

Abbey, which was described by Mr. Seaby, and the other half, the cliffs at Watchet, where the Keuper and Lower Lias are well exposed. The geology was explained by Mr. Hallam and Dr. Stanley Smith. In the evening Peter Scott, president of the Union, delivered his address; he explained two coloured films, one of bird life in northern Europe taken during his visit to Scandinavia in 1950, and the other illustrating experiments in netting wild geese for the purpose of ringing. In this work, nets are carried over the flock after it has settled, by means of rockets electrically exploded.

The final morning was occupied by the council and general meetings, with A. O. Rowden presiding over both. In the course of his remarks at the general meeting, Mr. Rowden alluded to the recent public inquiry into the use by the military of Braunton Burrows and to the matter of footpaths. The secretary reported that the South Western Naturalists' Union embraces at the present time twenty-one affiliated societies or sections of societies.

SILTING IN BRITISH RESERVOIRS

By R. M. PROTHERO

ARTICLES in previous issues of *Nature*¹ have stressed the need for the proper study of the relationship between rainfall and run-off in Britain, since its influence in promoting soil erosion, dependent on the vegetation cover and on the soil cover itself, may be more considerable than we imagine. There is the danger that because of the lack of spectacular examples of soil erosion such as occur in other parts of the world, we may ignore it and fail to realize its presence. As a result of this attitude, precise information is practically non-existent and it is necessary to rely on evidence which is fragmentary in nature and which has often been collected only incidentally.

Important evidence relating to the removal of soil by heavy rainfall is provided by information on the silting, caused by the deposition of this material, of British reservoirs. A survey, covering twenty-eight of the major water-undertakings in Britain, revealed in the first place an absence of any co-ordinated information. An attempt to survey the floor of a reservoir in the Tâf Fawr valley, Breconshire, during the drought of 1949 was unfortunately unsuccessful owing to the onset of rain. This would undoubtedly have provided important and precise evidence as to the rate of silting in that area.

It is possible to prevent the transport of material of large size into reservoirs by the construction of catch-pits and wreck-lodges in the tributary streams. To prevent the entry of finer material, carried in suspension during periods of high stream flow, is a more difficult problem. Such material, deposited on the floor of a reservoir, may accumulate in a short time and seriously reduce its capacity. In Great Britain examples are not so outstanding as in the United States, where in 1934 the Soil Conservation Service reported that in a survey of fifty-six reservoirs, it was found that thirteen major dams, with an average height of 30 ft., had silted up completely during an average life of twenty-nine years.

The most outstanding example in Britain known to me, of nearly a 50 per cent reduction in capacity in seventy-eight years, has already been quoted in a

previous article². Rates of silting vary considerably: from an accumulation during a hundred years of 6 ft. of silt on the floor of a reservoir with an area of 40 acres and an average depth of 25 ft. at the time of construction; to 6 in. accumulated over a 44-year period. In many of the reservoirs there is no marked silting at all, but in eleven out of the twenty-eight undertakings for which information was received it will become serious within the next hundred years. But even if the rate of silting is slow, we must take a long-term view of our facilities for providing water, remembering that demands on available supplies are steadily increasing. In four reservoirs built in 1798, 1830, 1876 and 1880, capacity has been reduced by 12, 12, 5.5 and 8 per cent respectively; but the situation will become serious only if an increased demand exceeds the surplus available at the present time. In such circumstances the engineer reported that it would be more practical to increase capacity by raising the top-water-level of the reservoirs rather than to attempt to remove the silt. In only one instance was there an actual reference to allowance being made for reduction in capacity by silting at the time of the construction of the undertaking. The allowance was for a 20-million gallon reduction in the case of one reservoir and of 10 million gallons each for the other two. But though allowance had been made for reduction in total capacity, several hundred tons of silt had to be removed from around the draw-off tunnel of one of the reservoirs in 1933.

The problem of silting does not appear to have been allowed for in the calculated capacities of the reservoirs now being constructed as an integral part of the hydro-electric power schemes in the Scottish Highlands. In fact, the possibility of the problem arising does not seem to have been considered. A recent article on the developments taking place³ stated that, in addition to the influence they would exert on flood control, "The reservoirs will also act as traps for sand and silt which at the present time are washed down to the sea and in many places, particularly on the north-east coast, have filled up estuaries and harbours".

While acknowledging the benefit to Scottish harbours, it must be pointed out that this will only be attained at the expense of creating a problem in the reservoirs themselves. The dredging of a harbour would appear to be a much simpler operation than the removal of silt from a reservoir, quite apart from the interference with water supply to the turbines entailed in carrying it out.

Silting is most marked where erosion, particularly by gullying in the beds of the streams feeding the reservoirs, takes place in deposits of sand and peat. It is also a feature where glacial till, widespread in the north and west of Britain, is being eroded. In being complementary to erosion, silting is the most significant evidence available of the existence of the former. Even if silting may not become a serious problem for a hundred years or more, the time to take action to prevent it is at the present. The remedial measures necessary have been stated in previous articles; but in order that they may be planned to produce the maximum effect it is essential that a considerable body of accurate information be accumulated on the related factors of rainfall, run-off, erosion and silting.

¹ *Nature*, 164, 805 (1949); 166, 584 (1950).

² *Nature*, 166, 584 (1950).

³ *Scot. Geog. Mag.*, 66, No. 2, 74 (1950).