

Lecture 21, 30 Oct 2007
Conservation Practice

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

Kevin Bonine
Cathy Hulshof

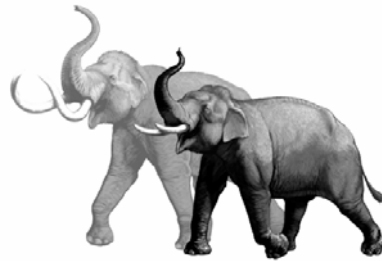


Figure 1: Could the Asian elephant (right) serve as an ecological proxy for North American mammoths (left) in an effort to restore megaherbivore function to North America? Illustration by Coll Bull.

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.

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

San Miguel Watershed
Colorado, United States

Major Habitat Type:
Temperate Coniferous Forests

Ecoregions: Southern Rocky Mountains and Colorado Plateau

Targets: Riparian vegetation and shrublands

Threats: Invasive species, hydrologic alteration

Strategy: Restore riparian habitat by eradicating invasive plants

Partners: local ranchers, federal, state and local government agencies, Terra Foundation

Major Habitat Types of North America

major habitat type:
A grouping of ecoregions with the same dominant ecosystems. Major habitat types reflect the broadest ecological patterns of biological organization and diversity on Earth.

The Nature Conservancy
Protecting nature. Preserving life.™

Temperate Grassland Ecoregions of North America

ecoregion:
A large area of land or water that contains a geographically distinct assemblage of ecosystems and natural communities, and is differentiated by climate, subsurface geology, physiography, hydrology, soils and vegetation.

Orange Plains/Flint Hills Prairie Ecoregion

conservation project:
A set of strategies and actions undertaken by the Conservancy and/or an organized group of partners to achieve an agreed-upon conservation result. Guided by global and ecoregional priorities, The Nature Conservancy establishes projects at multiple scales to develop and implement conservation strategies.

Tallgrass prairie and American bison are conservation targets in the Flint Hills landscape. Prescribed fire is one of several strategies used to maintain the prairie's ecological integrity.

Multiple Use

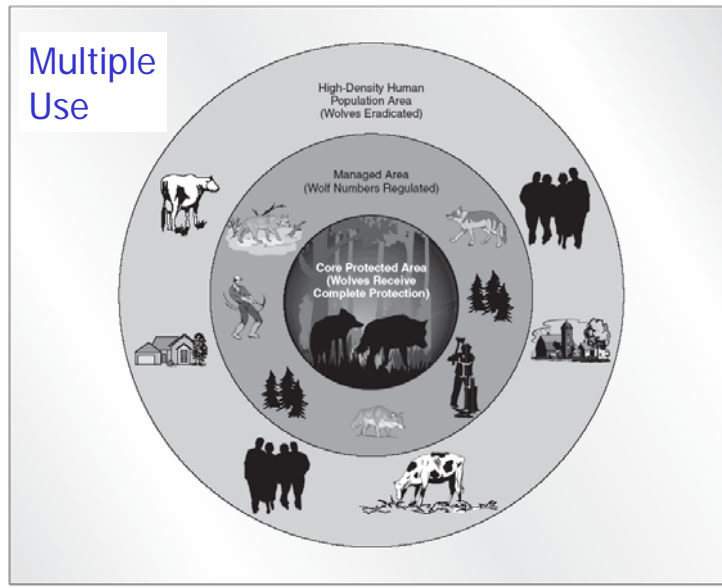
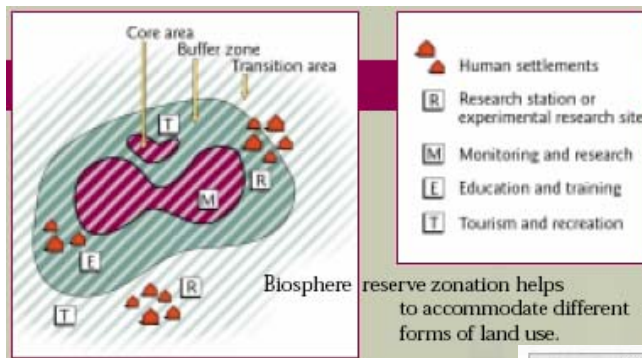


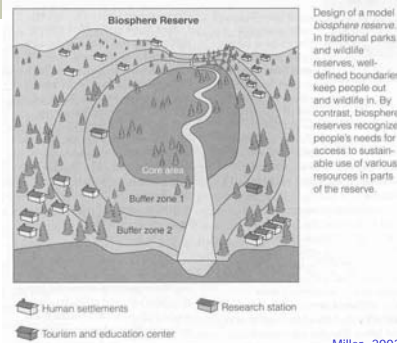
Figure 10.10
 "Zonation management" for wolves or other large, mobile predators. In a core protected area with low human densities and minimal human impacts, wolves receive complete protection. In a surrounding area (management area), wolf numbers are regulated and individual wolves that kill livestock 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 Meach (1995). 13

Van Dyke 2003



Biosphere reserve zonation helps to accommodate different forms of land use.

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



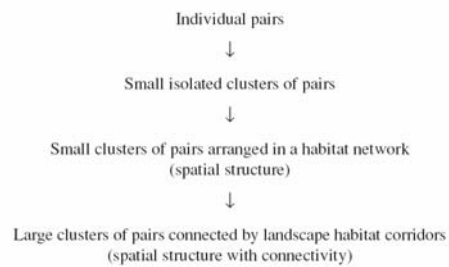
Miller, 2003
 Chapter 7



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

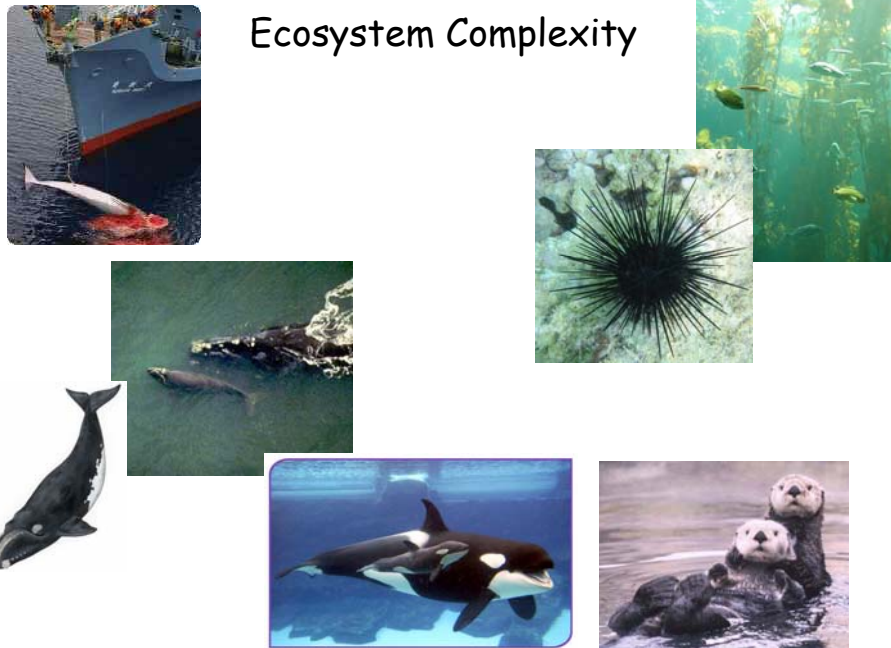


African Southern White Rhinoceros
Ceratotherium simum simum
 <200 in 1900
 >11,000 today (and growing)
 habitat loss, poaching (\$)
 CITES Appendix I



Look Ma,
 No Horns!?

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.

...production

DOD!

DOE!

NPS - ????

Sustainable?

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Compiled from U.S. Congressional Research Service 1994.

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

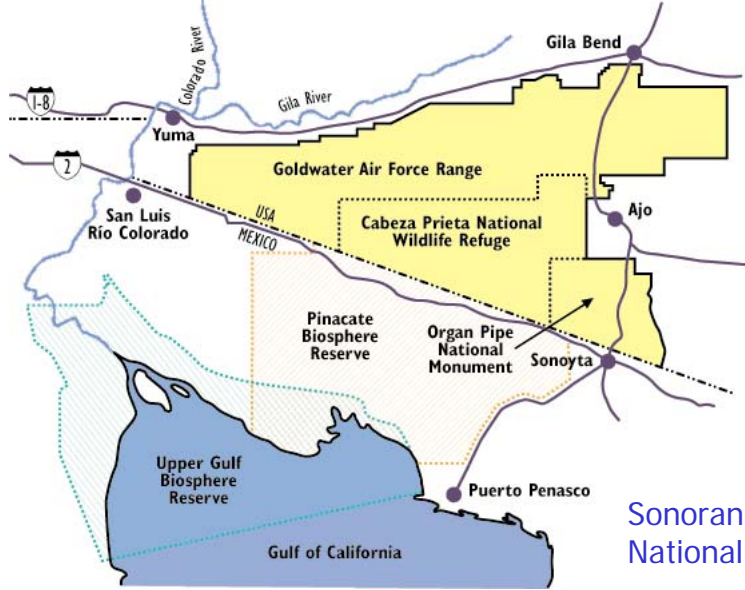
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Organ Pipe Cactus National Monument
Pinacate Biosphere Reserve
Gulf of California Biosphere Reserve



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



Sonoran Desert
 National Park?

Pleistocene I

Weapons shed new light on '1st Americans'

SCRIPPS HOWARD NEWS SERVICE

The people who for decades have been presumed to be the first inhabitants of the New World probably were not, according to a new study dating tools to a more recent age about 12,000 years ago.

Clovis points, the distinctive stone spear points chipped out by what has come to be known as the Clovis culture, were among the most efficient big-game killers of the Stone Age.

Fluted at the bottom so they would break off a spear shaft and remain embedded in prey, they allowed the multiple hits needed to bring down a mammoth or the other large animals that roamed the landscape at the end of the last ice age.

Since the signature spearhead was found in Clovis, N.M., in 1933, tens of thousands have been discovered in all 48 contiguous states, as well as across Central America.

But only a handful of those sites have been reliably dated using the radioactive decay of carbon from plant and animal remains found with the points, and many of those were done

CENTER FOR STUDY OF THE FIRST AMERICANS, TEXAS A&M VIA SCRIPPS HOWARD

Clovis points from throughout North America all display the distinctive shapes that made them so effective at killing big game. Those who made them were likely not the first Americans, it now seems.

decades ago.

A team led by Michael Waters, director of the Center for the Study of the First Americans at Texas A&M University; and Thomas Stafford, of Stafford Research Laboratories in Lafayette, Colo., sought to recalibrate the timing of the Clovis culture using modern radiocarbon dating. Their report was published today in the *Journal Science*.

"It was always argued that Clovis represented the first people who came to the Ameri-

cas," Waters said. "The new dating that we did indicates that the Clovis Complex ranges from 11,000 to 10,900 radiocarbon years before the present," or about 13,300 to 12,800 calendar years ago.

Having a more solid timeline for Clovis is important, because in the past few decades archaeologists have turned up evidence that humans were in the New World as early as 18,000 to 20,000 years ago at sites as far-flung as Virginia, Washington and Chile.

azDailyStar_23Feb2007

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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)



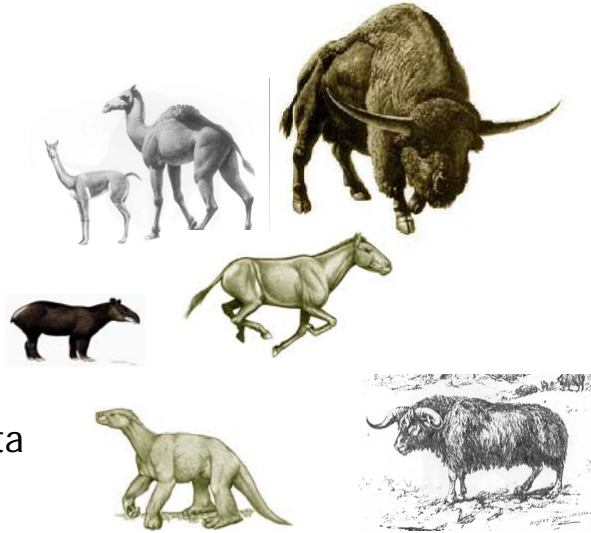
Barely Extinct Mammals of the SW

- 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

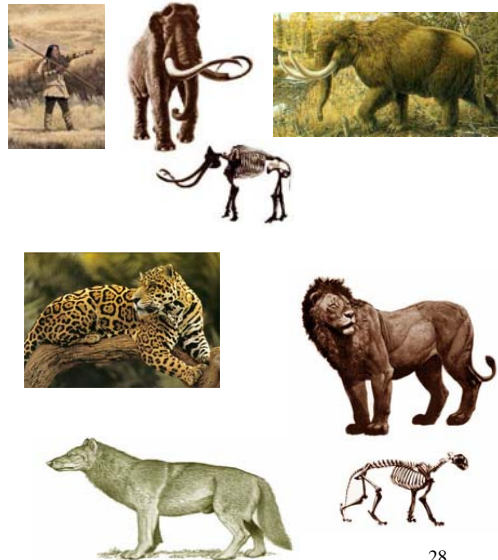
- *Bison latifrons*
(longhorn bison)
- *Camelops*
- *Hemiauchenia*
- Horse
- *Euceratherium*
(shrub ox)
- *Nothrotheriops shastensis* (Shasta ground sloth)
- *Tapirus* (tapir)



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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

- Start with non-threatening herbivores:

- 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

- Then bring in the big guys on private property:
- 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)



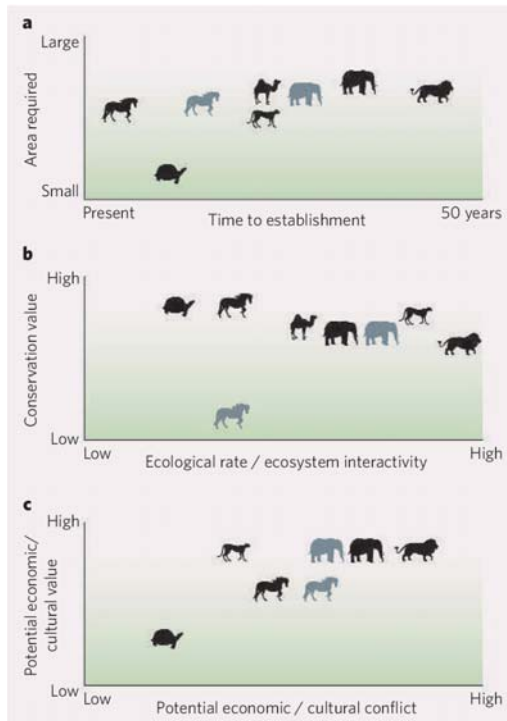


Figure 1 Pleistocene re-wilding in North America. Symbols represent horses (*Equus caballus* and *E. asinus* in black; *E. przewalskii* and *E. hemionus* in grey), Bolson tortoises, camels, cheetahs, Asian (grey) and African (black) elephants, and lions. **a**, The likely timescale and area required 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

C. Josh Donlan,^{1,2} Joel Berger,^{3,4} Carl E. Bock,^{5,6} Jane H. Bock,^{5,6} David A. Burney,^{4,5} James A. Estes,^{4,5} Dave Foreman,^{7,8} Paul S. Martin,^{9,10} Gary W. Roemer,^{4,5} Felisa A. Smith,¹⁰ Michael E. Soulé,^{10,11} and Harry W. Greene¹²

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- Submitted November 2, 2005; Accepted June 6, 2006; Electronically published September 25, 2006

species over past and weed assemblages, facilitate the persistence and ecological effectiveness of megafauna on a global scale, and broaden the underlying premise 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 continue through the coming decades with elephants and felid lions. Our example taxa would contribute biological, economic, and cultural benefits to North America. Owners of large tracts of private land in the central and western United States could be the first to implement this restoration. Tasks of Pleistocene rewilding include the possibility of altered faunal ecology and associated human health implications, as well as unexpected ecological and sociopolitical consequences of reintroductions. Establishment of programs to monitor status of species interactions and their consequences for biodiversity and ecosystem health will be a significant challenge. Success among 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: carnivores, ecological history, megafauna, predation, re-introduction, taxon substitution.

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 a carefully managed ecosystem manipulation whereby costs and benefits are objectively addressed on a case-by-case and locality-by-locality basis. Pleistocene rewilding would deliberately promote large, long-lived

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. 2004a, 2004b; 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 pricier, in the sense of being substantially free from human influence, and indeed, most major land

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Pleistocene Rewilding

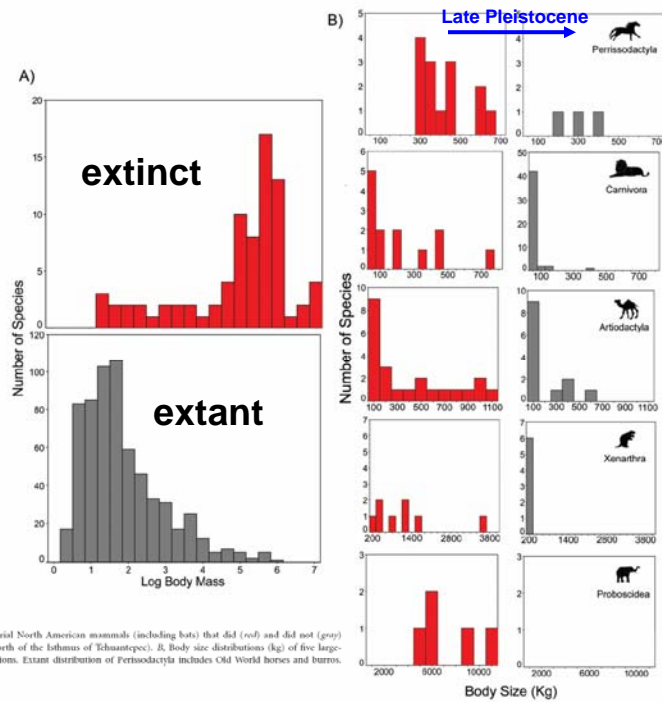


Figure 2. A, Body size distributions (log body mass) of terrestrial North American mammals (including bats) that did (red) and did not (grey) become extinct during the late Pleistocene (LP) extinctions (north of the Isthmus of Tehuantepec). B, Body size distributions (kg) of five large-bodied (>44 kg) taxonomic groups before and after LP extinctions. Extant distribution of Perissodactyla includes Old World horses and burros. 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*	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-nt" or "LR-nt"). A plus sign represents an increase in respective qualitative category.

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

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

^c Work in Namibia has demonstrated coexistence with ranchers and cheetahs through education and alternative pastoral practices (Marker et al. 2003b).

^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 Kaczor and Hartnett 1990.

(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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