

## RESTORATION ECOLOGY MIDTERM – Fall 2007

**Definitions** – Fill in the blanks in the sentences below with the appropriate term. Answer 9 of the following 10 questions (2 points each)

A(n) metapopulation is a set of geographically isolated subpopulations that are connected by gene flow and colonization.

For seeds that have thick seeds coats to survive passing through the digestive system of animals, it may be necessary to scarify the seeds to increase their germination rate.

Mycorrhizae are fungi that form mutualistic associations with plants. They help the plants with nutrient and water uptake.

A(n) hard release is when animals are transported from a capture site or captive breeding site and introduced to their new habitat without any prior conditioning.

Bogs or peatlands are continually inundated wetlands that are acidic and have soil with extremely high organic matter.

Because of the lack of oxygen in wetlands, heavy metals, such as iron, are in their reduced form.

Solarization is covering areas with a clear plastic tarp to create high temperatures to kill the seed bank prior to planting.

The best way to predict whether a species will be invasive in a certain location is whether it has invaded elsewhere.

Reclamation or rehabilitation is the return a damage ecosystem to a productive and socially acceptable condition short of restoration.

Resilience is the natural ability of an ecosystem to recover from disturbance.

**Short answer questions** - Answer 5 of the following 6 questions (6 points each) – Note that only 1 point was given for answers that were vague or repetitive.

List three habitat/landscape characteristics that need to be restored to provide suitable conditions for a specific faunal group of your choice. There are many possibilities – one example - Fish

1. suitable substrate for spawning habitat
2. appropriate water temperature
3. sufficient oxygen
4. good water quality

List three methods used for cleaning up hazardous wastes in terrestrial systems with a brief description of each of the terms.

Bioremediation/phytoremediation - use of microorganisms/plants/fungi to detoxify or mineralize hazardous chemicals

Soil Washing – removing toxicants by leaching with water

Phytodegradation – using plants to break down toxic compounds

Phytovolatilization – using plants that can uptake toxic compounds and emit them in a gaseous non-toxic form

Chemical extraction – leaching toxic chemicals with other chemicals that remove them from the soil

Incineration – burning up compounds

Airstripping – blowing air over at a high speed to volatilize compounds

Phytostimulation – when plants extra enzymes that help microorganisms break down chemicals

List three beneficial effects of increasing organic matter in soil.

Increases cation exchange capacity

Increase water holding capacity

Form soil aggregates and reduce erosion

Increase nutrient availability

Helps mediate temperature fluctuations

Increase microorganisms

Increase aeration

Increase N fixation

Increase filtration

Increase decomposition

Easier for plants to establish roots

**Partial credit:**

Increase soil quality

Increase oxygen

List three potential negative effects of fertilizing plants as part of restoration projects.

Plants may have higher N content and be more susceptible to herbivores

May favor weeds over native plants

May leach off into nearby water bodies

Increases cost expensive

May make plants dependent on nutrients so that they aren't well adapted when fertilization stops

List the three criteria used to delineate wetlands. – Note that there were only three possible answers for this question.

1. Hydrology

2. Vegetation

3. Soils

List three invasive species in Hawaii that have had strong negative impacts on native species.

Gorse

Feral pigs

Feral cats

Mongoose

Rats

Banana poka vine

Mosquitoes

Cows

**Short essays** - Answer 2 of the following 3 questions (14 points each) on lined paper. Please put your name on each sheet and staple the sheets to this portion of the exam.

1. As has been discussed in both the class and readings, there are pros and cons to using native and non-native (exotic) plant species in restoration efforts. Discuss two arguments for using non-native plants species in some restoration projects, and two concerns about using non-native plant species for restoration. Finally, discuss two precautions that could be taken to minimize the concerns discussed.  
- 2 points each for pro, each concern, and each caution, 2 pt SOT (style, organization and thoroughness)

- Pros:
- N-fixation
  - Fast growing to stabilize soils
  - Decrease erosion
  - Shade out weeds
  - Shade in natives that need shade
  - Using tree farms for \$ as well as restoration
  - Less difficult to grow sometimes
  - Less expensive to grow sometimes
  - Provide quickly established habitat for animals
- Cons:
- Invasive – can spread out of site
  - Change succession trajectory
  - Alleopathy effects on natives
  - Hard to remove
  - Can inhibit native species

Partial credit:  
Unforeseen bad effects

- Precautions:
- Select those species observed not invasive in other areas
  - Knowledge of natural history, seed bank
  - Preliminary research on invasiveness and effects on natives
  - Monitor carefully
  - Chose plants that are sterile varieties/will not breed

2. Discuss the classic view of succession. Briefly discuss two criticisms of this view and why each is relevant to restoring damaged ecosystems. – 4 points for discussion of succession (S), 2 points each for two criticisms (C) and why each relevant to restore damaged ecosystems R, plus 2 points SOT

Classic view of succession – must mention the following 3 points

1. specific sequence of plant communities occurs on a given site
2. each community prepares the site for subsequent invaders
3. at the end of the sequence is a stable climax community

- Criticisms:
- Ecosystems not necessarily in stable state
  - Not necessarily a climax community
  - Could be many successional trajectories
  - In some ecosystems the plants that initially become established may be part of the later-successional ecosystem - deserts, tundra
  - earlier colonizing species may have positive and/or negative effects on later colonizing species

Why Relevant:

Cannot determine correct “stage” for restored site

Could go on different trajectory than desired

Need to think about whether earlier successional plants will facilitate or inhibit later plants

3. Increasingly design of restoration projects will have to consider climate change. Pick a specific ecosystem type and briefly discuss three ways in which the ecosystem might be affected by climate change. Then discuss three ways to design the restoration project to incorporate a consideration of these changes. 2 points each for effects of climate change (E) and 2 points each for designing for climate change (D), plus 2 pt SOT

Example: wetlands

1. sea level rise will affect where they are located
2. there may be more hurricanes for coastal wetlands
3. temperature may affect the plants than can survive there

Ways to design project

1. acquire land for restoration at a range of elevations along the coast to the wetlands can move upland
2. plant or seed plants that are adapted to a range of flooding and salinity
3. use brush fences or other coastal barriers to minimize the impacts of wave action from storms

**Long essay - Answer 1 of the following 2 questions (24 points) on lined paper.**

You are hired by CalTrans as (California Dept. of Transportation) as a consultant on the routing of a new freeway corridor between two cities. One route cuts through important mountain lion habitat effectively splitting the population into two populations that may be too small to reproduce. The alternate route would destroy one of the few remaining Santa Cruz tarweed populations. Suggest proposals to mitigate for each of these routes. For each proposal discuss at least three problems/considerations. Then chose one of these alternatives, justifying your decision.

MOUNTAIN LION PROPOSAL - 2 points - e.g. freeway overpass to allow for a corridor

CONCERNS - 2 points each (6 pt total) - e.g - corridor isn't wide enough for cats to cross, edge effects, habitat on either side may not be of equal quality, prey may not cross corridor, other negative effects of roads such as garbage or smoke

TARWEED PROPOSAL - 2 points - e.g. transplanting tarweed, creating a new population from another existing population

CONCERNS – (6 pt total) e.g. are site conditions at transplant site appropriate, how genetically diverse is source population, competition with exotics, are there pollinators at new site, can tarplant withstand transplanting stress, will seeds readily germinate

RECOMMENDATION - 1 point

JUSTIFICATION OF RECOMMENDATION - 4 points - example - if recommended protecting mountain lion - probably less expensive, easier to move tarplant than to reroute mountain lions, would have more effect on food chain because is a predator

ORGANIZATION/STYLE/TONE/OVERALL THOROUGHNESS OF ANSWER - 3 points