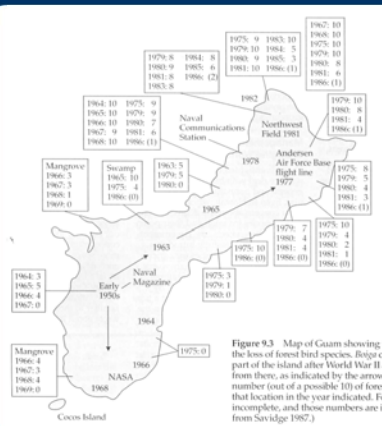
Invasión de la culebra café arbórea en Guam



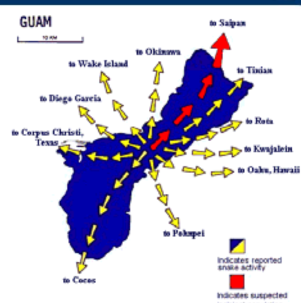


Figure 9.3 Map of Guam showing the spread of *Boiga* and the loss of forest bird species. *Boiga* colonized the southern part of the island after World War II and progressively spread from there, as indicated by the arrows. Each box lists the number (out of a possible 10) of forest bird species found at that location in the year indicated. For 1986, the surveys were incomplete, and those numbers are in parentheses. (Modified from Savidge 1987.)

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Cambios en las interacciones tróficas con la introducción de *Boiga* en Guam

TABLE 9.2 *Changes in Vertebrate Trophic Interactions on Guam before (1945) and after the Brown Tree Snake Invasion (1995)*

	1945	1995
Carnivores	Fairy Tern	Brown tree snake
	Mangrove Monitor*	Mangrove Monitor*
	Micronesian Kingfisher	
	Oceanic gecko*	
Insectivores	Pelagic gecko	Curious skink*
	Blue-tailed skink	Blue-tailed skink
	Mariana skink	Mourning gecko
	Spotted-belly gecko	House gecko
	Mourning gecko	Mutilating gecko*
	House gecko	Moth skink
	Mutilating gecko*	
	Moth skink	
	Rufous Fantail	
Omnivores	Black rat*	Black rat*
	Polynesian rat*	Polynesian rat*
	House mouse*	House mouse*
	Guam Rail	
	Mariana Crow	
	Bridled White-eye	
	Micronesian Honeyeater	
Herbivores	Micronesian Starling	Philippine Turtle-dove*
	Philippine Turtle-dove*	
	Mariana fruit bat	
	White-throated Ground-dove	
	Mariana Fruit-dove	

Source: After Fritts and Rodda 1998.
*Indicates historic introductions that preceded the brown tree snake.

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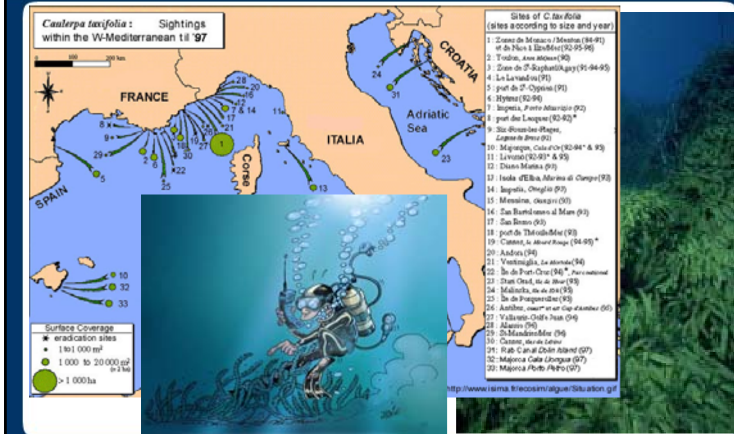
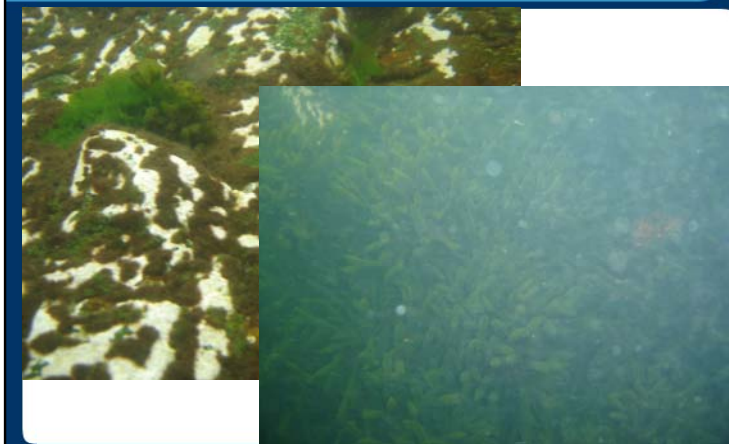
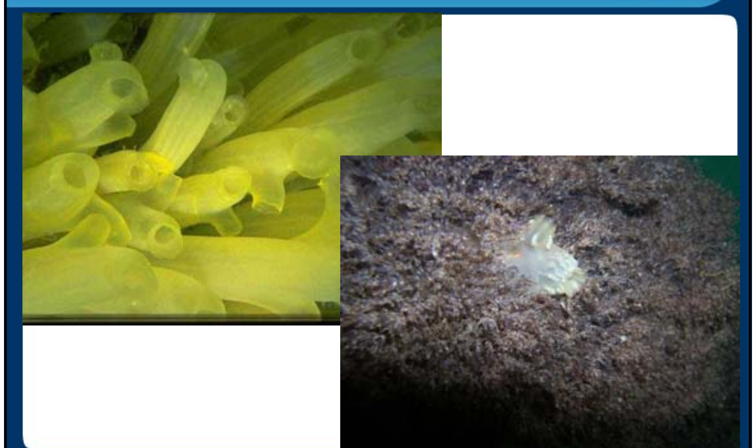
El caso de *Caulerpa taxifolia*



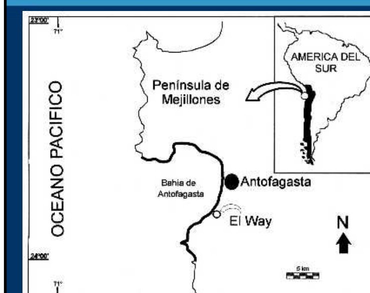
Codium fragile en Chile



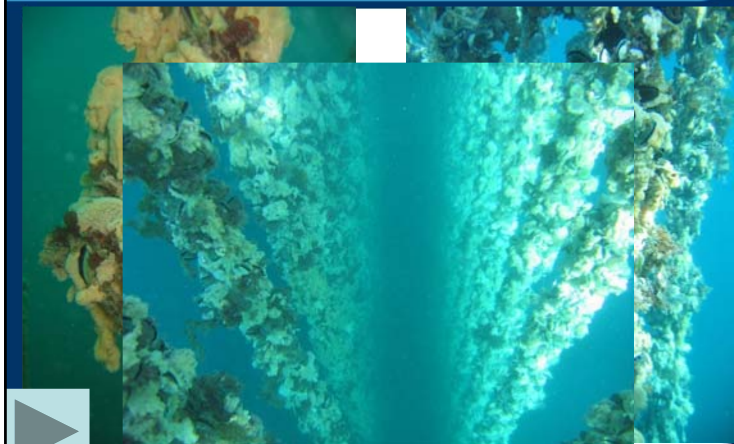
Ciona intestinalis en Chile



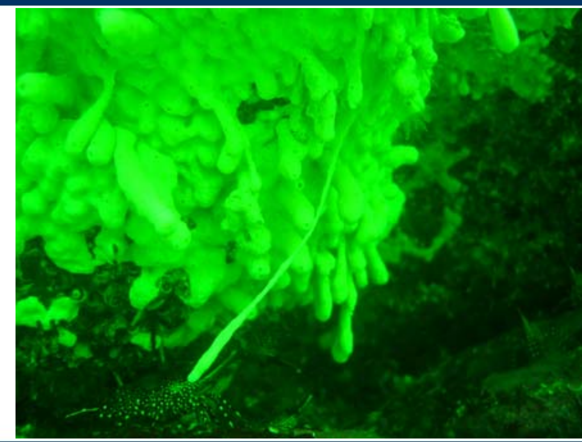
Pyura praeputialis



Didemnum vexillum (tunicate from hell)



¿Tunicate from hell en Chile?



Competencia entre mejillones nativos e introducidos

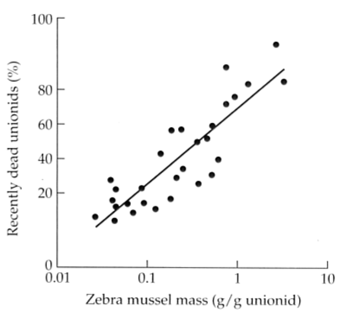


Figure 9.4 Percent of native unionid mussels recently dead as a function of the relative wet weight of introduced European zebra mussels (*Dreissena polymorpha*) attached to their shells. Note log scales. (Modified from Ricciardi 2003.)

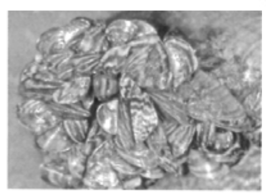


Figure B The zebra mussel (*Dreissena polymorpha*) was first found in North America in Lake St. Clair (upstream of Lake Erie) in 1988 by undergraduate university students. The mussel has since spread to lakes, reservoirs, and rivers throughout temperate, eastern North America. (Photograph © Oxford scientific/photolibrary/Scott Camazine.)

Competidores introducidos

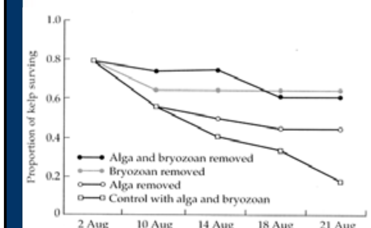


Figure 9.5 Impacts of the introduced Asian alga (*Codium fragile* ssp. *tomentosoide*) and European bryozoan (*Membranipora membranipora*) on the survival of native subtidal kelp as shown by a 1997 experiment in the Gulf of Maine. Kelp survival increased more when the bryozoan was removed than when the alga was removed. Solid circles represent sites where the alga and the bryozoan were removed. Gray circles represent removal of only the bryozoan, while open circles represent removal of only the alga. Open squares represent controls with both introduced species present. (Modified from Levin et al. 2002.)

Efecto de una "floración" de ctenóforo introducido en el Mar Negro

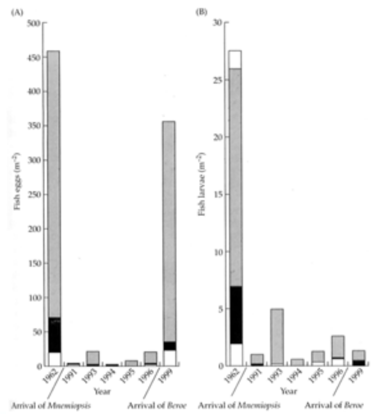


Figure 9.6 Change in the abundance of (A) fish eggs and (B) fish larvae in the northern Black Sea for anchovy (gray), Mediterranean horse mackerel (black), and other species (white) following the bloom of the Atlantic ctenophore *Mnemiopsis leidyi* in 1988, and the arrival of the Mediterranean ctenophore *Beroe ovata* in 1997. (Modified from Shiganova and Bulgakova 2000.)

Efecto de invasión de plantas sobre la tasa de polinización y producción de semillas

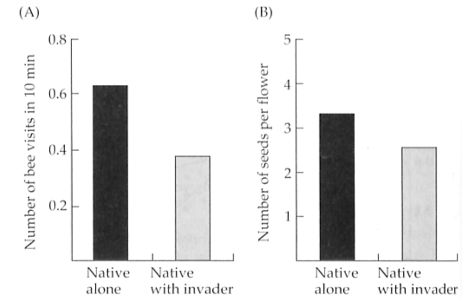


Figure 9.7 Bumblebee visits to (A) and seed set of (B) the native marsh woundwort *Stachys palustris* were significantly greater in pure stands (black bars) than in mixed patches with the introduced Asian annual *Impatiens glandulifera* (gray bars). Bars show mean values. (Modified from Chittka and Schürkens 2001.)

Cambio de preferencia en la ovo-posición de una mariposa

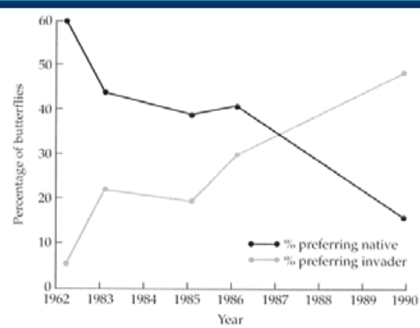


Figure 9.8 Percent of *Euphydryas editha* (a native checkerspot butterfly) preferring to oviposit on the native plant *Collinsia parviflora* (black line) versus the introduced *Plantago lanceolata* (gray line) over time in Nevada. (Modified from Singer et al. 1993.)

Eventos que llevan a una invasión exitosa

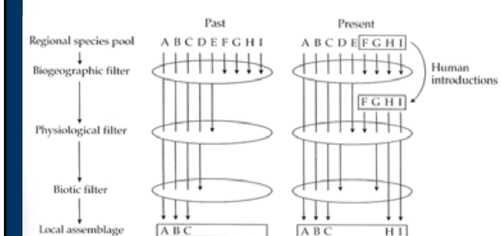


Figure 9.9 The series of events leading to a successful invasion can be pictured as a series of bottlenecks, where fewer individuals of each species, and fewer species overall, pass to each successive stage. The biogeographic filter represents physical barriers for some species. Human activities bring those species that were separated naturally into contact. The physiological filter represents the match between the species and existing climate, while the biotic filter represents the interactions between native and the introduced species. (Modified from Carlton 1985 and Rahel 2002.)

Características asociadas con la invasibilidad en plantas

TABLE 9.3 *Characteristics Asociated with Invasiveness in 114 Species of Nonnative Woody Plants in North America*

Variables	Function coefficients: All species	Function coefficients: Excluding "invades elsewhere"
Invades elsewhere	–0.349	n/a
Reproduces vegetatively	–0.301	–0.348
Length of time fruit on plant	–0.281	–0.447
Flowers perfect	–0.238	—
Flowers in winter	0.260	—
Cold needed for seed germination	0.323	—
Native to temperate Asia	0.342	0.330
Leaves evergreen	0.414	0.637
Intraspecific hybrid	0.521	0.517
Native to North America	0.700	0.910
No seed pretreatment needed for germination	—	–0.332

Note: Negative values indicate characteristics that contribute significantly to spread; positive values indicate characteristics associated with *not* spreading.

Source: Reichard and Hamilton 1997.

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Características de invasibilidad de peces en los grandes lagos de NA

TABLE 9.4 *Biological Characteristics Associated with Invasion Success, Rapid Spread, and Pest or Nuisance Status for Introduced Fishes in The North American Great Lakes*

Invading fish species	Biological characteristics
Successful	Faster growth, wider temperature tolerance, wider salinity tolerance
Quickly-spreading	Slower growth, wider temperature tolerance, lower survival at high temperature
Nuisance	Better survival at low temperature, wider salinity tolerance, smaller eggs

Source: After Kolar and Lodge 2003.

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Invasión en Reservas Naturales

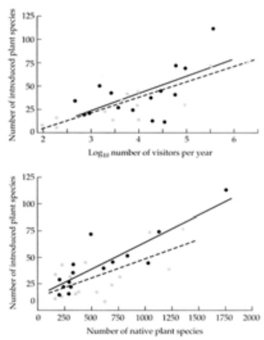

Figure 9.13 The number of introduced plants increases with (A) an increasing annual number of human visitors, and (B) the number of native plants, in terrestrial reserves in South Africa. Reserves in different biomes are shown with different symbols: solid circles (solid line regression) represent tropical dry forest, and gray circles (dashed line regression) represent evergreen forest. (Modified from Macdonald et al. 1989.)

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Disponibilidad y uso de recursos

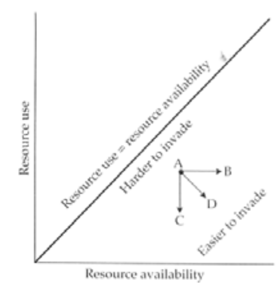

Figure 9.14 A representation of the conceptual theory that increased resource availability increases a plant community's susceptibility to invasion. The resource availability at a given time (A) could increase due to an increase in resources (B), a decline in resource use by resident species (C), or both (D). Each of these scenarios would predict an increase in the community's invasibility. (Modified from Davis et al. 2000.)

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Resistencia a la invasión

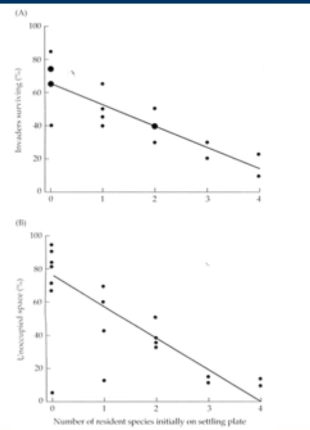


Figure 9.15 On subtidal settling plates colonized by 0–4 native marine invertebrate species in Long Island Sound, (A) the survival of naturally-recruiting introduced Pacific ascidians *Botrylloides diegensis*, and (B) the availability of free space (which decreased significantly with increasing number of native species). This suggests that competition for space may drive the observed relationship between invasion success and resident species richness. Larger dots indicate two data points on top of each other. (Modified from Stachowicz et al. 1999.)

Nativas versus invasoras en sitios reservas y no reservas

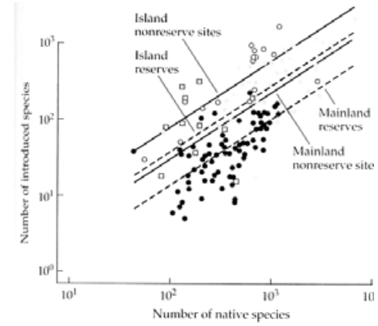


Figure 9.10 The ratio of introduced to native species for 177 sites and regions around with world, showing island nonreserve sites (open circles, solid lines) and reserves (open squares, dashed lines), and mainland nonreserve sites (gray circles, solid lines) and reserves (solid circles, dashed lines). Note log scale on both axes. (Modified from Lonsdale 1999.)

Interacciones entre dos caracoles de barro?

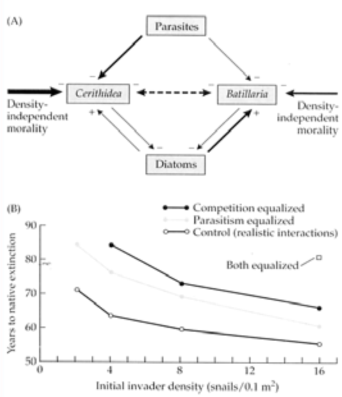


Figure 9.11 (A) Schematic of the observed interactions between the introduced mudsnail *Batillaria attramentaria* and the native *Cerithidea californica*, showing the invader's three advantages: lower mortality, stronger competition, and lower susceptibility to parasitism. Boxes show the interacting species, and arrows show the direction, type (positive or negative), and strength (indicated by arrow thickness) of impact. Dashed line represents the indirect competitive effect of the two species on each other. (B) Results of a computer experiment showing the average number of years to C. *californica*'s extinction, as a function of invader density, when the invader's advantage is modeled realistically (open circles), and when competition (black circles), parasitism (gray circles), or both (open square) are adjusted to make the species equal. The model shows that differences in both competition and parasitism contribute to the native species' mortality. (Modified from Byers and Goldwasser 2001.)

Resistencia a la invasión de malezas en el margen de ríos

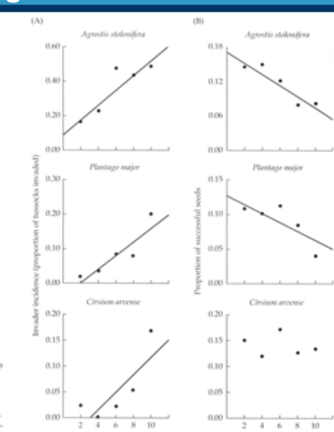


Figure 9.12 (A) In a streamside tussock plant community in northern California, the presence of the introduced Canada thistle (*Cirsium arvense*), common plantain (*Plantago major*), and creeping bent grass (*Agrostis stolonifera*) increased with increasing species richness. (B) In experimental transplants, however, the proportion of *A. stolonifera* and *P. major* (but not *C. arvense*) seeds that germinated decreased with increasing species richness. (Modified from Levine 2000.)

Botando el agua de lastre (contrapeso)

Erradicar o controlar?: la decisión de políticos y manejadores

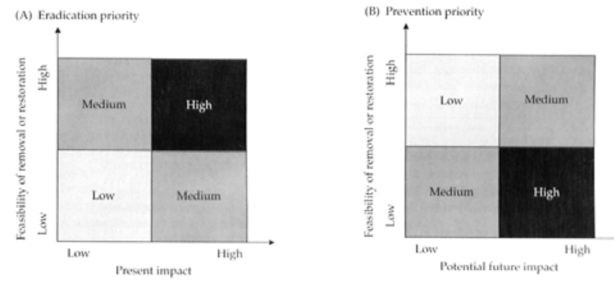


Figure 9.17 Schematic for the process faced by policymakers and managers who must decide which nonindigenous species to (A) eradicate or control, once already present in the system, or (B) keep out, if not already present in the system. (Modified from Parker et al. 1999.)

Cambio en la legislación de USA respecto a las especies invasoras

TABLE 9.5 *Timeline of Selected Federal U.S. Legislation Relating to Introduced Species*

1900	Lacey Act	Prohibits import of species that harm wildlife
1912	Plant Quarantine Act	Allows regulation and quarantine of nursery stock for plant diseases and insect pests
1931	Animal Damage Control Act	Allows control of any animal that damages agriculture, aquaculture, public health, or other enterprise
1939	Federal Seed Act	Regulates import and transport of seeds, especially of noxious weeds
1944	USDA Organic Act	Allows federal eradication of plant pests including noxious weeds
1957	Federal Plant Pest Act	Prohibits import and transport of plant pests (animals, fungi, other plants)
1968	Carlson-Foley Act	Allows federal government access to noxious plants in states with noxious weed acts
1974	Federal Noxious Weeds Act	Reulates the transport of plants listed as noxious
1977	President Carter's Executive Order 11987	Restricts federal agency introductions of nonnative species into "any natural ecosystem"
1990	National Aquatic Nuisance Prevention and Control Act	Establishes voluntary ballast water management guidelines
1996	National Invasive Species Act	Establishes compulsory ballast water management guidelines
1999	President Clinton's Executive Order 13112	Establishes National Invasive Species Council, with a mandate to develop a National Invasive Species Management Plan coordinating all federal on activity introduced species
2000	Plant Protection Act	Regulates plant pest transport, both accidental and intentional for biological control
2001	National Invasive Species Management Plan	Mandated by Executive Order 13112; provides a blueprint for federal prevention, management, research, and outreach on introduced species

Invasiones en los Grandes lagos en los últimos 100 años

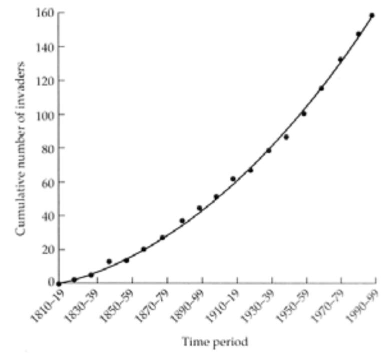


Figure A Reported invasion rate for invasive species in the Laurentian Great Lakes. The accumulation of invaders increased during the 1990s despite a ban on discharge of foreign, fresh ballast water by transoceanic vessels in 1993. (Modified from Holeck et al. 2004.)

Control biológicos de las especies invasoras

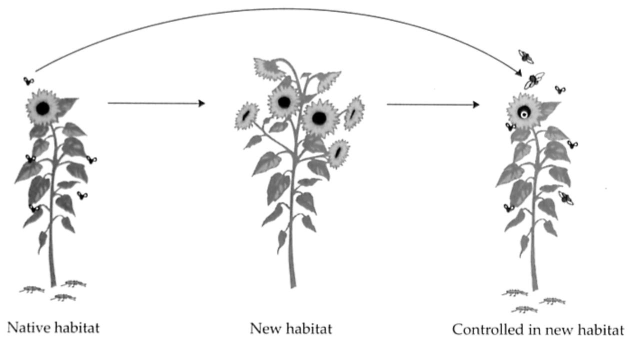


Figure A Invasive species are often those that escape their herbivores from their native habitat in a new habitat, and grow at a much higher rate as a result. Biocontrol attempts to halt this rapid growth by introducing the herbivore(s) that kept the plant in check into its new habitat.

GISP: resultado del CDC

http://www.gisp.org/

IABIN

La Red Interamericana de Información sobre Biodiversidad (IABIN, por su siglas en inglés), es un foro que propicia la colaboración técnica y la coordinación entre los países de las Américas para recolectar, compartir y utilizar información sobre biodiversidad que sea relevante para los procesos de toma de decisiones sobre conservación y manejo de la biodiversidad, así como para la educación en la región.

http://www.iabin.net/

Leer

Groom MJ, GK Meffe y CR Carroll. 2006. Principles of Conservation Biology. Third Edition. Sinauer Associates, Inc., Sunderland, Massachusetts. Capítulo 9: Species Invasions

Ver también: www.sinauer.com/groom

UNIDAD I: Fundamentos Conceptuales de la Conservación Biológica

Clase 2

Amenazas Primarias a la Biodiversidad

Tema 1: Degradación y Pérdida de Hábitats

Tema 2: Fragmentación de Hábitats

Tema 3: Sobre-explotación

Tema 4: Especies Invasoras

Tema 5: Cambio Climático

Efecto Invernadero

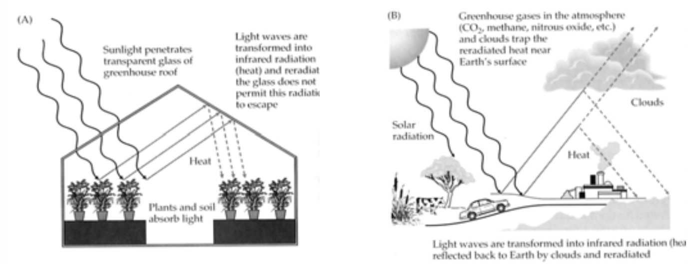


Figure 10.1 The greenhouse effect. Earth's atmosphere already serves as a greenhouse that warms Earth's surface (A), but human influences are increasing this effect (B). About 70' of UV wavelengths pass through Earth's atmosphere, where about 30% are reflected. Burning of fossil fuels in industry, au tomobiles, and buildings, as well as deforestation give off CC to the atmosphere that enhance the greenhouse effect. In add tion, methane from swamps, rice paddies, and cattle enter th upper atmosphere and trap heat. (From Primack 2004.)

Temperatura global últimos 65 millones de años

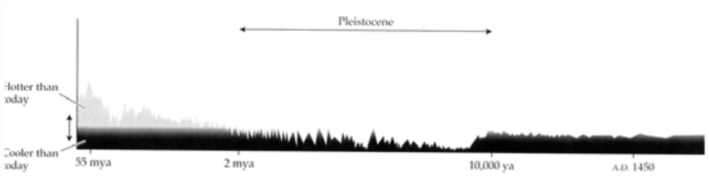


Figure 10.2 Average global temperature over the last 65 million years. Gray indicates temperatures hotter than today; black indicates temperatures cooler than today. At 65–100 million years ago (mya; the age of the dinosaurs), CO_2 was much higher than it is today and the climate was much warmer and wetter. About 13 million years ago, we start to see brief periods in which temperature and CO_2 levels were as high as they are today. The Pleistocene period began around 2 mya and ended 12,000 years ago, during which Earth cycled between glacial (frozen) and interglacial (warm) periods. Note that climate had been relatively stable over the past 10,000 years. (Modifed from *National Geographic*, May 1998.)

Temperatura y Concentración de CO_2

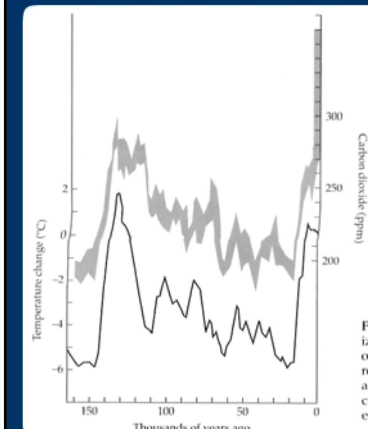


Figure 10.3 The relationship between temperature (normalized to today's average global °C), and carbon dioxide (ppm) over the past 160,000 years. Ice core samples show a clear correlation between atmospheric CO_2 concentrations (gray line) and the global temperature record (black line). Note that the current level of CO_2 (at 360 ppm) is far higher than the highest natural level. (Modified from IPCC 2001a.)

Temperatura y Concentración de CO_2

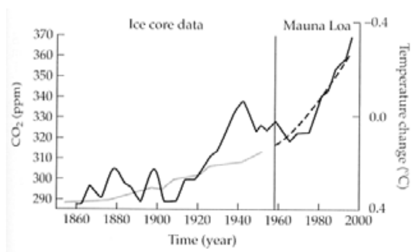
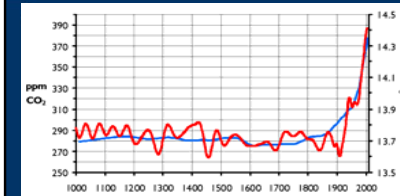
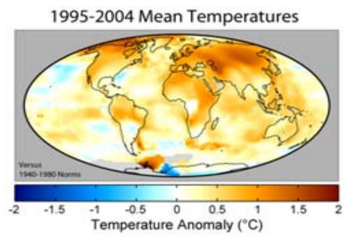
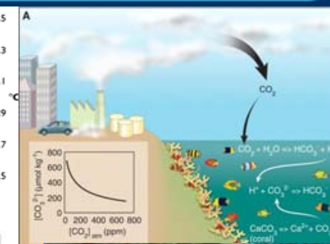
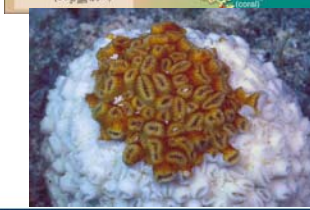


Figure 10.4 Relationship between twentieth century levels of atmospheric carbon dioxide and global temperature. The solid gray line shows CO_2 records from ice cores, the dashed black line shows annual average CO_2 records from atmospheric measurements in Hawaii, and the black line shows mean yearly global temperature trends. This steady increase of CO_2 in the atmosphere has caused greater retention of heat and a gradual warming of Earth. (Modified from IPCC 2001a.)









Forzamiento radiativo en el balance de energía global

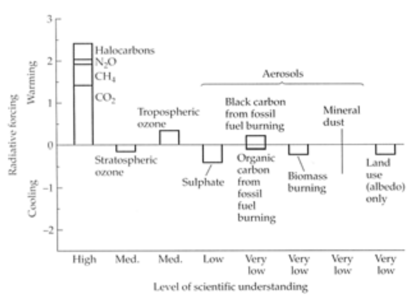
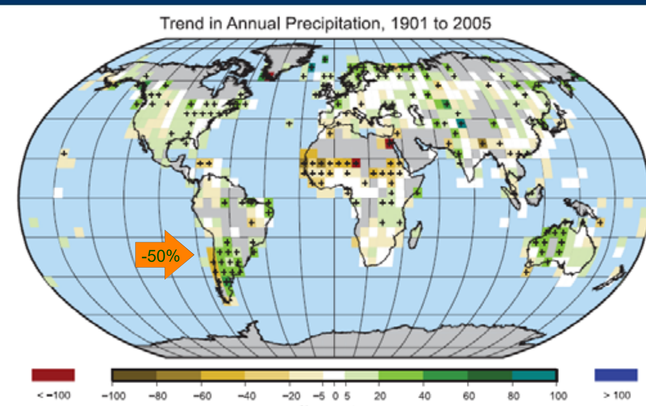


Figure 10.5 Estimates of strengths of radiative forces on global energy budget. Radiative forcing is in watts/m². Positive forces (above zero) warm Earth's surface; negative forces (below zero) cool Earth's surface. (Modified from IPCC 2001a.)

Cambio en las precipitaciones en el mundo en los últimos 100 años

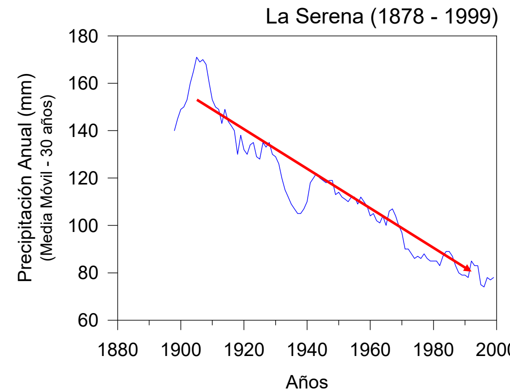


Tomado de IPCC 2007

Cambio en las precipitaciones en USA (últimos 100 años)

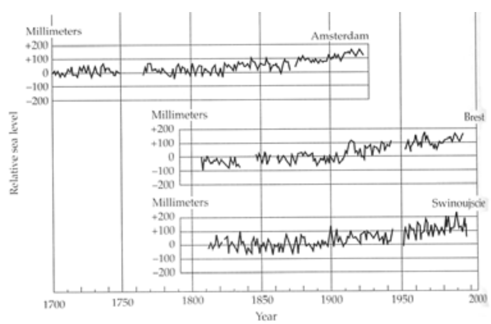
Figure 10.7 Precipitation trends from 1901 to 1998. Black indicates areas where precipitation is increasing and gray indicates where it is decreasing. The size of the dot indicates the magnitude of precipitation changes, with the largest dots indicating a 40% change in the precipitation over 100 years. (From National Climatic Data Center/NESDIS/NOAA.)

Precipitación Anual - La Serena (30°S)



Nivel del Mar durante los últimos 300 años en Europa

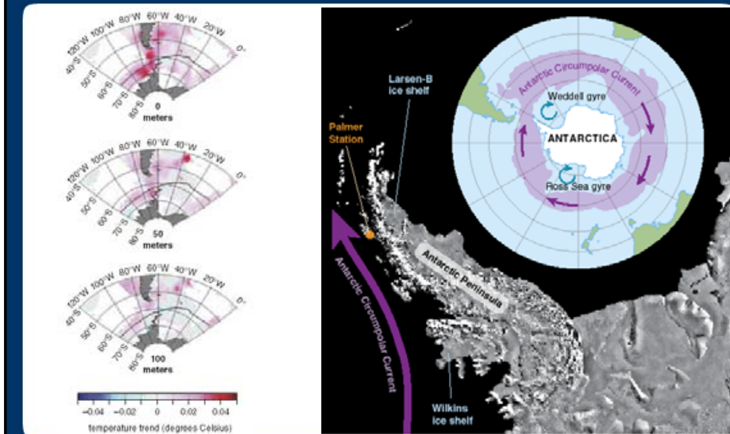
Figure 10.8 Sea level rise over the past 300 years in three European cities. A limited number of sites in Europe have nearly continuous records of sea level spanning 300 years; these records show that the greatest rise in sea level took place over the twentieth century. Records shown from Amsterdam, The Netherlands, Brest, France, and Swinoujscie, Poland, as well as other sites, confirm the accelerated rise in sea level over the twentieth century as compared to the nineteenth. (From IPCC 2001c.)



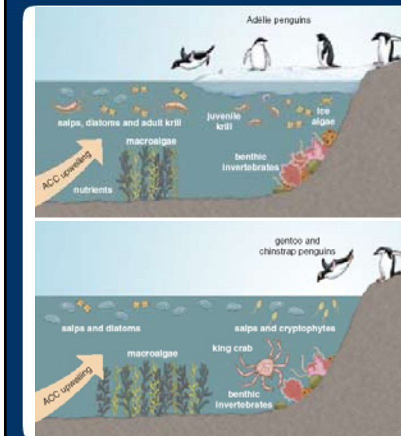
Reducción de los Glaciares

Figure 10.9 Worldwide, glaciers are retreating. Here date signs show the retreat of the Exit Glacier in the Kenai Peninsula, Alaska. (Photograph © Y. Momatiuk/Photo Researchers, Inc.)

Reducción de plataformas antárticas



Reducción de plataformas antárticas



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Temperatura y eventos extremos

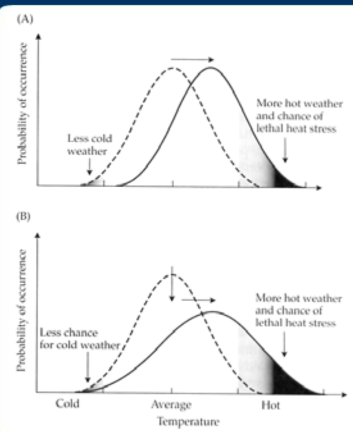

Figure 10.10 Increases in mean temperature and temperature variability will affect the probability that an individual experiences extreme events. Areas in gray represent temperatures at which an individual suffers heat stress or cold stress; areas in black represent lethal hot or cold temperatures. (A) An increase in mean temperature, leading to more record hot weather, will lead to greater heat stress and lethal heat events, and less cold stress. (B) An increase in both the mean temperature and variance, leading to much greater heat stress and lethal hot weather events, and less cold stress. (Modified from IPCC 2001c.)

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Temperatura media anual de la superficie del océano

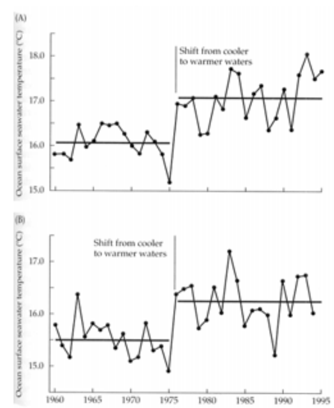

Figure 10.11 Mean annual ocean surface temperatures at (A) Scripps Pier and (B) Santa Barbara, California, from 1960 to 1995. Horizontal lines indicate long-term mean temperatures for the periods of 1960–1975 and 1976–1995. Leaders indicate a regime shift from cooler to warmer waters during 1976–1977. (Modified from Holbrook et al. 1997.)

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Cambio en el origen de los peces

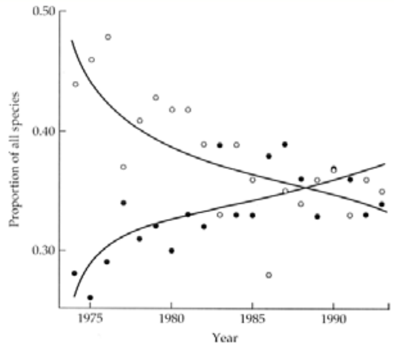


Figure 10.12 Proportions of the species of kelp forest fish present that were northern (open circles) or southern (closed circles) during censuses off of southern California from 1974 to 1995. (Modified from Holbrook et al. 1997.)

Patrones de extinciones locales

Figure 10.13 Patterns of population extinctions of *Euphydryas editha* from 1860 to 1996. Each triangle represents a single population. Historical records are from 1860 to 1983. Black represents populations still present during the 1994–1996 census. Gray represents populations recorded as extinct during the 1994–1996 census. (From Parmesan 1996.)

Expansión en el rango de distribución

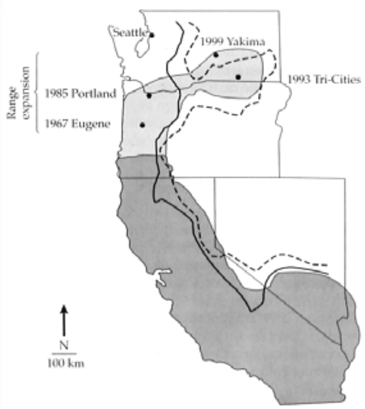


Figure 10.14 The overwintering range of the sachem skipper butterfly (*Atalopedes campestris*) includes Washington, Oregon, California, and Nevada. The historical range is shaded dark, while range expansion over the past three decades is shown in lighter shading. Colonization dates of *A. campestris* in four cities in Oregon and Washington are shown. Contour lines represent the boundary of January average minimum temperature of 0°C (solid) and −4°C (dashed). (From Crozier 2003b.)

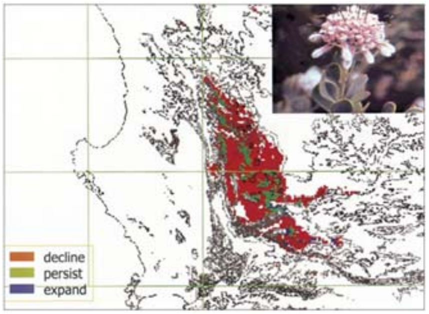
Cambios observados versus predichos por cambio climático

TABLE 10.1 *A Summary of Observed Changes from Studies of 944 Species*

Climate change prediction	Changed as predicted (%)	Changed opposite to prediction (%)	Statistical likelihood of obtaining pattern by chance
Earlier timing of spring events	87	13	Very unlikely
Extensions of poleward or upper species' range boundaries	81	19	Very unlikely
Community (abundance) predictions: Cold-adapted species declining and warm-adapted species increasing	85	15	Very unlikely

Source: Data from Parmesan and Yohe 2003.

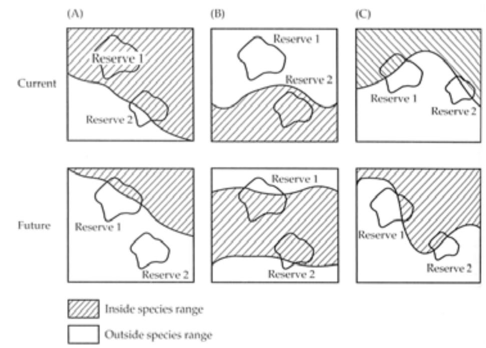
Cambios de distribución proyectados



The plant shown in the inset is *Vexatorella amoena*, a member of the Protea family that grows in the mountains above Cape Town, South Africa. The map shows the plant's projected range in 2050. The range it will retain then is shown in green, the range that will have been lost is shown in red, and blue denotes areas the plant will find newly suitable in 2050 because of expected climatic changes

Cambio en el rango de distribución y el límite de las reservas

Figure 10.16 Changing relationships between reserve boundaries and a species' range as climate changes. (A) Decreasing range of the species within a reserve and its absence where it was formerly present; (B) decreasing range of the species within a reserve and its presence where it was formerly absent; (C) change in the location of the species' range. (Modified from Hannah et al. 2005.)



Principales eventos de política referidos a Cambio Climático

TABLE 10.2 *A Chronology of Major Climate Change Policy Events*

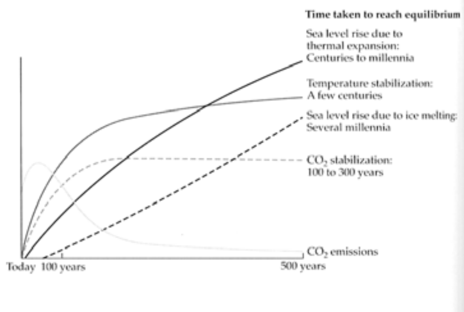
Date	Meeting or event	Results and conclusions
1896	First attribution of the connection between atmospheric carbon and climate	Svante Arrhenius made the connection between CO_2 and atmospheric temperature and speculated that burning fossil fuels such as coal could increase the concentration of carbon in the atmosphere in the future and lead to an increase in global temperatures. His research was widely disregarded by other scientists at the time.
1979	First World Climate Conference	Human-induced climate change is identified as a potential threat.
1980	Montreal Protocol	World leaders meet to sign an agreement designed to gradually phase out the production and use of chemicals that destroy atmospheric ozone.
1988	Formation of IPCC	The United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) create the Intergovernmental Panel on Climate Change (IPCC) to coordinate research and analysis of climate change.
1990	First IPCC Report	The IPCC states global climate is clearly changing, and these changes are probably a result of human activity.
1992	Rio Convention	The United Nations Conference on the Environment and Development (also known as the Earth Summit or Rio Convention) convenes in Rio de Janeiro, Brazil. A total of 154 nations sign the United Nations Framework Convention on Climate Change (UNFCCC), which asks signatories to reduce greenhouse gas emissions and creates a feedback mechanism for future talks. Developed nations (also known as Annex 1 countries) will be asked to make larger reductions than developing nations.
1995	Second IPCC Report	The second report states that "the balance of evidence" leads the authors to conclude that there was a "discernible human influence on the global climate system." New evidence suggests that climate change processes are more serious than they were described in 1990, and the first attempt at reducing human impacts seems weak. Many policymakers and scientists believe the UNFCCC needs stronger teeth.
1995	COP1: The Berlin Mandate	At the first Council of the Parties (COPs) meeting, the Berlin Mandate is signed, which formally recognizes the ineffectiveness of UNFCCC calls for voluntary greenhouse gas reductions. A committee drafts protocols to design other strategies for the 1997 COPs meeting.

Principales eventos de política referidos a Cambio Climático

Date	Meeting or event	Results and conclusions
1997	COP3: The Kyoto Protocol	Delegates in Kyoto, Japan, agree that Rio Convention targets are insufficient and emissions should be reduced more quickly. Global emission levels should be 5% less than 1990 levels by 2012, Annex 1 nations are asked to make much more substantial reductions to meet the global figure. The U.S. agrees to a 7% reduction and Canada to 6%; the European Union level is an 8% reduction. Some nations go much farther. Germany promises to reduce emissions by 25% and the United Kingdom by 15%. About 160 nations sign the accord, which must then be ratified or acceded to in each country. The treaty does not become activated until the 1990 emissions levels of ratifying countries totals at least 55% of 1990 levels. At this point, a stepwise series of greenhouse gas emissions kicks in. Greenhouse gas reduction mechanisms will be detailed at COP6 in 2000.
2000	COP6: The Hague, Netherlands	The U.S. under George W. Bush (elected in 2000) and Canada under Jean Chrétien want larger amounts of carbonsink credit for forest growth (thereby allowing for higher net carbon emissions) than other signatories will allow. The meeting fails to negotiate an agreement on mechanisms and breaks up. A second meeting held shortly afterwards again dissolves without an agreement. Since the U.S. is the largest emitter of greenhouse gases worldwide, many observers feel that the Kyoto Protocol will have little impact without U.S. support. The Kyoto Protocol is widely pronounced to be dead.
2001	COP7: Bonn, Germany	Some 180 countries constituting all of the Kyoto Protocol signatories except the U.S. and Australia (but now including Canada) approve the mechanism framework for implementing the accord. Supporters of the Kyoto Protocol focus on pressuring other large emitters (e.g., Russia and Japan) to ratify the treaty.
2001	Third IPCC Report	More sophisticated modeling leads IPCC authors to write "globally averaged mean suface temperature is projected to increase by 1.4° to 5.8°C over the period 1990 to 2100." The third report also compiles substantial evidence of biotic effects.
2002	Rio + 10: Johanesburg, South Africa	The U.N. World Summit on Sustainable Development follows up on issues raised by the Rio de Janiero summit in 1992 (hence the conference's alternate name: Rio + 10), with special attention to finding means to create climate-friendly development.
2004	Moscow	Russia's president Vladimir Putin ratifies the Kyoto Protocol, which immediately activates provisions of the treaty.
2007	Fourth IPCC Report	Work has begun already to prepare the next scheduled IPCC report, due in 2007.

Aumento de temperatura proyectado

Figure 10.18 Projected rise in global mean temperature over the next 100 years depicts Earth's "commitment to climate change." This figure is a generic illustration for CO_2 stabilization at any concentration between 450 and 1000 ppm, and therefore has no units on the response axis. Responses to stabilization in this range show broadly similar time courses, but the impacts become progressively larger at higher concentrations of CO_2. After CO_2 emissions are reduced and atmospheric concentrations stabilize, surface air temperature continues to rise by a few tenths of a degree per century for a century or more. Thermal expansion of the ocean should continue long after CO_2 emissions have been reduced, while melting of ice sheets should contribute to sea level rise for many centuries. (Modified from IPCC 2001c.)



Efecto del cambio climático en las interacciones bióticas (bosque)

Figure A Effects of climatic warming on the biotic interactions likely to influence forest composition in northern Finland, Norway, and Sweden. (Modified from Niemela et al. 2001.)

Efecto del cambio climático en las interacciones bióticas (bosque Alaska)

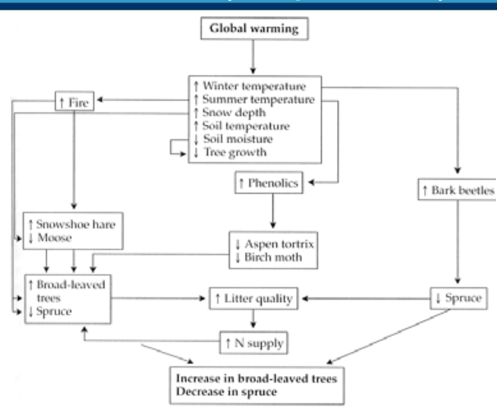


Figure B Effects of climatic warming on the biotic interactions likely to influence forest composition in interior Alaska. (Modified from Niemela et al. 2001.)

Efecto del cambio climático en las interacciones bióticas con spp invasivas

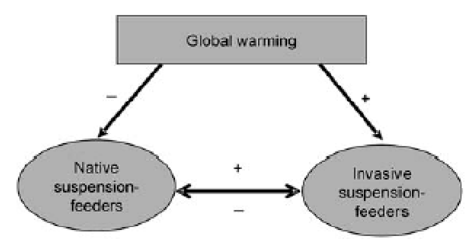
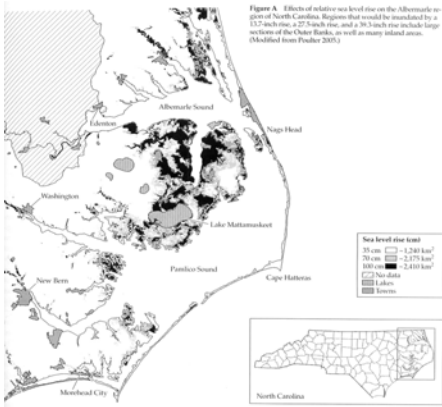


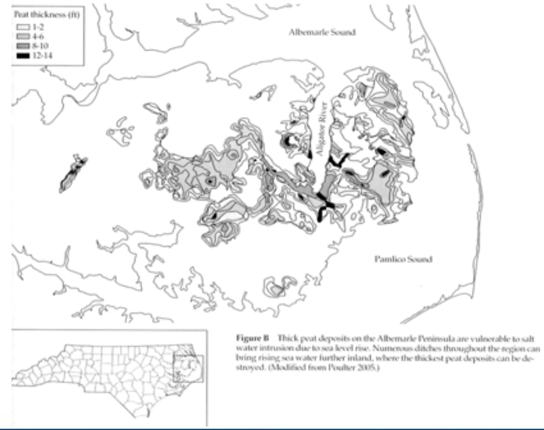
Fig. 3 Global warming facilitating invader dominance and inhibiting recruitment of residents. Within-guild interactions may not entail exclusion of residents (see text)

Reise & van Beusekom, 2008

Efecto del aumento del nivel del mar en Albermarle, Carolina del Norte



Depósitos de turba son vulnerables a la intrusión de agua salada



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Influencia del cambio climático y aumento del nivel del mar sobre aves migratorias

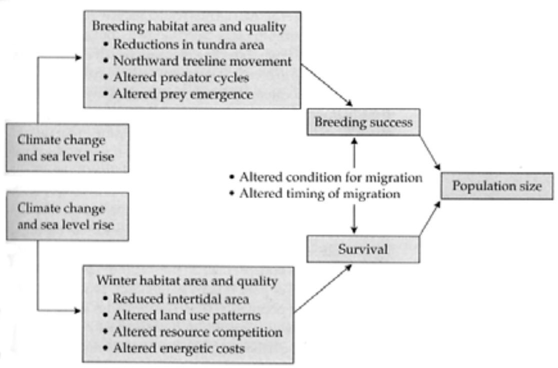

Figure A Examples of the mechanisms by which climate change and sea level rise are likely to influence population size in migrant birds that breed in the Arctic and overwinter in temperate coastal zones.

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Influencia del cambio climático y aumento del nivel del mar sobre aves marinas

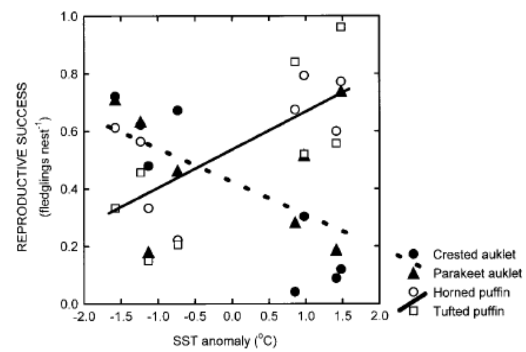

Fig. 4. Reproductive success of planktivorous auklets and piscivorous puffins in relation to SST anomaly during 1 July – 30 August in Tauyskaya Bay.

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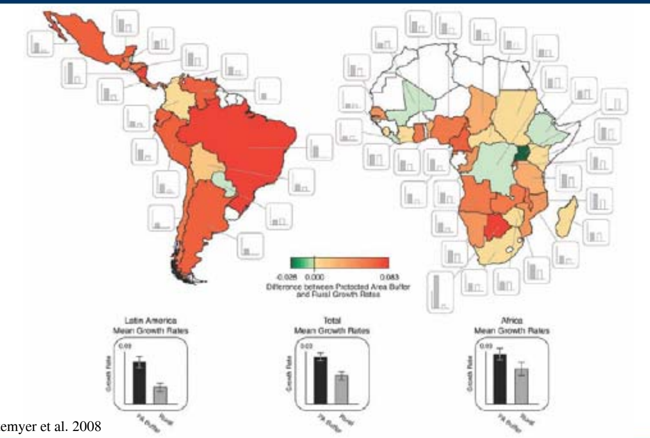
Población humana asociada a margen de APs



Wittemyer et al. 2008

Leer

Groom MJ, GK Meffe y CR Carroll. 2006. Principles of Conservation Biology. Third Edition. Sinauer Associates, Inc., Sunderland, Massachusetts. Capítulo 10: Biological Impacts of Climate Change

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