# FIRE CONTROL AND ECOLOGICAL SUCCESSION IN McCARTY WOODS, HERNANDO COUNTY, FLORIDA

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Forest fire has been traditionally viewed negatively, as an evil to be conquered. We speak of so many acres of forest being "destroyed" by wildfire, of "battles" won or lost by fire crews hired to prevent the loss of so many board-feet of timber, of lives lost fighting forest fires. This negative image of fire is often held by those attempting to preserve areas in their natural state, as well as by those with an economic interest in on-site resources.

Until recently, the preservation of environmentally sensitive areas, when attempted, has entailed the suppression or elimination of fire. Fires, whether caused by natural factors such as lightning, or by human factors such as carelessness, vandalism, or design, play an important role in the ecology of these areas. Fire is just one element in the intricate ecological equation. Human modification of one side of this equation, however slight, has effects on the other. The effects can result in changes in the species composition of an area.

Ecological succession is a directional, cumulative change in the species composition of an area. One of the best ways to document succession is by making repeated observations of the same plot over a number of years (Barbour et al. 1980, 211).

In the middle 1960s, Stephen L. Beckwith measured the species composition of the plant communities in an area called McCarty Woods, in Hernando County. This area has been protected from fires since before 1932 (Beckwith 1967, 250). Part of his research involved the permanent staking out of defined plots, thereby establishing a base for comparison with future data. In April, 1985, the communities measured by Beckwith were re-measured, using similar techniques, by Dr. David C. Hartnett and his plant ecology class at the University of South Florida (Hartnett 1985). Dr. Hartnett had previously located Beckwith's original stakes. This enabled the researchers to take measurements from Beckwith's own reference points.

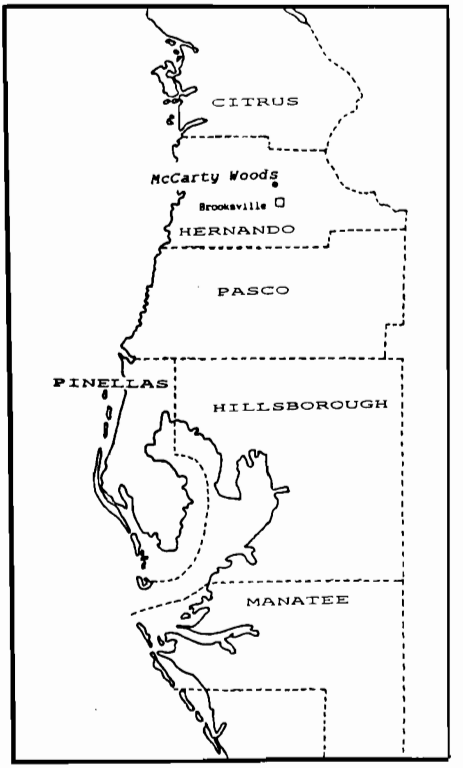


Fig. 1. McCarty Woods, Hernando County, Florida.

The purpose of this paper is to analyze and compare these recent data with those obtained by Beckwith, in order to

document changes, if any, in the species composition of the plant communities. Changes in species composition can be used to ascertain the position of a community in an ecological model of succession. This can indicate the direction of succession, either progressive (towards a climax community), or retrogressive (back to a seral stage) (Barbour et al. 1980, 206). The objective will be to compare the species compositions obtained in both studies to determine if the McCarty Woods area has shifted from a sub-climax seral stage due to the exclusion of fire (as predicted by Beckwith), and if so, in what direction.

The study region is some six miles north of Brooksville in Hernando County in an area known as Chinsegut Hill-McCarty Woods (Fig 1). An unusual feature of Chinsegut Hill is a 400 acre tract of virgin longleaf pine forest (*Pinus palustris*), one of the last remaining large pieces of such a community in Florida. The property was transferred to the Federal Government in 1932 "for maintenance of a wildlife refuge, forest preserve, and experiment station" (Beckwith 1967, 251). In order to perpetuate in its natural state a portion of the longleaf pine forest in the area, the Nature Conservancy bought a five acre tract bordering the west side of Chinsegut Hill. This piece is McCarty Woods (Fig. 2) (Beckwith 1967, 251).

Longleaf pine is a species ideally suited to frequent fires, which are required to maintain the community (Barbour et al. 1980, 377). The regular recurrence of fire can maintain a community at the sub-climax seral stage. Therefore, elimination of fire should allow progressive succession towards a climax stage.

The nature of the communities on the site range from longleaf pine to mesic hardwood hammock. The hammock vegetation occurs on the acres that are less well drained, due to a clay subsoil. The only major tree species which are characteristic of the true climax in this region and were not found by Beckwith are *Magnolia grandiflora* and *Ilex opaca* (Southern magnolia and American holly) (Beckwith 1967, 258-66). Table 1 lists the major tree species found in both studies, and those expected in a typical climax hammock.

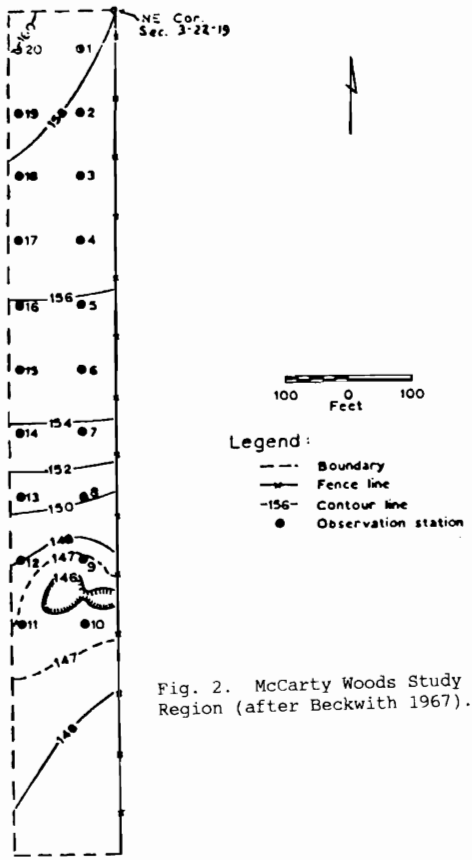


Fig. 2. McCarty Woods Study Region (after Beckwith 1967).

An examination of Table 1 would seem to indicate that the species composition is progressing towards a climax hammock. This conclusion is based on the the addition of several species, such as magnolia, dogwood, and laurel oak.

TABLE 1

Tree Species Found in McCarty Woods Studies and in Typical Climax Hammock

| Tree Species | Species Present in Beckwith 1966 | 1985 Study | Climax Hammock |
|---|---|---|---|
| Dogwood | | x | x |
| Sweetgum | x | x | x |
| Magnolia | | x | x |
| Laurel Oak | | x | x |
| Live Oak | x | | x |
| Pignut Hickory | x | x | x |
| Slash pine | | | x |
| Longleaf Pine | x | x | x |
| American Holly | | | x |
| Cabbage Palm | x | | x |
| Hornbeam | x | x | x |
| Persimmon | x | | x |
| False Buckthorn | | x | x |
| Winged Sumac | | | x |
| Mockernut Hickory | | | x |
| Ironwood | x | | |
| Water Oak | x | | |
| White Ash | x | x | |
| Swamp Chestnut Oak | x | x | |

Source: Beckwith (1967), field notes, and Deuver (1984).

The direction of succession can also be inferred by examining the understory vegetation as well as the overstory. The dominant trees of the future may be today's saplings. In the longleaf pine area, the absence of fire has allowed hardwood saplings to increase in number and size. Pine seedlings are shade intolerant, and require mineral soils as a seedbed (Barbour et al. 1980, 377). A brief examination of the McCarty Woods area reveals the near absence of pine seedlings, a fact also noted by Beckwith (1967, 266).

In addition to the lack of pine reproduction, the pines that do remain are old, now averaging 136 years, the youngest being about 125 (Beckwith 1967, 260). They are also few in number. This means that the loss of a few trees has a major impact on the population. Longleaf pines are generally taller than the surrounding trees (80-100 feet), and are thus susceptible to lightning strikes, not an uncommon occurrence in this part of Florida (Beckwith 1967, 260, 266, 277). The increase in hardwoods also puts the pines at a disadvantage in the event of a prolonged drought. Hardwood species are better able to withstand such conditions (Beckwith 1967, 266).

McCarty Woods was set aside for several purposes. One was to preserve a near climax community. This has been successful, as the study indicates continued progression towards the typical climax vegetation. Another was to preserve a portion of the longleaf pine community. The data obtained by Beckwith, and the data from the recent study, indicate that this goal has not been achieved. The decline and near absence of pine seedlings, due to the exclusion of fire, will result in the progressive succession and replacement of pines by hardwood species, and as Beckwith predicted. Beckwith recommended girdling or poisoning some of the larger hardwoods, and beginning a program of controlled burning to kill the hardwood saplings, as a means of re-establishing the longleaf pine community on the site (Beckwith 1967, 266).

It is probably too late to return the northern portion of the site to its former predominantly pine community. Perhaps it would be more useful simply to allow succession to proceed so that more may be learned from periodic re-examination of McCarty Woods.

## Methodology

Both studies involved the use of quadrat and point-centered quarter sampling techniques. Beckwith used twenty point-centered quarters for his overstory examination, and ninety one-meter square quadrats for the understory analysis. The recent study used ten point-centered quarters for the overstory, and ten ten-meter square quadrats for the understory. The aluminum stakes used by Beckwith were placed every 100 feet along two lines 100 feet apart (Fig. 2). The 1985 survey used each stake along the eastern line (stakes 1-10) as a corner of a ten meter square quadrat. The relative cover of each species in a quadrat was estimated visually and recorded.

In the point-centered quarter method used in the recent study, stakes 1-10 served as points. The line 1-10 was used as one axis through all points. Perpendiculars were drawn from each point, and in each quadrant the distance to the nearest tree, its basal area, and species were recorded. "Trees" were defined as any woody plant greater than three inches DBH (diameter at breast height). Understory saplings were measured up to 4.5 feet tall.

The data obtained in this way were used to calculate the relative density, relative dominance, and relative frequency of each species. From these, an importance value (IV) was determined, according to the following general formulas:

Density = number of individuals/area sampled

Relative Density = (Density for a species/total densities for all species) X 100

Dominance = Total basal area or coverage values/area sampled

Relative Dominance = (Dominance for a species/total dominance for all species) X 100

Frequency = Number of plots or points of occurrence/total number of plots or points

Relative Frequency = (Frequency for a species/total frequencies for all species) X 100

Importance Value (IV) = Relative Density + Relative Dominance + Relative Frequency

In order to compare the understory importance values obtained in 1985 with Beckwith's data, an Importance Value had to be calculated from the 1966 data. These are shown in Table 2. The data indicate a general increase in the importance values of various hardwood saplings. The data for *Pinus palustris* was insufficient to calculate an IV for 1966. However, as previously mentioned, there is a near absence of pine seedlings on the site, and the trend of succession is readily apparent visually. This tends to support Beckwith's conclusion that longleaf pine is being replaced by hardwoods due to the exclusion of fire from the site.

Overstory data were compared by frequency, and no importance value was calculated for Beckwith's data. These data are shown in Table 3.

Discrepancies in the interpretation of the data cold be the result of an insufficient number of sample points, one-half of Beckwith's. For example, Table 1 indicates that live oak was present in 1966 but not in 1985. Live oak is in fact well represented on the site, but none were picked up in the

TABLE 2

Importance Value Data, Understory, 1966 and 1985

| Tree Species | Importance Values | |
|---|---|---|
| | Beckwith 1966 | 1985 Study |
| Sweetgum | 9.6 | 13.3 |
| Pignut Hickory | 5.1 | 4.8 |
| Longleaf Pine | N/A | 2.0 |
| American Hornbeam | 18.5 | 32.0 |
| Eastern Hophornbeam | 7.4 | 5.0 |
| Water Oak | 22.3 | 37.3 |
| Swamp Chestnut Oak | 3.8 | 8.1 |
| Sour Orange | 5.8 | 8.9 |

Source: Beckwith (1967) and field notes

TABLE 3

Overstory Vegetation, Frequency of Occurrence

| Tree Species | Frequency (%) | |
|---|---|---|
| | Beckwith 1966 | 1985 Study |
| Sweetgum | 36.3 | 50.0 |
| Pignut Hickory | 8.8 | 20.0 |
| Longleaf Pine | 7.5 | 20.0 |
| American Hornbeam | 8.8 | 40.0 |
| Eastern Hophornbeam | 8.8 | 60.0 |
| Water Oak | 15.0 | 30.0 |
| Swamp Chestnut Oak | 5.0 | 10.0 |
| Winged Elm | 1.2 | 20.0 |

Source: Beckwith (1967) and field notes

sample. Also, Beckwith used ninety quadrats, located in a more random fashion than were the ten quadrats used in the recent study. Furthermore, the stakes themselves were not randomly located. This may affect the statistical validity of the samples in some unforeseen way. Since the recent study was a field exercise with limited time available, visual estimates of relative cover in the quadrats were averaged out among the members of the groups, a procedure considerably less rigorous, and therefore probably less accurate, than that employed by Beckwith.

Nonetheless, it is hoped that future phytogeography investigations will be conducted using the reference points placed in McCarty Woods by Beckwith as a mean of documenting succession in the area.

## References


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