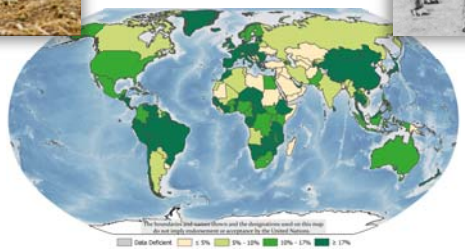
CONSERVATION APPROACHES

in-situ vs. *ex-situ* approaches
scale of conservation
economic approaches
international agreements & organizations
setting conservation priorities
the role of science



CONSERVATION APPROACHES - LOCATION

in-situ: "on site"

parks, hunting bans, 'value reduction'

BENEFITS ?

RISKS ?

ex-situ: "off site"

zoos, seed banks, captive breeding

BENEFITS ?

RISKS ?

CONSERVATION APPROACHES - LOCATION

in-situ: "on site"

parks, hunting bans, 'value reduction'

cheaper
species + habitat
ecosystem function
hard to monitor, patrol

ex-situ: "off site"

zoos, seed banks, captive breeding

expensive
species only
no ecosystem
easier to monitor, guard

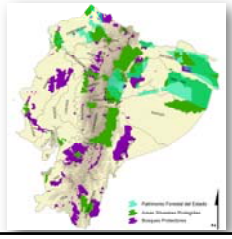
in-situ Approaches - National Parks

strengths

large areas
perpetuity
creation by decree
large bodied animals, predators, low β-diversity

weaknesses

political whim
funding
enforcement scarce : *"Paper Parks" Syndrome*
economics of timber, mining, oil

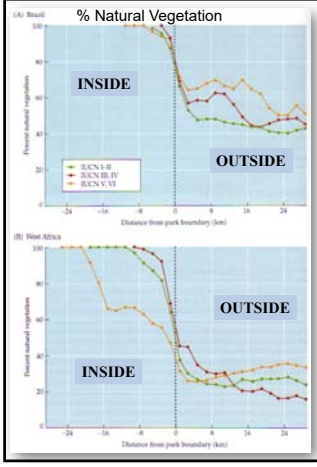


Strict Preservation (John Muir)

Planned Use (Gifford Pinchot)

Land Ethic (Aldo Leopold)

Effect of Reserves



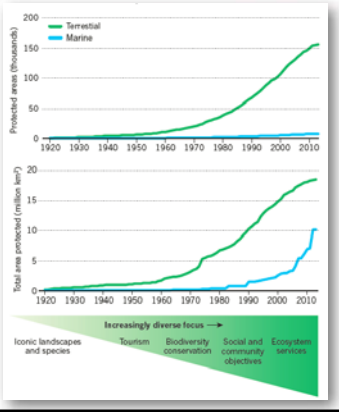
▲ % natural vegetation
▲ population size, health

▲ fish size
"spillover" effect (*marine*)

benefits to local people: *jobs, tourism, ecosystem services*

Mexico: 82% of mammals are in protected areas (4% national area)
Britain: 88% of plants
China: 81% of vegetation types

Growth of National Protected Areas



Summary *(UNEP 2014)*:

197,368 areas = 20.6 million km²

15.4% of terrestrial surface

CBD 2010 Targets:

17% of terrestrial surface
(*USA = 12%; global = 15.4% + 3.4%)

E.O. Wilson - *"Half Earth"*

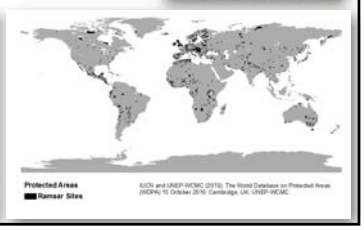
Problems:

17% of threatened birds, mammals, amphibs not protected

in-situ Approaches - International Reserves

Biosphere Reserves & World Heritage Sites (UNESCO)
Important Bird Areas (IUCN, CI, BirdLife)
Ramsar Wetlands (1971)

(+) cross-border species -- migrants, mobile animals
(-) enforcement



in-situ Approaches - Private Reserves

strengths
small, critical areas
no government
local management
high β-diversity systems

weaknesses
landowner commitment
small size
incentives?

Pahuma - *Easement*
Lalo Loor - *Management Rights*

in-situ Approaches - Private Reserves

Legal Tools for Protection

- "Private Protected Forest" -- Bosque Protector Privado
  + Red de Bosques Privados
- Conservation Easement
  "servidumbre ecológica"
- Private Legal Agreements
  **handshake and trust!*
- (and Purchase)

in-situ Approaches - Community Reserves

strengths
?

weaknesses
?

in-situ Approaches - Community Reserves

strengths
large areas
cultural component
community as stewards (?)

weaknesses
degraded habitat (?)
community squabbles
uncertain land tenure

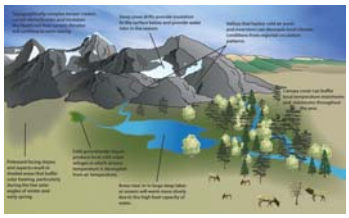
in-situ Approaches - Private Game Ranches

Namibia & S. Africa
5 black rhino bulls / y
"surplus" males
income for protection ($350k/rhino)

Population Biology w/ Hunting
▲ calving success as %males ▼
▼ inbreeding (old bulls dominate)
▼ mortality, poaching (bulls 'peripheral')

since 2004
population increased 51%

in-situ Approaches - Response to Climate Change



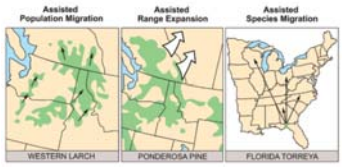
Climate Refugia

- paleohistory of success
- identify potential refugia: *e.g., cold valleys*
- incorporate into conservation planning

Assisted Migration

- identify species at risk
- find new, suitable sites
- translocate individuals

**within, or beyond original range*



ex-situ Approaches - When and Why?

extinction inevitable -- *50-500-5000* rule*

boost population

reintroduction, restocking

Cost: captive rhino = 50X wild rhino

original threats?

ex-situ - Zoos, Aquariums, Botanical Gardens

BENEFITS ?

RISKS ?

ex-situ - Zoos, Aquariums, Botanical Gardens

(+) public awareness

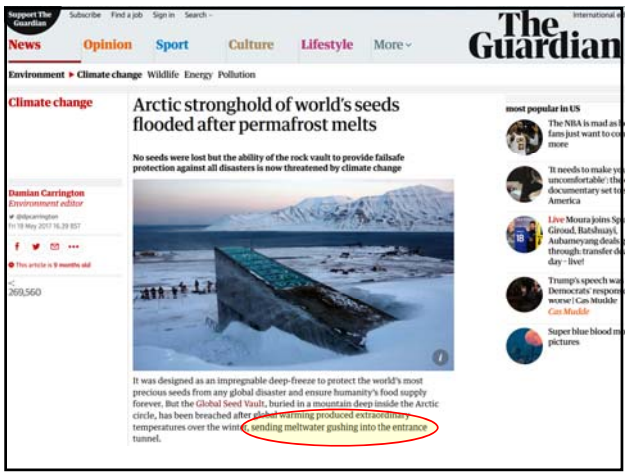
(+) re-introductions?

(+) seed & gene banking
Kew, Norway

(-) expensive

(-) seed viability limits

(-) catastrophe risk - *cheetahs in OR.*



ex-situ Approaches - Demand Replacement

Wildlife Ranching & Farms:

reduce hunting pressure
(#1 cause of spp. extinction)

legal supply of meat, hides

Green iguana (*Iguana iguana)*

Capybara

+ llama, alligators, shrimp, *et al.*

RISKS ?

ex-situ Approaches - Demand Replacement

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Green iguana (*Iguana iguana)*

Capybara

+ llama, alligators, shrimp, *et al.*

Risks: maintain bushmeat popularity

legal outlets for illegal trade

escape of new diseases, alleles

ex-situ Approaches - Demand Prohibition

25 Jan 2016

ex-situ Approaches - Demand Prohibition

31 Jan 2018

ex-situ + *in-situ*: Captive Breeding

"reintroduction" vs. "restocking",
"translocation" vs. "introduction"

Orangutan - Borneo (1980's)

Harpy Eagle - Panama (1990's)

Rhino - Sumatra (1984-2015)

Reintroduction: failures up to 95%

Translocation success: *"near zero"*

Assortative mating: 83% *(Slade et al 2014)*

Pre-Release Training

Must teach juveniles:

- foraging
- predator-avoidance*
- soft vs. hard release

Prepare human population!

SCALE: SINGLE SPECIES CONSERVATION

"charismatic megafauna" (flagship, umbrella spp.)

often "keystone species"

collection bans, harvest quotas, "bodyguards"

ivory trade? legal hunting? ... corruption?

"single-species" reserves

Javan Rhino

Harpy Eagle (TCS 2006)

Panthera onca

SCALE: SINGLE SPECIES CONSERVATION

DAILY SCIENCE

Is "green militarization" the best way to save rhinos?

by Brandon Keim | Feb 15, 2017

Rhinoceroses have become symbols of modern human rapacity. Global populations plummeted from 500,000 at the 20th century's beginning to 29,000 now; images of the majestic animals left to die with their horns hacked off by poachers are tragically iconic. And yet: a very different tale is being told in Nepal and India.

Anthropocene Magazine Feb 2017

Nepal:

rhinos ▲ 21% in 5 years

no poaching events

#1 - strict penalties, and rigorous enforcement

#2 - 33% of park income goes to communities

…aryal et al. 2017. Global lessons from successful rhinoceros conservation in Nepal. *Conservation Biology*

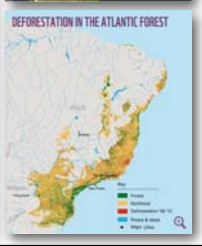
SCALE: ECOSYSTEM CONSERVATION

Atlantic Rainforest, Brazil

unique ecosystem

high richness, endemism

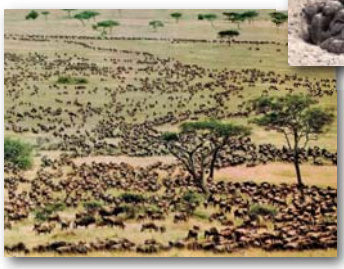
only 2% under protection



SCALE: LANDSCAPE CONSERVATION

species using >1 ecosystems:

- migratory birds
- migratory mammals
- sea turtles
- diadromous fish



One Person: Behavior Change & Participation

Communication & Education: Dr. Bret Shaw (UW)

- persuasion (~~info~~) --> participation
- break down *biased self-evaluation*
- speak audience's language

Behavior Change through 'Social Marketing'

- identify specific behavior
- identify perceived barriers & benefits
- identify opinion leaders

Self-enhancement Bias

ECONOMIC APPROACHES & FINANCIAL INCENTIVES

Conservation Concessions

lease usage rights

outbid loggers, miners

**temporary measure*

Guayana:

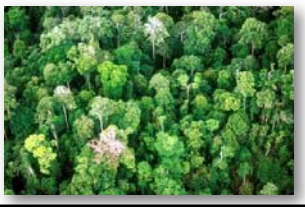
C.I.: 81,000ha for 30y at $0.15/ha

Peru:

Los Amigos Biological Station
145,000 ha

FINANCIAL APPROACHES - DEBT FOR NATURE

Kalimantan - deforest or conserve?



Debt for Nature Swaps

developing countries owe > $4 trillion
to *World Bank, IMF, G8, "Global North"*

debt purchased by NGO
sold cheaply (*22% value, Brazil*)

"forgiven" (swapped) for conservation

Ecuador's Case

1970-2006: $1.2b --> $14.2b debt
1979-81: 6% --> 21% interest

1989-2006: 86% of debt = interest payments

2008,'09: *default*; 35% buyback

PAYMENT for ECOSYSTEM SERVICES

Ecosystem Services

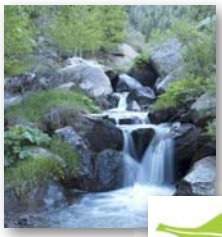
clean water *(NY City)*

clean air *(Kyoto)*

pollination

disease prevention

et cetera ...



Socio Bosque : Ecuador

landowners protect forest

paid up to $30/ha/y

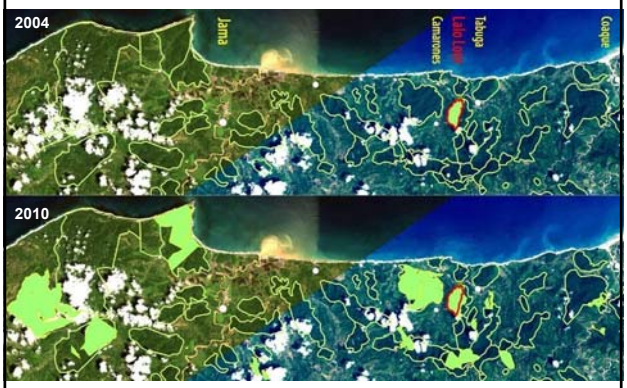
services = air, water, biodiversity

SocioManglar, SocioParamo, SocioRestauracion*

SocioBosque

Programa de protección de bosques

Socio Bosque and Ceiba Foundation



FINANCIAL APPROACHES - Ecuador's ITT

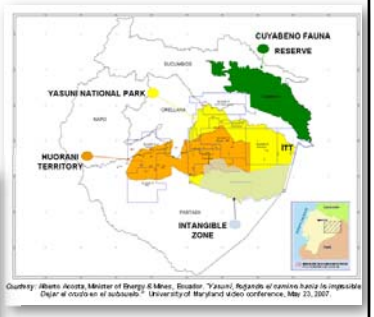
ITT = *Ishpingo - Tambococha - Tiputini*

- 900m barrels est. oil reserves

2007: Correa asks $350m/y for 10y
2012, 2013: Pledges total $100m/y

2013: Ecuador cancels proposal

2016: 1/3 of Amazon to Chinese:
- *Ecuador owes $7bn (1/10 GDP)*



NATIONAL CONSERVATION AGREEMENTS

Endangered Species Act (USA)

1973 - Richard Nixon *(R!)*

Ecuador:

2004 - Biodiversity Law
2008 - Constitution: inalienable "right" of biodiversity to exist and flourish

strengths:
- "easily" enacted
- single jurisdiction

weaknesses:
- cross-border species, habitats
- shifting political opinion

INTERNATIONAL AGREEMENTS - Migratory Birds

For: international systems -- Antarctic, oceans
mobile species -- marine life, seabirds

Convention on Conservation of Migratory Species of Wild Animals (1979) - "Bonn Convention"

Sooty-Shearwater

INTERNATIONAL AGREEMENTS - Carbon Emissions

Kyoto Protocol: 1997 - 2012 (2020)

Reduce emissions to 92% of 1990
wealthy nations objected

REDD and REDD+:
reduce deforestation & degradation
**standing forest CO_2 balance?*
Indigenous groups object!
**Paoli 2010 - Indonesia findings?*

Carbon trading ($$ --> *Socio Bosque*)

INTERNATIONAL CONSERVATION AGREEMENTS

CITES:
(Convention on International Trade in Endangered Species)

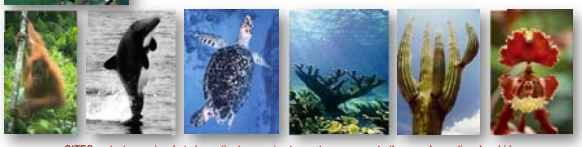
IUCN Red Data Books (1966):
EX, CR, EN, VU, NT, LC

Appendix I: trade prohibited
export and import permit

www.iucnredlist.org

Ecuador Mammals - IUCN

Ateles belzebuth
Harpia harpyja
Lagothrix lagotricha
Mazama rufina
Priodontes maximus
Melanosuchus niger
Myrmecophaga tridactyla
Pteronura brasiliensis
Tapirus terrestris
Tayassu pecari
Tremarctos ornatus



CITES protects species, but also entire taxa: primates, cetaceans, sea turtles, corals, cacti and orchids

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Mazama rufina (VU)
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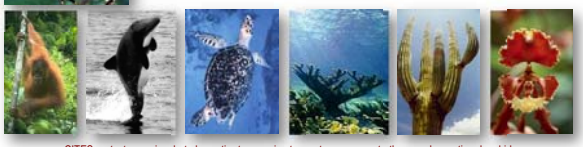
Melanosuchus niger (LC)
Myrmecophaga tridactyla (VU)
Pteronura brasiliensis (EN)
Tapirus terrestris (VU)
Tayassu pecari (VU)
Tremarctos ornatus (VU)



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INTERNATIONAL CONSERVATION - BIODIVERSITY

Convention on Biodiversity (CBD): Rio, 1992
- *conserve biodiversity*
- *promote sustainable use, sharing of benefits*

INTERNATIONAL CONSERVATION - BIODIVERSITY

Convention on Biodiversity (CBD): Rio, 1992
- *conserve biodiversity*
- *promote sustainable use, sharing of benefits*

2010 Protection Targets (for 2020):
17% of Terrestrial areas; 10% of Marine
**Joppa et al.: Area & Species targets not aligned*
**IUCN: in rush to establish, parks underfunded*

CBCs: Community-Based Conservation Programs
success = project design + capacity building (2013 study)

CONSERVATION PLANNING: THE ROLE OF SCIENCE

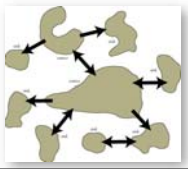
Species distributions

Ecosystem services

Environmental impact statements

Locate reserves and parks

Species health, extinction risk:
- Population Viability Analysis (PVA)
  - minimum viable population size (MVP)
- Metapopulation Models
  - connectivity



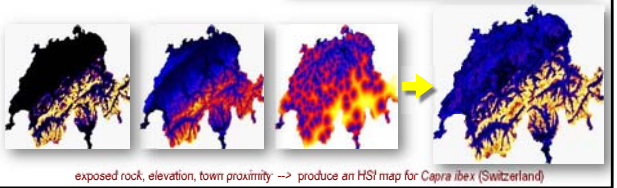
HABITAT SUITABILITY INDEX (HSI)

Understand, map preferences

Recommend management, or release sites

Variables:
- forest age
- distance from towns
- elevation, *etc.*

*Required for all USA endangered species



exposed rock, elevation, town proximity --> produce an HSI map for Capra ibex (Switzerland)

BIODIVERSITY HOTSPOTS

Conservation Prioritization

criterion #1: > 1500 endemic plant species

* *"decent" predictor for other taxa*

criterion #2: > 70% habitat lost

Results

35 areas = 2.3% of Earth land area

>50% of all plants

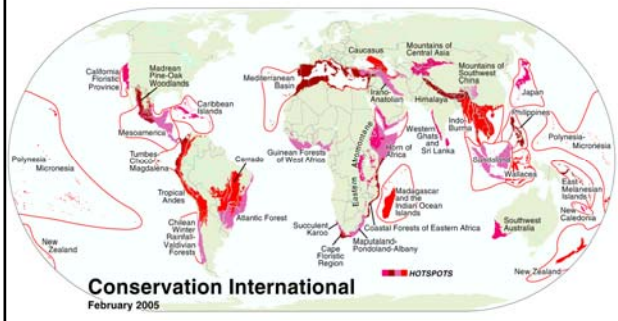
43% of terrestrial vertebrates

Bornean Rhinoceros Hornbill

Atlantic Forest Golden Lion Tamarins

Madagascar Aye-aye

BIODIVERSITY HOTSPOTS



El Pahuma: *Tropical Andes*

Lalo Loor: *Tumbes-Chocó-Magdalena*

VIDEO: CAPTIVE BREEDING PROGRAMS

from PBS's "The Loneliest Animals"