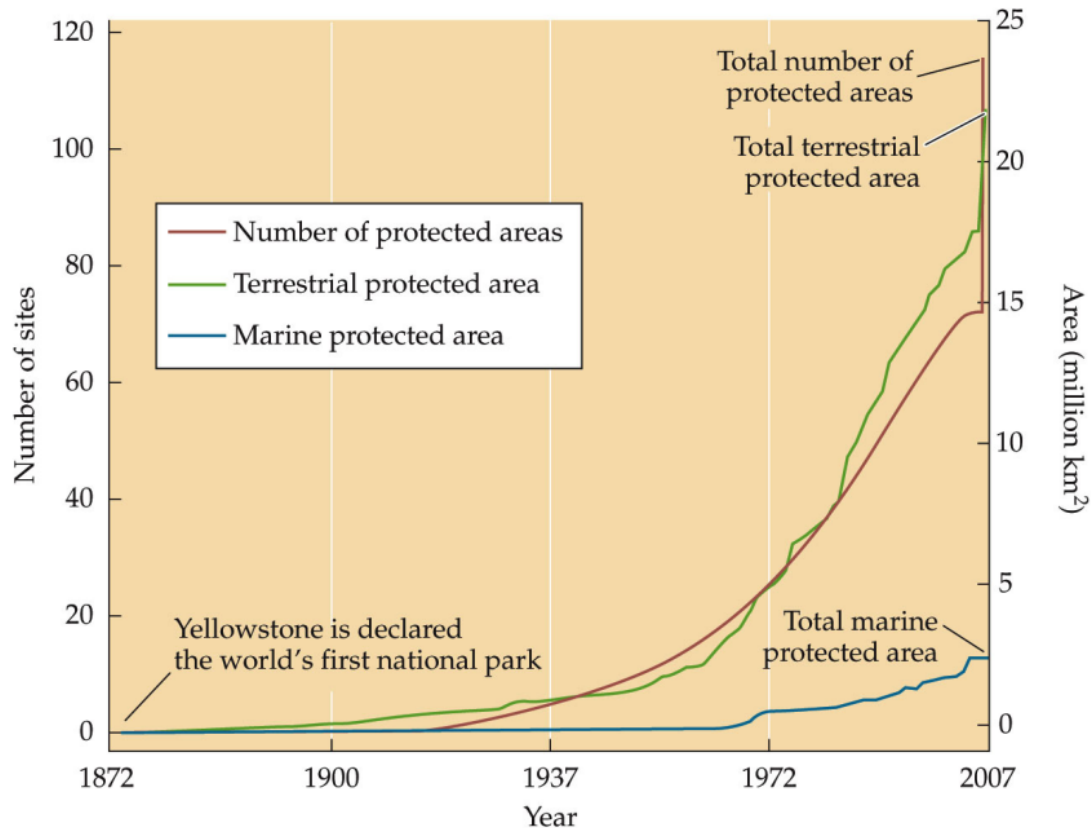


Establishing Protected Areas



without protection, most of the planet will become a wasteland of human sprawl

The good news



the rate of creation of protected areas has increased

this reflects in great part a realization of the ecological, social and economic importance of protected areas

if we can increasingly show economic gain, the rate will accelerate

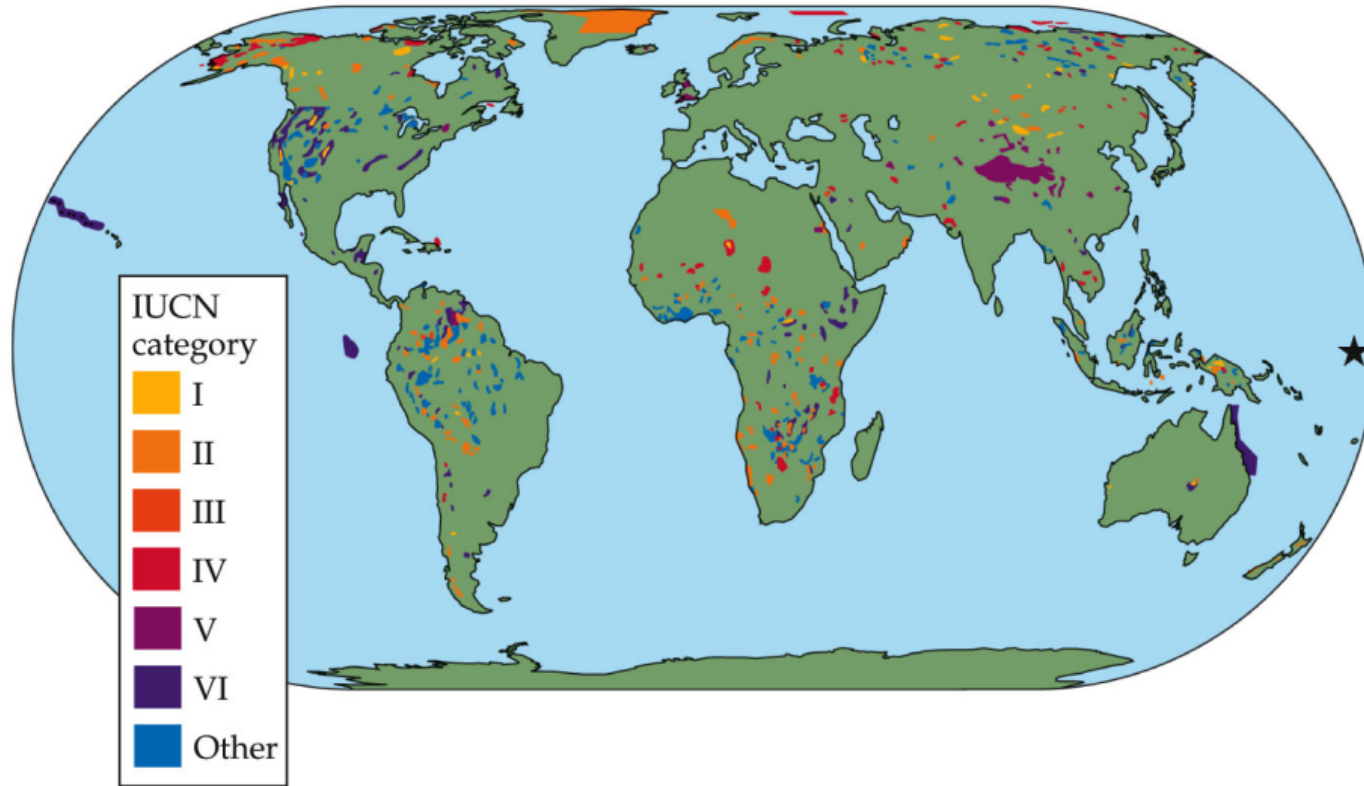
IUCN Classification system – most important

Category	Description
Ia Strict nature reserves	Managed mainly for scientific research and monitoring; areas of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features, and/or species
Ib Wilderness areas	Managed mainly for wilderness protection; large areas of unmodified or slightly modified land and/or sea retaining their natural character and influence, without permanent or significant habitation, which are protected and managed so as to preserve their natural condition
II National parks	Managed mainly for ecosystem protection and recreation; natural areas of land and/or sea designated to (1) protect the ecological integrity of one or more ecosystems for present and future generations; (2) exclude exploitation or occupation inimical to the purposes of designation of the area; and (3) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible
III Natural monuments	Managed mainly for conservation of specific natural features; areas containing one or more-specific natural or natural/cultural features of outstanding or unique value because of inherent rarity, representative or aesthetic qualities, or cultural significance

IUCN Classification system – less important

Category	Description
IV Habitat/species management areas	Managed mainly for conservation through management intervention; areas of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species
V Protected landscapes and seascapes	Managed mainly for landscape/seascape conservation and recreation; areas of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological, and/or cultural value, and often with high biological diversity
VI Managed-resource protected areas	Managed mainly for the sustainable use of natural ecosystems; areas containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while also providing a sustainable flow of natural products and services to meet community needs

Existing protected areas

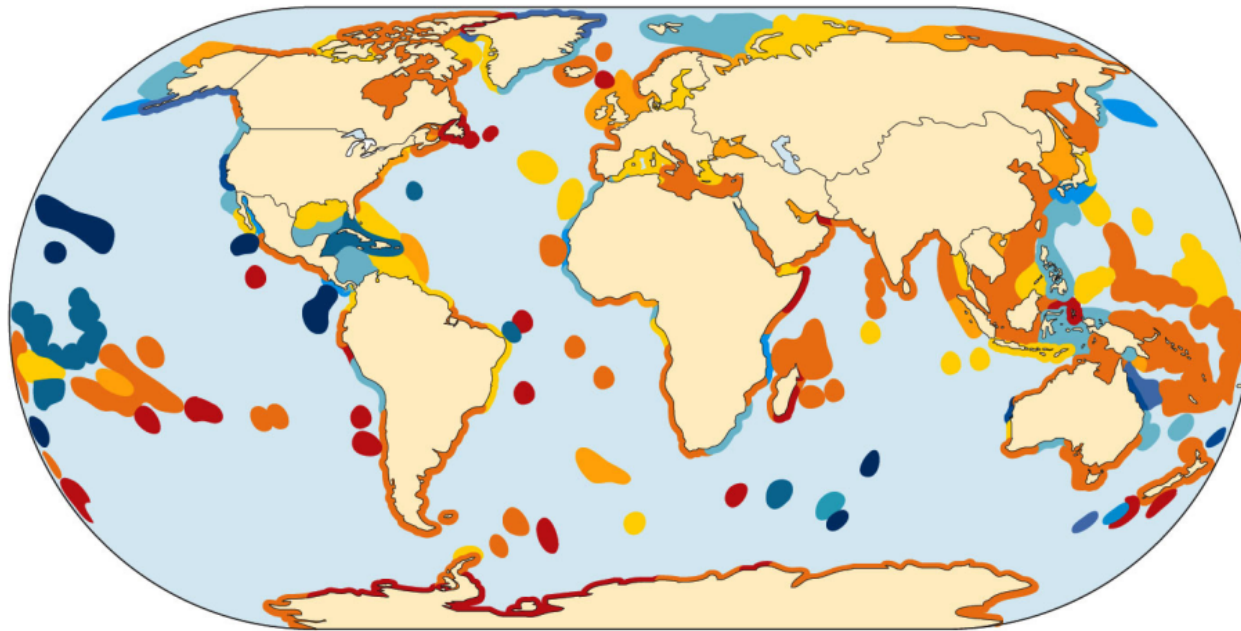


These represent <math><13\%</math> of earth's surface

In the USA, few are from classes I to III and most allow extraction

Largest is single area is the Northeast Greenland National Park

Existing protected marine areas



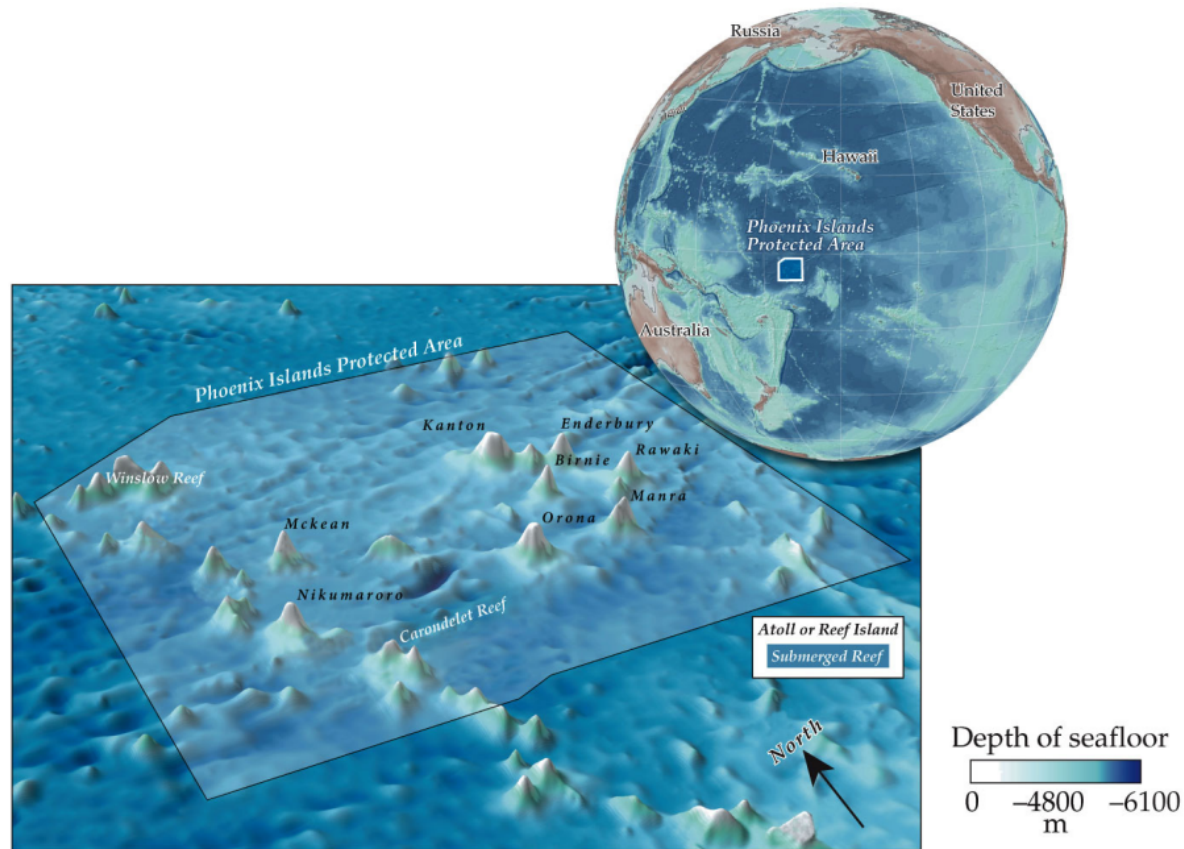
Percentage	
0	6-10
<1	11-30
1-2	31-60
3-5	Over 60

percentage of continental shelf or similar habitat actually protected

Only about 1% of marine habitat is protected

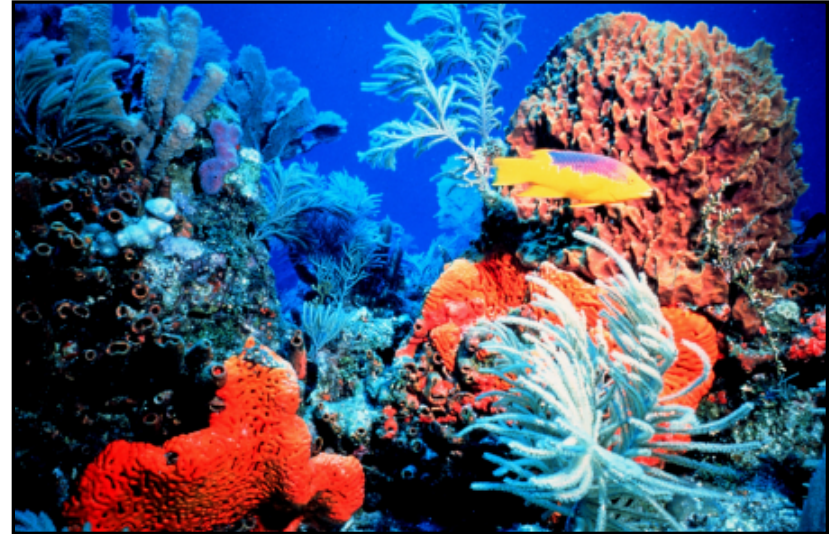
At least 20% requires protection to sustain fish stocks

Phoenix Islands Protected Area



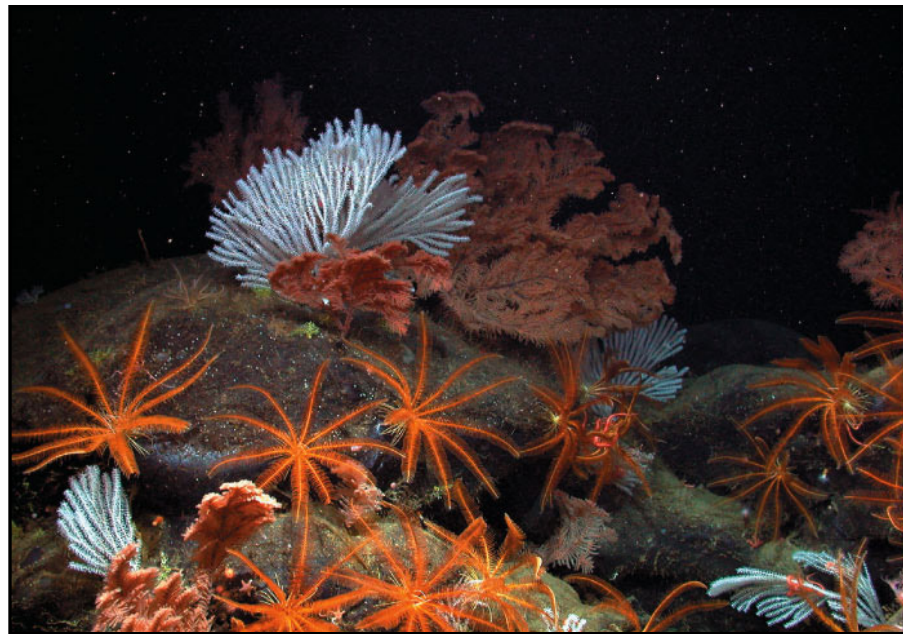
This is a collection of atolls and submerged reefs as well as the sea bed
A substantial amount of international financial support is required to maintain it

Phoenix Islands Protected Area



high biodiversity and endemism above and below the water

Monterey Bay National Marine Sanctuary



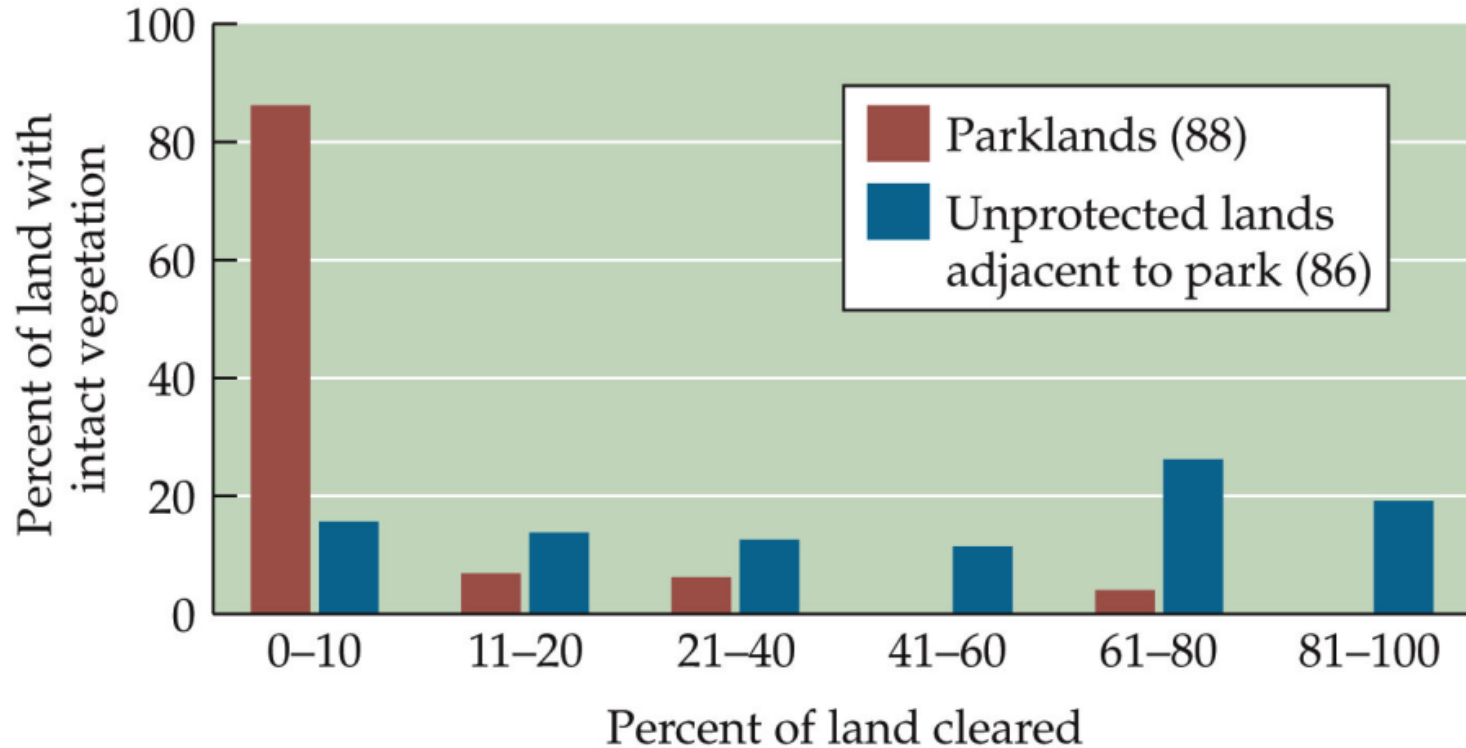
This is one of thirteen marine sanctuaries in the USA

It encompasses 276 miles of coast and >6900 square-miles of ocean

Shoreline protection is managed cooperatively with over 50 local, state and federal parks areas including Point Lobos

MBNMS is administered by NOAA but huge amounts of private money is involved including a large annual donation from the Packard foundation (of Hewlett-Packard)

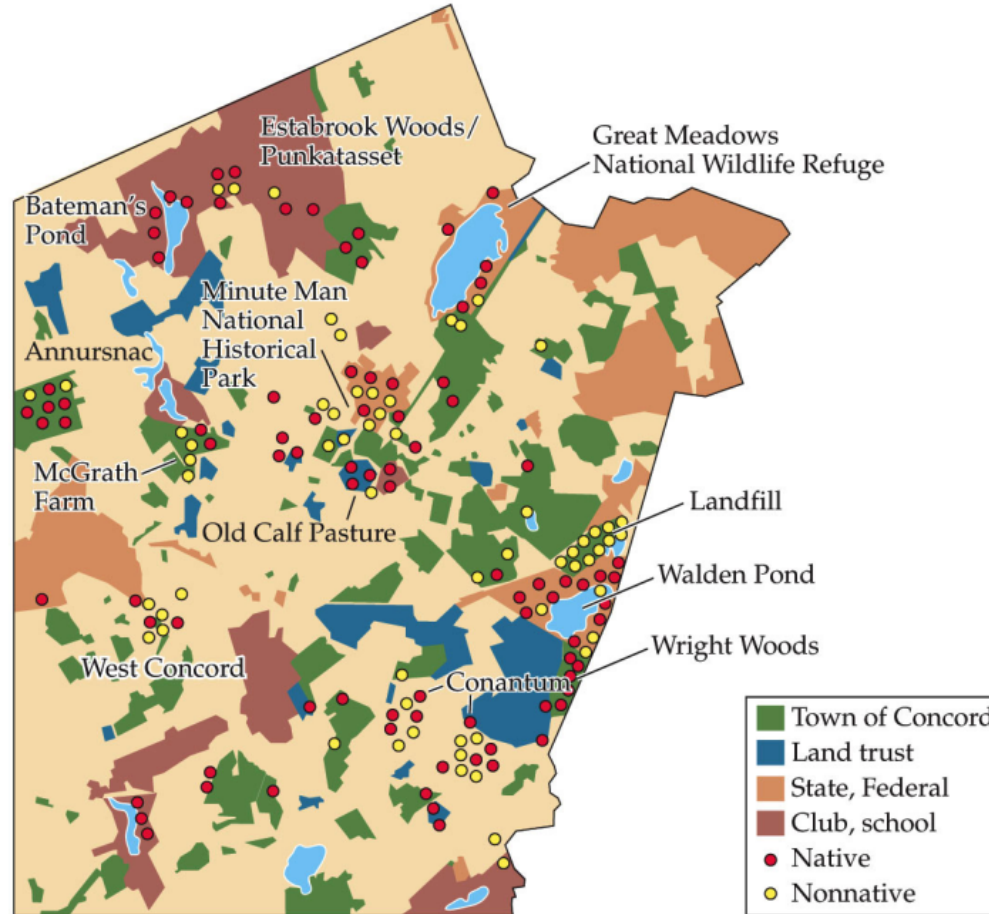
Are protected areas effective?



More than 80% of the parks have nearly intact vegetation (0-10% cleared)

Adjacent land does not fare as well

Creating New Protected Areas



Creation of protected areas requires cooperation of many groups including government and non-government agencies as well as private citizens

Involving educational and research groups usually helps

What should be protected?

Distinctiveness or irreplaceability

- Ecosystem containing rare or endemic species or other unusual attributes
- Species are given more weight that are unique
- Populations of species that have unusual genetic characters

Endangerment or vulnerability

- Ecosystems that are threatened with imminent destruction
- Ecosystems containing endangered species

Utility

- Ecosystems with species that have present or future value
- Ecosystems with species of great cultural value
- Ecosystems of major economic or ecological service value

What should be protected?



The komodo dragon fits all 3 criteria as it is the world's largest lizard (distinct), occurs on only a few islands (endangered) and is of great scientific and tourist interest (utility)

It is also just way cool!!!

The Western Ghats are a mountainous region of India that contain numerous endemic rare and endangered species and that provide numerous forest products that support the region



Which areas should be protected?



The species approach makes use of *focal or indicator species* that may be typical of or unique to certain ecosystems

The northern spotted owl has become the iconic symbol in attempts to preserve old-growth forests especially in the Pacific Northwest

The argument goes that since the northern spotted owl is threatened (under the ESA) all habitat should be protected.

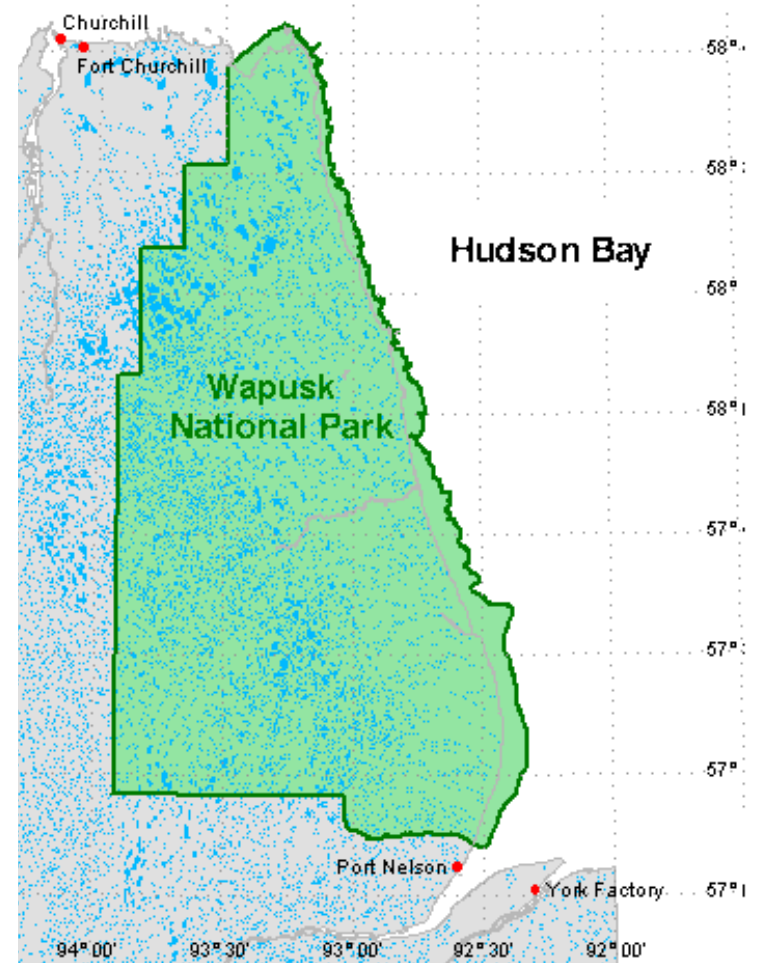
Were it endangered, that would be true

Which areas should be protected?

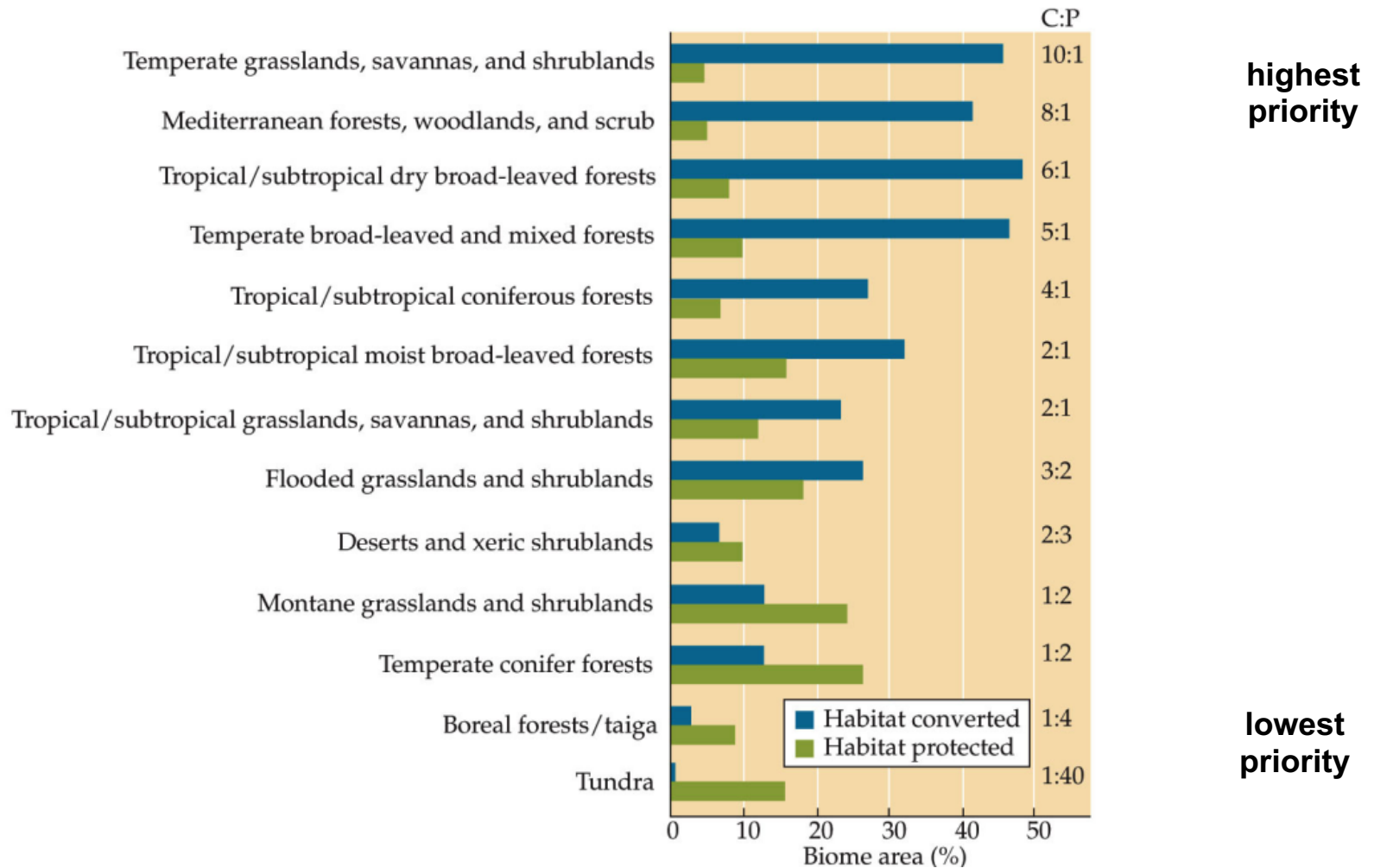


Flagship species can often be used to secure areas for the protection of the entire area and all the species in it

This is a standard approach for Parks Canada

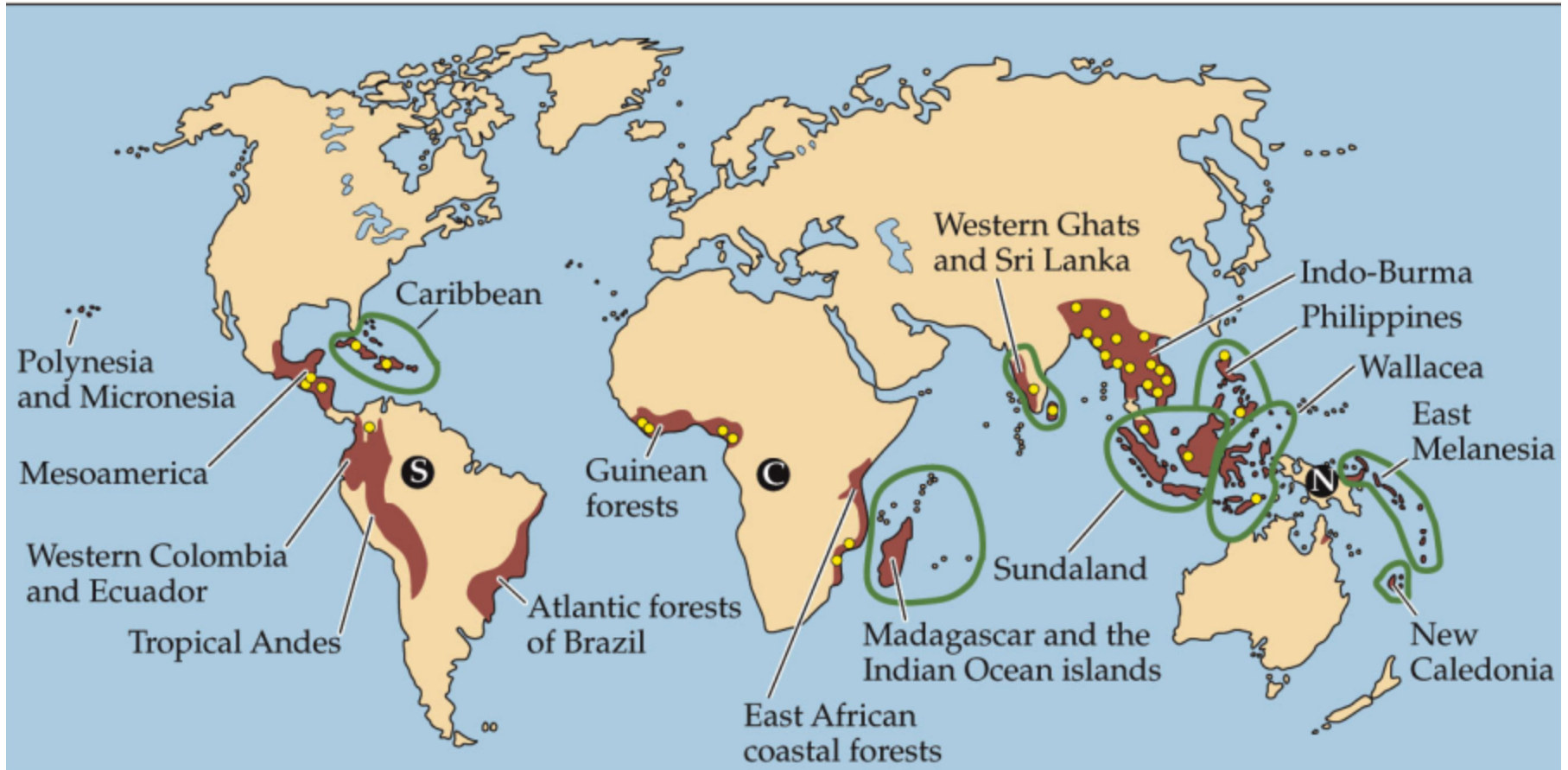


Which areas should be protected?



In the ecosystem approach, higher priority is given to “under-protected’ types

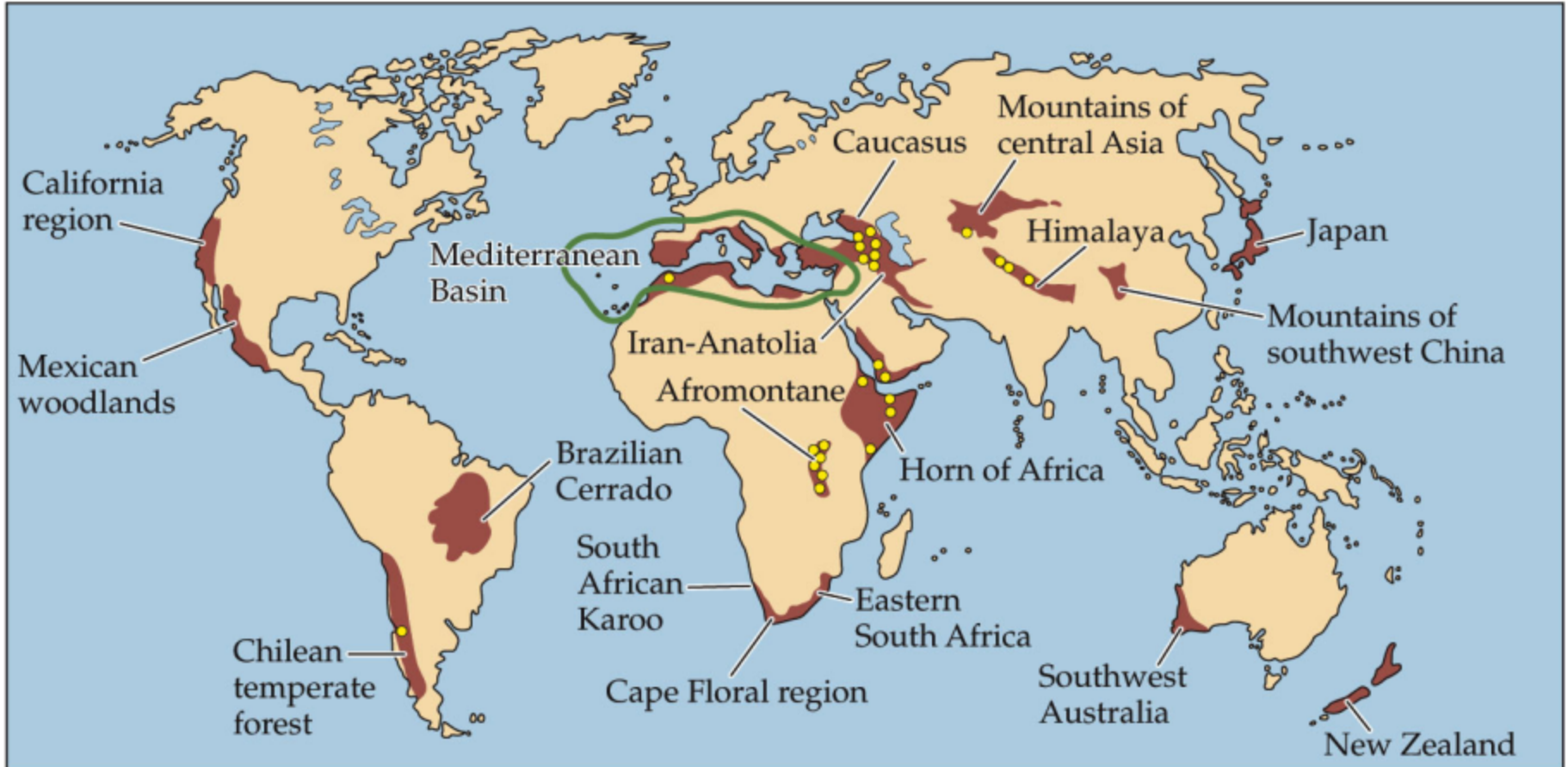
Which areas should be protected?



The hotspot approach identifies ecosystems with particular characteristics

In this case tropical forests with highest endemism that are threatened are targeted

Which areas should be protected?



In this case other types of threatened ecosystems with high endemism are targeted
I personally do not buy high endemism or biodiversity as a single criterion

Which areas should be protected?

TABLE 15.2 A Comparison of 34 Global Hotspots (*Part 1*)

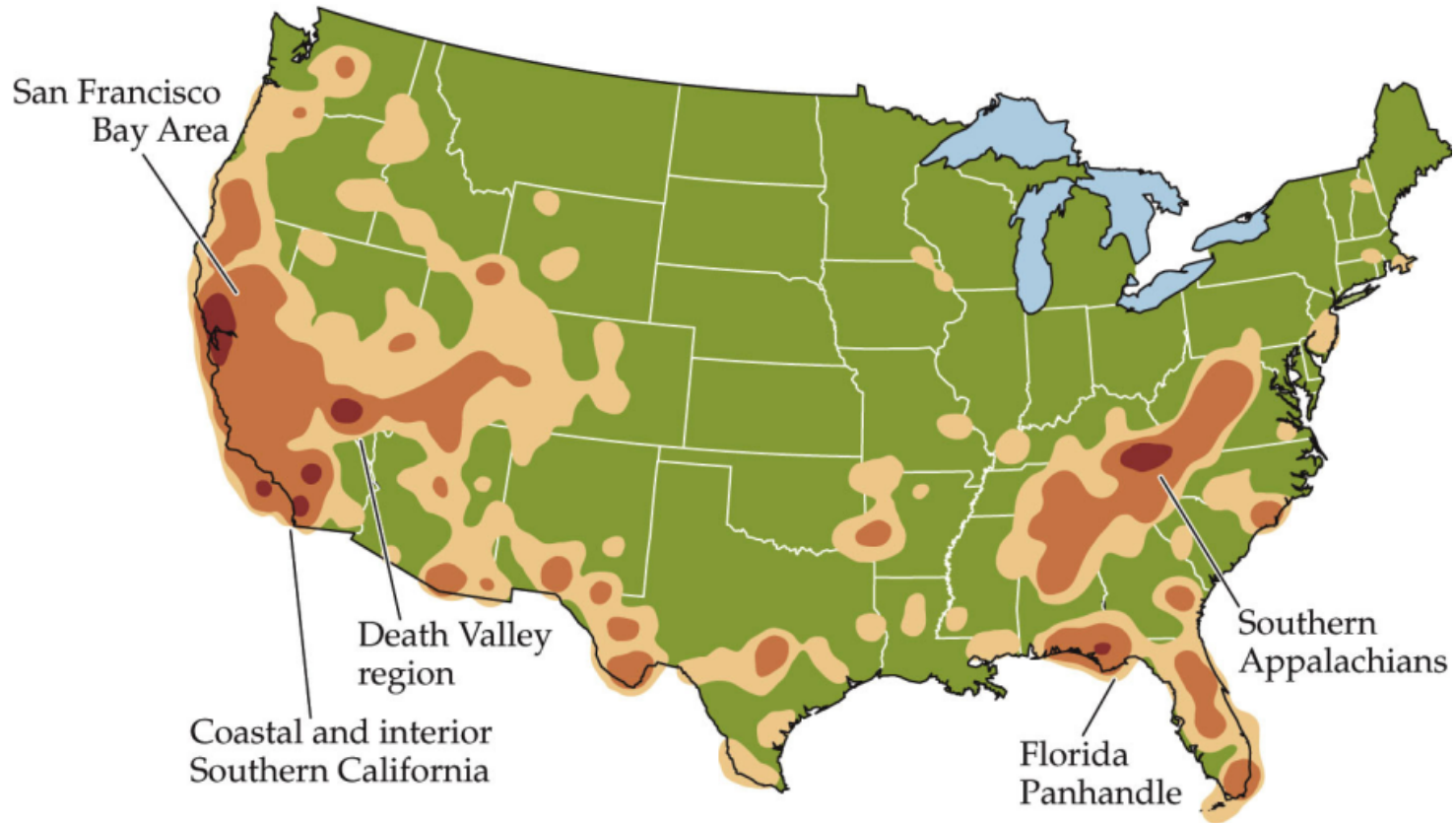
Location ^a	Original extent (×1000 km ²)	Undisturbed vegetation remaining (%)	Included in protected areas (%) ^b	Number of species		
				Plants	Birds	Mammals
THE AMERICAS						
Central Chile	397	30	11	3892	226	65
Tropical Andes	1543	25	8	30,000	728	569
Western Colombia/Ecuador	275	24	7	11,000	892	283
Atlantic forest of Brazil	1234	8	2	20,000	936	263
Brazilian Cerrado	2032	22	1	10,000	605	195
Mexican pine–oak woodlands	461	20	2	5300	525	328
California region	294	25	10	3488	341	151
Mesoamerica	1130	20	6	17,000	1124	440
Caribbean islands	230	10	7	13,000	607	89
AFRICA						
Guinean forests of West Africa	620	15	3	9000	793	320
South African Karoo	103	29	2	6356	227	74
Cape region of South Africa	79	20	13	9000	324	90
Southeastern South Africa	274	24	7	8100	541	193
Madagascar and Indian Ocean islands	600	10	2	13,000	367	183
East African coastal forests	291	10	4	4000	639	198
East Afromontane	1018	10	6	7598	1325	490
Horn of Africa	1659	5	3	5000	704	219

Which areas should be protected?

TABLE 15.2 A Comparison of 34 Global Hotspots (*Part 2*)

Location ^a	Original extent (×1000 km ²)	Undisturbed vegetation remaining (%)	Included in protected areas (%) ^b	Number of species		
				Plants	Birds	Mammals
EUROPE AND MIDEAST						
Mediterranean basin	2085	5	1	22,500	497	224
Caucasus Mountains region	863	20	1	6400	381	130
Iran–Anatolia	900	15	3	6000	364	141
CONTINENTAL ASIA						
Mountains of central Asia	863	20	7	5500	493	143
Himalaya	742	25	10	10,000	797	300
Western Ghats and Sri Lanka	190	23	11	5916	457	140
Indo–Burma	2373	5	6	13,500	1277	433
Mountains of southwest China	262	8	2	12,000	611	237
PACIFIC RIM						
Sundaland island region	1501	7	6	25,000	771	381
Wallacea island region	338	15	6	10,000	650	222
Philippines	297	7	6	9253	535	167
Southwest Australia	357	30	11	5571	285	57
East Melanesian islands	99	30	0	8000	365	86
New Caledonia	19	27	3	3270	105	9
New Zealand	270	22	22	2300	198	4
Japan	373	20	6	5600	368	91
Micronesia/Polynesia (includes Hawaii)	47	21	4	5330	300	15

Which areas should be protected?



the hotspot approach can be applied more locally and be based on local endangered species

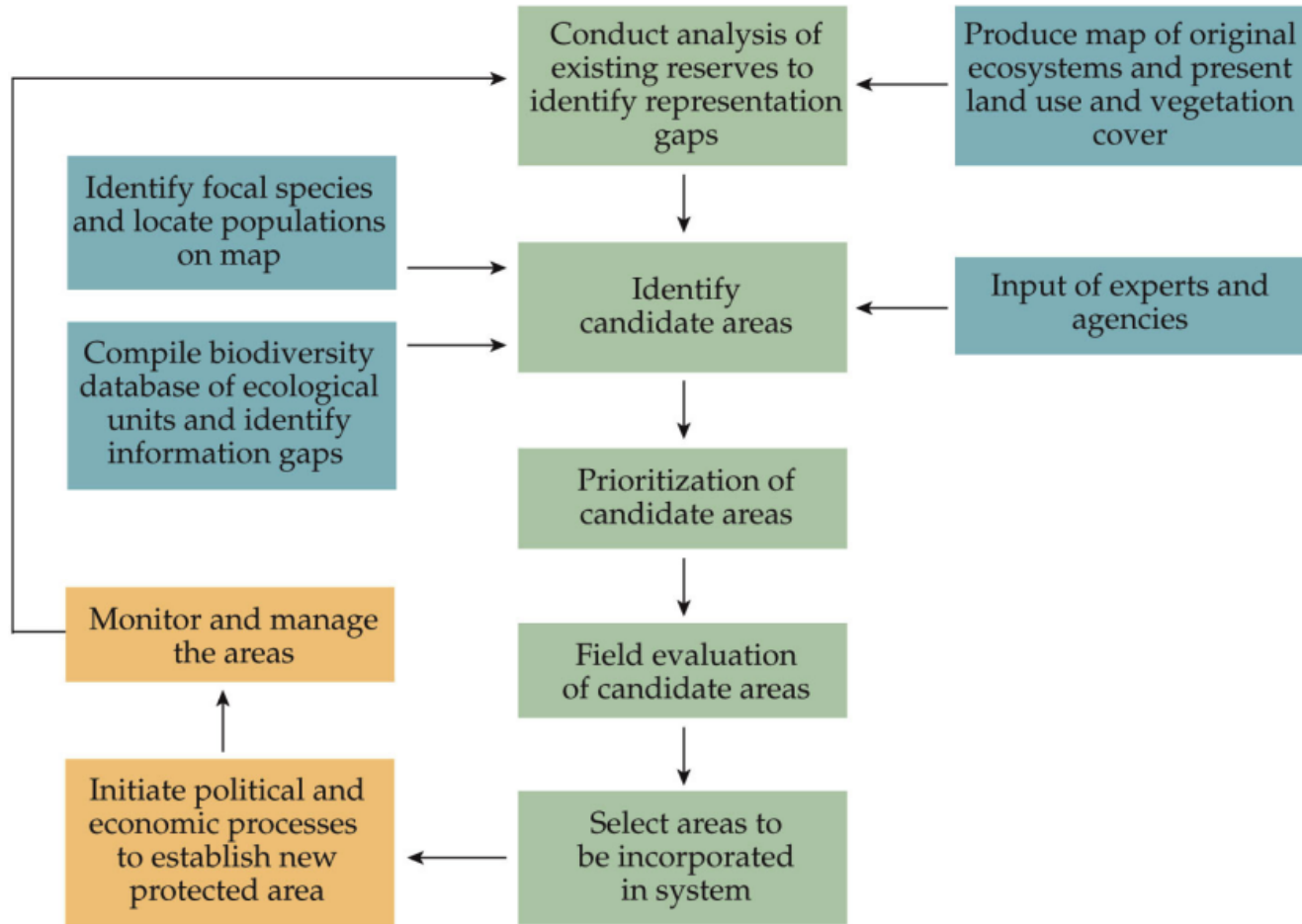
Wilderness areas

Large blocks of land that have been minimally impacted by humans can both serve as control areas for science and refugia for animals

Although they have been occupied, 3 large tropical areas are under immediate threat and should be given high priority of preservation

- *South America* contains huge tracts of forest threatened by logging, agricultural conversion and road development
- *Congo basin* also contains huge tracts threatened by logging and road development
- *New Guinea* has forest tracts threatened by logging, agricultural conversion and road development
- *Nunavut* has huge tracts of inland and coastal tundra threatened by mineral extraction and diamond mining

Linking Protected Areas with GAP Analysis

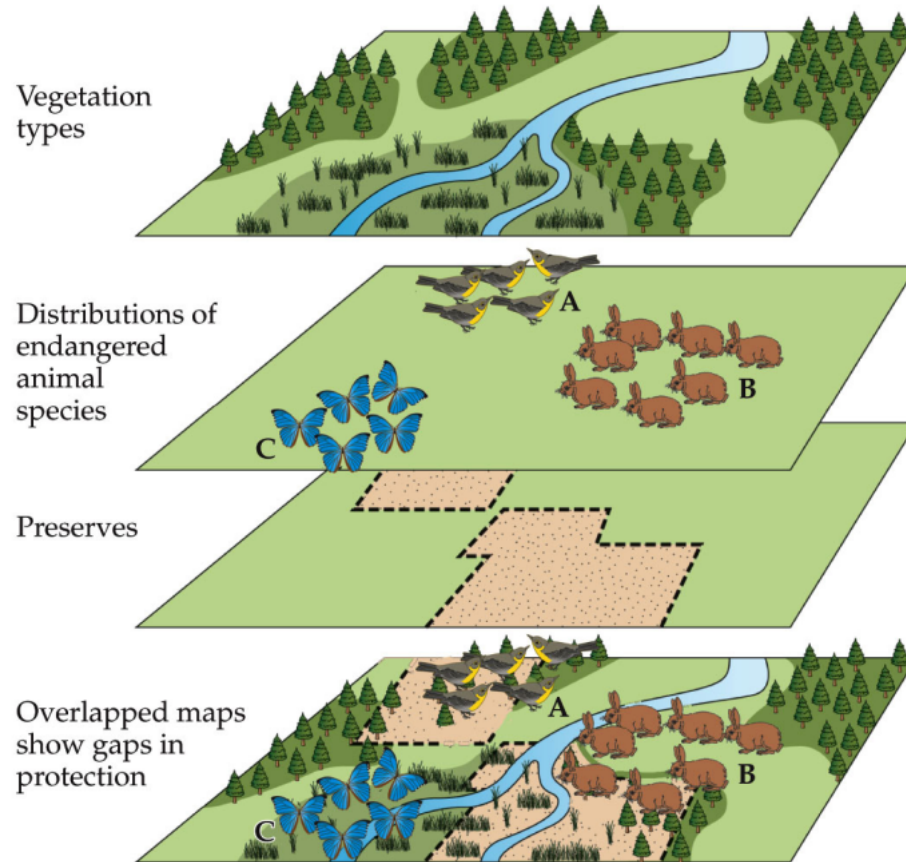


Using GAP Analyses to Protect Endangered Species



11,633 endangered species and protected areas were mapped globally
1424 of the species are *GAP* species in this analysis, falling outside protected areas

GAP Analyses use GIS Mapping Techniques



GIS thematic layers are created and overlain and in this local level analysis we see that species a is almost fully protected, species B partially so and species C has no protection

Designing Networks of Protected Areas



Walden's pond is protected through a network of linked areas that increases the likelihood that all of them will persist

That increase derives from both ecology and economics










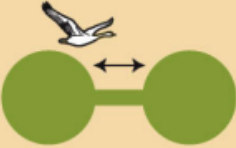


Issues of Reserve Design










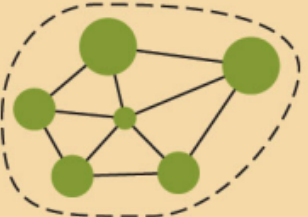


Wolong Preserve

- The goal is to effectively use available funds to optimize biodiversity protection
- *Representation* – contain as many aspects as possible
 - *Resiliency* – maintain biodiversity in a healthy state for foreseeable future
 - *Redundancy* – include enough examples to ensure long-term existence
 - *Reality* – must be enough funds and political will to acquire, manage and regulate

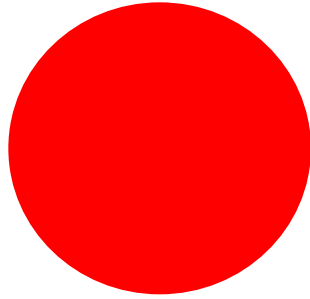
Basic Design Issues

	Worse	Better	
(A) Ecosystem partially protected			Ecosystem completely protected
(B) Smaller reserve			Larger reserve
(C) Fragmented reserve			Unfragmented reserve
(D) Fewer reserves			More reserves
(E) Isolated reserves			Corridors maintained
(F) Isolated reserves			"Stepping-stones" facilitate movement

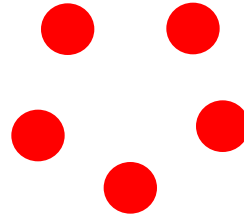
Basic Design Issues

	Worse	Better	
(G) Uniform habitat protected	 <p>300 ha reserve</p>	 <p>100 ha core</p>	Diverse habitats (e.g., mountains, lakes, forests) protected
(H) Irregular shape	 <p>300 ha reserve</p>	 <p>300 ha reserve</p>	Reserve shape closer to round (fewer edge effects)
(I) Only large reserves			Mix of large and small reserves
(J) Reserves managed individually			Reserves managed regionally
(K) Humans excluded	 <p>Stop</p>		Human integration; buffer zones

The SLOSS Debate



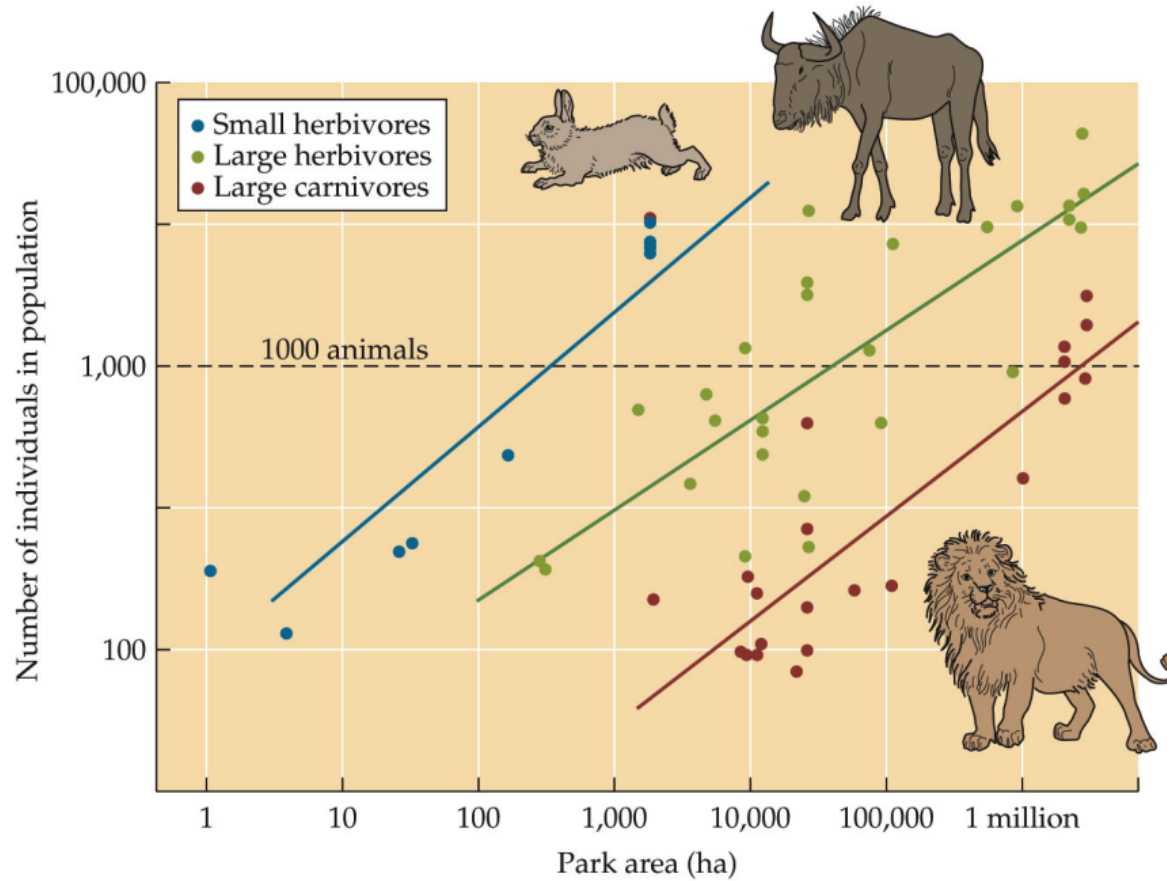
single large



several small

- as single large preserve puts all the “eggs” in 1 basket
- each of the several small preserves may place individuals at risk from demographic stochasticity or inbreeding depression
- it is more difficult to obtain a single large preserve
- it is more difficult to coordinate activities and jurisdiction for several small

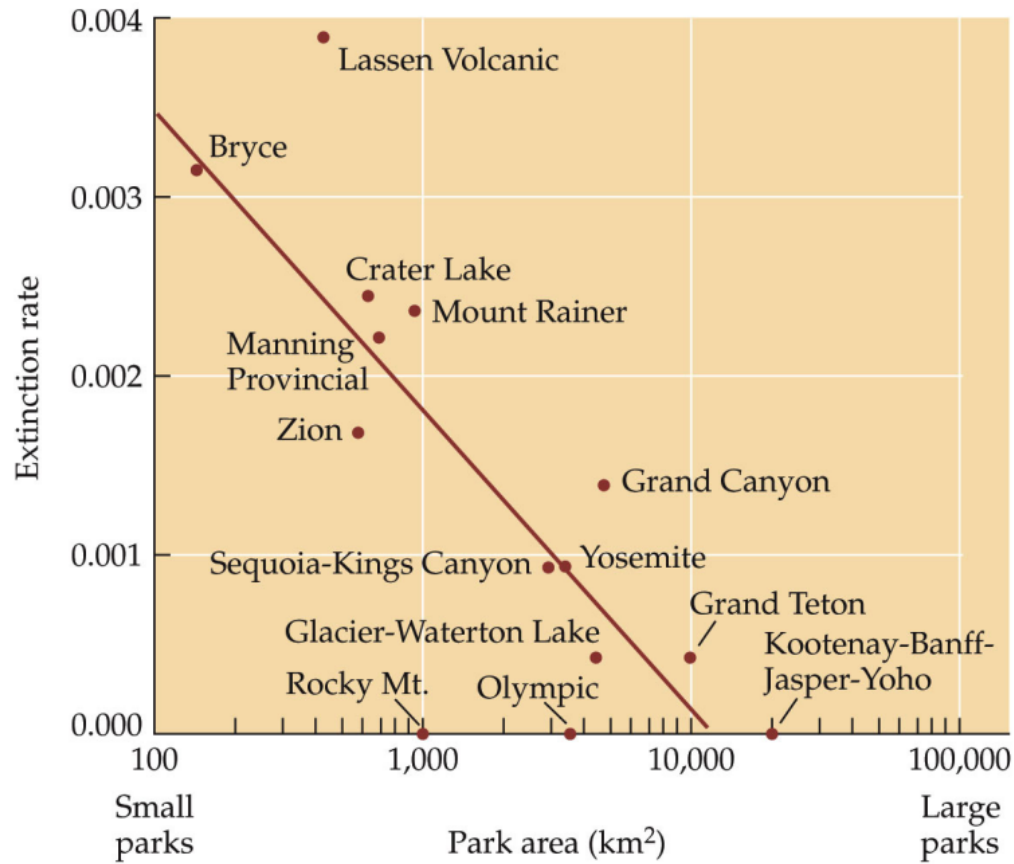
Protected areas and size



large preserves support higher N

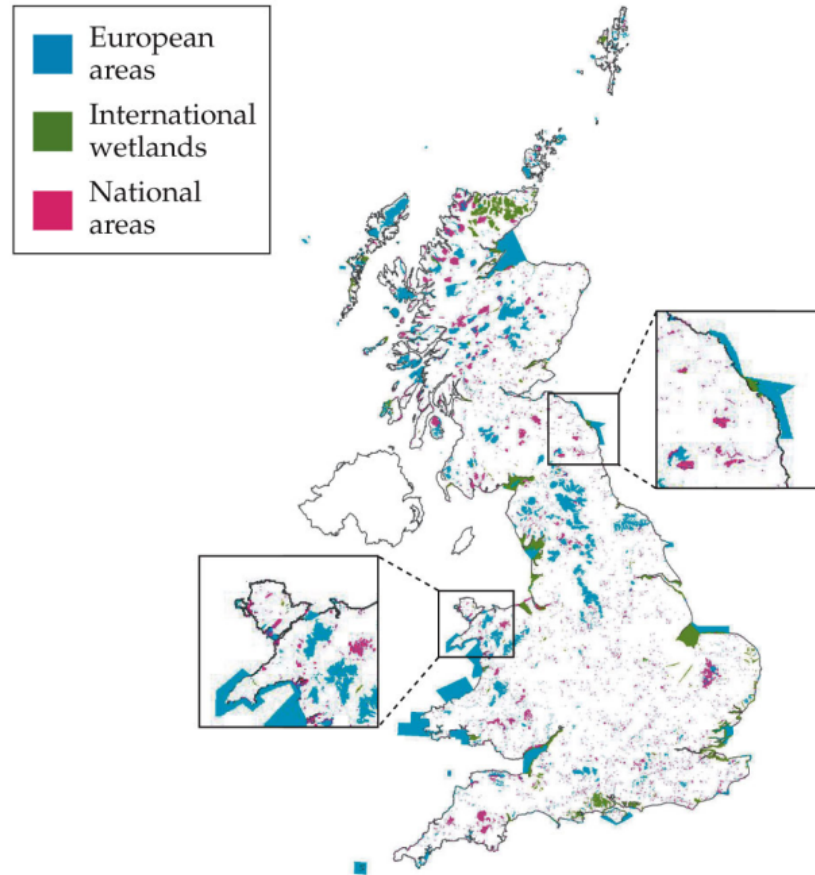
this trend hold for many taxa

Protected areas and size



larger parks have lower extinction rates

Large numbers of small preserves can be effective



The absence of large tracts of land in much of Great Britain precludes developing large preserves

Thousands of small preserves protect many species

Making use of novel systems

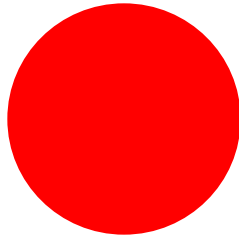
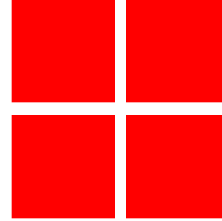


The red-cockaded woodpecker is a flagship species of southern pine forests

Because it is threatened, the forest service has made special attempts to provide nest holes (a limiting resource)

A huge tract of land surrounding the Savannah River nuclear power plant was set aside as a preserve for this species and many other taxa are protected

Pattern and Shape are Important



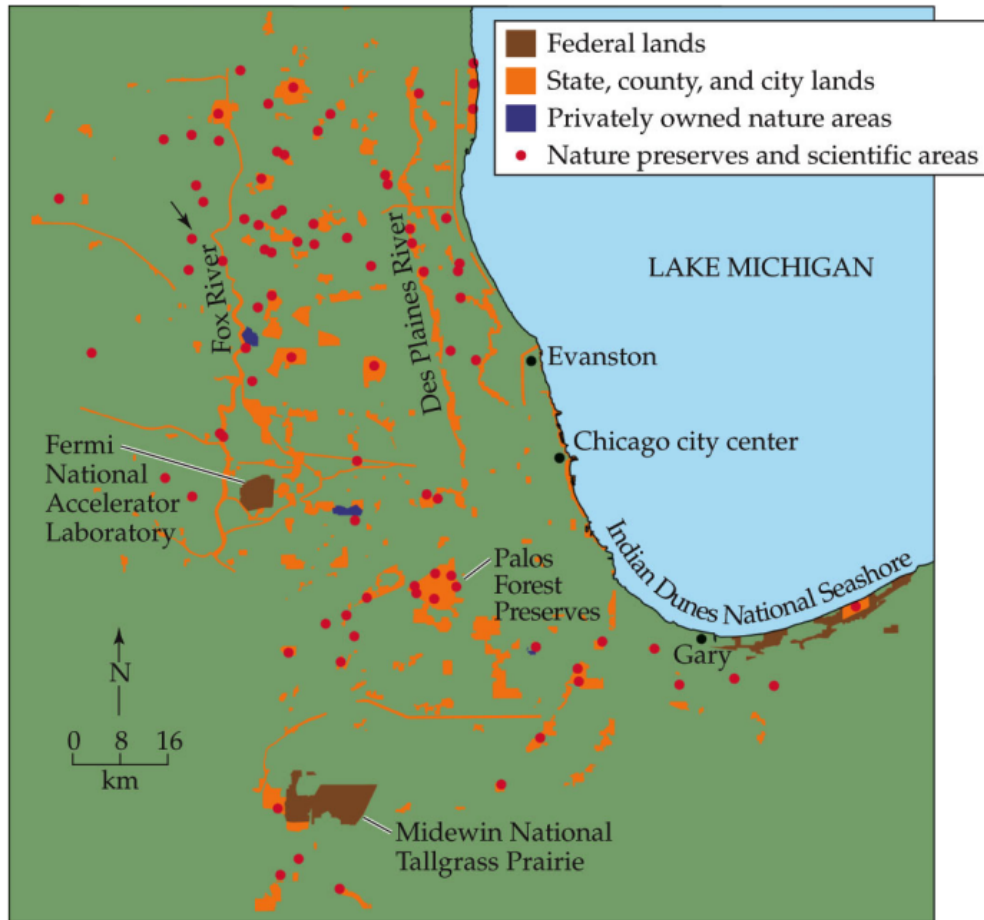
Of these three pairs of equal-sized preserves, the left member is better because it has less edge

Cooperative efforts



Agronomists from the Nature Conservancy work with farmers whose land borders preserves to plant crops that provide buffers

Networked Preserves

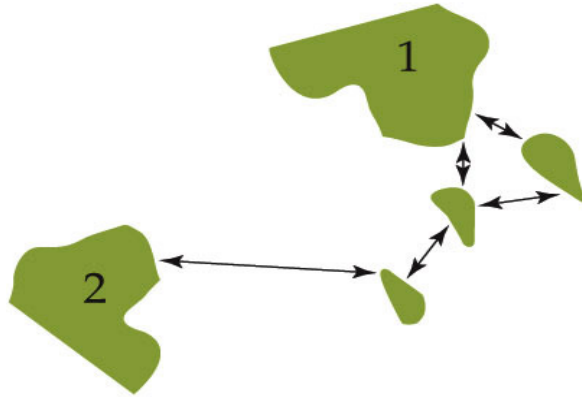


When agencies can not afford the preferred large preserve, it is possible to cooperate with other agencies to produce a network of small preserves

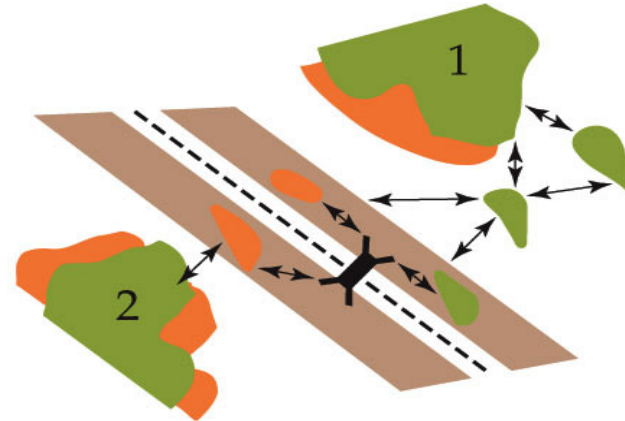
Once established, the next goal should be to connect the small preserves with migration corridors allowing safe movement that increases effective population sizes

Natural corridors need to be augmented

Before fragmentation

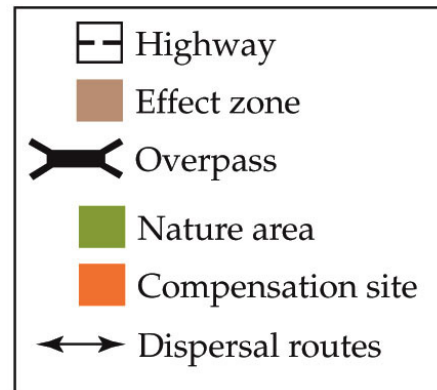


After fragmentation



In this situation, fragmentation was increased by a highway that interfered with natural migration corridors

The situation was improved by adding compensation habitat to the larger segments and adding a bridge over the highway that itself included compensation habitat



Case Studies - Banff

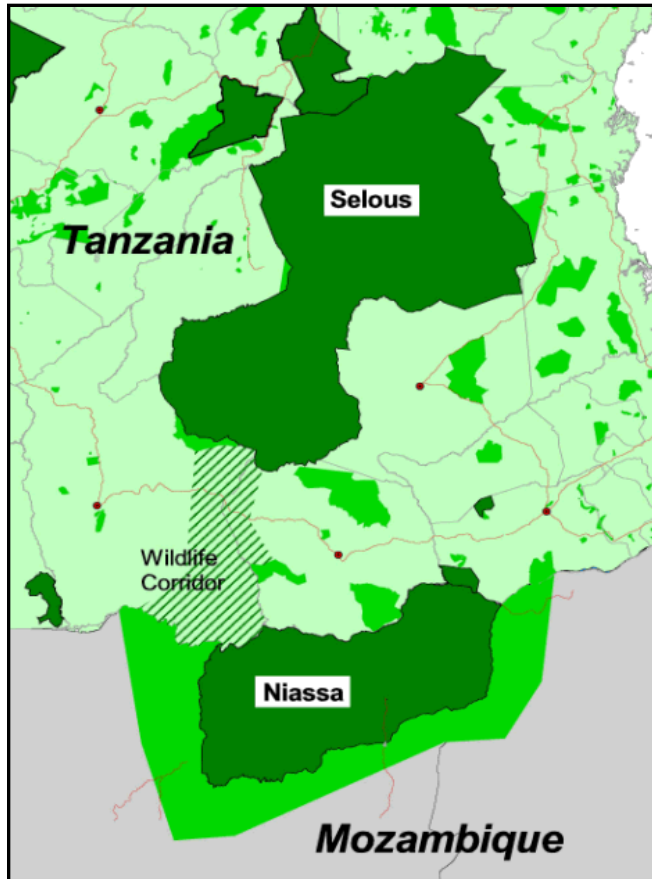


This is the actual dispersal corridor bridge diagramed previously

While this reduces mortality during dispersal and increases N_e does come at a cost

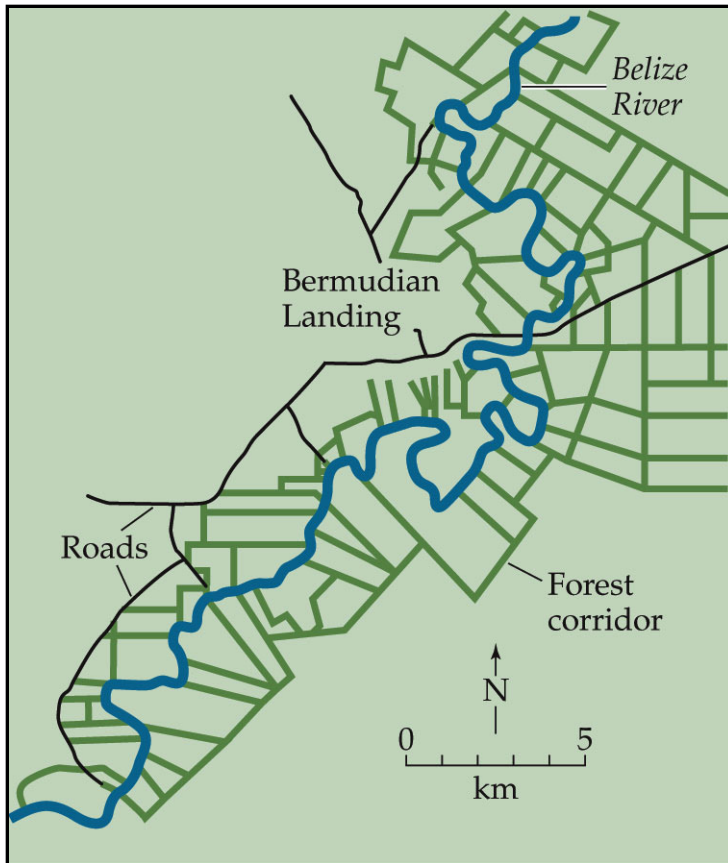
The corridor provides an avenue for rapid transfer of disease agents and pest species

Seleous-Niassa Wildlife Corridor



This protected corridor connects two huge game preserves

Community Baboon Project - Belize

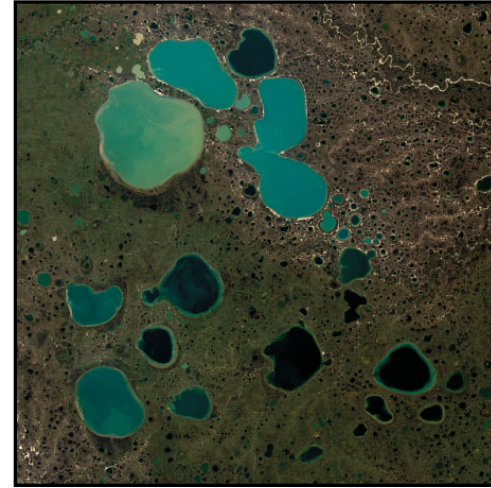


Black howler monkeys are called “baboons” in the local Creole dialect.

They are not true baboons.

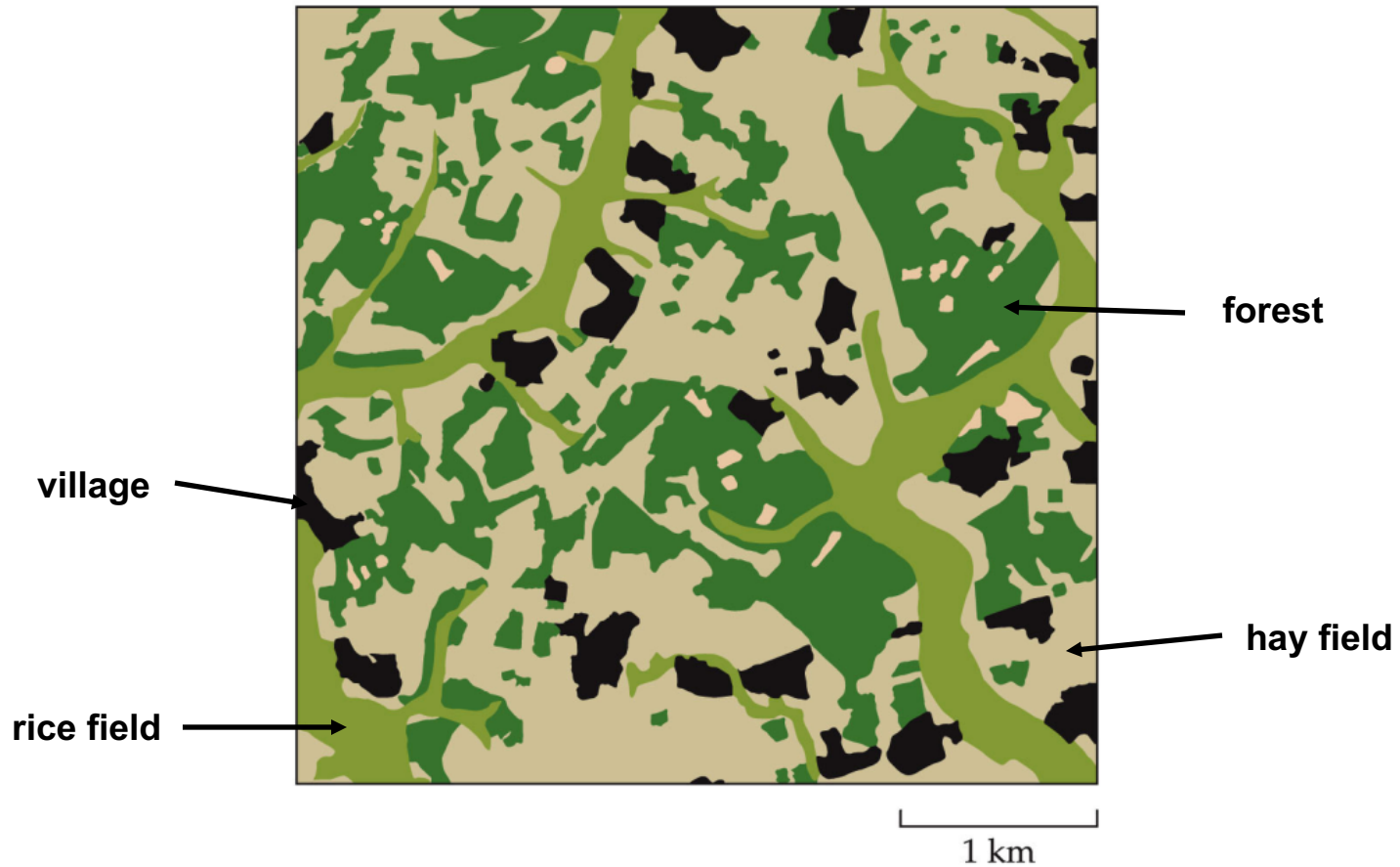
Using a combination of forested corridors and “bridges” over roads, this NGO is trying to preserve the threatened black howler monkeys

Landscape Ecology



Landscape ecology examines repeated units within areas and how their interconnections influence persistence of species

Landscape Ecology



In traditional rural Japan, *satoyama* are integrated combinations of flooded rice fields, hay fields, villages and forests that provide an integrated landscape supporting many wild species

Yellowstone to Yukon Project

In the largest regional effort in North America, numerous government, not-for-profit and business agencies are attempting to provide a protected corridor for this entire region

