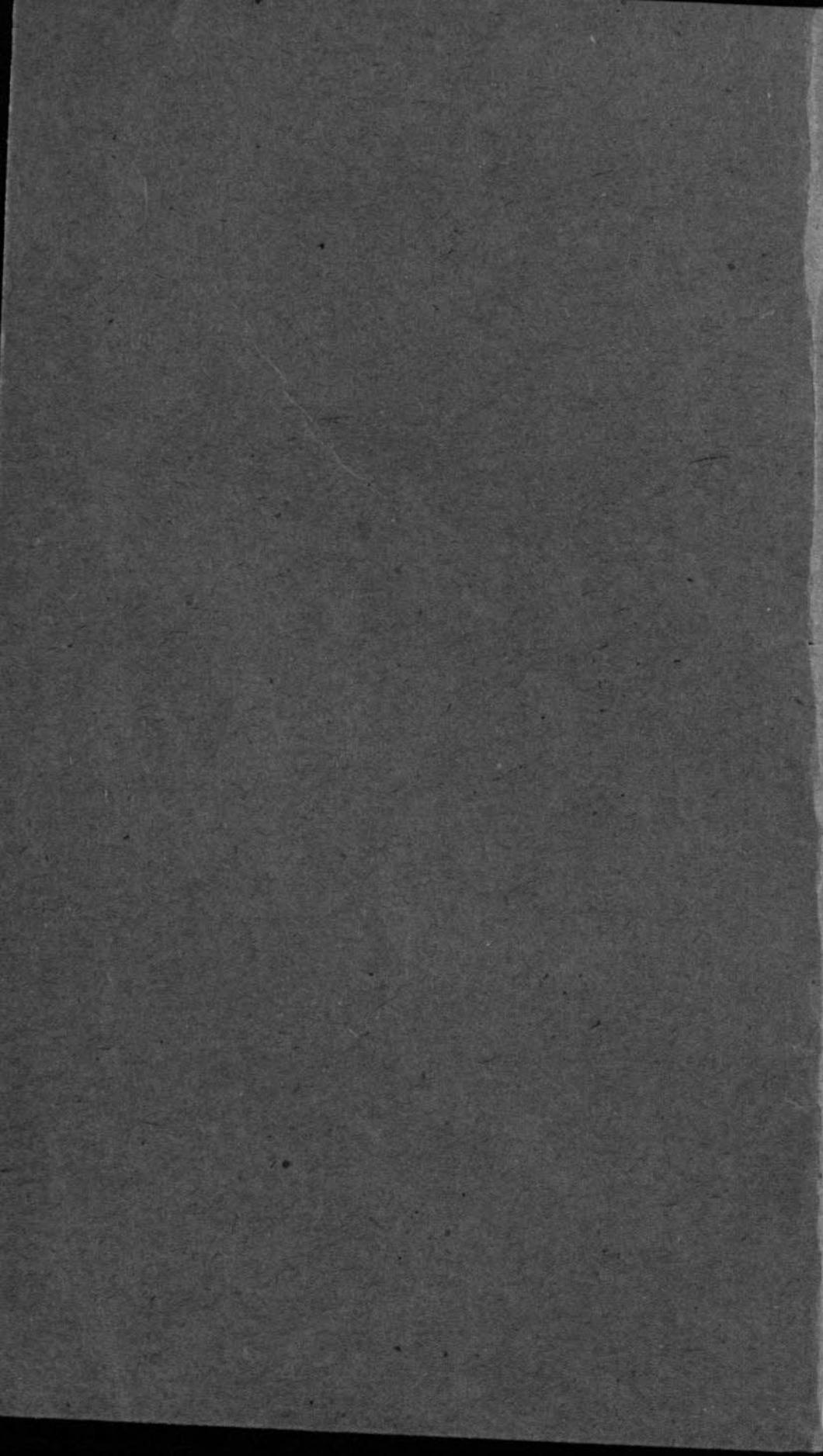


Wossac 44893

**SOILS IN RELATION TO NATIVE
POPULATION IN WEST USAMBARA**

G. Milne

GEOGRAPHY 29, p107-113 (1944)



SOILS IN RELATION TO NATIVE POPULATION IN WEST USAMBARA.*

G. MILNE.

THE West Usambaras present agricultural and administrative problems which are fundamentally concerned with the properties of soils. It is the pedologist's sphere to study these and offer what advice he can on the use of land. The present study, which was primarily to investigate ways of easing the pressure of native population on the plateau of West Usambara, deals first, in some detail, with an area of outlying country thought to be capable of native settlement, and then reviews the position in the West Usambaras as a whole.

The outlying lands under consideration lie in the neighbourhood of Kitivo at the N.E. foot of the Usambara escarpment where the Umba River emerges on to the plain. The geographical features may be classified under the following heads:—

The Escarpment.—Descending from a level of about 4,500 feet, the plateau breaks down eastwards and north-eastwards in a number of deep, rocky V-sectioned valleys separated by steeply descending promontories to a level of 1,500–1,800 feet. The belt of precipitous country so formed is about three miles wide.

The Sloping Foreland that forms the transition from the base of the escarpment to the outer plain, mostly a narrow strip of width varying up to half a mile. It is interrupted by the valleys of the larger streams, and between them it is scored at intervals by minor torrent-beds.

The Bays formed by the opening out of the major valleys, and extending some distance out into the plain. They form favourably watered alluvial areas or "inland deltas," commonly called "kitivo."

The Riverain Strips that issue from the *kitivos* towards the outer plain. Only the main Umba stream is permanent.

The Plain to which the foreland descends and which forms the outermost fanslope of the escarpment.

The Umba Steppe, without permanent water or any definite stream-courses.

Rainfall on the plateau-rim over eight years to 1912 averaged 56.5 inches, and more recent records show a range of great variability over five years of from 39.5 to 65 inches per annum. Nearly half the year's total rain falls between November and January, and during that time the principal flooding of the *kitivos* takes place. Rainfall diminishes rapidly as one goes from the plateau edge to the plain. From the semi-arid nature of the vegetation on the outer forelands one may deduce that the rainfall is about 25 inches per annum, with high evaporation and a severe dry season. It was noticed on several occasions that while the escarpment top was cloud-capped, light

* Being a résumé by W. E. Calton of an unpublished Report on a Soil Reconnaissance in the neighbourhood of Kitivo, Lushoto District, Tanganyika Territory, and in parts of the adjacent (West Usambara) Highlands, September-October, 1937, by the late G. Milne, Soil Chemist, East African Agricultural Research Station, Amani.

showers only were falling in the inner parts of the bays, the foreland received a negligible sprinkling and the plain remained dry. This is probably a typical distribution.

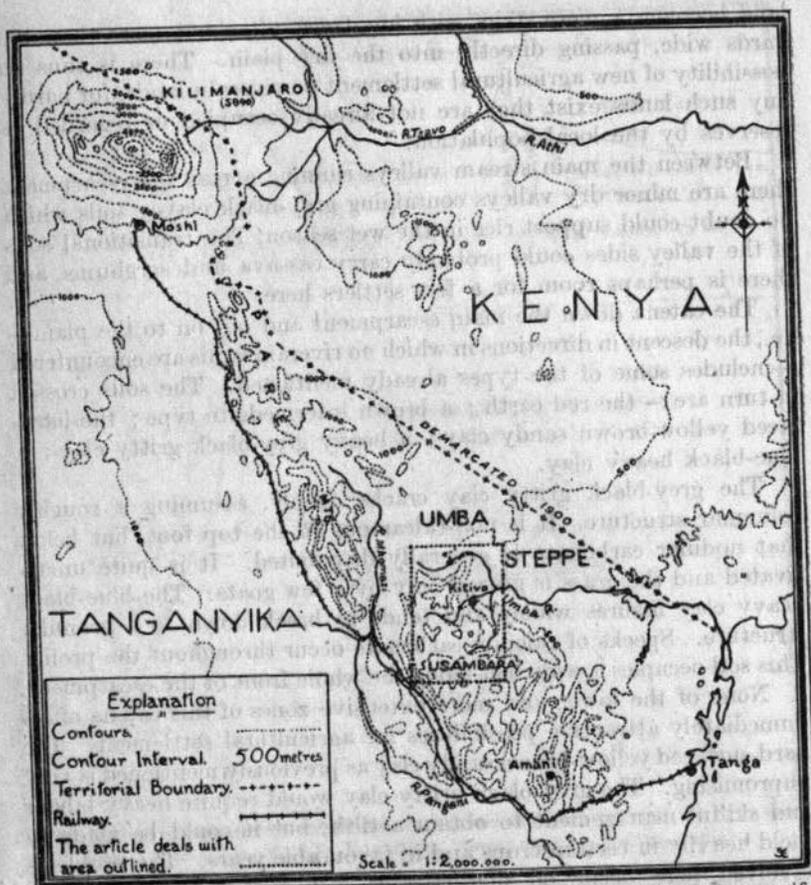
Only the alluvial *kitivo* areas are at the present time cultivated to any extent. These lands are subject to seasonal flooding, and, throughout the rest of the year, are watered by natural sub-irrigation. The *kitivos* are, in fact, oases. Their total area is not large and the question arises whether any of the land outside the *kitivos* can be put to agricultural use. A reply to this question should be based largely on a survey of the soils.

Along the upper foreland runs a narrow strip of red earth which at the N.E. corner of the escarpment flattens out into a considerable area of red plain with local accumulation of calcium carbonate. Under the existing low rainfall conditions, this strip might be worked by a people based on the *kitivos* for their main subsistence, but a crop could not be expected oftener than once in every two or three years; it would always rank as supplementary marginal land.

The descent from the red earth towards lower ground crosses zones of different soils the nature of which is determined largely by slope and drainage conditions. The term *catena* (Latin = a chain) is used for such a topographic succession of soils. The simplest *catena* occurs in the upper valleys where the red earth abuts directly on the valley soils. The latter consist of deep loamy somewhat stratified blackish-brown alluvium showing remarkable fertility under crops. Further down-stream this passes gradually into the *kitivo* lands.

A more gradual descent from red earth to *kitivo* where the valleys have broadened out shows a sequence of brownish types and then coarse stratified sand. The higher-lying types are of minor extent. The stratified sand exhibits a well-marked yellow-rusty horizon at 3 feet, indicating a fluctuating water-table at about that depth. Some cultivation was noticed on this type, but it appears incapable of carrying a crop through to the end of the dry season. A further distinctive soil type occurs between the stratified sand of the lower foreland and the water-bearing alluvium of the *kitivo* along the *catena* at the mouth of the valleys. It is a hard-surfaced yellow-brown sandy clay showing signs of seasonal water-logging at depth and severe seasonal drought. Agriculturally it is very unattractive, but serves for village sites, being above flood level and bearing springs surrounded by heavy riparian forest.

The *kitivo* lands can be divided into central and peripheral zones. The central zone, which is most regularly flooded, carries fine-textured but friable grey-black loams. It is firm level land, water-bearing, but rarely swampy. Normal cropping is rice, with maize between floods. The peripheral soils are more variable, depending on what stratum of the alluvium forms the surface. They carry maize, with cotton fields along their outer margins. There are no trees in this zone, no bananas or cassava, and of course no huts. On both sides of the Umba River the *kitivo* land of both central and peripheral zones appears.



Sketch map showing situation of Kitivo in relation to the W. Usambara massif.

to be fully occupied, or at any rate allotted and cultivated from time to time—some of it being held by residents on the highland plateau, who grow their rice and their between-season maize down below and have their cattle and main crop, maize, up above.

A related type occurs in two patches further downstream, where the land lies just too high to be flooded, though the river runs alongside. Since their deposition as alluvium, the stream has cut down into its own bed and now seldom overflows at those places. The one farthest downstream divides the Uba into two nearly equal and permanently flowing channels, each with its fringe of riverside trees. The channels reunite lower down; the island so formed is about two-thirds of a mile long and 200–400 yards wide. The soil is a rich milk-chocolate-coloured clay loam of excellent crumb-structure, holding ample ground water. The bush was clearly secondary, and this choice piece of land, obviously of high fertility, was regarded by the cattle-keeping colony as a reserve for food-growing in times of drought. Further downstream still, the riverain

land becomes a mere strip, with low trees, often not more than 100 yards wide, passing directly into the dry plain. There is thus no possibility of new agricultural settlement on riverain lands, for hardly any such lands exist that are not already occupied or regarded as reserves by the local population.

Between the main stream valleys running across the escarpment there are minor dry valleys containing grey-black clayey soils which no doubt could support rice in the wet season. The transitional soils of the valley sides could probably carry cassava and sorghums, and there is perhaps room for a few settlers here.

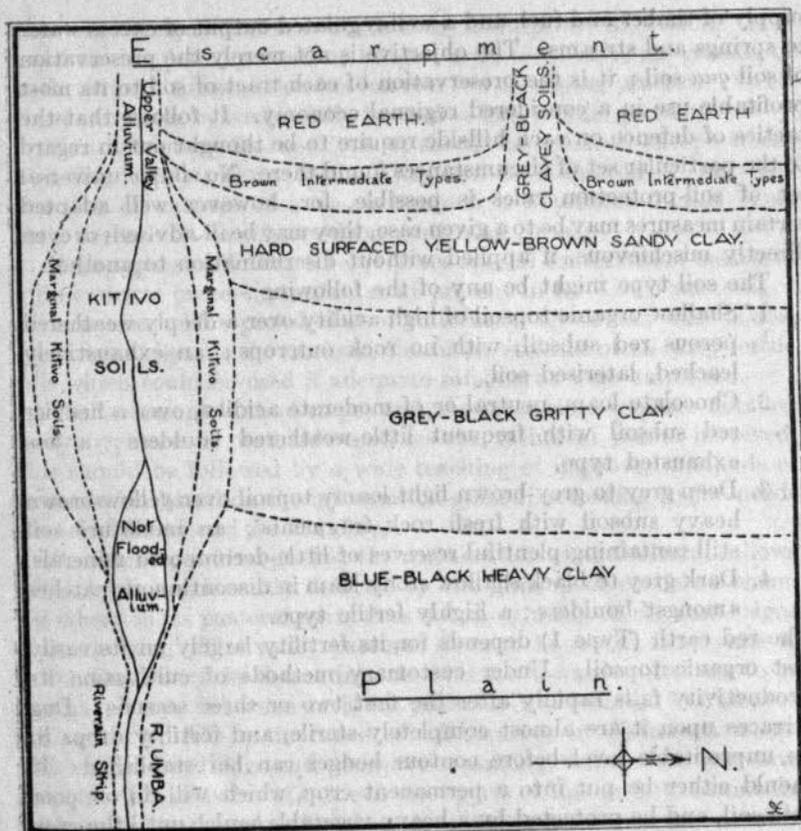
The catena down the main escarpment and out on to the plain—i.e., the descent in directions in which no riverain lands are encountered—includes some of the types already mentioned. The soils crossed in turn are :- the red earth ; a brown intermediate type ; the hard-faced yellow-brown sandy clay ; a heavy grey-black gritty clay ; a blue-black heavy clay.

The grey-black gritty clay cracks deeply, assuming a roughly columnar structure. It is non-calcareous in the top foot, but below that nodular carbonate is generally distributed. It is quite uncultivated and the grass is grazed only by a few goats. The blue-black heavy clay fissures widely and tends to break down to a granular structure. Specks of calcium carbonate occur throughout the profile. This soil occupies a wide belt along the whole front of the escarpment.

None of the lower and more extensive zones of this catena offers immediately attractive possibilities for agricultural settlement. The hard-surfaced yellow-brown sandy clay as previously mentioned is very unpromising. The grey-black gritty clay would require heavy labour and skilful management to obtain a tilth, but it could be made to yield heavily in certain crops and in favourable years. The problems involved here occur on non-irrigable semi-arid black clay lands throughout East Africa, and their solution becomes more urgent as the lighter soils in native occupation become overpopulated and progressively deteriorate. Chemical reserves of these heavy lands are probably high ; the only likely deficiency is nitrogen, which would be made good by natural processes under tillage and a rotation of crops. It is felt that there is a case for experimental work on the cultivation of these soils and in the teaching of the native to use such methods as can be devised. Although the problem is not especially urgent along the Usambara escarpment-foot, this area has some advantages for tackling the problem, being near supplies of food and water and not remote from an administrative centre.

The potentialities of the more arid blue-black heavy clays are difficult to assess, and rainfall data are necessary before their utilisation can be seriously considered.

The possibilities of irrigation were investigated, and though there is apparently sufficient water to irrigate a fair acreage of land, it was concluded that an irrigation scheme would require an efficiency of organisation beyond the present capacity of the local peasant settlers.



Major Soil Zones of N.E. Usambara Escarpment (Diagrammatic).

More intensive use of the *kitivo* areas and their margins would be facilitated if cattle could be kept and they and their manure were made part of the agricultural system. The utilisation of the black clay zones is out of the question without cattle, and this depends on whether or not tsetse fly can be eliminated.

The present position on the outlying lowlands is, therefore, so unpromising that one is forced back to the highlands to consider whether pressure of population can be relieved in other ways.

CULTIVATION ON SLOPES.

In West Usambara there is usually no alternative to cultivation on slopes, the extent of bottomlands being relatively trivial. It is now generally recognised that hillsides in tillage tend to lose their soil unless the agricultural methods in use expressly provide safeguards—which the methods of the local people, unsophisticated, do not. The present total productivity of the hillside lands must be maintained, and the increase (if any) of the population must be provided for by net gains on restored lands. "Total productivity" includes not only agricultural, but also pastoral production, the

supply of timber and fuel, and a well-regulated output of excess water to springs and streams. The objective is not merely the preservation of soil *qua* soil; it is the preservation of each tract of soil to its most profitable use in a considered regional economy. It follows that the tactics of defence on each hillside require to be thought out in regard to the particular set of circumstances found there. No simple universal set of soil-protection rules is possible, for, however well adapted certain measures may be to a given case, they may be ill-advised, or even directly mischievous, if applied without discrimination to another.

The soil type might be any of the following:—

1. Shallow organic topsoil of high acidity over a deeply weathered porous red subsoil, with no rock outcrops; an exhaustively leached, laterised soil.
2. Chocolate loam, neutral or of moderate acidity, over a heavier red subsoil with frequent little-weathered boulders; a less exhausted type.
3. Deep grey to grey-brown light loamy topsoil over yellow-brown heavy subsoil with fresh rock fragments; an immature soil still containing plentiful reserves of little-decomposed minerals.
4. Dark grey to black shallow stony loam in discontinuous patches amongst boulders; a highly fertile type.

The red earth (Type 1) depends for its fertility largely on its easily lost organic topsoil. Under customary methods of cultivation its productivity falls rapidly after the first two or three seasons. Dug terraces upon it are almost completely sterile, and fertility drops to an unprofitable level before contour hedges can be established. It should either be put into a permanent crop, which will do on poor acid soil, and be protected by a heavy vegetable mulch until the crop provides a complete cover, or not be cultivated at all. A great deal of land of this type that has been under field crops has been sheet-eroded and has gone back to scrub. There is little prospect of restoring it to *agricultural* productivity, but it might be utilisable as *pastoral* land. Developed as such, it would reduce the extent of cattle grazing in agricultural bush fallows, which is the present damaging and almost universal practice.

The chocolate loam (Type 2), though of greater intrinsic fertility than the red earth, is incapable of bearing a long succession of crops without recuperative periods under bush fallow. Tilled slopes are liable to gully erosion, and the best treatment for this land is probably strip-cropping, with up to 3 acres under fallow for every acre in cultivation. Some reorganisation of boundaries of holdings would be necessary to put this into practice.

The yellowish immature soil (Type 3) appears to be able to support suitably rotated crops with shorter intervals for rest than the previous types. If some form of manuring were introduced bush fallow could probably be eliminated altogether. It lies on very steep slopes. Whilst being prepared for planting, it is steadily moved down-hill by the strokes of the hoe and pushed further by the worker's feet; but its loose consistence probably makes it very absorptive of rain, and

there are no signs that it is particularly susceptible to erosion. It is best held in place by contour hedges, and, as always, the grazing of cattle through the stubble after harvest is a damaging practice. Steep slopes can never be successfully treated as long as this goes on.

The dark stony loams (Type 4) should be utilised, except where crest-line forest is threatened. They can be stabilised by the construction of terraces of loose rock which is abundant in this type. They deserve to be managed on gardening lines.

Each type of soil, therefore, requires special conservation measures and empirical protection rules, as at present in force, are wasteful of soil resources. The prohibition of cultivation on stream sides is also open to criticism, as the banks of Usambara streams often carry fertile soils which could be used if adequate safeguards were employed.

The treatment both of slopes and of stream sides requires detailed study by someone well informed on the technical points involved. This should be followed by a wide teaching of improved methods of conservation based on the information gained, according to the needs of each hillside and each valley.

Overstocking.—Except that the regeneration of agricultural fallows under bush is grievously delayed by the grazing of cattle on them, Usambara in its pastoral parts does not show many of the usual signs of overgrazing. The valley pastures seem to be rested from time to time. Gullied tracks descending the hillsides towards water are to be seen in plenty, but some such are probably unavoidable in unfenced hill country. The main cause of soil damage in Usambara is unplanned hillside tillage and *uncontrolled* grazing, rather than excessive grazing. The presence of cattle in most parts of highland W. Usambara ought to be a great agricultural asset, and the use of farmyard manure and composts could usefully be developed.

The total extent of reserved and European-controlled forest in West Usambara is large for so thickly populated a district. To preserve land to forest is to safeguard timber and the soil under it, fuel supplies and stream flow, but it does not of itself keep on the land the agricultural population that is to enjoy these things. By planting up unattractive sites too far gone in accelerated erosion to be fit for anything but the growing of trees, their soil, now lying idle and deteriorating further, will be usefully employed. If, then, as must be admitted, much of West Usambara is better classified as forest land than as agricultural land, forestry might contribute towards "easing the pressure on the land" by maintaining a maximum population of forest workers.

As a general conclusion, it seems that the development of fresh lands on the plains for the accommodation of ex-highland cultivators need not become a pressing problem at the present, rather slow, rate of increase of numbers of the people, provided that the rate of progress in conservation of the highland soils is greatly improved. The most immediately profitable field of work towards putting the population in permanent possession of enough productive land for their needs lies on the highland plateau rather than on the arid lowlands.

THE EVOLUTION OF GUILDFORD.

L. M. BUDDEN.

GUILDFORD, on the River Wey, has spread its tentacles far beyond its original boundary, the narrow confines of the gap between Pewley Hill and the Hog's Back, and the residential areas extend to Stoughton on the north, Merrow on the east, Onslow Village on the west, and Shalford on the south. On the Hog's Back, given to the town by the Onslow Village Estate Company, and Pewley Hill, given by the Friary Brewery, are two public open spaces.

On the escarpments, south of the chalk downs, are a number of poultry farms. South of these lies a narrow belt of gault clay. In this valley are dairy farms. Others are found north of the downs on the London clay. Beyond rise the wooded sandstone hills of St. Martha's, the Chantries and St. Catherine's. The Chantries and the gault clay vale have been acquired by the town to control development. On each side of the river is a belt of fertile alluvium.

The river has built up many eyots and follows a braided course. The meanders near St. Catherine's show perfect examples of under cutting and deposition. Between Millmead and St. Catherine's the river has built up its bed and now flows on a levée. At Millmead is a fall of six feet in the river level.

Guldeford, so named in Alfred's will as a royal possession, cannot mean "the ford of the guild," for there were no guilds in Alfred's day. According to Neville, the Wey was the Guilou named in Asser's "Deeds of Alfred," so that the name may mean "the ford of the Guilou." "Surrey Place Names" suggests that it is the "the Golden Ford." The bare red-gold sand of the steep slope from the river to the top of St. Catherine's Hill is conspicuous from several points.

In Domesday Book we are told that "In Guldeford King William possesses 75 tenements in which reside 175 men."

The castle-mound is partly artificial. The square keep was erected before 1213, when it was captured by the French Louis in John's reign. John and his son Henry lived in buildings just outside the keep, which was used as prison and fortress. Henry kept his wines in the chalk caverns in Rack's Close.

Henry the Second enforested the Manor of Guildford and finally declared the whole county forest. By 1642 the only royal forest in Surrey was that of Guildford; this now includes a residential area, Guildford Park.

Trade followed the line of the downs east and west; the forested country north and south was difficult to penetrate. The old British trackway (The Mount) ran along the chalk ridge and probably followed a Neolithic road. The Farnham Road, with its easier gradients, was cut to carry the stage coaches. The medieval road ran hard by the sandhills and to-day is called the Pilgrim's Way. The river alone formed a comparatively easy and useful trade route from north to

