SOME ASPECTS OF FOREST RESEARCH WORK

by

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Below we propose to deal with the outlines which forest research work in Suomi has endeavoured to follow. Partly, they can be used as a guide only in Suomi and in areas with a corresponding geographic position, but partly they may have a wider application.

From a practical as well as from a scientific point of view, it is of the greatest importance that s i t e s a r e c l a s s i f i e d in most objective and exact classes of quality. This is important from a silvicultural point of view, for the tending of forests has to vary not only for each different species, but must also vary considerably according to the site, even if the species remains the same. It is a universally recognised fact that we have to distinguish between different quality classes of site for purposes of forest mensuration. This is necessary, because growth even in the most normal stands of a species varies greatly according to the quality of the site. As we are concerned, then, with classification of *sites*, this must be effected irrespective of *species*, or, in other words, we are bound to use uniform classification for all species. Again, quality classes of the same denomination for different species must correspond to one another, otherwise we could, for instance, not compare the yield of different species, when grown on a site of the same class. Also for forest statistics, it is essential that forest lands are classified with the greatest possible uniformity and objectivity. It is evident that the same classification of sites according to quality ought to be applicable to *silviculture*, *forest mensuration* and *statistics*. Moreover, for the *science of forestry* an objective classification of the quality of sites is highly important. For, when we want to solve a problem using the method of comparative examination and apply it either in the forest or make special comparative experiments, the comparison leads to a correct result only, if all other factors, except the variable one under test, do not vary, i. e. are constant in all areas, where the comparison is made or in all comparative experiments. Therefore,

it is just the site which must be of equal biological value in all cases to which the comparison is applied, as these are often scattered over large areas.

Methods of classification according to quality which are now used do not, however, satisfy these claims. Such classification is applied chiefly in forest mensuration and organization and forest statistics. Sites are not at present classified irrespective of species, but there are for *each species* different classes according to the quality of *site*. Thus, class III for pine does not correspond to the same class for beech, nor is class III the same thing for spruce and oak, and there is further no certainty as to how these classes of site may be compared with one another, especially as the same classes for even the same tree do not completely correspond to one another in different countries. These quality classes cannot be applied to *silviculture*, for the quality class V for pine, for instance, is not a conception which can be biologically defined, especially as it includes sites that differ radically from each other, each of which demands quite different silvicultural treatment. With the aid of methods commonly practised, which are used in the first instance for the construction of growth and yield tables (strip method, directing curve method, and the method based upon an indication stand) it is not possible to form a natural and uniform classification of sites according to their quality. Up to the present, soil physics have not been able to supply a satisfactory foundation of natural site classes. For the biological value of a site depends on the co-operation of very numerous site factors, and these factors may vary greatly independently of one another. In addition to this, climate modifies the influence of the factors of the soil, so that climate also must be taken into account as a factor of site. It seems that both methods, the one derived from forest mensuration and the other one derived from soil physics and meteorology, need a supplementary method by which sites could be classified, even if only in a preliminary and rough way, and on the basis of this classification the other methods could proceed in their constructions and correct the first method, where this is found necessary.

In Suomi, we have tried to solve the problem with the aid of vegetation, relying on the so-called f o r e s t t y p e s. When making a distinction between different forest types, plant communities consisting of regularly developed, mature stands of normal density have generally been taken as a basis. As belonging to the same

forest type we then regard all those normally developed stands which represent the same plant community, and also such plant communities or varieties of them which show differences from the normal type owing to some accidental cause, and may grow on the same site as the stand of normal type. Such accidental causes which are independent of the site are, for instance, the younger age of the stand, its thickness or thinness, or the fact that it has been used as pasture. Investigations concerning the significance of forest types have not yet been completed, but everything seems to point in the direction of its being possible on the above basis to construct a fairly objective and uniform classification of sites. Also, it seems that this classification can, if necessary, be developed and revised on the basis of forest mensuration and of soil physics, and that it also will satisfy silvicultural demands. Normal yield tables in Suomi (1920) and the recently finished general forest survey of the whole country (1922—24), as well as the continuous cartographic survey and inventory of the State forests (from 1914), are based, so far as classification of sites is concerned, on forest types. *In any case, to attain an objective ground for the classification of forest lands according to their quality, would be of such importance for the development of practical forestry* (silviculture and forest mensuration) *as well as for the sciences of forestry, that the attention of scientific forestry research should be seriously directed to solve this problem.*

S i l v i c u l t u r e must be based on insight into and understanding of the life of forests, of their b i o l o g y, even if economic considerations ultimately decide what forms of silviculture in each case must be adopted. Research into the biology of forests implies research into the biology of trees: conditions of regeneration for each species, thriving and development of seedlings under different conditions, growth of individual trees and their requirements of light etc. The study of trees as individuals, however, is not sufficient, but we must investigate their biology as whole stands and the formation of biological classes of trees through differentiation of individual trees in the stand. Further, we have to examine the mutual development of these classes and the process of thinning, which follows upon this development, under different conditions, both in pure stands, where individuals of only one species come into contact, and in mixed ones, where different species under most varied conditions either favour or suppress one another. The biology of the stand also implies that of the undergrowth, the significance of which is

best seen in reafforested areas, where young plants struggle for their lives with undergrowth and in cases where forest land gets swampy. Moreover, the biology of the undergrowth must not be neglected at other ages of the trees and on normal forest land. Investigation of the biology of the forest involves particularly research into the struggle of tree roots with one another and with the roots of the undergrowth, and it also implies the influence the microbiological flora and fauna of the soil exercise on the vegetation and especially on trees. Further, it embraces the study of relations of greater fungi to vegetation generally and to trees in particular. All these relations vary considerably according to the quality of the site (forest type). We have still to take into account the influence of the standing crop and vegetation generally on the quality of the site, namely on different aspects of climate of the site and on the quality of the soil, and to note how these factors in their turn react on the vegetation generally and on the standing crop in particular. The ideal of silviculture and of forestry generally ought not to be natural forests as such, but it must be the use of forests for continuous and steady production. The fulfilment of this purpose, however, involves comprehensive insight into the biology of the forest, or in other words familiarity with the way the forest as a unit reacts to every measure applied to it. Forestry research in Suomi which has gained in efficiency since the foundation of the Society of Forestry of Suomi (1909) and the Forest Research Institute (1917), has been guided by these principles and has to a great extent built on purely plant biological investigations, even when these do not at first sight seem to be of much consequence to practical forestry, but aim at forming a common basis for silviculture. Such a biological basis has been regarded as all the more important as natural regeneration in the northern countries for an indefinite lapse of time seems to retain a dominating position in the regeneration of forests.

Objects within the sphere of the science of forestry are generally not of such a character that they could be determined by application of one or more measurements, but results are mostly obtained from the average of many measurements or observations. Therefore, in numerous cases of forest research it is important to adopt m a t h e m a t i c a l-s t a t i s t i c a l methods. This applies above all to forest mensuration and also forest statistics, but very often too, to problems of silviculture. In Suomi, since the thesis of *W. Cajanus:* Über die Entwicklung gleichaltriger Waldbestände (1914) was published, mathematical statistics have on the above grounds consistently

been taken into use, as without them we could not with certainty decide the correctness of mean values, which have been reached, and could not determine how many observations are wanted. Naturally, this method has to be applied critically. Mathematical statistics with their applications to biological research generally have at the present time been developed to such a stage that they can advantageously be used in forestry research.

Above we have dealt only with some outlines by which the Finnish forestry research has been guided. It may be mentioned that some special fields of the biology of forests naturally demand extensive special investigation. Such are the questions of the biology of foreign species and of the possibility of their cultivation; the question of heredity from the point of view of forestry, connected with the problem of the origin of the tree (plant) races, of the formation of species in general and of the improvement of forest tree races in particular. Further, problems arise from forest lands becoming swampy, from the processes that swamps undergo and the possibilities of their re-afforestation. Besides, there is the wide field of research which is concerned with the relations between forest life and conditions and processes of the soil. Our purpose in the above account *has only been to emphasize* 1) *the importance of bringing the classification of sites on to an objective, exact and general basis;* 2) *the significance of a comprehensive investigation and appreciation of the biology of forest life as the basis for the development of silviculture;* 3) *the importance of using mathematical-statistical methods as a resource and means of control, in order to bring investigations, based on mean values, on to a solid and exact basis.* Scientific study of forestry from an economic or social standpoint has been left out in this connection. Only some aspects of forest research which seem to command special attention at present, particularly in the work of forest experiment stations, have here been dealt with.

Suomenkielinen selostus.

Eräitä metsätieteellisen tutkimustyön suuntaviivoja.

Edellä olevassa esitelmässä kosketellaan välttämättömyyttä saattaa metsätaloudellinen kasvupaikkojen luokittelu yhtenäiselle luontaiselle ja samalla objektiiviselle kannalle, sen sijaan, että se nykyään on suuressa määrässä subjektiivinen ja epäyhtenäinen. Mainitunlainen luokittelu on tarpeen

sekä metsätaksatoorisia tarkoituksia varten (metsänkasvun, kannattavaisuuden y. m. laskemiseen) että metsänhoidollisiin tarkoituksiin (pohjaksi sovelletulle metsänhoito-opille) ja siten luonnollisesti myös metsätalouden järjestelylle ja metsätilastotarkoituksiin. Suomessa tätä tarkoitusperää on koetettu saavuttaa metsätyyppien avulla, jotka meillä ovatkin tulleet yhä yleisempään käytäntöön.

Metsänhoidon kehittämiseksi luonnonmukaisella pohjalla edellyttää kaikinpuolisia metsäbiologisia tutkimuksia, joiden tarkoituksena on päästä mahdollisimman täydellisesti ymmärtämään metsän elämää, jotta tällä pohjalla voitaisiin järjestää metsäin hoitotoimenpiteet luonnon asettamia vaatimuksia silmällä pitäen.

Muodollisessa suhteessa on tärkeätä metsätieteellisessä tutkimustyössä, joka hyvin olennaiseksi osaksi nojautuu edustaviin tilastoaineistoihin, noudattaa matemaatillisessa tilastossa käytännössä olevia menettelytapoja.