Workshop Title:

Population Assessment and Distribution of elusive species

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Background

For effective management and conservation of biodiversity, it is critical to understand the spatial population ecology of animals and plants (Lawton 1993). Accurate estimates of ecological state variables such as animal density provide key metrics for monitoring population changes over time in response to changes in environmental conditions or as a result of conservation actions. The proportion of an area occupied or used by a species on the other hand can help estimate species distribution and changes over time.

The biggest challenge with most wildlife species is that one can seldom detect them perfectly, i.e. there may always be individuals in the sampled area that might miss getting detected, and counted. Estimation of probability of detection leads to reliable and replicable estimates that are necessary for effective assessment and monitoring of wildlife. The same holds true for species that might be present in an area but never be recorded thus leading to biased estimates about their true distributions.

Spatial Capture Recapture (SCR) methods to estimate wildlife population density and size of wildlife populations were first introduced by Efford (2004), and have developed rapidly since (Borchers and Efford 2008; Royle and Young 2008). Occupancy based estimates were introduced first by Mackenzie et al. (2002), and have since been widely used to assess and report distribution and status of many species, albeit without informing anything about the number of individuals. Recent applications of occupancy methods to improve inferences from local ecological knowledge (LEK) have widened their scope to conduct rapid assessments species distribution in space and time. While abundance (number of individuals in an area) is the most widely sought and easy to explain state variable for monitoring species, the cost of estimating these numbers is typically high as it requires specialized equipment and training. Secondary information based on LEK occupancy methods on the other hand is quick and relatively inexpensive to obtain, but only provides coarse scale information about probabilities of different parts of the study area being used by the species of interest.

In combination, Spatial Capture Recapture and Occupancy methods can provide a handy tool-kit to survey large areas and conduct intensive sampling to estimate global populations of rare and elusive species such as the snow leopard. The proposed one-day workshop will introduce the participants to the two methods. It will also cover design principles for surveys of large areas in general, and for surveys using SCR and occupancy methods in particular.

Workshop outline

1. Introduction
    a. Why estimate distributions and abundances of species
    b. What is detection probability and why bother about it
    c. What Occupancy methods can tell you
    d. What SCR methods can tell you
2. Occupancy Methods
    a. What Data do Occupancy methods need?
        i. Sites and their covariates
        ii. Encounter histories and detection covariates
    b. Occupancy Model components
        i. Encounter models
        ii. Spatial models for presence/absence
3. SCR Methods
    a. The difference between SCR and conventional CR
    b. What Data does SCR need?
        i. Detectors and their covariates
        ii. Encounter histories and detection covariates
        iii. Spatial meshes and their covariates
    c. SCR Model components
        i. Encounter and detection models
        ii. Spatial models
    d. Advanced SCR methods
        i. Uncertain identities
        ii. Activity centre movement
        iii. Open populations
4. Survey Design
    a. Model-based vs Design-based inference
    b. General spatial design principles
    c. Some Occupancy design issues
    d. Some SCR Design issues
        i. Number and placement of detectors
        ii. Sub-sampling space & how Occupancy can help
        iii. Model-based vs design-based estimation

Participants will be provided sample codes and real data to run the population and occupancy models. It is highly advisable that they bring their own computers to run the models themselves.

Expected level of prior training:

1 Understanding of animal ecology
2 Basic knowledge of GIS
3 Basic data management skills using Excel or R
4 Basic familiarity with R and RStudio environments