

1995 VISITOR IMPACT AND MONITORING PROGRAM TRANSECT SUMMARY BRYCE CANYON NATIONAL PARK

Bryce Canyon National Park has recorded increases in visitation of about 10% per year over the past decade. In 1993, the park recorded over 1.6 million visitors, the majority of which frequented the more prominent overlooks. Overlooks such as Sunrise, Sunset, Inspiration, Bryce Point, Farview, and Rainbow Point are heavily impacted by foot traffic, especially in areas where people choose not to stay on established trails.

In the spring of 1994 transects were established in different areas of high use by the general public. The purpose of these transects was to begin collecting information that would help in understanding the impacts that heavy visitor use has on the natural environment of the overlooks. Prior to this time, the park did not have a monitoring program to determine visitor impacts on vegetation or soils. Measuring parameters such as vegetation cover, bare ground, soil compaction, and soil permeability in areas of heavy, moderate, and light visitor use enable us to establish trends in human-caused impacts. Understanding these trends and causes can help determine effective actions for mitigation. Transect readings in areas of different amounts of human usage will allow comparison and determination of "acceptable" impacts.

Ten transects were established along the main amphitheater. The transects were laid out parallel to the rim, enabling measurement of trails to and from the rim. Two of these transects were located in areas with little or no impact to act as a control to what the natural or non-impacted area would be.

Each transect is 100 meters in length with plot, or square measurements, taken at 5 meter increments, giving 20 plots. Each 5 meter plot reading was laid out the same so as to produce a consistent reading and replication in the future. Readings were estimated and recorded for the percent of grass, shrub, litter, and bare area. No readings of trees or woody material were recorded since people have a tendency not to walk on them.

Soil penetrometer (compaction) measurements were also taken at 5 meter increments. Penetrometer measurements tell us how much the soil has been compacted by foot traffic and also other causes.

Social trails crossing the transect were recorded at the first point of intersection and the last point. For example, if the trail is first encountered at 15'3" and last encountered at 16'5" it would be recorded with these measurements. This provided us with an actual measurement of bare area due to social trails along the transect. We considered a social trail to be three or more sets of footprints on the same route or a distinct path developed. Designated (hardened) trails were measured and included in the calculations. Although these designated trails were established by the park, they still represent "bare ground", where vegetation does not exist. The width of a designated trail generally is a constant, unless widened by the park.

In 1994, we established and read the transects once in the spring, before heavy visitation, and once again in the fall, as the visitation began to lighten. In 1995, we repeated this process and read all transects twice, except for the Sunrise Point transect, which could not be located. It was

replaced in the fall and an additional transect was established in the Swamp Canyon Connecting Trailhead area. The data from Swamp Canyon is not included in the 1995 analysis.

Table 1 compares spring 1994 to fall 1994 data. It shows that due to impacts caused by human footsteps, there is 36.80% more bare area than compared to the control areas which receive minimal foot traffic. This number is derived from the trailed areas (19.19%), added to the absolute value of the decrease in organic component (17.61% - includes the grass, forb, shrub, and litter loss added together).

Table 1 1994 Data

	% grass	% forb	% shrub	% litter	% bare	av. pen.	% trail	% organic
Transect Averages	1.89	1.70	4.45	12.48	18.96	9.88	19.19	20.52
Control Averages	7.94	2.44	7.75	20.00	1.53	7.73	0.00	38.13
Variation	-6.05	-0.74	-3.30	-7.52	17.43	2.15	19.19	-17.61

Table 2 displays the 1995 transect data and shows that in areas crossed by trails the total bare area has increased to 41.99% (the total of 20.48% and 21.51%). This is an increase from 1994 to 1995 of 5.19% in bare area.

Table 2 1995 Data

	% grass	% forb	% shrub	% litter	% bare	av. pen.	% trail	% organic
Transect Averages	1.95	1.23	4.76	8.92	21.72	9.54	20.48	16.86
Control Averages	12.16	2.72	8.50	15.00	1.44	6.64	0.00	38.38
Variation	-10.21	-1.49	-3.74	-6.08	20.28	2.90	20.48	-21.51

An explanation of this data is important. First, and most obvious, wherever trails are developed

vegetative material is removed, increasing bare area. This is true whether the trails are designated and hardened or social trails created by visitors choosing not to use designated trails. The second important finding is the reduction of vegetative material in the areas of social trails. The combination of the grass, forb, shrub, and litter forms the organic category and we see an average decrease of almost 20% in biomass or organic material (vegetation and litter) where we have trails, in particular social trails. The last area of concern is in bare area. We found that in areas where trailing occurs, we have increased (when compared to the control areas) bare area by an average of 19.84% (the average trailed area increase for the two years). This alone would be justification for drastic management measures, but when we combine this with the additional 19.56% average decrease of organic matter to the surface area, we have a net increase of 39.4% of bare area when compared to the control areas.

Between the years of 1994 and 1995 we have experienced continued degradation of resources in the main amphitheater area. The data from these transects indicate bare area increased 5.19%. This is an alarming fact that merits immediate management attention. However, reading transects on only a two year basis does not establish a scientific trend. Many variables (weather patterns, visitor use patterns, vegetation response to environmental conditions, etc.) may play a major role in establishing trends. Therefore it is imperative these measurements be continued over a long term (at least five to eight years to establish a trend). It is important management not delay corrective action to wait for such findings.

With the closure of the road in the south end of the park additional areas were damaged, in particular, the Swamp Canyon Trailhead. In little more than two years this area was heavily damaged and may take decades to rehabilitate. In only one transect measurement, we found 38.75% bare ground, in a previously dense manzanita area.

It is of particular interest that during the summer of 1994 and spring of 1995, rope and fence barriers were erected in both the Sunset Point and Inspiration Point areas. Observations of visitor use on social trails in these areas by staff conducting the VIMP transects showed a marked decrease in the use of non-designated trails in these areas. Prior to the installation of the rope barriers, 74% of the visitors at Inspiration did not remain on designated trails. At Sunset Point, approximately 37% of the visitors left designated trails before the log fences were installed. After only partial installation, this number dropped to 8%. This number clearly indicates the majority of visitors are respectful of fences and other types of barriers.

The category of penetrometer readings is interesting. In the spring the soils are relatively non-compacted due to the winter freeze and thawing effects. Late summer rains help bring minerals to the surface which will naturally increase hardness of soil. Due to this seasonal variation, we have not used the soil penetrometer readings in our analysis. Through this study we found, however, that leaf litter and other organic material on the soil surface tends to greatly decrease the soil compaction. In areas where there are social trails we have a decrease in soil penetration.

This relates to three areas of critical concern. One is seed introductions in the soil and the subsequent root penetrating ability. When soils become too compacted seeds will not penetrate the surface and establish themselves. If they do, the roots emerging will not be able to penetrate into the soil to establish and remove the nutrients necessary for life.

The second factor is water penetration. When soils become compact water cannot penetrate into them and thus run off of the surface. This will cause two problems. The first is erosion. Water that cannot percolate into the soil will run along the surface and remove vegetative material that would replenish nutrient supplies for plants and animals living within the soil. The second is the restoring of the water supply within the soil itself, or the water table. When this drops too low, plants die and the cycle continues at a vicious pace.

The third area mentioned before is the season of soil compaction. In spring and early summer when soil is least compacted we have the greatest potential for damage by traffic. Seeds and organic material in this loose soil are trampled upon, broken and easily carried away by feet, water and wind. Thus, seeds do not establish providing no subsequent vegetation and no soil genesis occurs furthering the degradation of the area.

The Visitor Impact Monitoring Program has shown an increasing negative impact to the soils and vegetation in those areas of Bryce Canyon National Park where visitor use is concentrated and heavy. This study has also clearly shown that barrier structures (fences) can reduce the number of visitors creating and using social trails. We will continue to monitor the transects so we can obtain information that will help us manage this beautiful area while protecting the valuable resources we come here to see. Continued recording of this data will enable us to see trends happen on seasonal and yearly basis, but more importantly, plan and implement measures to protect the resources.

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