CSS 496 -- Monitoring Human Impacts in Protected Areas & Wilderness

Monitoring Program Exercise - Step Four
Sampling Approach and Measurement Methods
Due Tuesday 4/11

Purpose: A well-designed, statistically-sound sampling approach allows you to capture the natural variability in area conditions and allows you to draw conclusions about overall area conditions based on what you found at your sample sites. A census approach allows you to draw conclusions about all the sites you collected information about. A detailed, consistent method for collecting information and training personnel is essential to increase inter-observer reliability.

Assignment:
For **three** of the indicators selected in step three, produce a report that includes the following information:

a. **Where** will information on the indicator be collected? For example, you might specify random site locations over entire area (sampling approach), or at selected sites (e.g. all campsites, or all beaches - census approach), or by various strata (e.g. weekdays/weekends, high/middle/low elevations, 3 seasons, holidays/non-holidays, etc.).

b. **How** will the information be collected - what measurement methods will be used? How would you design an inventory or survey form that you could use in the field to collect data?

c. **How** you will train the people who will be collecting the information?

d. **How** you will store collected information so it is readily available and easy to access?

Example of Step Four Assignment

Alaska Basin Zone - Jedediah Smith Wilderness, WY.

1. Trail transect

A simple random sampling approach will be used to locate trail transects. The objective is to characterize overall trail conditions in the Alaska Basin zone. It is unknown how much variability exists in trail conditions, thus in 1988 6 trail transects will be randomly located on each of 5 trail segments: Mt. Meek trail, Buck Mtn. trail, Alaska Basin Shelf trail, South Teton to Sunset Lake trail and the abandoned Mt. Meek trail. The number of transects may need to be increased in later years if the variance in measurements is higher than acceptable.

The exact location of trail transect sites will be determined as follows: the exact length of the trail segment in feet will be determined (e.g. the Mt. Meek trail is 10,560 ft.). A random number table will be used to pick 6 numbers between 0 and 10,560. Each number will represent the distance in feet from the beginning of the trail to the transect site. Trail transect locations for each trail segment will be determined independently. A wheel measure will be used to locate trail transect sites on the ground.

In addition to the randomly placed transect locations, trail transects will also be established wherever the trail is currently eroded more than 6" deep. Information from these transects will not be included with the overall trail condition measurements. Instead, they will be used to document trail erosion in especially sensitive areas.

All trail transect locations will be documented using compass azimuths and wheel-measured distances. The trail transect measurement procedures described by Leonard and Whitney (1977) will be used. In addition to the transect measurements, the following information will be recorded for each transect site: slope, soil type, parent material (granite or limestone), vegetation type, and elevation. All personnel who will be collecting transect information will spend one full day practicing the measurement and documentation procedures until inter-observer reliability is greater than 90%. Information will be recorded on forms and stored on the Forest Service data general computer. A computer file will be set up for each trail. Graphs will be drawn to display the transect data and will be stored in folders set up for each trail.

Measurements from the 6 transects will be used to calculate the average soil loss for each trail segment. The following formulae will be used to calculate the area of soil loss:

$$A= (V_1 + V_2)/2 + (V_2 + V_3)/2 + (V_n + V_{n+1})/2 \text{ x } D$$

A = area in square cm.
V_n = Vertical distance measurements
D = interval on horizontal axis

2. Fecal coliforn / Fecal streptococci

The intent of using this indicator is to document human fecal contamination of drinking water used by visitors thus sample sites will be selectively located where visitors normally obtain drinking water. Four types of water sources will be examined: springs, streams, lake inlets and lake outlets. For each sample site, a minimum of 5 samples per 30 day period will be taken (Flora, et al. 1984). Sample jars will be labeled to identify the water source where the sample was collected. All people collecting samples will be instructed how to collect samples in terms of which part of the water source the sample should be taken from and how to keep the sample jar clean. All samples will be collected in the norming, immediately wrapped in a down vest and transported to the nearest trailhead. Samples will then be put in an ice cooler and immediately transported to Rexburg for analysis. The membrane filter technique will be used to analyze samples (APHA 1985). Results of the lab analysis will be stored on the Forest SErvice data general computer. Once a month (every 30 day period) the average coliform count for the 5 samples from each water source will be made available to the wilderness rangers so they can communicate the information to visitors.

3. Relative abundance of marmots

H_o = abundance of marmots in AB = abundance of marmots in S. Leigh Lakes
H_a = abundance of marmots in AB = abundance of marmots in S. Leigh Lakes

South Leigh lakes is a subalpine lake basin environmentally similar to AB but is trailless and has only light recreation use. The abundance of marmots in both Alaska Basin and South Leigh lakes will be estimated using a direct mark - recapture sampling approach (Schaeffer, et.al. 1986). Immediately after snowmelt (~July 6), 20 live traps will be randomly placed in both Alaska Basin and South Leigh lakes. The random location of traps will be determined by laying a 10 sq. ft. cell size grid over the maps of Alaska Basin and South Leigh lakes. A number will be assigned to each grid cell then 20 random numbers will be selected using a random number table. The traps will be baited with a salty food mixture. The traps will be checked 24 hours later and all captured marmots will be marked with a dye that colors their fur then will be released. The dye must last for at least 1 month but must wear off by the following year. At the end of July, the traps will again be set out in the same locations. All traps will be checked the next day and the number of marked and unmarked marmots recorded. All people involved in this experiment will spend one day with a wildlife biologist learning how to set and bait traps, handle and mark marmots and record information.
The following formulaes will be used:

N = estimate of population size
t = number of marmots marked in beginning of July
n = total number of marmots (marked and unmarked) caught at end of July
s = number of marked marmots caught at end of July

Variance of N $\quad V(N) = t^2 n(n-s)/s^3$

Bound on error of estimation = 2 V(N)

If the abundance of marmots in South Leigh lakes falls outside of the bound for abundance of marmots in Alaska Basin then the null hypothesis (H_o) would be rejected and the alternative hypothesis (H_a) would be accepted. We sould then conclude that recreation use in Alaska Basin may be altering marmot abundance. This experiment will be repeated each July for 3 years to see if there is a consistant difference in marmot bundance between Alaska Basin and South Leigh lakes. All collected information will be stored on the Forest Service data general computer.

References:

Leonard, R.E. and A.M. Whitney. 1977. Trail transects: a method for documenting trail changes. USDA For. Ser. Res. Pap. NE-389.

Flora, M.D. et.al. 1984. Water quality criteria: an overview for park natural resource specialists. Tech. Rep. 84-4. Water Resources Field Support Lab. Water Resources Branch NPS Colo. State Univ. Fort Collins, CO.

APHA 1985. Standard methods for the examination of water and waste water. 16th edition. Am. Public Health Assoc. Wash. D.C.

Schaeffer, R.L. et.al. 1986. Elementary survey sampling. 3rd edition. Duxbury Press. Boston, MA.