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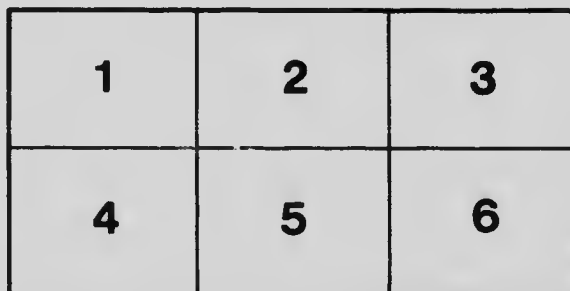
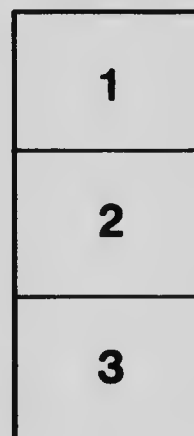
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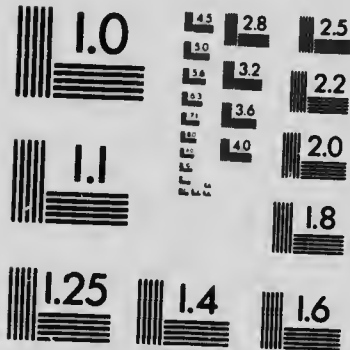
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REFERENCE

The Relation of Forest Cover to Water
Supply, with Particular Reference
: : to the Cypress Hills : :



AN ADDRESS

BY

E. H. FINLAYSON

Inspector of Forestry, Alberta

at the

Thirteenth Annual Convention
of the Western Canada Irrigation Association,
Medicine Hat, Alberta, August 1919



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THE RELATION OF FOREST COVER TO WATER SUPPLY WITH PARTICULAR REFERENCE TO CYPRESS HILLS

As irrigators you are fundamentally interested in the question of stream flow. You are first of all interested in the amount of the flow, but more particularly you are interested in the character of this flow. Mr. Pearce in describing his scheme for north western Saskatchewan said there was a limit to the land on which the water can be applied. There always is a limit in the amount, but it is particularly in connection with the character of the stream flow as irrigators that you are primarily interested. Now, for a great many years it has been pretty thoroughly recognized that the presence of forests in a country has a direct relation to stream flow and I purpose to go into one or two reasons for which this has been recognized—not probably by all the people, but by people who have given study to the matter.

I would like to say a few words about the effect of a forest upon the climate. In the first place, it lowers the temperature above and below it. It is a matter of common every day knowledge now. It is claimed that this effect on temperature is felt to a height of 5,000 feet. There may be a great many reasons for this, but, undoubtedly it is due to certain processes going on in the forest. Evaporation through the vegetation of the forest, by which there is necessarily a consumption of the heat from the sun; and for that reason it has the effect of reducing the temperature. In the second place we are all aware of the effect that radiation of heat has. It is accompanied by greater radiation at night, and for that reason the effects are bound to be carried over to a certain extent at least in the day time. The lower temperature of the forest has been proved by experiments extending in European countries over forty and fifty years and they all indicate the points to which I have referred.

We have also more recently heard the experience of aviators returning from the war. I think all of us have heard them speak of heat bumps. It so happens that a number of the men on my staff in Alberta have been overseas in the capacity of aviators and I have been making a few enquiries from them. While they did not experience these heat bumps with any idea of investigating the conditions of temperature within the forest, nevertheless, we have all heard of them speak about the heat bumps. I am told that as a general rule when they go from a plain country to a timber country, whether or not the topography is pronounced, they experience a heat bump. Really, what they experience when they go from the plain to the forest country is a temperature "slam." I have not experienced that myself, but I am definitely told by air-

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fore men that they do experience this, and they experience it more when passing over a timbered country than when passing over a plain country; and with greater effect from a timbered country than a town.

The forest also exerts its influence over the soil in summer. It makes it cooler and in winter increases its temperature; it also increases the humidity in the air due to transpiration of the leaves and by reason of the fact that the temperature is lower and the air is nearer the point of saturation.

I come to another point which I think I can safely claim is generally accepted within certain limits; and that is the effect on precipitation. Forests increase the abundance and frequency of precipitation over the area which they occupy. This condition is almost undoubtedly due to the fact that the temperature in the forest is lower and the relative humidity is greater. Now, if you have a moisture laden current approaching a forested region, in approaching or crossing that region, it is crossing temperature, and has moisture conditions below it which have a chilling effect on the moisture laden currents. It is claimed therefore, that the effect of the forest is not to increase the absolute amount of precipitation over a large area of the country, but it has the effect of rendering the local precipitation more frequent. This is more noticeable in the hilly or mountainous regions, and it is there that the effect is of most importance to you irrigators.

Now, coming directly to the question of stream flow. The total discharge available for stream flow depends upon climate precipitation and evaporation; but the regularity of stream flow depends upon something else. The regularity of stream flow depends almost entirely upon the storage capacity of the water shed. As I have said before, the main difficulty for irrigators is not the amount. We heard Mr. Pearee giving figures this morning that clearly indicated that there was plenty of water in the Cypress Hills regions, but he pointed out some reason for storing that flow over a greater length of time.

Now, theoretically, the ideal for the irrigator would be a stream giving sufficient moisture which could be turned off and on at will. Practically, this is out of the question and I claim the next best thing is for a stream with as steady a flow as may be possible from month to month, and particularly during the vegetation season, for it is during the vegetation season that the irrigator desires to distribute moisture to the limit.

The main loss of precipitation in a hilly region is from surface run-off. It is our contention that forests present obstructions to surface run-off. In the first place they break the violence of the rain. We all know that in a very violent rain storm we get a good deal of protection if we get under the trees. The water does not reach the ground as quickly as it does in the open.

In the second place, they retard the melting of the snow. We all know that in the open the snow is melted and gone long before the frost is out of the ground. In the forest there is a tendency by retarding the melting of the snow to conserve and hold moisture there, and I am sure you have at one time or another visited the timber areas particularly in the higher regions and found snow, cakes of ice and other forms of moisture still held in the forest.

In the third place, the forest increases the absorbing capacity of the soil. The processes which are going on during and after plant growth in the forest are such as to cover the mineral soil with a layer of humus, which has the effect of increasing the absorbing capacity of the soil.

In the fourth place, they prevent erosion; and that is a pretty serious thing at times. In a forest region, where there is a heavy rain fall, there is bound to be a certain amount of erosion, but as a rule erosion that takes place under those conditions is not such as to give us worry. On a bare surface where the sod has already been worn to its mineral nature, erosion can become a very serious thing. In fact, many valuable lands can be buried to a considerable depth with the wash and sediment and silt absolutely unsuited to the purpose for which the land is required.

By checking the surface run-off we claim that the forest has a very beneficial effect in conserving the water supply. By checking it they increase the underground seepage and make possible on a large scale the formation of springs, and, of course, it is very largely upon these springs and the class of water in the soil in different places, particularly beneath the surface that we are dependent for our stream flow. I need not enter into a discussion as to the mechanical effect of too rapid a run-off. Violent floods in the spring have caused considerable damage and dams have been washed out.

Coming to the question of the Cypress Hills reserve itself, I do not intend to say much. Although the remarks I have made have general application, the bulk of my work lies in the Rocky Mountain Forest Reserve. Here in this country south some thirty to thirty-five miles from this city, we have a tract of land in a forest reserve of some 178 square miles. A tract which is at an elevation higher than this city by 600 feet above sea level. I have said that the effect of stream flow is more pronounced in these regions. I will say again that the summit of the Cypress Hills is more than twice the elevation of Medicine Hat above sea level. It is a timbered area. The majority of the people going out to the Hills for the first time and seeing them timbered, when they approach them might be disappointed, when they get on the top, to see the hay meadows there. Prior to 1886, the Cypress Hills were covered with a fine stand of merchantable timber, but the fire of that year wiped out the bulk of it. We claim that by protection of that forest there is—and there is considerable and it might surprise people how much is there particularly when they consider the destitute nature of the country around it

with regard to timber,—by conserving that timber and encouraging natural regeneration and going further and providing for artificial regeneration, by the establishing of a small nursery, we can bring the Cypress Hills closer to its original state.

The question of artificial reservoirs is something that can be built up in a reasonable length of time, but a forest reserve takes a considerable time to build up. Nevertheless, if you have artificial reservoirs, you have a body of exposed water, but in a forest it may have more or less exposed water within it, but the evaporation of free bodies of water in the forest is not nearly so great as it is in the case of free bodies of water in the open, so it is our claim that, although the artificial reservoirs are necessary, we cannot be expected to build up in a period of eight or ten years something that depends upon the class of timber you are trying to get, something that might take from 40 to 150 years. Nevertheless steps should be taken to do as much as possible to convert this reserve back to its original state.

The question of stream flow is just as important. This is of importance to the people of all regions. It must be, in a hilly country or at least in a country that has a certain irregularity of topography, that irrigation works have to be carried out because after all, we have to depend upon gravity.

In closing, I want to say a few words about the period we have been through in the last two months. Mr. Prettie told me yesterday of an incident that happened on one of the logging railways. The C. P. R. had brought in oil to operate the train. Tiding on the way down on the oil locomotive with two others, these fellows threw away cigarette butts and they had to stop and put out the fires resulting from that action. Now, we have had a lot of fires in Alberta this year and a lot of them have been caused by campers and some, which have cost us as much as \$15,000 to get under control, have been caused by absolute carelessness.

On Monday when I came here and looked at this peaceful forest scene on the platform, I thought it was the most peaceful scene I had seen.

It makes me feel indignant every time I see a person on a train, in a street car in the cities, throwing cigarette butts away. In our work it is all these little things that have to be guarded against in order to conserve our forests.

Just a word of explanation, as to the difficulties in our work in the forest reserve. If there is one season since I have been associated with the Forestry Department that I entered with a degree of doubt, it is this year. The year 1916 was all right. 1917 was getting drier. Last year we got through, if I might use a slang expression, "by the skin of our teeth," and we had fires and fires but managed to keep them under control. This year we

had a season in which the organization was shot to pieces. We are all familiar with the steps being taken to employ returned soldiers, and our department as well as others is doing all that is possible in that direction. You can get men amongst the returned soldiers who have all the practical experience, and they have the right dispositions to make ideal men. We are taken them, but I am sorry to say that only a small part of them happen to have experience in the particular districts to which we have sent them. In our organization this season we had on three reserves out of eight almost an entirely new line-up of men to control the fires. On one reserve we had a staff of men only one of whom had been on the staff for a year or more. That has been the hardest situation with which I have had to cope. It is a pretty serious situation for me, as inspector of the province, when fires would occur I felt I had to be out there because I would know more about that district than the men in charge of it did. It has been the most disappointing experience I have ever had. I was just making a rough sketch map the other night and I am afraid this year we have burned up 5 per cent. of the Rocky Mountain reserve. From the standpoint of stream flow that is a catastrophe. We can guard against it by building up. We have been considerably created by the government appropriation. But this year, we have already spent three or four times the amount of our fire reserve and we will have to trust to the tender mercies of the fall session to help us out.

We have to build up not from the beginning, but from a pretty well broken up organization and I trust that we will have the co-operation of this Association in so doing. It happens that in your work a piece of work might be undertaken; for instance, a survey might be started, and it could be left and then taken up again; but with us the key note of our organization is that, we cannot have success unless we have men kept on the work, and in charge in the district all the season.

