* ~~Changing climate 🡪 increased temps~~
  + ~~Increased temps 🡪 increased seasonal temps~~
  + ~~Increased seasonal temps 🡪 increased growing seasons~~
  + ~~Increased growing seasons 🡪 increased insect generations~~
  + ~~Increased insect generations~~ ***~~can lead to~~*** ~~pest pressure~~
  + ~~Increased pest pressure 🡪 increased damage~~
  + ~~Increased damage 🡪 increased management~~
  + ~~Increasing management~~ ***~~requires an understanding how insects will respond~~***
* ~~Responding to climate 🡪 winners and losers~~
  + ~~Losers 🡪 less genetic variability and extinction~~
  + ~~Winners 🡪 through~~ *~~redistribution and adaptation~~*
    - ~~Redistribution 🡪 range expansion or shifting~~
      * ~~Range expansion 🡪 pest insects in novel habitats~~
      * ~~Pest insects in novel habitats 🡪 effects food security~~
    - ~~Adaptation 🡪 mechanisms: colonization, fitness~~
      * ~~Colonization vs extinction~~
      * ~~Changes in fitness 🡪 Mean of fitness vs variance of fitness~~
  + ~~Evolution 🡪 starts with plasticity in phenos~~
  + ~~Phenotypic Plasticity 🡪 shifts in dormancy;~~ ***~~could be a way insects mitigate the effects of a changing climate~~***
* ~~Plasticity in Dormancy 🡪 response to environment~~
  + ~~Response to environ 🡪 preparing for reduced resources~~
  + ~~Diapause is Preparative 🡪 genetically determined diapause~~
  + ~~Genetically determined diapause 🡪 physiological events~~
    - ~~Physiology changes 🡪 survival of diapause~~
      * diapause 🡪 protection from environment
        + Initiation, length, reduced development and metabolism
      * diapause 🡪 accumulated resources
        + Fats 🡪 reservoir of energy and water
        + Proteins 🡪 reservoir of energy, amino acids, enzymes, chaperone proteins
  + Response to environment 🡪 shifts in dormancy
  + shifts in dormancy 🡪 changes in seasonal light/temp relationship
  + Seasonal Light/temp relationship 🡪 changes in environment when diapause is initiated
  + ECB are a great model for this type of study
* European corn borer
  + Pest
  + Genetic Facultative diapause
  + Clinal distribution of facultative diapause

**Diapause and Food Security:** Populations are expected to rise from the 321.2 million to 398.3 million people here in the United States (Population Reference Bureau 2015). Farmers depend on the predictive nature of these seasonal cues to determine when to plant, chemically treat, and harvest their field crops to meet the food demand of the nation. As temperatures warm, insect pests are expected to respond with increased growth rates, longer seasons, and increases in populations. These additional factors will stress an already stressed system and managing the effects of these pressures will necessitate the use of more chemical pesticides and result in increased crop losses.

Food, mates, water, shelter; these are all resources that organisms must manage to be competitive and survive within their environment, so how is this accomplished? During periods of food abundance one can intuit how managing it can be understood. Simplistically, when available food concentrations are higher than the amount of food required for an organism to survive, they will either consume just enough resources to survive or they will over consume. The dynamics of survival during times of food scarcity is not as simplistic but can be understood in general terms. Overcoming resource decline in most cases leads to different types of dormancy but the intensity, preparation, and duration of that dormancy are all able to be modulated to meet the specific requirements of an organism’s current environment. Organisms experiencing environments with reduced resources can cope with these stressful periods by migrating to locations where resources more readily available. Another way organisms compensate for these resource poor times is by storing more resources during resource rich times to last through the stressful period.

Changes in food, water, oxygen, and temperature can all have direct effects on the immediate developmental state of an organism. Quiescent dormancy is an organisms immediate response to these types of environmental changes. This type of dormancy is not genetically predetermined and while it does reduce the activity of an organism, its metabolic activity is relatively constant (effect of chilling and reduced oxygen and how insects respond to these types of changes… useful and old example in drosophilla). Diapause is a state of dormancy that is initiated in advance of shifting environmental conditions. This type of dormancy is generally precipitates from environmental cues such as light or temperature. Diapausing insects use these environmental cues to initiate physiological changes that function as to protect the insect from the seasonal absence of resources. The genetic programming that is initiated when diapause is induced can result in the acquisition and storage of more resources necessary to survival. (unfinished)