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INDIAN-SET FIRES IN THE FORESTS OF THE NORTHEASTERN UNITED STATES¹

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Abstract. The historical evidence for the Indians' burning the forests of the northeastern United States is reevaluated. Of 35 documents that describe vegetation or Indian life in the 16th or 17th centuries, only half mention any use of fire except for cooking. Only six purportedly first-hand accounts might refer to purposeful, widespread, and frequent use of fire. These six are all consistent with use of fire only locally near camps or villages, or with accidentally escaped fires. It is concluded that the frequent use of fires by the Indians to burn the forests was probably at most a local occurrence. The Indians' presence in the region and their use of fire for many purposes did, however, increase the frequency of fires above the low levels caused by lightning, and thus had some effect on the vegetation; for example, grasses characterized the ground cover at small, local, frequently burned sites.

Key words: *Amerinds; fire; Indians; northeastern United States; precolonial vegetation.*

INTRODUCTION

The human role in changing the forests of northeastern North America began long before European colonization. The extent and intensity of this early role are, however, obscure. If Indians frequently and regularly burned the forests, for example, there would have been few extensive natural "climax" forests when Europeans first arrived in North America. If, on the other hand, the influence of the Indians was less extensive and intensive, precolonial forest composition would have been mainly determined by seed sources and the climate, soils, and other natural (nonhuman) conditions of the time. An understanding of the influence of man on the prehistoric forest, especially in his use of fire, is thus important for answering questions about the relationships of precolonial vegetation to the nonhuman environment and may help in reconstructing paleoclimates.

Many ecologists and geographers believe that fires set deliberately by Indians greatly modified the forest vegetation of the eastern United States, especially those forests dominated by oaks (*Quercus* spp.; e.g., Stewart 1956, Little 1974, Bormann and Likens 1979, Nicholson et al. 1979, Niering 1981). There are some, however, who have disputed this belief. For example, Brown and Davis (1973:16) stated that "it is at least a fair assumption that no habitual or systematic burning was carried out by the Indians." The major reason for this lack of consensus is the difficulty of interpreting the direct evidence, which is mainly scattered 17th- and 18th-century descriptions of forests and Indian activities.

Other approaches to understanding precolonial

vegetational patterns have used survey records and/or pollen diagrams as sources of data (e.g., Ogden 1961, McIntosh 1962, Siccama 1971, Greller 1972, Heinselman 1973, Swain 1973, Russell 1981). However, for much of the Northeast, which was settled before the American Revolution, only scattered survey records are available (Russell 1981). Palynological studies give interesting and useful approximations of vegetational patterns, but can throw light on the question of human impact only indirectly, by extrapolation from the vegetational patterns to causation of the patterns. The importance of man in the precolonial forests can be approached directly only through the use of historical records.

The first major interpretive study indicating widespread burning of the forests by Indians was that of Maxwell in 1910. Basing his argument primarily on circumstantial evidence, he attributed the supposed openness of the precolonial forests to extensive Indian-set fires. Bromley (1935) studied the phenomenon of Indian-set fires in southern New England. He concluded that in that region "there was probably a sufficient population [of Indians] to bring about an annual burning of most of the country sufficiently dry for a conflagration." He cited two descriptions of the Indians' use of fire in Massachusetts and several descriptions of the openness of the forests as proof.

Raup (1937) was unconvinced that the Indians were "aboriginal pyromaniacs." He suggested that a slow climatic change would account for the apparent lack of successful oak regeneration in some oak forests, and a change to more northern hardwoods, such as sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*), and hemlock (*Tsuga canadensis*). Raup did not directly consider the documents used to substantiate Bromley's conclusions.

Day (1953) added more evidence to support the contention that Indians had burned the forests of the

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Northeast extensively and frequently before European colonization. His study is widely cited as evidence of this widespread, systematic use of fire by Indians (e.g., Stewart 1956, Little 1974, Nicholson et al. 1979). Day himself, however, pointed out that "it seems that there is no evidence for the wholesale conflagration of New England . . . but only burning 'in those places where the *Indians* inhabit' (Wood 1634)." Martin (1973) carried this argument further, concluding that "to charge the Indians with habitually setting wildfires seems unwarranted." Martin, however, still argued that there were periodic surface fires which "spared the forests from the great destruction that would most certainly have resulted from intense wildfires." He gave little evidence for these extensive surface fires or the lack of severe fires.

In this paper I will assess the 16th- and 17th-century evidence for the use of fire by Indians of the northeastern United States, from the Carolinas to Maine, including those sources commonly cited as proof that the Indians practiced widespread and frequent burning of the forests. The potential composition of a frequently burned forest, as determined by recent vegetational studies, will be briefly compared with the early descriptions of the forests, as indirect evidence of the importance of fire in the precolonial forests.

METHODS

The major collections of carefully edited, original descriptions of North America from the Carolinas to Maine were scanned for any reference to the kinds of trees, the amount of forested land, the use of fire by Indians, or Indians' methods of hunting. Other documents frequently cited on these subjects were also compiled including all of those used by Day (1953). The search included all relevant sources found in the Rutgers and Princeton University libraries as well as those listed in standard bibliographies of early American documents (Handlin et al. 1954, American Historical Association 1961). Only sources written before ≈1700 AD were used because by then the number of Indians and their ways of life had been greatly modified by contact with European colonists. Their hunting traditions had shifted from subsistence hunting to hunting for trade (McDowell 1955, Sauer 1971, Zimmerman 1974), and disease had decimated their populations (Sauer 1971, Cook 1973).

Each document was subjected to standard historical criticism before it was included in the study. This analysis considered the objectivity of the witness, his knowledge of the subject matter, and the chronological and geographical consistency of his description with what is known of his travels and the areas he visited (Collingwood 1956, Barzun and Graff 1970). This information was generally gleaned from editors' notes and general historical treatises. Any biases are noted where appropriate.

Knowing whether a description was first hand or not

is frequently difficult. The narratives were often written as if the author had been a first-hand witness, but evidence may suggest that he was not. In other cases, a series of descriptions are so similar that one suspects that they do not actually represent independent observations. When present, such problems are noted below.

Finally, each source was treated in context, both in chronological terms and in terms of the meaning of the rest of the source. A statement may have a different meaning if it was made by a trader seeking furs rather than by a potential farmer, because of their different interests and backgrounds. Similarly, a statement may take on different meaning if it is included in a primarily religious tract rather than in a prospectus for colonization.

The sources chosen and analyzed by these processes were then placed in one or more of eight categories, which included all uses of fire mentioned: (1) campfires or cooking fires, (2) fires used for clearing agricultural land, (3) signal fires or hostile actions, (4) circular hunts, (5) fire drives, (6) smoke or fires seen from the sea, (7) widespread burning of the forests, and (8) frequent burning of the forests. The location of the observation, date (where known), and references to the openness of the forests by the same author in the same work are also noted, because openness of the forest has often been cited as evidence for fires. General descriptions of the forest were tallied for authors who mentioned forest details.

RESULTS

Table 1 includes 35 purportedly first-hand accounts describing Indians and/or vegetation from the Carolinas to Maine in the 16th and 17th centuries. That there are so many references indicates an interest in Great Britain and Europe in learning about the natural aspects of the colonies. Publications in the colonies during this period were limited to religious tracts, ephemeral almanacs, and efforts to communicate with the Indians to convert them to Christianity (Evans 1903). Explorers were mainly interested in economic gains, not natural history, and their ships did not usually carry natural historians. Letters and broadsides sent back across the sea were designed generally to attract fellow colonists, and most only inadvertently reported on details of the natural environment except where it had direct economic importance, such as providing timber or as good farm land.

The reliability of these accounts varies, but there is a good chance that all have some claim to factual reporting. No author said that he actually saw the Indians burning the woods. Several, however, indicated indirectly that they had seen this.

Half of the 35 sources mentioned the use of fire by Indians. Six of the 35 implied or stated that the Indians burned the forests extensively. Several others, cited elsewhere as evidence that Indians burned the forests

TABLE 1. References to uses of fire by Indians in northeastern North America and to openness of the forest vegetation, 16th and 17th centuries. References are listed in chronological order of the earliest reported observations.

Reference	Location and date of observation*	Category of fire							Wide-spread	Fre-quency	Mention of fire	No mention of fire	Mention of open-ness of the forest
		Camp- fire or cooking	Agricul- tural clear- ing	Hostil- ity or signal	Circu- lar hunt	Drive for game	Seen from the sea						
Wroth 1970	NC-NY; 1524	?		?				x					x
Barlowe 1906	VA, NC; 1584											x	
Lane 1906	VA, 1585-1586											x	
White 1906	FL-VA; 1590	x							x				
Brereton 1906	New England; 1602											x	x
Anonymous 1906a	ME, MA; 1603	x		x									
Rosier 1906	ME; 1605	x											x
Percy 1625	VA; 1606	x	?	?									?
Anonymous 1906b	ME; 1607-1608												x
Juet 1959	NJ; 1609							x					
Champlain 1922-1936	Canada; 1613-1632											x	
Smith 1625, 1836	FL-ME; 1616, VA; 1623				x	x							x
Anonymous 1625	New England; 1625									?			
Rasieres 1909	NJ, NY; 1628-1630											x	
Higginson 1976	New England; 1630											x	
Winthrop 1908	New England; 1630-1649											x	
Morton 1838	MA; 1632									?	semi-annual		
DeLaet 1909	NY; 1633, 1640											x	
DeVries 1909	NJ; 1632							x	?	annual		x	x
Hall 1910	MD; 1633-1684											x	x
White 1910a,b	MD; 1633, 1634			?						?			x
Yong 1912	PA, NJ, DE; 1634											x	
Wood 1635	MA; 1629-1633									?	annual		x
Josselyn 1865	New England; 1638, 1663											x	x
Anonymous 1856a	NJ, NY; 1641, 1646											x	
Williams 1973	MA; 1643									?			
Anonymous 1856b	NJ, NY; 1649											x	
Johnson 1910	MA; 1628-1651												x
Lindeström 1925	NJ, PA; 1654-1656				x					?	frequent annual		
Van der Donck 1968	NY; =1655									x	annual		x
Denton 1937	NJ; 1670									?	annual		
Paschall 1912	PA, NJ; 1683											x	
Penn 1912	PA, NJ; 1683											x	
Budd 1902	PA, NJ; 1685											x	x
Thomas 1698	PA, NJ; 1698											x	x

* Dates and locations are approximate. Locations are given in terms of present-day political geography. "?" indicates that either the author was uncertain of the type of fire use he saw, or that he described it in a way that was hard to interpret. State code: DE = Delaware, FL = Florida, MA = Massachusetts, ME = Maine, MD = Maryland, NC = North Carolina, NJ = New Jersey, NY = New York, PA = Pennsylvania, VA = Virginia.

widely, have been taken out of context; when these references are interpreted carefully in context they provide a different picture of the uses of fire. Seventeen sources which described vegetation and/or hunting included no references to fires except occasional casual mention of campfires. William Penn (1912) had the most complete description of the life of the Indians in New Jersey, and included no mention of fire for clearing the forests or for hunting. At least 14 authors referred to the openness of the forests, but only half of these also mentioned widespread or frequent fires as the probable cause of the openness. These six (Wood 1635, Morton 1838, Van der Donck 1968, and possibly

Johnson 1910, Denton 1937, and Williams 1973) are the major 17th-century references providing evidence of purposeful frequent and widespread burning of the forests.

References to extensive fires

New Netherlands (New York and New Jersey).—In 1655 Adriaen Van der Donck, who lived on an island in the Hudson River, published a work expressly to benefit his "naturally noble province" and to attract industrious Dutch colonists. He stated that:

"the Indians have a yearly custom (which some of

our Christians have also adopted) of burning the woods, plains and meadows in the fall of the year, when the leaves have fallen, and when the grass and vegetable substances are dry. Those places which are then passed over are fired in the spring in April. This . . . is done for several reasons: First to render hunting easier, as the bush and vegetable growth renders the walking difficult for the hunter, and the crackling of the dry substances betrays him and frightens away the game. Secondly, to thin out and clear the woods of all dead substances and grass, which grow better the ensuing spring. Thirdly, to circumscribe and enclose the game within the lines of the fire, when it is more easily taken, and also, because the game is more easily tracked over the burned parts of the woods.

The bush burning presents a grand and sublime appearance. On seeing it from without, we would imagine that not only the dry leaves, vegetables and limbs would be burnt but that the whole woods would be consumed where the fire passes, for it frequently spreads and rages with such violence, that it is awful to behold and where the fire approaches houses, gardens and wooden enclosures, then great care and vigilance are necessary for their preservation, for I have seen several houses which have recently been destroyed, before the owners were apprized of their danger.

Notwithstanding the apparent danger of the entire destruction of the woodlands by the burning, still the green trees do not suffer. The outside bark is scorched three or four feet high, which does them no injury, for the trees are not killed" (Van der Donck 1968:20–21).

Van der Donck here presented a detailed picture of surface fires, including scorching the trees 1–1.3 m (3–4 feet) high without killing them outright. Elsewhere he described crown fires "leaping from treetop to treetop" (Van der Donck 1968:14) resulting from the surface fires reaching a stand of pines where the understory was very thick and high. Only the surface fires could have been used to encircle game, a practice which would have burned only certain patches of the forest. These Indians were Lenni Lenape, as were those described by Lindeström (1925), and perhaps they used fire for a ritual hunt at the start of the hunting season as described below.

Van der Donck's description postdates the arrival of Dutch settlers to the area. They had already built houses and gardens, and "some of [the] Christians [had] also adopted" the practice of "bush-burning." By this time, therefore, the Indians and the land had been influenced by European colonists. This is, nevertheless, one of the clearest statements of the use of fire by the Indians to burn the forests extensively. If these fires were annual, or even biennial, however, it is unlikely that there would have been such extensive

oak forest left, since over the centuries much reproduction would have been destroyed and small trees damaged. Certainly there would not have been forests as he described earlier: "the whole country is covered with wood, and in our manner of speaking, there is all too much of it, and in our way. . . . The oak trees are very large; from sixty to seventy feet (18–21 m) high without knots."

Fifteen years later, Daniel Denton (1937) published another tract which seems to have been designed to attract settlers. Although his preface stated that his text was a "Brief but true Relation of a known unknown part of America," his aim appears to have been to make the land sound as attractive as possible. For example, he described an area of New Netherlands (in New Jersey) along the Raritan River as having "stately Oaks, whose broad-branched tops serve for no other use, but to keep off the Sun's heat from the wilde beasts of the Wilderness, where is grass as high as mans middle, that serves for no other end except to maintain the Elks and Deer, who never devour a hundredth part of it, then to be burnt every Spring to make way for new." He made no mention of who did the burning every spring. By 1673 the town of Newark had regularized burning the town's meadows and woods annually, by a group consisting of "every male from Sixty to sixteen" (Whitehead 1881). The burning described by Denton could have been that done by the citizens of Newark. His description was also cited, with no attribution, in the "Description of America by John Ogilbie," which was included in Lockhart's (1683) "A further Account of East-New-Jersey . . ." In other words, the description was widely circulated and most likely used as advertising to attract settlers.

Massachusetts.—The New England references to frequent and possibly widespread burning of the forest concerned the establishment of the Massachusetts Bay colonies. All of the authors except Wood (1635) wrote expressly religious tracts. Roger Williams (1973) stated in 1643 that the Indians viewed forest fires as beneficial if they happened to spread from an accidental spark, but he did not mention purposeful burning of the woods. He did not mention fire as a method used in hunting, though he said that on occasion the Indians drove deer by other means. Williams himself traded with the Indians to support his preaching, so he had more first-hand knowledge of them than many other Pilgrims.

Johnson's "Wonder-Working Providence of Sions Saviour in New England" detailed the travails of the Christians against the wilderness as they established churches in the Plymouth colony (Johnson 1910). In one area "the Lord [had] mitigated [the] labors [of the colonists] by the Indians frequent firing of the woods . . . which makes them thin of Timber in many places" (Johnson 1910:85), but in most other places they had to "teare up the Roots and Bushes" to make a field. In travelling, if "their compasse [miscarried] in croud-

ing (sic) through the Bushes, they sadly [searched] up and down for a known way, the Indians paths being not above one foot broad, so that a man may travell many dayes and never find one" (Johnson 1910:113). Taken together, these statements suggest a forest thick with undergrowth, broken in places by clearer areas. The Indians had at the most burned in some places which were "thin of Timber."

Morton (1838) and Wood (1635) described the Indians' activities in more detail, though they too had other aims in writing than providing a clear picture of aboriginal culture. Morton's aim was to "Prove New England the principall part of all America, and most commodious and fit for habitation," and he found, after living in the colony for 10 yr, that the Indians had a "tractable" nature and bore "love towards the English." However, Johnson wrote 20 yr later (in 1654, Johnson 1910) that the colonists lived in "continuall feare of the Indians approach, whose cruelties were much spoken of and more especially during the time of the Pequot wars" (Johnson 1910:115). Severe depopulation and changing attitudes had greatly altered the Indians' ways of life even by the first half of the 17th century, so that neither Morton nor Johnson witnessed Indian activities unaffected by European colonization. Even before the English arrived in New England in the early 17th century so many Indians had been killed by a "plague caught from the French" that they had supposedly not been able to bury their dead (Morton 1838:18-19).

Morton (1838), nevertheless, described the activities of the Indians in 1632 as customs which had "bin continued from the beginninge." With reference to the use of fire, he wrote:

"the Salvages are accustomed to set fire of the Country in all places where they come; and to burne it, twice a yeare vixe at the Spring and the fall of the leafe. The reason that mooves them to doe so, is because it would other wise be so overgrowne with underwedes, that it would be all a copice wood, and the people would not be able in any wise to passe through the Country out of a beaten path. The burning of the grasse destroyes the underwood, and so scorceth the elder trees, that it shrinks them, and hinders their growth very much: So that hee that will looke to finde large trees and good tymber, must not depend upon the help, of a woodden prospect to finde them on the upland ground" (Morton 1838:37).

In other words, the Indians burned the undergrowth out twice a year, which not only cleared the understory, but also damaged the trees such that there were no big trees left on the uplands. Good timber was to be found only in the lowlands,

"for the Salvages by this Custome of theirs, have spoiled all the rest For when the fire is once

kindled, it dilates and spreads it selfe as well against, as with the winde; burning continually night and day, untill a shower of raine falls to quench it. And this custome of firing the Country is the meanes to make it passable, and by the means the trees growe here, and there as in our parks and makes the Country very beautifull and commodious" (Morton 1838:37).

Since it would be practically impossible to burn the Massachusetts oak forest twice a year, because of inadequate litter accumulation, fires burned different areas in the spring and the fall. These were the "places where they [the Indians] came," not everywhere. Morton (1838) and Van der Donck (1968) were not describing the same kind of fire, if in New York the fires did not harm the trees, and in Massachusetts they did. Perhaps Morton was referring to burning patches of forest, perhaps near camps, and occasional wild fires which may have damaged old as well as young trees. Van der Donck also described two types of fires: those that did not harm the large trees and those that leaped from crown to crown. Finally, grass seems to have been the ground cover where there were frequent fires, as in New Netherlands, indicating that only some places were burned frequently.

William Wood, another Massachusetts Bay colonist, who lived there from 1629 to 1633, also described the Indians' use of fire. He wrote:

"there is no underwood saving in swamps and low grounds that are wet, . . . it being the custom of the Indians to burne the wood in November, when the grasse is withered, and leaves dried, it consumes all the underwood, and rubbish, which otherwise would over grow the Countrey, making it unpassable, and spoyle their much affected hunting; so that by this meanes in those places where the Indians inhabit, there is scarce a bush or bramble, or any cumbersome underwood to bee seene in the more champion ground In some places where the Indians died of the Plague some foureteene yeares agoe, is much underwood, as in the mid way betwixt Wessaguscus and Plimouth, because it hath not bene burned" (Wood 1635:13).

These two references present a case for the use of fire by the Indians in Massachusetts to create a forest free of understory growth. There are, however, some inconsistencies which lead to a rather more conservative view of this use of fire. This is especially true when considered in the context of settlement in Massachusetts in the early 17th century. The two accounts emphasize the openness of the upland woods, compared with the thick growth in swamps. Several factors might have created this impression. Both men came from England, where heavy use of the forests for industrial purposes, such as making charcoal or cutting mine props, had caused alarm over a potential timber

shortage by the mid- to late-16th century (Baker 1973). They arrived on a foreign shore, expecting to find thick, impenetrable forest. Instead they found many Indian clearings: for example, where the Pilgrims settled in 1620 "there was good corn-ground ready to their hands, as was seen by experience in the goodly Corn it yielded" (Morton 1838:17). The Indians had already fled from many of these sites, leaving lodges and stores of corn and beans.

English settlement logically followed the patterns set by the Indians' villages. Near these villages the small wood was used by the Indians for fires, so the woods were clear. Nearby woods had possibly also been burned by sparks from campfires.

Both Morton and Wood said that the woods were clear in places where the Indians lived: neither really generalized this to the entire forested area. Both, in fact, described good building timber of upland trees, especially oak, which would only have grown where fires were not frequent. Van der Donck (1968) made similar reference to the good quality of the timber in New Netherland.

Other categories of fires

Other sources described different types of fires, with varying amounts of detail. Before 1625 campfires or cooking fires were the most commonly mentioned types of fires. After 1625, such fires were not mentioned, or were passed over so lightly in the accounts that they are hardly relevant to this discussion. They were included in Table 1 for the early period because Day (1953) interpreted them differently.

Several of these accounts refer to early attempts at colonization in Virginia. John White, for example, in searching for the "lost colony" at Roanoke wrote that on 13 August 1590, "we saw a great smoke rise in the Ile Roanoke neere the place where I left our colony in the yeere 1587, which smoake (sic) put us in good hope that some of the Colony were there expecting my returne out of England" (White 1906:314-315). The next day his party set off to find the "smoke." "Before we were halfe way betweene our ships and the shore we saw another great smoke to the Southwest of Kindrikars Mountes." They went to this second smoke, and there "found no man nor signe that any had bene there lately." "Man" referred to Englishman; Indians were referred to generally as "Indians" or "Savages." This smoke may have been an Indian campfire. On the night of 17 August they "espied . . . the light of a great fire thorow (sic) the woods, to which [they] rowed." They sang and shouted to get answers, but got none. At daybreak, they landed and "coming to the fire, [they] found the grasse and sundry rotten trees burning about the place." The cause of this fire is unknown. That the men saw three separate fires on different days and had to travel to get to any of them suggests that the fires were of limited extent. Such fires could have burned a large area of the forest ac-

identally, given the right weather conditions, though apparently in this case they did not.

Also in Virginia, in 1606, Percy, an associate of John Smith, arrived at a place where there had been a "large" fire, "and [Indians] had been newly a roasting (sic) Oysters" (Percy 1625:1685). The Indians had left in such a hurry that they had left oysters in the fire. After collecting mussels and oysters in a place with no bushes [salt marsh?] the exploration party went farther into the woods, where they saw "great smoaks of fire." "Wee marched to those smoakes and found that the Savages had bene there burning downe the grasse, as wee thought either to make their plantations there, or else to give signes to bring their forces together, to give us battell" (Percy 1625:1686). This could be a reference to widespread burning, but it was not interpreted as such by the observers. It was probably a localized activity, though, as with other fires, under certain weather conditions it could have affected a large area. These Virginia references give us a picture of Indians travelling through the woods and building fires of various sorts. There is no indication that they purposely set the woods on fire, though it is likely that such small fires could have had large effects on the forests in particularly dry years.

The cartographer Peter Lindeström (1925) described another type of fire, along the shore of the Delaware River, in 1656-1657. He noted that in the autumn, when the grass was dry, the Indians gathered in some areas of grass and sparse trees on coarse soil containing many mussels and other shells. After the men formed a circle $\approx 0.5-2$ (Swedish) miles in diameter, each one started a fire, which burned toward the center of the circle. When the circle was small, they shot all the game that it enclosed. After eating all the kill they could, they dedicated the remainder to spirits. Later in the year "when the grass [had] thus been burnt off the land, they [did] not care to arrange any more such hunts, but [shot] the animals wherever they [found] them in the woods" (Lindeström 1925:215). Burning the grass here probably related to specific areas or circles where the vegetation was altered by the frequent fires, and did not include burning large areas of forest. As with the areas where there had been fires in Virginia, these were characterized by grasses. Since the Indians had no good way of containing these fires if they spread, nor probably any interest in doing so, they may well have been the sources of large conflagrations in dry years.

Robert Beverley in 1705 described a similar type of fire hunt in Virginia, but one modified by the European demand for furs since the Indians killed the beasts "only for the sake of the skins, leaving the Carcases to perish in the Woods" (Beverley 1947:155). John Smith (1625) also described a circular hunt in Virginia, as did Hennepin (1972) in the Great Lakes Region and Hanna (1911) along the Ohio River in the 18th and 19th centuries. This type of hunt covered an area limited

TABLE 2. Descriptions of 16th- and 17th-century vegetation in northeastern North America.

Reference	Location and date*	Vegetation†
Wroth 1970	Carolinas: 1524 NJ, NY; 1524	Palms, laurels, cypress, cedars Open forest of oak, cypress, cedars
Lane 1906	VA to ≈24 km inland: 1586–1587	Walnut, sassafras
Brereton 1906	New England; 1602	Oak, beech, cedar, sassafras
Anonymous 1906a	ME; 1603	In north: cedar, spruce, pine, fir In south: tall oaks, beeches, pines, fir
	MA; 1603	Sassafras, vines, cedars, oaks, ash, beech
Rosier 1906	ME; 1605	Birch, fir, ash, big oaks, spruce, meadows
Percy 1625	VA; 1606	Cedar, cypress, oak, excellent timber
Anonymous 1906b	ME; 1607	Oak, walnut
Smith 1625	VA; 1623	Oak, walnut, good timber
Rasieres 1909	NY, NJ; 1628–1630	Oak, elm, walnut, fir, cedar, chestnut, grassy meadows
Winthrop 1908	New England; 1630–1649	“Woody land,” “Indian meadows”
Morton 1838	MA; 1632	Oaks, excellent for building
DeLaet 1909	NY; 1633, 1640	Large trees, including walnut, grapes
White 1610	MD; 1633, 1634	Tall hickories, oaks, cypress, grapes, meadows
Yong 1940	PA, NJ, DE; 1634	“Stately timber,” Indian clearings
Wood 1635	MA; 1629–1633	Oak, walnut, good for building, meadows
Josselyn 1865	New England; 1638, 1663	Spruce uplands, thick woods in lowlands, oak, fir, pine, spruce
Anonymous 1856a	NJ, NY; 1641–1646	Oak, hickory, chestnut, vines
Anonymous 1856b	NJ, NY; 1649	Oak, hickory, chestnut, beech, vines, meadows
Johnson 1910	MA; 1628–1651	Thickets, thick woods
Van der Donck 1968	NY; 1655	Oaks, “nut wood” (hickory and/or chestnut), “fine woods”
Denton 1937	NJ; 1670	Oaks, meadows, tall grass, excellent timber
Paschall 1940	PA, NJ; 1683	Oaks, clearings
Penn 1940	PA, NJ; 1683	Black walnut, cedar, cypress, chestnut, oaks, grapes
Thomas 1698	PA, NJ; 1698	Oaks, ash, chestnut, pine, cedar

* Dates and locations are approximate. Locations are in terms of present-day political geography. For state codes, see Table 1 footnote.

† Includes the first few species listed by each of these authors, plus any general comments. Taxa are probably as follows: palm = *Palmae*, laurel = *Persea*?, cypress = *Taxodium* or *Chamaecyparis*, cedar = *Chamaecyparis* or *Juniperus*, oak = *Quercus*, walnut = *Carya* or *Juglans*, sassafras = *Sassafras*, spruce = *Picea*, pine = *Pinus*, fir = *Abies* (any of these last three may include *Tsuga*), beech = *Fagus*, ash = *Fraxinus*, elm = *Ulmus*, chestnut = *Castanea*, grape or vines = *Vitis*, hickory = *Carya*, and black walnut = *Juglans nigra*.

by practical factors such as communications and the size of a hunting group. It was also limited to days with little wind, since the fire ring had to burn to the center. Shouting and clapping hands also helped drive the animals to the center (e.g., Lindström 1925). In the East only Smith (1625) described using fire to drive game to a river or cliff. This type of activity would also be limited to appropriate topography. Where hunting was by either of these methods the local vegetation would show the effects of frequent fires, since the relatively few appropriate areas would be burned often. The grassy vegetation described in several sources would be an example of this.

The incident of Martin Pring in the Massachusetts Bay area involved a different sort of fire (Anonymous 1906a). People valued sassafras (*Sassafras albidum*) highly for medicinal purposes in the early 17th cen-

tury, and ships cruised the coast looking for it. In ≈1625, a ship's crew landed at Plymouth Bay to cut sassafras. A group of Indians startled the harvesters one day when they were napping. The harvesters' mastiff awakened them and scared the Indians away. “The Indians dissembled a jesting manner as they left yet not long after, even the day before our departure, they set fire on the woodes where wee wrought, which we did behold to burne for a mile space” (Anonymous 1906a:351). This seems to have been a hostile use of fire rather than evidence of general burning of the forests.

Several other possible references to widespread or frequent burning of the forests are circumstantial, such as descriptions of fires or smoke seen from ships, for example, those described by Drake (Biggs 1893), Verazzano (Wroth 1970), Juet (1959), and DeVries (1909).

Verrazzano saw "huge fires . . . on the seashores." He described the sweet smell of cedar smoke, detected at sea, but did not specify whether the cedars were burned for a local clearing or were burned accidentally (Wroth 1970:134). While the other authors probably saw fires, the fires may or may not have been purposely set by the Indians, and if they were, we have no evidence of where or why they were set. A statement that the fires were set annually by the Indians (DeVries 1909) is not proof that they were, but merely suggests that he was told this by someone else. We have no way to test the reliability of the first-hand witness in this case. Accidental fires may have been more frequent in the autumn when Indians were hunting and building campfires in small clearings in the woods, and may have appeared to have been set regularly at that time of year. And finally, two colonists lost in the woods in the Massachusetts Bay Colony, ≈ 1625, found a 6.4-km (4-mile) stretch of burned land. They suggested that the "savages" had burnt the woods, yet they saw neither the fire nor the Indians (Anonymous 1625).

Descriptions of vegetation

The major tree genera listed in early vegetational descriptions correspond well with those present near the coast today. In southern Maine vegetation dominated primarily by deciduous genera replaced that dominated by spruce (*Picea*) and fir (*Abies*) (Anonymous 1906a, b, Rosier 1906) (Table 2). South of this, oaks (*Quercus* spp.) were important, accompanied by beech (*Fagus*) in the north (Anonymous 1906a, Breton 1906, Rosier 1906) and hickory (*Carya*) farther south, from Massachusetts to Virginia (Table 2). In Virginia and the Carolinas, cypress (either *Taxodium* or *Chamaecyparis*) entered the descriptions. In general, other species which were mentioned somewhat haphazardly are not included in Table 2. Oak was the common denominator, even southward where forests are dominated today by various species of pine (*Pinus*).

Good building timber figured in many descriptions, though the location of this timber on the landscape was not made clear. The low, wet areas were thick brushy thickets and frequently had good cedar (*Chamaecyparis*). Good oaks and other hardwood species were found on uplands. The forests were broken frequently by "meadows." These were probably Indian clearings or marshes, and would have been most common near the coasts and rivers where explorers made their first observations.

DISCUSSION

To summarize the direct historical evidence for Indian-set fires:

- 1) There is no first-hand description of the setting of surface fires in the forest, with the possible exception of Lindeström's (1925) description of a small circular fire drive.
- 2) Fires were frequent in locations with grassy ground cover.
- 3) Where fires were said to be the custom, the stated frequency varied from twice a year, to annually, to frequently.
- 4) Different authors gave different reasons for the burning, such as opening the forest for hunting, making travel easier, or circular hunts.
- 5) The most frequently described fires were scattered fires of limited extent.

Many explanations other than widespread fire exist for the alleged openness of the precolonial forest. First, many of the surviving descriptions of this feature of the forest were written to attract colonists. Emphasis on the ease of converting this open woodland to farms would go far to allay the fears of potential colonists, who were contemplating fleeing a civilized land for the unknown wilderness. The importance of this factor cannot be assessed directly, but the writings of at least some authors, such as Van der Donck (1968), openly claimed to be advertisements for colonists, and others probably shared this goal (e.g., Morton 1838, Denton 1937).

Second, the early commentators probably did not stray far from the precarious settlements, which were generally located where Indians had abandoned land. If they did travel, it was probably along well-established Indian paths. In either of these areas the effects of hundreds of years of collecting firewood, building materials, and other forest products would have cleared out much of the understory. Captain John Smith (1625) remarked on this effect in Virginia: "Near their habitations is little small wood or old trees on the ground by reason of their burning of them for fire. So that a man may gallop a horse amongst these woods any way, but where the creeks and Rivers shall hinder" (Smith 1625:1698).

Finally, Van der Donck (1968) in New Netherlands attributed the lack of undergrowth to the shade of the large old trees. Openness of the forest, as described, can thus be the result of a variety of factors other than widespread and frequent burning of the forests.

One would expect that annual, or frequent, widespread fires would have attracted much more attention from authors than is apparently the case. Ethnographic accounts especially would be expected to give details of what would have been a major event in the life of the Indians, and yet these are silent on this account. There is also no ethnographical evidence that the eastern Woodlands Indians were sufficiently organized to carry out systematic burning of a large area.

Frequent, widespread burning would have created difficulties for the Indians. First, though browse may have been increased by fire, mast, a source of protein for Indians and their quarry alike, would probably have

been at least partly destroyed by frequent fires. Frequent fires would also have destroyed much easily gathered firewood, especially if, as Van der Donck described, they burned the twigs so that walking was quieter. Other necessary forest products such as saplings and bark for construction of lodges, bark canoes, and dugouts, bark for baskets and vessels, and wood for other construction and tools may have been destroyed except in the swamps. However, sprouting after fires, if fires were not too frequent, might have increased the production of smaller wood (H. Kraft, *personal communication*).

Frequent fires would also have affected the species composition of the forests. Recent studies of the effects of fires on forests vary greatly in the amount of information available about both the intensity of the fires and the vegetation before and after the fires, making comparisons difficult (e.g., Ahlgren and Ahlgren 1960). It is unfortunate that the historical documents also do not allow clear separation of areas of largely hemlock and northern hardwoods, where fires are very rare, from largely oak forests, which burn more easily and frequently. It appears from most of the documents, however, that oak species predominated in the precolonial forests, from southern Maine to Virginia (Table 2). Would this have occurred under a long-term regime of frequent fires? In one study of oak forests in West Virginia, a light fire within the last 20 yr improved oak regeneration (Carvel and Tryon 1961). On the other hand, fires at 1- or 5-yr intervals over 8 or 9 yr in oak forests in Tennessee diminished the average size of the oaks (*Quercus falcata*, *Q. stellata*, and *Q. coccinea*), and eliminated many understory and shrub species (Thor and Nichols 1974). Niering et al. (1970) and W. A. Niering, S. Taylor, and M. J. McDonnell (*personal communication*) observed high mortality of black and red oak (*Q. velutina* and *Q. rubra*) trees 15 cm in diameter after 8 yr of biennial burning, though this was not evident after the first 3 yr of fires. Thus while an occasional light fire may improve oak regeneration for some species, more frequent fires stunt or kill the trees and would probably produce forests different from those first described for the northeastern United States.

Occasional wildfires may favor forests similar to oak forests described by early colonists and reconstructed by pollen analyses (Table 2; Ogden 1961, 1964, Davis 1965, Russell 1980, 1981). For example, although severe fires sometime in the past on a site in Rhode Island apparently destroyed much natural reproduction, white and scarlet oaks (*Q. alba* and *Q. coccinea*) were fairly resistant to damage, and they dominate the forest today (Brown 1960). Severe fires in the past in both Connecticut and Rhode Island may have locally eliminated hemlock (Nichols 1913, Brown 1960). The area in Connecticut, which had burned about a century before it was studied, had been colonized by oaks (*Q. rubra* and *Q. prinus*). Similar results in

New York State, where the effect of fire on oak and northern hardwoods stands were compared, reinforce the conclusion that oaks are less damaged by occasional fires than are northern hardwoods (Swan 1970). These studies indicate that occasional wildfires favor oak forests, such as the ones the early colonists found, over northern hardwoods. Such forests would have developed under a natural regime of lightning fires and accidental fires caused by Indians, as well as other natural disturbances (Raup 1981).

CONCLUSION

There is no strong evidence that Indians purposely burned large areas of the forested northeastern United States frequently. The presence of Indians did, however, undoubtedly increase the frequency of fires above the low numbers caused by lightning. The increase from the "natural" situation was greatest in local areas near Indian habitations. In these areas fires and gathering firewood may have thinned the timber, creating an open forest, free of undergrowth.

Grass characterized the ground cover of areas which were burned frequently, for example as part of ritual or circular hunts. These as well as other types of fires, such as signal fires or campfires, probably increased the frequency of fires from the natural regime, when they escaped control. There is no evidence that the Indians had the ability or even any desire to stop wildfires (Stewart 1956, Lutz 1959). In most areas climate and soils probably played the major role in determining the precolonial forests; in the forest at large, fires accidentally caused by Indians merely augmented the number of natural fires.

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