What are the relative impacts of invasive species and climate change on the present and future diversity of island ecosystems? How should conservation biologists help mitigate these impacts?

The best essays will be organized, well written, define terms, explain and justify points of view, and include citations of literature.
Adaptive Radiation

http://www.rit.edu/~rhrsbi/GalapagosPages/mockingbird.html

http://www.rit.edu/~rhrsbi/GalapagosPages/DarwinFinch.html

http://www.rit.edu/~rhrsbi/GalapagosPages/mockingbird.html

http://www.rit.edu/~rhrsbi/GalapagosPages/DarwinFinch.html

http://www.rit.edu/~rhrsbi/GalapagosPages/mockingbird.html

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http://www.rit.edu/~rhrsbi/GalapagosPages/mockingbird.html
Alfred Wegener, winter 1912-1913

Crustal Plates moving 1-12 cm / year

Plate Tectonics - not fully accepted until 1960s

Wallace’s Line
Weber’s Line
Sulawesi
Sunda shelf
Sahul Shelf

Dispersal Ability

Dispersal Ability (Isolation by Distance)
2. 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.

(From the VanDyke text)

<table>
<thead>
<tr>
<th>Source</th>
<th>Sink</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image: b vs. d]</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5.17

A non-sequential representation of the network model of habitat disturbance. In source habitat, reproductive produces a population (e.g., a colony does not diminish the number of individuals because of uncorrelated through reproduction). Sink individuals move to sink habitats where mortality is greater, leading to local extinction. Sink habitats are colonized by reproduction, but require an immigration to maintain a population.

Juggling Balls, Oranges, and Mites:

| [Image: Juggling Balls, Oranges, and Mites] |


Metapopulation:

| [Image: Metapopulation] |

Hydrothermal Vents

Lowland Leopard Frogs
(thanks to Don Swann)
Distribution of Lowland Leopard Frogs in Rincon Mountains, 1996-2001

Metapopulation Dynamics
3. Habitat Heterogeneity

Conserve Bigger Area?

Conserve More Diverse Habitats?

4. Disturbances

- Endogenous
- Exogenous

Habitat Heterogeneity and Disturbance

Climax Community vs. Shifting Mosaic

- Tree Fall in Forest
- Fire
- Beaver Dam on Stream

Intermediate Disturbance Hypothesis

"succession reset" "supercompetitors"
Populations & Extinction
(seen Primack Ch 5 & 6 etc.)

Species' Vulnerability to Extinction, LIST A
1. Small geographic range
2. One or only a few populations
3. Small population size(s)
4. Declining population size(s)
5. Actively harvested by humans

Species' Vulnerability to Extinction, LIST B
1. Individuals have large home ranges
2. Individuals have large bodies
3. Poor dispersers
4. Seasonal migrants
5. Low genetic variability
6. Specialized habitat
7. Only in stable, pristine environments
8. Individuals aggregate
9. Evolved isolated from humans
10. Species with threatened/extinct relatives

Populations & PVA
(population viability analysis)

(thanks to Margaret Evans)

Population Dynamics

Figure 22.3: Population dynamics should be understood as resulting from a variety of processes affecting populations at different levels. Landscape-level changes in the availability of habitat determine how much suitable habitat exists for a given species, and its configuration (and therefore its accessibility). The availability of suitable habitat and the behavior and physiology of individual organisms contribute to influence the dynamics of populations.

Groom, Meffe, & Carroll 2006
populations are dynamic, not static

Cause of cyclic change in population not completely understood. Cycle length average 3.8 years. Mass migration in response to high density with decreasing food supply, sometimes swimming involved.

Population sizes change over time

Why?
What causes change in population size?
What regulates population size?

If we can answer these questions, we might be able to make changes that increase populations of declining (endangered) species

1. Exponential growth
density-independent, deterministic

In a closed population (no immigration or emigration), population growth is a function of birth and death rates

\[
\frac{dN}{dt} = (b-d)N
\]

exponential growth: an unrealistic model?

Humans on planet Earth
2. Logistic growth

density-dependent, deterministic

\[
\frac{dN}{dt} = rN \left( \frac{K-N}{K} \right)
\]

intraspecific competition stabilizes population size
birth rates go down and/or death rates go up with increasing population size

carrying capacity (K)

Alternatively,
The population growth rate may increase with population size (positive density-dependence)

Allee effect

minimum viable population size

Allee effect

How?

In animals:
- group defense against predators
- group attack of prey
- mates difficult to find
- critical number to stimulate breeding behavior

In plants:
- pollinator limitation
- self-incompatibility
- inbreeding depression

How?

group defense against predators

FIGURE 1.2
Success rate of predator attacking pigeons in the truck

The increase in predation success, as captured in Figure 1.2, can be seen as the critical number for group defense against predators to be effective.