THE PLAINS SHELTERBELT PROJECT

by

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THE PLAINS SHELTERBELT PROJECT

I. Introduction:

The present administration (The New Deal) has been responsible for fostering many projects in the past year that has been of vital interest to forestry and to those interested in the forestry game. Perhaps the most outstanding undertaking of any that has yet been advanced is the launching of THE PLAINS SHELTERBELT PROJECT. This project dates back to July 21, 1935, when it was made official by President Roosevelt's executive order of that date.

Because of the broad scope of the plan and the daring manner with which it was so suddenly announced, it is small wonder indeed, that it not only attracted the immediate attention of the United States, but likewise the entire world at large. The project is intended to include a planned planting program in the plains region to the extent and degree sufficient enough to have some measurable affect on the physical conditions of the area. Because this has been a subject of limited interest and not discussed to any extent in prominent technical circles, it has naturally led to wide discussions throughout the field of forestry and even by those in all walks of life who may be influenced by it. Most of the doubt and sceptical attitude that appears in numerous articles comes naturally from the fact that there is only limited
evidence of whether trees will grow there or not. People just naturally question the logic of this plan, as it seems off hand like a wild scheme.

This thesis therefore is an attempt to discuss the problem from its many points of view, explain and point out the workings of the plan in detail, to set forth the feasibility of the project, and to take into account an unbiased weighing of all the arguments that have to date come against this project. The idea, however, is not to make for a whole hearted acceptance of the plan merely because it is a forestry project, but to present the material in such a manner that one may get a broader view of the whole situation.

Many ideas presented are not iron-clad, but merely show a direction or a tendency. Nothing presented here is final; it is only a discussion. Only time will tell of the effectiveness of this project. Many of the ideas presented here will need to be revised with the advance of time and knowledge.

II. The Shelterbelt: What it is: Where it is.

The first item in this discussion, I believe, must be a definition of a shelterbelt, the PLAINS SHELTERBELT in particular, so that we may understand the background of the situation. The shelterbelt considered in connection with this project is an artificial forest plantation as a protection for man and beast against arranged in orderly strips in such a manner to serve the elements, and to materially aid in the physical improve-
ment and conservation of the soil and water resources of the area.

Geographic Location: From the above definition it will be seen that the intended use of the shelterbelt fits in very well with the geographic location. It is to be placed though the drough area, that portion of the mid-west that suffers most from human occupation, and is the seat of the majority of the severe dust storms of the region. The shelterbelt is to be approximately one-hundred miles wide and as nearly as possible follow the border between the "long grass" prairie of the Mississippi and the "short grass" plains of the west. In other words it will follow the general rainfall area of 20 to 30 inches, beginning in the north at the Canadian border and running due south, through the middle of the Dakotas, Nebraska, Kansas, and into western Oklahoma and the Pan-Handle of Texas for a total distance of 1,000 miles.

Purpose: It is evident therefore, that the key, or one might say that the fundamental conception of this project is one of protection. When the notice of this project was issued, the protection phase was at once highly lauded and praised by many papers and particularly by those people who were immediately in connection with it. At this time little attention was given to details or the weighing of statements printed to give them their proper significance. The purpose at that time was for the
Government authorities to strike upon something as a foothold by which they could ameliorate the demand of the inhabitants of this drought struck area. Change in climate and increase in rainfall were of course two of the first purposes given. These statements were made in straight matter of fact way without revision or facts to substantiate them. This naturally aroused a storm of protest and immediately the Forest Service, who is to have charge of the project, prepared articles to the effect of what they thought really could be expected from a project of this kind. The following are some of these statements:

* "The shelterbelt will provide windbreaks, snowtraps, and shade in a region where these are largely lacking. The Forest Service inaugurated this project in the belief that trees will mitigate the effects of future droughts, as by preventing the quick drying and subsequent "blowing" of soils, similarly protecting growing crops from excessive drying, slightly modifying extremes of temperature in the same way that green fields cool the air, and through other local effects modify their immediate environment and the living conditions for man, beast, bird and vegetation."

Thus the latter statements are to the effect that the shelterbelt will not "cure drought" but aims at bettering some of the influencing physical factors thereof.

People, I believe, should be made aware that the shelterbelt project will not cure all the ailments of

* Statement prepared by The Lake States Forest Experiment Station, U.S.F.S. and The Department of Agriculture, 1934
the drouth area "over night" as some of the politicans first asserted. It will, at best, be but very slow moving, and the maximum effect will be expected only in a matter of 20 years or so. Nevertheless the plan aims to provide the beginning of a permanent improvement for farms on this marginal area between the "short grass" area of the plateau region and the "long grass" area of the Mississippi Valley.

It is evident, I think, that any improvement at all would be much superior to standing still or worse yet to abandon the land altogether and let it revert to desert entirely. The idea chosen by the Government is for one of long time permanent improvement that would materially do the greatest good for the greatest number involved. Unquestionably the shelterbelt was chosen as this ideal because of its success in similar instances in Europe as well as being one, if not the most important, influence noted by actual planting of this kind already in the region.

It is stated by many that this area is entirely marginal. That at best it will only raise crops in the better years. However, it supports a large population at present, and the Government feels justified in starting permanent improvement work which they believe will better conditions, even if only slightly, to the extent where the population can exist at a fair subsistence standard, even in times of drouth. The question then arises, if
this can be done with the project to take in all the area to the west, this is definitely answered by the fact that the shelterbelt, in present plans, will be extended as far west as it is feasible, to go.

By feasible is, of course, meant the possibility of making trees grow to a sufficient height and density so that the physical effects of wind stoppage may be obtained in a reasonable degree. Thus the west line of the shelterbelt will automatically be the boundary for the marginal farm land.

A further purpose is to provide an incentive for the farmers of this area to further plantings and improvements of a similar kind on their own initiative. As the plan states the present line-up will give but meager protection and additional plantings in the intervening areas will greatly add to the effectiveness of the project.

Last of all can be discussed the political purpose. While there is no doubt that the shelterbelt project originated and was launched by the New Deal, yet if it was for political reasons they are obscure and little if any data is available to actually determine this. The reason for the project being hustled in so suddenly, no doubt, was due directly to political pressure brought about by the drouth sufferers. However, I believe the actual incentive behind it is for planned land uses. A
statement by John Mitchell brings this out more clearly:

"The greatest significance of our own shelterbelt is the evidence it gives of a turn toward a more settled, civilized way of life.

"Greater than any economic advantage will be the protection afforded human beings and beasts against the prairie winds of winter and summer sun.

"When you begin to have shelterbelts, terraced fields, artificial water holes, you are approaching an agriculture that is fundamentally conservative, where pleasantness of life and a traditional decent use of the land is beginning to be more important than snatching a quick fortune."

Principles Involved: The general idea of the project is to spread the benefit over a wide area and produce the greatest good for the greatest number. This is shown by examination of the plans which call for 100 ft. strips of trees every mile, whenever possible.

The idea of "Permanent Benefit" is the other main idea of the project. This seems to be United States Forester Silcox's battle cry on the project.

"This tremendous project is not without precedent. On the contrary, it is based upon the long time experience of several European countries, notably, Italy, Hungary, and Russia. In those countries, where shelterbelts have been used over a period of years and on an extensive scale, farming enterprises have been stabilized and have succeeded even in the worst seasons when farmers in other areas have suffered serious losses to their crops through adverse weather conditions."

Silcox furthermore, has sound belief in the poss-
ibilities of this project based on observances and records of tree growth on planted strips of various kinds that have been made from time to time in past years. His further ideas on permanency is to do a thorough job, which the Federal Government is starting, in place of encouraging the states and other agencies whose forces have resulted in work of a scattered nature.

Paramount in the idea of immediate benefits was to afford relief to the drought stricken farmers. At the date of this writing many of them are employed in work on the first planting areas.

This present employment that has been started is in the nature of preliminary experimental planting, but includes a program in 1935 for 21,000 man days of work.

An idea of the vast amount of work to be made available to the permanent residents and the monetary benefits alone to be derived by them may be judged by the following figures: i.e. The building of some 200,000 miles of fence. The cultivation of some 2,000,000 acres of land. This means not only the original cultivation for the planting of the seedlings but also subsequent cultivation for weeding etc.

The planting and care of some 200,000,000 in seedlings annually will amount to the ultimate cost of approximately $75,000,000, it is estimated, and over 90%
of it will go to the farmers.

Thus can readily be seen the importance of this project and what it will mean particularly to those who are to reap the benefits.

III. The Influence of the Shelterbelts

The esthetic value of trees has a great deal of bearing upon the planting that has been done particularly in the plains region. In this drouth area their need is very keenly felt. This fact is due not only to the lack of the trees themselves, but partly because of the unbroken monotony of the plains region. Trees in this region are indeed a friendly sight.

As C. G. Bates states: "I am sure everyone "senses" the importance of the lack of trees and of the things which are associated with them."

Directly in line with esthetic values may be considered the physical influence that the trees have on human and the animal life involved in this region. In this particular sense the effect of the trees is a refuge from the winds, which are so prevalent on the plains.

Reduction of Surface Winds: One of the first major values produced by the presence of a shelterbelt is the reduction of surface winds. There apparently is no controversy on this score. The questions that do arise however, are how much and how far to the leeward is the

effect apparent. Many estimates have been made, but they vary as to results, usually because of the different localities and variable conditions under which the measurements were made. However, it is the popular consensus of opinion that the effect which may amount to as much as 80% reduction in velocity directly behind a good windbreak has just about tapered-out to insignificance at twenty times the height of the tree. The distance and degree of effect may well be appreciably less than this if the windbreak is not thoroughly tight. On the other hand it has great possibilities of better protection if the shelterbelt is both tight and so shaped as to give a definite upward thrust to the air current. Also if it is tight to the ground the effects to windward may be appreciable.

There seems to be little probability in theory as to the success of the cumulative effect of successive windbreaks. This matter, however, could only be proven by extensive research.

The effect of deflecting of the wind and a resulting calmed area on the lee has almost everything to do with the value of windbreaks in increasing human comfort and that of animals which find refuge in the grove during stormy weather. It has been amply demonstrated that the effect of wind in general is a great factor in affecting the condition of livestock. A good shelter is valuable
in terms of amount of feed consumed etc. Also in relation to man it is an important protection from the elements.

Conservation of Moisture: The effect of the wind reduction of evaporation is probably more important than the actual wind reduction itself. As the available moisture is at the minimum anyway, any means or device to conserve at least a small portion of it would be better than none at all.

While in the past the methods of planting and the species planted led to a result almost nil in most cases of really gaining protection from the winter winds in mechanical way; still winter is the only likely period for moisture storage in the soil. Even in moderately wet years the depth of the soil wetting is only about 3 ft. It is evident, then, that the conservation of surface moisture is very important. If the surface is dried quickly after each snow or rain, then there is very little opportunity of accumulation to any depth.

The main arguments to support the conservation of moisture is the fact that tree plantings will aid in catching the snow and prevent it from piling in drifts in gullies where it would melt and run off without producing any good. They will also prevent rapid surface run off, disseminate the snow more evenly, and provide for a slower melting rate and consequently complete absorption of the water in place of run-off.
By actual measurement it has been determined that 10,000 cubic feet of water more per acre is caught and held than in unprotected areas.

In so far, therefore, as shelterbelts stop snow movement on the higher ground, permitting the snow to lodge and melt there, there is actually a more favorable distribution than before although uneven.

**Possible Increase in Total Moisture:** So far we have primarily dealt with wind evaporation and additional winter moisture storage. This definite probability of making more moisture available for crops does not mean a permanent hold-over. It simply means that a fraction which would disappear from the region when all evaporation is very low would be more evenly distributed and carried forward into the crops season. If then the crops have a more available supply, by their very dissipation of this excess later in the season, it is conceivable that the local atmosphere will be improved by addition to the affect the rainy period. This is hardly understandable except after considering carefully the character of a strictly continental climate, and the origin of its moisture supply.

The popular consensus of opinion is that all the moisture is derived from the ocean and this belief also fails to take in to account the continental climate.
An excellent example is to be had in the article by C. G. Bates.

"For the sake of clear argument, a concrete example applicable to the region of the Dakotas when the most 'Continental climate' prevails, will be given as follows:

* "The total precipitation is 20 inches.
A. Only one inch of this returns to the sea (approximately 26 years of records for the Red River at Fargo, North Dakota.)
B. A conservative estimate of total run-off from the higher ground is 5 inches. Therefore about 4 inches annually flows into glacial depressions and either sinks into the water table or evaporates directly. Presumably, with this replenishment the water-table level remains stationary so that (a) the ground water either drains away to other regions—of which there is no evidence—or (b) serves as a steady supply to replenish atmospheric moisture, being tapped to some extent by deep-rooted plants and seepage.
C. There then remains 15 inches to wet the surface of upland areas in general and this amount does no more. Lime deposits show moisture rarely penetrates more than 8 inches. This entire supply then must be re-evaporated directly from soil or plants."

If excessive run-off could be prevented and evaporation somewhat relieved as well as making the cover more retentive of moisture at least most of the 5 inches of the rain supply from the Gulf that is now lost would be conserved into the growing season and become an important figure in the success of the crops of this shelterbelt area.

Effects on Crops: There is just cause for the obvious skeptical attitude as to the effects that the shelterbelt might have on crops in the way of preventing evaporation, wind motion, etc.

There is no doubt that information collected in the past has not been at all thorough. However, there are enough records on file and documents, and Government bulletins to give a few good illustrations of the influencing effects already obtained by such shelterbelts both in the region mentioned and from Europe. The need for satisfying experiment and observations is felt; however, I believe that observations in the past are of a high enough quality to justify the launching of the project.

While most of the hear-say evidence is unreliable, it points definitely to the success of shelterbelts. Also among other observations are the findings of 1908, which was a study in corn yields. From these studies come the result that on an average crops are effected by an increase in yield of 10% to 20% when protected by a shelterbelt as compared to an open field. This range of course is within the limits of an area 10 to 20 times the height of the shelterbelt.
IV. Important Features of the Plan

Holding to the view of the above mentioned discussions we may consider some rules which should govern the planning and distribution of shelterbelts.

1. It is evident therefore that there is a definite western boundary beyond which it would not be feasible to plant trees. Thus the shelterbelt will only be established as far west as it is feasible to go. The idea being to obtain sufficient growth and protection in a reasonable time.

This of course can be determined with an intensive survey of the area.

2. The distribution of shelterbelts within the wide zone must be as even as possible. No individual or group is to be particularly benefited to the disadvantages of others.

Certain unfavorable sits will make it possible to skip some areas and concentrate in others where soil retention is more important.

3. There are many ways of placing the trees within any given area. However, the final placement will rest largely upon favorable site, ownership, present plantings, and the type of protection desired.

There are some decided advantages in following topographic lines by keeping shelterbelts near the tops of the ridges where their mechanical effects will be greatest etc.
4. The orientation of shelterbelts should be varied as far as possible in any locality to break up any uninterrupted sweep of the wind. In most of the regions a "quartering" orientation from northeast to southwest is most desirable.

V. Composition of the Belt

The trees to be used will be those species which have survived the dry situations and drought conditions more frequently than any others. These species will be grown not because of their fast growing habit, or are easiest to handle in nursery etc, but because they have been tested and what they will do in the long run is more or less certain. They are for the most part, native trees of the region, and have become adjusted to the climate and soil through many generations. The list is long and varies from north to south as new and different trees are used.

Red Cedar (Juniperus virginiana) is the outstanding conifer because it is found in its natural state throughout this entire range. It is perhaps the first tree to be considered.

Green Ash (Fraxinus lanceolata) is the next outstanding tree and is considered the best of all hardwoods. However in the south it is prevalent to attack by borers.
Chinese elm, Russian olive are the exotic species to be most used.

The other outstanding species to be used are Black locust (Robinia pseudoacacia), Honey locust (Gleditsia triacanthos), Cottonwood (Populus deltoides) and Hackberry (Celtis occidentalis). The species mentioned are to be used in that section where they will obtain the best growth results and be free from insect attack. There are numerous others of less importance, and in the field of shorter trees and shrubs a fairly large assortment is had.

In the case of every native species stress is laid on the collection of seed within the region and the latitudinal zone in which the trees are to be planted.

The latitudinal range of the trees change progressively from north to south. In the Dakotas Blue Spruce, Green Ash, and Russian olive are the predominant species to be used. In the central portion of the range Red cedar, Hackberry and Cottonwood come first; while in the extreme southern portions Black locust and Arizona cypress will be used.

VI. Technical Plans

Extent and Direction: The following are a few figures given to indicate the size of the project. The total area of the shelterbelt is about 100,000 square
miles or approximately 64,000,000 acres in extent. This however, includes all the land within the boundaries. The actual planted strips, however, include only about two million acres, or an average of about 16 acres per section. Because of the extent of the project it is estimated that it will take 10 years to complete, which will involve a yearly planting rate of 180,000 acres.

In the main, this planting is to take the form of strips 8 to 10 rods wide through the central portion of each section of land making about 16 to 20 acres. The width of the planting should be at least 100 ft. if the shelterbelt is to be effective in its own growth and as a windbreak. A strip 8 rods or 132 ft. wide will be obtained and fenced against stock of all kinds.

The belts will rarely be planted along section lines because, if trees are too close to roads, they greatly increase the difficulty of winter maintenance.

The strips cannot be located the same in every section nor under any mathematical scheme, due to the fact that the winds do not blow constantly from the same direction nor are they of the same kind at different latitudes. East-west belts should predominate if the greatest protection is to be afforded.

In many places the direction will have to be varied to suit the use of the land and the topography.
Width and Form: It has been asked why only one strip was to be planted per section. This is to be answered by the fact that any additional would result in too much added expense. The project as it stands already represents an enormous expenditure on the part of the Government and it is considered by them that the present set up is the maximum amount that can be attempted at this time. It is the opinion of experts, however, that it would take at least six times the plantings in the present plan to make the project really effective (100%).

There are two reasons for planting the strips 8 rods wide in place of several narrower ones. The first is the enormous expense of several belts, and the second is the theory that mass planting is the only really effective method of securing effective protection both as a shelterbelt and as a protection to themselves.

For protection purposes the three essentials are height, length, and density of the shelterbelt. The greatest height is to be obtained by putting the tallest-growing trees in the center of the belt. These are flanked by shorter trees and on the edges by brush or shrubby growth. Thus the shape of a cross sectional view of the shelterbelt will be oval, and the shelterbelt itself will be like a rounded roof. This shape tends to divert surface wind current upwards. If evergreens are used near the outside, there will be greater assurance of the effectiveness of the windbreak.
Soil Preparation and Cultivation: Successful Planting in this region requires that the ground be plowed and fallowed for at least a summer.

Weed growth must be kept down after planting. This will require cultivation for several years.

Nurseries: This plan which contemplates the growing and planting of about 200,000,000 trees annually in this 1000 mile zone must use every suitable facility. Government nurseries will be installed as needed in strategic positions where good soil and water can be found.

In the main, trees must be grown in nurseries from one to two years, but not longer if they are to develop. Thus the recognition of a few general principles believed to be essential to the success of the project are:

1. Stock will be grown in nurseries east of the shelterbelt zone where conditions are better for quick production.

2. Stock will not be watered heavily.

3. The stock will be planted when very young.

4. The whole object is to have thoroughly hardened trees with small tops, roots in as high a ratio to tops as is possible with good root length.

As to the planting methods to be employed, little need be said except that attention will be stressed on planting well, rather than speedily.
VII. Summary

In summing up the possibilities of this project it is important to bear in mind the many factors that may affect it one way or another. Many of the eyes turned toward it are eyes of skepticism, but it must be remembered that those who oppose it most are those least familiar with the existing conditions and the probability of its success. It has been amply demonstrated to the present by use of questionnaires in the Journal of Forestry, and Forestry News Digest, that practically all Forest Service men, agriculturalists, botanists, and other scientists familiar with the conditions endorse this project. Particularly do those who live in the region and who are familiar with present plantings endorse the project heartily.

To substantiate their beliefs the work of planting has already been started on a small scale in some parts of nearly all the states. It is believed that by early summer 150 miles of shelterbelt planting will have been completed.

The future alone holds the secret to the success of the project. The success of the plan and its smoothness of execution depends largely on the appropriations available. At the date of this writing the project is progressing still under the original million dollars allotment. Although always a possibility, it
seems rather remote that anything of this nature will halt the plan, as appropriations have been practically guaranteed to finance it for several years to come.

Thus with the vigor of its beginning and the support which it apparently has from all angles, it seems destined as one of America's greatest achievements in forestry.
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