

Lecture 13, 04 October 2005

Conservation Biology  
 ECOL 406R/506R  
 University of Arizona  
 Fall 2005

Kevin Bonine  
 Kathy Gerst

Conservation Biology 406R/506R

1. Creativity Projects?
2. Hans-Werner Herrmann
3. Exam Discussion
4. Lab Friday, Mt. Lemmon 0700h, 07 Oct
5. Paradigms and Theories (Ch5)
6. Conservation Genetics (Ch6)

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	Indiv. Exam 75 max	Group Exam 20 max
Mean	64.46	15.67
Max	72.5	18.5
Min	46.5	13
S.D.	6.78	1.45

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Niobrara amber snail



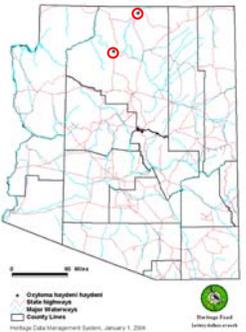
Kanab amber snail



“strange” non-continuous pattern, large gaps  
 sympatric populations in Arizona and Alberta?

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*Oxytoma haydeni haydeni* occurrences in Arizona



*Oxytoma haydeni kanabensis* occurrences in Arizona

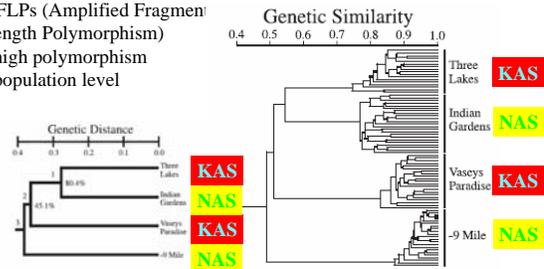


overall spotty distribution possibly related to habitat's permanently wet soil surface and/or shallow standing water (*Typha*)

**Molecular approaches**

Mark Miller et al., NAU

AFLPs (Amplified Fragment Length Polymorphism)  
 - high polymorphism  
 - population level



Three Lakes and Indian Gardens high level of genetic diversity,  
 Vaseys Paradise and -9 Mile low levels (floods and/or selfing)

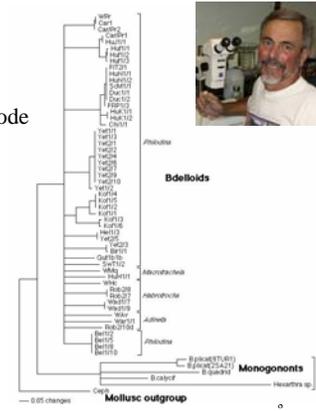
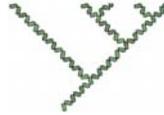


*Bdelloid Rotifer*

Bill Birky, EEB

Asexual "Species"

4Ne generations since node



**Kanab Amber Snail**

Brandt Child bought 500 acres of property in Utah in 1990, planning to build a campground and golf course near its three lakes. The next year, the U.S. Fish and Wildlife Service told him he couldn't use his property because the lakes were inhabited by 200,000 federally protected thumb-nail-sized Kanab amber snails. The snails differ from other snails only because of their golden color.

A few months later, Mr. Child discovered 10 domestic geese near his ponds. After dutifully notifying federal officials, he was told that if the geese had eaten any snails, he faced a fine of \$50,000 per snail. A state wildlife agent and a Highway Patrolman arrived with a shotgun intending to shoot the geese and remove their stomachs to find out if any snails had been eaten.

The only thing that saved the geese was a reporter with the Southern Utah News who showed up and told them that she would photograph the massacre. The agents then decided to back off and finally settled on forcing the geese to vomit. No dead snails were found.

The geese are now safe, but Mr. Child is still out \$2.5 million because he can't use his property, and the government refuses to compensate him for his loss.

*The Wall Street Journal* -- December 27, 1993

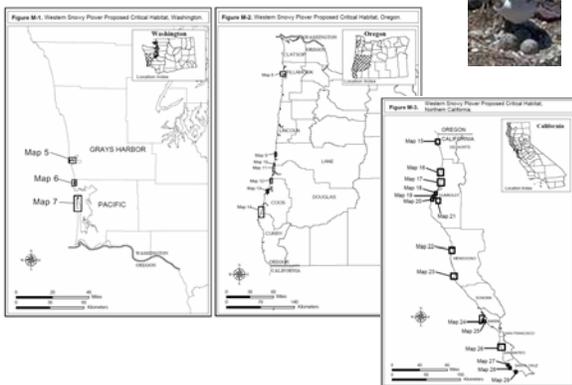
Pombo, Republican Congressman from CA

Critical Habitat?

Economic Hardship

VIS = very important snail

**western snowy plover**



The U.S. Fish and Wildlife Service has completed a final rule designating 32 units of critical habitat along the coast of California, Oregon, and Washington for the Pacific coast population of the western snowy plover, a Federally threatened species. The critical habitat units total 12,145 acres, nearly 40 per cent less acreage than an earlier critical habitat plan the Service adopted in 1999.

Of the designated units, 24 are in California (7,472 acres), five are in Oregon (2,147 acres), and three are in Washington (2,526 acres). Of the total acreage, 2,479 acres (20 percent) are on Federal lands; 6,474 acres (53 percent) are owned by states or local agencies; and 3,191 acres (26 percent) are private.

Compared to the 1999 plan, today's action designates more critical habitat units but generally smaller ones, based on increased knowledge of the species' needs and better mapping. This new rule designates 32 units covering 12,145 acres, compared to 28 units covering 19,474 acres in the 1999 plan.

The rule will take effect 30 days after publication.

Some 2,859 acres of proposed critical habitat in six units were deleted based on the projected cost of designating critical habitat. An economic analysis prepared by Industrial Economics Inc. projected that critical habitat could cost between \$273 million and \$645 million, with the biggest costs due to beach recreation losses. More than three-quarters of the loss was found to occur in five proposed California critical habitat units, located on Coronado's Silver Strand, Morro Bay, Pismo Beach, and two on Monterey Bay.

In addition, 615 acres were deleted because of management plans and commitments -- such as Habitat Conservation Plans -- and 1,621 acres were deleted because they are covered by military land management plans or national security needs.

[http://www.fws.gov/pacific/sacramento/ea/news\\_releases/2005%20News%20Releases/WSP\\_fCH2005\\_NR.htm](http://www.fws.gov/pacific/sacramento/ea/news_releases/2005%20News%20Releases/WSP_fCH2005_NR.htm)

ANALYSIS of H.R. 3824  
Threatened and Endangered Species Recovery Act of 2005 (TESRA)

The Threatened and Endangered Species Recovery Act of 2005 updates and improves the Endangered Species Act (ESA) by:

- Providing for the use of the best available scientific data in all decisions;
- Replacing the critical habitat program with a more integrated recovery planning process that includes the identification of specific areas that are of special value to the conservation of the species which are then given priority as recovery efforts;
- Providing for active implementation of recovery plans through implementation agreements between the Secretary and other federal agencies where the federal agency agrees to implement programs and projects identified in the recovery plans;
- Increasing the role for States, Indian tribes, counties and local governments by:
  - ensuring that a Governor and responsible State agencies, county and local governments are provided full notice and opportunity to comment on ESA decisions affecting their States and regions;
  - developing recovery plan goals for species on a state-by-state basis and improving the State and Indian tribe cooperative agreement provisions of Section 6 to cover candidate species and other species of concern; and
  - clarifying the treatment of Section 6 cooperative agreement activities under the consultation provisions of Section 7 and take prohibitions of Sections 4(d) and 9;
- Improving the Section 7 consultation process by:
  - enhancing the development of alternative consultation procedures that are consistent with the existing consultation provisions;
  - providing more certainty to the "openly" standard by providing that "openly" means where "the action reasonably would be expected to significantly impede, directly or indirectly, the conservation in the long-term of the species in the wild;"
  - ensuring that permit and license applicants fully participate in the consultation process; and

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- Ensuring public accountability by requiring the Secretary maintain a publicly accessible website that includes: (1) endangered and threatened species lists; (2) all final and proposed endangered and threatened species regulations issued under Section 4; (3) draft and final recovery plans; (4) the results of five year status reviews; and (5) all Reports and supporting data to Congress required under what would be the recovery planning provisions of Sections 5 and the Annual Cost Analysis under Section 18; and
- Providing for annual and biennial reports to Congress on the status of listed species as well as expenditures for species recovery efforts.

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RECOVERY PLANS

Removes Mandate for Recovery (Sec. 9 and 10)

The Pombo bill deletes the current statute (ESA §4(f)) and rewrites it, leaving out the current specification of a recovery plan as being for the "conservation and survival of endangered species and threatened species." (Page 17, line 24) This reduces the mandate on the federal government to recover threatened or endangered species.

Specifies Recovery Plans are Voluntary (Sec. 9, Sec. 10 amended)

Although it requires that recovery plans are published within two years of listing the species as threatened or endangered, the Pombo bill explicitly assures that recovery plans have no regulatory weight to ensure their implementation. "Nothing in a recovery plan shall be construed to establish regulatory requirements." (Page 26, line 12) Federal agencies would not be required to work toward the recovery goals and objectives for endangered species.

Requires Recovery Plans to Include Industry Wishes (Sec. 9 and 10)

The Pombo bill specifically requires the recovery plans include the desires of industry and commercial interests. It requires the Secretary to ensure that each recovery team "includes sufficient representation from constituencies with a demonstrated direct interest in the species and its conservation or in the economic and social aspects of its conservation to ensure that the views of such constituencies will be considered in the development of the plan." (Page 23, line 16) Currently, recovery plans are supposed to represent the biological needs and goals for threatened and endangered species, as developed by the scientific experts on each species. The Pombo bill would allow commercial interests to determine the biological needs of the species.

PROTECTIONS

Removes Protections from Declining Species (Sec. 10)

The Pombo bill allows individual states to "pursue a determination that the portion of the species found in that State may be removed from [the threatened or endangered species lists]" (Page 27, line 7) Such a system would allow individual states to remove protections for the species that state even if the species is declining overall.

Discourages Protections for Distinct Populations (Sec. 4)

The Pombo bill requires Fish and Wildlife Service to use the authority "to determine any distinct population of any species of vertebrate fish or wildlife to be an endangered species or a threatened species only sparingly" (Page 6, line 11) The Endangered Species Act currently allows the listing of species, subspecies, and "distinct population segments." Pombo's bill attempts to make it harder to list populations by requiring that to be done "sparingly."

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- clarifying that terms and conditions to avoid accidental take imposed under Section 7 should be roughly proportional to the impact of the identified accidental take;

Establishing new incentives for voluntary conservation efforts including:

- Species Recovery Agreements which will allow landowners to enter into species recovery agreements for terms of no less than five years to carry out activities that protect and restore habitat for covered species and contribute to the recovery of listed species;
  - Species Conservation Contract Agreements which establish agreements with terms of 30 years, 20 years, and 10 year for the implementation of a management plan for endangered, threatened and candidate species as well as other species conspicuously designated under State law;
  - Authorization of technical assistance and management training to support enrollment in Species Recovery Agreements and Species Conservation Contract Agreements; and
  - Establishment of a conservation grants program to promote voluntary conservation of listed species on private property and to provide financial compensation to alleviate the burden of conservation measures imposed upon private property owners;
- Modifying the No Surprises Assurances policy for persons developing habitat conservation plans;
- Improving the habitat conservation plan procedures under Section 10 by ensuring that plans include objective, measurable goals to be achieved for the species, monitoring procedures and adaptive management provisions to respond to reasonably foreseeable changed circumstances in a species status;
  - Providing certain fee private property owners by allowing landowners to request a written determination as to whether their land use activities will violate the take prohibitions of Section 9, granting the landowner incidental take coverage where the written determination is that they comply with Section 9 and giving a mechanism for compensating the private property for foregone use of the property where the determination is that the activity would violate the take prohibitions;
  - Compensating private property owners for the fair market value of loss of use for forgoing use of their property where the Secretary has determined that the use of that property would constitute a "take" under Section 9 and the activity is not otherwise determined a "nuisance" under principles of property and insurance law;

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The following analysis was prepared by Center for Biological Diversity staff

H.R. 3824

Rep. Pombo's Anti-Endangered Species Bill  
As Amended in Committee Sept 22

On September 19, 2005, Representative Richard Pombo (R-CA) introduced H.R. 3824, the so-called *Threatened and Endangered Species Recovery Act of 2005*. A give-away to developers and the oil and mining industries, this bill would cut the heart out of the Endangered Species Act, America's safety net for plants and wildlife on the brink of extinction. Below are some of the worst provisions of the Pombo bill as amended in committee.

CRITICAL HABITAT

**Completely Eliminates Critical Habitat Protections (Sec. 5, Sec. 10 amended)**  
The Pombo bill completely eliminates the critical habitat protections of the Endangered Species Act. The Endangered Species Act requires the designation of "critical habitat" areas for all threatened and endangered species. Critical habitat is the only portion of the Act that specifically protects habitat and explicitly establishes recovery as a management goal. It works: species with critical habitat are twice as likely to be recovering as species without it.

No Protection for Habitat (Sec. 10)

The Pombo bill requires that recovery plans identify "those specific areas that are of special value to the conservation of the species." (Page 21, line 4) Presumably, this is meant to substitute for the critical habitat protections for endangered species habitat eliminated by this bill. However, the Pombo bill does not define "areas of special value," provides no legal protection to these areas, and allows industry and commercial interests to determine which areas are of special interest to endangered species (Page 23, line 16).

SCIENCE

**Increases Political Manipulation of Scientific Decisions (Sec. 3)**  
The Pombo bill allows a political appointee, the Secretary of Commerce, rather than scientists, to determine what constitutes the best science to be used in endangered species decisions. "[T]he Secretary shall issue regulations that establish criteria that must be met to determine which data constitute the best available scientific data." (Page 3, line 10) The Endangered Species Act currently requires that all decisions be made on the basis of "the best available scientific information" and leaves it up to the scientific community to determine the best available science based on the current and continually changing scientific technology, knowledge, and methods. Pombo's bill would place a political appointee in charge of the scientific decision-making process and allow for greater political manipulation of scientific decisions.

Restricts Use of Commercial Data (Sec. 3)

The Pombo bill removes the phrase "commercial data" from the "best available scientific and commercial data" available for use in scientific decisions. (Page 3, line 1) This would, for example, preclude the use of fishing land data as measurements of fish populations.

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CONSULTATION

Example States from Federal Oversight (Sec. 11)

The Pombo bill exempts state actions that may harm a threatened or endangered species once the state has a cooperative conservation agreement with the federal government for that species. "[A]ny incidental take statement issued on the agreement shall apply to any such species, and to the State and landowners enrolled in any program under the agreement, without further consultation." (Page 38, line 13) As currently written, the Endangered Species Act provides full protection to each new species added to the endangered species list. The Pombo bill allows the U.S. Fish and Wildlife Service and NOAA Fisheries to sign an agreement with individual states prior to a species being listed, which prohibits any protections for those species. This would allow future actions that harm the species even if the cooperative agreement did not address such action, and even if the agreement was entered before the species was listed as threatened or endangered.

Regulatory Standard (Sec. 3)

The Pombo bill changes the standard by which federal actions are prohibited from jeopardizing endangered species. The prohibition of federal actions that would "reduce appreciably the likelihood of survival and recovery of a species to a prohibited action that would significantly impede, directly or indirectly, the conservation in the long-term of the species." (Page 5, line 2) This would make it harder to show harm to species, as well as allow actions that would harm species in the short-term.

Allows Destructive Projects to Proceed by Default (Sec. 13, amended)

The Endangered Species Act currently requires a destructive project can not proceed until it is reviewed and approved by government scientists. The review can not take place unless the agency or corporation proposing the project provides detailed information about the project and its likely effects. The Pombo bill then has this precautionary process on its head by specifying that destructive projects are allowed to proceed unless government scientists intercede to stop it. "If the Secretary fails to provide a written determination before the expiration of the [180-day period], the Secretary is deemed to have determined that the proposed use complies." (Page 53, line 6) The scientists will have little information to make such an intervention, because the Pombo bill allows agencies to provide only the name, the specific location, and the anticipated schedule and duration of the proposed action" (Page 54, line 6), not enough information to allow a scientific review.

Eliminates Independent Federal Oversight (Sec. 12)

The Pombo bill allows the exemption of "specific agency actions or categories of agency actions" (Page 43, line 10) from independent review and annual independent mandated "substantive procedures." (Page 44, line 3) The Endangered Species Act requires that Fish and Wildlife Service or NOAA Fisheries Service biologists review all federal actions that may harm endangered species. The review is done only on the basis of the best available science, and is conducted by scientists independent of the federal agency proposing the harmful action. The Pombo bill moves to eliminate this independent oversight of projects that can harm endangered species.

Eliminates the Endangered Species Committee (Sec. 12)

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The Pombo bill eliminates entirely the Endangered Species Committee process, known as the God squad (Page 48, line 1). This cabinet-level review process to allow federal agencies to override the protections of the Endangered Species Act, has previously riled against the federal government and for endangered species.

**PRIVATE LANDOWNERS**

• **Clarifies "No Surprises" Regulations (Sec. 13)**  
The Pombo bill codifies the "No Surprises" policy—currently a highly controversial administrative regulation that has been widely condemned by scientists. The Pombo bill prohibits the U.S. Fish and Wildlife Service and NOAA Fisheries from updating existing Habitat Conservation Plans unless the private land owner holding the permit agrees. Thus new scientific information and the results of biological monitoring no longer require updating of plans. "For any changed circumstance not identified in the permit or incorporated document, the Secretary may, in the absence of consent of the [permittee], require only such additional consultation, mitigation, or other measures to address such changed circumstance that do not involve the commitment of any additional land, water, or financial compensation not otherwise committed, or the imposition of additional restrictions on the use of any land, water, or other natural resources otherwise available for development or use, under the original terms and conditions of the permit or incorporated document." (Page 51, line 18)

• **Bankrupts DOI to Give Payouts to Developers (Sec. 14)**  
The Pombo bill requires the federal government to pay private landowners for the loss of commercial value when an action (timber harvest, development, etc.) is prohibited by the protections of the Endangered Species Act. The Pombo bill calls this provision "conservation aid." The bill specifies that "The amount of the Aid is to be no less than the fair market value of the forgo use of the affected portion of the property." (Page 59, line 2) That is, the federal government would have to pay for profits developers hoped to gain by developing that portion of the land, including any profits lost due to mitigation, asked of the landowner, such as creating riparian corridors or setting aside mitigation habitat. This not only would have a tremendous impact on the federal budget, it would set a precedent to require the government to pay industry for any profits lost to environmental protection, and it would reward developers who plan the maximum and most potentially profitable projects for the most ecologically important habitat. In short, it begs developers to plan projects that allow them to extort payments from the government.

Furthermore, this provision requires that the payment for the "aid" is paid from the budget of the Interior Department by the end of the fiscal year. "If sufficient funds are not available to pay an aid award in full, the Secretary shall pay any remaining balance when funds next become available." (Page 58, line 21) "The Secretary shall pay the aid required by this section from any funds available to the Secretary that are not mandated by law to be spent for other activities or obligations." (Page 59, line 12) These payments would take priority over all other programs not just of the endangered species program, but the entire Department of Interior.

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Chapter 5 (Paradigms...)

- Genetic Diversity (MVP, PVA)
- Island Biogeography
- Metapopulations
- Habitat Heterogeneity
- Disturbance



Chap 6 – Genetics of Conservation Biology

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Metapopulation:

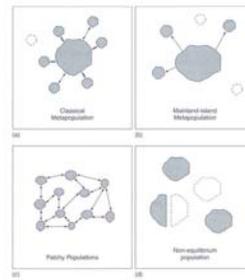
“Spatially disjunct groups of individuals with some demographic or genetic connection”

“largely independent yet interconnected by migration”

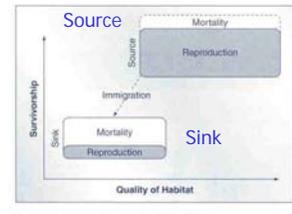
1. All local populations must be prone to extinction
2. Persistence of entire population requires recolonization of individual sites.

See p.193 in VanDyke text

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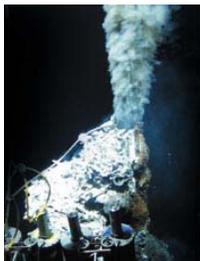
**Figure 5.16**  
Four metapopulation models. In a classical metapopulation, all some colonies may not within high rates of movement for long periods of time. Also, colonization may occur several patches within a larger patch, not a single one that colonize to other sites. Classical metapopulation for disjunct local extinction occurring mostly among or within populations. The modified island, constant in extinction, functions as the major provider of colonies. The island and sink metapopulation have different spatial parameters. In patchy populations, the distance or frequency of dispersal and immigration, the patches function as a single one. It is one kind of metapopulation in habitat where the population is not continuous. Extinction of metapopulations occur as part of an overall regional decline (i.e., a product of the reduction, fragmentation, or destruction of a habitat).  
After Hartman (1995).



**Figure 5.17**  
A visual representation of the source-sink model of habitat distribution. In source habitats, reproduction produces a population surplus (i.e., mortality does not decrease the number of individuals because of overcompensation through reproduction). Surplus individuals move to sink habitats where mortality exceeds survivorship. Sink habitats cannot be maintained by reproduction, but depend on immigration to maintain a population.

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Metapopulation:



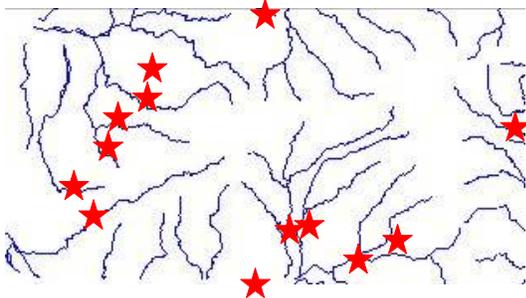
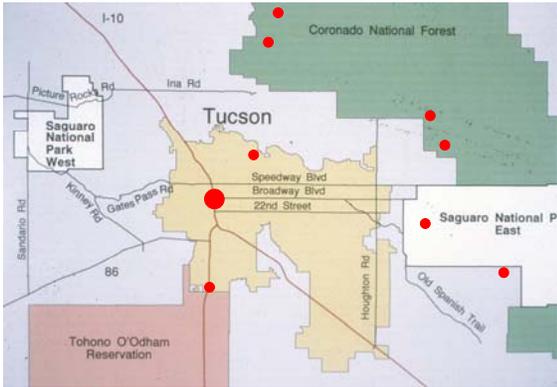
Hydrothermal Vents



Lowland Leopard Frogs (thanks to Don Swann)

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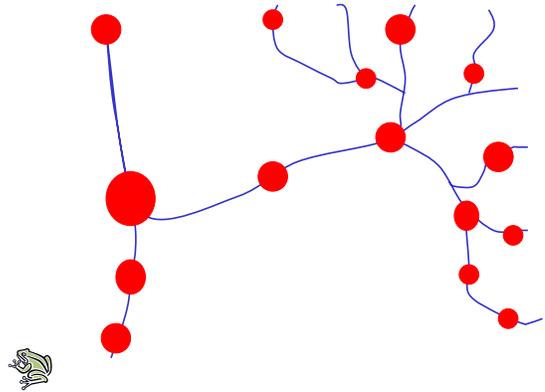




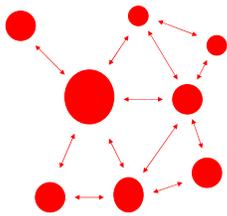
Distribution of Lowland Leopard Frogs in Rincon Mountains, 1996-2001

4 km

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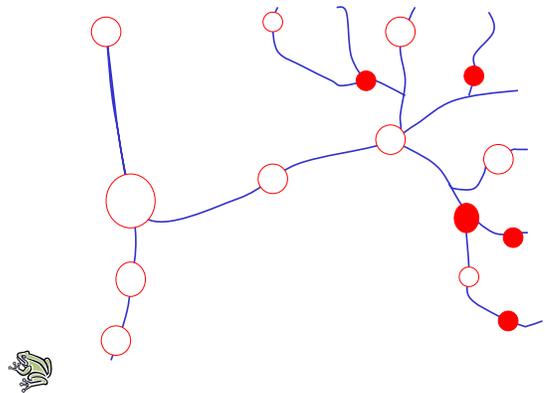
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Metapopulation Dynamics



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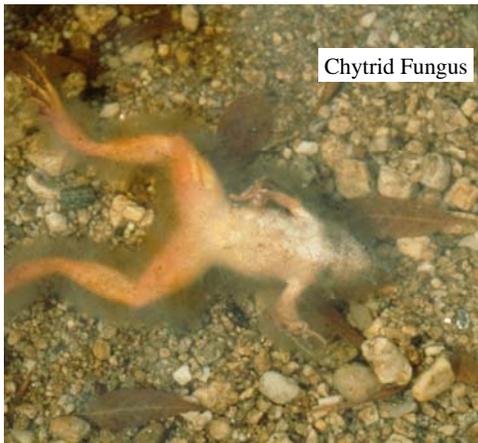
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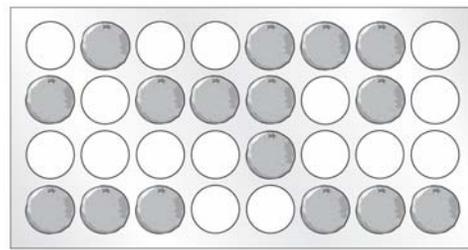
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Juggling Balls, Oranges, and Mites:



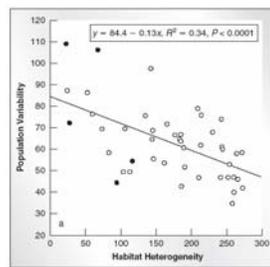
**Figure 5.11**  
A diagrammatic representation of Huffaker's experiment on the persistence of a predator-prey system of two species of mite. Dark circles represent oranges that mites could colonize and white circles represent rubber balls of "nonhabitat" that they could not colonize.  
After Huffaker (1958) and Huffaker, Shea, and Herman (1963).

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Habitat Heterogeneity

Conserve Bigger Area?

Conserve More Diverse Habitats?



**Figure 5.23**  
Populations of bush cricket (*Mantoptera bicolor*) subunits exemplify that population size is less variable as heterogeneity increases. Dark circles indicate patches where local extinctions occurred. White circles indicate patches with extant populations. Population variability was measured by the coefficient of variance (cv) of local population size, and habitat heterogeneity was measured using digitized infrared aerial photographs. Each patch was assigned values according to how much the patch deviated from the standard level of gray in the photographs (Dohue).  
After Kinshull (1996).

Disturbances

- Endogenous
- Exogenous



An SUV is seen covered by sand as residents walk to their homes to inspect the damage by hurricane Ivan Wednesday, Sept. 22, 2004 in Pensacola Beach, Fla. Beach residents were allowed to see their homes for the first time since the hurricane. (AP Photo/Alan Diaz)



## Habitat Heterogeneity and Disturbance

### Climax Community vs. Shifting Mosaic

- Tree Fall in Forest
- Beaver Dam on Stream

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Dr. Melanie Culver  
SNR, UA

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## Applications of Genetics to Conservation Biology

- Molecular Taxonomy
- Populations, Gene Flow, Phylogeography
- Relatedness - Kinship, Paternity, Individual ID



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## Conservation Biology

- Population biology
- Physiology
- Island biogeography
- Hazard evaluation
- Veterinary medicine
- Environmental monitoring
- Social science
- Natural Resources
- Policy
- Management
- Genetics

## Conservation Genetics

- Evolution (M,M,S,D)
- Systematics (Taxonomy)
- Small populations
- Population structure
- Inbreeding/Outbreeding
- Hybridization
- Genetic diversity
- Genetic management
- Reintroduction
- Species biology
- Forensics

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## How can genetics minimize extinction?

- Understanding species biology
  - Relatedness (kinship, paternity, individual ID)
  - Gene flow (migration, dispersal, movement patterns)
- Molecular Systematics
  - Resolve taxonomic uncertainty
  - Resolve population structure (phylogeography)
  - Define management units
  - Identify populations of concern

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## How can genetics minimize extinction? (continued)

- Detect and minimize inbreeding and loss of genetic diversity
- Detect and minimize hybridization
- Non-intrusive (non-invasive) sampling
- Identify best population for reintroduction
- Forensics

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