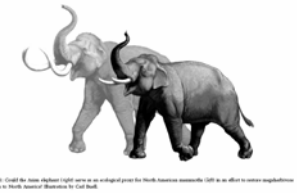
Lecture 21, 30 Oct 2007
Conservation Practice

Conservation Biology
ECOL 406R/506R
University of Arizona
Fall 2007

Kevin Bonine
Cathy Hulshof



Upcoming Readings
today: Ch 10, Donlan Readings
Thurs 01 Nov: Exam 2

Thanks to Matt Skroch
Q4 due 13 November

1

Conservation Biology Lab 406L/506L

Friday 02 Oct 1230 –> 1530, Sea Turtle MVP
Meet 1230h BSE 328

See lab website for more information

2

Debate 15 November 2007:
RE: Galapagos Conservation

Three groups – one will debate, another will evaluate, third will observe, then we rotate.

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Debate 1 (20 Sept.)
Group A debate
Group B evaluate
Group C observe
Debate 2 (23 Oct.)
Group A observe
Group B debate
Group C evaluate
Debate 3 (15 Nov.)
Group A evaluate
Group B observe
Group C debate

Debate 1 (20 Sept.)
506 A assist
506 B assist
506 C observe
Debate 2 (23 Oct.)
506 A observe
506 B assist
506 C assist
Debate 3 (15 Nov.)
506 A assist
506 B observe
506 C assist

3

Wednesday, October 31, BSE Room 225, 12:00 Noon

This week's presentation will be by Dr. Ed de Steiguer

Title: **Semi-Arid Rangelands and Carbon Offsets: A Look at the Economic Prospects**

Abstract: The carbon offset market is increasingly seen as a voluntary means of mitigating global climate change. Currently, offsets represents a $21 billion market involving a variety of projects to either reduce carbon dioxide emissions or enhance sequestration possibilities. This presentation provides an overview of offset markets and provides a preliminary look at the economic potential of semi-arid rangelands to participate.

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The UA Museum of Art invites you to join us as we welcome El Anatsui, a celebrated African artist, to the University of Arizona. Using found materials, El Anatsui draws on traditional African idioms and contemporary western art practices, to comment on West African culture, history, and society. The artist will give a lecture on his work Thursday, November 1st at 4 pm, followed by an opening reception for the exhibition at the UA Museum of Art at 5 pm. Please see the attached flier for more information. We look forward to seeing you there.
Content-Type: application/pdf; name=uama_elanatsui.pdf
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Content-Disposition: attachment; filename=uama_elanatsui.pdf

uama_elanatsui.pdf

5

Event: UA Visitor Center Open House - New Water Harvesting & Solar Installations

Open House 8:00 am to 4:30 pm

Come check out the new landscaping and photovoltaic system at the Visitor Center. Student groups have been working hard on a major rainwater harvesting project and collaborated with faculty and staff to make the building a green showcase for the University of Arizona.

U of A President Robert Shelton will attend the open house. He will be speaking at 2:45 pm.
Location: UA Visitor Center - 881 N. Euclid Ave.
Visitor Center Website
Heather D. Lukach

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Fall 2007 Conservation Biology course presents....

A Creativity Project Exhibit

a student project display integrating artistic innovations with a goal to foster the education and communication of conservation issues

- poetry
- short stories
- children's books
- music
- art
- sculpture

and more...

Thursday, November 29, 2007

Forbes lobby
2-3 pm

7

2003

8

2003

9

2004

Bob's Reflection Pool

Ryan M. sings the Blues

2004

Reserve Design Considerations

The Conservation of Habitat and Landscape

Multiple Use

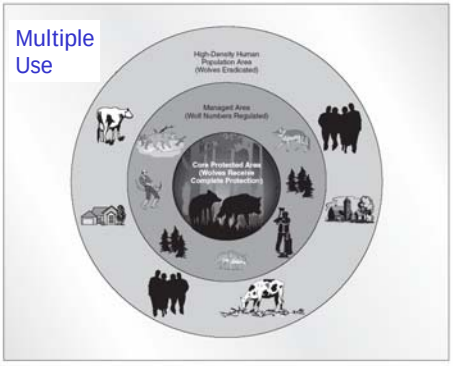

Figure 10.10
"Creation management" for wolves or other large, mobile predators. In a core protected area with low human densities and minimal human impacts, wolves receive complete protection. In a surrounding area (management area), wolf numbers are regulated and individual wolves that kill livestock or pets are destroyed. In surrounding areas of high human population densities and impacts, wolves are killed if they enter the area. *Based on a concept described by Mech (1995).*

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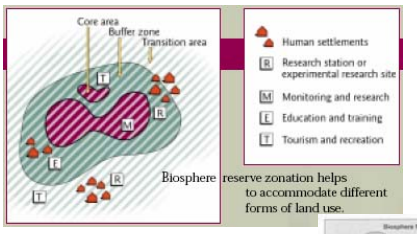
Van Dyke 2003



Biosphere reserves
(core, buffer, transition)
- Research and Monitoring
- Conservation
- Local Development

Miller, 2003 Chapter 7

Figure 10.13
The northern spotted owl (*Strix occidentalis caurina*), a species that can be effectively preserved only with an ecosystem management approach to its obligate habitat, old-growth conifer forests.

Van Dyke 2003

Northern Spotted Owl

-Old Growth Forests

-Thomas Report 1990

-towards an Ecosystem Approach

Individual pairs
↓
Small isolated clusters of pairs
↓
Small clusters of pairs arranged in a habitat network (spatial structure)
↓
Large clusters of pairs connected by landscape habitat corridors (spatial structure with connectivity)

African Southern White Rhinoceros
Ceratotherium simum simum
<200 in 1900
>11,000 today (and growing)
habitat loss, poaching ($)
CITES Appendix I

Look Ma,
No Horns!?

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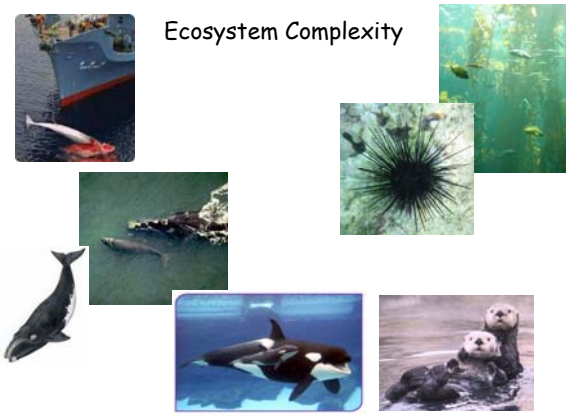

Ecosystem Complexity

Ecosystem Management
Ch10 Van Dyke text

"...land management system that seeks protect viable populations of all native species, perpetuates natural disturbance regimes on the regional scale, adopts a planning timeline of centuries, and allows human use at levels that do not result in long-term ecological degradation"

Ecosystem:
-energy and nutrient processing system with physical structure and function that circulates matter and energy.

Definitions are debatable...

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Table 10.1 Some Definitions of Ecosystem Management from U.S. Federal Agencies

AGENCY	DEFINITION
Department of Agriculture	The integration of ecological principles and social factors to manage ecosystems to safeguard ecological sustainability, biodiversity, and productivity.
Department of Commerce, National Oceanic and Atmospheric Administration	Activities that seek to restore and maintain the health, integrity, and functional values of natural ecosystems that are the cornerstone of productive, sustainable economies.
Department of Defense	The identification of target areas, including Department of Defense lands, and the implementation of a "holistic approach" instead of a "species-by-species approach" in order to enhance biodiversity.
Department of Energy	A consensual process based on the best available science that specifically includes human interactions and management and uses natural instead of political boundaries in order to restore and enhance environmental quality.
Department of the Interior: Bureau of Land Management	The integration of ecological, economic, and social principles to manage biological and physical systems in a manner safeguarding the long-term ecological sustainability, natural diversity, and productivity of the landscape.
Fish and Wildlife Service	Protection or restoration of the function, structure, and species composition of an ecosystem, recognizing that all components are interrelated.
National Park Service	A philosophical approach that respects all living things and seeks to sustain natural processes and the dignity of all species and to ensure that common interests flourish.
U.S. Geological Survey	Ecosystem management to emphasize natural boundaries, such as watersheds, biological communities, and physiographic provinces, and bases management decisions on an integrated scientific understanding of the entire ecosystem.
Environmental Protection Agency	To maintain overall ecological integrity of the environment while ensuring that ecosystem outputs meet human needs on a sustainable level.
National Science Foundation	An integrative approach to the maintenance of land and water resources as functional habitat for an array of organisms and the provision of goods and services to society.

Compiled from U.S. Congressional Research Service 1994.

...production

DOD!

DOE!

NPS - ????

Sustainable?

Van Dyke 2003

Ecosystem Management (Ch10 Van Dyke text)

Why?
-erosion, pollution, waste disposal, sedimentation
-small or uncharismatic species, recreation, intrinsic value
-single species approach very expensive
(SDCP model)

-driven by CAPACITY to deliver goods, services, functions; NOT Demand for them
(forest as an ecosystem, not just a tree farm)

-management experimental and adaptive (SDCP)
-monitoring

-cooperation, stakeholders

"Managers recognize the need for human communities to utilize some ecosystem resources" (VanDyke p.272)

-Define "some"
-Where do we draw the line?
-Human population increase?

Unit of ecosystem management?
-watershed?
-make sure include important components
(Everglades and Lake Okeechobee)

Ecosystem Processes: Necessary vs. Sufficient
-Hawaii missing 90% native vertebrates
-fire, water, herbivory, predation

Organ Pipe Cactus National Monument
Pinacate Biosphere Reserve
Gulf of California Biosphere Reserve

Organ Pipe Cactus National Monument
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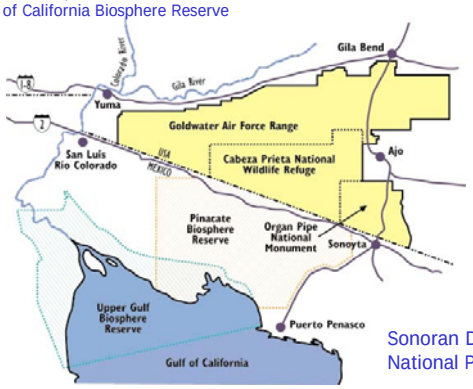


Sonoran Desert National Park?

Pleistocene I

Weapons shed new light on '1st Americans'

azDailyStar_23Feb2007

Barely Extinct Mammals of the SW

- If you go to Southern Africa you will find many habitats like South Western US and Mexico:
- Deserts, grasslands, woodlands, tropical dry forests with many species of plants that look similar to ours.
- But you will also see elephants, lions, rhinos, zebras, and many deer and antelope.

(Thanks to Larry Venable via Kathy Gerst)



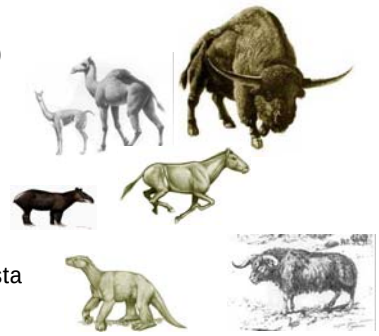
Barely Extinct Mammals of the SW

- North America was like that until only 12,000 years ago.
- Our pronghorns probably run so fast because they evolved alongside the American Cheetah.
- Horses and camels evolved in America before moving to the old world.
- We got ripped-off (by our Clovis hunter predecessors)!



Barely Extinct Mammals of the SW

- *Bison latifrons* (longhorn bison)
- *Camelops*
- *Hemiauchenia*
- Horse
- *Euceratherium* (shrub ox)
- *Nothrotheriops shastensis* (Shasta ground sloth)
- *Tapirus* (tapir)



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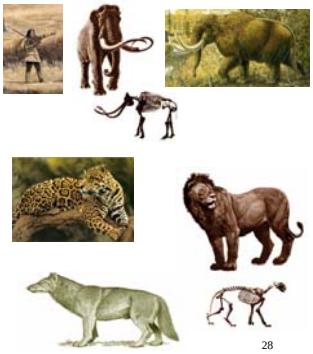
Barely Extinct Mammals of the SW

- *Mammuthus columbi* (Mammoth)
- *Mammut* (Mastodon)
- *Panthera* (jaguar)
- *Panthera leo atrox* (American lion)
- *Canis dirus* (dire wolf)



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Re-wilding of North America

- <u>Start with non-threatening herbivores:</u>
- The 50-kg Bolson tortoise (*Gopherus flavomarginatus*) – still in Mexico
- Feral horses (*Equus caballus*) and asses (*E. asinus*), critically endangered Asian asses (*E. hemionus*) and Przewalski's horse (*E. przewalskii*).
- Bactrian camels (*Camelus bactrianus*), now on the verge of extinction in the Gobi desert.



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Re-wilding of North America

- <u>Then bring in the big guys on private property:</u>
- small numbers of African cheetahs (*Acinonyx jubatus*), Asian (*Elephas maximus*) and African (*Loxodonta africana*) elephants, and lions (*Panthera leo*).
- Eventually create 'ecological history parks', covering vast areas of economically depressed parts of the Great Plains.
- Perimeter fencing would limit the movements of otherwise free-roaming ungulates, elephants and large carnivores.
- (like parks in Africa)



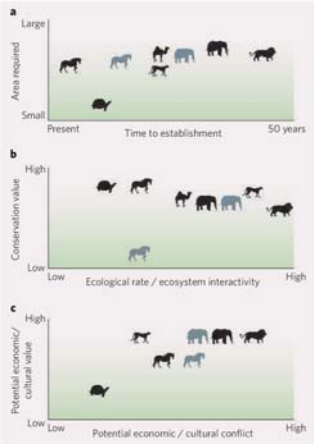

Figure 1 | Pleistocene re-wilding in North America. Symbols represent horses (*Equus caballus* and *E. asinus* in black; *E. przewalskii* and *E. hemionus* in grey), Bolson tortoises, camelids, cheetahs, Asian (grey) and African (black) elephants, and lions. **a**, The likely timescale and area required to restore proxies for extinct large vertebrates. **b**, Conservation value and ecological role (interactivity with other species) on the landscape. **c**, Potential economic/cultural value versus potential conflict.

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Pleistocene Rewilding: An Optimistic Agenda for Twenty-First Century Conservation

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ABSTRACT: Large vertebrates are strong interactors in food webs, yet they were lost from most ecosystems after the dispersal of modern humans from Africa and Eurasia. We call for restoration of missing ecological functions and evolutionary potential of lost North American megafauna using extant congeners and related taxa. We refer to this restoration as Pleistocene rewilding; it is conceived as carefully managed ecosystem manipulation whereby costs and benefits are objectively addressed on a case-by-case and feasible by-facility basis. Pleistocene rewilding would deliberately promote large, long-lived species over pest and weed assemblages, facilitate the persistence and ecological effectiveness of megafauna on a global scale, and broaden the marketing promise of conservation from managing extinction to encompass restoring ecological and evolutionary processes. Pleistocene rewilding can begin immediately with species such as Bolson tortoises and feral horses and continues through the coming decades with elephants and Holarctic lions. One example runs would contribute biological, economic, and cultural benefits to North America. The Great Plains of the United States and Canada and the Great Basin of the United States could be the first to implement this restoration. Risks of Pleistocene rewilding include the possibility of altered disease ecology and associated human health implications, as well as unexpected ecological and ecosystemic consequences of translocations. Establishment of programs to encode scales of species interactions and their consequences for biodiversity and ecosystem health will be a significant challenge. Socio-fencing would be a major economic cost, and social challenges will include acceptance of predation as an overriding natural process and the incorporation of pre-Columbian ecological frameworks into conservation strategies.

Keywords: conservation, ecological history, megafauna, predation, re-introduction, trophic rehabilitation.

Far more than any other species in the history of life on Earth, humans alter their environments by eliminating species and changing ecosystem function, thereby affecting the very future of evolution (Sala et al. 2000; Myers and Knoll 2001; Smith 2003; Thomas et al. 2004*a*, 2004*b*; Meyer 2004; Flannery 2006). We will surely continue to do so for the foreseeable future, either by default or by design (Wilson and Willis 1975; Western 2001). Earth is now nowhere pristine, in the sense of being substantially free from human influence, and indeed, most major land

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Pleistocene Rewilding

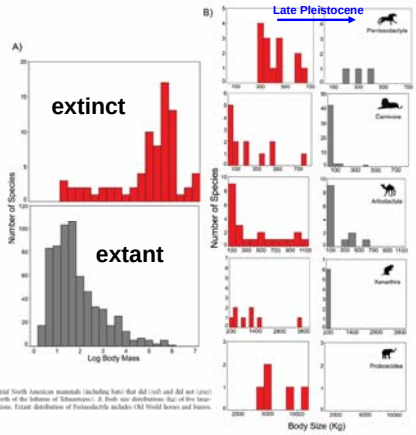

Figure 2: A, Body size distributions (log body mass) of terrestrial North American mammals (including bats) that did (red) and did not (gray) become extinct during the late Pleistocene (LP) extinctions (north of the Isthmus of Tehuantepec). B, Body size distributions (kg) of five large-bodied (>44 kg) taxonomic groups before and after LP extinctions. Extant distribution of Perissodactyla includes Old World horses and bantes. Modified from Lyons et al. 2004.

Table 1: Magnitude of biodiversity loss of North American megafauna (north of the Isthmus of Tehuantepec) and potential benefits and costs of Pleistocene rewilding

Order or family	LP	Current (T/E)	Proxy[a]	Ecological benefits	Ecological costs	Economic benefits	Economic costs	Ease of establishment	Popularity
Predators:									
Felidae	13	8 (3)	Cheetah	Predation[b]	?	Tourism	Fencing; livestock mortality[c]	++	+++
			Lion	Predation	?	Tourism; hunting	Human conflict	++	+++
Ursidae	6	3 (2)							
Canidae	9	8 (3)							
Herbivores:									
Xenarthra	14	6 (2)							
Bovidae	13	5 (2)							
Equidae	11	0	Equids	Seed dispersal; prey[d]	Potential overgrazing	Tourism	Fencing; compete with cattle	+++	++
Cervidae	10	6							
Antilocapridae	6	1							
Proboscidea	5	0	Elephants	Heterogeneity; seed dispersal[e]	Density- and scale-dependent effects	Tourism; hunting	Fencing	+	+++
Camelidae	4	0	Camels	Heterogeneity; seed dispersal[f]	Potential overbrowsing	Meat, fiber production	Fencing	+++	++
Tapiridae	4	1							
Tayassuidae	3	1							
Hydrochoeridae	2	0							
Castoridae	2	1							
Testudinidae	4	0	Bolson tortoise	Heterogeneity[g]	None/slight	Tourism	None	+++	+
Total	106	40 (10)							

Note: The table displays Late Pleistocene (LP) and current diversity of continental, large-bodied North American mammalian orders and families and some potential species proxies. The "Current" column excludes insular taxa. Extant species in each taxon are significantly biased toward smaller body size (Lyons et al. 2004). T/E = threatened or endangered, listed by United States Endangered Species Act or in the International Union for Conservation of Nature and Natural Resources 2001 Red List category "Near Threatened" (or equivalent 1994 categories "LR-cd" or "LR-nt"). A plus sign represents an increase in respective qualitative category.

[a] Potential proxies. Camel: *Camelus dromedarius, Camelus ferus, Lama guanicoe, Vicugna vicugna*; equid: *Equus caballus, Equus przewalskii, Equus hemionus*; cheetah: *Acinonyx jubatus*; lion: *Panthera leo*; elephant: *Elephas maximus, Loxodonta africana*; Bolson tortoise: *Gopherus flavomarginatus*.

[b] Predation on mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) would be limited latitudinally by climate.

[c] Work in Namibia has demonstrated coexistence with ranchers and cheetah through education and alternative pastoral practices (Marker et al. 2003*b*).

[d] Janzen and Martin 1982; Berger 1986; Barlow 2000.

[e] Janzen and Martin 1982; Barlow 2000; Whyte et al. 2003; Western and Maitumo 2004.

[f] Barlow 2000; Hare 2001.

[g] Kacoze and Hartnett 1990.

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(Pleistocene) Re-wilding of North America

Donlan et al. 2005, Nature, 436:913-914.

1. What happened about 13k yrs ago in N. America?
2. Are there really no apparent costs to restoring Bolson's tortoise?
3. How do you predict African cheetahs and US mountain lions would interact?
4. Is this paper about "playing God"?
   Are we a natural force in the evolution of life on this planet?
5. Do we have an ethical obligation to restore?
   What do we restore to?

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