* Some populations cycle between large and small
  + Although the logistic growth pattern is better than any other model for describing the general growth pattern of populations, some populations cycle between periods of growth and rapid shrinkage.
    - Predators and prey are linked together
      * Plants effect rabbits, which effect lynxes etc.
* “Maximum Sustainable yield” is a useful but nearly impossible to implement concept.
  + Based upon models of population growth, it might seem easy to utilize natural resources efficiently and sustainably
  + In practice, however, difficulties such as estimating population size and carrying capacity complicate the implementation of such strategies.

**2. A life history is like a species summary.**

* Life histories are shaped by natural selection
  + An organism’s investment pattern in growth, reproduction, and survival is described by its life history.
  + Very different strategies can achieve the same outcome in which a mating pair of individuals produces at least two surviving offspring.
* There are trade-offs between growth, reproduction, and longevity.
  + Because constraints limit evolution, life histories are characterized by trade-offs between investments in growth, reproduction, and survival.
* Populations can be described quantitatively in life tables and survivorship curves.
  + Life tables and survivorship curves summarize the survival and reproduction patterns of the individuals in a population.
  + Species vary greatly in these patterns: the highest risk of mortality may occur among the oldest individuals or among juveniles, or mortality may strike evenly at all ages.

**3. Ecology influences the evolution of aging in a population.**

* **What determines the average longevity in different species?**
  + The rate of aging and pattern of morality by the hazard factor of the organism’s environment.
  + In environments characterized by low mortality risk, populations of slowly aging individuals with long life spans evolve.
  + In environments characterized by high mortality risk, populations of early-aging, short-lived individuals evolve.

**4. The human population is growing rapidly.**

* **Age pyramids reveal much about a population.**
  + Age pyramids show the number of individuals in a population within any age group.
  + They allow us to estimate birth and death rates over multi-year periods
* Human Population growth: how high can it go?
  + The world’s human population is currently growing at a very high rate but limited resources will eventually limit this growth, most likely at a population size between 7 and 11 billion

1. **Ecosystems have living and non-living components.**

* + An ecosystem is a community of biological organisms plus non-living organisms
* Biomes are large systems that occur around the world, each determined by temperature and rainfall.
  + Biomes are the major ecological communities of earth, characterized mostly by the vegetation present.
  + Different biomes result from differences in temperature and precipitation, and the extent to which both vary from season to season.

**Interacting physical forces create weather.**

* Global air circulation patterns create deserts and rain forests.
  + Global patterns of weather are largely determined by the earth’s round shape.
  + Solar enery hits the equator at a more direct angle than at the Poles, leading to warmer temperatures at lower latitudes.
  + This temperature gradient generates atmospheric circulation patterns that result in heavy rain at the equator and many deserts at 30° N and S latitude.
* Local topography influences the weather.
  + Local features of topography influence the weather
  + With higher altitude, the temperature drops.
  + On the windward side of the mountains, rainfall is high; on the back side, descending air reduces rainfall, causing rain shadow deserts.
  + Urban development increases the absorption of solar energy, leading to higher temperatures, and creates wind near the bottom of tall buildings.
* Ocean currents affect the weather.
  + Oceans have global circulation patterns
  + Disruptions in these patterns occur every few years and can cause extreme climate disruptions around the world.

**Energy and chemicals flow within ecosystems**

* Energy flows from producers to consumers.
  + Energy from the sun passes through an ecosystem in several steps known as trophic levels:
    1. Producers convert light energy to chemical energy into photosynthesis …..
* Energy pyramids reveal the inefficiency of food chains
  + Energy pyramids reveal that the biomass of producers in an ecosystem tends to be far greater than the biomass of herbivores
  + Similarly, the biomass transferred at each successive steps along the food chain tends to be only about 10% of the biomass of the organisms consumed.
  + As a consequence of this inefficiency, food chains rarely exceed four levels.
* Essential chemicals cycle through ecosystems
  + Chemicals essential to life-including carbon, nitrogen, and phosphorus- cycle through ecosystems.
  + They are usually captured from the atmosphere, soil or water by growing organisms, passed from one trophic level to the next as organisms eat other organisms, and returned to the environment through respiration, decomposition, and erosion.
  + These cycles can be disrupted as human activities significantly increase the amounts of chemicals released to the environment.