Lecture 03, 29 Aug 2006
Ch1 & Noss 1999

Conservation Biology
ECOL 406R/506R
University of Arizona
Fall 2006

Kevin Bonine
Kathy Gerst

1. What is Con Bio?
-origins

Ch3 and Callicott reading for Thursday

1

Housekeeping, 29 August 2006

If not in lecture last week, please see us after class.

Upcoming Readings

today: Textbook, chapter 1; Noss 1999
Thurs 31 Aug: Textbook chapter 3; Callicott 1997
Tues 05 Sept: Textbook Ch. 3, Leopold readings

Short oral presentations
29 Aug Kevin Gilliam and Whitney Henderson
31 Aug open
05 Sept open

2

Global Climate Change Lecture Series

All lectures will take place at UA Centennial Hall.

All lectures begin at 7pm and are free to the public. Call 520.621.4090 for more information.

Tuesday, October 17
Global Climate Change: The Evidence
Malcolm Hughes, Professor of Dendrochronology

http://cos.arizona.edu/climate/

Tuesday, October 24
Global Climate Change: What's Ahead
Jonathan Overpeck, Director of the Institute for the Study of Planet Earth and Professor of Geosciences

Tuesday, October 31
Global Climate Change: The Role of Living Things
Travis Huxman, Assistant Professor of Ecology and Evolutionary Biology

Tuesday, November 7
Global Climate Change: Ocean Impacts and Feedbacks
Julia Cole, Associate Professor of Geosciences

Tuesday, November 14
Global Climate Change: Disease and Society
Andrew Comrie, Dean of the Graduate College and Professor of Geography and Regional Development

Tuesday, November 21
Global Climate Change: Could Geoengineering Reverse It?
Roger Angel, Regents' Professor of Astronomy

Tuesday, November 28
Global Climate Change: Designing Policy Responses
Paul Portney, Dean of the Eller College of Management and Professor of Economics

3

Sky Island Alliance Wilderness Celebration Weekend
Chiricahua Mountains Wilderness September 1st - 4th
Join the Sky Island Alliance in the magnificent Chiricahuas

We are celebrating the 42nd Anniversary of the Wilderness Act

With the signing of the Wilderness Act by President Lyndon B. Johnson on September 3, 1964, the National Wilderness Preservation System was established to *"...secure for the American people of present and future generations the benefits of an enduring resource of wilderness.* "

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Please contact Trevor Hare with RSVPs and questions! trevor@skyislandalliance.org or 520 624-708 x204

Quiz:

What were the four questions that the Noss (1999) paper attempts to address?

1) are there any robust principles of conservation biology? 2) Is advocacy an appropriate activity of conservation biologists? 3) Are we educating conservation biologists properly? 4) Is conservation biology distinct from other biological and resource management disciplines?

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Kevin Gilliam and Whitney Henderson …

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Nevertheless, conservation biologists increasingly recognize that the proximate and ultimate threats to biodiversity virtually all have to do with humans.

Noss 1999, p. 118

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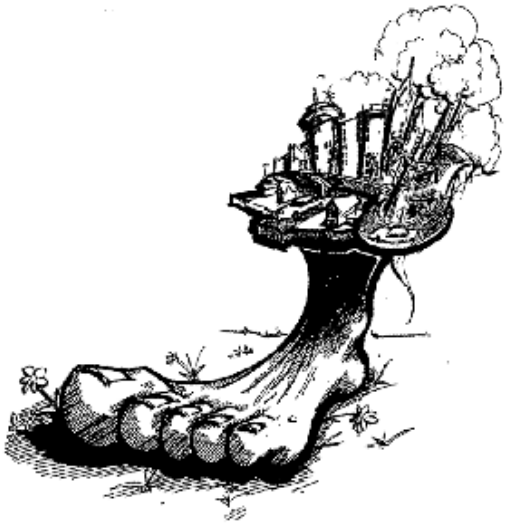

8

Develop**ed** Countries
1.2 billion people (~19%)
high average per capita purchasing power
have 85% world's wealth
use 88% natural resources
generate 75% waste and pollution

I = P A T

Environmental Impact = Population x Affluence x Technology

(of a society) (consumption)

Develop**ing** Countries
81% of the people
have 15% world's wealth
use 12% world's natural resources
produce 25% waste and pollution

Poor parents in a developing country need to have 70-200 children to equal the impact of 2 U.S. children

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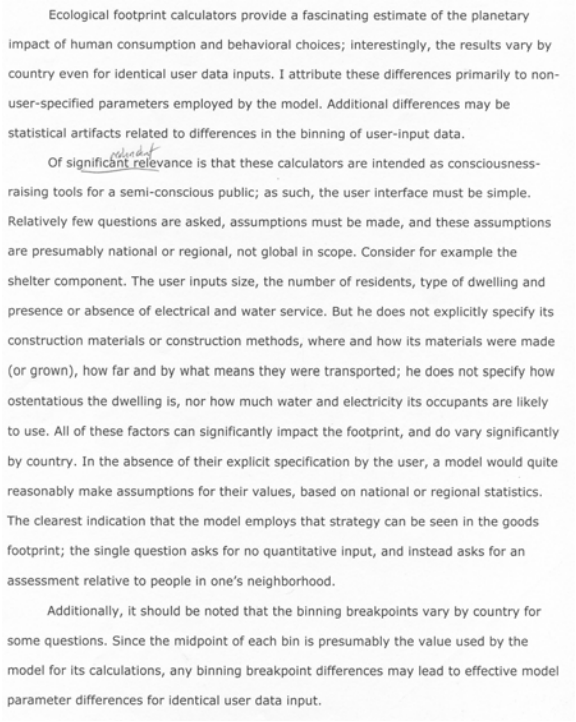
Writing Assignments



Ecological footprint calculators provide a fascinating estimate of the planetary impact of human consumption and behavioral choices; interestingly, the results vary by country even for identical user data inputs. I attribute these differences primarily to non-user-specified parameters employed by the model. Additional differences may be statistical artifacts related to differences in the binning of user-input data.

Of significant relevance is that these calculators are intended as consciousness-raising tools for a semi-conscious public; as such, the user interface must be simple. Relatively few questions are asked, assumptions must be made, and these assumptions are presumably national or regional, not global in scope. Consider for example the shelter component. The user inputs size, the number of residents, type of dwelling and presence or absence of electrical and water service. But he does not explicitly specify its construction materials or construction methods, where and how its materials were made (or grown), how far and by what means they were transported; he does not specify how ostentatious the dwelling is, nor how much water and electricity its occupants are likely to use. All of these factors can significantly impact the footprint, and do vary significantly by country. In the absence of their explicit specification by the user, a model would quite reasonably make assumptions for their values, based on national or regional statistics. The clearest indication that the model employs that strategy can be seen in the goods footprint; the single question asks for no quantitative input, and instead asks for an assessment relative to people in one's neighborhood.

Additionally, it should be noted that the binning breakpoints vary by country for some questions. Since the midpoint of each bin is presumably the value used by the model for its calculations, any binning breakpoint differences may lead to effective model parameter differences for identical user data input.

~Romantic-Transcendentalist Ethic:

Ralph Waldo Emerson
Henry David Thoreau
John Muir
- -Sierra Club 1892
- -NGO
- -Education, Lobby, Law/Politics

Yellowstone National Park 1872
Yosemite National Park 1890

ESA 1917 --> Nature Conservancy 1950

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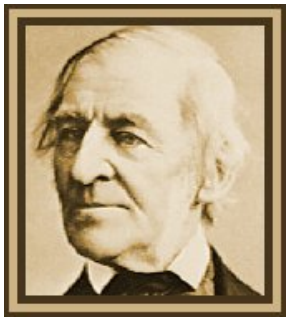

Ralph Waldo Emerson
1803-1882

A Successful life

"To laugh often and much; to win the respect of intelligent people and the affection of children; to earn the appreciation of honest critics and endure the betrayal of false friends; to appreciate beauty; to find the best in others; to leave the world a bit better, whether by a healthy child, a garden patch, or a redeemed social condition; to know even one life has breathed easier because you have lived."
- Ralph Waldo Emerson -

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Henry David Thoreau (1817-1862)

"Many go fishing all their lives without knowing that it is not fish they are after."

"Beware of all enterprises that require new clothes. "

"It is not worthwhile to go around the world to count the cats in Zanzibar. "

"Wherever a man goes, men will pursue him and paw him with their dirty institutions, and, if they can, constrain him to belong to their desperate oddfellow society. "

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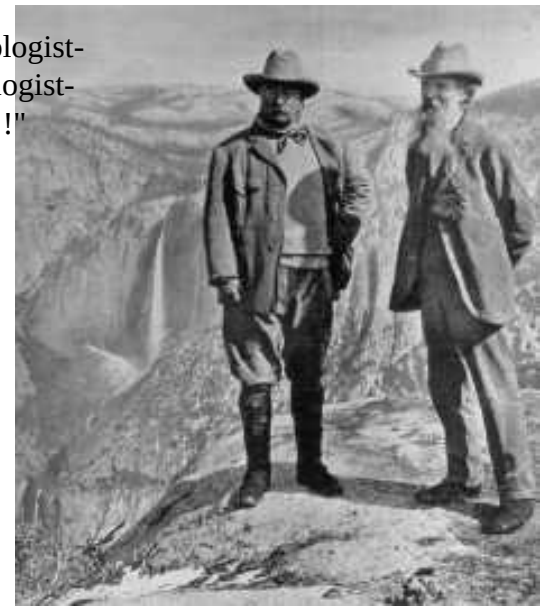
"poetico-trampo-geologist-botanist and ornithologist-naturalist etc. etc. !!!!"

John Muir (1838-1914)



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Teddy Roosevelt
(president 1901-1909)

~resource conservation ethic:

Figure 1.3 VanDyke 2003
Theodore Roosevelt, the twenty-sixth president of the United States (1901–1909), greatly supported the role of the federal government in conservation.

"To Roosevelt, it was clear that a handful of individuals and their companies were reaping most of the profits from natural resources that rightfully belonged to all citizens." Van Dyke 2003, p. 10

early 1900s "Trustbuster"

Resources for use, but forever.

National Wildlife Refuge System (52 designations by TR)

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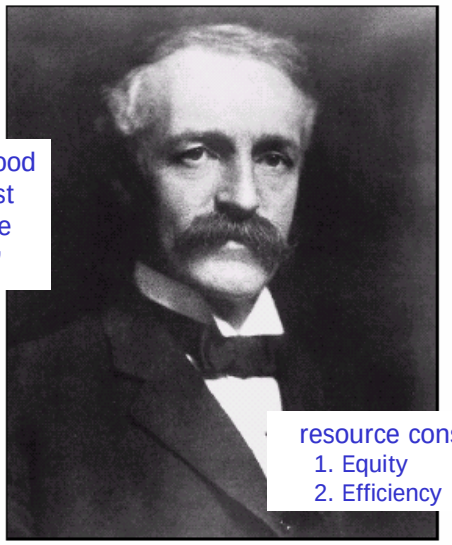
"The greatest good for the greatest number for the longest time"



Gifford Pinchot

resource conservation ethic:
1. Equity
2. Efficiency

Figure 1.4 VanDyke 2003
Gifford Pinchot, early head of the U.S. Forest Service and father of the resource conservation ethic. From an original staff of only 123 in 1898, Pinchot built the Forest Service to an organization of 1,500 people administering 150 million acres of public land within 10 years.

17

Sustainable Use
Maximum Sustained Yield

USE those resources!

18

Modern Conservation Biology
National Parks
U.S.

Transferable?

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Figure 1.5 Van Dyke 2003
Aldo Leopold, early twentieth-century conservationist and father of the modern land ethic.

Aldo Leopold

Game Management 1932

A Sand County Almanac (1966)
-evolution/ecology land ethic

Land Health and the A-B Cleavage

Commodities (A)
vs. Processes (B)

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Rachel Carson
Silent Spring 1962

-Bioaccumulation

-Levels and scale

-Environmental degradation threaten human health

-Increased Public Awareness

Figure 1.6 Van Dyke 2003
Rachel Carson, U.S. Fish and Wildlife Service biologist and author of *Silent Spring* (1962), a seminal book in the modern environmental movement.

The Science behind the Story

Pesticides and Child Development in Mexico's Yaqui Valley

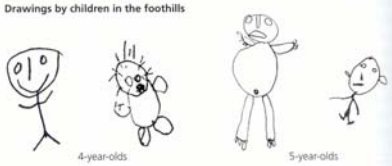
With spindly arms and big round eyes, one set of pictures shows the sorts of stick figures drawn by young children everywhere. Next to them is another group of drawings, mostly disconnected squiggles and lines, resembling nothing. Both sets of pictures are intended to depict people. The main difference identified between the two groups of young artists: long-term pesticide exposure.

Children's drawings are not a typical tool of toxicology, but Elizabeth Guillette, an anthropologist, wanted to try new methods. Guillette was interested in the effects of pesticides on children. She devised tests to measure childhood development based on techniques from anthropology and medicine. Searching for a study site, Guillette found the Yaqui Valley region of northwestern Mexico.

The Yaqui Valley is farming country, worked for generations by the indigenous group that gives the region its name. Synthetic pesticides arrived in the area in the 1940s. Some Yaqui embraced the agricultural innovations, spraying their farms in the valley to increase their yields. Yaqui farmers in the surrounding foothills, however, generally chose to bypass the chemicals and to continue following more traditional farming practices. Although differing in farming techniques, Yaqui in the valley and foothills continued to share the same culture, diet, education system, income levels, and family structure.

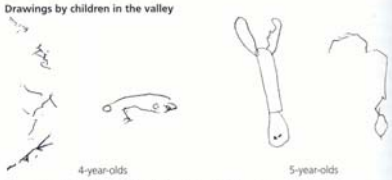
At the time of the study, in 1994, valley farmers planted crops twice a year, applying pesticides up to 45 times from planting to harvest. A previous study conducted in the valley in 1990, focusing on areas with the largest farms, had indicated high levels of multiple pesti-

Drawings by children in the foothills



4-year-olds 5-year-olds

Drawings by children in the valley



4-year-olds 5-year-olds

Elizabeth Guillette's study in Mexico's Yaqui Valley offers a startling example of apparent neurological effects of pesticide poisoning. Young children from foothills areas where pesticides were not commonly used drew recognizable figures of people. Children the same age from valley areas where pesticides were used heavily in industrialized agriculture could draw only scribbles when asked to draw people. Adapted from Elizabeth A. Guillette, et al., *Environmental Health Perspectives*, 1998.

Brennan and Withgott 2005

Table 2.1 Ecosystem Services and Functions

Ecosystem service*	Examples
Gas regulation	Carbon dioxide/oxygen balance, ozone for protection against ultraviolet light
Climate regulation	Greenhouse gas regulation, dimethyl sulphide production affecting cloud formation
Disturbance regulation	Storm protection, flood control, drought recovery, and other aspects controlled by vegetation structure
Water regulation	Provisioning of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation
Water supply	Provisioning of water by watersheds, reservoirs, and aquifers
Erosion control and sediment retention	Prevention of loss of soil by wind, runoff, or other removal processes; storage of silt in lakes and wetlands
Soil formation	Weathering of rock and the accumulation of organic material
Nutrient cycling	Nitrogen fixation, nitrogen, phosphorus, and other elemental or nutrient cycles
Waste treatment	Waste treatment, pollution control, detoxification
Pollination	Provisioning of pollinators for the reproduction of plant populations
Biological control	Keystone predator control of prey species; reduction of herbivory by top predators
Refugia	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds
Food production	Production of fish, game, crops, nuts, and fruits by hunting, gathering, subsistence farming, or fishing
Raw materials	The production of lumber, fuel, or fodder
Genetic resources	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants)
Recreation	Ecotourism, sport fishing, and other outdoor recreational activities
Cultural	Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems

*Ecosystem "goods" included in ecosystem services.
Source: Adapted with permission from Robert Costanza et al., "The value of the world's ecosystem services and natural capital," *Nature*, May 1997.

Brennan and Withgott 2005

Problems Addressed by Conservation Biologists:

1 Genetic Diversity
- variation, inbreeding, drift, hybridization

2 Species
- MVP, PVA
- small populations
- declining populations
- metapopulations

3 Habitat
- loss, fragmentation, isolation, heterogeneity

4 Ecosystem Processes
- scale

5 Human sustainability
- the crux

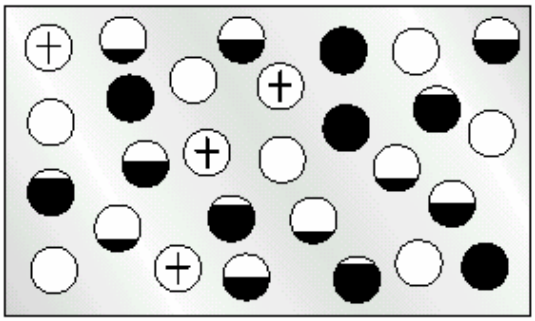


Figure 1.8
Diagrammatic representation of an arrangement of local populations ("metapopulation") based on Andrewartha and Birch (1954). Empty circles represent favorable habitats that individuals do not occupy. Partially or completely filled circles represent favorable habitats and relative densities of individuals in them as a proportion of the habitat's maximum capacity. Crosses indicate habitats in which local populations recently became extinct.

-Metapopulations

-Island Biogeography
MacArthur and
Wilson 1963

-Testable Hypotheses

-Thresholds

Van Dyke 2003

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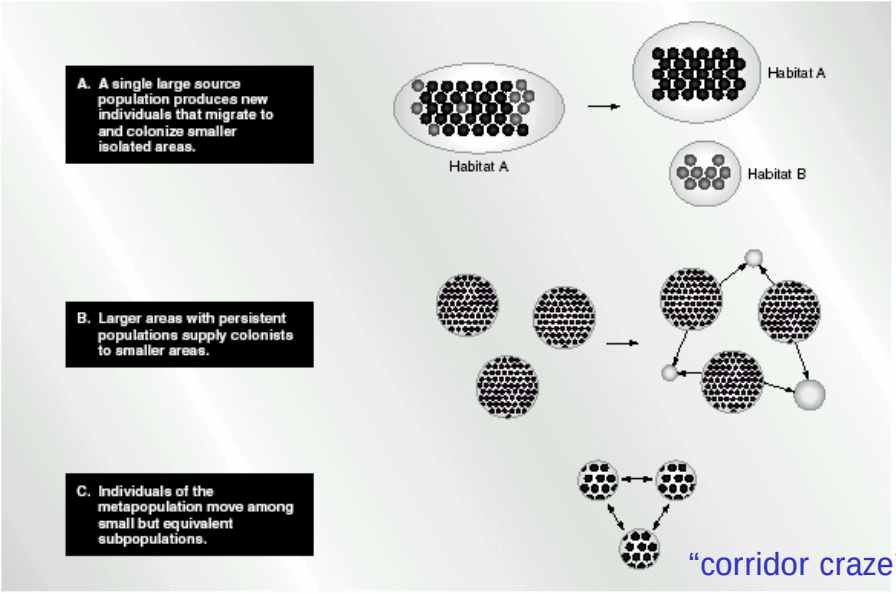

Figure 1.9 Van Dyke 2003
Three variations of the metapopulation concept. Although different in detail, all represent metapopulations as spatially distinct groups (subpopulations) that disperse to or among physically separated habitats.

Journal of Wildlife Management (1937)
Wildlife Society Bulletin

vs.

Conservation Biology
Biological Conservation

(movement from individual game species to large scale and generalized approaches)

Meffe and Carroll 1997

Figure 1.5 The first issue of the journal *Conservation Biology*, published in May 1987. (Photograph courtesy of E. P. Pister.)

Is conservation biology a distinct discipline?
-Biodiversity (levels and scales)
-Prevent degradation and loss

1. Scarcity and Abundance

2. Value laden and mission driven

3. Diversity and complexity good
   Untimely extinction bad

4. Evolution is good (genotypic variation)
   -process

5. Biotic diversity has intrinsic value

(see 8 traits in Van Dyke Ch1)

(~Soulé's normative postulates)

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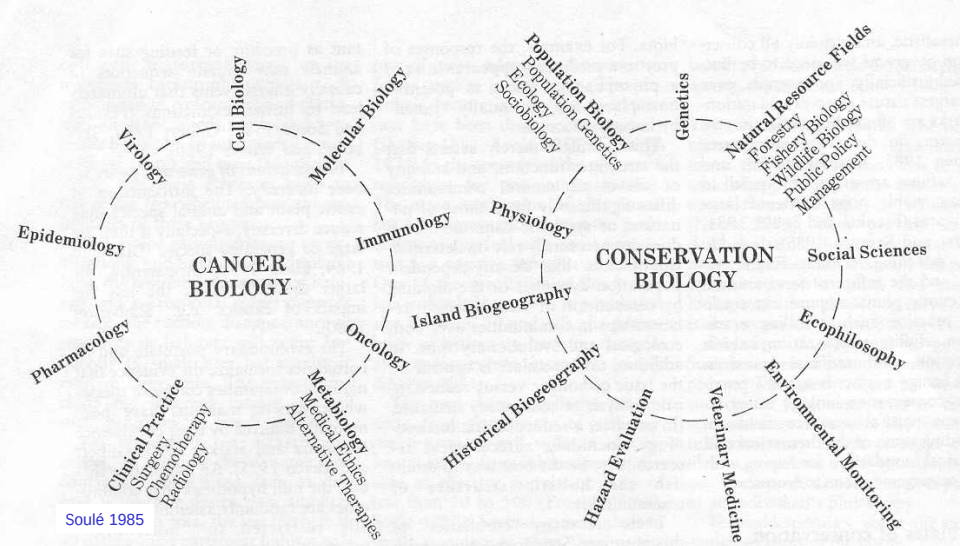

Soulé 1985

Figure 1. Cancer biology and conservation biology are both synthetic, multidisciplinary sciences. The dashed line indicates the artificial nature of the borders between disciplines and between "basic" and "applied" research. See text.

6. Crisis Discipline?

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"In crisis disciplines, one must act before knowing all the facts; crisis disciplines are thus a mixture of science and art, and their pursuit requires intuition as well as information" (Soulé 1985).

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Objectivity vs. Neutrality (Van Dyke p. 57)

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Noss 1999

Is there a special conservation biology?

Origins

Soulé et al. 1978+

SCB 1986

Conservation Biology 1987

Ideas

-Precautionary Principle

-Value Laden

-Species differences…

-Umbrella species

-Advocacy

Hutchinson 1948, as cited in Noss 1999

We should worry about global warming
as a result of altering geochemical cycles

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Pattern and Generality vs. Special Case

p. 116, Noss 1999

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Responsible Advocacy?

Ethical Advocacy?

p.117, Noss 1999:
tropical rainforest
vs.
economic development program

Is ConBio distinct discipline?

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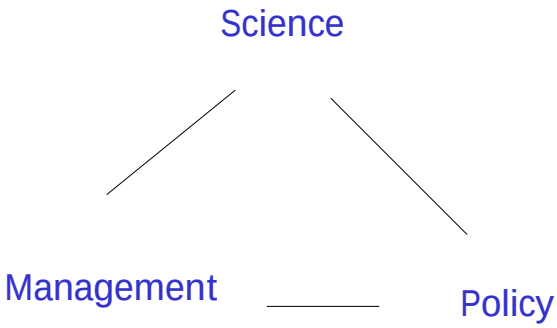

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