SPEECH BEFORE

THE EASTERN SNOW CONFERENCE
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After listening to the papers presented this afternoon, I have decided that the proper title for my talk this evening should be: "What Am I, a Forester, Doing Here?"

At bottom, I am just a dirt forester. I learned as a young squirt, wading hip-deep in snow up in the Maine woods, that forests help prolong the life of a snow pack.

But this scarcely qualified me as a scholar in hydrology or meteorology. It is unlikely, therefore, that any of you will leave this dinner with invaluable nuggets of new knowledge on snow.

As a matter of fact, my being here tonight reminds me of my first days as Pennsylvania's Secretary of Forests and Waters. Our hydraulic engineers persisted in throwing at me such words as cavitation, inverts, and capacity index curves, assuming, naturally, that I knew perfectly well what they were talking about.

After a few weeks' exposure to this treatment, I assimilated their jargon and found myself using their terms on my own. I astounded old friends and associates with this new-found knowledge; before long, many new acquaintances either forgot or never knew I was a forester. I became an expert engineer. Today, with perfect aplomb, I address the most sanctified professional engineering societies on our hydraulic problems.

I will be frank. I am semantically masquerading in somewhat the same way tonight. I meant my proposed title: "What Am I, a Forester, Doing Here?" seriously. What, indeed, is a forester doing talking to a group of experts interested in the problems of snow?

There are, of course, many people in this room who provide one kind of answer. I note, for instance, a number of our colleagues from the Northeast Forest Experiment Station of the U. S. Forest Service. Mr. Howard Lull and his associates in the watershed research section of that station have bridged the gap, if there ever was one, between forestry and hydrology with substantial research in the field of forest cover and its influence upon watersheds.

You have, in years past, heard from several others, such as Mr. Henry Baldwin, of the New Hampshire Forestry Commission, who also explored this vital subject. These gentlemen are engaged in what we old college professors like to call an "inter-disciplinary" discipline. That hyphen in "inter-disciplinary" is simply the grammatical equivalent of the will of nature.

Every day, our universities, shocked by the facts of life, are driven to creating a new hyphenated profession.

No matter how we divide and sub-divide our intellectual and scientific pursuits, the unity of the natural world refuses to let us work her as if she were made up of so many convenient pigeon holes.

Just a few weeks ago, I had occasion to hammer this home to one of our young foresters. He was well aware, from the textbooks I threw at him only a few years before when he was one of my students, that good forest management is an integral part of watershed management.

Still, after he left school and had been on the job for a few years, he persisted in going about his day-to-day operations as though all he wanted to harvest from the woodlands under his jurisdiction was timber. Rarely, in his everyday practice, did he operate his management plan with water yields and water retention in mind.

All of you are aware, I am certain, that water has suddenly become the nation's number one domestic problem. Massive urban regions, concentrating enormous numbers of people in great blots across the national landscape, strain to the utmost the watersheds within serviceable reach.

And it is not simply the increase in human numbers which has strained the demands on our watersheds. The habit patterns of an extravagant consumer economy and the water requirements of a mammoth industry have aggravated the demands for water eight or ten-fold.

Industrial production has increased by eight times since 1900. Our population has grown about 2 1/4 times in the same period. The absolute water needs of a human being -- by absolute I mean those specific everyday needs we all have whether we live in Melanesia or New York -- during normal times is about 20 gallons.

Today's American, taking into account the use of water in manufacturing his food and other necessities, uses about 1200 gallons per day.

Lack of good water has killed more than one civilization. It has driven us to the extremes of human ingenuity, as the New York City underground aqueducts or the Los Angeles water system will attest.

Water, not timber, has become the most important product of the forest. That

is why there are, and have been for 17 years, foresters among you at this conference.

This meeting is a symptom, I think, of the increasing concern which our society has for its basic resource -- water.

The Far West has always been heavily dependent upon the snow packs of the Sierra and Rockies for survival. But here in the Eastern United States, snow has seemed to play only a slight role in the over-all water supply.

Snow has been, and will continue to be of concern to us when, combined with rain, it brings floods. In past years, you have heard of the role of the snows of 1936 in the New England floods of that same year. The very same snows put my department in the flood control business. Prompted by the disasters brought on by these floods, the Pennsylvania General Assembly passed the Flood Control Act of 1936. Today, because of that law, Pennsylvania has one of the most extensive state flood control programs in the nation.

Snow has always been troublesome because of what it does to our utility lines, or our transportation network. The Pennsylvania Highway Department spends about $18,000,000 annually to remove snow from the state's roadways. I hate to admit it, but this is more money than the two-year appropriation for my entire Department.

Snow is not always a curse, however. We have just realized this in Pennsylvania. Those of you from upper New England, New York and Canada have known for some time the economic boost derived each year from winter sports.

My Department has just completed the first State Park designed exclusively for winter sports in Potter County, not far from the New York State border. This is a pilot project that will lead to others if successful.

It is not as a source of fun that we are taking a more profound interest in snow, however. It is as a source of water. For water, even in water-bountiful Pennsylvania, has suddenly become a major problem.

In 1958, 34 communities in our Commonwealth were drawing on inadequate water supplies. Northern New Jersey has had a particularly critical water picture for several years. New York City has gone further and further into the hinterlands searching for water. And all of us -- Pennsylvania, New Jersey and New York City -- have turned to the Delaware River to satisfy our increasing demands.

Now, the Delaware is a pretty small river. It is only 326 miles long and drains only 12,000 square miles. Yet, we estimate that about 22 million people in one way or another depend upon it. It serves one of the most highly industrialized regions in the world. A flood on the Delaware in 1955 cost

us $164,000,000 in damages and repairs. Recreation along the Delaware, as in the rest of the nation, has zoomed as work hours have shortened, wages increased, and transportation improved.

It is as an industrial river and as a source of water supply for the heart of the nation's largest urban region, however, that the Delaware takes on a pre-eminent role.

About 13 per cent of the country's industrial workers depend upon the water in the Delaware. Industry draws almost 85 per cent of all the water taken from the river. The catalogue of industries along the Delaware is fascinating -- 80 textile and dye plants, 78 chemical plants, 42 paper mills, 11 steel mills, 8 refineries, 6 tanneries, 4 coke and gas plants, 5 hydroelectric plants, 3 breweries and 2 distilleries.

It has been estimated that roughly half the world's crude oil is refined on the Delaware -- a process requiring huge amounts of water. The Tidewater Refinery in the State of Delaware withdraws water roughly equivalent to the domestic consumption of the entire city of Philadelphia.

The City of New York currently takes about 440 million gallons of water from the Delaware for its daily water needs. This is expected to increase to about 800 million gallons in the relatively near future.

Philadelphia and its environs are growing by leaps and bounds. Some municipalities in the area have already suffered from water shortages.

Obviously, therefore, the waters of the Delaware must be detained in their rush for the sea in order that man can make full use of them.

In May, the U. S. Army Corps of Engineers will complete a $2,000,000 study of the Delaware which will contain recommendations for the comprehensive development of the entire river. This study was carried out through the cooperation of 19 Federal agencies, four states, the two major cities of New York and Philadelphia and innumerable local organizations.

The mountain of paper, ink, tables, photographs and illustrations it contains is a testimony to the complex inter-relationships of nature. Here we have complete and documented proof of the utter dependence of the city dweller upon the subtle cycles of precipitation and the equally subtle cycles of the forest floor.

Every man has allowed the distractions and concrete of an urban civilization to divorce him from the intimate spiritual contact with nature he once had. But physically, though he knows it not, he is closer to Mother Earth than ever before.

Cities, through their concentration and dependence upon the resources in a relatively small area and through the kinds of human activities which they inspire, are most vulnerable to the vagaries of nature than the old agricultural and

nomadic societies -- surprising as it may seem.

It is for this as much as anything else that I am enthused over the study on the Delaware. This unique study and plan, it seems to me, represents the increasing influence of the resource specialist -- the hydrologist, the meteorologist, the forester, the agronomist -- in the affairs of an urban culture. We are coming once again to the realization that man is pretty much what his home, Earth, makes him.

While the most spectacular part of the Corps plan for the Delaware may be the scores of reservoirs it will call for, there are equally important parts of the study that may not strike the layman as impressive.

The retention of water in the basin long enough for it to be used by the cities involves more than a complex of reservoirs.

Here is where snow and forests share a common characteristic. They both retain water for gradual release to downstream water-users -- providing, of course, that unusual weather conditions do not complicate the picture, as in 1936.

The density of forest cover and the species of trees in that cover play an important part in encouraging or discouraging the lifetime of a snow pack.

Even in Northern Pennsylvania, we are well south of the region receiving more than 20 per cent of its precipitation in snow. Nevertheless, snow still provides a substantial amount of run-off. The Corps of Engineers, in cooperation with the U. S. Weather Bureau, has estimated that the annual snow fall in the Delaware Basin ranges from 15 inches in the bay region to about 70 inches in the headwaters up in the Catskills of New York and the Poconos of Pennsylvania. Obviously, this snowfall on the Upper Delaware can be put to work.

The U. S. Forest Service has played an important part, too, in the Corps study. The service has found that despite its close proximity to heavy centers of population, the upper Delaware Basin is forested over more than 70 per cent of its area. This, of course, is where the heaviest precipitation occurs. And this is where some of the largest reservoirs in the Corps plan will be built.

About three-fourths of the forest in this area is northern hardwoods. At first glance, this may seem less favorable than a forest cover of confiers in terms of prolonging snowmelt. But as Howard Lull and Norman Tripp have stated in their paper which appeared in the Journal of the New England Water Works Association a year ago last December, the advantages of increased shade and wind protection from conifers is frequently offset by the fact that the branches of conifers intercept a substantial portion of a snow fall which, resting on the branches, then evaporates and returns to the atmosphere.

Interestingly enough, the interception of snow fall by the branches of conifers more than off-sets their advantages over hardwoods. Pierce, Lull and Storey found that hardwoods averaged 1.75 times more snow depth than was measured in the open. The conifers had a ratio of 1.5.

The Department of Forests and Waters, together with the Northeast Forest Experiment Station, is currently carrying out an experiment to determine the best means for re-foresting those portions of the Delaware Basin plagued in the past by serious forest fires. It may well be that, as a result of this project, we will find that the best forest cover for prolonging snow-melt would be a mixed stand of conifer and northern hardwoods.

There is not a great deal of information available at present on snow packs in northern hardwood forests. Mr. Sartz and Mr. Trimble of the Northeast Forest Experiment Station published some of their work in the August, 1956, issue of the Journal of Forestry. As a result of their studies in a New Hampshire forest, they found that snow accumulation in hardwood forests can be increased and the snow pack prolonged by cutting narrow openings in the stand in an east-west direction. On the area they studied, strips about 30 to 40 feet wide were best, but other proposals might be better in the latitudes of the upper Delaware watershed.

Before the 13th meeting of this conference in 1956, Mr. Henry Baldwin noted that the forests exert considerable influence as a wind barrier and thus on snow depths on the lee side of a stand. He found that the largest accumulations were found where the distance between trees was equivalent to the height of the trees. He also noted that the water equivalent of the snow is usually greatest about 10 or 12 feet from the trees. These findings, as he noted, would be particularly useful in managing the forest cover around reservoir sites.

A number of scholars have discussed the beneficial role played by forests in the floods of 1936. By shading and by blocking the heavy rains from reaching the snow, the forests prevented about half the snow pack, where it was protected by the trees, from melting. The pack even retained some of the rain water that fell. In open fields and high on the barren mountain slopes, however, the rains melted nearly all the snow cover.

There is no question but that more research of this kind is needed. I commend to all of you two Station papers on this subject from the Northeast Forest Experiment Station, both of them derived from research in the Forests of New Hampshire. One called "Snow and Frost", by Mr. Richard Sartz, was published in 1957. The other, by George Trimble, outlines a program for Watershed-Management Research and was published last year.

In 1958, my department, together with the U. S. Forest Service and the Pennsylvania State University, announced a new Pennsylvania watershed management research project not far from State College. Called the Leading Ridge Experimental Watersheds, the project area will be used to make survey-type streamflow,

climatic, interception, evapo-transpiration, soil-moisture storage, groundwater, and plant association studies.

Obviously, however, work at Leading Ridge will not answer all the questions that we must find answers for in the Upper Delaware Watershed. More research is required in this specific area. In addition, so far as I can tell, we have not gone far enough in devising concrete forest management plans around the reservoir sites in the Corps of Engineers plan. By devising sound management plans with water retention and water yields in mind, we can, in effect, increase the size and capacity of these urgently needed reservoirs. We have an opportunity for the first time to embark upon a complete and integrated resource development for a major urban region. I urge that the techniques of forestry and hydrology be given as important a role as reservoir construction itself. In this way and only this way can we bring balance to the enormous New York-Philadelphia complex.

I view the comprehensive development of the Delaware River as one of the most vital public works programs not only in the nation, but in the world. Never before has a project of such magnitude benefitting as many people, serving as many interests, been devised and we hope soon implemented.

It will be unique in the fact that, for the first time, 4 states will enter into an interstate compact with the Federal Government as an equal partner. We hope it is a test of our governmental organization, of our civic spirit, of our faith in the future, and of our technology.

In implementing such a plan, perhaps we can for the first time realize that urban development, taken in its large sense, actually encourages sound conservation.

In a very perceptive paper which appeared last year in "Perspectives on Conservation", published by Resources for the Future, Luther Gulick stated that "the growth of urbanism has now raised resource matters to the level of imperative public interest." He continued that "Arising primarily out of the new pressures of urbanization on our resources, there are now four matters for priority action . . . these are allocating water resources, eliminating flood dangers and water pollution, reserving open spaces and controlling the general pattern of land use." He concluded, "These are four key factors I would identify as now calling for containment. If the American people will take a firm hold of water, open spaces, air pollution, and the land use pattern around the urban centers, they will be able to bring urbanization into reasonable and rational balance with the major national resources."