THE GAMMA FOREST AT BROOKHAVEN NATIONAL LABORATORY: A MODEL FOR DEPICTING GEOBOTANICAL DATA

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INTRODUCTION

There are numerous ways of presenting field data, ranging from line graphs showing animal and/or plant distributions, to histograms, depicting sedimentary characteristics (MacArthur 1972, Polunin 1971). Seldom do these methods adequately portray the interrelationships of the various components of the system under consideration.

Data obtained in the course of a recent study (Superina 1998) ranged from sediment chemistry and size to vegetational analysis. This paper will show geobotanical relationships by integrating the geological, chemical, and botanical data obtained during the study.

The data was obtained in the Gamma Forest at Brookhaven National Laboratory (BNL), the site of the classic study on the effects of long-term irradiation on a forest ecosystem (Sparrow and Woodwell 1962, Woodwell 1968). In 1979, at the termination of the study, the area was subdivided into 5 circular vegetational zones, each with a dominant vegetation type. This area was next surveyed in 1998, when obvious changes in the vegetational communities were noted (Superina 1998). The patterns observed in the present-day community structure of the Gamma Forest are directly related to the long-term irradiation which resulted in a differential mortality of various species. The dominant factors involved in determining the community structure of this woodland appear to be interspecific competition such as shading, and the indirect effect the radiation had on the chemical composition of the sediments, particularly those nearest the source, by eliminating the soil microorganisms. The Gamma Forest proved to be an ideal study area for designing the technique due to the distinct population distributions.

STUDY SITE

The Gamma Forest is located in the northeastern section of BNL (Figure 1). The undeveloped portions of BNL are densely vegetated, with pine-oak and oak-pine woodlands dominating the area. The Gamma Forest, prior to irradiation, consisted of a 65-hectare oak-pine woodland.

 Click on thumbnail to see larger figure.

Figure 1. Study Site

The present day Gamma Forest shows 6 distinct circular vegetational zones. Table 1 gives the vegetational zones and their dominant vegetation, along with their respective distances from the radiation source. The vegetational zones are shown in Figure 2.

Table 1. Circular Vegetation Zones in 1998

Name of Zone		Dominant Vegetation	Distance from radiation source (m)
Ground Zero	**A**	No obvious vegetation	0-2
Pine Core	**B**	Pitch Pine (*Pinus rigida*), Blueberry (*Vaccinium spp.*), Huckleberry (*Gaylussacia baccata*)	2-20
Sedge Zone	**C**	Pennsylvania Sedge (*Carex pensylvanica*)	20-35
Transition Zone	**D**	Blueberry, Huckleberry, Scrub Oak (*Quercus ilicifolia*)	35-50
Oak Forest	**E**	White Oak (*Quercus alba*), Scarlet Oak (*Quercus coccinea*), Blueberry, Huckleberry	50-80
Oak-Pine Forest	**F**	White Oak, Scarlet Oak, Pitch Pine	80+

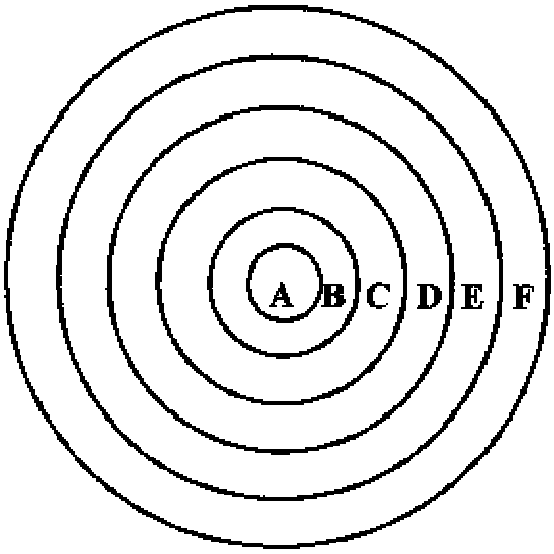

Figure 2. Vegetational Zones in the Gamma Forest 1998

METHODS

The methods employed in this study for the vegetational mapping were transects and quadrats. Sediments were collected randomly from each of the vegetation zones by soil boring or trenching. Upon collection, the sediments were divided to provide samples for size and chemical analysis. The size of the sediments composing each horizon was determined using standard sediment sieves. Each sample was separated into granules, very coarse, coarse, medium, fine, very fine sand and clay and silt. After sieving, each fraction was weighed, and the percent weight of each fraction was calculated and graphed.

A total of five chemical parameters: ammonia, nitrate, nitrite, phosphorous and potassium were determined using methods based on the Mehlich I Extraction Method which measures soil nutrients available for plants.

DATA

One method of showing vegetational distributions is through single species kite diagrams. Single species kite diagrams are shown for a North-South transect in the Gamma Forest (Figures 3,4).

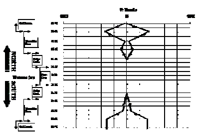

Figure 3. Scarlet Oak Distribution Kite Diagram

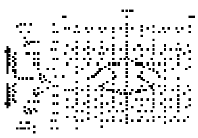

Figure 4. Pitch Pine Distribution Kite Diagram

This method does not adequately show the relationships among all the various species inhabiting the Gamma Forest. A composite kite diagram, showing the distribution of all species in the Gamma Forest community was developed to address this problem (Figure 5).

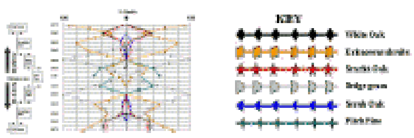

Figure 5. Composite Kite Diagram of Vegetational Distributions in the Gamma Forest

Standard methods of showing geological and chemical data are through histograms and line graphs and are given in Figures 6 and 7.


Figure 6. Geological Data


Figure 7. Chemical Data

These methods do not show the relationships among the geological, chemical, and botanical data of any given community. The composite vegetational diagrams are therefore further expanded with geological and chemical data (Figure 8).

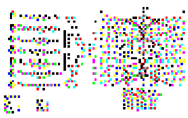

Figure 8. Composite Kite Diagram with Geological and Chemical Integration

DISCUSSION

The method described shows the dynamics of a woodland ecosystem. This technique may also be applied to other ecosystems. For example, the method can be applied to a variety of systems such as estuarine communities from the intertidal zone landward to and including the adjacent uplands.

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