RESERVE DESIGN & MANAGEMENT

1. Principles of Design
2. Principles of Management
3. Working with Stakeholders*
4. Adaptive Management

PRINCIPLES OF RESERVE DESIGN

The 4 R's:

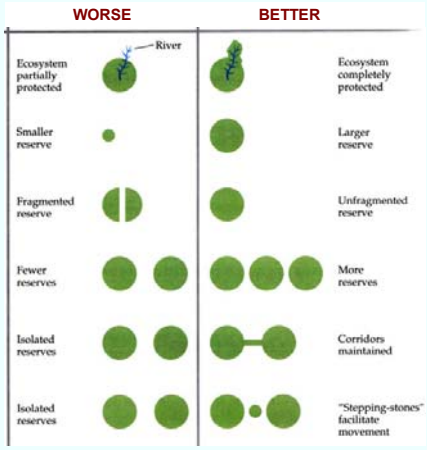
Representation: protect all habitat types

Resiliency: withstand disturbance, variability

Redundancy: multiple similar sites

Reality: be pragmatic

SIZE & SHAPE

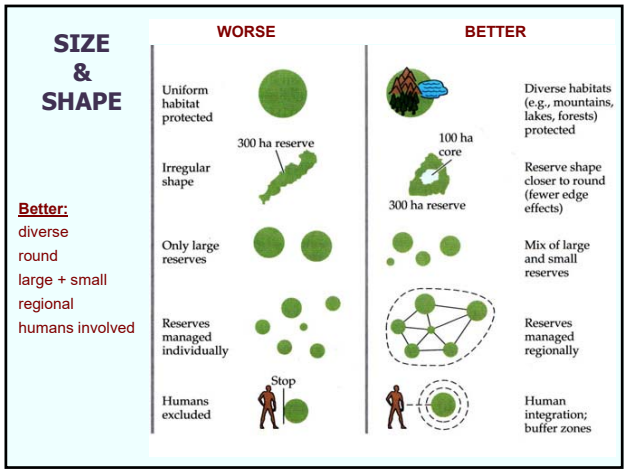


extinction ≈ 0 in parks >1000 km^2

benefits and risks

Better:
larger
unfragmented
more
connected

SIZE & SHAPE



Better:
diverse
round
large + small
regional
humans involved

CORRIDORS & BARRIERS

Banff N.P., Canada

240,000 uses

reduced mortality 95%

HIGH-VALUE MICROSITES

salt licks
standing dead (cavities)
fruit sources
Mauritia & Macaws

migratory stopovers
refuge from climate

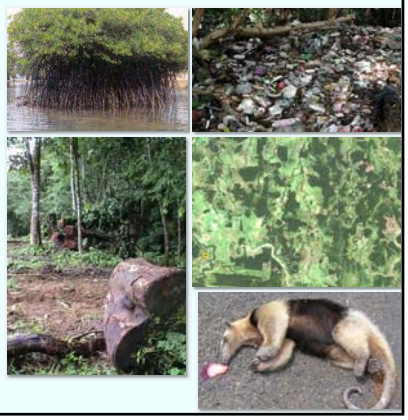
THREAT IDENTIFICATION & CONFRONTATION

Direct vs. Indirect

illegal extraction
(lumber, charcoal, etc.)
poaching
encroachment

roads
dumping, pollution
invasive species

Lalo Loor Dry Forest:
poaching, illegal logging, regional deforestation



RESERVE DESIGN: ZONATION

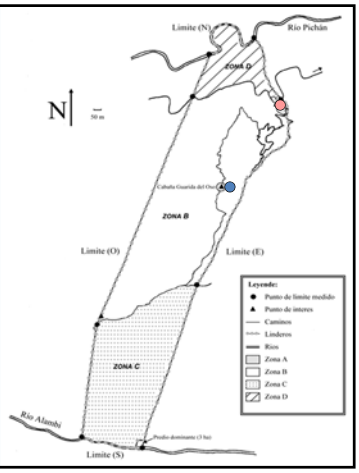
ZONIFICACIÓN EL PAHUMA

Zona A: Uso Intensivo

Zona B: Mínimo Impacto

Zona C: Intangible

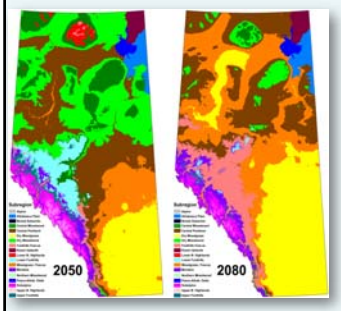
Zona D: Afuera del Convenio



RESERVE DESIGN: CLIMATE CHANGE

Alberta, Canada in 2080 (Schneider & Bayne, 2015):

"virtually all reserves will ... be comprised of different ecosystem types"

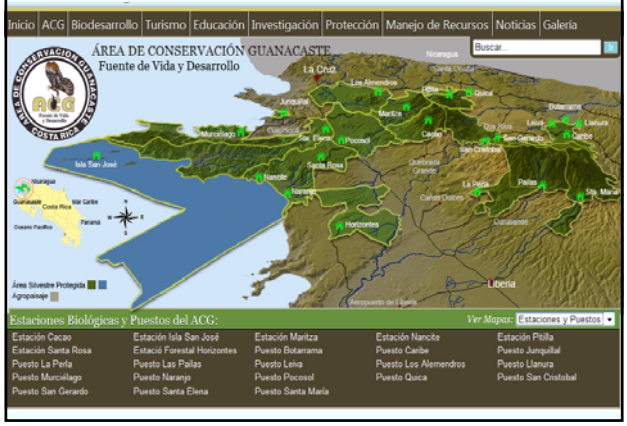


Alberta ecosystems

EHNWR "strategically located for both species adaptation from climate change impacts"

USA: prioritize NORTHWARD expansions

REGIONAL RESERVE SYSTEMS (aka Networks)



SURROUNDING AREAS - BEYOND THE 'BUFFER'

Corridors
connect patches, sm. reserves

***but:**
disease, fire, pest mobility

Landscape Management
stepping stones
retain habitat: e.g., Riparian

'Matrix' Permeability
mobility = survival

shade coffee (w/ legume trees) in Colombia

IN-HOLDINGS: HUMAN SETTLEMENTS

kick 'em out?
vs.
manage impacts?

Amboró N.P., Bolivia:
1984 = 180,000 ha
no people

1991 = 637,000 ha
people & *problems*

1996 = 440,000 ha
problems reduced

Huaorani clearing by Tiputini #2 bridge

RESERVE MANAGEMENT: PRINCIPLES

1. **identify objectives**
   biological & cultural evaluations
2. **pursue objectives**
   management plan
3. **evaluate results**
   monitoring & feedback

PROTECTION vs. PRODUCTION

Leopold & Muir vs. Pinchot

PROTECTION: limit activities & threats
direct: hunting, logging, mining, dumping
indirect: trails & roads, boat traffic, lights

PRODUCTION: yield & sustainability
hunting quotas, reduced impact logging, fishing gear limits

PROTECTION - the *problem* with tourists?

Ecotourism growing at 10 - 30% annually

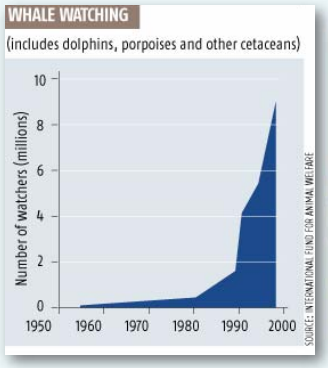
Bottlenose dolphins *(New Zealand):*
surface more, feed & rest less

Polar bears *(Canada):*
patrol more, rest less

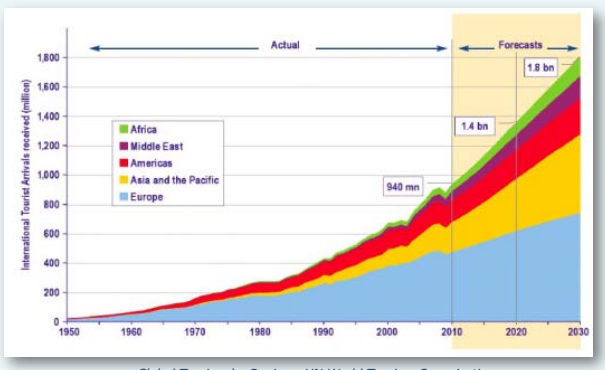
Yellow-eyed Penguins *(New Zealand):*
chick weights declined >10%

Meerkats *(Kalahari, Botswana):*
colony perished from human tuberculosis

TOURISM GROWTH & IMPACTS



TOURISM GROWTH & IMPACTS



Global Tourism by Region: UN World Tourism Organization

PARK GUARDS & PATROLS

Remote parks = difficult to patrol
Low funding --> "Paper Parks" syndrome:
Yasuní = 4 guards in 1.5 *million* ha
Guards provide monitoring data
Indigenous opportunity ... vs. trustworthy?

BUFFER ZONE MANAGEMENT

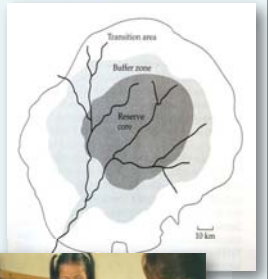
1. ***core*** = inviolable
2. ***buffer*** = limited protection
3. ***transition*** = management of broader impacts

often only way to protect large areas

work with neighboring groups *(*recall CBC)*

provide alternative food sources, sustainable livelihoods

manage extractive behaviors



LONG-TERM MANAGEMENT: THINK LIKE AN OAK

long-term management view

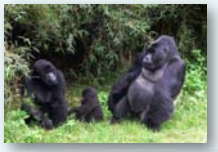
key species' lifespan

minimum critical area (MCA)

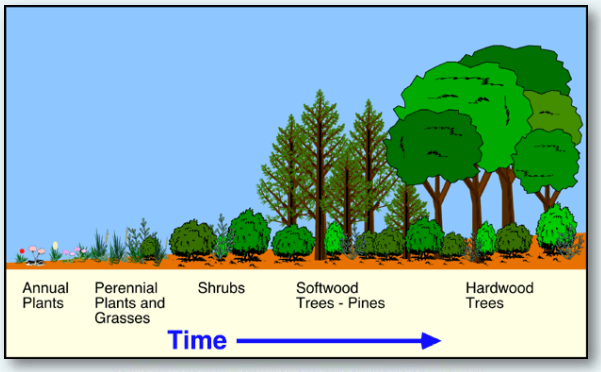
climate change:
altitudinal & latitudinal gradients
biological corridors

tolerate disturbances

understand the system (***do we?***)
challenge of managing dynamic ecosystems

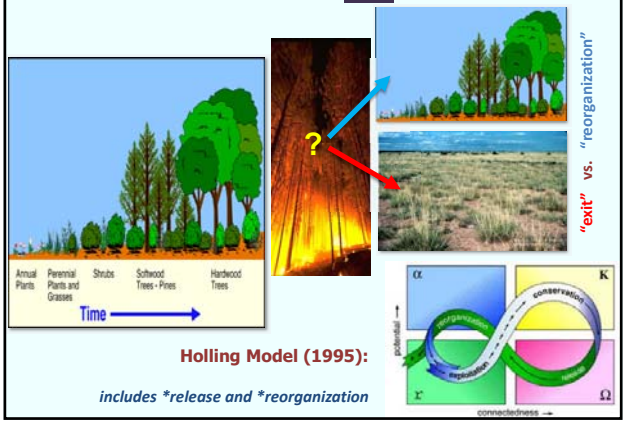


ECOSYSTEM DYNAMICS - old skool



the Clements "climax community" model (1916)

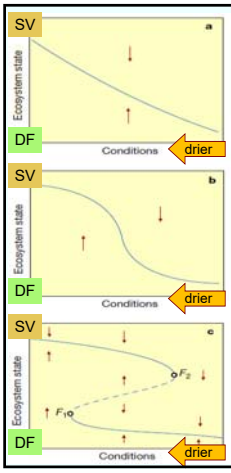
ECOSYSTEM DYNAMICS incl. DISTURBANCE



Holling Model (1995):

includes *release and *reorganization

ALTERNATE STABLE STATES



smooth response to changing conditions:
*dry forest grades into savannah w/ ▲ precip

non-linear (aka. "threshold") response:
*drying forest attacked by beetles, perished

two (aka. "alternate") stable states:
*vegetated Sahara flipped to desert (5000 ybp)
extreme '**threshold**' response (F2→F1), but return (F1→F2) very difficult (='**hysteresis**')

MANAGEMENT: MAINTAIN DISTURBANCE

Key Stochastic or Cyclical events:
block them, permit them, or ... mimic them?

Examples: manipulate water levels — *wetlands*
artificial floods — *Grand Canyon*
controlled burns — *prairies*

ECOSYSTEM THEORY & MANAGEMENT

Imperfect Understanding
+
Unpredictable Systems
=
MANAGEMENT MUST BE FLEXIBLE

ADAPTIVE MANAGEMENT

rigid management fails dynamic systems

leads to **collapse** -- common in fisheries
("threshold response")

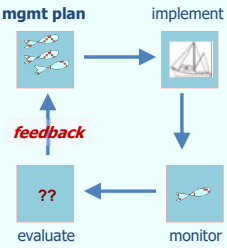
management = experiment
(within acceptable range)

plans = hypotheses

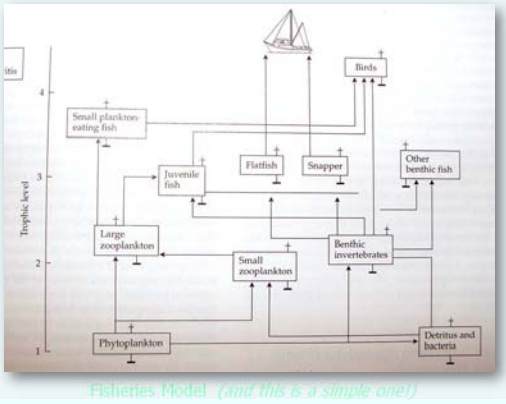
errors = as learning opportunities

feedback --> modify management

improve understanding of complex systems
for: managers, users, conservationists, public
role of computer models



ADAPTIVE MANAGEMENT - FISHERIES



Fisheries Model *(and this is a simple one!)*

ADAPTIVE MANAGEMENT in USA

Everglades Restoration Plan
- Hydrological regime altered by agriculture
- Massive wading bird declines
- system, stakeholders too complex for simple management

Chesapeake Bay Program
- Overfishing + heavy inputs
- Fisheries crashed
- Multiple overlapping jurisdictions

ECOSYSTEM MANAGEMENT

USA Adopted E.M. in 1990s
- consider adjacent systems
- manage in economic context
- inevitability of change
- upstream --> downstream

Importance of scale:
- *local* mgmt ≠ regional
- model large, complex systems

Galapagos Islands

1998 Special Law - Charles Darwin Foundation

Ecosystem management model:
terrestrial & marine systems

Local people as **partners**, not adversaries

Tourism as savior and scourge

Problems: shark-fins, sea cucumbers, tuna fleets, sea lion penis, etc.