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TITUS SMITH, A PIONEER OF PLANT ECOLOGY IN NORTH AMERICA

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The contribution of the early naturalists to plant ecology is seldom acknowledged, though many of the facts upon which ecology is based were observed and correctly interpreted long before the subject became established professionally. In calling attention to the neglected yet brilliant investigations of Titus Smith, Jr., the writer hopes both to rescue from undeserved oblivion one of the earliest North American ecologists, and at the same time to provide an example of the marked capacity for careful observation and induction exhibited by many of the early amateurs.

Titus Smith, Jr., born in 1768 and died in 1850, was a native of New England who accompanied his father to Halifax, Nova Scotia, in 1783. After a broad education at home, he became a land surveyor, and in 1801 was commissioned by the governor of the colony to make a survey of the unfrequented areas of Nova Scotia, for the purpose of describing their natural resources, agricultural potentialities, and suitability for settlement. During 1801 and 1802 Smith made three trips, to the eastern, western, and northern parts of the Nova Scotian mainland, largely through the woods and with a single companion (none on the northern tour). The unpublished journals of these tours, together with a map, lists of the flora, and notes on the various tree species, provide an admirable

description of the interior of the province at that time, and are deposited in the Public Archives of Nova Scotia. Their importance to geographers of northeastern America has recently been emphasized by Clark (1953 and *in press*). While they also contain much material of value to ecologists interested in Nova Scotian vegetation, it was in a later paper, published by Loudon in the *Magazine of Natural History* for 1835, that Smith presented the ecological theories which must have had their origin in his observations on the governor's survey. Since the above journal is unlikely to be widely available, frequent and extensive quotation can alone do justice to what may well be the first major contribution to plant ecology in North America.

PLANT SUCCESSIONS

Succession has of course long been recognized and described by naturalists (*cf.* Clements 1916, Deevey 1942, Spurr 1952, Gorham 1953). However, for wideness of scope and clearness of appreciation, Smith's account can hardly be rivalled, either in America or Europe. We may begin by considering the changes following disturbance of the forest by storm, fire or man. Of the hardwood forests he writes²: "This portion of the forest can rarely be affected by fires, as the leaves in summer are full of watery juices. Should a part of it be overthrown by a hurricane, it is very soon replaced. Shoots from the old roots and seedlings spring up, among which a few scattered plants

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The writer wishes to thank Professor D. C. Harvey, Provincial Archivist of Nova Scotia, for informing him of the existence of Smith's unpublished MSS. He is also grateful to Professor Andrew H. Clark of University of Wisconsin, who has provided a copy of the transcribed MSS.

² The quotations to follow have been abridged wherever possible without loss of meaning, and are all from the paper of 1835. Smith's plant names are elucidated in an appendix.

of the balsam fir (*Abies balsamifera* Mx.) appear, which, overtopping the hardwood, by their shelter accelerate its growth, and, being short-lived trees, are in their turn, overtopped and suffocated by the hardwood, when it no longer needs their assistance." In contrast, however: "Whenever a growth of hardwood, on a poor soil, is cut down, the land burnt over, and exposed for several years to pasturage, it will, if left undisturbed, grow up with a mixture of fir and spruce." In the case of evergreen forests, Smith implies an origin from heathy barrens: "When the woods of fir become so thick that the kalmia perishes, the soil generally becomes covered with various kinds of dry moss. As this vegetable is not quickly decomposed, it forms a portion of the turf, and it assists in preventing its decomposition by excluding the light and air; and securing it from sudden changes in the temperature; as may be proved by the late period at which ground covered with it freezes in winter and thaws in spring." These woods are claimed to be much exposed to fire, the easily inflammable moss spreading the blaze to the resinous branches of the conifers. The consequences are: "The leaves and small spray of the branches are consumed, together with the litter which covered the surface. The naked black surface is now exposed to the sun, and putrefaction commences in earnest, affecting the turf as well as the roots of vegetables which have been killed. The increased temperature brings into action the vegetative powers of seeds which had lain dormant for centuries; raspberries spring up in abundance, together with red-berried elder, birdcherry, sumach, prickly aralia (?*Aralia spinosa*), and the evergreen fumitory. The French willow (*Epilobium angustifolium*) and the cocalias soon find out their favorite light soil. Tracts of a hundred acres are thickly covered by raspberries, loaded with a luxuriant crop. The low barren levels overspread with blueberries; and large tracts occupied by the French willow, together with the large clusters of the scarlet elderberry; altogether give an idea of fertility which forms a remarkable contrast with the sterile appearance previous to the fire.

Within three years this fertility disappears; the turf is greatly reduced in quantity; the land becomes hard and cold, presenting that exhausted appearance which always follows the raising of crops on a burnt soil. Shoots from the white maple (*Acer dasycarpon* Ehrh. syn. *eriocarpon* Mx.) (the roots of which are never killed by fires), brakes, sweet fern (*Comptonia asplenifolia* H.K.), dwarf willows, and withrod, occupy the ground, presently followed by alder; and, when they have formed a sufficient shelter, the firs again spring

up, mixed with white birch (*Betula populifolia* H.K.) and poplars. In the lower and more barren tracts the blueberry (?*Vaccinium ?venustum* H.K.) is, by degrees, overgrown by the kalmia and rhodora (*Rhodora canadensis* L.), which are in their turn overtopped by the alder, soon followed by a growth of firs. A number of plants whose seeds never vegetate during the fertile period now appear; the mayflower, the trailing evergreens (lycopodiums), snakeroot (*Aristolochia Serpentaria* L.), mitchella (*Mitchella repens* W.), linnea (*Linnaea borealis* Gron.), pigeonberry, mountain tea (*Gaultheria procumbens* L.), maidenhair (*Adiantum pedatum* L.),³ several kinds of aster, and goldenrods (*Solidago*). The mosses follow, and the thicket, in thirty or forty years, resumes nearly its former appearance, except that the trees are smaller, and the balsam fir forms a larger proportion of the wood. This tree of rapid growth covers the spruce from winds, and prevents it from forming strong lateral branches, till, having reached the height of 30 ft. or 40 ft., it is overtopped and suffocated by it. When a very old growth of hemlock (*Abies canadensis* Mx.) and spruce has been destroyed by fire, sometimes a growth of beech (*Fagus sylvatica* L. and *ferruginea* L.), birch, and maple takes its place. It also sometimes happens that when an old grove of pine is destroyed, it is replaced by white (*Betula populifolia* H.K.) and yellow birch (*Betula excelsa* H.K.) and oak. But these changes are less frequent than is imagined. Most hemlock woods, when killed by fires, are at first overgrown with birch hooppoles, mixed with firs; but, when the birch has reached the height of 20 ft. or 30 ft., it turns mossy, and continues stationary for perhaps twenty years, during which a young growth of hemlock again springs up, and most of the birches perish. In a similar way, the pine woods, when killed, are first covered with alder, followed by white birch, poplars, and a little oak; but these trees rarely reach any considerable size before they are overtopped by spruce and hacketac, which is, finally, again mixed with pine."

Later on Smith continues his discussion of nurse plants, by denoting the principal forest trees of the area and pointing out the roles of other plants in bringing them to ascendancy. The principle of autogenesis is further explored in the descriptions of succession on bare ground: "The lichens and mosses are necessary to the other plants of barren soils: they prevent the ground from freezing early, or to a great depth, and from thawing

³ Obviously an error, in the MSS maidenhair is *Vaccinium* (now *Gaultheria*) *hispidulum*, a much more likely plant in such sites.

easily." The effects of frost-heaving are thus minimized. Where this does occur, especially on barren soil, "The *Lichen ericetorum* serves to heal breaches in the green coating of the earth. Upon this crust caribou (reindeer) moss, and other lichens spring up, soon followed by hawkweed, goldenrod, kalmia, and alder." A lucid exposition of xerosere development follows: "The family of lichens appear to derive their nourishment from the air alone. These vegetables serve to introduce soil upon hills of naked rock. It is at first overspread with the crustaceous species; these are followed by the leafy kinds: when they decay their bulk is little diminished. As soon as an inch of turf is formed, the caribou moss appears. A small portion of the rock is changed to sand by the action of the turf. The Acadian heath (*Ceratiola ericoides* L.) and the *Potentilla tridentata* finally spring up, followed, as the turf increases, by black whortle, candleberry myrtle, and other shrubs. The small long-limbed Hudson's Bay pine (*Pinus Banksiana* Lamb.) is usually the first tree on these shallow soils."

The hydrosere also comes in for detailed attention: "Wherever the soil is so poor that turf is formed on the upland, peat earth is formed in the swamps and bogs, generally, in situations that have formerly been ponds or shallow lakes." A good deal of the peat is believed to come from erosion of the upland turf and litter after fires. When the basins are nearly filled with mud mat formation takes place: "The *Andromeda calyculata* is the first shrub that grows upon it; bog moss with Indian cups follows, and the Indian tea, rosemary-leaved kalmia (*Kalmia glauca* L. var. *rosmarinifolia* Ph.), Dutch myrtle, and other bog plants and shrubs, coming in, with a sprinkling of the tough-rooted cotton grasses and sedges, a strong turf is formed, which alternately floats or rests on the mud. When the water sinks below its surface, as it generally does in dry weather, in swamps which have large streams running through them, the upper layer changes to a kind of mould capable of producing grass and alder, and the swamps become natural meadows, which are mostly poor on stony vitriolic soils, but better where the upland is a sandy loam, because a portion of it is always carried by rains into the swamps; while on the rocky soils scarcely any earth is mixed with the vegetable matter. These deposits on granite soils are collected in basins formed by the rock; but on the vitriolic soils, where the peat is most abundant, the soil is rendered impervious by slate clay mixed with ochre. The wet peat having the property of changing the slate to clay, considerable quantities

of vitriol⁴ are contained in the water which enters peat bogs, but it is immediately decomposed. Ochre is always deposited where a rill of vitriolic water enters the swamps: the sulphur probably unites with the peat, as the water runs from the swamps soft and free from vitriol, but usually holding a little carbonaceous matter in solution."

The swamps are also envisaged as a source for reforestation: "The swamps, which escape the fire always, together with the different species of fir, contain alder. This shrub, producing abundance of light seed, which is spread far and wide by the winds, usually composes the greater part of the first growth upon bleak naked hills. When the shrubbery of alder attains the height of 3 ft. or 4 ft., the firs always begin to appear. All the trees of the fir kind are, as well as the alder, furnished with winged seeds."

Another theory elaborated by Smith concerns the anthropogenic origin of heathland: "The great influx of inhabitants in 1783 produced a complete change in the forest. The fires necessary for clearing the land were communicated to the spruce thickets. The profusion of herbage which followed, for a time furnished pasture. This failed in three or four years. The next dry season the fire was rekindled, for renewing it, which it would do in a less degree. Raspberries, French willow, and other vegetables, would appear, but of inferior growth. The roots of the spruce and balsam fir spread horizontally, and take but slight hold of the ground. Being loosened by the sinking of the turf, they are overthrown in every wind, and furnish fuel for successive fires, usually rekindled every dry season till, the combustible matter being consumed, with the exception of that portion washed by rains into the swamps, the ground becomes so much exhausted, that it produces only a growth of heathy shrubs, among which the kalmia predominates; and, in many places, it is necessary that this should continue long enough to form a few inches of turf, before the alder and other large shrubs can be reproduced, as a shelter for another growth of firs.

Near to the cultivated districts, the wood becomes scarce; and the swamps are finally attacked, thus destroying the trees which used to furnish seeds: and it is probable that, at no very distant period, many large tracts will present nearly the same appearance as the naked heaths and downs of the old world.

Although the kalmia burns freely in a dry season, it does not seem possible to destroy it by fires where the surface is covered with broken stones.

⁴ Vitriol and sulphureous iron pyrites are terms used interchangeably by Smith.

After it is burnt off, a growth of whortles (*Vaccinium* sp.) often springs up, and bears a plentiful crop for two or three years; but it is finally overpowered by shoots from the roots of the kalmia. It disappears, however, where the turf is completely burnt off from sand or gravel, and is replaced by a growth of lower or trailing shrubs. These are the uva-ursi, the crakeberry heath (*Empetrum nigrum* L.), the yellow-flowering cistus (*Hudsonia ericoides* L.), Acadian heath (*Ceratiola ericoides* L.), and (near the sea) the Acadian savine. Upon comparing what we observe upon our barren lands with the productions of similar soils in Europe, we shall find reason to believe that the heaths and downs of the old country have formerly been forests; and that they might again be covered with wood by imitating the process by which the forest is reproduced on our barrens." This would involve planting the margins of the swamps with the trees and other plants native to the forests of the country.

DIFFERENTIATION OF FOREST TYPES

As might be expected, the different types of forest in Nova Scotia were given special notice, particularly in the unpublished MSS, where Smith discusses individually each of the main tree species. The following notes present his main ecological conclusions. The modern Latin name for each species is included.

Larch, hackmatac, or juniper (*Larix laricina*).—Grows naturally in very barren places, either upon very poor, dry, gravel, upon rocks, or in cold mossy swamps. Seldom more than a foot in diameter.

White pine (*Pinus strobus*).—Grows naturally on wet and dry barren soils, found on all rocky barrens (where it is short), and especially beside lakes. This is the tallest tree in the woods, though not so tall as in New Hampshire. A tree of 60 feet in height and 3 feet in diameter is regarded as large. The best pine occurs on sandy soil.

Yellow pine (*Pinus resinosa*).—Grows in similar soil to white pine, but is much scarcer.

Mountain pine (*Pinus banksiana*).—Very scarce, growing short and scrubbed on the tops of high hills of rock.

Hemlock (*Tsuga canadensis*).—Grows most commonly on gravelly soils, poor but better than the soils of pine; more rarely upon clayey soils. This is one of the largest trees, commonly 2-3 feet in diameter and 60-70 feet in height.

Balsam fir (*Abies balsamea*).—Grows in almost every kind of soil, but thrives best in that which is moist and rich. Not a large tree, seldom more than 15 inches in diameter.

White spruce (*Picea glauca*).—Grows on poor

gravelly soil. A large tree but not very plentiful.

Red spruce (*Picea rubens*).—Grows in dry gravelly land, neither very fertile nor barren. More plentiful than pine, and taller than any tree but white pine.

Black spruce (*Picea mariana*).—This is probably a variety of the red spruce, occasioned by the difference of the soil [cf. Marie-Victorin 1935]. The leaves are a trifle larger than those of red spruce and have a little difference in their taste. It grows in the most barren places, on rocks, in wet mossy swamps, and on very barren land or gravel. The wood is harder than that of red spruce, owing to its slow growth; every softwood being hardest where the grains or years' growths join, and this hard part being of nearly the same thickness whether the grain be thick or thin. The roots of both red and black spruce spread horizontally, covered only by the turf and moss which always occur on spruce land.

Black or yellow birch (*Betula lutea*).—This tree is considered distinct from the black birch of New York [Smith probably refers to *Betula lenta*], perhaps on account of climatic differences. It is almost always to be found on good land, and often on poor soil; and is said to enrich the soil where it grows. Where the soil is poor it sends out horizontal roots for as much as 50-60 feet. It is a large tree, often 3 feet in diameter.

White birch (*Betula populifolia* and *B. papyrifera*).—This tree is noted as the main species on woodland recently burnt out, provided the soil is not extremely barren.

Dwarf birch (*Betula pumila* or possibly *B. Michauxii*).—This is remarked as a small shrub growing on mossy bogs. While the above two species are not recorded from the mainland of Nova Scotia by Roland (1947), they are given by Fernald (1950), and the habitat note fits best to these plants.

Beech (*Fagus grandifolia*).—Forms the greater part of the woods on the best land, hardwood land being generally covered by beech with a small proportion of birch and maple.

Sugar or rock maple (*Acer saccharum*).—Grows chiefly in moist habitats, near brooks and upon intervals. Always on rich soils, frequent on limestone, and abundant mostly in the eastern part of the province. It is usually from 2 to 3 feet in diameter when mature.

Red, flowering, white, soft maple (*Acer rubrum* and *A. saccharinum*).—Grows on almost all soil types, but best near the water.

Moose-wood maple (*Acer pensylvanicum*).—A small tree, rarely more than 4 inches in diameter, and of very rapid growth. It forms the

principal winter food of the moose except on very barren land where it seldom grows. Chief habitat along small brooks in stony hemlock land.

Dwarf maple (*Acer spicatum*).—A troublesome bush on newly cleared land because of its rapid growth, but only about half the size of the preceding species.

Elm (*Ulmus americana*).—A very rare tree except on the intervals of the eastern districts, where it often grows to 3-4 feet in diameter. It is said that elm ashes contain more than four times as much potash as those of beech or maple.

Horn-beam (*Ostrya virginiana*).—Grows only on rich soils, especially in intervals. It seldom reaches a large size.

Black or pigeon cherry (*Prunus serotina*).—A very rare plant except upon intervals, seldom more than 16 inches in diameter although it grows bigger in the United States.

Red cherry (*Prunus pensylvanica*).—Commonly grows on dry stony ground after burning, but seldom to a size more than 16 inches in diameter.

Choak cherry (*Prunus virginiana*).—A common bush, less than 2 inches in diameter, by brooksides on rich moist upland.

White cedar (*Thuja occidentalis*).—Grows only in the valley of the Annapolis River, and not plentiful there. Smith notes that it is not the same tree as the white cedar of the southern States.

Trembling and white poplar (*Populus tremuloides* and *P. grandidentata*).—These species always grow on burnt land, along with white birch. They are tall but seldom more than 16 inches in diameter.

Mountain ash or Fowlers service (*Sorbus americana*).—A small tree, rarely 6 inches in diameter, growing mostly on very poor soils. The bark is the favorite food of the beaver. The branches are said to be frequently covered with insect nests, even 20 miles from any settlement.

Wild or Indian pear (*Amelanchier*).—A small flowering tree, less than 6 inches in diameter, growing mainly near water on barren soils. Bears good fruit about the size of cherries.

Oak (*Quercus rubra*).—Grows chiefly on poor land, best upon very sandy intervals. It occurs scattered over the province, but reaches a greater size in the eastern parts.

White ash (*Fraxinus americana*).—A very tall tree, usually on rich land and beside brooks, but occasionally in cold swamps.

Black ash (*Fraxinus nigra*).—Grows only in swamps, which, though rich, require draining to produce grass. Seldom of sufficient size to make barrel staves.

With regard to forest communities, Smith re-

marks that the hardwoods, dominated by beech, occur mainly on the hills, where also the best soils are found. His explanation is that the frequent fires in the lowlands allow nutritive products of organic decay to escape into the air, whence they are blown to the hilltops where the hardwoods absorb them. Probably the burning did have an effect through keeping the communities at an early stage of seral development; and of course the impeded drainage of the lowland causes much of it to be covered with spruce and larch bog, in this heavily glaciated province.

The importance of soil fertility is strongly emphasized in the paper of 1835: "Upon the fertile soils the vegetation is composed of hardwood, and succulent plants with annual leaves. Their growth is rapid, and the outer bark is extremely thin.

Upon a barren soil the trees are evergreen, except the hachmetac: the greater part of the shrubs and plants are also evergreens. Their leaves contain more resinous and more woody matter, than the plants of fertile soils; they have also a strong thick epidermis. The trees on this soil grow slowly, the unusual quantity of epidermis increases in an inverse proportion to the growth of the tree."

In the MSS, Smith has some interesting remarks upon the soils of Nova Scotia. The most fertile soils, occurring beneath hardwoods, are said to be dark in color. On limestone, they are stated to be especially good, and chocolate-colored. In contrast, on the poorest softwood hills the soils were often almost white; undoubtedly Smith was observing the A₂ horizons of podzols. Loams developed from decayed slate were found to be extremely infertile wherever sulphureous iron pyrites was abundant, otherwise this rock did not yield barren soils. Those derived from the granites around Shelburne were claimed to be rather less fertile than usual, a fact associated by Smith with an abundance of isinglass (mica) in them.

Also noted in 1835 was the fact that elm and black cherry, common southward, are restricted in Nova Scotia chiefly to interval soils of an alluvial type. In this connection, it is also of interest that Smith records near Lake Rossignol a number of plants which he knows nowhere else in the province but which grow in the southern States. While he gives no names, it is tempting to see this as the first recognition of the southern coastal plain element in the Nova Scotian flora, especially as green briar (*Smilax rotundifolia*, badly transcribed as *Simula*) and evergreen gallberry (*Ilex glabra*, given as *Prinus Glaber*) occur in his plant lists, with one or two other plants of similar affinities.

The value of ground herbs as indicating soil

type is clearly stated in the MSS, where for example Smith writes of blackberries, virgin's bower and touch-me-not (*Rubus*, *Clematis*, and *Impatiens*) as plants of rich land suitable for growing timothy grass.

DIFFERENTIATION OF HUMUS LAYERS

A most interesting feature of Smith's work is the attention given to humus layers in the forest. In the MSS, soils are said to vary greatly in fertility according to the different proportions and qualities of vegetable mould in them. In the published paper he writes concerning hardwoods: "The annual crop of leaves, the trees overthrown or dying of age, and the lowest twigs, furnish a large quantity of dead vegetable matter, which, by the operations of the Fungi, insects, and the succeeding process of putrefaction, is soon changed into mould, which must continue to accumulate till the trees are fully grown; thus removing to the surface the most fertile part, from the greatest depth to which the roots of a tree can reach. Upon this soil neither turf nor peat earth is formed; but a fine mould lies under the dead leaves." In the case of the evergreens: "The large proportion of two almost imperishable substances, resin, and the epidermis of trees and other vegetables, appears to be connected with the formation of turf; as it is certain that they are produced in the greatest abundance on the most barren soils, and that in the same situations the greatest quantity of turf is formed. It may also be remarked that there are, in the vegetables of the most barren soils, very large proportions of tannin and gallic acid, well known to be very powerful in resisting putrefaction."

After remarking the importance of the moss layer to turf formation (as noted previously), Smith goes on: "Enough, perhaps, has been said of the causes which prevent the rapid change of dead vegetable matter to mould upon barren soils. At any rate a turf *is* formed, the depth of which, in an old forest, is generally in direct proportion to the barrenness of the subsoil. It produces timber fit for many purposes upon the barren whinstone plains, where the surface is covered by from 1 ft. to 2 ft. of broken stone and upon hills of granite which have not 4 in. of soil. It also increases the earthy portion of the turf by slowly decomposing the surface of the subjacent rock.

This turf appears to contain considerable decayed wood, little changed from the state to which it was reduced by the Fungi, and of the epidermis of trees and shrubs, and the cones of spruce very little altered. At the bottom, a very shallow layer, generally mixed with charcoal, approaches to the state of mould. In this bottom layer, the

seeds of the raspberry are to be found in abundance, with some of the wild cherry, red-berried elder (*Sambucus pubens* Mx.), and other shrubs that usually spring up after a fire." This ties in with the account of turf activation quoted earlier.

CONCLUDING REMARKS

The accuracy of many of Smith's descriptions may be checked by reference to Nichols (1918), who made a study of northern Cape Breton Island in which, for example, the successional role of balsam fir is described, and also the pioneer activity of *Chamaedaphne* (= *Andromeda*) *calyculata* in mat formation around pools. The autecological notes on forest trees compare well with those of Roland (1947). The role of *Baeomyces roseus* in colonizing frost-heaved areas of barren soil has often been observed by the present writer in the vicinity of Halifax, N.S., where also occurs the succession to *Pinus banksiana* as described. The two types of humus layer named mould and turf by Smith parallel the mull and mor of P. E. Müller (cf. Romell 1935a, Heiberg and Chandler 1941), and the mould and upland peat of Coville (1913), whose contribution to the study of American forest humus layers is usually overlooked. Incidentally, the last-named writer is perhaps the first to point out the local importance of myriapods as mull-formers. (cf. Romell 1935b). While Smith did make mistakes, notably in the assumption that turf is poorly aerated, many others have also fallen into this error, and the excellence of this account of turf activation more than makes up for it.

All in all, it may fairly be claimed that these quotations from Smith's work betray an insight into the pattern and process of vegetation development far in advance of his time. As a fellow ecologist and Nova Scotian, who has lived for many years only a few miles from Smith's home, the present writer is pleased to make this tribute to his memory.

For those interested in the life of this great naturalist, a short biography has been prepared by Piers (1938).

SUMMARY

Attention is drawn to the early ecological studies of Titus Smith, Jr. (1768-1850), whose brilliant observations upon the vegetation of Nova Scotia may well comprise the first major contribution to plant ecology in North America.

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APPENDIX

Trees and other plants mentioned by Smith, with their probable modern Latin equivalents (nomenclature according to Fernald 1950).

Smith's common name	Smith's Latin name	Modern Latin equivalent
Trees (in the order of autecological notes in text):		
Larch, Hackmatack or Juniper	<i>Pinus Larix</i>	<i>Larix laricina</i> (Du Roi) K. Koch.
White Pine	<i>Pinus Strobus</i>	<i>Pinus strobus</i> L.
Yellow Pine	<i>Pinus Sylvestria</i>	<i>Pinus resinosa</i> Ait.
Hudson's Bay Pine, Mountain Pine	<i>Pinus Banksiana</i> Lamb., <i>Pinus Pinea</i>	<i>Pinus banksiana</i> Lamb.
Hemlock	<i>Pinus, Abies canadensis</i> Mx.	<i>Tsuga canadensis</i> (L.) Carr.
Balsam Tar or Fir	<i>Pinus balsamifera, Abies balsamifera</i> Mx.	<i>Abies balsamea</i> (L.) Mill.
White Spruce	<i>Pinus</i>	<i>Picea glauca</i> (Moench) Voss
Red Spruce	<i>Pinus</i>	<i>Picea rubens</i> Sarg.
Black Spruce	<i>Pinus</i>	<i>Picea mariana</i> (Mill.) BSP.
Black or Yellow Birch	<i>Bitula nigra, Betula excelsa</i> H.K.	<i>Betula lutea</i> Michx. f.
Black Birch of New York	———	<i>Betula lenta</i> L.?
White Birch	<i>Bitula alba, Betula populifolia</i> H.K.	<i>Betula papyrifera</i> Marsh., <i>B. populifolia</i> Marsh.
Dwarf Birch	<i>Bitula nana</i>	<i>Betula pumila</i> L. or <i>B. michauxii</i> Spach
Beech	<i>Fagus sylvatica</i> L., <i>Fagus ferruginea</i> L.	<i>Fagus grandifolia</i> Ehrh.
Sugar, Rock, Curled or Birdseye Maple	<i>Acer Saccharinum</i>	<i>Acer saccharum</i> Marsh.
Red, Flowering, White or Soft Maple	<i>Acer rubrum, Acer dasycarpon</i> Ehrh., <i>Acer eriocarpon</i> Mx.	<i>Acer rubrum</i> L., <i>A. saccharinum</i> L.
Moosewood Maple	<i>Acer</i>	<i>Acer pensylvanicum</i> L.
Dwarf Maple	<i>Acer Mana</i>	<i>Acer spicatum</i> Lam.
Elm	<i>Ulmus Americana</i>	<i>Ulmus americana</i> L.
Hornbeam	<i>Carpinus Ostria</i>	<i>Ostrya virginiana</i> (Mill.) K. Koch.
Black or Pigeon Cherry	<i>Prunus</i>	<i>Prunus serotina</i> Ehrh.
Bird or Red Cherry	<i>Prunus Avisim</i>	<i>Prunus pensylvanica</i> L. f.
Choak Cherry	<i>Prunus Virginica</i>	<i>Prunus virginiana</i> L.
White Cedar	<i>Thaya Occidentalis</i>	<i>Thuja occidentalis</i> L.
Trembling Poplar	<i>Populus Tremula</i>	<i>Populus tremuloides</i> Michx.
White Poplar	<i>Populus Alba</i>	<i>Populus grandidentata</i> Michx.
Mountain Ash or Fowler's Service	<i>Sorbus Aucuparia</i>	<i>Pyrus americana</i> (Marsh.) DC.
Wild or Indian Pear	<i>Mespilus</i>	<i>Amelanchier</i> Medic.
Oak	<i>Quercus rubra</i>	<i>Quercus rubra</i> L.
White Ash	<i>Fraxinus Americana</i>	<i>Fraxinus americana</i> L.
Black Ash	<i>Fraxinus</i>	<i>Fraxinus nigra</i> Marsh.

Other plants (roughly in order of appearance in text) :

Kalmia, Dwarf Laurel	<i>Kalmia</i>	<i>Kalmia angustifolia</i> L.
Raspberry	<i>Rubus Idaeus</i>	<i>Rubus idaeus</i> L.
Red-berried Elder	<i>Sambucus racemosa</i> , <i>Sambucus pubens</i> Mx.	<i>Sambucus pubens</i> Michx.
Sumach	<i>Rhus conidensis</i>	<i>Rhus typhina</i> L.
Prickly Aralia or Sarsaparilla	? <i>Aralia spinosa</i>	<i>Aralia hispida</i> Vent.
Evergreen fumitory	—	<i>Corydalis sempervirens</i> (L.) Pers.
French Willow	<i>Epilobium angustifolium</i>	<i>Epilobium angustifolium</i> L.
Cacalias	—	Compositae (see Lindley and Moore 1870) inclusive term
Blueberry	<i>Vaccinium Album</i> , ? <i>Vaccinium ?venustum</i> H.K.	<i>Vaccinium</i> L.
Brakes	—	<i>Pteridium aquilinum</i> (L.) Kuhn, and other ferns?
Sweet Fern	<i>Myrica Asplinifolia</i> , <i>Comptonia asplenifolia</i> H.K.	<i>Comptonia peregrina</i> (L.) Coul.
Dwarf Willows	<i>Salix</i>	<i>Salix</i> L.
Withrod	<i>Viburnum</i>	<i>Viburnum cassinoides</i> L.
Alder	<i>Bitula Alnus</i>	<i>Alnus crispa</i> (Ait.) Pursh and <i>A.</i> <i>rugosa</i> (Du Roi) Spreng.
Rhodora	<i>Rhodora Canadensis</i> L.	<i>Rhododendron canadense</i> (L.) Torr.
Mayflower	<i>Ehigola</i>	<i>Epigaea repens</i> L.
Trailing evergreens	<i>Lycopodium</i> species	<i>Lycopodium</i> L.
Snakeroot	<i>Aristolochia Serpentaria</i> L.	Not present in N.S., the writer is at a loss for the correct plant
Mitchella	<i>Mitchella repens</i> W.	<i>Mitchella repens</i> L.
Linnea	<i>Linnæa borealis</i> Gron.	<i>Linnaea borealis</i> L.
Pigeonberry	<i>Cornus Canadensis</i>	<i>Cornus canadensis</i> L.
Mountain tea	<i>Gaultheria procumbens</i> L.	<i>Gaultheria procumbens</i> L.
Maidenhair	<i>Vaccinium Hispidulum</i> , <i>Adiantum pedatum</i> in error in 1835	<i>Gaultheria hispidula</i> (L.) Bigel.
Aster	<i>Aster</i> , several nondescript species	<i>Aster</i> L.
Goldenrods	<i>Solidago</i> , several species	<i>Solidago</i> L.
—	<i>Lichen ericetorum</i>	<i>Baeomyces roseus</i> L.
Caribou (reindeer) moss	—	<i>Cladonia rangiferina</i> L.
Hawkweed	<i>Hieracium</i>	<i>Hieracium</i> L.
Acadian heath	<i>Ceratiola ericoides</i> L.	<i>Corema Conradii</i> Torr.
—	<i>Potentilla tridentata</i>	<i>Potentilla tridentata</i> Ait.
Black Whortle	<i>Vaccinium Myrtillus</i>	<i>Vaccinium</i> L.
Candleberry Myrtle	<i>Myrica cerifera</i>	<i>Myrica pensylvanica</i> Loisel.
Round-leaved Andromeda	<i>Andromeda calyculata</i>	<i>Chamaedaphne calyculata</i> (L.) Moench
Bog Moss	—	Presumably <i>Sphagnum</i>
Indian Cups	<i>Sarracena purpurea</i>	<i>Sarracenia purpurea</i> L.
Indian Tea	<i>Ledum</i>	<i>Ledum groenlandicum</i> Oeder
Rosemary-leaved Kalmia	<i>Kalmia glauca</i> L. var. <i>rosmarinifolia</i> Ph.	<i>Kalmia polifolia</i> Wang. or possibly <i>Andromeda glaucophylla</i> Link
Dutch Myrtle	<i>Myrica Gale</i>	<i>Myrica gale</i> L.
Cotton Grasses	<i>Eriophorum Alpinum</i>	<i>Eriophorum</i> L.
Sedges	<i>Carex</i> , several species	<i>Carex</i> L.
Bearberry, Uva-ursi	<i>Arbutus Alca Urse</i>	<i>Arctostaphylos uva-ursi</i> (L.) Spreng.
Berry-bearing Heath, Crakeberry	<i>Empetrum nigrum</i> L.	<i>Empetrum nigrum</i> L.
Heath	—	—
Yellow-flowering cistus	<i>Hudsonia ericoides</i> L.	<i>Hudsonia ericoides</i> L.
Acadian savine	<i>Juniperus Sabina</i>	<i>Juniperus horizontalis</i> Moench
Green Briar	<i>Simula rotundifolia</i>	<i>Smilax rotundifolia</i> L.
Evergreen Gall berry	<i>Prinus Glaber</i>	<i>Ilex glabra</i> (L.) Gray
Blackberry	<i>Rubus Fructicosus</i>	<i>Rubus</i> L., Subgenus <i>Eubatus</i> Focke
Virgin's bower	<i>Clematis vitalla</i>	<i>Clematis virginiana</i> L.
Touch-me-not	—	<i>Impatiens</i> L.

N.B. In the MSS, Smith's Latin names were often badly transcribed from the original document, witness for example *Ehigola* for *Epigaea*. Those of Smith's Latin names with authorities come from the published paper, as do a few of those without.