2 Theory

2.1 Thermal Time

For ectotherms (like plants) whose body temperature depends on their environment, the rate of development can be written $r\left[T(t)\right] = m\left[T(t) - T_b\right]$ where m is the change in rate per change in temperature and T_b is a "base temperature" below which no development occurs. When $T(t) > T_b$, the total fraction of development $f(t)$ completed at time t is

$$f(t) = \int_0^t r\left[T(t')\right]\, dt' = m\,\tau(t) \tag{3}$$

where $\tau(t)$ can be called a "thermal time" defined as

$$\tau(t) = \int_0^t \left[T(t') - T_b\right]\, dt'. \tag{4}$$

For example, *Hornbuckle et al.* (2016) used thermal time to determine when corn reached its third reproductive stage after planting.

2.1.1 Assumptions

We make assumptions when using thermal time as defined by (4) to predict organism development.

- The rate of development r can be approximated by a linear function of temperature.
- No development occurs for $T(t) \leq T_b$.
- The temperatures used to calculate thermal time are the temperatures actually experienced by the organism.

These assumptions are *never* completely valid.

II. Theory

A. Thermal Time

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