A NEW APPROACH TO BROWSE SAMPLING AND ITS APPLICATION FOR MOOSE ON ISLE ROYALE

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Abstract: Estimating biomass of browse by species in stands as complex as those in Isle Royale National Park, Michigan presents a sampling dilemma. The forests can be stratified by type, but within most types spatial patchiness is still so great that a large number of observations is necessary to quantify species' dispersion and biomass-density. The size of sample required for this often precludes taking a precise measurement at each point, i.e. clipping and weighing, due to cost.

We are experimenting with a 2-stage system in which we 1st sample widely but imprecisely, then revisit to take precise measurements from a subset of the original sample. The scheme may be likened to a stratified sampling wherein a large set of observations becomes the basis for stratification, and these strata are then sampled to determine the characteristic in question - species' biomass-density. In the 1st sampling, species and their relative biomass are estimated on many plots, these being marked for relocation. A subset of these plots is then clipped. We can decide at what level of precision we wish to estimate each species. Then we optimally allocate sampling effort in accordance with strata information gained in the 1st stage.

Preliminary results indicate that with 400 initial observations and 100-clipped plots/study site, confidence intervals on species' biomass-density are around ±15 percent for the Isle Royale understory where 6-12 species must be sampled at the 2nd stage. We are currently testing the efficiency of this method relative to a single-stage sampling which would produce the same level of precision.

Several modifications are possible. For those species which are widely abundant but not sought intensely by moose, e.g. *Alnus rugosa*, we accept wider confidence intervals and hence require less sampling. Also, one can include estimates of utilization as well as production; for winter browsing a double set of 2nd-stage plots is allocated, 1 to be clipped in fall and the other in spring with the difference being an estimate of removal. Finally, there may be instances in which, with some prior expectation of stand composition, the 2nd-stage revisititation is avoided by clipping selected plots during the 1st stage. This requires a greater number of clippings, but the cost of this may be less than that of revisiting.