Conservation Ecology – Reserve Design
Timothy Bonebrake – April 4 2014

I. Definitions
1. Reserve: natural areas which are protected from most human activities and use (same as protected area).
2. Gap analysis: analytical approach for locating holes in existing reserve systems.
3. Flagship species: a species with a compelling and public profile which can draw in conservation resources.
4. Umbrella species: a wide-ranging species whose resource use encompasses the requirements of many other species to serve as a surrogate.

II. Why is reserve design important?
1. LIMITED RESOURCES!
   “The effectiveness of systematic conservation planning comes from its efficiency in using limited resources to achieve conservation goals, its defensibility and flexibility in the face of competing land uses, and its accountability in allowing decisions to be critically reviewed.” (Margules and Pressey 2000)

III. Biodiversity hot-spots globally
1. Myers (2000) based the hotspots on the number of endemic species (plants) and rates of habitat loss.
   a. $750 million (USD) spent from 1988-2005 on hotspot conservation.
   b. Major focus of many conservation organizations (e.g. Conservation International).
2. Many criticisms however: plant species patterns might not be a good surrogate, maybe not accurate at smaller spatial scales, doesn’t reflect biodiversity threats other than habitat loss, no ecosystem services.

IV. Systematic conservation planning – reserve systems
1. We don’t know all the biodiversity in a landscape. Therefore we use surrogates such as other species (flagship, umbrella), environmental variables (climate, geology), habitats/ ecosystems and political boundaries.
2. Gap analysis – where are the gaps in protection?
   a. Features: often find that reserves are high elevation sites (good scenery, difficult to develop), effective and systematic first step in finding gaps, proactive and focusing on common species.
   b. Drawbacks: not often dynamic, threatened species usually under-represented, hard to prioritize gaps.
3. What are we conserving?
   a. Representativeness – Protected areas (PAs) will protect a representative sample of the ecosystems, species etc. of the region.
   b. Efficiency – PAs represent the region’s biodiversity in the most cost effective manner, many algorithms available to do this (e.g. Marxan).
4. Basic principles based on Island Biogeography:
   a. Species-area relationship
   b. Single large better than several small (but remember SLOSS)
c. If multiple small reserves, should be in close proximity
d. Small reserves should be clustered
e. Connecting corridors will aid dispersal
f. Circular reserves enhance dispersal within and eliminate edge effects

5. Size – larger reserves preferable because they...
a. can contain larger populations (more likely to be self-sustaining) and can accommodate larger ranged species (top predators).
b. have less edges, therefore more secure from invasive exotics and easier to patrol and prevent poaching.
c. are less vulnerable to natural catastrophes and disturbances.

6. Shape – minimize edge effects/attempt to achieve low edge to area ratios.

7. Connectivity/Corridors
a. Maintaining connectivity among reserves is important and can maintain persistence of species which require:
   i. Daily movements of animals within home ranges.
   ii. Annual migrations between winter and summer ranges.
   iii. Dispersal of juvenile animals and seeds, spores, pollen.
   iv. Range shifts in response to climate change.
b. Double edged sword however! Lack of containment and spread of risk, negative impacts of corridors include:
   i. Invasive species, disease spreading.
   ii. Natural disasters not contained.
c. Not always effective anyway in providing connectivity.

8. Buffer zones – set up around “core” protected areas in order to balance socio-economic and conservation goals (usually of mixed land uses). Ideally this would lessen the impacts of outside-PA activities on the biodiversity within the PAs.