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THE IRREGULAR SHELTER-WOOD SYSTEM

1. TERMINOLOGY

THIS system, commonly known as the Swiss or Baden *Femelschlag*, may be defined as a system of successive regeneration fellings with a long and indefinite regeneration period, the chief object of which is to secure light increment for selected stems of the overwood and to produce young crops of a somewhat uneven-aged type for protective reasons.

The French equivalent is *méthode d'exploitation par coupes jardinatoires*.

The following German terms are employed: *Badischer Femelschlag*, *Schweizer Femelschlag*, *Langfristiger Blenderschlag* (Wagner), *Blendergrossschlag* or *Blenderschlagbetrieb* (see under Group System, p. 64).

The term 'Irregular Shelter-wood System' is proposed as a suitable English equivalent. The Swiss or Baden *Femelschlag* is sometimes referred to under the group system. Although in its initial stages it might in some respects be regarded as a form of the group or uniform system, it differs so radically from either of these two systems in its objects and application that it cannot be conveniently considered under either. Actually the system can best be regarded as a compromise between the uniform and group systems on the one hand and the selection system on the other.

2. GENERAL DESCRIPTION

Swiss Femelschlag. In Switzerland this system is applied to mixed forests of spruce, silver fir, and beech, sometimes with an admixture of other species such as Scots pine, larch, oak, ash, and maple. The general procedure is as follows:

1. A nominal rotation, generally of 100 years, is adopted, but this may be regarded merely as the average age of trees felled, the actual ages varying from, say, 80 to 120 years or more.

2. The regeneration period is an indefinite but long one, usually extending up to 50 years; the length of the period may vary considerably from place to place, even in the same compartment.

3. There are no periodic blocks; regeneration areas, which may be much scattered, are re-allotted every 10 years, and much latitude

is allowed, not only in regard to the selection of areas for felling each year but also in regard to the volume of material felled annually, provided that the total prescribed volume for the 10-year period is not exceeded.

4. Until regeneration begins the crop is subjected to light thinnings at frequent intervals, care being taken to keep it dense in order to produce clean boles, to protect the soil, and to prevent weed-growth.

5. Regeneration fellings begin with a slight opening of the canopy as soon as the trees are capable of bearing good seed, that is, when the crop averages about 60 to 70 years, while advantage is taken of any advance growth appearing in gaps caused by wind or snow; further successive regeneration fellings take place at frequent intervals, often with centrifugal enlargement of gaps as in the group system, the canopy being opened gradually where beech and silver fir regeneration predominates, and more rapidly where groups of spruce have to be freed; the final felling is made when the young crop is of any age up to about 50 years.

6. Owing to the gradual and somewhat irregular removal of the overwood, and the long regeneration period, an uneven-aged young crop is produced, but in time the irregularity becomes less apparent.

7. A certain number of the best-shaped stems of the overwood are retained for as long as the young crop will stand it, the object being to place these stems in the position of producing the maximum increment possible; in this way specially selected trees may remain until they are 130 or 140 years of age.

In practice the system varies in detail according to the composition of the crop. Where beech is present in sufficient quantity, the first light regeneration felling usually coincides with the occurrence of a beech mast-year, and results in the appearance of groups of beech regeneration. Silver fir follows soon after, and spruce later on, when there are sufficient gaps in the canopy. Last of all, light-demanders such as Scots pine and larch, if present, seed up blanks after the canopy has been well opened out, seed-bearers of these species being retained for this purpose. If necessary the conifers have to be assisted in the early stages by cutting away the beech regeneration in places. Where beech is not present in sufficient quantity, it is introduced artificially in groups, either in gaps caused by wind or snow or under a slightly opened canopy. Artificial regeneration of other species is carried out where necessary, light-demanders being employed to fill up gaps after the regeneration of shade-bearers has been completed. In some localities beech and

silver fir are regenerated first under the usual *Femelschlag* fellings, and spruce and Scots pine are regenerated afterwards by strip fellings (see p. 102 and Fig. 54).

The irregularity of this system may be realized from the fact that

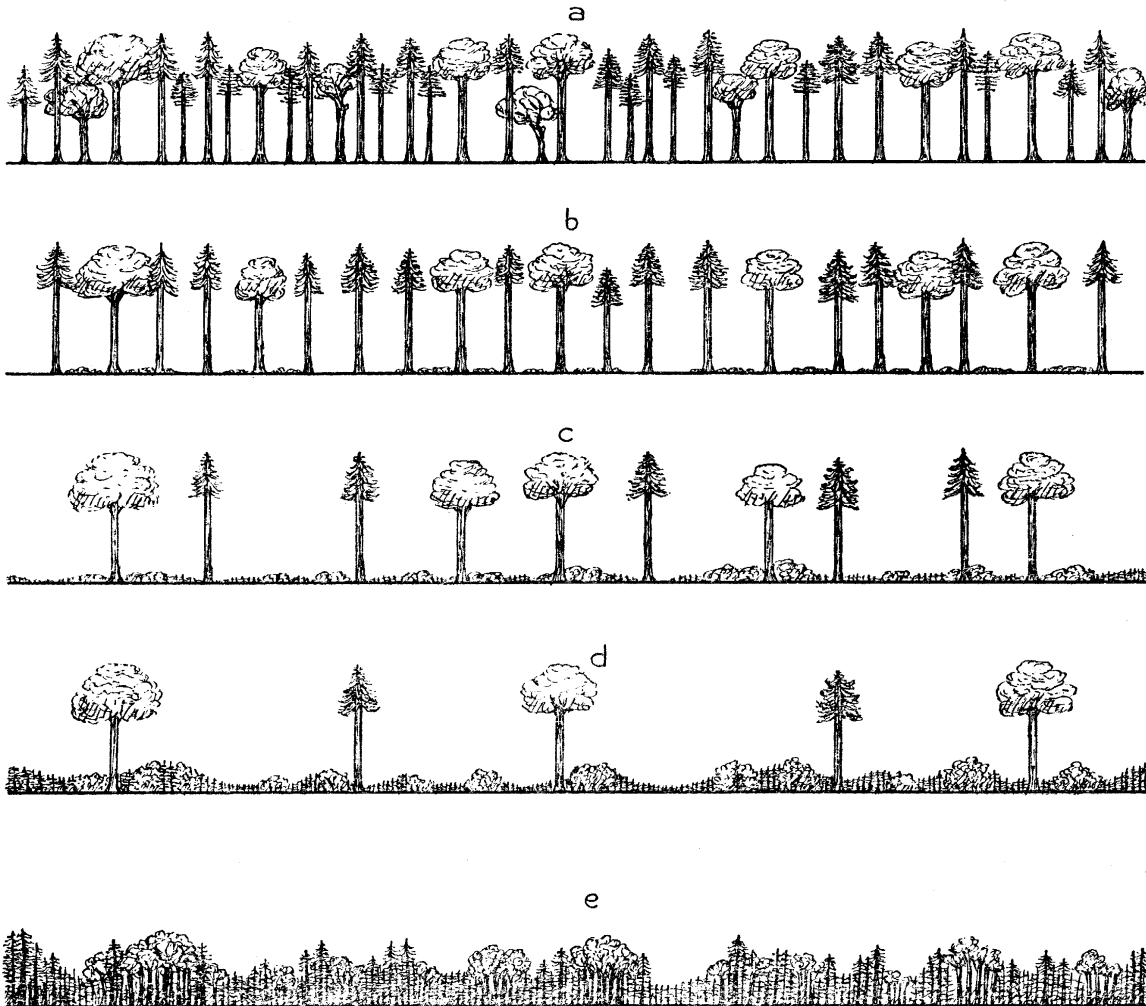


FIG. 32. Swiss *Femelschlag*, showing successive stages of regeneration in mixed forest of spruce, silver fir, and beech. *a*, mixed crop 40–80 years old (average 60 years), ready for regeneration to begin ; *b*, beech regeneration appearing as the result of a seeding felling ; *c*, regeneration of beech and silver fir establishing itself, and spruce appearing in gaps ; *d*, young crop with selected trees of the old wood retained for increment purposes ; *e*, young crop up to 50 years of age, after the final felling, showing irregular appearance.

one part of a compartment may be under regeneration while the remainder is not, while again some portions of a crop may be under thinnings while other portions may be still in the seedling or sapling stage with a considerable amount of overwood standing over the young crop.

Successive stages of regeneration are shown in Figs. 32 to 35.

Baden Femelschlag. The general principles of the Baden *Femelschlag* are similar to those of the Swiss *Femelschlag*. It is applied mainly to spruce and silver fir forests, in which as a rule the rotation is nominally 120 years but actually varies greatly, vigorous trees being left to grow and weakly or cankerous stems being cut out early. The regeneration period varies generally from 40 to 60 years, the longer period being adopted where silver fir predominates. Where the period is a long one the young crop has a very uneven-aged appearance (see Fig. 36). In this system great importance is attached to the production of storm-firm trees, while light increment in the best stems is considered to be more important than special measures to secure regeneration. For this reason there are no drastic seeding fellings; efforts are concentrated rather, during the thinning stages, on the individual development of the best stems with the object of securing vigorous seed-bearers with good crowns and root-systems, trees which when opened out will resist storms and put on rapid light increment. When such trees are obtained, natural regeneration follows as a rule without difficulty.

Regeneration fellings are carried out gradually and cautiously; in order to reduce damage to the young crop to a minimum they begin as a rule at the top of a slope and proceed in a downhill direction. The fellings take the form of freeing groups of advance growth rather than creating gaps deliberately, since the gradual opening of the canopy by the removal of defective stems generally results in the appearance of advance growth, while in addition there are often natural gaps caused by snow and wind. In some cases the removal of the overwood is completed by strip fellings, as in the case of the Swiss *Femelschlag*.

3. ADVANTAGES AND DISADVANTAGES OF THE IRREGULAR SHELTER-WOOD SYSTEM

The chief advantages and disadvantages of the irregular shelter-wood system are as follows:

ADVANTAGES: 1. The long period and the cautious opening of the canopy tend to prevent soil exposure and weed-growth, and to allow regeneration to appear with tolerable certainty.

2. The development of individual stems and the production of an uneven-aged type of crop are protective measures against wind and snow damage.

3. Enhanced increment is secured on the best and most valuable stems.

4. Time is saved in obtaining established regeneration, the young



FIG. 33. Irregular shelter-wood system (Swiss *Femelschlag*). Spruce, silver fir, and beech. Early stage in regeneration; beech and silver fir beginning to appear in groups. Forest of Bienne, Switzerland.



FIG. 34. The same. Later stage in development of shade-bearing group.



FIG. 35. Irregular shelter-wood system (Swiss *Femelschlag*). Regeneration well advanced; beech trees retained to put on increment. Forest of Bienne, Switzerland.



FIG. 36. Irregular shelter-wood system (Baden *Femelschlag*). Spruce and silver fir. Uneven-aged crop produced by long regeneration period; overwood not yet all removed. Herrenwies, Baden Black Forest.

crop being anything up to 50 or 60 years old by the end of the rotation.

5. The system is an elastic one, and gives a free hand to the manager (but see under Disadvantages, 5).

DISADVANTAGES: 1. The system favours shade-bearers against light-demanders; in the Black Forest there are instances of mixed crops having been converted to pure silver fir by this system.

2. The young crop, kept for many years under cover of the overwood, does not develop so rapidly as it would if completely freed; the advantage of enhanced increment in the overwood, therefore, is discounted to some extent by retarded increment in the young crop.

3. Much damage may be caused during the felling of trees over the young crop and the extraction of timber through thickets of all ages and even groups of poles; this is particularly the case on steep slopes where logs get out of control. For this reason the lopping of branches is sometimes carried out prior to felling, thus adding to the cost of the work. In Switzerland damage is reduced to a minimum by carrying out all felling and extraction by means of skilled wood-cutters working directly under the Forest Department; felling and extraction by purchasers is never allowed in State forests.

4. The large area under regeneration at one time leads to diffusion of work and adds to the difficulty of supervision and control, and the scattered fellings add to the cost of working.

5. The elasticity and irregularity of working combined with the long regeneration period demand a good deal of skill on the part of the manager, and may result in serious mistakes, through lack of continuity, in the event of frequent changes of personnel.

6. Felling and logging amongst dense and often wet thickets is troublesome, and is unpopular with the woodmen.

7. The trees produced under this system are more branchy than those produced under the more even-aged systems.

4. APPLICATION OF THE IRREGULAR SHELTER-WOOD SYSTEM

This system is widely practised in the mixed spruce, silver fir, and beech forests of Switzerland, where, through Gayer's influence, it was introduced in the latter part of last century in supersession of the clear-cutting system, which had led to unsatisfactory results (see p. 20). In Baden, particularly in the Black Forest, it has been in operation for many years in spruce and silver fir forests, having to some extent superseded the selection system. In both regions the main ideas underlying its adoption were: (1) protection against

wind and snow, (2) adherence to natural methods, (3) maintenance of soil fertility, (4) enhanced production of timber. The first three of these advantages, at all events, have doubtless been secured, though at the expense of certain disadvantages enumerated in the previous section. It is significant that the success of this system has been greatest in districts where the same officer has been in charge for a long period of years. Close individual attention and intimate knowledge of local conditions are essential to its success, for which reason it is unsuitable for large areas where intensive working is impracticable, or where changes of personnel are frequent. It requires a good system of roads in order to counteract the effect of scattered work and to minimize damage on hill slopes by subdividing the areas under exploitation. It is adapted for the regeneration of mixed shade-bearers rather than of light-demanders.

In Switzerland this system is in some cases employed as a transition stage in converting from even-aged to selection forest, for which purpose it is well suited. In actual practice there are great variations in detail, and crops in all stages of transition may be met with. It would be equally suitable as a transition stage from selection to even-aged forest.

Where close supervision is not exercised, this system may result in grave damage. Instances have been observed in parts of the Black Forest where during temporary lack of supervision, owing to a change of personnel, extensive areas of thickets on hill-sides have been almost exterminated during the extraction of timber, resulting in large weed-covered blanks which necessitated costly artificial restocking. There is also a tendency, with changes of personnel, for work to become dislocated and responsibility to be evaded through insufficiently precise control over the progress of felling and regeneration. Areas may be seen where trees of the overwood have been left standing too long over the young crop, resulting in suppression of the latter or in scattered windfalls causing much damage to the young growth.