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CONSERVING OUR SOIL

SOME people are shocked by the idea of the need for conservation of resources. They are still attuned to the thought of wide open spaces — all the West to fill — Canada the granary of the world — and all that.

Their sort of thinking marches alongside the old idea that man's chief end is to conquer nature. Today, we realize as never before that man can only remain top of creation by working with nature.

The fact that agricultural soil resources in the world are limited makes it necessary to use and conserve them to our best ability. Dr. E. S. Archibald, director of the Experimental Farms Service at Ottawa, and now an executive in the Food and Agriculture Organization of the United Nations, estimated in 1949 that we have only two acres to support each person in the world.

That is not much soil to supply all our food needs, but when proper development and conservation are used we can make it do. This is why farmers are introducing new practices, and learning to use technology and science.

Conservation may be embraced as a way of life, designed to promote better and more enduring values for the human race. The human element is the very foundation of every conservation programme, as well as being the reason for it.

There is no need for hysteria about conservation. While accomplishments up to now in relation to needs give no cause for complacency, the great strides that have been made in research in a few years are truly impressive. The work looks small against the backlog of things undone. It lagged in its early days because of the too-great enthusiasm of its crusading supporters who killed public interest by their exaggerations. Now we are starting to catch up with the realities.

What IS Conservation?

Conservation is the informed, conscientious management of resources. It is development as well as protection. It is use as well as saving.

Conservation means more than putting the brakes on use of field crops, trees and minerals. The conservationist is not a hoarder, but a person who makes judicious choices. He has three general principles. In the first place, he applies resources primarily to those uses for which they possess particular qualifications: for example, crude oil can either be burned under a boiler in competition with coal or, when refined into gasoline, be used in ways with which coal cannot compete. In the second place, he prefers to use continuing or recurring resources instead of fund resources: vegetation, water and sunshine instead of minerals, when such a substitution is economically feasible. And in the third place, he tries to protect his sources of supply.

Conservation may be summarized as meaning "We will use without using up." It also means the restoration to sustained productivity of worn or damaged resources, and it means selection of land for use according to the best it is capable of giving.

A report of the United States Soil Conservation Service in 1948 said: "Of the approximately 450 million acres now classified as cropland, about 60 million should be taken out of cultivation altogether." That land is too steep, too shallow, too poor, or too susceptible to erosion to be cultivated successfully.

In our economic system, wherein farmers are free agents, there is no authority to "take" their land out of cultivation. Use and care of their land is the responsibility of owners and users. They may, however, call upon government authorities to help them.

Agriculture in Canada

It will be realized that how to use our land resources is at once a national problem, a local problem and an individual problem.

Canada has, said last year's census, a total farm area of 174 million acres, about 7½ per cent of our total land area. Our grain exports reached an all-time high record in the crop year which ended on July 31st, 1952: 509 million bushels, including 357 million bushels of wheat and flour, 72 million bushels of oats, and 70 million bushels of barley.

How much more farm land have we? Dr. Archibald told a UNESCO conference in 1949 that estimates of the total potential acreage in Canada suitable for cultivation ranged from some 350 million acres to about 130 million acres. The higher figure represents land which is physically arable, and the lower figure represents land which on present day economic and technical levels would support a self-sustaining agriculture. "Unsettled, tillable land in Canada suitable for present-day agriculture," he said, "would probably not exceed some 40 million acres, much of which is as yet inaccessible."

Canada's continued prosperity in agriculture reflects the fact that many of the practices which are basic in a planned soil conservation programme have been followed for years by our more progressive farmers.

Some farms which have been under cultivation since long before Confederation are producing far above the average yields of farm crops. Their owners have appreciated the fact that the maintenance of soil fertility is the key to successful land use and preservation. They have not mined their soils, but have consistently put something back into the soil as a capital investment.

The changes that have taken place since those farms were first ploughed, and the changes which are in prospect daily, make farming a many-sided business. Young men who look forward to farming as an occupation will need to learn the skills associated with mechanization, how to conduct a complex business enterprise, and the chemistry and physics of conservation. Those who are well adapted for a business of this kind are likely to find in agriculture opportunities for gracious living and a sense of achievement as good as in any other occupation.

The Needy World

That is Canada. But beyond Canada there is a needy world. Since the beginning of the industrial revolution there has been an explosive upsurge in world population. We have increased in number fourfold in the last two hundred years, and experts do not predict a slackening in the rate of increase for at least fifty years. Every day there are 60,000 more people to feed and clothe from the resources of the earth than there were the day before.

About half of the world's people, a billion of them, are under-nourished or near starvation, declares Dr. O. M. McConkey in his book *Conservation in Canada* published this year. His estimate is confirmed by an article in the *Annals* of the American Academy of Political and Social Science, where Dr. H. L. Shirley, acting dean of the State University of New York, says: "In a world where half the people are poorly fed and housed, needless waste of resources is viewed as a sin against mankind." Sir John Orr (now Lord Boyd-Orr), who was director general of the Food and Agriculture Organization of the United Nations, said in 1947 that we must double the world's food production if all the people in the world are to enjoy an adequate diet. If we keep increasing our population at the present rate we are heading toward a food crisis.

Some people in the well-endowed western world think that public men and writers are unduly pessimistic. In our own interests we should not deride the thoughtful students of resources who point out that there *is* a limit to how much the land can produce, and that the day *can* come when, as it was phrased by the conservation director of the Izaak Walton League of America: "there will be a smaller cut of the pie for each to have."

There remain few appreciable areas of unused fertile topsoil on earth except in regions where production is impractical because of climatic conditions or lack of water. However far apart the "prophets of doom" and the optimistic "cornucopians" may appear, both groups agree that, if man is to escape want, all known methods of decreasing present waste and of increasing production and productivity will have to be much more widely understood and applied during the next fifty years.

Three books which go deeply into the problem have been published within the past few years. They are: Fairfield Osborn's *Our Plundered Planet;* William Vogt's *Road to Survival,* and Egon Glesinger's *The Coming Age of Wood.*

Since our space for growing crops is limited, the problems of resource adequacy in future years will involve primarily human wisdom. Conservation calls for co-operation of city and country, of agriculture and industry.

Because all wealth derives primarily from the earth and water, industry has an enormous stake in conservation. It can prosper only if there is a bounty of raw materials from which to fabricate the products it sells. Our homes, our incomes, our food and our clothing come, at some stage or another of their existence, from natural resources. There is, indeed, a very human element in conservation.

"Water" is a Key Word

Water, a basic resource, has suffered because of man's lack of understanding. We have accepted it casually. Because it is so readily available, we have wasted it; we have allowed it to run wild on our farm lands.

Waste of water by unnecessary runoff, by excessive use in industry, in the home, and in irrigation, can lower the underground water level over wide areas and may deplete the resource dangerously. In some places water has become the earth's most precious resource.

Animals and plants are tied, by their life cycle, to water. Most crops require between 300 and 400 pounds of water for every pound of dry matter they produce.

Conservation of water begins with the watershed which is the area of drainage that feeds water by run-off and seepage to surface and underground streams. A watershed may be a small basin supplying a single stream tributary to a larger stream, or it may be the drainage area, hundreds of square miles in extent, supplying water to a large river.

Erosion must be controlled in the watershed if floods are to be avoided, if reservoirs are not to become silted up, if water is to be stored in times of rain and fed out in times of drought.

Watershed development demands careful planning and the best technical skill. Sound land-use and land-protection programmes are needed as well as dams and other stabilization works.

There is no magic formula that will reclaim overnight a watershed that has been allowed to deteriorate over many years. Only thoughtfulness, a desire to set things right, and skilful work will do the trick.

Some parts of Canada have the problem of surplus water, and drainage is needed. This is particularly true in Eastern Canada, where heavy clay and muck soils become unworkable for long periods. Observation reported by Dr. McConkey showed that the average yield of grain was increased 23 bushels per acre on drained land as compared with undrained land in the first year.

In dry areas, irrigation takes a great deal of the risk out of farming, and a bigger variety of crops can be grown. Even in Ontario, where drought is not the problem it is in the West, crops sometimes suffer from dryness during the critical growing periods.

To increase underground water for wells, for springs, and for maintenance of streams, every effort should be made to have the rainfall sink into the ground, and to store it in pools on high land and at stream sources.

Ponds are now being widely used in the conservation programme in Western Canada. Earth is removed at a low part of a pasture field, or in a gully, and built into a dyke or small dam. Then a few trees, such as willow, elm or soft maple are planted around the pond, and turf is grown down to the water edge.

Besides acting as reservoirs for replenishment of streams, these ponds store water for domestic animals and accommodate fish and other wildlife creatures.

It is not Amusing

The need for conservation is not something to be brushed off lightly, even in a well-endowed country like Canada. Study of what caused the downfall of once great countries shows that failure to conserve natural and renewable resources had much to do with their collapse. Many of them were just as rich as Canada.

In sections of Europe, Asia and Africa nothing is left but scars and ugliness and the ashes of burned-out civilizations.

There are some striking contrasts. China, whose northern mountainsides were left bare by removal of forests and other natural coverings, is a ghastly epitaph of human effort misapplied, while Corsica, its hillsides covered with cultivated chestnut trees, is an example of conservation practically applied over centuries.

The Middle East, believed to be the birthplace of civilization, has been deforested and erosion is widespread. At the beginning of our Christian era Palestine had three million people; by 1850 the population had been reduced, largely by war, abuse of land, and the cutting down of forests, to below 200,000.

On the other hand, consider what was done by people on the Andean Plateau in South America. They were challenged by a bleak climate and a grudging soil. Their coast approached the barrenness of an equatorial desert, but they husbanded the scanty water that descended from the western plateau and gave life to the plains by irrigation: the pioneers on the high plateau transformed their hill-sides into fields by husbanding the scanty soil on terraces preserved by retaining walls.

All the past is a lesson to the most wealthy countries of today as well as to those which have constant or recurring scarcities: on the one hand to preserve what they have, and on the other to rebuild to the extent of their ability.

How it is to be Done

Conservation grows only through a continuous, critical correction of past errors.

Take erosion control, for example. The erosion process is vicious. A gully, eaten out by unchecked water, is a cancer which can spread into a farmer's richest land, ruining it. Wind erosion not only carries away soil, but it changes the texture of the land through removal of fertile elements. Samples taken of dust carried by the wind contained more than three times as much organic matter and nitrogen, nearly five times as much phosphoric acid, one and a quarter times as much potash, as the original soil.

Water erosion starts with the first drop of rain, because the impact of the raindrop tamps the soil into a thin hard layer that reduces infiltration, increases runoff and encourages the water to pursue its devastating course.

Small grain crops, such as wheat, oats, barley and rye, will lose 16 to 40 times as much soil to water erosion as will woodlands, forests and undisturbed prairies. Dr. McConkey provides a table showing the soil eroded on test lots in 1945 to 1950. The loss per acre on summer fallow was 154.7 tons; on land planted to corn 172 tons; on oats 3.85 tons, and on alfalfa 0.29 tons.

Loss of Fertility

What does this mean in loss of soil fertility? The late Dr. F. A. Wyatt, professor of soils at the University of Alberta, said that the loss of one inch of soil from

one acre of land in the black soils belt of Alberta means the removal of 300 pounds of phosphorus, 1,500 pounds of nitrogen and 15 tons of organic matter. It would require 150 tons of farm manure to replace the lost nitrogen, and the phosphorus lost would be equal to the amount removed from the soil by 20 crops of wheat, each yielding 50 bushels to the acre.

Some preventive measures are purely mechanical, such as terracing to slow down the runoff, but the higher and more rewarding forms of soil conservation involve various modes of incorporating plant material in the soil. They build up the fertility of the soil. Only a fertile soil can resist erosive forces.

Contour cultivating is a variation of the terrace idea, and strip cropping is a supplement which pays well in Eastern Canada by placing a further impediment in the way of the water, and in Western Canada by reducing the creeping menace of erosion by wind.

Crop rotation plays its part. By growing different kinds of crops on the same land in recurring succession it varies the consumption and replacement of organic material and nitrogen in the soil, increases absorbency and reduces water runoff.

Stubble-mulch farming is a system in which the residues of the crops are left on the surface. This mulch prevents rainfall from packing the soil, it holds water, it resists wind action, and as it decays and forms humus it improves the soil structure.

This last is very important, because sick soil means sick crops. A deficiency of humus means a deficiency of bacteria in the soil and a deficiency of those useful aids to agriculture, the earthworms (to which someone gave the poetic title "The ploughs of God").

The farmer's soil is not a dead storehouse, but a living dynamic system in which constructive and destructive forces are constantly proceeding.

On Blaming the Past

Man has indeed, in the past, marked the earth with ruin, but spread of knowledge leaves today's men without the excuse that can be made for ancestors ignorant of the facts science has uncovered.

With no criticism of the past, but having reached maturity and being anxious to avoid the natural mistakes of our youth, we need to formulate and carry out plans which will cause our successors of a hundred years hence to say that we had the imagination and courage to carry out the conservation plans which our science made possible.

We need a broader and more earnest educational drive. Conservation of Canada's natural resources is not a subject to fill an odd hour, or to hover around on the periphery of the school curriculum.

For Canada as a whole the bottom of the barrel seems well covered, but for people in many sections of Canada it is frighteningly bare.

Looking to the Future

Our conservation education and efforts need the support of every citizen — farmer, industrialist, professional man, housewife, merchant, union leader, parliamentarian, journalist and artisan.

Searching always for water-saving practices, for weed and pest control, for adaptation of seeds and plants to our Canadian climate, and for farming operations designed to make for better farm living, the directors and scientists and technicians of federal and provincial government departments and of private enterprises are doing good work to turn human effort to nature's way. But more is needed.

The activities of government at all levels should promote and assist the conservation practices which are to be undertaken by individuals, and government must accept the responsibility for necessary enterprises which are beyond the capacity of individuals. Government must, too, bring in regulatory measures, which are the rules of the game, just as necessary in conservation as they are in transportation, communication and other enterprises that affect the public welfare.

Wide public support is essential. Interest and activity in conservation give every one of us the chance to say that we are a part of the answer to a world problem and not part of the problem itself. Through membership in and support of the national and provincial and community conservation organizations we can participate personally in a great endeavour.

If we are farmers, we can redesign our farms to put every acre to its best use in accord with its individual capabilities. Our farm plants can be actually redesigned, just as factories are, for more efficient operation.

The conservation job is far from completed. A series of major problems and tasks stretch out before the people of Canada, and especially before the owners of natural resources and industries. It is a sign of the highest intelligence to take effective action before rather than after a threatening event.

By thinking constructively and acting energetically, we may avert the need for desperate emergency measures of reclamation and rehabilitation.

Whoever destroys, or by his negligence allows to be destroyed, the fertility of the soil in any region is doing an injury to mankind as a whole.

As sane and responsible people, we will subscribe to the creed of a Nigerian chieftain who said:

> I conceive that the land belongs to a vast family, of which many are dead, few are living, and countless numbers are still unborn.

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