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OUR FORESTS.

The Effect of their Destruction upon
Climate and Vegetation.

A Plea in Behalf of Trees.

The following able and interesting paper on the preservation of forests and the planting of timber was read at the recent annual meeting of the State Agricultural Society. Its importance deserves circulation and careful study.

ON THE PRESERVATION OF FORESTS AND THE PLANTING OF TIMBER.

BY FRANKLIN B. HOUGH.

When the region now included in the State of New York first became known to Europeans it was covered with a heavy growth of forests. The only exceptions were parts occupied by rocks, marsh or river intervals, the beaver meadows here and there along the streams, and now and then a little patch of open ground where the native Indians tilled the soil in their rude and simple way, by the side of some favorite lake or stream, which afforded the best opportunities for subsistence by hunting and fishing.

This forest opposed the first resistance to the labors of civilized man, and must be cleared off before the first field could be sown or the first fruit tree planted.

Although forest products afforded from the beginning an important class of commodities needed in the old world, and an abundance of conveniences of greatest use in the new, still the apparently inexhaustible supply seems to have licensed an unlimited waste. The cash receipts for potash would go far towards meeting the first payments for land, and so the work of destruction, begun with necessity, went on as if there were no hereafter, and wanton waste had made sad havoc with

our timber long before it came to be realized that even its conversion into lumber for exportation, and use in the cities, was more economical than burning it to ashes on the ground.

Through the first two hundred years no other fuel was thought of any where in our country, and even now, except along our thoroughfares of canal and railroad traffic, wood is still the principal or only fuel. The construction of these lines of communication, while it has favored the introduction of mineral coal, and thus reduced the demand for fire wood, has at the same time opened channels for transportation, and stimulated the demand for lumber and other forest products is a still greater degree; so that if there is now less waste, there is a greater and rapidly increasing consumption. If the *asheries*, once so numerous, have mostly disappeared, the *saw mills* and *tanneries* have in like ratio multiplied, and the havoc to our forests has gone on until even these have in many places exhausted the supplies around them. The soil, indeed, has been opened to cultivation; yet over extensive areas scarcely a tree has been left to shelter it from the sun and the winds. I invite your attention to some of the consequences which may be expected to follow this improvident waste, and will venture to propose some conservative measures tending to compensate for this continued exhaustion of supply.

Were it not for the fact that a part of our timber and lumber has been for many years derived from Canada and the Northwestern States, the want of these essential articles would ere this have been severely felt, and at present rates, these extra-limited sources must in a few years become exhausted, and we may realize, when too late, the folly of not providing a seasonable and sufficient remedy.

We will first notice the demand for wood by railroads. According to the last report of the State Engineer and Surveyor, we have in this State about 6,000 miles of roads finished upon main lines, and 2,000 upon branches, making for these, and for sidings and double tracks, about 11,000 miles to keep supplied with ties, to say nothing of the rapid increase from year to year. This single item demanded 28,675,000 pieces, which on the average must be renewed once in six years, requiring an annual supply of 4,445,830 pieces, or about two and a quarter million of trees. The cost of fuel on railroads was about seven and a half million of dol-

13

SI 381
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lars. We have no statement of the number of locomotives, but allowing half to be wood burners, and wood at \$4 to the cord, there will be required for railroad fuel alone, about a million of cords of wood annually. Add to these items the amount of lumber and timber used for fences, bridges, and other structures, and we shall find that it requires not less than 50,000 acres of woodland a year, to supply the demand for railroad use alone, in the State of New York.

If we take into account the vast consumption for farm fences, for fuel and for building purposes, and the vast amount required to supply the various manufactories of wooden wares and implements, and which are steadily increasing in number and magnitude, we shall begin to realize the stern realities before us, and should stop to consider the remedies that may be applied.

There are also considerations of the influence of the forests upon climate, and results that have been observed to follow their destruction, which claim our careful attention. It is a matter of common observation, that as our woodlands are cleared away the swamps and rills which feed the streams, diminish or disappear. Mills built upon streams which in the early settlement of the country, afforded an abundant water power throughout the year, must now stop from want of water in the summer months, or use steam power during a part of the year. The feeders of our State Canals diminish, and new sources of supply must be sought. Springs and wells fail, and the increasing population of our cities and large towns, finds more and more difficulty every year, in obtaining the supplies of pure and wholesome water, so essential to health and happiness.

In warmer climates, the effects of this cutting off of forests become still more apparent, and we will notice two or three instances in which the disasters following this improvident destruction of timber have been most sadly realized. The Danish island of Santa Cruz, in the West Indies, some twenty-five years ago was a garden of freshness, beauty and fertility. Woods covered the hills, trees were everywhere abundant, and the rains profuse and frequent. A gentleman of my acquaintance who visited the island when in its greatest beauty, was induced by the memory of its loveliness, to resort thither a year or two since, at a corresponding season of the year, to gratify his love of botanical study, and revel in the floral beauties which his former

experience had led him to anticipate. He found a third of the island an utter desert. The short, copious showers which frequently occurred in former times, had ceased, and the process of desiccation was gradually advancing, leaving a barren waste except along the shore, where a narrow belt of green marked the presence of the shrubs that flourish along the high water mark of the sea shore. The desolation came slowly but irresistibly. First the sugar canes failed—then a meagre pasturage was maintained for a few years, and then the desert, with its sparse and prickly vegetation of cactus and other worthless plants. Some attempt had been made to stay the impending ruin, and one planter had set out a thousand trees—but every one failed.

The island of St. Thomas, some thirty miles distant, is somewhat similarly affected, but being more broken, it receives more rain. Fifty miles west is Porto Rico, largely covered with mountains, well supplied with forests, and abundantly watered by rains.

The island of Curacao was, within the memory of living persons, a garden of fertility—but now, whole plantations with their once beautiful villas and terraced gardens, are nothing but an arid waste; and yet sixty miles away, along the Spanish main, the rankest vegetation covers the hills, and the burdened clouds shower down abundant blessings.

The causes of these changes are directly attributable to the cutting down of timber, and in the smaller islands of tropical seas, where irrigation is impossible, the injury may be altogether beyond the power of man to repair.

Palestine was anciently described as "a good land, a land of brooks of water, of fountains and depths that spring out of valleys and hills." (Deut. viii, 7.) It was "a land that floweth with milk and honey . . . a land of hills and valleys, and that drinketh water of the rain of heaven." (Deut. xi, 9-11.) But the vegetation which these conditions imply, has largely disappeared, and with it in proportional degree, "the rains of heaven."

These instances might be multiplied to a great extent—the experience of the world in all climates tending to establish the same great fact, that sterility and drouth are the natural consequences of the destruction of forests. There may be exceptional cases in which a country exposed to warm ocean winds may receive an adequate amount of rain-fall irrespective of its woodlands or open fields, and we must admit that the normal quantity is much dependent upon distance from the sea,

and the influence of mountains, and other modifying circumstances. The usual quantity of rain, for example, in our State, is about 45 inches a year at New York city, about 40 at Albany, about 38 at Buffalo, and about 32 along the St. Lawrence.

We are equally justified in saying that the restoration of timber after it has been once cut off, tends to bring back the wonted showers of sylvan times, and some instances of this will be noticed.

The celebrated philosopher, Humboldt, towards the close of the last century, visited the valley of Aragua, in Venezuela, which lies land-locked, at no great distance from the coast, but without an outlet, the drainage being into a beautiful lake at the bottom of the valley, some 1,300 feet above tide level. The country around had been cleared and settled, and the inhabitants began to notice from year to year a wasting away of these waters, as if they had found some outlet. Villages on the lake shore appeared to recede, and islands, before unknown, arose above the surface. The felling of trees which crowned the slopes and crests of the mountains, was assigned as the cause of the evidently decreasing amount of rain-fall, by which, says this eminent observer, "men in all climates seem to bring upon future generations two calamities at once—a want of fuel and a scarcity of water."^{*}

A civil war followed, in the course of which, agriculture was neglected, and forest vegetation again returned, so that a traveler twenty-five years afterwards described the lake as again rising, and plantations along its banks submerged and abandoned. The streams, which in times of former drouth, had been drained dry for the purposes of irrigation, were now in full flow, the copious rains rendering irrigation no longer necessary.

In Utah we observe a somewhat similar result. It is well known to all present that agriculture has chiefly been maintained in that territory by irrigation, and that the construction and maintenance of canals for bringing the mountain streams across the plains has from the first been a subject of constant care and expense. In 1866, they had 127,798 acres under irrigation, and the amount expended during one year was \$303,863.77 or about \$2.73 to the acre.† All observers agree that the

climate is improving under the increasing breadth of vegetation which this system of cultivation has created. Much less water is needed than formerly to produce a given effect, the rain-fall is increasing, and the waters of the great Salt Lake stand about twelve feet above the old high water marks, and are still rising.‡ The industrious Mormons have a right to expect, that as the breadth of cultivation extends, the rains will increase in the same ratio. That the air will become more humid as trees are planted, and that a self-sustaining amount of rain fall may in time be obtained.

These results afford a hopeful promise to the treeless regions of the other territories where nothing but water is required to bring fertility to the soil, and with the vegetation which this invites, a humid atmosphere and showers of rain.

The Hon. Paul A. Chadbourne, President of Williams College, in an address before the Massachusetts Board of Agriculture, published in their report of 1871-2, (p. 61-9,) says, that Salt Lake contains nearly or quite as much water as it did when the Mormons came, and that it has risen at least one foot a year for the last ten years:

"But it is not in Salt Lake Valley alone, or immediately around the lake, but in all the valleys around there, and throughout that territory, that the water is increasing in quantity. Capt. Stover, who went from the State of Maine, told me, that ten years ago he cut grass on the borders of Stockton Lake, where now the water is forty feet deep. . . . When you pass up and down throughout the Territory as I have done this summer, you will find evidence that in all the streams the amount of water is constantly increasing, and that the Mormons regard it as a direct interposition of God."

In speaking of this change, Mr. C. was informed by Brigham Young that twelve years before they had planted a settlement where, by careful measurement, there was found water for only twelve families. Now there is a population of fifteen hundred souls at that place and an abundance of water for all. There is now much less timber on the mountains and in the canyons than formerly. But the evaporation has been greatly checked by cultivation and by groves of young trees. This writer does not think that more rains fall now than formerly, but that evaporation is less, and the general humidity much greater, thus checking the influence of drying winds.

^{*} Humboldt. Vol. V., p. 173.

[†] Of this, \$136,610.85 was on canals, \$27,702.27 on dams, \$66,696.57 on cleaning out and repairs, and \$72,852.75 on private canals. Rep. Deseret Ag. and Mfac. Soc., 1867, p. 2.

[‡] Editorial correspondence of the Country Gentleman, Nov. 27, 1873.

The influence of forests upon the dews is important; and depends upon the greater humidity and coolness imparted to the air around them, and to the shelter from the winds which they furnish. In the immediate shade of a tree, the radiation from the earth may be in part returned, and less may be deposited; but a little further off, the humid influence of a grove is decidedly observed. To this may perhaps be ascribed the freshness of pastures interspersed with clumps of trees, at a time when a naked pasture will be parched and brown. §

We should not forget to mention the relation existing between malaria and growing trees. Fortunately in our State diseases occasioned by malarious exhalations have, in a great degree, disappeared from the central and western portions, since the decaying mould and rotten wood exposed to the air in the new clearings have become thoroughly decomposed. But in warmer climates, where rank vegetation is allowed to decay in wet places, this poisonous element acquires its greatest virulence. Such are the Pontine Marshes near the city of Rome, where an overflow from obstructions in the Tiber, and neglect of agriculture has brought on an insalubrity throughout a once healthy and fertile region, which ages of patient industry can scarcely redeem. It has been found, that next after the drainage of the spongy morass, which a luxuriant and neglected growth of herbage had occasioned, the planting of trees in belts and groves, affords the best means of absorbing the poison, and preventing its dispersion by the winds. The cutting down of a forest, which for ages had covered the slopes of a hill between the city and the marshes, let in the malaria upon a part of the city where it was before unknown.

The *Eucalyptus*, an Australian tree of most vigorous growth in warm countries, has been of late especially noticed as capable of absorbing the poisonous exhalations of marshes. A recent writer^{||} gives many instances of its successful treatment of malaria. It is asserted that this tree will absorb from the earth ten times its weight of water daily, giving off

with the renovated emanations of its foliage a camphorated aroma, alike antiseptic and agreeable.

Somewhat similar properties are claimed for the long-leaved pine and other trees, as well as for the sunflower, planted in belts along the border of marshes. Wherever intermittent fevers appear to be occasioned by marshes, the planting of trees along the margin of the wet lands, so as to break the winds passing over them, would, in all probability, be followed by a decided abatement, if not a complete suppression of the evil. It is to be remembered that prevailing sickness from malaria seldom appears in our climate so long as the country is timbered, but only as decaying vegetable matter is exposed to the sun.

It is quite probable that electrical conditions dependent upon vegetation may have a decided influence upon the precipitation of rain. We know that a hispid plant, insulated and heavily charged with electricity, quickly loses its charge, and that every point of a leaf or plant is an agency for receiving or passing off an electrical current. The telegraph wire is robbed of its message in passing through a tree top, if contact with the foliage is allowed; and I have no doubt but that a house surrounded by high trees is better guarded against lightning than if protected by a patent lightning rod of average construction.

There is scarcely a change of condition or of place in nature, in which electrical phenomena may not be noticed, when carefully observed. The passage of water into vapor, its condensation into rain, the friction of the winds, a change from heat to cold, or from cold to heat, combustion and slow decay, are all attended by electrical phenomena. In its ordinary conditions the air is positively electrified, but in fogs, rain and snow, and sometimes in cloudy weather it is negative. The conditions change with the hours of the day and the season of the year. The facility with which electricity passes from points or is received by them, suggests the probability that forest vegetation must have a marked influence upon these conditions and changes.

I should not omit to notice the benefit of copses and belts of woodland scattered among cultivated fields, for the shelter they afford to insectivorous birds. A very large proportion

§In India dew is deposited near rivulets when all around is perfectly dry. The limit of deposition was but fifteen or twenty feet.—[Col. Sykes, in Transactions of Royal Soc., 1850, p. 334.

||Monthly Report Department of Agriculture, December, 1873.

of our common song birds live upon insects injurious to the farmer, and when sheltered and protected they become his efficient helpers in saving from harm the harvest of his fields, working free of charges and boarding themselves.

At a Land and Forest Congress held at Vienna during the past summer, at which some three hundred delegates from nearly every civilized country were present, the importance of birds to the agriculturist was earnestly discussed, and a series of resolutions offered tending to protect and encourage them, by asking from all governments prohibitions and penalties against their injury or destruction. These useful allies of the field should be alike protected by stringent game laws and by a generous and appreciating public sentiment, favoring abundant opportunities for nesting in groves suited to their habits, and secure from harm.

Some, like the robin, make their homes in the orchard, and in the trees around our dwellings; but many more of great utility, love the seclusion of groves apart from human habitations, and we lose their services, where these shelters do not exist.

The records of rain-fall kept at various stations in this State and the United States, do not justify us in believing that any considerable amount of change has occurred in the total amount from year to year, although the distribution of rain and snow among the seasons is in many cases more irregular, as the country becomes older, and the wood lands less. Seasons of unusual drouth may succeed each other for several years together, and disastrous floods appear to be of more frequent occurrence now than formerly.

The great source of supply of aqueous vapor, which forms rain, is from the sea itself. The evaporation from its surface is constant, and over broad acres, under a tropical sun, the amount raised as vapor and borne landward by the winds is immense, and may be regarded as nearly uniform from year to year. If the surface were all water, we may readily believe that the changes of weather would follow in strictly regular succession, like day and night, and like winter and summer. But as a part of the surface is land, and of very unequal contour, we find the vicissitudes of the weather continually changing, from causes not yet fully understood. In some regions rains are altogether unknown; in others, they

are profuse, and in others scanty or abundant, as the causes which influence their precipitations are changed by the operations of nature, or through the agency of man.

Aqueous vapor is always present in our atmosphere, and when rain is most needed it is often in quantities sufficient for every want, if the temperature from any cause could be sufficiently reduced. This vapor is not usually perceptible to the senses, being held in suspension by the air. The capacity for absorbing vapor increases with the temperature, so that at the freezing point, the air can support but a one hundred and sixtieth part of its weight of vapor, while at 86° , it can hold a fortieth part, and at 118° a twentieth part. If from the common air, under a glass receiver, we exhaust a part, the remainder will expand to fill the whole space, and in so doing cools, and its capacity for holding vapor in suspension diminishes, until it may reach the point of saturation, and a dew will begin to form on the inner side of the glass, the air within being obscured by fog. The temperature at which this dew begins to appear is called the *dew point*, and to this degree must the air be always reduced before clouds and rain can be formed. In meteorological observations, the absolute and relative humidity are usually determined from a pair of thermometers, one covered with muslin and moistened with water. This instrument when wet, presently falls to a stationary degree, which is the dew point. The differences of reading with the aid of tables, readily afford the means of knowing the *absolute humidity* or total amount of vapor in the air, or its elastic force, represented by the height of a column of mercury which this force would support, and the *relative humidity* or ratio of the quantity of vapor present, expressed in decimals, absolute degrees being zero, and saturation 1.00.

There have not hitherto been taken within our State, any continued series of these psychrometrical observations through many years of time. But to illustrate the subject, I have prepared from the records of the Toronto, Magnetic and Meteorological Observatory, which have been kept with great accuracy under uniform rules, for over twenty years, some tables which give results quite similar to those we might expect in our State. The first of these exhibits the mean monthly elastic force of the vapor, and the second the mean monthly humidity:—

I. MEAN ELASTICITY OF AQUEOUS VAPOR AT TORONTO OBSERVATORY.
(The numbers show the height of a mercurial column in inches which the elastic force of vapor would support).

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1853.	122	110	136	207	258	434	550	478	444	287	180	109	279
1854.	125	108	132	208	258	434	550	478	444	287	180	109	279
1855.	125	108	132	208	258	434	550	478	444	287	180	109	279
1856.	125	108	132	208	258	434	550	478	444	287	180	109	279
1857.	125	108	132	208	258	434	550	478	444	287	180	109	279
1858.	125	108	132	208	258	434	550	478	444	287	180	109	279
1859.	125	108	132	208	258	434	550	478	444	287	180	109	279
1860.	125	108	132	208	258	434	550	478	444	287	180	109	279
1861.	125	108	132	208	258	434	550	478	444	287	180	109	279
1862.	125	108	132	208	258	434	550	478	444	287	180	109	279
1863.	125	108	132	208	258	434	550	478	444	287	180	109	279
1864.	125	108	132	208	258	434	550	478	444	287	180	109	279
1865.	125	108	132	208	258	434	550	478	444	287	180	109	279
1866.	125	108	132	208	258	434	550	478	444	287	180	109	279
1867.	125	108	132	208	258	434	550	478	444	287	180	109	279
1868.	125	108	132	208	258	434	550	478	444	287	180	109	279
1869.	125	108	132	208	258	434	550	478	444	287	180	109	279
1870.	125	108	132	208	258	434	550	478	444	287	180	109	279
1871.	125	108	132	208	258	434	550	478	444	287	180	109	279
1872.	125	108	132	208	258	434	550	478	444	287	180	109	279
1873.	125	108	132	208	258	434	550	478	444	287	180	109	279
Mean.	108	107	120	186	272	430	550	478	444	287	180	109	279
Highest.	134	147	154	208	258	434	550	478	444	287	180	109	279
Lowest.	100	100	100	100	100	100	100	100	100	100	100	100	100

II. MEAN HUMIDITY OF ATMOSPHERE AT TORONTO OBSERVATORY.
(The numbers show the relative amount of moisture .00 being complete dryness and 1.00 saturation).

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean of Year.
1853.	84	82	85	80	74	78	79	74	79	76	74	77	79
1854.	84	82	85	80	74	78	79	74	79	76	74	77	79
1855.	84	82	85	80	74	78	79	74	79	76	74	77	79
1856.	84	82	85	80	74	78	79	74	79	76	74	77	79
1857.	84	82	85	80	74	78	79	74	79	76	74	77	79
1858.	84	82	85	80	74	78	79	74	79	76	74	77	79
1859.	84	82	85	80	74	78	79	74	79	76	74	77	79
1860.	84	82	85	80	74	78	79	74	79	76	74	77	79
1861.	84	82	85	80	74	78	79	74	79	76	74	77	79
1862.	84	82	85	80	74	78	79	74	79	76	74	77	79
1863.	84	82	85	80	74	78	79	74	79	76	74	77	79
1864.	84	82	85	80	74	78	79	74	79	76	74	77	79
1865.	84	82	85	80	74	78	79	74	79	76	74	77	79
1866.	84	82	85	80	74	78	79	74	79	76	74	77	79
1867.	84	82	85	80	74	78	79	74	79	76	74	77	79
1868.	84	82	85	80	74	78	79	74	79	76	74	77	79
1869.	84	82	85	80	74	78	79	74	79	76	74	77	79
1870.	84	82	85	80	74	78	79	74	79	76	74	77	79
1871.	84	82	85	80	74	78	79	74	79	76	74	77	79
1872.	84	82	85	80	74	78	79	74	79	76	74	77	79
1873.	84	82	85	80	74	78	79	74	79	76	74	77	79
Highest.	89	84	85	80	76	79	79	78	80	82	84	87	79
Lowest.	78	76	69	63	62	63	60	68	71	72	74	77	73
Mean.	82	81	77	71	69	72	71	73	76	77	78	81	76

In woodlands the soil is sheltered from the sun, and is usually covered by a cushion of decaying leaves. This tends to equalize the temperature, making it warmer in winter and cooler in summer than in open fields. Being cooler in summer, it requires less change of temperature to bring the atmosphere to the clear point, and hence the influence of woodlands upon rains. Besides this, when in foliage the evaporation from the leaves due to the vital action of the trees, and the drying off of water from dews and rain, afford a direct cooling process, from the well known law of nature that nothing can pass from a denser to a rarer form without losing heat.

Being sheltered from the winds, the snows lie uniformly upon the ground in a forest, and wasting away more slowly, they tend to cool the air around them, and thus prevent the injury that very warm days in early spring might otherwise cause to fruit. This retarding of vegetation in spring is similar in its effects to that from large bodies of water, on the leeward side of which, as is well-known, the best fruit districts in the country are found.

Besides these effects, woodlands shade the sources of rills, and are a screen against drying winds. In fact, such is the amount of moisture exhaled from a forest in full leaf that a dry wind could not pass over a woodland of considerable extent without acquiring a degree of humidity favorable to the cultivated lands beyond.

We must probably admit, that less rain in a shower reaches the earth in a forest than in an open field, since much of it is intercepted by the leaves, and in warm weather soon evaporated. But such as does reach the earth, being in a damp and sheltered place, does not run quickly off, gully the hill sides and washing the soil into the streams, as in an open country, and inundating the valleys by sudden freshets. It sinks into the earth to reappear as springs, or is appropriated by the tender and juicy vegetation of the under growth, and the spongy and luxuriant growth of the swamps. The soil being more pervious to the water, in fact, absorbs much more than the sun-baked surface of clay in an open field, and hence we never hear of the drying up of streams, until the country is cleared of its forests.

In ordinary conditions, a rain gauge on the ground receives more rain than on a house top, and the latter more than one placed on a lofty tower. This can only be explained by admitting that rain drops increase in volume as they fall through an atmosphere saturated with vapor. Yet nothing is more common than a fall of rain on hilly woodlands, while "all signs fail" on the open plains below, and the rainless clouds pass over—showing to the anxious observer abundant streaks and filaments of falling rain from their under surface, which dry up and dissolve in air, long before reaching the parched and needy soil.

Such being the consequences of an improvident and indiscriminate clearing off of the timber, the inquiry naturally arises: "What shall we do to be saved?" The answer is plain and obvious: "Plant Trees."

A considerable area of the soil must, of course, be opened for cultivation, but there are many places where nothing but trees can grow to advantage, and many more where timber would yield a larger profit than any other crop, and with far less expense of labor, regarding only the value of the wood grown, without reference to the ameliorating influences of woodland upon the adjacent fields. If our hill-tops, steep hill-sides, ravines, road sides and waste places were planted with timber adapted to the circumstances of the place; if our existing timber lands were spared by taking out only the trees of mature growth, and by protecting the young trees, and if worn out and exhausted lands were sown and planted with trees, and fenced against cattle, we might as reasonably expect a return of profits from the investment, as when we sow in seed time, in soil properly prepared.

The return may be slower, and one generation may plant for the benefit of the next, yet the growth would in most cases be worth more than the interest of the money invested, and the value of the timber crop at any stage of its growth, like the interest on a bond, at any time after its date, could be readily determined.

In some European countries, vast forests are kept up by government. In England, in 1871, about 40,000 acres were planted in oak for the wants of the navy a hundred years hence, and more is being done every year to guard against coming wants. Upon the continent we find even a dozen schools of Forestry, where special instruction is imparted to the youth who are to take the future

care of the public forests, and private plantations. The graduates of these schools go to their duties thoroughly instructed in every detail of forest management; are able to compute the present worth of a given piece of timber land, its rate of increase in value, the amount that may be taken annually without permanent injury to the forest, and the various scientific details upon which success in management depends.

I am not aware that in the United States, attention has hitherto been more than incidentally given in any college, to the applications of science to forest-culture, or that the student can anywhere in this State listen to a single lecture upon this exceedingly practical subject, in the whole course of his studies. Lands owned by the government may be reserved, or sold subject to conditions, as the future interests of the nation may indicate to be wise and proper. Whatever is done in this way must come within the jurisdiction of Congress, and of States that own lands. The State of New York has already parted with most of these titles.

As for the planting of timber upon lands already sold, this must begin with the owners, who, under our tenures, are the sole judges of how these lands shall be cultivated, and what crops they shall produce. The profits of tree-culture must be widely taught, and thoroughly believed. Our State and local Agricultural Societies should in every way possible, disseminate correct information upon the subject, and encourage emulation by premiums for greatest amount of tree planting, and best methods of management. A young grove should be looked upon by its owner with pride, and a tree as a thing of beauty and of promise, to be cared for and cherished both for present ornament and future use.

I will venture to notice some of the benefits which it may be within the power of our State government to confer upon the future, in the care of timber lands. A considerable amount of waste land exists in various parts of the State, and especially in the great northern wilderness, and much of this is returned annually to the Comptroller for non-payment of taxes. Should the proposed State Park find favor with the Legislature, as I earnestly hope it will, to this extent, it will secure the preservation of our timber lands. But there are also other tracts of waste land in various parts of the State of

little or no value except for the timber that may grow upon them. As a general rule it may be taken for granted, that where the owners allow wild lands to be sold, and do not redeem them, such lands are worth nothing for cultivation. They may have been already stripped of their timber, which was all the worth they had, and will not be again desirable until a new growth of trees springs up. Would it not be best to reserve these lands, and hold them as the property of the State, instead of selling for the paltry prices they would bring at a tax sale? Their immediate care, and protection against trespasses might be entrusted to the town authorities where located, and their condition reported annually at town meetings, and to some central State office. The sale of timber and other details might be so arranged as to secure the benefits at a reasonable expense, and doubtless with as much profit as is now derived from time to time by their sale.

The State may exercise its power in other ways, as has been done to some extent in other States, by exempting, for a limited time, from taxation lands planted and enclosed for timber growth. This feature appears in the law passed in Maine in 1872, which provides that owners planting any amount of land from which the forest has been entirely cut away, and cultivating for three years, the trees being not less than 2,000 to the acre and well distributed, may, upon application to the Assessors, and upon filing a map and description of the location, and all the facts in relation to the growth and cultivation of his grove, or incipient forest, be exempted from taxes on such land for twenty years, if kept alive and in thriving condition during that time.

In Nebraska, the 10th of April is set apart by law as "Arbor Day" an agricultural festival devoted to the planting of trees. Its State Agricultural Society has offered a premium of \$100 to the Farmer's Society of the country, and \$25 to the individual planting the greatest number of trees on that day.

A State owes it as a duty to its citizens that the public interest shall be protected at the public cost, and on this principle it causes roads and bridges to be made and maintained by assessments often payable in labor, and always chargeable upon those supposed to derive the greatest benefit from their use. In like manner might it justly charge a tree-tax, payable in the planting of trees by the

owners of farming lands, or the commutation of this tax if paid in money, to be applied to this object, along the public highways.

Necessity will, within a few years, teach our farmers the important fact, that a large part of our fencing, might be saved, if they would confine their stock *within* the range allowed for pasturage, instead of keeping them *out* of the places where they are not wanted, much that is essential may be made of stone walls and live hedges instead of wood.

With the introduction of other materials for building in many cases, and the increased use of coal and peat as fuel, it may be within our means to produce within the State, a sufficient growth of wood to supply our wants till the latest period of time. But to secure this provision public sentiment among our farming population must be strongly aroused and the sooner the necessities of the case are understood and acted upon, the easier will be the remedy and the greater the benefit. It will be easier to meet the difficulty half way, by anticipating the necessity, than to be driven to find a remedy when the want becomes an imperative demand. It is doubtless known to most present, that more than thirty years since, the subject of tree-culture was embraced in a survey of the zoological and botanical resources of the State of Massachusetts, and that in 1846, an able and careful report upon the native trees and shrubs of that State was made by Mr. George B. Emerson. An arboratum for the naturalization of foreign trees, in that State is now being formed, and not only there, but in other States, especially in the west, attention has been prominently directed to this subject. In Europe, field and forest culture divides the attention of societies formed for the advancement of agriculture in its broadest sense, and as an example I may notice that in 1873, the Highland and Agricultural society of Scotland offered not less than fifteen premiums for essays and successful results upon special subjects of foresting.

Permit me in conclusion to express the hope that this society will take early and effectual measures to promote this object, by disseminating correct information, promoting discussion, and rewarding successful culture, and that ere long we may see local societies emulating each other in the extent and value of timber planted in the districts embraced within their borders, until there shall be no waste spot without its trees, and no farm without sufficient shelter of woodland shade.