The Ecology of Seeds and Seedlings

I. The nature of seeds.
   A. Fruits versus seeds
   B. The sizes of fruits and seeds

II. Dispersal of seeds
   A. Wind and gravitational dispersal
   B. Water dispersal
   C. Animal dispersal
   D. Ecological consequences of dispersal distance
      1. Escape from seed predation/herbivory and competition-- The Janzen-Connell hypothesis
      2. Arrival at a suitable habitat--the safe site

III. The importance of predation

IV. The seed bank
   A. Longevity of seeds in the soil
      1. Long-term experiments with buried seeds
      2. Survivorship curves for seeds
      3. Species composition of seed banks: comparison to above ground

V. Germination of seeds
   A. What is required for germination?
      1. Imbibition of water
      2. Breakage of dormancy, if any
      3. Initiation of growth
   B. The importance of germinating at the right time
   C. How do seeds detect the right time
      1. Dormancy and quiescence
      2. Light quality effects-- shade light versus sunlight and the phytochrome system
      3. Temperature- fire but also high soil temperatures in a gap
      4. Nitrate- released in gap formation and may trigger germination
      5. Removal of an inhibitor-seeds in the desert
   D. Dimorphic seeds
      1. *Atriplex* -- germination requirements differ between black and brown seeds
      2. *Cakile maritima*-- dispersal differs depending on position in the fruit.

VI. The growth of seedlings
   A. The seedling bank and oskars
      1. Importance of treefall gaps in forest ecology
      2. Different modes of regeneration in gaps
   B. The importance of maternal investment in reserves
   C. Responses of seedlings to light
      1. In most instances, height growth is a function of seedling reserves
      2. Survival is a function of seedling reserves

Readings
TEXT: Chapter 8, pages 161-164 discusses the ecology of fruits and seeds. There is also material on seed dispersal and germination on pages 265-266. I suggest Silvertown and Lovett-Doust, pages 82-92 for a good discussion of seed banks, safe sites, germination, etc.

Study questions:

1. Why is it important for a seed to have mechanisms to signal when the environment is appropriate. What are some of these signals that operate in 1. a desert environment and 2. for a gap-dependent pioneer species in a tropical forest, for a chaparral shrub that recovers from fire via seedling establishment rather than resprouting.

2. You observe in a forest that adult individuals of a species are spaced on average 25 m apart. The spacing varies considerably, however, so that a few individuals are closer than this average distance and at some places the spacing is much further apart. In looking for seedlings, you observe that they are relatively rare under the parent trees, and rare in places where there are no parent trees nearby. Seedlings are most abundant at intermediate distances from adults. What factors could be involved in explaining this pattern of seedling distribution?

3. In a forested area you observe a weedy species in large gaps that produces many small seeds with fine hairs on them (like cottonwood), a shrub species producing berry-like fruits, each containing 4-5 seeds and a tree species producing large (20 g) fruits consisting mostly of one large seed. Compare the dispersal modes of these different species. What are the relative advantages of each given where these species occur? How are the differences in seed numbers and seed characteristics likely to influence the demography of these species, at least in the early stages.

4. In a forest, why are you likely to find that the seed bank has quite a different composition than the above-ground vegetation?

5. What is a safe site? What characteristics should it have?

6. Compare vegetative reproduction and sexual reproduction via seeds in terms of their consequences for genetic variation, dispersal, survival of offspring, parental investment in an offspring.