

PLANT COMMUNITY DISTRIBUTION AND DYNAMICS  
IN BRYCE CANYON NATIONAL PARK

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Objectives

The overall objectives of the research are: 1) to develop a comprehensive classification for all stages of successional development for all vegetation types within the Park, 2) to map the potential vegetation and current vegetation types throughout the Park, 3) to develop a simple succession model for predicting vegetation dynamics for each vegetation type in the Park, and 4) to map distributions of rare or endangered plant species within the Park. The combination of these objectives will provide Park managers with a predictive tool for Park management, and will provide vegetation ecologists with a comprehensive knowledge of the landscape vegetation dynamics of a range of vegetation types.

Methods and Results to Date

1) Comprehensive Vegetation Classification -- The first objective is completed for the forest vegetation within the Park. The potential climax vegetation within the Park was classified into habitat types according to Youngblood and Mauk (1985). This classification scheme divides the environment into areas of equal vegetation potential, based primarily on the shade tolerance relations of the tree species and competitive hierarchy of undergrowth species. Within habitat types a wide range of successional communities may exist, determined by the historical pattern of disturbance (primarily wildland fire) and chance events. Based on our understanding of the competitive relations and autecological characteristics of the tree species, a simple but logical successional community classification has been developed for each potential vegetation type. This successional community classification follows the successional pyramid model of Steele (1984).

Potential vegetation and current vegetation classifications are not yet complete for the non-forest vegetation within the Park. The non-forest vegetation sampled intensively in the 1987 field season, and data analyses to produce these classifications are proceeding. A non-hierarchical cluster optimization algorithm will be employed to produce the non-forest habitat type classification. This procedure produces vegetation classes with maximum within-class compositional similarity

and minimum between-class similarity, and leads to an efficient classification scheme.

The successional community classification for the non-forest habitat types will be based on our assessment of the competitive hierarchy within these communities, and will employ a structure similar to the forest successional community classifications. Unfortunately, there is not a wide range of successional communities present for the non-forest vegetation, and sampling was somewhat restricted to late seral vegetation.

2) Mapping Potential and Current Vegetation -- The forest habitat type (potential vegetation type) map is nearly complete for the entire Park. Due to an exceptionally productive field season in 1987 large areas of the Park were field mapped, and very little area needs to be mapped by extrapolation. Efforts to map the forested area of the Park to current vegetation type are proceeding. During the two field seasons approximately 160 sample plots were located throughout the forested area, and these sample plots have been located on the topographic base maps for transfer to the color aerial photographs. Analysis of the image characteristics of the sample plots combined with the habitat type map will be employed to map the current forest vegetation throughout the Park. Preliminary analysis of extrapolation methods has demonstrated that the classification tree method (Breiman and others 1984) produces superior results over linear discriminant analysis. We will continue our analysis of the relative merits of different techniques for map extrapolation, but are focusing on classification trees.

Non-forest vegetation has been mapped to tentative habitat types, pending completion of the data analysis and finalization of the types. As noted above, there does not appear to be a great amount of successional diversity within the non-forest communities, and mapping of successional community types will largely follow the habitat types.

3) Development of Simple Succession Models -- Starting with simple autecological characteristics of tree species (vital attributes as per Nobel and Slayter 1980) we have developed a simple stochastic simulation model which predicts the quantitative composition of individual vegetation types at specified points in time, assuming characteristic disturbance intervals. This model is based on the competitive relations and resistance to disturbance of individual tree species within the community, with other species estimated by correlation. In addition to estimating the community composition, the model classifies each stand by successional community type and predicts the successional pathway of each community. Communities subject to recurrent disturbance show characteristic response with complex succession and disturbance pathways. We are currently employing the model in an investigation of the effects of fire return interval on the vegetation composition of mesic forests in the Park. Similar models will be developed for the non-forest communities by emphasizing the characteristics of potential dominant species, and again predicting lesser species by correlation with the dominants.

4) Mapping the Distribution of Rare or Endangered Species -- Two potentially rare or endangered plant taxa are known to occur within the Park: *Pediomelum pariense* (previously *Psoralea pariensis*) and *Castilleja revealii*. During the course of the study the known range of distribution of *Pediomelum* in the Park has been significantly extended, with new sightings in several areas. Accordingly, we have initiated a study of the habitat requirements of this species, and hope to determine potential areas for this species. Previously, *Castilleja revealii* had only been observed once in the Park. Several additional sightings have now been made, but this species appears to have limited distribution within the Park. Populations of both species have been documented on the base maps of the Park.

#### Literature Cited

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