SOME OF THE UNSOLVED PROBLEMS IN MICHIGAN FORESTRY.*

BY DR. W. J. BEAL.

In June, 1887, one thousand dollars was placed by the legislature at the disposal of a forestry commission which made some observations, held one convention, and published one report. After four years the act was repealed. Since that time the interest in forestry has increased as the timber rapidly disappeared.

The legislature of 1899 passed an act to create a second commission to canvass the subject and recommend legislation in 1901. In the minds of most people there is a vague notion that something should be done, but what to do is not clear. A very small number believe it best to leave the subject, as in the past, entirely to the people in each locality to do as they please.

In the Report of the State Horticultural Society for 1898, I presented a paper recommending twenty-five things as already established regarding the management of forests. At this time and in this place it seems eminently suitable to mention about seventy-five things that should be investigated or concerning which careful experiments should be made in the interest of the forests.

There are so many things to be learned, and trees need so much time to mature, that it is time we were at the subject with energy and financial support.

It took Germany one hundred years to prove that our white pine was an excellent tree for producing timber in that country.

In November, 1887, when B. E. Fernow, then Chief of the Forestry Department at Washington, was asked to name some of the things most necessary to do regarding the forests of Michigan, he replied, "On the whole, studies in the natural woods, observations seem to me more needed than experiments."

Here is an enumeration of some of the work that ought to be done in Michigan:

1. Have the harbors at the mouth of rivers needed more dredging since the trees were cut off along the margins of the streams?
2. Note the influence, if any, on different farm crops and orchards at different distances from forests of various degrees of density and light.
3. Observe the effects of spring and summer floods and mill-ponds on timber and note which kinds perish and which continue to thrive, with the view to learning what may be planted on such ground.
4. Note the effect of drainage of the land on forest trees.
5. Note the physical condition of the soil where excellent trees and where inferior trees of any promising species may be growing.
6. Study and experiment to learn which species of trees improve the soil most and which least.

*Read before the Michigan Academy of Science.

7. Discover the reason why one mixture of trees sometimes changes abruptly for another growing near by.

8. Discover by experiments in removing all the litter from certain portions of a forest, every year, once in two years, three years, four years, or a portion of the litter every year.

9. Compare the litter and soil to the depth of one foot in a good forest with the soil of a field that has been cultivated thirty, forty, fifty years or more.

10. Study the regions of sand-dunes and drifting sands in all places with reference to improvement.

11. Study the root systems of different sorts of trees growing under various conditions of soil and elevation.

12. Find out the geographical distribution in the State of any one or each kind of tree and the reasons therefor.

13. Note the distribution of the species in "second growth" on stump lands in many places, the kinds and the probable sources from "grubs" or seeds.

14. Make observations on the succession of forests to see if any further reasons can be discovered, as in case of pines, oaks, maples, etc.

15. Study the life history of any species, or all in Michigan, by noting its development from seed to maturity, as learned by studying at one time trees of all ages in the same forest.

16. What amount of wood by weight or bulk is built per year by a leaf surface of 1,000 square feet, of one to many species of trees, and the weight of the leaves in each case exposing the 1,000 square feet of surface?

17. How much is the surface of one to many species of trees reduced in winter compared with summer?

18. Study the rapidity of growth of each kind of desirable tree, each in large numbers, to learn the most favorable and most economical place and the least suitable place for growing each.

19. Compare some good maple trees of the same size growing on good land and on poor in the Upper Peninsula and in Lenawee county to learn which makes the most wood and which the best wood.

20. Compare the length of the growing season of one to many species of trees in the Upper Peninsula with the same in Lenawee county.

21. Compare the condition of large trees and of small ones as found standing in an old pasture with those growing in the woods. When opportunity offers, see about the rapidity of growth since pasturing a wood lot.

22. Try to learn the conditions or various causes for a large annual growth or a small annual growth in any one or more trees of one or more species.

23. On a variety of acres, how many cubic feet of timber are produced in a year?

24. State all of our native trees and shrubs and grade them with reference to the relative amount of light they need or shade they will endure.

25. Experiment and observe to show that thin-foliaged trees should not be planted by themselves.

26. Which species of trees are least liable and which most liable to serious trouble from insects, fungi, wind, sleet, etc.?

27. Compare the economic value of good trees of different species, taking into account the rapidity of growth and freedom from insects and disease, and the value of the land on which they grow.

28. Secure seeds of every promising species from ten to twenty other States and test side by side with Michigan seed to learn where is the best place to secure seeds.

29. For a series of years, record the seasons when each species fruits abundantly, noting frosts in spring.

30. Note the ages of different species, as they begin to bear fruit and as they bear it in abundance, and those rarely fruiting, with seasons for the latter.

31. Test the vitality of seeds and nuts buried at different depths.

32. Observe the modes and the distances of seed dispersed, and what becomes of all the nuts and seeds, with many details.

33. Observe when each kind of seed begins to grow and follow up seedlings to see what becomes of them in certain specified areas.

34. Experiment on seedlings of various promising species to learn most suitable size for transplanting.

35. Experiment on numerous methods for learning the best and most economical way for securing thrifty young white and Norway pines planted where they are needed for a forest.

36. Experiment to learn the proper distances for planting white pine.

37. Observe and experiment to learn the readiness with which some different species of trees reproduce trees from sprouts.

38. Try different methods of renewing a forest.

39. Try different modes of management in cultivation, in mulching, and in leaving to nature.

40. Compare trees of all sorts that grow from sprouts with seeding of the same kinds, for vigor and health.

41. Experiment to see if it pays to thin trees, or lop off the tops of trees of poor quality as they grow about trees of desirable species.

42. Note the changes for some years that take place in the neighboring young trees that surround the spot where one or more large trees have been removed.

43. It is estimated that twice as much timber is stolen as is destroyed by fire. This subject should be referred to an able committee, of whom some should be lawyers, to devise the best modes of putting a stop to such work. This is the problem of first importance.

44. Enumerate the sources of danger from fires in the State.

45. Where are the fires most frequent and severe? In such neighborhood try by working with the people to induce reform.

46. Work out the details as to origin, course, extent and damage of some one fire.

47. In some few places prepare open roads and burn every year to keep them clean, noting results.

48. Make a few experiments on removing or burning the rubbish where timber has been cut out, to show the cost, to show whether it is feasible or utter folly.

49. Study the stunted, slow-growing little woody plants as repeatedly killed above ground by fire; see their growth after all trees have been removed.

50. Experiment with the common locust in various places and under varying conditions to learn how to prevent the borers.

51. Test chestnut trees for thrift in many places and under varying conditions.

52. Test any American trees not found in the State in several places and grown under various conditions to possibly find some that are profitable to grow in Michigan.

53. Experiment with perhaps thirty or more species and shrubs to learn which are best to use as nurse trees to shade the ground in a forest.

54. Observe trees that have vertical splits and their attempt to heal. What are such trees? Under what conditions are they most liable to split?

55. Find out what they are and compare trees that split at the forks or crotches; also what trees break most by snow and sleet.

56. Compare trees of any species of varying ages to note how rapidly they must usually grow to be able to recover from injury.

57. Study and compare many trees, noting the successes and failures in repairing wounds from decaying limbs and other causes.

58. Seek to find the sources of all possible injury to all sorts of trees and the preventives. Why are there so few pine trees to any acre?

59. Compare the specific gravity of any kind of wood grown in different parts of the State on sand, clay, or rich loam.

60. Test the weight, strength and durability of wood taken from different parts of an oak or arbor vitæ.

61. Compare the length and size of fibres of any broad-leaved tree or tracheids of cone-bearing tree, at different ages or periods of growth.

62. Where land is to be cleared, estimate carefully how much timber of different grades occur to a certain measured area, and see how it comes out.

63. Years of work can be profitably employed in comparing the structure of wood of different kinds at different ages, with the view of learning its physical peculiarities and adaptability for certain uses.

64. Compare the tops of fifty trees of any species that have grown in the open with each other, noting whether the shapes change as the trees become larger.

65. Compare trees of either species grown in the open with trees of the same species grown in the forest.

66. Note and record the easiest popular points for identifying each species of tree as seen in winter, as seen in summer.

67. Which species of trees hold their leaves on low branches in a dense forest; on which species are the lower limbs naked?

68. Observe for some years the kinds, thickness, shape, size of tops of young trees from two to ten feet high and much crowded to see about dying branches and dying trees.

69. Compare the appearance, external and internal, of trees grown north and south.

70. Study pieces of oak openings of "timbered land," and try to make out all points of difference and try to account for these differences.

71. Pass over an old forest and study it with reference to removing ripe trees and younger trees of slow growth or poor quality.

72. Note where one hundred, one thousand or more trees are growing in a forest and try to account for their distribution.

73. Knowing the nature of the soil for any acre or more, what are the kinds of timber and the quality, also the kinds of shrubs and herbs? What kind of roots have the perennial herbs for each kind of soil, as on hills, upland, river bottom, clay, sand, loam?

74. Note what trees seem to be dying at the top in several forests, and find the reason.

75. What are all the sorts of trees and shrubs surrounding a first-class tree and the soil and climate of the locality?

76. Compare a number of trees of a number of species found on the north slope, on the south, on the east, on the west. Are any species doing better on the north slope, on the south slope, and which species, if any, and the probable reasons?

77. Study the sizes and shapes and texture of leaves of white oak as found on lower limbs in the shade, in exposed places; also note those at the tops of the trees, and near the center of the top. The same for any number of other species. If duplicates are observed and compared, all the better.

78. In addition to any of the foregoing, it will be useful to study all the details possible in a large number of good places in a forest, i. e., in a good forest. Note, almost by diagrams, the positions occupied by the leading trees of each species, their relative heights and sizes, the nature of the undergrowth, the dead leaves, sticks, logs, every detail.

79. After much time in study this many-sided question begins to make plans for growing good timber to advantage, whether they are ever carried out or not.

ILLUSTRATIONS OF TREE GROWTH.

PRESIDENT OF THE COMMISSION.

In this report the Michigan Forestry Commission has gathered a number of illustrations of growth of forest trees from seed, the thought being to make clear the rapid development of trees into timber values, and to answer the objection often made to planting trees for forests, that one must plant for his children or possibly for his grandchildren.

One view is an elm, the seed of which, was planted on the farm belonging to the President of the Michigan Forestry Commission in the spring of 1879. This tree has had no advantage of deep rich soil, but grows in loose gravel forty-five to fifty feet above the general water table. At a height of eighteen inches from the ground it measures sixty inches in circumference.

The second plate is a picture of a white pine of the same age as the elm and stands less than twenty feet from it. It will now cut a twelve-foot log, larger than a great many which are seen floating down our rivers to market, and has a circumference of forty-seven inches at the place where it would naturally be sawed off for timber.

There are a number of succeeding plates in this volume which are made from photographs of a young forest of six acres upon Burton Farm, the plantation having been made in the spring of 1891. When planted these were mostly yearling trees from the seed, although in some cases the seed was planted where the tree now grows. The ground was prepared as for corn and rowed both ways. The plantation was made so the individual trees would be four feet in the row and the rows eight feet apart, giving each tree thirty-two square feet