A Tree Census of Pre and Post-Tornado Forest Conditions of Happy Valley, Jefferson County, Kentucky

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Abstract

A tree census was taken in a wooded valley which was struck by a tornado in April, 1974. Pre-tornado data indicated this was a near mature, second growth, sugar maple-buckeye community. Post-tornado analysis shows a loss of about one-third of the trees and a change to a sugar maple-white ash-swamp white oak community. This study affords baseline data to follow secondary succession within the forest.

Introduction

A tornado struck the Hanover College campus on April 3, 1974, and damaged a wooded valley, Happy Valley, northeast of campus. The partial destruction of the forest initiated secondary succession in the valley. The study site was the tornado blow-down area known as Happy Valley, which is located in the W½ Sec. 7 T3N R10E, Madison West Quadrangle, Jefferson County, Indiana (Fig. 1). The valley was a secondary growth sub-climax, mixed deciduous forest with good drainage from the uplands which surround the valley. The purpose of this study was to document the extent of forest destruction in the valley and to ascertain the immediate post-tornado condition of the woods so that future studies can evaluate the nature of forest recovery.

Pre-tornado data were obtained from class projects dating from the mid-1960's to the fall of 1973. The most useful was a project done in 1973 in which the class (Davis) transect paralleled the No. 2 transect in this study about 61 m to the south. Data from initial post-tornado study made in May 1974 was expanded into this report.

Methods

Point-quarter sampling (Cottam and Curtis, 1956) at 15.2 m intervals along three line transects, yielded phyto-sociological data. Nomenclature of tree species follows Gleason (1952).

Data analysis involved computations of relative values of density, frequency, and basal area which were averaged to yield percent importance (Cottam & Curtis, 1956). The tree data were divided into four diameter size classes as follows:

Class 1: 5.1 to 10.2 cm in diameter
Class 2: 10.2 to 20.4 cm in diameter
Class 3: 20.4 to 30.6 cm in diameter
Class 4: Greater than 30.6 cm in diameter.

A Hewlett-Packard 9820A was used for the statistical calculations. A program was written to calculate relative dominance and relative basal area per class size.

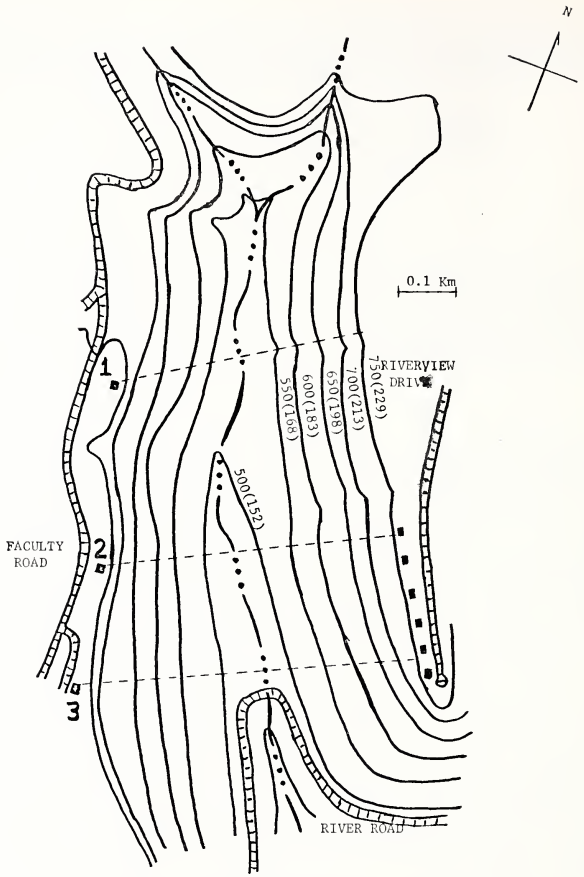

FIGURE 1. *Topographic map of Happy Valley study site. Numbers 1, 2 and 3 designate origins of each transect. Contour interval: 50 ft (15.2 m).*

Results

Transect No. 2 was used as representative post-tornado data (Table 1) as it closely parallels the pre-tornado (Davis) transect. Relative dominance and importance values could not be compared for lack of pre-tornado data. For an overall view of the blow-down area transect Nos. 1 and 2 are combined (Table 1). Transect No. 3 is not applicable here for an estimated one-half of it is outside the blow-down area.

A summary of the relative importance values from transect No. 2 is offered in Table 2. A comparison of percent importance by class size characterizes the species composition at different stages of growth, which in turn may represent a shift in species composition of the forest.

TABLE 1. *A comparison of pre and post tornado data of the forest stand. The following symbols are used in Tables 1 and 2: RD= relative density; RF= relative frequency; RIV= relative importance value; MD= mean distance; MA= mean area; T/H = trees per hectare.*

Davis transect			Transect No. 2		
Species	RD	RF	Species	RD	RF
Acer saccharum	45	31	*Acer saccharum*	64	42
Aesculus glabra	18	19	*Ulmus sp.*	8	12
Prunus virginiana	7	9	*Fraxinus americana*	5	9
Ostrya virginiana	5	7	*Aesculus glabra*	4	7
Quercus prinus	5	7	*Quercus bicolor*	4	5
Ulmus sp.	5	5			
Fraxinus americana	2	2			
Miscellaneous sp.	17	20	Miscellaneous sp.	15	25
Totals	100	100		100	100

Summary of pre and post-tornado tree census data.

Transect	MD(m)	MA(m^2)	T/H
Davis	4.42	19.56	511.7
No. 1	5.06	25.64	390.7
No. 2	4.66	21.78	459.8
Woods*	4.85	23.70	425.3

* Woods summarizes data from Nos. 1 and 2.

Discussion

In analyzing the summary data it is evident that pre-tornado conditions include greater numbers of trees per hectare along with a decreased mean area and mean distance per tree (Table 1). Post-tornado conditions indicate an increase in relative density and dominance in *Acer saccharum, Ulmus sp.* and *Fraxinus americana,* accompanied with a decrease of those values in *Aesculus glabra* (Table 1).

When the composition of the forest considers species percentage of importance by class size, the direction of succession becomes evident. In all four class sizes *A. saccharum* has a far greater relative importance value (Table 2). *U. sp.* has the second largest relative importance value in classes 1 and 3, third largest in class 2 and it is not represented in class 4.

The forest was previously an *Acer saccharum-Aesculus glabra* community. Analysis combining transect Nos. 1 and 2 using relative importance values indicates *A. saccharum* strongly established while *A. glabra* has been reduced greatly. Increasing dominance of *F. americana* and *Quercus bicolor* along with *A. saccharum* appear to characterize the beginning of secondary succession within the forest.

TABLE 2. *Species percent importance by size class using transect No. 2.*

Class 1		Class 2	
Species	RIV	Species	RIV
Acer saccharum	210.6	*Acer saccharum*	181.4
Ulmus sp.	26.8	*Quercus bicolor*	25.3
Cercis canadensis	18.3	*Ulmus sp.*	20.9
Fraxinus americana	16.2	*Fraxinus americana*	20.2
Aesculus glabra	16.2	*Celtis occidentalis*	11.6
Celtis occidentalis	8.5	*Carya cordiformis*	11.0
Tilia americana	8.5	*Juglans nigra*	10.4
		Quercus borealis	10.4
		Fagus grandifolia	8.4
Totals	305.1		299.6

Class 3		Class 4	
Species	RIV	Species	RIV
Acer saccharum	157.1	*Acer saccharum*	79.0
Ulmus sp.	45.4	*Juglans nigra*	55.0
Carya cordiformis	36.5	*Quercus bicolor*	51.8
Aesculus glabra	35.3	*Platanus occidentalis*	43.5
Celtis occidentalis	25.7	*Quercus prinus*	37.2
		Fraxinus americana	33.4
Totals	300.0		299.9

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