

1854 and ending 1870, during which time I had the immediate control of the formation, the planting, and subsequent management of something like twenty one millions of trees, principally on the Seafield estates, in Banff and Invernesshire, and the Invercauld estates in Aberdeenshire.

In order to success anywhere there must be put in operation, upon a system, such a combination of the scientific and practical knowledge that at present exists as shall most likely bring about the fullest realization of tree value. That system is universal in its application, however small or large the scale, or however varied the conditions. Whether we pull down or rebuild, or make entirely new, the system will apply, and as it is by entirely new work that any system is best exhibited I will ask you to go with me to the Prairie. The subject then is almost an entirely treeless one, with an undulating, but generally uniform level surface, an occasional ridge, a lake, a river, cutting deep through the unshaded land, and bounded on the north-west by high lands as I have outlined on the map. Here, men need never hope to gather wealth of agriculture in all its branches without the help of trees. I think there exists nowhere in the world an example of *universal farming* reliability unattended by trees. I see no great future for Manitoba and our Northwest unless extensive systematic forestry precedes. The sooner our Government realizes this the better. All methods of farming, railway and water communication, minerals, natural grazing, or any other form of good things will never "make" a country without trees. We are not theorising in this. A *peopled agricultural country is an impossibility without trees.*

In our treeless region, therefore, experience has made us acquainted with a variety of wants that can be subserved by trees, and science points to more. Together then they make up a bill that may be thus summarised:

1. Roadside shade.
2. Shelter for dwellings.
3. Shelter for cultivated farm crops.
4. Shelter for open natural grazings.
5. Shelter for enclosed grazings.
6. Head water conservation.
7. Wind breaks.
8. Climatic amelioration.

Either of these would of course serve more purposes than that implied by its name, but a full illustration of the system requires a form for each.

Now this map professes to show all these: from the single shade tree up to the great climatic plantation, the area or district embraced and the size of each of the classes would be subject to requirements, from one acre to as much as 1,000 acres each; the system or principle is not affected by size, but, position and form, or outline, are prime factors.

Size would be regulated by the particular physical features of the district and the object in view; form by prevailing winds as well as the particular object and partly by physical features.

In our prairie example on the map we have a farm of 160 acres made up as follows:

Timber	30 acres
Cultivated	125 "
Orchard, garden, buildings, roads..	5 "
Total	160 "

The fields and roads lie northwest and southeast, and therefore also northeast and southeast. By preference the buildings are situated on the southern angle of the farm at a junction of a concession and a side road. In the first place the roads are lined with sycamore trees, which serve as shade to animals in some of the fields as well. Then the dwelling house and orchard while open to the southeast, south, and southwest, are shaded by ornamental standards and lined on the north and northwest by trees. This tree line may be called the 2nd sub-wind break of the farm. The barns with two small fields or paddocks, are also open to the south and protected from the colder winds by a narrow belt of timber in positions similar to the others. The six other fields are, in the first instance, sheltered by a broad belt all around from the east, via north, to the west, capable of breaking and mellowing the whole farm for cropping. But, for live stock, under

such circumstances, and with twenty acre fields it is necessary to provide other shade and shelter. This is best supplied by what I have proved in actual practice both in Scotland and Canada. I know of no better form and position of a shade and shelter clump of trees than that illustrated in Fig. C., and the position of which is also shown in our farm example. It serves two fields, and from whatever direction the wind comes, or the sunshines, the animals can find a retreat in either field. You cannot shoot a straight line across this clump and not find a safe corner.

Then, in the adaptation of one form of shelter to four fields (Fig. E) is neat and serviceable, and when supplied with water in the centre is a very valuable acquisition to pastures. In the case of extensive open grazings, the circular belt (Fig. D) is also best for various reasons. It resists and breaks wind storms better than other outlines; it is less liable to damage by cattle or wind, is more compact and affords more outside shelter. There should be two passages not far apart and facing south as much as possible; one passage is not enough with a large number of cattle going and coming, and provision is necessary for a stack of hay in the centre.

These are what may be called the purely agricultural divisions of arboriculture, and are definite and practical enough, upon which little difference of opinion is likely to arise. In what remains of my subject there may be not only difference of opinion in regard to details, but considerable difficulty in satisfying that anything more is needed than what has already been sketched. It will be said: As each farm has its proper amount of shade, shelter, fuel supply, and even wood revenue otherwise, what more does the country require?

I have not seen in any work on rural economy that it is as much the duty of nations to administer their arboriculture as their laws of health. Then while everyone acknowledges that without the proper measure of trees there cannot exist the proper health, political economy, science, agriculture and all society, is equally interested in this question, and as I have already indicated its national aspect, it is only necessary to point out how more than the immediate farmer's work is required.

Over a great plain, such as our prairie, where storms rage unchecked, where rains come and go irregularly and uneconomized in any form, and where sunshine is unmelting, it is necessary to establish agents for the purpose of subserving these and other climatic purposes. Assuming that all the country were planted to the extent already shown for immediate farm use, there exists nothing in particular spots, — no plantations exactly placed to conserve head water streams, no great and small wind breaks, and no great climatic plantations, — the agents respectively.

On the map these are shown in position, proper outline and extent. *Position* is regulated by elevation and neighborhood of other physical conditions, such as water surface, and high land; *outline* is regulated by direction of prevailing winds, conformation of surface, and partly by public roads, while the *extent* is directed by the indefinitely known influence that a certain body of trees possess over climate; climate being understood as distribution of rainfall, evaporation, natural drainage, and temperature.

I am aware that we cannot reason on this from any clear or precise experience, and are driven to draw conclusions from actual facts, and there seems to be no doubt that it requires a certain massing and kinds of trees to ameliorate climate, narrow strips and clumps being insufficient, or incapable of doing so.

Head water plantations, as implied in the name, must surround, or be in the immediate neighborhood of, sources of streams, and have an outline to nurse them, with area consistent to the importance of the source. The circular form is good and applicable to the two springs at G., or it may be oval as illustrated at the mouth of the valley, and would also take the position and area of that at the small lake.

Great wind breaks being meant to fend the smaller plantations as well as particular districts, have to be carefully outlined, of very considerable extent, and must command an exact position.

CHASE & SANBORN

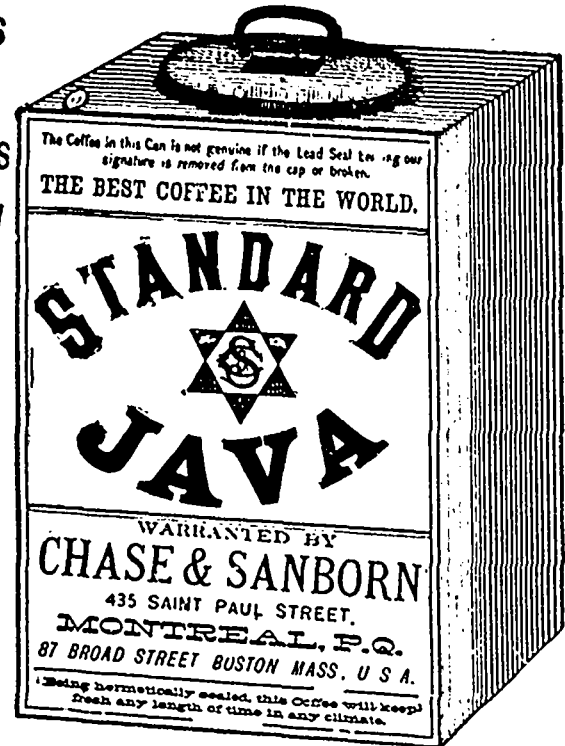
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In the example of H. on the ridge, which is designed to break the storms from the adjoining ranch, several points are noticeable: The land occupied by the plantation is within one block, or range of roads, and therefore does not encroach; it occupies also part of a ridge that generally is less valuable for agricultural purposes, it is formed to cut or feather the storms that prevail in the district—south west by west—a point in forestry of very great importance indeed; it is massive or in sufficient body to resist and break, and it is so situated main force of the storms. It may be remarked that it would be better to extend the plantation eastward upon the point of the ridge, this I have avoided in order to make the example more difficult.

The other great wind break is of a different form, while serving a similar purpose. It parallels with the public roads, makes no awkward corners for cultivation of adjoining land, faces prevailing winds with the exception of southeast end, and will protect a large area of country.

Lesser wind breaks, as at J., are placed where, either by the form of the country on the prevailing wind side, or where a larger break is difficult to establish. The example on the east of the large lake exhibits both. Position here is very important and it will be observed that outline and area are arranged to receive the storms across the lake, break them, and yet yield to them.

Sub wind breaks are easily arranged and can take various forms and sizes to suit conditions as at K.

Another kind of plantation, as already referred to, is that which I call climatic,—the objects of which have been explained. Their position in a country among others is not so easily reasoned, either scientifically or practically. Area is obviously of more consequence than form, because it requires a great field of leaves to do what leaves are said to do in climatic amelioration. M. with eight sides, and the other with four, are designed as concentrated masses adapted to Canada, and of course in their case, more than other plantations, the cost of establishment would be less per acre, and

would also better meet the item of revenue. L. is an example of a conjoint-wind break and climatic plantation.

Canadian forestry, whatever its future, will never realize all it should unless hand in hand with science.

ESTIMATE OF FINANCIAL POSITION OF A MIXED PLANTATION OF 100 ACRES IN CANADA.

(Manitoba and the Northwest particularly.)

REVENUE.	
1st Thinning when 15 years old, 3,000 poles, 20 ft long at 30c.....	\$ 90
2nd Thinning at 18 years; 8,000 trees, at 5c.	400
3rd Thinning at 25 years; 15,000 trees, 12 inches diameter at base, 40 feet, at 30c.	4,500
4th Thinning at 35 years; 25,000 trees, 20 inches diameter; 50 feet, at 50c.....	12,500
5th Thinning, at 40 years; 30,000 trees, 22 inches diameter.....	22,400
6th Thinning, at 45 years; 21,000 trees, 25 inches diameter, at \$1.00.....	21,000
7th Thinning at 50 years; 18,000 trees, at \$1.10.....	19,800
Gross Revenue.....	\$ 80,000
10,000 trees felled, leaving 20,000 trees, or 200 per acre as permanent crop.	
EXPENDITURE.	
1,000 rods of fence, at 75 cents.....	\$ 750
Drainage of portions.....	250
150,000 trees, 1 year seedling, 1 year transplanted, at 1c.....	1,500
Planting same.....	575
Freight on trees.....	150
Original cost.....	\$ 3,225
Per acre.....	\$32.
Replanting failures for three years, 5,000 trees	100
General attendance, up-keep of fence, &c., for 15 years.....	300
Gross cost.....	\$ 3,625
Per acre until revenue begins.....	\$36.
Cost of thinning and hauling to road.....	\$ 13,100
General superintendence and incidentals for 35 years.....	8,500
Gross expenditure.....	\$ 20,225
Balance being clear revenue.....	\$ 60,605
	\$ 80,790

No allowance is made for interest on outlay and rent of land, on the one hand, nor for interest on revenue, and value of grazing for 25 years, on the other hand. Neither is credit given for climatic amelioration, not for value of permanent crop.