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WOODY UNDERSTORY AFTER A SPRING BURN AT THE ROCKY BRANCH NATURE PRESERVE, CLARK COUNTY, ILLINOIS

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ABSTRACT

The woody understory at the Rocky Branch Nature Preserve was surveyed in burned and unburned forested areas. In the unburned areas seedlings average 1.57 individuals per sq m and saplings 0.29 individuals per sq m. In the burned area no saplings are present, but seedlings average 8.73 individuals per sq m. In both areas sugar maple is the most important understory component, accounting for more than 30% of the seedlings and 80% of the saplings in the unburned area, and 75% of the seedlings in the burned area. Very few seedlings and saplings of oak and hickory species occur in the understory. The data indicates that a ground fire will remove most of the sugar maple saplings, and will open the sapling canopy. Sugar maple, however, will continue to dominate in these newly created gaps after a single fire.

INTRODUCTION

Rocky Branch Nature Preserve is a 53 ha (130 acre) woodlot located six miles northwest of Marshall, Clark County, Illinois. This preserve is in the northern part of the Southern Uplands Section of the Wabash Border Natural Division (Schwegman, 1973). In this section the oak forests contain a mixture of beech, sugar maple, tulip tree, and other species typical of the forests to the east of Illinois.

Several vegetation studies have been undertaken in the preserve. The plant associations and a checklist of the vascular plant species were reported by Stover (1930), while Arzeni (1947) prepared a checklist of the bryophytes. Ebinger and

Parker (1969) studied the woody vegetation of the western section of the preserve, the eastern section was surveyed by Hughes and Ebinger (1973), while Hellinga and Ebinger (1970) prepared a checklist of the vascular plants. In 1985 the woody vegetation of the western section was again surveyed (Clapp and Ebinger, 1988). The results of these surveys indicate that the forests in the preserve are undergoing a change in structure and species composition. The major changes involve the explosive increase in sugar maple (*Acer saccharum* Marsh), and a corresponding decrease in the importance of the oak species.

In the original study of the western section of the preserve (Ebinger and Parker, 1969) sugar maple ranked fifth in importance value (IV) while presently it ranks second in IV behind white oak (Clapp and Ebinger, 1988). Other taxa with high IV's include black and red oak along with mockernut, shagbark and pignut hickory. Similar results have been observed in other forests in east-central Illinois (McClain and Ebinger, 1968; Newman and Ebinger, 1985). These findings indicate that sugar maple is replacing oaks and hickories as the dominant forest species in central Illinois (Ebinger, 1986). Runkle (1984) found that this aggressive species is able to rapidly fill tree-fall gaps. Also, this species grows rapidly, even in fairly small gaps, due to its ability to grow and form extensive root systems at low light levels (Logan, 1965).

The present study was undertaken to determine the woody understory composition of a section of this woodlot that had been subjected to a ground fire in 1980, and compare the result to an adjacent portion that had not burned. The results give some indication as to the effect of a single fire on a sugar maple dominated understory.

DESCRIPTION OF THE STUDY AREA

The study area is located in the western most portion of the Rocky Branch Nature Preserve, which consists of a 6.5 ha (16 acre) woodlot located in the NE ¼, SE ¼ of Section 30, T12N, R12W, Clark County, Illinois. The topography of the area varies from a level to gently sloping upland in the western part while the remainder of the area is divided by ravines with gradually sloping sides to steep banks. Ebinger and Parker (1969) divided the woodlot into three vegetation regions based on woody overstory composition: a white oak region which occurs on the relatively flat uplands, a sugar maple region on a steep north-facing hillside, and a mixed hardwood region on the slopes and lowland areas associated with small streams and ravines. The present study was conducted in the white oak region. Here white oak accounts for over 40% of the total IV with 87 stems per ha, while black oak (18.3 stems per ha, IV of 20.9) and hickories (49.2 stems per ha, IV of 28.5) are the most common associates. Also, in this cover type sugar maple is extremely common in the seedling and sapling categories, as well as in the lower diameter classes, averaging 45.8 stems per ha and with an IV of 23.3 (Clapp and Ebinger, 1988).

METHODS AND MATERIALS

Eight 50 m transects were randomly located in the unburned section of the white oak region while four 25 m transects were located in the burned section. Along each transect continuous 1 sq m quadrats were established and all woody

seedlings (less than 2.5 cm dbh) and saplings (2.5-10.0 cm dbh) were counted and identified (Mohlenbrock, 1975). For all seedlings and saplings over 100 cm in height a basal cross section of the stem was removed and the number of annual rings determined. Also, the height (cm) and basal diameter (mm) of all of these individuals was recorded. All woody seedlings were recorded by height class (less than 40 cm tall, 40-100 cm tall, more than 100 cm tall). From this data the density (individuals per sq m) and the frequency was determined for each species.

RESULTS AND DISCUSSION

In the early spring of 1980 a ground fire of unknown origin burned through part of the woodlot at the western edge of the Rocky Branch Nature Preserve. A small part of the mixed hardwood region and less than one-quarter of the white oak region burned. The fire resulted in a total top kill of all woody seedlings, saplings, and a few of the smaller diameter trees, but did not kill any tree with a diameter greater than about 15 cm dbh.

Twelve species of woody seedlings were recorded from the plots in the section of the white oak region that had not burned (Table 1). Of these species, only *Acer saccharum* and *Ulmus rubra* are commonly encountered, both average more than 0.5 seedlings per sq m and with a frequency of 29% or greater. Most of the *A. saccharum* seedlings are small, usually less than 40 cm tall, while the majority of the *U. rubra* seedlings are between 40 and 100 cm in height. The seedlings of the other species encountered are always less than 40 cm tall, and most appear to be one or two year old plants. *Acer saccharum* completely dominates the sapling category in this section of the white oak region (Table 1), averaging 0.25 individuals per sq m. Of the *A. saccharum* individuals over 100 cm tall two distinct size classes are present. A few individuals are found that averaged close to ten years in age, have an average basal diameter of 10 mm, and an average height of 126 cm. The second group exceed 20 years in age, has a diameter greater than 20 mm, and a height greater than 240 cm. This gap in size and age is probably the result of past disturbance in the woods 12 to 15 years ago. This disturbance was probably a ground fire, since old fire scares are present on some of the older saplings and young sugar maple trees.

In the section of the white oak region that burned in 1980, *Acer saccharum* seedlings dominate the understory, accounting for more than 75% of all the individuals recorded (Table 2). Overall, this species averages 6.62 seedlings per sq m with most of the individuals in the less than 40 cm height class. The larger seedlings of this species (over 100 cm height class) are mostly stump sprouts from top killed saplings, are seven years old, average 11.4 mm in diameter at the base, and are less than 2 m tall. The seedlings of all other species are poorly represented, and except for a few individuals of *Ostrya virginiana*, *Ulmus rubra*, and *Cornus florida*, none reached more than the 100 cm height class (Table 2). All of the oak and hickory seedlings encountered in this region are less than 40 cm tall. No saplings were encountered in the plots in this section of the woodlot.

Though the western section of Rocky Branch Nature Preserve still contains many large oak and hickory trees (Clapp and Ebinger, 1988), the present study indicates that they are not reproducing since few individuals of these species are found in the understory. The present data also suggests that sugar maple is an

aggressive species that will replace the oaks and hickories as these veteran trees die. The data also indicate that a ground fire will remove most of the sugar maple saplings and will open the shrub-sapling canopy. Sugar maple will continue to dominate in these newly created gaps after a single fire.

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Table 1. Density (individuals per sq m) and frequency of seedlings and saplings in the unburned part of the white oak region at the Rocky Branch Nature Preserve, Clark County, Illinois.

Species	Seedlings (less than 2.5 cm dbh)		Saplings (2.5-10.0 cm dbh)	
	Density	Freq. %	Density	Freq. %
Acer saccharum Marsh.	0.51	29	0.250	24
Ulmus rubra Muhl.	0.59	33	0.010	1
Quercus alba L.	0.15	12	—	—
Fraxinus americana L.	0.14	14	0.005	1
Carya cordiformis (Wang.) K. Koch.	0.07	7	—	—
Carya glabra (Mill.) Sweet.	0.02	2	—	—
Ostrya virginiana (Mill.) K. Koch.	0.02	1	0.010	1
Carya ovata (Mill.) K. Koch.	0.02	2	0.005	1
Prunus serotina Ehrh.	0.02	2	—	—
Quercus velutina Lam.	0.01	1	—	—
Morus rubra L.	0.01	1	—	—
Cornus florida L.	0.01	1	0.010	1
Totals	1.57		0.290	

Table 2. Density (individuals per sq m) and frequency by diameter class for woody seedlings in the burned area of the white oak region at the Rocky Branch Nature Preserve, Clark County, Illinois.

	Less than 40 cm		40-100 cm		More than 100 cm	
	Den.	Freq. %	Den.	Freq. %	Den.	Freq. %
Acer saccharum Marsh.	4.68	93	1.56	63	0.38	23
Quercus alba L.	0.37	27	—	—	—	—
Quercus velutina Lam.	0.18	13	—	—	—	—
Ostrya virginiana (Mill.) K. Koch.	0.15	12	0.16	13	0.02	2
Prunus serotina Ehrh.	0.10	8	0.05	4	—	—
Morus rubra L.	0.08	7	0.09	7	—	—
Ulmus rubra Muhl.	0.07	6	0.17	9	0.04	4
Cornus florida L.	0.06	4	0.13	7	0.09	3
Sassafras albidum (Nutt.) Nees.	0.05	3	—	—	—	—
Carya cordiformis (Wang.) K. Koch.	0.04	4	—	—	—	—
Staphylea trifolia L.	0.03	3	0.12	5	—	—
Carya glabra (Mill.) Sweet.	0.03	3	—	—	—	—
Fagus grandifolia Ehrh.	0.03	3	0.03	3	—	—
Quercus imbricaria Michx.	0.01	1	—	—	—	—
Totals	5.88		2.32		0.53	