

A Comparative Study of Logged
and Unlogged Forests

Dylan Tweney
Environmental Studies 102
12 May 1989

I. Introduction

The subject of the present study is whether there is a significant difference between forest which is regularly logged and forest which has been, for the most part, relatively unaffected by major human impact. A large part of Williamstown's green hillsides is economically valuable forest; and, as a rule, these woods are selectively logged. In general such logging takes the form of a cut which removes only trees of a certain stem diameter or greater. Often, only certain species of trees are harvested. Theoretically, such an approach (if carefully done, with attention towards the regeneration of each stand of trees) should result in a healthy, diverse forest, in which logging has minimal long range effects.

However, loggers do not always conduct their operations in wholly noble ways. Sometimes all the large trees are removed, leaving no mature trees to seed the stand and ensure a healthy regeneration. Sometimes damage is done to the stand remaining, or to surrounding areas, through which a logging road may pass. In order to restrict and control logging in Massachusetts, the Department of Environmental Management (DEM) requires landowners to file a plan prior to any major logging operations. This plan must include a statement of where the cutting is to be done, what species will be cut, and how many board feet will be harvested. The DEM retains the plans for Berkshire County cuts in their files in Pittsfield, at the Division of Forests and Parks.

The purpose of this project is to compare these logged areas with similar areas in Williamstown which are not logged. My initial hypothesis was that logged areas will have fewer trees and that the trees will tend to be of lower quality--as those trees of greatest economic value will already have been harvested. In order to locate areas which are logged, I examined the records which the DEM keeps on timber operations in Williamstown. Bob Lear, the forester at the DEM responsible for Northern Berkshire County, was especially helpful in this regard.

density may
be higher if
trees are small
and young

II. Methods

Once several sites were identified, it was then necessary to examine each site. I decided to concentrate on a small number of highly comparable sites, in an effort to reduce variability. [see Figure 1] Thus, all data was taken from locations on the western slope of Pine Cobble, with elevations between 900 and 1200 ft. For comparison, several sites were selected near the Pine Cobble trail, where logging has not been conducted on any significant scale since at least the turn of the century [Bob Lear].

Each location was examined on the basis of several aspects. Primarily, the basal area (in square feet of stem area per acre) was the datum of greatest concern, as it gave an indication of how dense the forest was. Tree species were identified, and an approximation was made of the percentage proportions of each species. Finally, I made verbal descriptions and quick sketches to note particular details, and to give a sense of the overall aspect of the site.

Basal area is measured using a basal area prism. The prism

Not really
it is a
measure
of cross-sectional
area or
dominance
of a species.
Density is
simply the
#/area

is ground in such a way that it offsets the image viewed through it a certain amount. This offsetting is such that any trunk within 33 of its own diameters of the viewer will appear to overlap its image in the prism. Beyond 33 trunk diameters the refracted image of the tree is completely separated from the unrefracted tree image. If one counts all the trees in a 360-degree arc, which are within a distance equal to 33 times their own diameter, and multiplies this number by 10, this gives (through some arcane mathematical equations) the average basal area in square feet per acre.

In order to achieve a more accurate estimate of the basal area, ten measurements were made for each location, and the results were averaged.

III. Results

Figure I locates all the sites considered on a topographic map of Williamstown. For those sites which are regularly logged, the area of the last officially recorded tber cut is given by a dotted outline. The unlogged sites (5 and 6) are within 150 feet of the Pine Cobble Trail, above the development site. Most of the sites are divided into two areas (a and b), each one separately analyzed and described.

↳ What is the basis for this distinction?

Table I gives the basal area of each site regularly logged. The breakdown by species is given in percentages; these are estimates of what proportion of each species was present in each site. The species identified were red oak (Quercus rubra), white oak (Q. alba), chestnut oak (Q. prinus), red maple (Acer rubrum),

beech (Fagus grandifolia), white birch (Betula papyrifera), and black birch (B. lenta). [Harlow, 1957] Species which I was unable to identify, or which made up less than 5% of a site, are included in the "miscellaneous" category. Table II gives the same information for the unlogged sites along the Pine Cobble trail.

IV. Discussion

The high standard deviations for the basal area data indicates a low degree of precision and makes generalizations difficult. Although the sites are fairly close together, have similar degrees of slope and exposure, and are at approximately the same elevations, there still are uncontrollable differences among areas. Site 1, for example, had a brook running through it, which may account for the higher BA there than at nearby site 2. Sites 3 and 4 are lower than the other two logged sites, and site 4b, which has a BA of 116, borders on an open meadow. This last site had no more trees than the others, but the trees there were much larger, and had greater trunk diameters. There was just as much evidence of logging in that site as the others (cut trunks, cut branches lying around, etc.) so the high BA may be merely a fluke; or, perhaps, that area may not have been logged in longer than DEM records indicate.

Furthermore, the sites along the Pine Cobble trail may be in a separate vegetation zone. Kathryn Saterson's vegetation map indicates several zones in that general area, but it is difficult to determine exactly where the present study's sites fall on this map. [Saterson, 1977] Nevertheless, a difference in basic forest

type may have a significant effect on the results. This difference is reflected in the much higher incidence of beech at the Pine Cobble sites; however, this may also be due to successional patterns which have not taken place at the sites where timber operations are conducted.

Nevertheless, there is a definite difference between logged and unlogged sites. The mean BA for the former is 70.7 sq. ft./acre, for the unlogged sites it is 112 sq. ft./acre. This is a difference of 41.3, and would seem to indicate that the unlogged woods are, in general, ^{more} ~~larger trees~~ (more dense). This difference is less than I had initially expected, however.

Both types of sites tend to be dominated by red oak, with a fairly high proportion of red maple, and a small but noticable population of white birch. In the unlogged sites, however, there is a great deal of beech, and much less red maple. There is also very little white oak present at the unlogged sites.

Finally, the observations I recorded at each site are not included in any table, but should be mentioned here. In general, the regularly logged sites presented a somewhat "cleaner" aspect. There tended to be less large-scale detritus on the forest floor. What was there gave evidence of human intervention, and stumps abounded, in varying states of decay. The unlogged sites, on the other hand, had a more jumbled and varied appearance, and generally a thicker layer of detritus at the forest floor. Furthermore, the trees at these unlogged sites tended to be smaller, more crowded together, and had a greater tendency to grow crookedly. *is this what you expected?*

V. Conclusions

It would seem that regularly and selectively logging the larger trees along the western slope of Pine Cobble has two primary effects. First, it reduces the overall density of the woods, removing large tree and leaving space and light for younger trees to grow. As a result, these younger trees tend to grow straighter and their trunks tend to be fatter, although the amount of material on the forest floor is reduced, thereby reducing the amount of organic detritus available for decomposition. Second, this logging reduces the variety of tree sizes, but increases the number of species present, because in an unlogged area, certain species tend to gain ascendancy over time, at the expense of diversity. Logging allows new species to break into the forest, but it also ensures that the forest is comprised of younger and smaller trees.

- early successional species can reenter -

VI. References

William M. Harlow: Trees of the Eastern and Central United States and Canada. Dover, 1957.

Bob Lear, Department of Environmental Management, Division of Forests and Parks, Pittsfield. Personal communications and DEM records.

Kathryn Saterson: "A Vegetation Map of Williamstown," 1977.

Species differences in growth form? in general high density stands with oak will have the straightest form - overgrown trees tend to have large lower branches & crooked stems.

FIGURE I: Sites investigated

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS

--- BORDER OF LAST RECORDED
LOGGING AT SITE

WILLIAMSBURG
MASS.
7.5 MINUTE

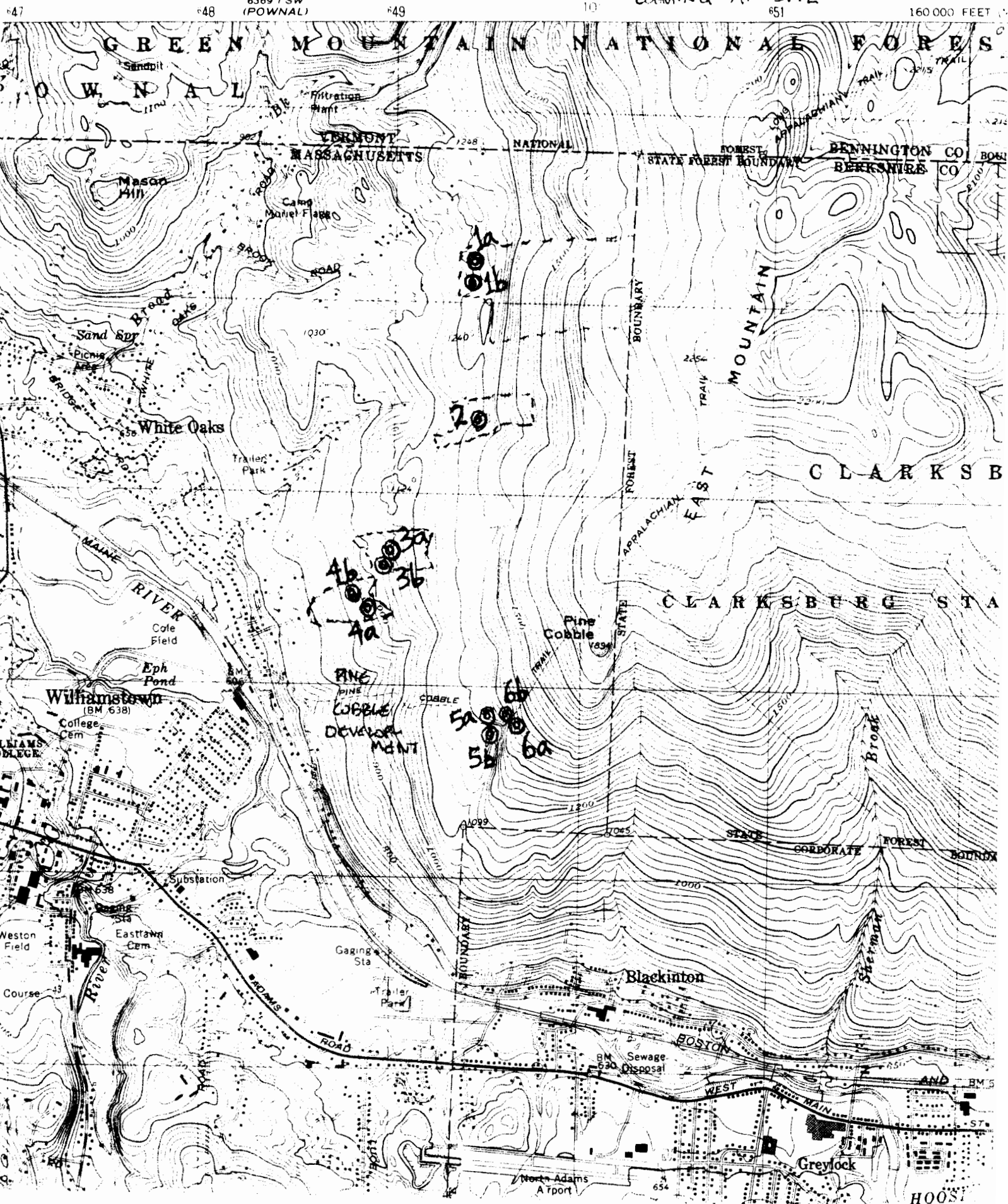


FIGURE I

TABLE I: Sites Recently Logged

	B.A. ft ² /a	red oak	wh. oak	ch. oak	red maple	beech	wh. birch	bl. birch	misc.	Notes
1a	63	50	--	--	25	--	10	05	10	
1b	72	45	05	--	30	--	10	05	05	
2	44	40	05	--	30	--	05	05	15	ident. difficult
3a	66	30	15	10	20	10	05	--	10	
3b	59	35	10	05	25	05	05	--	15	ident. difficult
4a	75	40	10	05	10	20	05	--	10	
4b	116	40	05	10	35	--	05	--	05	unusually large trees

Mean B.A. = 70.7 ft²/aStd. deviation \pm 20.7

TABLE II: Unlogged Sites

	B.A. ft ² /a	red oak	wh. oak	ch. oak	red maple	beech	wh. birch	bl. birch	misc.	Notes
5a	114	35	--	05	10	35	10	--	05	Elev. c. 1150
5b	107									
6a	132	40	--	05	10	25	10	--	10	Elev. c. 1250
6b	95									

Mean B.A. = 112.0 ft²/aStd. deviation \pm 13.4Date of last recorded
logging operation

Site 1: Elev. 1200. Northernmost site, off Henderson Rd.

15 Nov. 1984

Site 2: Elev. 1250. Eastern Mountain Sportsman's Club.

15 Oct. 1984

Site 3: Elev. 1050. Off of Chestnut St.

30 July 1984

Site 4: Next to 3. a) elev. 1000. b) elev. 900.

Fall of 1986

Site 5: Just off Pine Cobble trail.

Site 6: Just off Pine Cobble trail.

Noting that in relative terms beech & red maple are the only 2 species to differ between the sites. Is there any indication that either of these species were ^{or not logged} logged? or are they just more prevalent in that portion of Pine Cobble near the trail in the case of beech & away from the trail in the case of red maple - $\frac{B+A}{A}$