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## Forest development types in the region of Kirchleerau, Canton of Aargau, Switzerland

By Erwin AICHINGER

with a vegetation map by Dr. Helke BOSSE-MARTIN

The forest region of Schöftland, Kirchleerau and Moosleerau was mapped also by the phytosociological method of AICHINGER. This method stresses especially the dynamics in vegetation. The forests of the surveyed region were formerly devastated by various human influences, viz. burning, intermediate agricultural utilization, extensive pasturing, clear-cutting, moving, coppice-system and forest litter utilization. According to their special ecology, the forest stands recuperate differently. The more humid inferior slope-parts ("*semi-superirrigatum*"), especially the shady slopes, recuperate quicker than the dry, sunny slope-parts ("*silicicolum*") because the former receive water and fine earth from the superior slope parts.

Intermediate agricultural land use, especially shifting cultivation, on the plateaus has provoked water-logging ("*agrum solum paludosum*") by forming soil compaction at the depth of plough furrow. Disturbance of the nutrition cycle by litter-utilization or irregular shifting cultivation has reduced the activity of soil-micro-organisms and has favoured the formation of raw humus.

These statements are supported by the fact that most of the deciduous forests are reproduced from stool. Many acidity indicators prove the existence of raw humus, such as *Blechnum spicant*, *Deschampsia flexuosa*, *Carex pilulifera*, *Luzula luzuloides*, *Lathyrus montanus*, *Pyrola secunda*, *P. minor*, *Vaccinium vitis-idaea*, *V. myrtillus*, *Veronica officinalis* and *Melampyrum pratense*. Moreover the microrelief of many forest parts still shows the former agricultural use.

The forests were surveyed with Dr. Helke BOSSE-MARTIN. I have determined the vegetation units ("forest development types") whereas Mrs. BOSSE designed the vegetation map according to my directions. The vegetation units are based on relevés by the method of BRAUN-BLANQUET and are evaluated:

1. physiognomic-floristically (association)
2. ecological-floristically (e.g. "silicicolum")
3. syngenetic-floristically (dynamics of the unit)
4. floristic-sociologically (lower units).

## Evaluation by a group of silviculturalists of the results from the comparison of several methods of site classification

(Location of the study area: Switzerland, Canton of Aargau, Forest district of Zofingen)

Twelve professors of silviculture from several countries were invited to express their opinions on the mapping methods. This invitation was accepted by Prof. OLA-BØRSET, Oslo; Prof. KÖSTLER, Munich; and Prof. LEIBUNDGUT, Zürich. Dr. ROTH, forest district officer, assisted as a fourth expert.

This study was planned and prepared by Prof. RICHARD and Prof. ELLENBERG, who deserve a great deal of credit for developing this approach toward clarification of the problems of site mapping which play such an important role in both silvicultural research and practice. The contributions of the colleagues who participated in the site mapping is acknowledged. All those who contributed to the large amount of work in the site classification, preparation of reports, and organization of the meeting deserve a great deal of thanks for their efforts. In particular, the efforts of Dr. ROTH in establishing the study area are greatly appreciated.

Five methods were included in the evaluation, which was based on maps and accompanying, already printed texts:

1. mapping of the *plant associations* by the BRAUN-BLANQUET method, by Dr. H.-K. FREHNER, forest engineer,
2. mapping of *vegetation belts* and *biocenoses* by the method of EMIL SCHMID, by Dr. A. SAXER,
3. mapping of *forest development types* by the method of E. AICHINGER, by Dr. (Mrs.) BOSSE-MARTIN,
4. mapping of forest sites by the combined vegetational-ecological method of Dr. D. KOPP, by forest engineer EBERHARDT, with the cooperation of Dr. H. PASSARGE in preparation.
5. *Soil types* were mapped as a basis for method No. 4. They are presented on a transparent cover sheet belonging to the map of "site type groups", so that they can be compared with it or any other map.

A brief introductory statement was made for each of the first four methods. Then the concrete results for several points on the terrain were presented and discussed. Since those who prepared the report on the fourth method could not present it personally, Dr. ELLENBERG presented the introduction and detailed reports.

The impressions of the group of silviculturalists can be presented briefly as follows:

1. The "*combined method*" requires a considerable amount of time for both preparation of the mapping units and the mapping itself, but it provides the most accurate and the most kinds of silvicultural information. The large expenditure necessary can be fully justified in regions with intensive management, such as the Swiss lowland.

This method has its greatest advantage where the vegetation is influenced strongly by human activity, so that the present condition is no longer representative of the actual productivity of the site. On the mapping area this could be observed on some plateaus, e.g., in the example mentioned by KOPP. Here FREHNER mapped a *Querco-Abietetum* on a part of the area, with a dominance of acid indicating plants such as *Vaccinium myrtillus*. Near this association he found a *Melico-Fagetum asperuletosum* association. Both are on the same soil type and have been included in the same site type group by KOPP. They can be explained only by human influence on the humus of the upper soil layer (pasture and tilling in former times). This effect is reversible and does not influence the productivity of the stand.

Cases of this kind were rarely found in the mapped area. Therefore, a good phytosociological map may be sufficient without detailed soil investigations. It would be hazardous to make this statement as a general conclusion, particularly since FREHNER himself used soil evaluations to complete his investigations.

2. The vegetational map using BRAUN-BLANQUET's method is very well suited to the sites in question. The nomenclature of the units and their definitions seem good. Uncertainties in classification of the sites by vegetation types were resolved by soil interpretation. By this procedure the practical interpretation for silviculture and forest management was promoted. FREHNER published a summary: "The vegetation types of the forests in the 5th forest district of the Canton of Aargau" (1961). It contains, in addition to the vegetation types of the sites, a general description of soil characteristics. The increasing influence of the mountainous climate in the southern part of the mapping area was reflected by the *Milio-Fagetum* association. All of the other methods applied did not recognize this unit, except a passing reference by PASSARGE.

3. The method developed by E. SCHMID, according to his description, aims at providing a comparative representation of the vegetation of the world. For this reason, the primary purpose cannot be to give detailed interpretations for silviculture. However, it seems that the novel idea of using "growth forms" (life forms) could be applied to an even greater degree for the characterization of plant associations for silvicultural purposes. At least, this is the impression one gets from the investigations of SAXER. The vegetation map of Switzerland published by Prof. SCHMID, at a scale of 1:200000, may be very useful to give a general picture, even for foresters. The nomenclature for the mapping units in the detoiled map of the Moosleerau region is very complicated and at some places did not correspond with the geological formations.

4. The map of E. AICHINGER differs from the others in that the boundaries of the units were not drawn in the field, Dr. (Mrs.) HELKE BOSSE-MARTIN made some 500 relevés (examinations of the vegetation) on the area. Afterwards the results were interpreted in map form. This procedure gave results which corresponded to the other methods in many instances, but also differed considerably from them in a number of cases. Some of the terminology for the main type groups can mislead the reader, e.g., the sites at the bottoms of slopes are called "Super-irrigatum" and plateaus with a suspended water table are designated as "Paludosum". Prof. AICHINGER himself emphasized during the meeting that he would have mapped according to the BRAUN-BLANQUET method in this area, if he had not been asked to apply his own method. The mapping of forest development types stresses succession heavily, not only that occurring from natural causes but especially that caused by human activity. Thus, the history of the site is taken into account, a procedure which is very helpful for silvicultural interpretations in many regions. However, on the maps presented in this study, no successional series nor any tendencies in development of succession are indicated. There are only a few general remarks in the text.

5. *Soil mapping* was not evaluated by itself, because today purely pedological methods are generally not considered sufficient for site characterization.

The general evaluation must be based on an accurate definition of the purpose of the site classification. The silviculturalist or forest manager concerned with site mapping wants information on the best treatment of the forests, in particular on the choice of tree species, on measures to improve stand quality and on regeneration. The primary unit with which he is concerned is the forest stand. The natural distribution of the forest cover and of sites rarely coincides with the stand distribution, which depends to a large extent on the road system and the means of timber transport. Therefore, it is necessary to compromise between the ideal breakdown of sites and agree on units with some practical limitations.

For forestry purposes the soil and vegetation mosaic may be pictured in many different ways. There are two main techniques which have, in fact, led to complete methods:

One is based on the vegetation, i.e. on forest associations or vegetation types such as developed by CAJANDER, the other is based on soil properties. Through the influence of BRAUN-BLANQUET, LEIBUNDGUT, and ELLENBERG the former approach, was preferred in Switzerland, while the latter was followed e.g. in Bayern, favored, in particular, by KRAUSS.

However, it must be recognized that a purely phytosociological investigation interprets only the depth of soil in which the indicator plants are rooted. On some sites the rooting zone of the forest stand may be much deeper. If such a site is occupied by a stand consisting of non-indigenous species, the whole soil profile must be considered in order to characterize the site correctly. This is the reason for combining a soil survey with the investigation of vegetation types. In some regions this comparison is essential, in other regions a vegetation survey may be sufficient for site evaluation. The choice of method depends on the sites in question and on their history. In each case it must be decided individually whether only a vegetational study is required or whether a pedological study should also be undertaken.

The development of the various methods is also related to other differing conditions. In Switzerland, with its great variety of relief, the natural site indicator plants can still be found, whereas in the more uniform landscape of central Europe the natural vegetation has practically disappeared due to the establishment of pine and spruce plantations on vast areas.

There is *a clear tendency towards the combined methods*, even in the vegetational methods presented here we can feel this trend. Another conclusion is that, as a rule, in the vegetation methods an attempt is made to relate them to local silvicultural practice. The methods of BRAUN-BLANQUET and KOPP are both typical in this respect.

Regarding the choice of tree species, the interpretations of the four maps were never in serious disagreement.

The *costs* of the various methods can be evaluated only by a comparison of the time necessary for the field work, including both graduate professional personnel and sub-professional assistants. For this comparison it was assumed that one day of professional time was equal to two days time for an assistant. The average area mapped per day was:

| | |
|---|---|
| Method of E. SCHMID | 18 ha |
| Method of BRAUN-BLANQUET | 13 ha |
| Method of AICHINGER | 10 ha |
| Combined method (KOPP) | 4 ha |

These values cannot be used for a definite comparison of the methods. The method of E. SCHMID compares favorably with the BRAUN-BLANQUET method, which has undergone local testing, and required one day per 13 ha. AICHINGER's method is not much below BRAUN-BLANQUET. On the other hand, the time needed for the Eberswalde method was about three-fold that of the BRAUN-BLANQUET method.

However, the BRAUN-BLANQUET method, as modified by FREHNER, is probably not in as favorable a position as it appears. The 415 ha presented here by FREHNER was only part of a total area of 9000 ha which he mapped, i.e. the 5th forest district of the Canton of Aargau. He had the advantage of a well developed terminology and a method which suits the region very well. For the other methods, a great deal of preliminary information had to be elaborated because the scientists were not familiar with the region. They would have needed less time if they had started on an equal footing with the BRAUN-BLANQUET method. Dr. KOPP informed us that in a region where the mappers were familiar with site conditions, they map 8–10 ha per day or 1600–1800 ha in 9 months of field work.

No definite answer could be given to the question of the *potential increment* on the sites. It is hazardous to calculate mean total increment from just a few height measurements. It is difficult to compare different sites, because even within the same site or within the same plant association the species, to be compared, should have the same age, the same stage of development, and the same position in the stand. All of the trials in this respect met insurmountable obstacles even under simple conditions. Therefore, it was necessary to limit the information to approximate values describing the ranges of increment characteristic of particular types (e.g. 7–9 $m^3$ mean total annual increment). Thus, comparison of the various mapping methods in respect to prediction of increment was not possible on the basis of the available data.

OLA-BØRSET, KÖSTLER, LEIBUNDGUT, ROTH