

3 Enumerations, Mapping and Working Plans¹

There had been enumeration surveys in a few of the major forests prior to 1951 but these had not been critically designed and supervised to reduce errors and facilitate statistical analysis. The recently appointed Forest Ecologist, after practical trials, produced new guidelines addressing both these points based on a layout of randomised pairs of parallel transects within strata composed of parallel strips of forest. Each transect comprised a series of temporarily demarcated plots two chains long and one chain across (40m x 10m), which permitted rigorous field checking of a proportion of the records by a supervisor, besides differentiation and location of forest types already recognised on air photos. Detailed forest type mapping of all the major natural forests was a very important aid in the interpretation of enumeration data as well as in the planning of operations of all sorts. For management purposes, especially the issue of licences to sawmills, it is important to have a reliable estimate of the *minimum* stocking of timber that can be expected (RME = Reliable Minimum Estimate) and it was decided to aim at an RME which was not more than 20% below the mean at 95% probability. Trials showed that in a forest of 50 sq miles (130 km²) this could be achieved with a sampling proportion of only 2%. Full details are given in Dawkins (1958).

This fundamental management tool for the preparation of working plans in unharvested natural forest was later complemented by two further important inventory practices for monitoring progress. One was the use of diagnostic sampling to assess the status of regeneration along temporary transects through recently harvested natural forest, as indicated by the condition of the leading desirables in each plot. From this it is possible to determine whether liberation or refinement treatments are required, the former being directed at freeing the individual desirable tree, while the latter effects a general removal of weed species and inferior stems from the crop. Full details are given in Dawkins (1958).

The other was the establishment, starting in 1958, of a system of permanent continuous inventory plots in all major forests, whether plantations or natural forests, remeasured every few years. The aim of these was to provide a flow of information both on the silvicultural condition of the crop and on the probable yield at harvest. Within a very few years the plots in the fast-growing softwood plantations had provided valuable information on their growth,

¹ See 'Statistical Tables', Table 4A.

which by comparison with the growth of older Kenyan and South African crops permitted predictions of yield and enabled important adjustments to be made to thinning schedules. Developments in the natural forests were slower and depended more on comparisons of remeasurements, so had not yet received detailed analysis by the end of this period (see Appendix H).

A major programme was started for enumerating all the major forests where harvesting was taking place, both for the immediate control of harvesting and as a basis for the preparation of working plans. In 1951, the Forest Ecologist (H.C. Dawkins) completed the enumerations of Nakiza and Uni forests in South Mengo. A paper on the subject prepared by him was published which included the following conclusions:

- (a) a stratified random two-per-block layout of one chain (20m) wide fully demarcated transects interrupted at two chains (40m) was suitable;
- (b) a table of sampling intensity applicable to South Mengo but probably also to the forests of Bunyoro, Toro and Ankole was agreed;
- (c) when estimates of volume or quantity of regeneration are required from an enumeration, they should not be based on the mean but on the mean minus its standard error.

Enumerations were carried out in Buganda, Toro and Bunyoro. A 100% enumeration of exploitable timber was done in coupe IV of Budongo by Forest School Learners and mill-hands employed by the concessionaires and from this stock maps on 1:50,000 scale were prepared. The milling company was so impressed with the result that it sent a man to the Forest School to be trained in this method.

Enumerations were started in the lake shore forests of Masaka. There were indications that illegal felling during the war had resulted in a lack of good-sized timber. On Mt Elgon the forest was divided into hill/valley units. The first unit of $1\frac{1}{2}$ sq m (3.9 km^2) was sampled on a 5% basis. Provisional data indicated that timber of exploitable size worked out at about 640 ft³ per acre (44 m^3 per ha), 50% known to be marketable.

Considerable thought was given in 1952 to the simplification of costing records and working plan forms. Clarification was also necessary on the definition of units of management – the compartment. The Budongo and South Mengo plans had prescribed very large compartments coincident with forest types – a courageous attempt at simplification but, in practice, difficult to apply. A more normal division of the area based on annual coupes was considered to be preferable.

The most important single working plan project in 1954 was the second revision (1955–64) of the Budongo Working Plan (170 sq m , 440 km^2). The main features of the plan, the implementing of which would bring in a guaranteed minimum revenue of £23,000, were:

- (a) division into Production and Research Working Circles – the old Mahogany and Ironwood Circles were abandoned;
- (b) adoption of the old coupes as compartments – future compartments were to be based largely on natural features;

- (c) shortening of the felling cycle to 60 years – raising of the mahogany minimum girth limit to 12ft 6in (3.80m) and fixing the mahogany annual volume yield at 450,000 ft³ (12,750 m³) – control of other species to be by area and girth limit;
- (d) adoption of natural regeneration techniques based largely on the use of arboricides.

Preparation of this plan was assisted by the use of an excellent topographic and stock map of the forest prepared by the former DFO (A. B. Cahusac) at the International Training Centre for Aerial Survey at Delft, Holland, using the 1951 aerial photographs. In the following year (1955) a small Map Section was set up under his charge. Its duties were to be primarily responsible for type-mapping all forest reserves from such aerial photograph cover as was available and, eventually, to take responsibility for the indexing and custody of all Head Office maps and for the co-ordination of mapping and map production throughout the Department. A most encouraging start was made in forest stock-mapping. During 1956 there was a remarkable improvement in the standard of maps produced due to the growing experience of the young drawing office staff but also to the much higher standard of plotting accuracy demanded by the radial line plotter. As the Chief Conservator of Forests (Swabey) remarked later – ‘it was difficult to understand how the Department had managed to do without a Map Section for so long’.

Enumerations of a block of 43 sq m (110 km²) in South Busoga and another unit on Mt Elgon were completed. Results on the former case indicated that exploitable timber averaged 280 tons/sq mile (117 tonnes/sq km) of mvule and 410 tons/sq mile (172 tonnes/sq km) of other species, mainly *Albizia*. With regard to Mt Elgon, the estimate of 2,000 tons of exploitable timber per square mile (840 tonnes/sq km) appeared to be optimistic but as the stands were highly gregarious, with considerable concentrations of timber species scattered in a relatively barren matrix, the yield was considered to offer a possible commercial proposition. The deciding factor would probably be that of extraction from a rugged country terrain.

Enumerations of four reserves on the Sesse Islands revealed a disappointingly low volume (90 ft³ per acre; 7 m³ per ha) of marketable species.

The major enumeration work in 1956 was in Kibale/Itwara where 100 sq m (260 km²) were sampled at approximately 1% which required over 80 miles (130 km) of transect lines. The enumeration confirmed previous estimates of elephant damage of regeneration over the last 50 years. It was a remarkably rapid bit of work which reflected the greatest credit on the African staff engaged on it.

Following their triumphs in Kibale, the enumeration team moved to Bugoma and again the value of air map cover was outstanding. Results showed that the volume of standing timber of harvestable size, i.e. above 5 ft (1.5 m) gab (girth above buttress) of all species enumerated, was about 54 million ft³ (1.5 million m³). This was equivalent to a sustained annual yield of about 407,000 ft³ (11,500 m³) of species which were then marketable. The principal economic species were *Cynometra* (33%), *Alstonia* (14%), *Albizia* (12%) and *Celtis* (12%).

Analysis of the Zoka enumeration in 1960/61 showed a high proportion of trees with signs

of game damage. From the size class distribution it was clear that the forest was not regenerating, the reason being the heavy concentration of elephant and buffalo at times in the area and the consequent damage to the younger trees.

The Busoga mvule enumeration from 1960 to 1962 over 1,000 sq miles (2,600 km²) indicated that there was much more mvule of harvestable size than was thought originally. It was reckoned that there was an RME (reliable mean estimate) of about 6.6 million cu ft (1.87 million m³) of harvestable mvule remaining in Busoga – equivalent to about 20 years cutting at the existing rate of harvesting, although it was realised that mvule was very unpredictable with regard to hidden defects such as ‘stone’ and fire damage which would reduce the usable amount of timber.

Map Section’s work continued to be concentrated chiefly on production of boundary plans for regazetting purposes. A welcome addition to the staff in 1963/64 was a Norwegian Peace Corps volunteer trained in photogrammetry. A good deal of attention was devoted to the possibility of flying and photographing reserve boundaries suitably marked, to complete survey more quickly and cheaply than by ground methods. For this purpose a suitable camera was hired and mounted in a home-made frame slung on the outside of a door of a light aircraft. The photographs taken all proved to be satisfactory although there was much still to be learned about the technique of this work. The main limitation on the speed of the work was in the capacity of the Section to deal with the resultant mapping.

The production of working plans was regrettably slow in the early 1950s, only 16% of the gazetted estate being under plan. According to the PFO/Northern Province, the reason was that ‘officers are too prone to approach the making of working plans with unwarranted awe’. Whether or not that had been the reason, there was a great improvement over the next four years, 1954 to 1957, when no less than 46 plans were approved. A specialist Working Plans Officer was appointed in 1957 and by the end of 1963, 98% of the estate was under plan. (See Table 4A and Appendix A.)

There were no new enumerations in that year, all forests under intensive management having been already sampled.

Progress on the establishment of permanent inventory plots (see Appendix H) in natural forest and plantations remained unsatisfactory due chiefly to shortage of staff.