our statement was not a careless one and that it meant what it said. Although intensive study was not possible until 1938, the increasingly unhealthy appearance of birch had been under observation since 1932 (see above reference). We were careful, however, to avoid labelling this as something more than normal decadence, or a passing physiological disturbance, until all doubt was removed in 1935.

G. W. Barter and J. Clark of this Laboratory have recently completed an analysis of meteorological data and measurements of tree growth that provides further evidence regarding the apparent spread of dieback. It indicates that growth was being affected as early as 1935 in central New Brunswick. I hope that the publication of this information will help to prevent speculation about the cause of this malady that does not fit the facts of its occurrence.

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FIELD NOTES

By Cam Place

Last year, Dr. L. Leyton of the Imperial Institute of Forestry at Oxford University spent about six months in North America, and lectured on British research in forestry at a number of the universities. I was most impressed with the contributions research has made to forestry practice in Great Britain and by how much we could benefit from the work there. I was pleased, therefore, to learn that the University of Toronto may publish a forestry bulletin based on these talks.

In northern Europe good forestry is usually traditional; but in England good silviculture was rare before 1920: the landed gentry were more interested in the beauty and game of their woodlands. The lessons of two wars were necessary to convert the landowners and government to the "religion" of forestry.

Forestry research had to start from nearly scratch just as did ours, but being bound by no traditions, it has developed along novel and interesting lines. Since heath and peat moors occupy about a tenth of England and Wales and more than half of Scotland, it is not surprising that most research has dealt with the problems associated with afforestation and with tending plantations. In particular, the afforestation of infertile lands has led to much study of tree nutrition. Dr. Leyton himself has contributed greatly to the use of foliar diagnosis to detect nutritional deficiencies, and has shown that this technique in expert hands can yield valuable information.

If deficiency of a particular nutrient limits growth, then increasing the supply of that nutrient results in a strong correlation between the level of the nutrient, the growth of the tree, and the nutrient concentration in the leaves. Over the range in which additional nutrient leads to a marked growth response, the relationship between tree growth and nutrient concentration in the foliage is essentially linear—even though the curve as a whole is one of diminishing returns.

For a given species and site, it is often possible to determine the critical nutrient concentration in the foliage which marks approximately the upper end of the linear portion of the curve. This has been done for certain species with nitrogen, potassium, and phosphorus. Interestingly enough, the evidence is beginning to suggest that these critical concentrations may be largely independent of site conditions. I have not mentioned the complications involved in the technique, but it is apparent that foliar diagnosis may be powerful means for determining the sufficiency of the nutrient supply of a stand and the range in which response to fertilization may reasonably be expected.

Now what relevance have these findings for us? The usual attitude is that forest trees have very low nutrient requirements and that since most nutrients are concentrated in the leaves and twigs, they are left in the forest anyway. Nature has managed to grow forests on the same soil for thousands of years without evident deterioration of the trees or soil. In any event, fertilization is economically unfeasible; the fertility of the forest soil is just one of those conditions of site that we have to live with.

Until a few years ago, that was largely my attitude also. However, in 1955 a colleague of Leyton's, Dr. Peter Rennie, published a work which shakes one's complacency. Utilizing all the data he could lay his hands on, he calculated the actual nutrient drain of European forests in 50- and 100-year rotations. A vastly greater amount of nitrogen, phosphorus, potassium, and calcium are removed in the trunk wood and bark than most of us have realized. This removal is particularly grave when considered in relation to the actual nutrient supplying capacity of many poor forest soils or depleted soils that are being afforested. Indeed, Rennie bluntly asserts that many of these soils simply do not have either the available or reserve supply of nutrients to support continuous growth and harvesting of trees without fertilization.

He also attacks the idea which is popular with many foresters and ecologists that establishing so-called "soil improving" hardwoods will regenerate virtually any degraded soil. Harvesting mature timber, leaching by rain, and to a lesser extent burning, do not immobilize nutrients within the site in a non-available form; they remove large quantities from it altogether.

Certain hardwoods can concentrate nutrients at the soil surface, particularly if the subsoil has large mineral reserves; they can sometimes improve the waterholding capacity of coarse soils; the alders and legumes can fix atmospheric nitrogen in the soil. But no trees or shrubs can create mineral elements that are not present in highly siliceous, inherently poor or worn out soils. As one of America's most eminent forest soil specialists is fond of putting it, "From nozzinks comes nozzinks".

I am not implying that Canada's forest soils are in imminent danger of exhaustion. Most forest soils that have not been exhausted by farming can probably stand considerable abuse. Many of them certainly get it. However, it does none of us harm to think about the future. For example, how long will the Douglas fir sites in the coastal rain forest stand the nutrient drain of

enormous timber crops and heavy leaching owing to high rainfall plus the occasional fire thrown in for good measure?

In eastern Canada and the adjacent United States, abandoned fields are a problem right now. The white spruce plantations at Grand'Mère, Quebec, are certainly suffering from nutrient deficiencies. Most foresters who have travelled through southern Ontario, Michigan, or Wisconsin have seen many stunted plantations with chlorotic foliage, or plantations which have stagnated after the canopies have closed.

My opinion is that many of the people who are so eagerly planting old fields will lose their proverbial shirts. It would be foolish to suggest that all the woes connected with plantations are owing to poor soils. Insects and fungi can cause havoc on their own, particularly when we help them by planting large areas to one or two species only. But nutrient deficiencies certainly aggravate damage caused by insects and fungi and often make it impossible for a stand to outgrow such damage.

Having implied that fertilization will eventually be necessary in many of our stands, I may as well be inconsistent and inveigh against indiscriminate fertilization. The literature on the subject is enormous. White and Leaf (1957) have published an annotated bibliography containing more than 700 references.

In North America, fertilizer trials in forest stands have so far been the realm of a few specialists. There have been some successes and many failures. This has also been the story in Europe. The non-specialists seldom hear of the failures. "So-and-so at Split-lip Creek applied umpteen dozen pounds per acre of superphosphate and ammonium nitrate and got a 300-percent increase in growth in five years. Why can't we?" Unfortunately ideas of this sort are being encouraged by fertilizer manufacturers who have over-expanded production facilities, particularly of nitrogen. Mayer-Krapoll's (1956) report on German foresters' successes with fertilizers is a good example of an uncritical review designed to promote unjustified optimism.

Inevitably much money will be wasted in dumping the wrong fertilizer on the wrong soil for the wrong species because the users do not know enough about soil chemistry, the action of fertilizers, or the nutrient requirements of the trees they are trying to grow. To mention obvious examples, there is little point in fertilizing trees growing on deep, coarse soils where moisture is a limiting factor, or on waterlogged soils that lack sufficient aeration.

Actually little is known about the nutrient requirements of most of our commercially important trees. Carefully designed experiments are needed to give a scientific basis for the use of fertilizers in the forest. A few investigators are working at the problem—for example, Wilde and his associates in Wisconsin, White in Michigan, Stone in New York, Voigt in Connecticut, Armonson in Ontario, Aird in Quebec, and Stoate in British Columbia. Unfortunately this work takes time, and I am afraid the fertilizer boom may be upon us before we are ready. Those who are interested will find a well written and painless introduction to the topic in Chapter 16 of Professor Wilde's new text (1958).

References

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- RENNIE, Peter J. 1955. The uptake of nutrients by mature forest growth. *Plant and Soil* 7: 49-95.
- WHITE, D. P. and A. L. LEAF. 1957 Forest fertilization. 303 pp. New York State College of Forestry. Tech. Pub. 81. Syracuse University, Syracuse 10, N.Y.
- WILDE, S. A. 1958. Forest Soils. ix+537 pp. Ronald Press Company, New York.

B.C. REGISTERED FORESTERS ELECT OFFICERS

Charles B. Dunham, Director of Forest Operations, Canadian Chemical & Cellulose Co. Ltd., was elected President of the Association of British Columbia Foresters at the Tenth Annual Meeting held in Vancouver on January 31st.

He succeeds H. M. Pogue, i/c Forest Surveys Division, Victoria, who reported that the total membership had grown to 290 with 19 members registered during the year.

Vice-President is William P. Hall, Chief, Surveys & Mapping Branch, Dept. of Lands, Victoria.

Re-elected members of Council are George S. Allen, Dean of Forestry, U.B.C. and Walter G. Hughes, i/c Working Plans Division, Forest Service, Victoria.

New Council members are Alfred C. Buckland, Consulting Forester, West Vancouver; Alan Moss, Woodlands Manager, S. M. Simpson Ltd., Kelowna; John S. Stokes, i/c Management, Forest Service, Victoria.

F. M. Knapp, Faculty of Forestry, U.B.C., was re-elected Registrar.

FORESTRY MEMORIAL SCHOLARSHIP

The University of Toronto has awarded two Forestry Memorial Scholarships to the value of \$286 and \$250 respectively for the session 1957-58 to K. P. Campbell and J. F. K. McNutt, First Year students in the Faculty of Forestry.

The scholarships were awarded on the basis of their standing in the Ontario Grade XIII examinations last June.

Kevin Patrick Campbell is 18 years old and is the son of Mr. and Mrs. V. P. Campbell of 94 Douglas Avenue, Toronto. He entered the First Year of the Forestry course in September from St. Michael's College School.

James Frederick Kirby McNutt is 18 years old and is the son of Mr. and Mrs. J. W. McNutt of North Bay, Ontario. James McNutt entered the First Year of the Forestry course in September from North Bay Collegiate Institute and Vocational School.

ENTOMOLOGISTS PLAN MEETING

The eighth annual meeting of the Entomological Society of Canada and the ninety-fifth annual meeting of the Entomological Society of Ontario will be held jointly at Guelph, Ont., on October 29 to 31, 1958.