WHAT POINTS OF VIEW HAVE TO BE TAKEN INTO CONSIDERATION, WHEN DRAINING SWAMP LANDS FOR AFFORESTATION

by

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According to the results arrived at in Suomi in connection with the recent General Forest Survey of the Republic, 35 % of the total land area of Suomi consists of swamps, those of the northern half of Suomi amounting to 43.5 % of the total land area, and those of the southern half to 26.2 %. About 20 % of the swamps are k o r p i-swamps consisting of slowly growing spruce, about 55 % are r ä m e-swamps, growing sparse, dwarfed pinewood, while the treeless, open n e v a-swamps amount to about 25 %. According to investigations made (by A. L. Backman and others), about 90 % of the swamps of Suomi have usurped the place of former firm forest lands, and this process still continues at the present time.

With regard to their afforestation capacity, 40 % of the swamps of Suomi are estimated to be of such a kind that, after having been drained, they begin to grow to a satisfactory degree. The rest of the swamps are of such a poor quality that even after draining they would only produce trees of a poor growth.

The conditions in Suomi ought not to be exceptional with regard to the above proportions, but in its main features the case should be the same elsewhere in Northern Europe, and probably also in similar climatic areas in other parts of the world. The question as to the afforestation of open swamps and of improving the growth capacity of forest growing swamps has thus quite a wide economic bearing. Consequently, in the following, and chiefly on the strength of experience gained in Suomi, and by investigations carried out in Suomi, those points of view are touched upon that seem to be worthy of consideration in connection with draining.

Apart from forest drainings of an occasional nature, carried out already since the middle of last century, actual forest drainings on a big scale have been carried out in Suomi during the last twenty

years. The draining of swamps has been carried out most systematically in State forests. Up to now, about 46,000 hectares of swamps have been drained in the State forests.

As the draining of swamps demands a lot of money, it has to be carried out according to a well-planned scheme. Strict attention must also be paid to the fact that only such swamps are drained, the afforestation capacity of which after the draining is, at least, satisfactory, as well as to the fact, that those swamps which have been selected for draining, should be drained as cheaply as possible and thus, in a way, fully answer the purpose in every respect.

As the surface vegetation of swamps and lands in general is a very good exponent of the biological value of the soil, and besides, as the peat on swamps is formed from the vegetation growing on the surface of the swamps, this having a determining influence upon the composition, and even upon the decay of the peat, and further, as the tree-roots even on drained swamps extend only to a comparatively thin surface layer of the swamp, important conclusions, based on the surface vegetation of swamps, can already be made about the forest growth capacity of swamps after they have been drained. The classification of swamps, generally in practice in Suomi, according to their surface vegetation, into so-called swamp types, is therefore particularly important to the drainers with regard to the afforestation of swamps. Indeed, the investigations (especially those of A. Tanttu and S. E. Multamäki) have further proved that certain swamp types, when drained, generally change into forest land corresponding to a certain forest type, even with regard to their forest growing capacity. In so far as the surface peat of the swamp reaches downward to the same depth as that of the tree-roots, as is the case with most of the swamps, it is possible to judge from the swamp type what kind of tree-producing capacity the swamp is going to have, when drained.

With regard to the fact that tree-roots are dependent upon only a comparatively thin peat-layer, the influence of the bottom earth upon the forest growth can be noticed only on swamps covered with a thin peat-layer. The bottom earth has no influence on swamps covered with a thick peat-layer. Experience has plainly shown us, and contrary to the prevailing opinion, that the thickness of the peat-layer is not a deciding factor with regard to the draining fitness of the swamp. According to our experience, excellent forest will after draining grow up even on swamps with the very thickest of peat, provided they are of a good swamp type.

Besides the afforestation capacity of a swamp, the draining difficulties must also be taken into consideration, when swamps are chosen for draining, for the economic profitableness depends very much upon these difficulties. Consequently, the draining of a very shallow mudded and stony swamp may become unprofitable, whilst, on the other hand, the draining of a very thickly mudded and wet swamp generally is more expensive than that of swamps of medium depth (1—2 m). Extensive main drains may also make the draining unprofitable, particularly in case of small and distant swamps. There remains to be considered the dangerous influence a swamp may exert upon the adjacent forest lands. Should this influence make itself particularly felt, it may become more profitable to drain even a swamp of poor quality, unless the dangerous influence of the swamp cannot be prevented by protective draining on the border of the swamp.

When estimating the draining fitness of swamps, further attention must be paid to the difficulties accompanying the afforestation of swamps in different cases. The draining of such swamps becomes most profitable, where a forest already exists which is expected to thrive after the draining. Likewise, a swamp, where a forest is beginning to grow after the draining in a natural way by the seeding of trees, growing either on the swamp itself or on its borders, is, of course, much more profitably drained than a vast, treeless neva-swamp, almost entirely lacking the opportunities of a natural seeding.

Finally, the demand for forest products must, of course, be taken into consideration, as this exerts quite a decisive influence upon the profitableness of the draining. Nor is the greater or smaller supply of workers as well as the level of wages prevailing in the district without importance.

The practical execution of the work of swamp draining in Suomi is divided into three series:

(a) ocular investigation of swamps;

(b) instrumental investigation of swamps; and

(c) the realization of the scheme, or execution of the ditching.

The measures called for by the forests already growing on a drained swamp, or by the afforestation of a swamp then follow as separate work.

For ocular investigation in Suomi a map is used, drawn up on the ordinary scale of the Finnish forest maps of 1 : 8000 or 1 : 20000. In these investigations on each map figure the swamp type is at first recorded which, as has already been stated, in most

cases is alone sufficient to decide the forest growth capacity of the swamp. In spite of this the peat conditions of the swamp are always examined from the surface of the swamp right down to its bottom. A special peat-drill is used for this purpose. The botanical composition of the peat layers is then recorded, also the degree of decay (a scale 0—5 is used) as well as the moisture, existence of trunks, etc. The surface peat-layer of the swamp is particularly carefully examined, as the future forest growth capacity of the swamp primarily depends upon this. In order to decide the forest growth qualifications of a swamp it would, indeed, not be necessary to examine the lower peat layers of deep swamps, but for technical purposes of draining the peat conditions of the swamps are examined from the surface right down to the bottom, provided the swamps are not of a greater depth than four metres, as deeper peat-drilling is not customary in Suomi during practical swamp investigations for forestry purposes. The examination of lower peat layers is necessary too, because ocular investigation, though it is mainly intended to ascertain the afforestation qualifications of swamps, also draws attention to the arableness of the swamp, as well as to the technical utilization chances, *i. e.*, for the manufacture of fuel-peat and moss-litter. During swamp examinations the kind of soil at the bottom of the swamp is also recorded.

Approximate observations are made about the water outlet conditions and drying possibilities of the swamps, and in exceptional cases a levelling instrument is used already during ocular investigation, should a general ascertaining of the drying possibilities demand it. Attention is also paid to the quality of the adjacent forest lands and above all to the possibility of their decaying into swamps. For the prevention of this it may become necessary to carry out protective draining for the safety of the forest lands and thus to drain even swamps of a poor quality. In case it contains some forest, a short statement is recorded about each map figure, and the possible felling of the forest before the ditching of the swamp is taken into consideration.

On the strength of the investigation records a continuous register is compiled from the swamp reports. Each swamp is included in a certain draining qualification class on the strength of its afforestation capacity and other facts that may influence the draining possibility. These documents, derived from the ocular investigation of swamps, and the swamp-registers together with maps and reports

attached to them, are only prepared during the indoor working season of the following winter.

For those swamps that have been approved for draining, the draining schemes are now prepared, a work which is generally known by the name of instrumental investigation of swamps. This work is most suitably begun by an examination of the natural water outlets and brooks that in most cases must be opened to draw off the actual drainage water. For the right placing of the actual ditches with regard to even fair-sized swamps it generally becomes necessary to make a surface levelling of those swamps that are to be ditched. The swamps are piled with a sufficient number of levelling points, the proportional levels of which are ascertained by the aid of a levelling instrument. On the same spots the depth of the swamp is also taken. The levelling and measuring results are recorded on a so-called surface levelling map, on which the surface and bottom-height curves are drawn on the strength of results achieved. The ditch lines are subsequently planned on the same map. It is not possible or even necessary to observe strict formality with regard to the placing of the forest ditches, but the ditches are placed in such a way that the drying capacity of each ditch becomes as great as possible, as the swamp is then dried up as cheaply as possible. With an eye to the reduction of expenses the ditches are planned only in such numbers and at such distances that the swamp dries up satisfactorily for forest growth. With regard to big swamps with a thick peat cover, the digging of only the main ditches and the border-ditches for the swamp is first planned. The digging of necessary complementary ditches is planned only, when the swamp has settled under the influence of the main ditches.

On poor swamps, not considered to be good enough to be drained for forest growth, the problem of protective draining often arises, as has already been pointed out. By protective ditches such ditches are meant that are dug on the border of a swamp in order to prevent the swamp water from spreading to the adjacent forest lands and thus making them swampy. The importance of such drains is often very great.

When the draining has been planned on the surface levelling map, the ditch lines are staked out, measured and piled. In order to make the digging safe, it is customary also to level the ditch lines, leaving the smallest ditches out of account. At the same time depth measuring of the swamp is made along the ditch lines and the so-

called class of digging difficulty is recorded for each space between the poles for the making of an estimate of costs.[1])

The documents in connection with the draining schemes, the maps giving the position of the ditches, vertical drawings and the estimate of costs, together with the reports attached to the draining scheme are usually only prepared during the indoor working season of the following winter. As the documents are accompanied by a report on the swamp area which is to be dried up by the realization of the draining scheme, preliminary as well as completely, and a report on the areas of the forest land, which are threatened with the spreading of the swamp and are expected to profit by the draining, and as these documents further are accompanied by an explanation as to the average expenses per hectare, the necessary basis exists for an estimate of the profitableness of realizing the draining scheme.

The execution of the actual ditching in accordance with a prepared draining scheme and an estimate of costs is a fairly simple task. The digging is almost without exception done in Suomi by contract, which is very suitable for this kind of work. Two or three men work at the same ditch. The foreman has only to give each draining-group information about the dimensions of the ditches between the poles, about wages that have to be paid, all these data being entered on so-called contract-forms; he has further to inspect the work done, and he has plenty of time to supervise the work of about a hundred ditchers.

The main part of the drainings so far carried out in Suomi has been done on swamps which were already more or less covered with forest in the natural state. The drainings have then led to an improvement of the growth of swamp forests. As a result of draining, the needles and leaves of trees of all kinds, and all ages at once begin to show a constant increase in size during the first, second and third years after the draining. Gradually the influence of the draining also begins to manifest itself visibly in the height and diameter growth of the trees. This recovery is most noticeable in middle-aged and particularly in young trees. After the draining there is every reason to leave the younger part of the forest to continue its revived growth on the swamp, whilst it is most profitable to remove the older part

[1]) For making an estimate of draining costs for ditches of various depths with fixed bottom width and side-slopes a table is used in Suomi on which there are ready calculated the corresponding surface-widths and the cubic amounts for metre lengths as well as the price of ditching per metre length of the ditches for swamps of 10 different classes of digging difficulty.

of the forest as being capital of too poor a yield, particularly as space is thus acquired for the natural regeneration of a forest which in most cases thrives exceptionally well after the draining.

According to the experience gained in Suomi, the drained open swamps are much inclined to afforestation. The natural afforestation is almost guaranteed on swamps, where there are growing seed trees, even if they occur very sparsely, also on totally treeless swamps, where the distance between the seeding border-forests may amount to as much as a hundred metres. Only on very extensive treeless neva-swamps has artificial afforestation to be resorted to and even then the cheapest means of artificial afforestation, *i. e.* simple broadcast sowing, will suffice.

Suomenkielinen selostus.

Mitä näkökohtia on otettava huomioon ojitettaessa vesiperäisiä maita metsänkasvua varten.

Koska suonkuivaustyö tulee suhteellisen kalliiksi, on se tehtävä kaikin puolin harkitun suunnitelman mukaan. On kiinnitettävä tarkkaa huomiota niin hyvin siihen, että ojitetaan vain soita, joiden metsänkasvukyky ojituksen jälkeen on vähintäin tyydyttävä kuin myöskin siihen, että ojitettavaksi hyväksytyt suot ojitetaan mahdollisimman halvalla ja tarkoitustaan joka suhteessa silti täysin vastaavalla tavalla.

Soiden ojituskelpoisuutta arvosteltaessa on ensiksikin otettava huomioon suon metsänkasvukyky, joka useimmissa tapauksissa voidaan ratkaista jo suotyypin nojalla, koska määrätyt suotyypit muuttuvat ojitettuina määrättyjä metsätyyppejä vastaaviksi metsämaiksi myöskin mitä metsänkasvukykyyn tulee. Tuloksen varmentamiseksi tutkitaan myöskin suon turvesuhteet ja erityisesti suon pintaturpeen laatu. Koska ojituksen taloudelliseen kannattavaisuuteen vaikuttavat myöskin suon ojitus- ja metsittämisvaikeudet sekä suon metsämaita soistuttava vaikutus, on soiden ojituskelpoisuutta arvosteltaessa kiinnitettävä huomiota myöskin näihin seikkoihin.

Yhtä tärkeätä kuin on ojitettavien soiden oikea valinta, on myöskin ojien oikea suunnittelu. Ojituskustannuksien mahdollisimman alhaisina pysymistä silmälläpitäen suunnitellaan ojat kulkemaan siten, että kunkin ojan kuivatusteho tulee mahdollisimman suureksi, ja että suo siis saadaan kuivatuksi niin pienellä ojamäärällä kuin suinkin. Erityisesti on ojalinjoja suunniteltaessa otettava huomioon soistumisen ehkäisemisen edellyttämät näkökohdat.

Kaivuutöiden suoritus valmiin suunnitelman ja kustannusarvion mukaan on suhteellisen yksinkertainen tehtävä ja soveltuu se hyvin urakkatyöksi, jolloin yksi työnjohtaja ennättää valvoa noin sadan ojurin työt.

Kituvankin suometsän nuorempi osa elpyy jo muutaman vuoden kuluttua ojituksen jälkeen. Vanhempi metsä sen sijaan on syytä poistaa uuden nuorennoksen tieltä. Kokemuksen mukaan metsittyvät ojitetut suot luontaisesti varsin helposti. Keinolliseen metsittämiseen on tarpeellista ryhtyä vain laajoilla puuttomilla nevoilla ja näilläkin voidaan tyytyä kaikkein halvimpaan keinollisen metsittämisen muotoon, yksinkertaiseen hajakylvöön.
