Conservation

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COLLOQUIUM
1952

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Conservation
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FOREWORD

The Biology Colloquium is conducted in a spirit of informal discussion and provides opportunity for participation from the floor. The colloquium is sponsored by the Oregon State Chapter of Phi Kappa Phi with the collaboration of Sigma Xi, Phi Sigma, and Omicron Nu. Sigma Xi assumes special responsibility for the colloquium luncheon. Phi Sigma and Omicron Nu provide afternoon tea. The College Library arranges special displays of the writings of colloquium leaders and notable works on the colloquium theme.

Grateful acknowledgment is made of the cooperation and interest of the several faculties of Oregon State College that are concerned with biology, of those biologists contributing to the program, of Chancellor Charles D. Byrne, President A. L. Strand, and other executives of Oregon State College.

The first Biology Colloquium was held March 4, 1939, with Dr. Charles Atwood Kofoid of the University of California as leader, on the theme “Recent Advances in Biological Science.” Leaders and themes of succeeding colloquia have been: 1940, Dr. Homer LeRoy Shantz, Chief of the Division of Wildlife Management of the United States Forest Service, theme “Ecology”; 1941, Dr. Cornelis Bernardus van Niel, Professor of Microbiology, Hopkins Marine Station, Stanford University, in collaboration with Dr. Henrik Dam, Biochemical Institute, University of Copenhagen, theme “Growth and Metabolism”; 1942, Dr. William Brodbeck Herms, Professor of Parasitology and Head of the Division of Entomology and Parasitology, University of California, theme “The Biologist in a World at War”; 1943, Dr. August Leroy Strand, Biologist and President of Oregon State College, theme “Contributions of Biological Sciences to Victory”; 1944, Dr. George Wells Beadle, Geneticist and Professor of Biology, Stanford University, theme “Genetics and the Integration of Biological Sciences”; 1945, Colloquium omitted because of wartime travel restrictions; 1946, Dr. Robert C. Miller, Director of the California Academy of Sciences, theme “Aquatic Biology”; 1947, Dr. Ernst Antevs, Research Associate, Carnegie Institution of Washington, theme “Biogeography”; 1948, Dr. Robert R. Williams, Williams-Watson Foundation, theme “Nutrition”; 1949, Dr. Eugene M. K. Geiling, Head of the Department of Pharmacology, University of Chicago, theme “Radioisotopes in Biology”; 1950, Dr. Wendell M. Stanley, in charge of Virus Laboratory, University of California, theme “Viruses”; 1951, Dr. Curt Stern, Professor of Zoology, University of California, theme “Effects of Atomic Radiations on Living Organisms.”

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Leader of Thirteenth Annual Biology Colloquium
Thirteenth Annual Biology Colloquium

Theme: CONSERVATION

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Opening of the Colloquium

Dr. McCulloch: Ladies and Gentlemen: After the Colloquium sponsors had decided on the theme of Conservation for this meeting, it became the task of the committee to define the field. It is not possible to cover all resources adequately in one day, so a first step was to restrict consideration to biological resources. Within the biological area, agriculture and forestry are of prime importance to the Northwest and to Oregon particularly, so today's program was limited to these two resources.

Agriculture and forestry do not exist in a vacuum, however; they exist in relation to other resources and to people. Conservation measures applicable to them are affected by social and economic considerations as well as biologic. At times, conservation has suffered from the zeal of proponents who have overlooked these factors. Among the uninformed there is the belief that conservation can be accomplished by legislative decree. The problems are not that simple. Social and economic considerations cannot be ignored, for in the long run they will control conservation practices.

For this reason, the committee proposes to present a balanced picture of conservation in agriculture and forestry. The speakers are informed, and they know the intrinsic limitations as well as the hopeful developments in their fields. Dr. Cain will open with a picture of the broad social relationships involved in resource use. Mr. Isaac and Mr. Pechanec will discuss the biological characteristics which make conservation possible in agriculture and forestry. Dr. Vaux and Dr. Plath will treat the economic limitations within which conservation measures must operate in these two fields. In closing, Dr. Cain will present the international implications of resource use, a facet of the whole problem which is of great significance today.

Dr. Gilfillan:* Dr. McCulloch and members of the Colloquium: It is extremely unfor-
tunate that President Strand had to be in Chicago this week-end, because I know that he has been looking forward to this meeting. However, Dr. Strand’s misfortune is my good luck, and it is my great pleasure to welcome the members of this Thirteenth Annual Biology Colloquium.

The Biology Colloquium originated not in the minds of the scientists of Oregon State College (I wish it had), nor even in the mind of a scientist. The Biology Colloquium was the idea of one of our staff members, Mr. Delmer M. Goode, who is Director of Publications, and as such maintains a pretty close watch on campus affairs. It is sponsored by the Phi Kappa Phi Honorary Society and, over the thirteen years it has been held, we have considered such topics as ecology, genetics, geography, nutrition, radioisotopes, viruses, and other related subjects. For this particular colloquium we have branched out, taking the subject of “Conservation.”

Conservation is everybody’s business. Some of you may have read a book by William Vogt, who calls himself an ornithologist. Some of my friends have criticized Mr. Vogt’s book, Road to Survival, as being based not on fact but on emotion. I trust that your consideration of conservation will be scientific rather than emotional. It is certain that we are going to have to consider conservation. We are going to have to control our environment or it will control us. This is illustrated in a little poem which has meant a good deal to me since I ran across it a few years ago and which I think you will appreciate when you consider conservation and where we are going.

**THE DINOSAUR**

Behold the mighty dinosaur—famous in prehistoric lore
Not only for his weight and strength, but for his intellectual length.
You will observe by these remains, the creature had two sets of brains,
One in his head (the usual place), the other at his spinal base.
Thus he could reason *a priori* as well as *a posteriori*.
No problem bothered him a bit: he made both head and tail of it.
So wise he was, so wise and solemn, each thought filled just a spinal column.
If one brain found the pressure strong, it passed a few ideas along:
If something slipped his forward mind, ’twas rescued by the one behind:
And if in error he was caught, he had a saving afterthought.
As he thought twice before he spoke, he had no judgments to revoke:
For he could think without congestion upon both sides of every question.
Oh, gaze upon this model beast, defunct ten million years at least!

Paleontologists tell us that the dinosaur failed to control his environment, whereupon his environment controlled him. I trust our talks today will be objective, dispassionate, and, above all, scientific.

**Conservation Is Everybody’s Business**

**Stanley A. Cain**

In spite of the saying that “What is everybody’s business is nobody’s business,” I want to suggest that conservation is not only a job for specialists, but its accomplishment will require the understanding of the people generally. After considering what conservation is, some attention will be given to the present trends and conditions of natural resource use and, finally, some of the reasons why conservation is everybody’s business.

**What Is Conservation?**

The term “conservation” does not have the same meaning for everyone. Its connotation has changed with time, and today its meaning shifts with people’s interests and experiences, because most of us have only a partial understanding of the nature of resources and of the problems of their development and distribution.

It is well understood that conservation has to do with the natural resources, such as soil, water, minerals, crops, trees, fish, and wildlife. But it is not just agriculture, forestry, wildlife management, mining, or any of the technologies *per se*, although they participate in the conservation process. We know that conservation has to do with certain techniques, such as contour plowing, sustained yield forestry, flood control and reclamation, habitat control, cutting waste in mining and manufacturing, and protecting rare and vanishing species by regulations and reservations; but we know it is not just a series of techniques, nor a mere saving or locking up of resources. The very term “resource” implies human use.

One way to get some idea of the breadth and inclusiveness of conservation is to note some of...
the types of persons interested in it. We find among them some business men, industrialists, and bankers; some lawyers, engineers, and physicians; and some physical and natural scientists and technologists of various sorts. Among social scientists interested in conservation are some historians, political scientists, sociologists, cultural anthropologists, and economists—but not all, by any means.

A list of interested organizations, many of them with conservation policies and programs, again illustrates the extent of the feeling of a need for conservation. In addition to avowed conservation organizations and sportsman's clubs, a list would include the National Association of Manufacturers, the National Chamber of Commerce, the CIO, the National Grange, the Federated Garden Clubs of America, the National Association of Churches of Christ, the League of Women Voters, the Planned Parenthood Federation, the National Research Council, etc. Other than for their common interest in conservation, some of these organizations would make uncomfortable bedfellows. Whatever conservation is, it has a lot of different people interested.

If conservation is not a science or a series of loosely related technologies, is it, perhaps, a system of economy or a philosophy? Is it a form of planning, and does it lead toward statism and socialism? Is conservation easier under one than another political system? Is it natural or anti-thetical to democracy? Does it, somehow, have to do with social responsibility, with mores, and, for example, the development of land ethics? Is it a matter of natural and human resource stewardship? Is it a way of life?

There are no pat answers to such questions. The word "conservation" means different things to different people. Some limit their consideration to organic, renewable resources. Others include also the nonrenewable, fund resources. Still others extend the concept and problem area to human resources, including all of the cultural processes. For some, in fact, resources are not things. Raw materials are but latent or potential resources, and they become resources in fact, or in being, only because of the cultural characteristics and capacities of the people who are concerned with them.

I shall eventually come up with a definition of conservation that at least satisfies my present need in discussion of a belief that conservation is everybody's business. Before that, however, I want to point up the significance of our lack of knowledge as to what conservation means to people. In general, conservationists talk to each other, like ministers preaching to half-empty churches of the already converted. It would be very useful to conservation education and promotion if some survey research organization would find out on a national basis what people think conservation is about—what farmers, school teachers, housewives, bankers, etc., have in information and misinformation about natural resources; and what are their attitudes; and what conditions their beliefs and actions—their voting, for example—when natural resources are involved.

It would be useful to know who thinks in terms of single resources, and who thinks in terms of the total environment and the interrelations among the several resources and man. Who thinks that the interrelations among resources call for their integrated development and, perhaps, for their regional planning and management? What kinds of people think only of renewable resources as lying in the province of conservation, and why are their views limited? Who thinks of resources as absolute and who believes that they depend upon cultural factors such as the condition of the economy and technology? Who thinks of resources as supplying the material needs—food, clothing, shelter, the metals for machines and gadgets. Who includes also the less tangible benefits from natural resources, such as watershed protection, scenery, and solitude?

Who thinks of conservation as consisting of the management techniques of specialists; and who thinks in terms of striving for a total ecological harmony and balance between man and environment, thus involving all aspects of culture? Is conservation a sort of geotechnics, a preparing and repairing of the earth for man's benefit?

Also involved in the general question of resource supply and management, conservationwise, is the extent to which the public or segments of it believe that science and its handmaiden, technology, are or will be equal to solving all our problems. Who believes that the future will take care of itself—that although some resources may become short or even exhausted, there will be no end to man's resourcefulness? The engineers, chemists, and biologists will figure something out. They always have.

Who, besides some conservationists who have expressed themselves, believes in the concept of resource stewardship—the idea that no man because of the historical vagaries of private own-


cership has the moral right to destroy the land and its productivity and to waste resources? By and large we believe in individual initiative, private property, and fair rewards for labor and capital; but most people do not believe in uncontrolled economic power derived from natural resources and concentrated in the hands of a minute ownership group. People, resources, and resource ownership are distributed very unequally in the world. Many problems result that pertain to conservation. What do people think about these problems on a national scale, in international affairs, and as pertaining to peace and war? What are the roles of planning, of mores, and of law in conservation? How can a democratic society that is also exceedingly rich, industrialized, complex, and a world power learn how to practice conservation? There is a difference in time scale between exploitation and resource development; one is short and the other is long in its view. There are the pressing needs of heedlessness and of emergencies, and there are the future needs of the generations to come.

All of these matters bear on the initial question: What is conservation? There have been many definitions of conservation, and I propose the following statement because I believe that conservation is a sort of total process in human ecology.

Since conservation is concerned with all the resources and since the resources are interrelated, conservation has to do with the interrelations among the resources and with their integrated development; and since resources have meaning only in relation to human use, conservation is also concerned with the economic, social, and political problems and the implications of resource development and distribution; and all this for the purpose of attainment of the highest possible level of living and well-being for the people generally.

THE PRESENT CONDITION

If conservation is a broad action program directed toward attainment of some satisfactory relationship between resources and people, in a sense between supply and demand, we had better take a look at the balance sheet in mid-twentieth century if we are to conclude that conservation is everybody's business.

Many books, essays, and technical reports have been written about the present condition of the world's resources. I can only hope to suggest in a few words one aspect of the situation with which I am greatly impressed. That is the recent, greatly accelerated rate at which we are drawing upon our environment. We shall look, then, at a few trends.

It will be well to think of the nature of the demand for which the world's resources must provide supply. This demand arises, in the first place, from the ever growing numbers of people in the world and, in the second place, from the capacity of these people to utilize raw materials with increasing rapidity, especially in industrialized countries. The demand of rapidly growing numbers is, in some parts of the world, compounded by ever rising levels of consumption by individuals.

Working back from the recent decades that provide fairly reliable statistics of populations for portions of the world, demographers have made some cautious estimates of the total human population for various periods. At the beginning of the Christian Era, for example, the total world population was probably somewhat less than one-fourth billion. Some sixteen centuries later the world's population had doubled, being about one-half billion in 1650. By 1850 the number of people living on the earth had doubled again, being estimated at 1,091 million. In 1939, the calculation was 2,080 million persons. The United Nations statistical office's last estimate provides a round figure of 2.4 billion for 1951, with the world's population growing at the rate of about one per cent a year which, if maintained, would double the world's population in seventy years. The accelerating rate of world population growth is illustrated, then, by the length of time required for the population to double. After thousands of years of slow and probably irregular growth, something unusual happened a few short centuries ago—as indicated for 1650—and the years for successive doublings decreased from 200 to 90 to 70.

The period of rapidly accelerating world population growth is about that of the history of the United States. Since colonial times, the United States has had an average rate of about 2 per cent per annum. In 1850 it was 3.5 per cent, and in 1900 it was 2.0 per cent. Between 1930 and 1940 it dropped to 0.7 per cent, but during 1940 to 1950 it was back to 1.4 per cent. During the nineteenth century the proportion of western peoples in the world gained rapidly. However, in the longer-industrialized countries the rate of growth began to slow until the last 10 to 14 years.

Although the world's average rate is about 1 per cent, sufficient to double in 70 years, the
rate is very uneven for different parts of the world. In the United Kingdom the rate is 0.5 per cent, which would require 144 years to double, whereas in the Philippines the current rate is 2.9 per cent, which, if continued, would require only 25 years to double. Many countries—among them Mexico, Colombia, El Salvador, Brazil, Puerto Rico, the USSR, and Canada—will double their present populations in from 25 to 50 years if current rates are maintained.

During man's ancient history a series of technological advances permitted local populations to swell, cities to develop, and strong governments to come into existence in the valleys of the Indus, the Tigris and Euphrates, the Nile, and elsewhere. These technological advances included domestication of animals, development of agriculture, and such changes as from the Stone Age to the Bronze and Iron Ages. But the phenomenon of the industrial revolution and its influence on population is not only very recent; it is of a new order of magnitude.

We do not need to look far for the causes of the modern acceleration of the rate of population growth. It started in Europe with certain changes in agriculture and land practices that yielded more food and released a growing proportion of the people from the land. This new agricultural revolution continues with the impetus given it by science, technology, and political and economic changes. Then came the industrial revolution and the rapid growth of urbanization and factories. The significance of the industrial revolution seems to lie in man's capture of inanimate energy and his application of it to industrial and agricultural production. These two revolutions supported one another and made for the progressive retreat of the age-old enemies of man: malnutrition, hunger, and starvation. A third major factor consisting of advances in medicine and public health, Vogt's sanitary revolution, involved the substitution of science for folklore and religion in the universal problems of sickness.

Increasing production meant better life—more and better food, clothing—and the increasing knowledge of medicine, public health, and sanitation meant a longer life. What Justice Douglas calls the real, personal enemies of man—poverty, disease, illiteracy, and misgovernment—began to lose much of their sway. It is not clear that proportionately more people were being born, but certainly fewer were dying in infancy and longevity was increasing rapidly.

New forms and instruments of government were being invented and tested, and those that were providing man greater freedom and individual integrity were succeeding along with the improving standards of living. A final factor in the unparalleled growth of peoples of northwestern European extraction, whether at home or abroad, was the frontier. The vast and productive continent of North America was rapidly filling with people, as were lesser frontiers around the world. And in the United States the government was in the business of getting into private hands the ownership of the vast, rich public domain. Pioneer farmers began to produce a surplus that supported the growing cities of the Atlantic seaboard; and that surplus, flowing across the Atlantic in trade, helped support rapidly growing populations in the mother countries.

Such, then, were the causes of the rapidly growing populations of Europe and European descent. The general result was a wider distribution among the people of the production from natural resources. As Jefferson said, "To some parts sooner, to others later, but finally to all." The earth was made to support more people in a better fashion. Not all the world has become industrialized, but nearly every part has experienced some of the fruits of western technological methods. The phenomenal thing about their partial experience with the changes which have been called revolutions is that in most of these countries the outstanding result has been a sort of population explosion. A few illustrations will be sufficient. The population of El Salvador increased 11.5 times in the 144 years up to 1940, mostly under the influence of contact with a northern type of resource development. The Indian population has literally swarmed under some 75 years of British influence. The statistics, which are pretty good, show a net growth in the Indian population of 83 million just between 1921 and 1941. The population of Java under the Dutch influence increased three-fold in the seventy years between 1860 and 1930, until there were about 800 persons per square mile of land surface. The population is now said to be in excess of 1,000 persons per square mile. The Japanese people, who rapidly expanded during their swift industrialization, are greatly complicating their problems (and ours) by a further acceleration of population growth under the doubtfully benign influence of American occupation. The Japanese islands, which are about the size of California, now contain 84 million people. There has been a growth in population of over 12
million since 1945. Five million are repatriates, but seven million are a realization of the natural biological potential as a result largely of our assistance in reducing disease and supplementing their domestic food production.

People create the demand for resources. The use and the misuse of the environment is due not only to number of mouths to feed, but also, as we have seen, to rising levels of living or man's capacity to consume more per capita—if he can get it, that is.

I should like next to take a quick look at the present resource situation from which the supply must come to meet this rapidly growing demand. As in the case of population, the phenomenon that is most impressive is the recent rapidly increasing rate of change—the rate at which man is using, in fact using up, certain important resources.

Industrialized civilizations are built on the fossil fuels: coal, petroleum and gas. They are used resources and they are exhaustible. The faster they are used the quicker they will be used up and the more rapid will be their ultimate decline. Man has used coal for about 600 years, but its significant use awaited the invention of the steam engine and its application to railroads, steamships, factories, and electric power generation. The first coal production statistics on a world basis were available in 1864. From then until World War I the use of coal doubled every 17 years. Perhaps it is more graphic to state that three-quarters of the world's coal production has been used since 1900, and that half of it has been used since the 1920's. The story of petroleum is more striking. The first American well was put down just before the Civil War, about two years after the world's first commercial production in Rumania. During the first century of petroleum's history the rate of use has doubled about every seven years. Half the world's oil production has been used since the late thirties, and 97 per cent since the turn of the century. The history of gas is similar.

The industrialized civilizations are based on the fossil fuels. Currently in the United States 87 per cent of the energy for man's work comes from the fossil fuels. What this fact means for the future of the United States and for the industrialization of presently underdeveloped countries cannot be fully foreseen because of inadequate knowledge of reserves and of the future of technical advances, but it is certain that we are heading toward fundamental changes of great importance to us and the world. For example, in the New York Times for April 13, 1952, Dr. L. K. Sillcox of the New York Airbrake Co. says that by 1980 the U. S. will need five billion barrels of oil annually. This will be five times our probable production, and the world will need at least 40 per cent more oil than it will produce. He does not believe that the answer lies in oil shales, which can provide only about 3 per cent equivalent of our coal reserves, so Sillcox sees the future of power as being mostly from coal. At any rate, international competition will be even more severe than it is today, and the implications for world peace and cooperation are worthy of deep thought.

To round out a little the mineral picture, a word or two should be said about the nonfuel minerals—the malleable minerals used in construction and various machines and those used in chemical processes. Usable deposits of iron, tin, and many other minerals exist in geologically concentrated forms. Man's use of minerals is essentially a scattering process. They are not so much used up as they are dispersed about the world and the bottom of the sea in economically unsalvageable small pieces. This is a sort of material and economic entropy comparable to the steady loss of energy to outer space.

I need not dwell on the renewable resources—on food, feed, fiber, soil, and water. They are more often discussed and, in fact, are treated elsewhere at this Conference. I wish to say only that there are great and encouraging advances in the management of the renewable resources, but we have not yet reached a sustaining condition. There are still leaks in the cycles of renewable resources.

Our failures are not so much those of science and technology, as they are failures of the societal arts to keep up with the material arts. They are failures in political, economic, and social institutions and devices—a sort of cultural lag—that prevents the full application of man's know-how in the management of resources. It remains to be seen whether industrial civilizations can solve these problems and break the vicious cycles of history.

To sum up the situation at mid-twentieth century, as I see it, in the light of the trends that have been discussed, it would seem that we are faced with stupendous but not necessarily insurmountable problems that are world-wide in scope. We are or should be striving for an harmonious balance between supply and demand that will provide a satisfactory way of life for people generally. This is the direction of social evolution,
the drama on the stage of the world in which conservation must play a leading role.

This desirable, human ecological balance can be attained only if man operates on all of the variable and interdependent components of the equation. We have made tremendous strides in increasing production, but more astuteness is required in handling the raw materials for this production. On the population side we have made equally dramatic and beneficial advances in attack on sickness and the death rate, but we have made little or no effort to do anything about the birth rate. The result is an uncontrolled population growth that has caused in many countries a worsening of the lives of the swarming people. We are thus in a most difficult position, for uncontrolled population growth can only magnify our difficulties and theirs in this interdependent world. Skyrocketing populations and increasingly heavy drafts on the world's natural resource capital show no signs of lessening at this time. This situation can but underline the great need for a diffusion among the people of an understanding of the nature of and the limitations of natural resources and, of course, the significance of conservation.

Why Conservation Is Everybody's Business

I come, then, to the third and last phase of my thesis, to the reasons why conservation is everybody's business and not just the responsibility of the resource specialists. Briefly stated, the conclusion is this: Conservation is not just the responsibility of foresters, farmers, miners, engineers, manufacturers, and others who work with raw materials. Conservation is everybody's business for the simple reason that the problems of attaining and maintaining satisfactory levels of living are not mainly scientific and technical problems. They are largely human problems. Thereby they are political, economic, and social problems. And because they are, we are all involved in their solution.

The public does not need to know the techniques of land management, of forestry and agriculture, or of mining and manufacturing. But in a democratic government the public does need to have an adequate understanding of the interrelations between resources and politics, for example, and the effects of resource policies and practices on economic and social conditions. We need to know how resource problems affect international affairs, as well as our domestic ones, and the possibilities of war and peace. In concluding I wish to illustrate briefly the fact that conservation problems, in the sense of the definition I am using, will not stay confined to technical matters.

We can take the Japanese situation. Japan's importance to us is clear. It is our principal outpost, not only for Korea, but for the entire East. The basic problem of Japan, the only industrialized country of Asia, is the same as that of Britain in the North Atlantic—too many people, too little land, too few natural resources, and a need for markets for manufactured products in order to make up the deficiency in food and raw materials. Japan imports about three million tons of foodstuffs a year as well as much raw material. In order to import she must sell. Since 1945 the U.S. has bolstered Japan's economy by about two billion dollars of economic aid, and our soldiers have spent nearly another billion there. Japan's problem is accentuated by her loss of empire, and multiplied by her rapidly growing population. Her normal trade area is now partly in Communist hands. Without our underwriting, Japan will have to do business with China, for example. This is our dilemma. But are there any conservation problems in this situation; that is, problems in the U.S. natural resource picture that may also have economic, political, and social implications? I think so.

Take the matter of resources. Our two billion dollar support is not paper money. It was delivered in goods, foods, materials, products, machines, machine-tools, etc. These natural resources diminish our own supply, for home consumption or for use elsewhere.

That there are political problems also is clear enough, for the Japanese problem is part and parcel of the Korean and the Chinese problems. Our Congress and the people are not of one mind about the Chinese Nationalists, for example. There is the great danger of an enlarged war. Whatever may be the difficulties of adopting conservation practices in peace, the rate of use of natural resources is infinitesimal as compared with the rate of loss during war. The economics of the matter are likewise self-evident. The economic problems range from questions of expenditure for war and for technical and economic assistance to foreign nations to questions of trade. There are segments of American business that would find Japanese imports in competition with their products and would insist on tariff benefits and trade restrictions irrespective of the fact that if we do not buy from them the Japanese cannot buy from us. If we do not trade with them, they will have to find trade areas elsewhere.
Social aspects of this large conservation matter of attaining a satisfactory balance between resources and people are not lacking in the case of Japan. Admiral Sams, who was the chief health officer of the occupation, established several hundred clinics that, in addition to other matters, distributed birth control information that was desired by the Japanese. The Japanese Diet, with the approval of SCAP, of course, passed laws making it legal to manufacture, display, and sell contraceptive devices. SCAP and the Japanese people were attacking the social problem of a too rapidly growing population. However, the strength of the archaic opinion of a small, militant religious minority—brought to bear first in Japan and then in Washington—was enough to cause General MacArthur to make several moves. He denied the entrance of Margaret Sanger to Japan, although her visit was requested by the Japanese people, and he caused the recall and suppression of a publication on natural resources of Japan that was “indiscreet” enough to have a few paragraphs favoring family planning, rather than the accumulation of unwanted children as a result of ignorance.

I should like to take my second illustration from the Middle East. We all realize the importance of Persian oil, for example, the positive value of having this oil and the negative value of keeping it from the Russians. All observers also recognize the extreme poverty of the common people with which is combined a rebellious spirit and a growing nationalism. The modern troubles lie in the historical basic failure of governments, whether autonomous or colonial, to solve the quartet of the peoples’ problems of poverty, disease, illiteracy, and misgovernment.

These are extremely complicated problems that are faced by the people and their governments in many parts of the world and that we face as a world power. The Marshall Plan, Point Four, and the United Nations specialized agencies such as FAO, WHO, and UNESCO represent peaceful approaches to these problems. The United States can only aid and cooperate (unless we resort to power politics), and in the last analysis the governments must function for the people whether the present controlling power be military, political, economic, or some combination. Adjustments that will bring enough benefits to the people may call for upheaval of the status quo, and in some cases, perhaps, for revolution.

What is needed is not only more production and wealth, but also a more equal distribution of the fruits of resource development among the people. It is difficult for us to realize that the introduction of industrialization is revolutionary, not just in the limited sense of “industrial revolution,” but in terms of political and social change. The direction that these subsidiary revolutions will take will not necessarily be in the pattern of democracy as we understand it nor in patterns that are most pleasing to us.

There is neither need nor time to compound examples—to talk about the Philippines, the East Indies, the Belgian Congo, Tunisia, or Latin America. The point is that our industrialized civilization and our technical assistance and mutual security programs make us world members. Our favored position and the responsibilities of world eminence call on us to be world citizens. Isolation is a somewhat shabby dream of the nineteenth century that can have no reality for us today.

I return, then, to my central theme. Because the problems of the conservation of a single resource become involved with the problems of other resources and because the resources form a world pattern of unequal occurrence, development, and disharmonious demand, the problems of conservation quickly transcend the scientific and technological, the special and the local, and get into political, economic, and social ramifications. It is for these reasons that conservation is everybody’s business—everybody’s business at least so long as we have a democracy.

Biological Aspects of Forest Conservation
In Washington and Oregon

LEO A. ISAAC

Dr. Cain has spoken of the broad aspects of conservation as it relates to mankind and the universe as a whole. I have been asked to be specific and speak on forest conservation and its biological aspects. I should like to be even more specific and confine my discussion to the forests of Washington and Oregon.

“The act of conserving, preserving, or guard-
ing," is the definition given in Webster's Dictionary for the term "conservation." But in actual practice when applied to forests or other renewable resources, it has taken on a much broader meaning. Forest conservation has come to mean the wise harvest of forest products, without waste, done in such a manner as to provide for renewal by either natural or artificial means.

Major products of the forest are wood, livestock, water, wildlife, and recreation, listed somewhat in the order of importance; there are more of lesser significance, but any use may predominate on some particular area. Multiple use is the term applied when more than one major product is derived from a forest area. A good example of a multiple use forest is the ponderosa pine type east of the Cascades where timber, livestock, and water runoff for irrigation are produced on the same area. Soil cannot be called a forest product, yet it is perhaps the most important single factor in forest production, and its care and preservation are vital to all other uses.

What is the nature of our forests, what are the biological factors involved, and can we harvest forest crops in such a manner as to maintain and build up productivity rather than to tear down and destroy it? These are the questions I shall try to answer.

In most forest areas where wild stands are being placed under management, it has been found most satisfactory and profitable to aid nature in her process of renewing the primeval species rather than defy nature and effect a complete change through harvest and use, as in the case of clearing land for agricultural crops.

Since the forests of the humid region west of the Cascade summit are completely different from those of the semiarid region east of the Cascades, each general type will have to be treated separately. Recognizing differences within, I shall, for convenience, refer to the former as the Douglas-fir region and the latter as the ponderosa pine region. Since we are meeting here at Corvallis in the center of the great Douglas-fir region, it is appropriate that we start with a discussion of this type.

**Douglas-fir**

Douglas-fir occurs over a wide range in western America, but makes its maximum development here in the Douglas-fir region. It is surpassed in size only by redwood and has produced some of the finest timber stands in America, if not in the world. It often occurs in pure stands, but when in mixture it makes better development than its associates and provides more volume than all its associates combined. For these reasons, it should, in all probability, constitute the most important tree in the managed forests of the future and in our forest conservation program.

Douglas-fir is an intolerant tree that will not reproduce in its own shade. Seedlings become established best in light shade; but, once established, the stand thrives best in full top sunlight. Hence, all virgin forests started as practically even-aged stands except in the drier parts of the region. They followed the removal of the previous stand by fire, insects, disease or windfall, or a combination of these.

It is true that if a Douglas-fir stand is not destroyed by fire, tempest, or other enemies, its tolerant associates, cedar, hemlock, and the true firs, will develop as an understory in dense shade and eventually take over, as the even-aged Douglas-firs mature and die out one by one. We have many examples of this climax forest in different stages of the transition. However, this new climax forest of tolerant trees is inferior to the old even-aged subclimax forest of Douglas-fir. Furthermore, there is one other important point to remember: all of the tolerant associates make their most superior development, not in the all-aged climax forest, but only when they occur as even-aged stands associated with Douglas-fir or with each other.

It is, therefore, a lucky circumstance that man here in the Douglas-fir region needs only to substitute cutting and harvest for nature's methods of complete forest removal in order to prepare an area for renewal of the best type of forest that it can produce and at the same time to preserve other forest values. But substituting cutting and harvest for nature's method of removal is not an overly simple procedure. Nature in the process of renewal was never in a hurry, neither did she demand prompt and full stocking of commercially important species on every acre. In her scheme of things, recreation pressure was not great, runoff was ample even after fires, and there was plenty of time for wildlife to build up on a burned area. Under her methods of removal, soil was never torn up and it was seldom denuded to the extent that it would be highly subject to erosion or leaching.

Since man, for his greater comfort and pleasure, is demanding prompt and full timber crops and at the same time wishes to maintain recreation values, wildlife, stream flow, and other uses, he must aid nature in her processes and help to
speed them up. I shall attempt to tell you how this can be done.

Virgin old-growth stands and young-growth stands present different problems and require different treatment and, therefore, must be discussed separately.

Since under a conservation program we plan to harvest products that would drop out as natural losses, the first logical step is to give the best possible protection to all forest areas against fire, insects, and disease. Fire may be used as a tool to retard brush development, remove excessive debris or raw humus, and to reduce fire hazard. It is usually unnecessary as a silvicultural measure following cutting and has no place whatever in living young-growth or old-growth stands.

Most virgin forests are mature or overmature and many are very decadent. Because of this, they do not lend themselves to rejuvenation and prolonged life through partial cuttings. Studies show that partial cuts result in windfall losses, accelerated decay, and speedy conversion to the inferior climax forest of tolerant species.

Past experience has demonstrated that continuous clearcutting over wide areas associated with slash burning creates an uncontrollable slash hazard and leaves an inadequate seed source. This in turn results in reburns that often leave devastation and treeless brush areas in their wake.

In treating large or continuous forest areas or watersheds of old growth, the most satisfactory procedure arrived at, to date, is to cut in a patchwise pattern, taking the most overmature (or declining) stands first. If access roads are available, first cuttings can be widely spaced; but if trunk roads must be financed by the current cut, progress will be slower and the patches closer together. The patchwise pattern minimizes the possibility of erosion, makes fire control easier and provides an adequate seed supply for prompt restocking. To best accomplish these objectives, patches must be kept small, from 10 acres to a maximum of 40. Maximum effective seeding distances are under a quarter mile and for prompt and adequate restocking, the distance from a seed source should be a great deal less.

Large, continuous bodies of heavy timber are virtually biological deserts. Lesser vegetation, that may be palatable to big game, is low in nutrient content. There is a scarcity of berry and seed bearing plants that provide food for small game and bird life. Wildlife of all forms prefers to feed and live in the sunlit openings and retreat to the dense forest chiefly for protection and cover. A progressive patchwise system of cutting will provide these alternate sets of conditions for all time to come and make a more favorable habitat for wildlife than was found under virgin forest conditions.

Normal young-growth Douglas-fir stands start with a thousand or more trees to the acre. By the time the stand has reached the age of 25 years, the number of trees has gone down to 750, by 50 years, 450, and by 100 years, less than 200 trees per acre. Where topography is smooth enough to make thinnings, and there is a market for the material, many of the (550) trees that fall out of the stand between 25 and 100 years of age can be salvaged and marketed. Also, the trees in the final cut will be bigger and better than if the surplus trees were allowed to die and fall out of the stand. The total yield (including thinnings) will be far greater than that of a normal unthinned stand. Eventually, the time will arrive when there are not sufficient stems left to fully utilize the growth power of the acre and the stand is ready for the final harvest. The operators can then proceed by clear-cut patches in the manner prescribed for old-growth cutting. Here, one word of warning is necessary—thinnings must be accomplished in light, successive cuts. Windfall, sunscald, and insect losses follow heavy cuts in young growth, and this is the most common mistake made by the private operator. He will take from a 60-year-old stand all trees that will make a log, and this will include half of the stems and two-thirds of the volume. The remaining tall, slender trees tumble like jackstraws and his stand is completely destroyed. At times, the operator may wish to clearcut because of steep topography or for other reasons. In that event, he selects a rotation age and proceeds at once with the patchwise pattern of cutting.

Let us sum up the effects of harvesting old-growth Douglas-fir stands by a patchwise system of cutting and young-growth stands by thinnings and stand improvement cuttings. How do these fit into the forest conservation picture? How will cutting move forward? What will we have 100 years hence?

1. The trunk roads and cutting will gradually project themselves into the virgin areas.

2. The more decadent blocks (10 to 40 acres) are removed first in a scattered patchwise pattern moving gradually to less overmature stands.

3. Small size openings will minimize erosion and stream clogging possibilities.
4. Broad walls of green timber between small openings reduce the fire hazard and make necessary burning easier.

5. Seed flight is such that small areas should restock promptly because of an adequate seed source from fringe timber. In the event of a prolonged absence of seed crops or where surrounding timber is below seed bearing age, it may be necessary to resort to planting or seeding.

6. As years pass, a distribution of young age classes will replace the old forest. Under ideal conditions, before a final cut in old growth is made (in 50 to 100 years), some of the young stands will have reached the stage where thinnings can start and the procedure for young growth can take over. The approach to young growth management will gradually reduce waste.

7. A sustained patchwise pattern of openings and timber of different age classes will improve habitat conditions for all forms of wildlife and improve recreation possibilities as well.

Thus, it appears possible to harvest Douglas-fir timber on a sustained yield basis without sacrificing other forest uses.

Ponderosa Pine

The ponderosa pine region, east of the Cascade Mountains, presents a very different forest conservation picture from that of the Douglas-fir region. Ponderosa pine is as intolerant as Douglas-fir. Yet, because of moisture deficiency associated with insect attacks and disease, dense even-aged forests do not develop as they do in Douglas-fir. Instead, the virgin climax type over most of the region is an all-aged forest of ponderosa pine. Here again man may substitute timber harvest for natural losses from drought, insects, disease, fire, windfall, and decay and may do so without seriously impairing other forest uses. The forest use in pine is far more complicated than in Douglas-fir. Water runoff, forage production, wildlife, or recreation may parallel or exceed timber production in a multiple-use pattern. Burning and soil disturbance, because of injury to advanced reproduction and destruction of humus cover, can be far more damaging than in the fir region.

Insects are the most destructive enemy of the pine forests, but scientists have learned how to identify weakened trees that are most susceptible to attack. They have worked out a method of cutting that is known as the “sanitation salvage system” that moves rapidly over the forest with a light cut, taking out the overmature and highly susceptible trees. The method salvages natural loss in virgin stands and leaves the forest in a more vigorous condition for growth and resistance to disease and insect attack. In addition, the procedure enhances, rather than hinders, other multiple uses.

To date, the system is considered the most satisfactory early movement in the conversion from virgin stands to managed forests. Once the overmature element is removed from the forest, there is some question whether these stands can best be managed as all-aged forests or whether they will be most productive as even-aged stands as in the fir. There is a strong possibility that on the better sites in the more moist parts of the region, even-aged forestry will be found most productive; but, on the drier and poorer sites, nature’s method of an all-aged forest will probably prevail. Both systems can be consistent with continuous timber production without hindrance to other uses.

Conclusion

Let us again assume that forest conservation means wise use associated with sustained yield of products. I have tried, in this paper, to point out that our two major forest types are so constituted biologically that they will lend themselves to a true forest conservation program. But this discussion would not be complete if I failed to point out that while conservative use may conserve, overuse will destroy. Too rapid and complete cutting moves the timber edge back more rapidly than necessary for intervening areas to become seeded, and it also makes fire control difficult. Too much burning may destroy seed and seedlings and rob the soil of fertility and lay it open to erosion and leaching. Too much soil disturbance in logging destroys the soil profile and contributes to erosion and stream clogging. Overgrazing in the pine type not only reduces or destroys the annual forage crop but reduces the browse species that are the chief food item of big game and leaves the soil surface exposed to the forces of erosion. Overcutting, overburning, and overgrazing all tend to reduce or hinder the other uses of water runoff, wildlife, and recreation.

Thus, it is evident that here in the Northwest true forest conservation is consistent with conservative use, but it is equally evident that it is inconsistent with overuse.

Here in the Northwest, with reasonable care, we can both use our great forests and keep them.
Biological Aspects of Agricultural Development and Conservation

Joel F. Pechanec

Agricultural development and conservation are a subject that should be close to the hearts of all of us—whether we live in the city or on the farm; whether we work at a lathe, in a logging camp, or on the soil; whether our political doctrines are democratic, socialist, or communist; and whether our religious faith is Christian, Moslem, or other. The food we eat, much of the clothing we wear, much of the water we drink, bathe in, or use for industrial purposes, the relaxation we enjoy in fishing and hunting—all are products of the land directly or indirectly affected by agricultural development and conservation.

What is it that man is seeking to do in this vital field of agricultural development and conservation? Generally speaking, he is trying, first, to increase the populations of plants and animals that are desirable and useful to him; second, to decrease the populations of those species that are harmful, injurious, or not useful to him; and, third, to maintain a reasonable balance between communities of living things and land use practices so that the land can be used in perpetuity.

Why are we now so strongly concerned with agricultural development and conservation? We are concerned because it is essential that agricultural production be expanded to satisfy present world demands and to take care of the increasing demands of the future generations. Increased agricultural production may be brought about in two ways.

First, it may be brought about through what is popularly termed "bringing new land into production." This term is actually erroneous, as we use it, because it is actually converting land to a higher use. Good examples are the conversion of marginal dry-farm wheat land in Jefferson County, Oregon, to irrigated crop land or conversion of range land used in the spring and fall by livestock in central Washington to irrigated land.

Second, it may be brought about by making existing acreages produce more abundantly through employing good land use practices. For the immediate future, we should concentrate largely on this avenue.

Management of land involves production of a crop, whether cultivated, pasture, woodland, or wildlife—production of that crop useful to man which can be most profitably supported without permanent injury to the physical capacity of the land to produce. Modern land management is exceedingly complex. It involves consideration of all factors influencing the use of the land—technical, social, and economic. It will, however, stand or fall, be successful or not, in accordance with the degree to which it employs biologically sound practices.

All of this implies development and conservation by and for the benefit of man.

To make these general thoughts regarding biological aspects more specific, let us examine some of them as they may apply specifically to Oregon.

Two Phases of Biological Aspects—Crop Lands and Range Lands

In Oregon there are three major classes of land—forest, range, and crop. Agricultural development and conservation is concerned with two of these—range and crop land. The management of these two major classes of land illustrates rather divergent biological aspects: ones where man works with Nature, utilizing her process to the fullest to bring about maximum productivity under use, and ones where man seeks to alter environment to achieve maximum production.

To understand clearly the differences in the biological aspects involved, it is necessary to go back to the primeval conditions when Oregon's lands were covered with forest, prairie, meadow, and various types of natural vegetation. Soil productivity was generally fairly high in terms of the native vegetation. Some types of vegetation clothed the soil as fully as the available water would permit. Water relations were good; floods and erosion were occurring at a normal rate; indigenous people, the Indians, were deriving their meager needs from the products of the land.

When the white man came, the products to be derived from the native vegetation and animals would not satisfy his needs. Over the period since settlement began, he has drastically altered the balance achieved by Nature on the better lands where soils were deeper or better, precipitation more favorable, or where possibilities...
irrigation existed. He has cleared the forest, plowed up meadow and prairie, drained marshes, irrigated semideserts, brought in species of plants and animals that had never existed here before, controlled insects and disease, and otherwise injected himself as a dominant feature of the environment.

On the remainder—the rougher, rockier, drier lands—forage from native plants was converted into meat, hides, and work by the livestock introduced by man.

Owing to man’s lack of understanding of the forces of Nature in this new territory, and his failure to adopt biologically sound land management practices, four-fifths of the range lands are in a condition varying from slightly to seriously depleted; soil productivity and water relations have been impaired on much of the crop land.

There is no need to dwell on the misuse of the land that has occurred. You have heard these all too often. It is far more practical to examine some of the biological aspects of land management practices now available which will lead to maximum production under use. For the major portion of the crop lands and range lands we now have biologically sound practices which will permit rehabilitation and use in perpetuity.

BIOLOGICAL ASPECTS ON RANGE LANDS

Our range lands, roughly 40 million acres or about two-thirds of the land area of Oregon, are the lands where native forage plants furnish forage for livestock and big game. They are rough, rocky, semi-arid lands generally of relatively low productivity. At the present time they do not seem to warrant the use of expensive land management measures to alter the environment and make the land more productive.

Basically, our aim on range lands is to achieve maximum sustained production of forage, livestock and livestock products, and big game consistent with other uses of the land for watershed, recreation, and timber production. Because of the present condition of Oregon’s ranges, this means rehabilitation is our major job.

In achieving this aim, we seek to work with Nature, utilizing her processes to the fullest in maintaining and restoring soil productivity, water relations, and forage production. We have as our goal, until we can learn more about what can be attained with man as part of the environment, the restoration of pristine or primeval conditions of forage and soil.

We seek to achieve a maximum forage cover in the form of a complex plant society. This plant society, on a single 1,000-acre tract, may consist of 200 or more species of higher forms of plants. Some of these plants, perhaps one-third of the species, are highly desirable for grazing; some species are undesirable, furnish little forage, are unpalatable, or are poisonous; and the remainder are intermediate in usefulness. The maximum forage cover involves a balance between these classes, similar to that which was present in the primeval plant society.

We seek to secure maximum use of the water that falls as rain or snow, through working toward the primeval plant society, because we have found that maximum moisture infiltration and retention accompanies such a society.

We seek to restore and maintain satisfactory soil productivity, with its complex soil flora and fauna, again through working toward the primeval plant society.

Thus, even though our goal is one not greatly in excess of primeval, it is one in which we may convert the forage into a form useful to man by orderly harvest with livestock and big game, these to be in turn harvested by man. It is through the skillful use of the following biologically sound practices that the production of range lands can be restored and maintained under such grazing use.

Livestock and big game numbers must be balanced with forage production. Not all of the current production in any one year can be harvested. Part of the forage produced by the desirable plants must be left ungrazed if these species are to maintain vigor, and are to be able to compete with the other plant species in the society. Moreover, some ungrazed residue is essential to return to the soil, and maintain organic matter content, soil structure, infiltration capacity, and prevent erosion.

Ranges must be grazed during the proper season from the standpoint of plant growth. Grazing too early weakens the desirable plant species, and the trampling of the wet soil that accompanies it breaks down soil structure and infiltration capacity.

Desirable plants must be permitted to reseed themselves by keeping the numbers of grazing animals in proper balance with forage production and through the use of such systems of grazing as rotation and rotation-deferred, whereby part of the range is permitted to mature and go to seed each year.

The natural tendencies of livestock to concentrate on some areas and kill out the desirable
plants can be combated through the judicious use of fences, riding, herding, and placement of salt.

Nature can be given assistance in restoring desirable forage plants on the range and rebuilding the soil on areas that have been badly depleted through the artificial reseeding of either desirable native forage plants or introduced plants.

We can also assist Nature in rehabilitating ranges where undesirable range plants such as big sagebrush have increased in abundance far in excess of the original amounts or where introduced species such as St. Johnswort or cheatgrass have invaded ranges. Control through chemical, cultural, or biological means is the method at our disposal; but this must be accompanied by natural or artificial measures for restoration of desirable forage plants.

Control of rodents such as gophers and rabbits, and insects such as crickets and grasshoppers is still another means by which we may help Nature to rehabilitate the ranges. In some cases, rodents and harmful insects have increased as a result of range depletion, and in other cases, naturally periodic high populations occur. These rodent and insect attacks often prevent natural revegetation of the range. They may cause further deterioration, and the useful forage consumed by them is essentially lost to man.

Control or prevention of accidental fire is a means by which we can prevent unnecessary loss in forage, damage to the desirable plants, and damage to the soil. In one sense, the prevention of fire will be an alteration of the environment, because occasional fire was in many of the range types a factor in the formation of the primeval plant societies.

All of these measures, it can be seen, are an endeavor to restore maximum forage productivity, favorable water relations, and high soil productivity while at the same time converting part of the annual forage production into forms usable by man.

**BIOLOGICAL ASPECTS ON CROP LANDS**

On Oregon’s five million acres of crop lands, our goal is to achieve maximum production of crops (including animals) useful to man perpetually. In achieving this goal, man has available, and has used sound biological principles. In contrast to range lands, domesticated species are produced in habitats influenced by man. Plants and animals have been introduced that were never present in the primeval conditions. A single species of plant is grown and all others are eliminated; soil remains unclothed by vegetation during certain periods of the year; primeval soil productivity is improved upon by adding soil amendments and in other ways; water relations are improved upon where necessary by summer fallow, irrigation, and drainage; and the environment is altered in other ways.

Through these various practices, productivity of crops has been increased in many cases far beyond that on primeval soils. Substantial further increases over and above this level are possible with what we know now. Dr. Robert M. Salter, Chief of the Soil Conservation Service, reported recently at the National Wildlife Federation meeting in Des Moines as follows:

“Several studies aimed at estimating agriculture’s maximum production capacity are under way. I have examined preliminary results of some. They indicated that with the best combinations of known practices put into use on all farms production could be increased from 60 to 75 per cent. The studies indicate, for instance, that average corn and cotton yields in the United States could be increased about 75 per cent. The potential for small grain and soybeans doesn’t appear to be quite that high, but for hay and pasture it appears that we could double our forage production through grassland improvement.”

Without a doubt, these generalizations for the nation would apply equally well.

More specifically, some of the biologically sound practices available for agricultural development and conservation are as follows:

(1) Use of improved and new crop plants and animals has been and will continue to be a major force in increasing crop production. Plant and animal breeders have created new strains and varieties, and plant exploration parties have introduced new species and strains. Over a long period of time, the use of these improved crops often encourages soil depletion, unless their use is combined with other available practices for increasing production.

(2) Measures for the maintenance or improvement of soil productivity are of major consequence, especially in guaranteeing continued high levels of production. Sound cropping practices are fundamental, and give us improved ways of handling our soils. Crop rotations, involving the use of soil-building legumes, the use of grassland farming, the use of cover crops and green manure crops, and the return of crop residues and animal manures to the soil, offer real possibilities for building soil productivity. The magnitude of these possibilities can be more fully
realized through the use of the following excerpt from Dr. Salter's talk:

"One billion tons of manure, the annual product of livestock on American farms, if completely recovered, carefully preserved, and efficiently used, should produce six billion dollars worth of increase in crop production. The potential value of this agricultural resource is three times that of the Nation's wheat crop. The organic matter content is twice the soil organic matter destroyed in growing of the Nation's grain and cotton crops."

(3) Application of commercial fertilizers such as lime, nitrogen, and phosphate will make a substantial contribution to the productive capacity of the crop land, especially when used in conjunction with some of the other soil building practices. We are not, however, anywhere near the full potential that can be secured from the use of such fertilizers.

(4) Substantial improvements can be made in agricultural development and conservation through improved water supply or water relations, whereby more efficient use is made of the precipitation that falls on the land and the water that runs from it. Part or most of the soil building practices apply either directly or indirectly. Other practices, of major importance to us, are application of additional water through irrigation, removal of excess water through drainage, and retention of water through contour farming.

(5) Elimination of such adverse factors as insects, diseases, rodents, and noxious plants is also of considerable importance.

There are still other practices, whereby man seeks to drastically alter environment, such as frost prevention, hail prevention, and rain making.

It is evident that the biological aspects of agricultural development and conservation are many. The major portion of them are involved in working with Nature, or improving upon Nature. They are involved in understanding the requirements of plants and animals for achieving maximum production. They are involved in permitting the maintenance of maximum soil productivity in perpetuity. They are involved in making the resources of plants, animals, soil, and water of the greatest usefulness to man.

These biological aspects, together with the economic and political, set the stage upon which a program of agricultural development and conservation can be based. The biological and economic aspects should, however, form the basis for the formation of political decisions regarding land use.

In the development of biological principles for agricultural development and conservation, there is a challenge to almost all scientists in the biological fields, and to physical scientists as well. Each has, or can have, a major responsibility. It is up to us to accept this challenge.

**Economic Measures of Forest Conservation**

**Henry J. Vaux**

“What are economically feasible measures to be undertaken in forest conservation?” One answer to this question could be obtained by visiting the holdings of well-informed and progressive forest owners of the Northwest in order to learn what sorts of forest conservation practices they now find it feasible to use. But I have chosen to consider this matter in other terms than those of enlightened current practice, because I think the term “economic feasibility” involves considerations which transcend the profit and loss statement of the individual forest owner. My purpose here will be to raise some questions about what we mean by economic “feasibility” and, in the light of our answers, to suggest the sorts of economic measures which seem most important in furthering forest conservation.

First let me make clear the scope of my remarks in order to avoid misunderstanding. What I have to say is confined to timber resources, and, more particularly, to the use of those resources for production of wood. In order to keep my comments within reasonable bounds of both scope and time, I shall ignore quite deliberately other very important features of the forest conservation problem such as water, recreation, wildlife, and other nonwood forest products. I do this purely from expediency, in an effort to clarify certain issues, and not because of failure to recognize or appreciate forest values other than those inherent in wood.

**Economic Feasibility—What Does It Mean?**

What do we mean by “economic feasibility” in reference to timber conservation? In formu-
lating a precise definition, we encounter difficulty because of the fact that the word "conservation" itself is a term of many meanings. With respect to timber, Fernow, Pinchot, and the other fathers of American forestry popularized the concept of "sustained yield" as the criterion of conservation. Sustained yield implies continuous production with the aim of achieving, at the earliest practicable time, an approximate balance between net growth and harvest. It has provided an invaluable guide to policy and action throughout the formative stages of American forestry. But there are difficulties inherent in the concept of sustained yield, and these are becoming of increasing significance as the intensity of our use of forests grows.

One of the major difficulties is that this concept tells us nothing about the level at which growth and drain should be balanced. For example, today in the Middle Atlantic states sawtimber growth exceeds sawtimber drain. Regionally, timber conservation in the sense of sustained yield has been achieved there. Yet few informed people are satisfied with the forest situation in the Middle Atlantic states. Most people believe that the volume of growth in that area needs to be greatly expanded if proper forest conservation is to be achieved. Here is a case where the formal requirements of a sustained yield goal have been met, but we still fall short of having achieved the goal of conservation.

Besides this question of the appropriate level of growth, the sustained yield concept has certain other inherent weaknesses as a criterion of timber conservation. These include difficulty of application to virgin stands; inflexibility, particularly in relation to the cyclical nature of our economy; and other technical deficiencies which we need not examine in detail. Fortunately, it now seems possible to define a criterion which is free from some of the defects of the sustained yield notion. The purpose of conservation, however defined, is to increase human welfare. The economic component of welfare is largely identical with economic income and the amount, the timing, and the distribution of income are the principal indices of economic welfare. These aspects of income provide the economic yardsticks for implementing Secretary James Wilson's classic instruction to the Forest Service to so manage the resources intrusted to its care as to insure "the greatest good to the greatest number in the long run."

On this basis, then, economically feasible measures of forest conservation can be defined as those which will result in realizing, for the whole economy of the Pacific states, the maximum net income, consistent with an optimum distribution of that income among individuals, and with perpetuation of that income into the future.

**Impacts of a Century of Timber Use**

The meaning of this sort of a definition of economically feasible conservation can be illustrated by using it to evaluate our forest problem here on the Pacific Coast. The question we should like to answer is: How has the past use of the Pacific forest influenced the economic income, and hence the welfare, of the Pacific community? Have we used our standing timber in such a way that the value of the net returns to the economy of the three Pacific states will be as great as possible? Although such a question could be answered definitively only by careful research, the broad outlines of a conclusion seem to be apparent.

We know that since the Civil War more than 450 billion board feet of Pacific Coast timber have been converted into lumber—enough wood to replace every wooden dwelling in the United States today. Probably another 60 to 80 billion board feet have been cut into other useful products. On the one hand, this represents a vast depletion of the heritage of natural wealth which can be passed on to future generations. But, on the other, it has been one of the essential factors permitting economic development of the Pacific states. To adapt a virgin wilderness for human occupation, it was essential to have some source of ready cash with which to start. Standing timber provided a substantial part of these liquid assets which were needed to build the West. Directly, wood from the Pacific forests was used to build the homes, the farms, and the factories of our community. But even more important have been the indirect contributions. Without a cheap and plentiful source of wood, western agricultural development would have been severely restricted both for lack of material with which to build our farms and for lack of containers in which to ship our agricultural products. Many western transportation lines could not have been developed in the absence of traffic provided by our timber industries. In preserving the economic balance between the West and the more highly industrialized East, the fact that roughly half our lumber has found a market outside the Pacific states has been vital in maintaining our ability to import the industrial goods needed to expand and diversify our own economy. Par-
particularly during the earlier period of our growth, standing timber served as a major element in the tax base which permitted the establishment of adequate governmental services. As recently as 1929, forest property represented 36 per cent of the entire rural tax base in the State of Oregon.

In these ways and in many others, the standing timber of the Pacific forest has contributed tremendously to western economic development. Had our past rate of use of that timber been reduced, our development and our income would have been curtailed in roughly equal degree. The conclusion seems inevitable that the gross returns from past depletion of our standing timber have been high.

But, granting this, there are still important questions about the efficiency of past use. Would not income have been still greater if past use of standing timber had been less wasteful of raw material? Physical waste was for long an obvious feature of our wood-using industries. Until recently, as much as two-thirds of the volume of wood material in the standing tree was either lost or destroyed during the manufacturing process. There seems little doubt that part of this waste has been economically costly to society. Yet the costs on this account are easily overestimated. Physical waste and economic waste are not identical, at least when we are speaking of a renewable resource like timber. Sometimes, preventing the physical waste would not be socially desirable because of its excessive social costs. The lumbermen of another day used more standing timber than was physically necessary to produce a thousand feet of boards. Fuller utilization of standing timber would have required greater profligacy in the use of human labor, a resource which was then even scarcer and more vital than the timber resource, and this placed an iron limit on the degree of utilization consistent with maximum income to society.

Yes, we could have used our standing timber less wastefully, but the net savings on this account would probably have been relatively small, because the human effort required to avoid the waste would have been very costly in terms of the needs of a pioneering economy.

A second effect of past wood use on community income has to do with the timing of that use. Even if we grant that the western economy has reaped major benefits from past forest depletion, could these have been increased by spreading that depletion over a longer period of time? Would our economy be better off today, or in the future, if we had held back more of our standing timber supply for cutting in the years ahead? The answer to this question depends on what has happened to the wood-producing capacity of the forest. If our wood-producing capacity is at a level adequate to meet anticipated future wood requirements, then the net effect of rapid timber depletion on the aggregate of our future income is likely to be low. On the other hand, if forest productivity is not adequate to meet future wood requirements, such future timber shortages would constitute a concrete and measurable curtailment of economic welfare.

To determine whether or not such curtailment is likely, we have to make some appraisal both of potential future requirements for wood from the Pacific forest and of the effectiveness of the measures which have been taken to make this wood available.

How Much Timber Will We Need?

During the next half century or more what may we expect to happen to the demand for forest products in the United States? During the past fifty years a number of important factors have been at work which have tended to curtail that demand. Among the more important of these have been (1) the closing of the frontier and the virtual completion of major construction in the American farm economy, (2) periodic declines in the rate of population growth with a consequent effect on residential construction, (3) continued urbanization of our population which, coupled with great technical advances in the use of oil and gas fuels, has decimated our need for wood as fuel, and (4) development of improved nonwood materials and better ways of using them, with a resulting major substitution of such materials for wood. During the past forty years, the influence of these and other factors has been sufficient to offset those other influences which have been tending to expand the Nation's demand for wood. The latter have included principally (1) the truly amazing developments in chemical utilization, and (2) the general expansion of economic activity in the United States.

In speaking of our regional situation here in the West, two other expansive factors should be added: (1) the westward shift of our population, agriculture, and industry, and (2) the decline of eastern sources of timber supply as major competitors of the Pacific forest.

It seems likely that the effects on wood demand of a matured agriculture and of displacement of wood fuels have already largely been realized. Technical improvements in substitute
materials will undoubtedly continue. But better
research in wood technology plus relatively finite
supplies of metals and some other substitutes may
render the impact of this factor on wood demand
less important in the second half of our century
than it was in the first half.

Of the expansive factors, there seems little
doubt that the general growth of the American
economy is the most important element. I think
we often fail to appreciate the magnitude and
significance of this growth because it is some-
thing of which we ourselves are a part. Like
passengers in a night train across the desert, we
are carried along without visible standards of
comparison and hence find it difficult to appreciate
the speed with which we are moving. Ever
since the Civil War our national product has
been doubling about every twenty years. This
increased product results in part from increases in
the labor force and in part from increases in
labor productivity, as capital plant expands and
as organizational efficiency grows. There is rea-
son to expect continued expansion of output in
the future, perhaps at rates comparable to those
of the past.

Because of this expansive trend, the United
States is likely to use as much raw material in
the next thirty years as we have consumed during
the last century and a half. The implications of
this outlook are of the greatest possible import-
ance for a forest area such as our own. It im-
plies that the levels of demand for wood which
we in the Pacific states have experienced during
the past decade are quite likely to be sustained
almost indefinitely, provided we successfully
avoid major economic depressions and provided
we maintain an adequate supply of our timber in
the market.

In view of this outlook, it would seem fool-
hardy to appraise the adequacy of timber re-
sources in the Pacific states in terms of anything
less than their ability to sustain throughout the
next century levels of timber drain about equal
to those of the past decade.

**WILL FUTURE FOREST GROWTH MEET THE NEED?**

Recently, the level of drain from Pacific for-
est has been in the neighborhood of 20 billion
board feet of sawtimber per year. Is our forest
property in a condition to meet continued drains
of this magnitude? For the next 25 to 30 years,
20 billion board feet of drain per year could be
met from liquidation of our remaining virgin
stands. But thereafter most of the cut will have
to be supplied by lands which are now cutover.

The Pacific states contain a total of 63 million
acres of commercial forest land available for
timber production and not reserved for recrea-
tion or other special purposes. In 1945, the For-
est Service estimated that net growth on this com-
mercial forest area totaled 5.3 billion board feet
per year, or less than 30 per cent of the amount
which would ultimately be needed to sustain the
level of drain which we have taken as a norm.
Our net growth will inevitably increase, as virgin
stands are converted to productive condition, as
thriftily growing timber stands which now con-
tain mainly poles and saplings grow up to sawlog
size, and as utilization practices improve. But
even after allowance for these changes has been
made there seems little likelihood that growth in
the Pacific forest will expand to the 20 billion
board-foot level unless timber growing practices
are undertaken which are much more intensive
than those which we see on most of the area
today.

In economic terms this means that unless
there is a substantially greater rate of investment
in timber growing than has been true in the past,
we may well find, 40 or 50 years from now, that
the output of our forests can no longer keep pace
with the regional demand for wood. Unless we
invest more now, consumption then will have to
be curtailed and stumpage prices will have to rise.
This would take place in the presence of millions
of acres of underutilized forest land which could
have been made to produce more wood eco-
nomically, had the necessary investments in tim-
ber growing been made in time. There would
not be a timber famine. The economy of the
Pacific area would not collapse. Our wood in-
dustries would not wither away and die. They
would simply be smaller and less productive than
they might have been. The results would be less
spectacular than those of timber depletion in
China or even in the Lake states. But we would
not have achieved an economic level of forest
conservation, because the net income of our com-
community would be less than it might have been.

**INVESTMENT—THE ECONOMIC KEY TO
FOREST CONSERVATION**

We may thus summarize this economic ap-
praisal of the use of our timber resources about
as follows:

With respect to standing timber, our use of
the forest has perhaps been a bit profligate, but
such use has brought to the economy of the West
returns which have been of great value and which
probably could have been obtained in no other
way. At the same time our use has created a
situation with respect to long run resource pro-
ductivity which seems likely to lead to major
losses to the western economy, unless the situa-
tion is corrected. The key to avoiding major
economic losses on this account seems to lie in
speeding up, substantially and quickly, the amount
of investment in timber growing. We are more
fortunate than older forest regions in that there
is still time to do most of the job, although even
now it is growing late.

In visualizing how timber growing investment
might be increased—in formulating what appear
to be the most fundamental economically feasible
measures to be undertaken in forest conservation
—we may well ask: “Why is it that our economi-
c system seems to have resulted in a use of the
standing timber which conforms fairly well to the
dictates of economic welfare, while it has fallen
short of such a result where permanent produc-
tivity of the forest land is concerned?”

The answer to this question lies, I think, in
the nature of our economic institutions. These
institutions have a profound effect in determining
how closely the decisions made by public and pri-
ivate managers will correspond to what is in the
interest of public welfare and hence of conserva-
tion. It seems apparent that these institutions
have been reasonably appropriate to the job of
making use of the virgin forest asset as one of
the cornerstones on which western economic
development could be built. It seems equally ap-
parent that these same institutions have not been
well adapted to insuring that level of permanent
investment in timber growing which is needed to
maximize the long run economic welfare of the
Pacific region.

INSTITUTIONAL OBSTACLES TO CONSERVATION

How institutional obstacles have operated to
discourage forest conservation of a kind and de-
gree consistent with public welfare can be visu-
ialized by comparing the nature of investments in
timber growing with that of investments in other
lines of productive effort. There are always a
very great number and variety of investment op-
portunities available to absorb the capital funds
of our society. Choice between these opportuni-
ties is governed by familiar economic principles
which, if properly applied, will result in maxi-
mum returns to the economy as a whole. But this
happy result can only be achieved if the choice
of investments is made under certain rather
rigidly prescribed conditions. When we look at
our economic order it is apparent that the invest-
ment dice have been loaded. Forestry suffers
in comparison with other alternatives simply be-
cause of the nature of our economic organization.

Investment in timber growing takes the physi-
cal form, of course, of forest conservation prac-
tices: leaving heavier residual stands or clear-
cutting smaller, better located blocks at the time
of virgin timber harvest; improving the stand by
thinning, weeding, or cleaning; providing better
protection against natural enemies by sanitation,
road development, or other measures. Regard-
less of their physical character, forest investments
are all conditioned by certain common economic
characteristics which go a long way toward de-
termining whether or not they will be undertake
in preference to some alternative investment. Among
these common characteristics the follow-
ing seem to be particularly significant.

1. The attractiveness of an investment de-

depends not only on its prospective earnings but
also on its liquidity, on the ease with which the
investment can be used as a source of ready cash
in an emergency. Immature timber is a very
unliquid sort of investment. The private in-

vestor in timber conservation measures is putting
his money into a very deep freeze. If I buy a
service station, or a restaurant, or an iron foun-
dry, and if I suddenly face a need for cash, I
can usually go to the bank and obtain a loan.
Either by means of a mortgage or some other
legal device, the bank accepts the property in
which I have invested as security for the loan.
But, for the most part, the investor in forest
conservation does not have this option. This un-
favorable situation for forest investment results
from institutional causes rather than from any
fundamental economic circumstances. Under our
banking laws it is illegal for a national bank to
loan money on unimproved real estate as security.
The United States Comptroller of the Currency,
who has jurisdiction over such matters, has ruled
that forest property is unimproved real estate.
Thus, it is illegal for any national bank to extend
credit to anyone with timber property as security.
To be sure, state banks and certain other credit

agencies do not face this limitation and in some
areas they are doing much to improve the forest
credit picture. But clearly, investment in forest
conservation is prejudiced in comparison with
most other investments because of the character
of our credit institutions.

2. A closely related matter concerns the risks
faced by the forest investor, particularly those
from fire. The prudent investor in the filling
station, the restaurant, or the iron foundry can
insure his investment against loss from fire. The availability of insurance spreads the risk, reduces uncertainty, and makes the investment far more attractive than it otherwise would be. Apart from a few very recent and exceptional cases, the investor in forest conservation cannot insure, even though in many areas the actuarial risk of loss from fire may be no greater for the forest than for the foundry. Over the past forty years we have come a long way in improving forest fire protection in the Pacific states. But we have failed almost completely to exploit one of the major economic advantages which such improved protection permits—that is, the development of the institution of forest insurance.

3. No doubt the institution which is most often talked of as an obstacle to timber conservation measures is that of the general property tax. An annual property tax is a kind of a tax on expected future income, and each year that the owner pays a tax, he is being taxed on all his future incomes. Therefore, the more distant the incomes are in the future the more often they are taxed. It is perfectly clear that under this sort of arrangement, a taxpayer is under strong financial compulsion to reduce the number of times that his future income will be taxed; that is, he is pressed to realize those incomes just as soon as possible. This means a pressure against conservative management and an obstacle to investment in forest conservation. The ordinary non-forest investment is not subject to the same pressure, because there the investor has no chance to modify his operation so as to realize next year’s income this year and the effect of the general property tax on the timing of income is largely neutral.

Existing taxation institutions thus are prejudicial to forest investment simply because of the particular form of tax employed. It is a case of schizophrenic behavior on the part of a society which urges, subsidizes, and sometimes even forces conservation practices on owners with one set of public programs, meanwhile discouraging them in such practices with its method of taxation.

4. The institutional obstacles to economic forest conservation which I have thus far mentioned have all been located in the private sector of the forest economy. It would not do to infer that all of the obstacles are located there. Different, but comparable, institutional rigidities sometimes prevent the adoption on public land of forest conservation measures which are fundamentally economic from the standpoint of improved social welfare. We do not have time, nor is it necessary, to catalogue such situations in detail. We point to their existence merely to reinforce the conclusion that a wide variety of institutional obstacles to expanded forest investment do exist.

CONCLUSION

Because we are dealing with a resource which yields its return at very distant dates, with consequent great uncertainty as to the economic significance of those returns, the decision as to what constitutes an economically feasible conservation practice will always depend to a considerable degree on individual judgment. Once we have recognized this, there remain a great many things which can be done to revise or change our existing economic structure so that the actions of both private and public forest land owners will conform more closely to what is necessary to insure maximum economic returns to society from the use of our timber areas. Where the situation is acute and the need urgent, constructive institutional changes sometimes appear promptly. Perhaps the outstanding example of this was in response to your own Tillamook burn. Where it was perfectly evident that the existing institutional structure would not result in an investment in rehabilitation which was clearly essential to the economic welfare of the State, a new set of institutions was set up, providing a source of capital through special financing and channeling it into the needed conservation practices.

Where the need is less obvious, or where obstructing institutions are long established, the necessary action is much harder to achieve. Desirable changes in forest credit, insurance, taxation, and many other things that I have not had time to mention can place timber growing on a more equal footing with other types of venture as an economic enterprise. Once this more equal footing is achieved, expanded forest investment is inevitable. Such expanded investment will provide the measure of our progress toward a more economic level of forest resource conservation. Because our economic institutions are democratically contrived, changes in them will come about too slowly unless they are supported both by those with a direct interest in forestry and by the much larger group of citizens who are concerned about resource conservation. To motivate this larger group toward the job of identifying and removing institutional obstacles is, in my judgment, a most important step in developing economically feasible measures of forest conservation.
Conservation economics is a new field of social science. Because it is so new, I am glad to take this opportunity to present to you this new member in the field of conservation promoters. But please bear in mind the fact that I am introducing to you only that member of the family who applies his efforts to the field of agricultural production; other members of this group apply their efforts and talents to the economics of conserving our other natural resources. Furthermore, I feel that it is only fair that you should have an appreciation for my concept of economics. As I see it, for our immediate purposes, economics is merely an explanation of certain of the motives behind human behavior—the stimuli for some of the activity or inactivity of man in his daily quest for a living. If economics is part of our everyday experience, my task will be that of pointing out to you how the quest for a living influences farmers to apply conservation methods in their everyday agricultural production.

We owe it to ourselves and to our children to make a fuller—a wiser—use of the resources needed in light of present demands and techniques. This is true regardless of what future developments may hold in store for posterity in the way of new resources or new resource uses. This, if you please, may be the moral obligation that the biological, physical, and social scientists of today see as they work for the conservation of our resources. The economist sees his responsibility in helping to point the way to that goal by lighting the path with economic motives. In our time, economic motives are powerful beacons. It is my desire to indicate the manner in which those economic principles that motivate man's everyday activities play a vital role in determining the measure of conservation exercised in the utilization of our agricultural resources.

The part that the desire for higher profits plays in encouraging farmers to use conservation practices is, I believe, an important aspect of conservation. It is that aspect that is all too frequently overlooked by overzealous leaders whose actions are governed more by the heart than by the head. Certain of our agricultural leaders are among this group; they have a considerable following among some farm people. Although moral, spiritual, and esthetic values may be strong forces stimulating some of our farmers, especially those in the upper income brackets, nevertheless for the large majority of farmers in the middle income levels, economic forces are much the predominant motive in their farming methods. For them, conservation will not be a primary goal unless they believe that it also promises a greater income in the immediate future, as well as in the more distant future.

It is recognized that, among farm leaders and leading farmers, certain noneconomic social values probably appear near the top of the list of stimuli in conservation farming. We can look to these people to be the leaders when more profitable systems of conservation farming can be developed for our still exploitive agricultural areas.

**Economic Goals**

Conservation in agriculture has recently taken on a much broader view than it previously enjoyed. As Dr. Robert M. Salter, Chief of the Soil Conservation Service, recently stated, "The concept of soil conservation has come to mean proper land use, protecting the land against all forms of soil deterioration, rebuilding eroded soil, and conserving moisture for crop use, proper agricultural drainage, and irrigation where needed, building up soil fertility, and increasing yields and farm income—all at the same time." In Dr. Salter's final words, "and increasing yields and farm income—all at the same time," I see my justification for stating the economic goal in the conservation of agricultural resources. This goal is to increase farm incomes through increased production of agricultural products while maintaining or improving our agricultural resources. A long time aspect of this goal also includes substituting a larger proportion of flow resources for the fund resources now being used. Of the fund resources used in agriculture, it is our goal to minimize the use of those in relatively short supply while expanding the use of those in relative abundance. Such action, of course, is not only good conservation but also good economics as well and should, therefore, have wide appeal.

In making that statement of our economic goals in the conservation of agricultural resources, I have used two terms that may not
have common meaning. Therefore, let me explain what I mean by flow and fund resources. Flow resources are those that are renewable. Fund resources, on the other hand, are those that are nonrenewable; once they are used, they are gone, at least in that form. Commonly in economics we liken these types of resources to bank accounts. A flow resource is like a savings account wherein only the interest on the principal is used for current needs; the principal is not diminished and remains to satisfy needs as long as the source is not disturbed. Fund resources, on the other hand, are like a checking account wherein each withdrawal to satisfy a current need diminishes the amount left to satisfy future needs. Thus, we see that the use of a fund resource diminishes the amount of that resource available for use of future generations. But the use of a flow resource in agricultural production does not diminish the amount of that resource left available for use by future generations so long as its source is not harmed. The purpose here is not to examine the use of fund and flow resources in a bank but in agriculture, so let us turn to agricultural production and get some examples of the fund and flow resources used by farmers.

Fund resources (those that are nonrenewable) in use daily by farmers include such items as the mineral or inorganic constituents of the topsoil. If topsoil washes off a field through accelerated erosion, it is lost, at least to that field. The subsoil that may be exposed as a result of very serious erosion is another example of a fund resource that farmers use to a more limited extent. The mineral fertilizers, commonly called commercial fertilizers, are another example of fund resources. An exception to this are the nitrogen fertilizers which, to the extent that the nitrogen is fixed from the air, might be considered a flow resource. Nevertheless it is only reasonable to point out that the fixation of this nitrogen represents, in some cases, the expenditure of other fund resources. The use of machinery and equipment as a substitute for human or animal labor is another example of the expenditure of a fund resource. Among this incomplete listing of the fund resources used in agriculture, the most serious consideration must be given to the conservation of our topsoil. The others may gain increasing importance in conservation as time progresses but for the immediate future our topsoil is receiving top priority in conservation matters.

Flow resources, those that may be renewed, are represented in agriculture by the production of livestock. We in Oregon are fortunate in that nearly half of the value of our agricultural production is represented by livestock and livestock products, thereby minimizing our conservation problem. Organic fertilizers, including animal manures, and some of the nitrogen fertilizers, are examples of flow resources used to increase crop production. The growing of legumes and cover crops, as well as the use of good crop rotations, is another example. Better management of our farms through better tillage practices, the use of better seeds and varieties of plants, more timely operations, and plowing down green manure crops is another example of the use of flow resources.

Let us bear in mind that the economic goal in the conservation of agricultural resources calls for the substitution of an increasing proportion of flow resources for the fund resources now being used in agriculture. Furthermore, it is also our goal to minimize the use of those fund resources in relatively short supply while increasing the use of those in relative abundance today. This could mean, in a far distant future, that we would be forced gradually and slowly to replace some of the machinery and equipment that we are now using with hand and animal labor as our population continues to increase. Let us hope that our population never forces us to this point. Nevertheless, the first responsibility of agriculture is to expand production to feed the increasing population, no matter what the number may be.

We are ready for that critical question: How does agriculture in the United States measure up to this standard of conservation economics? Or stated in other words, is conservation farming in the United States economically sound?

**Conservation Farming Economically Sound in Long Run and Short Run in Some Areas**

There are areas in the United States, some within Oregon, in which conservation farming has proved to be economically sound, both in the long run and in the short run. By this I mean that there are some areas in which the farmers find conservation farming financially profitable not only as they consider saving the land for future use but also in their current year-to-year operations. In Oregon we find examples of this type of profitable conservation farming within the Willamette Valley where dairy farmers and grass seed farmers show greater profits by following conservation practices than if they do not do so. Our dairy producers along the Ore-
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gon coast are another example of those who find conservation farming profitable. Many of the farmers producing vegetable crops in western Oregon also find it profitable to follow conservation practices. Looking outside the State of Oregon, we find that in the corn belt of the Middle West those farmers who are following the accepted crop rotations for conservation are also finding it to be more profitable than exploitive farming. The dairy farmers of the Great Lakes states and the New England states also find that conservation pays for them, both this year and next year, as well as looking into the future.

Why is conservation farming economically sound in these areas? Basically it is because science has been developed to the extent that we now have methods of farming whereby we get increased production from our land at the same time we have lower unit costs. This means that through systems of conservation farming, it is possible for farmers to increase their production and produce each unit of product at a lower cost, while at the same time they are also conserving their agricultural resources. We must recognize that in some of these areas during a short period of transition from the system of exploitive farming into that of conservation farming, farmers may find their net income reduced some. This is due to capital investments being made in the interest of increased profits in the years ahead, and to lower production for a year or two while the new cropping system is becoming established. If conservation farming is profitable in such areas and we realize that all farmers are not practicing conservation, who is at fault? Who is falling down on his responsibilities?

For a clue to the answer let us turn back to Dr. Cain's remarks when he stated that "conservation is everybody's business." Certainly, it is true that everyone must be conscious of conservation problems and work toward a common goal of conserving our natural resources. Nevertheless, I feel confident that Dr. Cain did not mean that certain responsibilities need not be borne by various groups but rather he meant that it takes all groups—everybody—working together to achieve the conservation necessary for a continued high standard of living. I wish to indicate the part that some of these groups should play in this drama of man and his resources. Without some delegation of responsibility the drama might become a farce, and that wouldn't be humorous for the standard of living of future audiences.

Dr. Salter has said, "The best land operators in all parts of the country are making their soils produce about double what the average farm is producing." With this fact in mind, together with the statement that conservation farming is profitable for most farmers in these areas, why is it that we still do not have all of the farmers practicing conservation? I feel that the answer lies largely within the field of the educators and the social scientists. They have not done a good job of selling conservation to the farmers. Educators, both in the public schools and in the colleges, have not done a complete job of selling students on the importance and profitability of conservation farming. Agricultural extension workers, and federal and state agricultural personnel have not succeeded in convincing some of the farmers that conservation is best for them both in the immediate future and in the long run.

Within the field of social science much remains to be done on this problem. Improvement in land tenure needs to be made on many farms to make conservation more attractive. The leases on many of our rented farms are either too short in tenure or have terms that are not conducive to conservation. Many of them do not provide compensation for unused investments in long-term rotations. Only a few of the most progressive leases will provide flexible rent payments in times of a disaster not caused by the renter. These problems need to be corrected, and fortunately some progress is being made on them.

Another problem is farm credit. Production credit for the year-to-year operating expenses of farmers, and long-term mortgage credit for the purchase of farms generally are quite satisfactory these days. There needs to be considerable improvement in credit to be used in converting exploitive practices to conservation farming. The Federal Reserve Bank of St. Louis has been a pioneer in providing credit for farmers for the specific purpose of making conservation improvements on individual farms. These conservation improvement loans have been designed so that the terms of the loan meet the needs of the farmer. The interest rates are attractive both to the farmer and to the lending agency. The use of such loans needs to be more widespread throughout the United States.

Still another problem that needs to be tackled by the social scientists is that of unstable farm incomes. So long as farm incomes vary so widely from extremely low incomes as we saw during the depression days of the 1930's to the balmy days of 1948, conservation farming will
be difficult to sell to some farmers. Low incomes discourage conservation. With falling farm prices, high costs and high taxes, it is discouraging for low income farmers to attempt to change their system of farming to one that will conserve agricultural resources. Efforts that will help to stabilize the economy of our entire nation will also help to stabilize the income of farmers. It is necessary that we should work toward the end of stabilizing the entire economy of our nation rather than that of the farmers alone.

As conditions exist in 1952, I feel that the biggest piece of unfinished business for the biological and physical scientists in these farming areas lies within the realm of a greater degree of substitution of flow resources for those fund resources now being used in the farming operations. The use of greater managerial skills, the application of better techniques of tillage, the use of better varieties of crops, and the development of more satisfactory crop rotations might be some of the improvements that the biological and physical scientists can develop for these areas in the near future. Looking ahead, of course, there is the constant challenge of keeping up with the world in technical progress as it may be applied to agriculture. This matter of substituting more flow for fund resources represents a sort of a backlog or catching-up process as I see it now. But so much for these type-of-farming areas. Let us look to other regions within the United States and see whether or not conservation farming is economically sound there.

**CONSERVATION FARMING ECONOMICALLY SOUND ONLY IN LONG RUN IN SOME AREAS**

There are some areas within the United States in which conservation farming is economically sound for most farmers only in the long run. An example of such an area is the old cotton belt of southeastern United States. Perhaps the best single example within the state is our range land of southeastern Oregon. Ranchers of southeastern Oregon, similar to ranchers in other semiarid regions, find that it takes from three to five or even seven years after they have switched to a system of ranch management that might be considered conserving their resources before it really begins to pay them to do so. During this period of transition from the exploitive type of ranch organization and management to a conservation system, we find that most ranchers are actually making less income than they had been previously. During the transition they are investing in the future by making long term improvements to their range and to their ranch. Most of these improvements or capital investments are of a nature that they do not pay off financially within the first few years. Mr. Pechanec told us of many of these improvements. They include such things as seeding the range to better types of grasses, developing watering facilities, building fences so that the livestock may be managed more easily and equitably over the range, developing stock trails, and generally providing for better management of the livestock and the range. Why is it that a conservation system of ranching is profitable for the rancher in the long run but not in the short run?

During the period that a rancher is getting his grazing land and his livestock organized so that he may take advantage of nature's long range plan, he is making investments in future operations, and this involves expenses. True, we fully expect that he will be repaid for these expenditures in future years. Nevertheless, for at least a few years his expenses may exceed those under an exploitive system of ranching. In some instances his annual gross returns may be somewhat lower than they were under an exploitive operation of that ranch. Usually, it is only after a period of several years that the vegetation on the range has a chance to develop and increase to such an extent that he gets more days of grazing and consequently more pounds of beef, mutton, or wool to sell from his ranch. Then it is that conservation ranching really pays financially, and in other values as well.

Probably one of the best examples of a big area in which the conservation farming is economically sound for most farmers only in the long run is the old cotton belt of southeastern United States. Here we commonly find small farms, soils run down and eroded, farms poorly equipped, farmers not well educated to the possibilities of conservation, and farm families dependent upon an annual cash crop that will provide them with at least a meager subsistence until the next crop may be harvested. All too frequently in these areas the farmers depend almost entirely upon the cash obtained from the cotton crop for their subsistence. Some systems and methods of conservation farming have been developed to meet the needs of this area. It is unfortunate, however, that most of these systems and methods that have been developed for this area involve transitional changes in the farming methods that are expensive and are not economically profitable in the short run for most farmers. This is because they generally require additional...
capital investments during the period in which the conservation system is being established. The annual operating expenses frequently are higher during this early development period also. Then, too, during this period the cash crop may be decreased, thus providing less income for the family to live on during the next year. In such cases, farm families not only will not, but they can not, change over to a conservation system of farming.

Many of the farm families cannot take a lower income on a year-to-year basis even for a few years and still survive. This is true even though they realize, as we realize, that in the long run conservation does pay in this area. It pays because over the long run soil fertility will be built up, crop yields will be higher, in most instances more than one source of annual income will be used, and in general a more stabilized, profitable system of farming results. It is the hurdle of the first few years of getting this conservation system of farming established that is the unsurmountable obstacle to many of the farm families in the old cotton belt.

It is in these areas such as the range areas of southeastern Oregon and the old cotton belt of southeastern United States that I see a real challenge to the educators and social scientists. Our biological and physical scientists have provided us with conservation systems of farming that will be profitable in the long run. We have not sold these systems to the farmers to the extent that most of them can and will adapt them to their farming. In the cotton belt, the need for education is not only at the conservation level but also includes the three “R’s.” In the range areas, it is largely a matter of doing a better job of showing, telling, explaining, and defending the long run advantages of conservation ranching.

Perhaps the greatest need that can be satisfied by the social scientists in these two areas is that of land tenure improvements. Better leasing arrangements such as fairer rents, longer term leases, and greater flexibility of leases so that renters will be encouraged to practice conservation, and larger farm units are land tenure problems to be worked out. Another need is that of farm credit. Most of these farmers and ranchers need credit to establish a conservation system of farming or ranching. These credit needs are such that the existing forms of farm credit are not too satisfactory. The terms of the credit and the interest rates both need to be modified for conservation loans.

We require the continued help of the biological and physical scientists to develop ever better methods of conservation farming in these areas. We need better varieties of plants and better breeds of livestock to do a good job in the range area and in the cotton belt. Much progress has been made on these, as Mr. Pechanec has told us, but much remains to be done. In the cotton belt, we need better tillage methods and more suitable tillage implements as well as improved breeds and varieties. These are only some of the examples of things that the physical and biological scientists can help us develop in order to promote conservation farming and make it economically sound in the first few years of getting the practices developed on individual farms.

This may sound extremely pessimistic. It need not, for much progress has been made in the past 15 years. The biological, physical, and social scientists have developed ways and means of promoting conservation farming in these areas. Educators have spread the story of the benefits of conservation practices to farmers so that many of them have been sold and have adopted them to their farming operations. But much remains to be done, and it was my intent to paint a somewhat gloomy picture so that we would not, in our overoptimism, think that the job has been done. Let us turn now to a type-of-farming area in which the conservation picture to the biological and physical scientists is gloomy indeed.

Conservation Farming Not Economically Sound in Other Areas

There are some type-of-farming areas in the United States in which conservation is not economically sound for most farmers, especially in the short run. Perhaps our most outstanding example of one of these areas is the semiarid wheat regions. A good example of this is the Palouse wheat area of Washington and the upper Columbia Basin region of northeastern Oregon. In this area it has been proved that, for most farmers, it is not profitable to follow the conservation practices that have been devised by our scientists to conserve the soil. In the wheat region around Pendleton, Oregon, evidence indicates that during the period in which conservation farming is becoming established it is unprofitable to follow soil conserving methods. Even after a ten-year period to permit the farmer to get his conservation system well established, it has been rather difficult to prove that it is profitable for most of the farmers to follow conservation methods. Surely this is a real indictment that must be faced head on. I must hasten to add that even in this area there are some farmers who
find it profitable to follow conservation practices. This may be explained in part because they have a large enough scale of operations so that they can do a much easier and better job of making this transition from wheat to other forms of agricultural production, usually including some livestock. Many farmers now making a comfortable income from wheat are reluctant to raise any livestock.

Why is a conservation system of wheat farming in such areas unprofitable? The answer seems to lie in the simple fact that, under the conditions experienced in at least the past ten years, the wheat farmers in this region have discovered that they can make more money by exploiting their soils than they can by conserving them. This means that their crop yields through an exploitive system of farming have not decreased so much but that the production tied to the high price of wheat has permitted them to make a higher income from exploitive agriculture than would be possible from conservation farming. To make a gloomy picture appear even worse, I might add that conservation farming in this area would require additional capital investment plus the extra hardship of a lower income during the period in which the conservation system is becoming established. But this must not be taken as a complete indictment of our scientists. Certainly they have been at work in these areas. They have developed ways and means of producing higher crop yields—more wheat per acre. They have done this while lessening soil erosion but not while practicing what could strictly be called conservation farming in any true sense of the word. We can also add in defense of the physical and biological scientists that they have discovered ways and means of conservation farming. If a farmer chooses to follow the practices they have developed, he can be quite well assured that his farm will be in good condition to pass on to future generations. Where our scientists have failed thus far is in developing a system of conservation farming that would be profitable to the individual farmer in the short run, year after year, without undue risk of the loss of either his farm income or his topsoil.

To make the prospects look even more unpromising to the conservationist is the fact that some of our scientists view the situation as one in which it is not only uneconomic for the individual farmer to practice conservation methods in this area, but it is also scientifically unwise for him to do so. This view is expressed because some scientists feel that at least on some fields exploitive farming with its consequent loss of topsoil exposes subsoil which is even richer in its mineral content than the topsoil that is now being farmed. It is admitted by them that the subsoil does contain less organic matter, but this will be added as the roots of the wheat plants extend down to the lower depths. In this manner, the scientists maintain, a farmer with these deep soils is unwise to prevent a small loss of topsoil each year. It is the reverse of the situation of the Nile delta where farmers profit from the annual deposition from the overflowing of the Nile. In this instance, the farmers would profit, so it is claimed, by the loss of a small amount of topsoil each year, thus exposing rich subsoil to the root zone. Some rather noted soil scientists in other parts of the country have stated a similar view concerning a moderate amount of soil erosion in other types of farming regions of the United States. I believe that it is safe to state that in all cases these scientists modify their statement to include only a moderate amount of annual loss of topsoil. In some instances such a loss, without greater damaging effect, would be difficult to control.

In such farming areas, the real challenge to the biological and physical scientists as I see it now seems to be to develop a system of farming in which conservation of the topsoil will be profitable to the individual farmer. Undoubtedly this would entail better crop rotation, better tillage methods, better tillage implements, and perhaps better varieties of wheat. Our biological and physical scientists are making progress on this problem but the end is certainly not in sight at this moment.

In the semiarid wheat regions exemplified by the upper Columbia Basin of Oregon, we find a big unfinished job for the social scientist. If we accept the thesis that conservation farming in this area is not economically sound for most farmers, especially in the short run, then it is up to the social scientists to help the physical and biological scientists until the latter can solve the problem. As I see it, we have an urgent need for "stop-loss" measures while our biological and physical scientists develop better methods of farming applicable to these areas. So long as it is not profitable for the individual farmer to adopt conservation farming, I see a real case for public payments to make up the difference between the income that would be derived from conservation farming and the income that is derived from exploitive farming. This is based on the unproved assumption that conservation of
these resources is in the public interest. Although I personally cannot justify public payments for conservation practices that are profitable for the individual farmers to carry out without the benefit of these payments, still in this area I feel they have a real place. This is so because conservation farming, under these conditions, is not profitable in its own right. If it seems desirable in the long run to protect the topsoil of this farming region, then I feel that it is in the interest of future generations for the present public to make payments to individual farmers. These payments would make up the difference between the income derived from exploitive farming and the income that would be derived from conservation farming. Such public payments would aim to achieve the goal of saving our topsoil to produce higher yields for future generations.

Perhaps one approach to this problem would be that of assuring us that the price of wheat would be more in line with the price of other alternative agricultural products that might be produced in this region if conservation farming were followed. Such measures as better farm credit, better farm leases, more equitable rents, and generally better management of the farms would undoubtedly also help solve this problem and be within the jurisdiction of the social scientists. It is my understanding that until the biological, physical, and social scientists have made more headway toward solving this problem, the educators do not have as urgent a job as they do in other type-of-farming areas. Frankly, we do not have a positive, attractive, profitable conservation farming method that we can offer to the farmers in the semiarid wheat regions of the United States. Fortunately, that statement does not apply to most type-of-farming areas in the United States.

**Summary**

Let me summarize these views with a less pessimistic, more hopeful attitude toward the prospect of making conservation economically sound for more of our farmers throughout Oregon and the United States.

Perhaps it is desirable to remind you that, even as an economist, I am fully aware that people do things for reasons other than for profits alone. The desire to make a living is not the only force motivating farmers but, for probably a majority of our farmers, the profit motive is foremost. It is on this premise that the field of economics can be, should be, and must be used in promoting the conservation of our agricultural resources. In those areas where conservation farming is profitable, the fact that it is profitable should be emphasized more strongly by those who are educating farm people. A good salesman uses more than one appeal in selling his wares. Let conservationists be more aware of this strong selling point and insist that economists provide the factual information to use in the educational program.

In those areas where conservation farming is not now economically sound, economics can serve to guide the biological and physical scientists as they seek new methods of conserving the agricultural resources. The test of relative profitability of alternative farming systems and methods should be used as a final check on new developments in the science of agricultural production.

The economic goal of conservation farming is to increase farm incomes through increased agricultural production while maintaining or improving our natural resources. The long-time aspect of this goal calls for a gradual substitution of flow resources for the fund resources now used in farming operations.

In some type-of-farming areas, a system of conservation farming has not yet been developed to achieve this goal. In such areas as the wide-open range of the West, the old cotton belt of the Southeast, and the semiarid wheat lands of the Great Plains and the Northwest, it is more profitable, at least in the short run, for most farmers to continue exploitive farming, albeit more of a gamble on the weather. These areas provide a real challenge in conservation for the biological, physical, and social scientists.

The biological and physical scientists must discover new methods by which farmers find conservation farming profitable within one, two, or three years after adopting them. The farmers of today cannot wait for 25, 50, or 100 years to be paid for the things they do in the interest of posterity. Conservation must pay now as well as in the future or else society must make up the difference in the form of public payments. Farmers cannot be expected to bear such burdens alone.

For these areas social scientists must devise laws, credit systems, farm tenure policies and systems, as well as suitable methods of public subsidies, that will encourage the conservation of our agricultural resources until such time as the other scientists develop methods that make con-
Conservation farming economically sound. Educators have an important duty in all farming areas.

The role to be played by the various members of the conservation cast is not the same as the scenes shift from one farming area to another. Agriculture is dynamic both in time and in space; so must be the conservationists who would be of real service to farmers and consumers, present and future.

Trends in International Resource Development and Their Significance for the United States

Stanley A. Cain

Important as is the ideological division of the world between communist and noncommunist countries, it seems to me that the division between the developed and the underdeveloped countries is even greater. If tomorrow there were no more Communists, most of the serious problems of the world that are being faced by earnest men would still exist. We should still have to ask ourselves many questions about the underdeveloped countries and about the postwar efforts toward their development. These efforts are a part of the program of containment of Communism.

I shall speak eventually of the patterns of cooperation that are being developed between the stronger and the weaker countries, but first I wish to describe some of the characteristics of underdeveloped countries. Comparisons that are made of countries to show their degree of development usually have to do mostly with the material side: the numbers of tractors, refrigerators, miles of road, bathtubs, gadgets, electrification, etc. One often sees also statistics on population and the comparative numbers of schools, hospitals, teachers, and physicians, and something about the political and social conditions, trade, the national product, per capita income, etc. I do not wish to use statistics, however, revealing though they are, but to compare developed and underdeveloped countries in terms of education and the employment of inanimate energy. Herein lie many of the differences that are significant, especially as to resource development.

Education

In comparison with countries of the West, the people of underdeveloped countries are low in general education. This is not just a matter of literacy because, without learning and understanding, tradition, superstition, and prejudice characteristically determine attitudes and actions. All countries contain some persons of great learning, and there is often among the people of an underdeveloped country a profound respect for the few learned persons in their society. But learned persons can be too widely isolated both in space and time to be generally effective. There seems to be a kind of threshold: enough people have to have enough knowledge and understanding if there is to be effective change of public opinion and if the people are to rise above a certain level.

Learning in underdeveloped countries is largely in the areas of the humanities—religion, philosophy, and literature—and there is often skill in politics and law as well. But the primary distinction of underdeveloped countries is their low understanding and use of the scientific method.

It is the scientific method that erects hypotheses on a basis of known facts and then seeks verification through additional facts and a constant testing of the validity of principles. It can be demonstrated, I believe, that it is the wide difference in application of the scientific method that has brought about much of the present difference between the developed and the underdeveloped countries. It is the scientific method, applied largely to the material arts, in industrialized countries that has revolutionized in so short a time not only their ways of doing things but also their ways of looking at things.

By and large in underdeveloped countries the ways of doing things are traditional. Rule-of-thumb methods prevail. Learning is personalized through apprenticeship, and techniques apply only to specific tasks. The scientific method produces generalizations, and scientifically arrived at principles have a wide if not a universal application that can be learned from the printed page. Without scientific principles there is a certain randomness, a trial and error, in whatever search there may be for improvements. But the laws of genetics, for example, are equally applicable to the development of hybrid corn in Mex-
We should be humble about our superiority, however, and remember that underdeveloped countries have not reached that level of living that frees very many of their people from a continual struggle to keep body and soul together. It takes a certain excess production above a bare subsistence living for a country to attain the stability, security, and education that permits a widespread and continued application of scientific principles and technological methods. We need also to remember, in our efforts to provide technical assistance, that many of our specific techniques that function well in our culture may not be readily transferable to another culture whereas scientific principles are transferable.

There is a great contrast between countries as to the extent of their application of the scientific method. It should be noted, however, that in the western industrialized democracies the application of the scientific method and its spirit of rationality have been almost exclusively in the material arts—agriculture, industry, medicine, and some phases of business—and that this has made for great advances, but that the scientific method has scarcely been applied to the societal arts. The result is a growing spread between the material and the societal aspects of social organization. This cultural lag in the societal arts—as in political, social, and religious institutions—is natural, because the possibilities of verification of hypotheses are limited and difficult in this area. I do not mean to suggest that search for truth and a striving toward a better life can always employ the scientific method or that other methods are not proper and useful. But the possibilities of verification of hypotheses—the convincing secret of the scientific method—can and should be employed where appropriate with respect to human institutions as well as material matters.

In industrialized societies, in the United States for example, it is possible to rationalize freely about the material arts, but large elements of tradition, prejudice, and backwardness still rule the societal arts. There are contrasts, however. The corporation is a societal invention that is comparatively recent and very successful. It can be said, I think, that the hypothesis of the corporation has been verified. In contrast the county and township structure can be mentioned. Designed for and appropriate to horse and buggy days, these institutions are costly and inefficient in the present days of rapid transportation and communication. Max Ascoli has recently pointed out in the Reporter that political parties are inclined to cling to the past and shun experiment. They are, he says, ruled by the words of Ecclesiastes: "The thing that hath been, it is that which shall be."

If the cultural lag, the difference between the rate of advancement of the material and the societal arts, is as great as I suggest that it is in western countries, a sudden advancement of the material arts in many presently underdeveloped countries may produce an even greater disconformity there. A sudden introduction of industrialization in many countries can be disruptive to political, social, and economic institutions that are centuries old in their ways. This is an important point for our programs of technical and economic aid around the world and for a general acceptance of the scientific method. Even if it is confined to material things, it is revolutionary.

We are well adjusted to the idea of the industrial revolution. I think we are heedless or fooling ourselves, however, if we believe that we can transplant pieces of our industrial civilization into Asian, African, and Latin American cultures without violent reactions. It often seems that while trying to help the common man, through our programs of technical cooperation under Point Four and the like, we at the same time endeavor to preserve the status quo. What I mean is that our overseas power is often thrown with the prevailing power in a given country—with the vested and ruling interests, whether their power be military, political, economic, or social. This is a frustrating business that is currently illustrated in the United Nations by the Tunisian case. By using our influence in the United Nations to prevent consideration of the Tunisian case we are in effect backing French colonialism and blocking the interests of many small nations and underdeveloped countries. It is difficult for such people to believe our good intentions, to doubt our economic imperialism, and yet a strong France is also important in this sad stage of history. Such is one dilemma that we face. Are we or are we not for the common man? In the Belgian Congo? In the Near East? In Asia? And in other troubled spots where the spirit of man is seeking escape from the nineteenth century? People everywhere are stirring. They are seeking a better way of life. Many of them are experiencing their first hope. They want relief from poverty; ill health, illiteracy, and misgovernment. They want and need our assistance, but with the necessary freedom to
work out their own solutions. We aid and abet their aspirations with our programs of technical assistance and economic cooperation. We sometimes find ourselves in the incongruous role of helping the pot boil while trying to sit on the lid.

The United States started out as a capital importing country. Europeans invested money in the original colonies and the young United States. They invested their people. They sent us European culture in all its richness. We are now in a position to export capital. And capital is not just dollars. It is materials, machines, methods, organization, institutions, know-how. We can now help many countries get started toward improvement and capital accumulation—productive capital accumulation. Perhaps most important is our understanding of the scientific method, for capital accumulation includes the accumulation of inventions. At least in the area of the material arts, it can be said that the invention of inventiveness (America has no patent), controlled by the scientific method rather than by trial and error, is the most significant invention of all, and that inventiveness and our stock of inventions represent our richest resource.

These remarks have all been made under the head of education. I think that the great contrasts between developed and underdeveloped countries arise largely from the differing degrees to which people have come to understand and employ the scientific method. This is not the whole picture, and I think we have yet to learn much about our own culture while being extremely ignorant of other cultures. It is for such reasons that caution, patience, and great tolerance for the people of other cultures are indicated. Although the solution of many world problems is not a simple technological matter, I have great faith in the scientific spirit. I also have great faith in the “backward” people of underdeveloped countries. Their qualities are no less than ours, only their experience.

**Energy**

In trying to face the facts of life I have suggested the need for education, at home and abroad, in the sense of increased understanding. In addition to a general understanding of the interrelations of things and processes, I have stressed the great significance of the scientific method. I now wish to suggest that the outstanding fact in the application of the scientific method to the material arts is the adaptation of inanimate energy to man’s work through machines of various kinds. There have been, of course, many concomitant developments—the factory, various business institutions, labor organization, social insurance, etc.—but these are concomitants, not original causes.

In underdeveloped countries the energy available for man’s work is largely animate energy, the work being done by the muscles of man, his domestic animals, slaves, and women. This also was the condition of the presently industrialized countries before the industrial revolution. The first age of man, from an energy point of view, was based on animate energy and encompasses all history up to industrialization. The second age of man can be dated from Watt’s steam engine, at about the time of the signing of the Declaration of Independence of the United States, and is based on energy from the fossil fuels, coal at first and then petroleum and gas. The completeness of this change is illustrated, for the United States, by the fact that 87 percent of all energy used for production is now based on the fossil fuels.

It has been said that the change from animate to inanimate energy has caused the inevitability of scarcity to yield to the possibility of plenty. Man’s human energy potentials have been freed by his release from labors that machines can do better. He is freed, to a large measure, to play the roles for which his superior intellect has prepared him, for the development of characteristics that distinguish man—his reason, his awareness of beauty, and his moral sense. This freeing of man for higher roles is the ultimate significance of the mechanization of work.

Industrialization calls for, if it does not call forth, radical adjustments of old cultural patterns. I wish to illustrate this point by a brief reference to population problems. During the age of animate energy manpower needs and the general difficulties of production, low life expectancy and insecurity of many kinds called for a positive attitude toward large families. Many of the old values have been diminished, however, and in many cases a large family is now an economic liability rather than an asset.

If our goals include a standard of living that is satisfactory and includes more than material welfare, it is simple to see that its attainment will result from the nature of the relations between resources and people. The natural environment sets certain limitations. Coal, for example, is or is not present in the same region as iron; climate and soils are or are not readily conducive to intensive agriculture. But resources are not just things and physical conditions: re-
sources come into being, as it were, by virtue of the technical and other cultural conditions of the society involved. Copper, cobalt, tin, tungsten, petroleum, etc., had little if any significance for primitive cultures in comparison with their importance for an industrialized society; and uranium to pick another example, was an unimportant element until a few years ago. Our thriving economy can afford reclamation projects that make desert land arable, but at a cost of hundreds of dollars per acre, at costs far beyond those that can be sustained by many societies. Without compounding examples, the point is that the scientific method together with the use of inanimate energy results in greatly increased production in agriculture, basic industries, and manufacturing. In short the earth is made to yield more and more riches and an increasing abundance for man. These processes are favorable for an increased level of living and a general human betterment. But the equation has another element, people. They provide the demand for which the natural resources must provide the supply.

The needs of the people are compounded of two elements. The first need results from the numbers of people—to reduce it to its simplest terms, it is the mouths to be fed. The other element of the demand is the level of living. The capacity of man to consume natural resources goes up with industrialization. In the United States, the common man today lives better than kings of old. To return to the numbers problem, how many people there are is a result of the past action of the birth rate and the death rate. Independent changes of these rates have great significance for the rate of population growth.

Agricultural and industrial revolutions have resulted in increased production and have allowed larger populations to live better than ever before in the history of man. Furthermore, the sanitary revolution—improvements in medicine, public health, and sanitation—have operated with increasing importance on the death rate. Infant mortality, in fact death at all age classes, has been reduced until average life expectancy of babies born currently in the United States is pushing seventy years. This is in dramatic contrast with the life expectancy in underdeveloped countries today and for all peoples before two short centuries ago. But one factor of population is left out so far, the birth rate. The sanitary revolution has not yet significantly affected the birth rate for most peoples of the world. The world's population is currently growing faster than ever before in its history, and, by and large, production is not keeping pace with the growing demand.

I cannot help but have the impression that much of the opposition to population growth results from an emotional, rather than a rational, reaction. The public has not been educated to appreciate the value of the resources that help make it possible to support this growing population.

I wish to point out the great impetus to population growth received from industrialization and the accompanying factors. Although the rate of population growth has slowed somewhat in the countries that have had the longest experience with industrialization, their populations in the meantime grew several fold.

This point has the utmost significance for presently underdeveloped countries now taking steps along the historic paths of agricultural, industrial, and sanitary revolutions. In many cases these countries are already densely populated. It does not seem possible that increases in production can keep ahead of the biological potential of the people to expand their numbers when they begin to enjoy the first fruits of “westernization.” As a matter of fact much of the overcrowding of these countries is already due to these influences, and without appropriate population policies the condition of the rapidly growing populations promises to get much worse before it gets better. This is a pessimistic conclusion, but it is one that has already been substantiated in many places around the world. One can not be too hopeful for the future, because the governments involved, including our own, are leaving out of consideration one of the dependent variables of the equation that must be balanced if man's well-being is to be improved. Programs of international resource development can ill afford to ignore the population problem and, specifically, the necessity of operating on the birth rate as well as on the death rate.

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I should not want to minimize the difficulties of these problems, for they are ones to which man reacts emotionally rather than rationally. They are, however, problems that can be tackled technologically, as in the development of suitable contraceptives, and socially through the application of knowledge that can be gained by social psychologists and cultural anthropologists. We shall be more than remiss if these problems are ignored because of out-dated mores and Victorian taboos.

Patterns of cooperation

After this brief characterization of some of the differences between the developed and the underdeveloped countries, I wish to discuss some of the action programs in which the United States participates that are intended to facilitate economic development in various parts of the world. The needs, ideas, and agencies for meet-
ing these needs have been brilliantly discussed by many persons. I need only to refer to Paul G. Hoffman’s “Peace Can Be Won,” Nelson A. Rockefeller’s “Partners in Progress,” Stringfellow Barr’s “Let’s Join the Human Race,” and Arthur Goodfriend’s “The Only War We Seek,” to suggest the deep humanity with which the problem has been discussed.

President Roosevelt at the time of the signing of the Atlantic Charter, in discussing the third of the Four Freedoms, said eloquently: “We have come to a clear realization of the fact that true individual freedom cannot exist without economic security and independence. ‘Necessitous men are not free men.’ People who are hungry and out of a job are the stuff of which dictatorships are made.”

Point Four, to take a specific example of an activated development program, got its name from President Truman’s inaugural address in 1949 in which he described as the fourth point of the United States foreign policy a program of export of Yankee “know-how” and “show-how” to underdeveloped countries, backed up by governmental and private investment capital. The need for such a program President Truman described in the following words: “More than half the people of the world are living in conditions approaching misery. Their food is inadequate. They are victims of disease. Their economic life is primitive and stagnant. Their poverty is a handicap and a threat, both to them and to more prosperous areas.”

The Truman Plan for Greece and Turkey was our first post-war venture. It was quickly followed by the Marshall Plan for Western Europe (the ECA), and later by the Point Four Program (TCA). The ECA has developed a Far Eastern division, and all these far-flung efforts are now a part of the Mutual Security Agency (MSA). The amount of money that has been spent and that seems in the future to be required is measured in many billions of dollars, the current presidential message to Congress calling for $7.9 billions for military and economic purposes overseas. Private American capital is currently being invested overseas at the rate of about a billion dollars a year, but about two-thirds of this amount is in petroleum, and the total is inadequate for a significant world influence.

In the United Nations, the Economic and Social Council is much concerned with underdeveloped countries. It deals with higher standards of living, full employment, and conditions of economic and social progress and development; it seeks solutions of international economic, social, health, and related problems; it seeks international cultural and educational cooperation, and a universal respect for human rights and fundamental freedoms. Although attacking problems on a world scale, ECOSOC has regional commissions such as the Economic Commission for Europe (ECE), the Economic Commission for Asia and the Far East (ECAFE), and the Economic Commission for Latin America (ECLA). It cooperates with the Specialized Agencies of the United Nations, such as the International Labor Organization (ILO), the Food and Agriculture Organization (FAO), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the World Health Organization (WHO), the International Bank for Reconstruction and Development, etc. It cooperates through our State Department with the Point Four program, and also with very numerous nongovernmental agencies working in international development fields.

It is clear enough, I think, that there is a tremendous effort being made in recent years to improve the well-being of people generally. We should ask ourselves many searching questions about these matters. Should we let well enough alone? Can we really help effectively the whole world toward self-improvement? Is development necessary? Is development inevitable? Is it even a good thing? What do we mean by it? Can the United States afford to participate? If so, to what extent? Can we afford not to participate? Are the programs on which we are embarked soundly conceived? What are their chances of success? The costs of failure? What will be the effects after a few years on our economy? On our political and social institutions? Are we winning friends and allies, or are we further alienating many nations? Will our potential allies and enemies be strengthened, or will we be weakened? Can our economy stand such expenditures as seem to be required? Are we rapidly exhausting our own natural resources through our role as world leader? Can we isolate ourselves from world problems? If so, to what extent? If we agree that technical assistance can be extended to many countries around the world, do we have both the technologies and the technologists? Are our peculiar skills transferable? Are we trying to export democracy? Do we recognize that we are a revolutionary force in the world? Should we try to sit on the lid of countries boiling with nationalism or revolting against colonialism?
Why suggest more questions? The problems are innumerable, and exceedingly complex. They are not simple economic problems, nor simple technological problems for which we have immediate “know-how.” These problems will not stay confined. Surely they are economic and technical, as in agriculture and industry, but they are simultaneously political and social. The American culture and the diverse and divergent cultures of many countries around the world get inextricably tangled in these problems of development.

Back in 1938 Walter Lippman prophetically said, “In our time we shall witness the dawning realization that a new power exists which is destined to be . . . the giver of peace, and that its mission is to prepare itself for the accomplishment of that destiny. I refer, of course, to the United States of America. . . . It is better to play the part knowingly rather than to drift. However much Americans today may dislike it, they cannot refuse it. Their greatness, their position and their power among the peoples of the earth imply that they must accept their destiny. They must accept the enormous burdens and the heavy responsibilities.”

Early in 1951, after his experience as administrator of the ECA, Paul G. Hoffman said, “Almost all of us have now reluctantly accepted America’s new position of leadership in the world. But this does not automatically signify that we understand how that leadership can best affirm itself in ideas and action which reflect the national will and the national character. If we are to lead effectively, we must work with the rest of the free world on a basis of partnership and unity, founded on respect for views and interests other than our own. This is a matter of elementary psychology . . . .”

I have already implied and shall now affirm that I believe that the necessity and hence the drive toward development are inevitable. The United States, especially, and other developed countries must assume their necessary roles in the world picture. Although the advances in communication and transport have not made us One World, they have made all nations close neighbors. There is, furthermore, an international dependence that varies directly with the degree of development. It precludes isolation. Just think of the fact that the United States, with between 6 and 7 per cent of the world’s population, has about half the world’s industrial capacity and consumes about half of the world’s total mineral production. We are dependent upon many underdeveloped nations for such minerals as tin and chrome, and could not continue our peacetime economy without such imports. And in times of war and preparation for defense many dozens of imported items become strategic and critical. Our production capacity, in both agriculture and industry, exceeds our consumption by perhaps 17 per cent. We must sell overseas to keep the wheels of our industrial economy turning. We cannot sell without buying, except, perhaps, as we export dollars. It is recognized that underdeveloped countries must increase their purchasing power if they are to be our customers.

It has not been possible to resist the trend of economic development in the United States. During the rather short history of our nation our population has grown at a rate equal to about 2 per cent a year, to double every 35 years, but our national product has grown about twice as fast. Thereby hangs the explanation of our steadily rising level of living, and the inevitable nature of the economic development process. People like it.

I believe that the urge toward economic development will not be resisted in underdeveloped countries. People generally, even in the most remote areas of remote countries, have begun to believe that their traditional, depressed ways of life are not inevitable. If not for themselves, at least for their children, there is for the first time a hope for more food, better health, and, I believe, some measure of individual integrity and freedom. There is a stirring, a restlessness that will not be resisted. It is to be seen in the surging nationalism everywhere, and in the rebellion against imperialism. The common people everywhere want a better way of life, in material things, of course, but also in matters of the spirit. Their revolt is against the conditions of their lives. It is against their own people, against the landlords and the moneylenders, but it is also against foreigners because of their long history of political and economic domination and exploitation. It is ultimately a drive toward the brotherhood of man, an equality of opportunity and the freedom to chart one’s own course, although the people concerned may not be conscious of the direction of social evolution.

No country is at present completely isolated from the gadgets and the fruits of western development. Comfort, health, and security have become great goals. Nations want to work toward these goals. They are often dreadfully in need of assistance toward these goals, and as-
The authors of this report say, "The difficulties of economic development in the Far East are so great that even with increased production alone people will not have enough to eat. But I do not believe that the world's resources would permit the entire population to be fed. A 1950 report of the Rockefeller Foundation on Public Health and Demography in the Far East makes this point with great strength. It is the experience of the West, however, that the operation of these influences that are concomitant with industrialization do not effectively reduce the rate of population growth until several decades after the death rate has been cut. Underdeveloped countries tend to have high birth rates and high death rates. The first effect of industrialization is to cut the death rate. The birth rate is cut only decades later. In the meantime there is a tremendous population growth. Many presently underdeveloped countries already have very heavy population concentrations. There is reason to believe, in the absence of a positive population policy, that the imbalance between food production and population increase will result in widespread famine. It is extremely naive to conclude that by increasing production alone people will be better fed. A 1950 report of the Rockefeller Foundation on Public Health and Demography in the Far East makes this point with great strength. The authors of this report say, "The difficulties of economic development in the Far East are..."
and people will be improved in the near future merely by efforts toward increase of production. There must also be strong simultaneous efforts to operate directly on the population factor.

This is one of the disturbing conditions in nearly all of the programs of the various national and international development and technical assistance agencies. The only agencies, insofar as I know, that recognize the existence of the problem sufficiently even to discuss it publicly are ECOSOC and UNESCO. To a great extent United Nations agencies seem to ignore, be afraid of, or obfuscate this problem; and the same can be said of our national agencies such as Point Four.

There is some recognition, but I think an inadequate one, that the western technological civilization has tremendous cultural differences from the underdeveloped countries. The State Department's Foreign Service Institute is a step in the right direction. But we need a deeper recognition of the necessity of starting with people where we find them. We need a greater humility toward people who have the same qualities but not the same experience as the people of the developed countries. We need a greater respect for their cultural qualities that lie in the societal, rather than the material arts. At the same time we must recognize that the introduction of production-increasing developments will draw forth forms of political, social, and economic change that may not always be in the pattern of the United States. Without due recognition of these complicated matters there is danger of technological failure; there is real danger of not producing the human betterment that is our mutual goal.

The final danger is that our efforts may result only in exploitation, exploitation rather than development. That is to say, we run the danger of ruthless use of resources—a failure of conservation. The western countries have a very poor record in the use and care of their own resources, and in many instances a bad record of exploitation of the people and resources of underdeveloped countries. If only a short-time view is taken of the development process, exploitation and ultimate damage to the resource base will be the likely result. Our actions should have a long-time frame of reference. Fund resources should be used with caution; every effort should be made to place renewable resources on a sustaining basis. A failure adequately to recognize this problem may result in some immediate improvement in level of living, but can only end in disaster and the defeat of our hopes for strong and friendly world neighbors.

As a conservationist, I must also remark about the influence of the development process on our own resource base. There are economists who view all population increase as good, for it means more workers and more consumers. They also assume that the only healthy economy is a spirally growing one. Both these views ignore the physical limitations of the world's resources. There will be an end sometime to copper, to iron and tin, to coal and petroleum. There is ultimately a limit to cultivable land. These are tricky matters, and there is not time to discuss them; but it is self-evident that the world is finite and many resources as we now know them will sooner or later be exhausted. Perhaps man's resourcefulness will be adequate to the coming squeezes. We can hope so. The point, however, is that the American production machine is already drawing into its maw raw materials from the four corners of the world. Our programs of overseas assistance are also causing us to spend some of our national resources in export. As the development process gains headway in many countries, the demand for raw materials will produce increasingly drastic conflicts in national needs.

There would seem to me to be only one escape from this dilemma, and that is the erection of world-wide institutions for solutions of these problems. Patterns of cooperation can and must be developed, if only for our own benefit.

In conclusion, then, I wish to say that I am unequivocally for the various recent goals of the international development programs. But I think that we need to give serious thought to details of these programs, because they are fraught with hazards, and they are seriously out of balance. Whether it be the problem of containment of and ultimate defeat of Communism or the encouragement of world development and trade and a general rise in levels of living, production alone will provide no solution.

It is one thing to have our feet on the right road, but it is more important to be sure that we are headed in the right direction.
Selected Supplementary Reading

For “Conservation Is Everybody’s Business” and “Trends in International Resource Development.”


