

Background and Standard Operating Procedures
Craters of the Moon Vegetation Transects

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The vegetation transect monitoring program at Craters of the Moon has evolved over time.

"Permanent" Transects:

Four sets of "permanent" vegetation transects (six transects per set) were established by Ritchie in 1986 to study mule deer habitat. These transects were also used by Griffith in his 1980 mule deer study. In the late 1980's, an attempt was made to use the "permanent" transects for routine trend monitoring unrelated to the mule deer population. This attempt was unsuccessful because the goals of trend monitoring are quite different from those of monitoring for a specific species. The techniques used were too time consuming, and data was difficult to replicate with changing personnel. Data collection on these transects ceased in the late 1980's, however the transects have been retained in the field for possible future use.

Two of the "permanent" vegetation transects are located in the North End. The other two are in the wilderness area. A full description of location and monitoring techniques can be found in Griffith's publication on mule deer and vegetation transect monitoring.

"BLM" Transects

In 1985, a wildfire burned in the Quick Shot area on BLM land. The area had been grazed as a BLM allotment prior to the fire. Monument and U of I CPSU personnel established two transects with exclosures to monitor grazing as related to post-fire succession. Frequency data was collected on these transects. No grazing occurred on the allotment for several years after the fire, until 1991, when grazing was initiated again by Dillon Amy. He was licensed for 185 cows from 7/3/91 to 10/17/91, billed at 66% public lands (billed for 430 AUMs).

Since frequency data had been collected on the BLM transects, it was decided that they would continue to be read as part of the trend monitoring system at CRMO.

Revegetation Transects:

In 1987, Mary Laspina began several revegetation projects at the Spatter Cones, the housing area, and the old carcass dump site in the North End. Data was collected on these transects in 1987 and 1988. More information on the revegetation areas can be found in SOP's written by Mary Laspina (kept in the frequency sampling folder).

Carey Kipuka Transects:

Prior to addition of Carey Kipuka to the Monument, vegetation transects with soil pits were established by the BLM and the Soil Conservation Service. These transects were read for approximately ten years during the 1950s and 1960s by Passey, et al. This data was instrumental in adding the Kipuka area to the monument.

In 1988, Gerry Wright and Mack Barrington from the U of I CPSU located the Passey transects and collected data to replicate the Passey work. Gerry was doing this work without funding, so data analysis has not been completed yet.

In 1991, Dr. Neil West from Utah State University began a four year study to replicate Passey's work and determine vegetative changes since the 1960s work. His proposal is filed in the Investigator's Annual Report files in the RM office.

Trend Monitoring Transects:

In 1991, Gerry Wright and Steve Bunting from the University of Idaho and CRMO student intern Jim Steed established a new set of permanent vegetation transects for long-term monitoring. There are eight transects:

<u>General Location</u>	<u>UTM Coordinates</u>
1. Aspens above and west of the research camp (south side of Leech Creek)	290.28 E, 4816.73 N
2. Sagebrush on slope above north end road	291.01 E, 4816.30 N
3. Douglas fir on Grassy Cone	291.54 E, 4814.30 N
4. Cinder gardens near Devil's Orchard (N. of Devil's Orchard road)	294.53 E, 4814.22 N
5. Limber pine on Inferno Cone	293.97 E, 4813.15 N
6. BLM - Quick Shot East	293.53 E, 4818.63 N
7. BLM - Quick Shot West	293.47 E, 4818.50 N
8. Carey Kipuka - Vegetation type 11 (three-tip sage/Idaho fescue) - area where trail enters the kipuka	286.60 E, 4799.85 N

All the transect locations are shown on attached maps (except the BLM transects). All transects, except the BLM ones, are marked with orange and yellow metal fence posts. The transects generally follow contours. Posts were set in the ground so that the "knobs" on the flat surface of the post usually point directly away from the other post in order to aide location of both posts. Each

transect is 100 meters long.

The exclosures remain on the BLM transects. The middle 50 meters of each transect are within the exclosure. It is important that data from within the exclosure is recorded separately from outside data. In past years, this may not have been done because no grazing was occurring in the area.

Data was not collected in 1991 when the eight trend monitoring transects were established. 1992 will be the first year of data collection. Two transects will be read each year on a rotating basis:

- YEAR 1 (1992), (1996): 7. Inferno Cone
1. Above Research Camp
- YEAR 2 (1993), (1997): 6. First BLM transect (east)
3. Doug fir on Grassy Cone
- YEAR 3 (1994), (1998): 8. Carey Kipuka
2. Sage slope in North End
- YEAR 4 (1995), (1999): 4. Devil's Orchard cinder garden
7. Second BLM transect (west)

Transects will be read during the first three weeks in June every year

Equipment needed to read the transects

- * Post marked in decimeters - either the yellow/black one or the aluminum/black one
- * 35mm camera with 50mm lens and ASA 64 film (slide)
- * erasable/reusable sign with grease pen for marking
- * 100m fiberglass tape measure
- * frequency frame (Gerry Wright will send one to CRMO in spring, 1992)
- * additional 30m tape
- * dbh tape
- * Intermountain range plant name and symbols (Book by USFS, 1977)
- * data sheets (will need to be redesigned in 1992 to include tree data)
- * plastic bags with permanent marker for specimens

Each transect will be photographed on the years in which data is collected. Photos will be taken from the south or east end post. Place the post that is striped at decimeter intervals approximately 1 meter out from the end post as a height reference. Place a sign (erasable/reusable) indicating the date/time, transect location, and name of person collecting data in the photo. Use a 35mm camera with a 50mm lens and ASA 64 film.

Frequency data for forbes, grasses, shrubs, and tree

seedlings/saplings will be collected using a nested frame of 50cm x 50cm size. The frame is divided into four sections: 1) 10cm x 10cm, 2) 25cm x 25cm, 3) 25cm x 50cm, and 4) 50cm x 50cm. This size frame was selected because shrub communities are being monitored (as opposed to grass communities). The idea behind this nested frame is that a more abundant plant species will be found in the smaller frame section than a less abundant species, on average.

Species will be recorded using the four letter designations identified in the USFS Intermountain range plant names and symbols book

Stretch a 100m tape measure from end post to end post. Place the base side (the closed side) of the frame along the tape with the right side of the frame at the meter marks. The right side of the frame is the side with the smallest partition (the 10cm x 10cm). This will give you 100 readings. (See the attached diagram sheet for placement of frame).

Record every plant species observed within the frame with a corresponding frequency rating. The frequency number is a number from 1 to 4. It is determined by observing the smallest section of the frame in which the species is found. For example, starting with the smallest section, if species A is found for the first time in the smallest section, record a frequency rating of "1". If the species is not found in the 10 x 10 section, but is found in the 25 x 25 section, record a frequency rating of "2". If the first section in which a species is found is the 25 x 50 section, record a "3". A species that is first observed in the 50 x 50 section, would be recorded as a "4". Count only those plants that are rooted in the frame section. See the attached diagram sheet for a visual representation of the method.

Data will be collected on trees as well. On the aspen and Doug fir transects, measure all trees within 5m out from the tape on both sides. For the other vegetation types measure all trees 10m out from the tape on both sides, including all trees on the border. Record species and dbh for each tree, and each trunk on forked trees, excluding trees with a dbh of less than two inches.

DATA ANALYSIS:.....Sum Frequency Analysis by Hironaka

Frequency data: For each species, count the number of times a "1" was recorded. Since there are 100 plots, this number equals the percentage of plots in which that species was found in the smallest section. Then count the number of times a "2", "3", and "4" were recorded for that species, along with the number of plots the species was absent from. Also, count the number of dead trees and try to determine the cause of death.

Frequency data for grasses, forbes, and shrubs could also be lumped and compared to see if the different vegetation classes are changing, in addition to looking at individual species.

To compare from year to year, use the "95% Confidence Intervals for Frequency Observed for 100 Plots" table. If the CIs for frequency for the same species on the same transect in different years overlap, the two frequencies are not statistically significantly different.

Trees: Calculate density per standard area for each species. Data could also be broken down into size categories.

Compare the 95% confidence intervals for species density to see if statistically significant changes are occurring.

Actual field notes and mathematical worksheets should be included in the annual submission of administrative papers to the museum archives under a monitoring programs folder, after three years.

Insert by Gerry Wright 5/93

Background

The monitoring procedures using frequency data are designed to measure range trend. Range trend is the direction of change in range condition, which is commonly indicated by changes in species composition and species density. Plant frequency is the percentage of plots that contain a given plant species. Frequency data are a good measure of trend because they provide relatively precise measurements, they are fairly easy to collect, and they are sensitive to changes in range condition.

Other measures of range condition such as cover or yield are strongly influenced by between-year and between-season variations in weather and grazing and are therefore not as useful for examining trend. Plant density, particularly of perennial vegetation, is less affected by these factors but is tedious to measure particularly if plants are small or numerous.

Frequency data do however have certain limitations that must be accounted for to maximize their usefulness. Four factors that influence frequency analysis are: 1) plot size, 2) plant size, 3) plant distribution, and 4) plant density. A change in any one of these variables will change the resulting frequency value. It is impossible to control plant size, distribution or density when sampling vegetation. Plot size, therefore, is the only variable that can be altered to give desired frequency values. Because of variations in plant size, distribution, and density a given plot size will sample certain species more adequately than others.

The ideal frequency sampling scheme to account for such variations would involve having a different-sized plot for each species. This solution is however too complex. A simpler approach is to use a standard plot size for all vegetation types.

However, this approach makes it difficult to detect species that have relatively few individuals (a common situation in nature). Although most key management species monitored for range trend are

not rare, there are often cases when it is of interest to have data about both numerous and scarce species occupying the same site. Increasing species frequency by enlarging a single plot size could improve the likelihood of detecting range trend in species having lower frequencies. However, this is not practical since enlarging plot size would simultaneously increase the frequency for all species present. If the frequency of any species reached 100% it would become impossible to make comparisons because future increases in density of that species would still yield values of 100% frequency. Therefore, enlarging plot size could potentially reduce the number of species having frequency values useful for determining range trend. Appropriate frequency values for vegetation monitoring are usually considered to be in the 63 to 86% range for the most prevalent species.

The use of a nested frequency plot where 3 or 4 various sized plots are located (nested) within each other in a single configuration is one way to widen the range of frequency samples while at the same time improving the sensitivity to change for those species with lower frequency readings. A nested frequency plot system using 4 different plots has been the method chosen to monitor range vegetation at CRMO. The plot sizes are 10 x 10 cm (100 cm²), 25 x 25 cm (625 cm²), 25 x 50 cm (1250 cm²), and 50 x 50 cm (2500 cm²).

Data Analysis

There are two methods of analyzing data collected from nested frequency plots. One approach is to compare data from only the plot size which gives the most sensitive detection of change over time for a given species. This means for a given species, comparing the frequencies measured for one plot size in one year with the frequencies measured for the same plot size in a subsequent year. This is normally not necessary for the plant species found at CRMO, but this is always an option because the nested frequencies are always available.

Most studies have shown that summing the frequencies over all plots provides the greatest sensitivity to measuring vegetation change, and this is the recommended procedure. In using this procedure, for each species one counts the number of times a "1", "2", "3", or "4" are recorded for each species. Since there are 100 plots, this number gives the percentage of plots that the given species occurred in or its frequency of occurrence. An example of this calculation is given in Table 1.

The net or summed frequency is recorded and can then be compared with similar readings for that species in past or subsequent years. One evaluates changes in range trend by looking at changes in the frequencies of individual species or groups of species, e.g., perennial grasses. Frequency measures follow a binomial distribution which means that it is possible to know whether differences in plant frequency from one year to the next are due to sampling error or real differences. With a binomial distribution, a table of confidence intervals about each frequency percentage for a given number of plots can be calculated. A "95%

Confidence Interval Table" for the binomial distribution with 100 plots is enclosed with SOP. Using this table provides the easiest method to determine if a given change in frequency is "significant". For a plant species to show a significant change from one sampling date to another, the confidence intervals for the two frequency percentages should not overlap. When the percentages overlap, there is not a statistically significant difference in the data at the 95% level of probability and the difference could be due to sampling variation. For example a 50% frequency is not really different from a 55% frequency. The changes in frequency of occurrence in cheat grass shown in Table 1. are significant.

Table 1. Example of plant species frequency data measured in 100 plots.

Date	Species	Percent Occurrence (Frequency) by Plot Size				Sum
		1 (10x10)	2 (25x25)	3 (25x50)	4 (50x50)	
7/88	bluebunch					
	wheat grass	20	25	45	-	90
	cheat grass	5	10	10	5	30
7/90	bluebunch					
	wheat grass	15	25	35	10	85
	cheat grass	10	25	15	10	60