Ch2 methods

I should investigate this with simulation, as thinking through all the variables boggles the mind. We need to consider; species characteristics (density and detectability) and their relationship with the optimal size of plot, and the relationship of both of these to required effort (set up and survey time). We also need to consider survey time, to enable comparison with ds - ds accounts for missed individuals with the detection function, error rates are low, so a similar level of error should be sought for the quadrats. Notes:

- what is the relationship between species characteristics and optimal plot size?
- optimal: minimising variance, where the variance arises from number of plots, with a constraint on cost?
- if you have a fixed sample area, is there an optimal number of plots? Or just more is better?

- minimum plot size; 1m x 1m, cost is low - set up cost minimal, find the spot and plop the frame down, if stratum/site area is large, travel between plots may incur higher cost.
- set up cost and travel time as percentage of overall plot cost? Or percentage of budget?
- input should be required error rate and species characteristics - outputs are ideal plot size and time to survey
- side note: what is the standard definition for how many plots/what survey area to cover?
- something to do with within and between plot variance #detection rate and time for plot sample??
- plotCost <- #some function of size and search time
- setUp <- 1:100

- travel <- 1:100

#Notes on sampling theory

From Thompson (2012) Stratification: given a sample size n, the choice of how to allocate among strata, n_h can be;

- equal ($n_h = \frac{n}{L}$, where L is the number of strata),
- proportional to the size of the strata (if they differ in size; $n_h = \frac{nN_h}{N}$, where N is the total number of sampling units in the population, or survey area),
- optimal, where the variance of the estimated population mean or total is minimised, $n_h = \frac{nN_h\sigma_h}{\sum_{k=1}^{L} N_k\sigma_k}$, where σ_h is the sd for stratum h, k is the not clear - seems to be the same as h,
- can incorporate costs, for a fixed total cost c,

$$n_h = \frac{(c - c_0)N_h\sigma_h/\sqrt{c_h}}{\sum k = 1^L N_k\sigma_k\sqrt{c_k}}$$

, where c_0 is the 'overhead' or one-off costs, and c_h (and c_k?) is the cost in stratum h.

- the latter allocation gives larger sample size to larger or more variable strata, and smaller sample sizes to more expensive or more difficult to sample strata.
- From Guru's draft paper: the number of individuals detected [in a quadrat] follows a thinned Poisson process (Cox and Isham 1980), i.e.

$$N_d \sim Poiss(\lambda A_q q)$$

. q here is the probability of detection of an individual in the quadrat (N_d is N detected, A_q is the area of the quadrat and λ is defined as individuals per unit area). For ref,

$$q = 1 - e^{-\frac{W_e vT}{A_q}}$$

, where the numerator in the exponent is the 'effective area' searched, or W_e is effective search strip width, and the search path length L is expressed as the product of velocity, v, and time, T.

The theory leading to the equation for *q* comes from the 'random search' model, where observers follow some path through the search area. This does not apply for smaller plots, e.g. where observers are on their hands and knees and the whole plot is visible at once. Is it silly to think about field of vision? E.g. apply the random search assuming that the eye moves around the plot in a 'random' path?

Notes: how many plots? Always seems based on budget, where variance is minimised based on stratified variability and costs. What size of plot is generally not discussed.

Thompson, S.K., 2012. Sampling. John Wiley & Sons, Incorporated, New York, UNITED STATES.