

## 3.10 MALI

### Introduction

Mali has an area of 1 240 140 km<sup>2</sup>, a population of 7 492 000 (1983) and a mean population density of only 6 persons/km<sup>2</sup>. It is land-locked, being bounded by Niger, Burkina Faso, Cote d'Ivoire and Guinea in the south, by Senegal and Mauritania in the west, by Algeria in the north, and by Niger in the east. It extends from 10°04'N, at a triple junction with Guinea and Cote d'Ivoire, northwards across the Tropic of Cancer to 25°00'N at another triple junction with Mauritania and Algeria, a distance of approximately 1675 km. The extreme western point is at a longitude of 12°11'W at the confluence of the Senegal and Bafing Rivers, and the extreme eastern point is 4°14'E on the border with Niger, an E-W distance close to 1745 km. The country thus spans 14°56' of latitude and 16°17' of longitude.

The lowest land in Mali is in the far west, in the valley of the Bafing River. Here the Bafing flows northwest along the eastern side of the Bambouk Hills which lie along the border with Senegal, and an expanse of lowland, under 100 m asl, extends away from the river to the northeast. This is in fact the valley of an intermittent tributary stream, with some extensive lakes, e.g. the Mare de Magui, along its length. The lowlands here occupy some 20 000 km<sup>2</sup>, all below the 100 m contour. Other low land, between 100-200 m asl, extends up the valley of the Bafing for 200 km to the border with Guinea in the south, and up the valley of the Baoule River, a tributary, towards Bamako (12°40'N/7°59'W). This valley opens into a wide basin laced with intermittent watercourses on longitude 10°00'W, and this then extends eastwards to 8°40'W.

The other low lying land in Mali is situated in the Sahara, in the far north. Here, in the desert, two parallel depressions, below the 200 m contour, are oriented SE-NW. They are each close to 150 km in length, and both exceed 25 km in maximum width. Ephemeral watercourses enter these depressions and they contain large areas of saline marsh, kept moist in large part by subterranean water.

Apart from these two lowland areas the rest of Mali lies almost exclusively between 200-500 m asl, and presents a monotonous flat or gently undulating landscape. The only patches of highland are along the southern and eastern boundaries. In the south the Manding Plateau near Bamako is an extension of the Fouta Djallon Mountains of Guinea. This is a sandstone area, deeply incised by the valleys of the Niger and Senegal Rivers and their affluents, with plateau edges that fall away in steep cliffs. Both here and in the hills around Sikasso (11°19'N/5°40'W) land rises above 760 m, while to the northeast, along the south side of the middle course of the Niger River, the Dogon Plateau rises to 777 m, and Hombori Mountain (15°15'N/1°40'W) rises to a height of 1155 m asl, this being the highest point in Mali. In the northeast, on the border with Algeria, the Adrar des Iforas Massif rises to 980 m asl.

Drainage in the extreme southwest is to the Senegal and Bafing Rivers and thus to the Atlantic Ocean. The other highlands along the southern border drain to the Niger, and run-off from here thus reaches the Atlantic in the Gulf of Guinea. The vast northern areas are virtually rainless and have no important drainage system, apart from that leading to the two depressions mentioned above.

## Vegetation

Vegetational zones cross the country in parallel from east to west. Localised forest occurs along the border with Guinea and galleries of forest line the perennial rivers which flow through Soudanian savanna country. Here in the south there is often a mosaic of open forest and savanna, the forests dominated by *Khaya senegalensis* and *Lophira lanceolata*. North of Bamako *Acacia albida*, *Adansonia digitata*, *Bombax costatum*, *Borassus aethiopum*, *Parkia biglobosa* and *Tamarindus indica* are the characteristic trees, while the principal Soudanian grasses are *Andropogon gayanus*, *Ctenium newtonii*, *Cymbopogon giganteus*, *Hypparrhenia dissoluta* and *Loudetia simplex*, and some annuals including *Andropogon pseudapricus*, *Ctenium elegans*, *Eragrostis remula* and *Pennisetum pedicellatum*. The tree flora becomes poorer and the trees more scarce towards the Sahelian zone where they become restricted to species such as *Acacia scorpioides*, *Adansonia digitata*, *Anogeissus leiocarpus*, *Balanites aegyptiaca*, *Commiphora africana*, *Hyphaene thebeka* and *Ziziphus mauritiana* in wooded steppe country. The Sahelian zone proper is true steppe country in which *Cenchrus biflorus* (cram-cram) is dominant. In passing farther north permanent vegetation peters out and the north of Mali is in the Sahara. Here ephemeral plants such as *Aristida longiflora*, *A. pungens*, *Calligonum comosum*, *Cornulaca monocantha* and *Panicum turgidum* appear briefly after rain.

## Climate

There are two seasons in the south, a wet and a dry season. Reduced pressure occurs over the Tropic of Cancer in July and August, and at this time the SW Trade winds blow across the southern regions bringing rain behind the intertropical convergence zone, which reaches its most northerly position at this time. The rains occur during July and August in Tombouctou (16°46'N/3°01'W) and Gao (16°16'N/0°03'W), but south and west of these places the season is longer, lasting 5 months at Bamako (12°39'N/7°59'W), from June to October, and 4 months at Kayes (14°27'N/11°26'W), from June to September. To the north of Tombouctou the rains soon peter out and there is no reliable wet season.

In the Soudanian zone rainfall is between 600-1275 mm, while in the Sahelian zone it is 200-600 mm. Bamako has a mean annual rainfall of 1037 mm, with falls of 340 mm in August and over 200 mm in both July and September, while December-March are rainless. Sikasso is among the wettest places with a mean annual total close to 1400 mm. At Kayes, in the middle west, mean annual rainfall is 790 mm, while at Gao, in the middle east, it is 261 mm. In the latter place 8 months of the year (October-May) are virtually rainless, the mean 8 monthly total being 13 mm averaged over 64 years. Tessalit (20°12'N/1°00'E) in the far north has a mean annual rainfall of 82 mm. It rains on 79 days each year at Bamako, on 50 days at Mopti (14°30'N/4°12'W) in the Interior Delta of the Niger, and for

25 days at Tombouctou.

Two winds influence the country during the dry season. The hot dusty Harmattan blows from the northeast and east, bringing temperatures in excess of 40°C in the south of the country from March to June. During the December-February period, a northwesterly wind, the Alize, may bring cooler weather, but this wind becomes less reliable in passing east. In the far north temperatures are extreme, readings of 58°C having been made, and 47°C being a common shade temperature. The mean temperature of the coolest month at Bamako is 25°C and that of the warmest month 32°C, with similar figures for Sikasso. Corresponding figures for Tombouctou and Gao are 23 and 35°C, while for Kayes they are 24 and 35°C.

Relative humidity seldom reaches 20% over the northern half of the country in January, but may approach 40% in August, while in the south it reaches 80% along the Guinea border in August, falling to 40% in January. Most of the south experiences relative humidities of 50-70% during August and 20-30% during January. Potential evapo-transpiration exceeds 2000 mm over the delta.

## **Wetlands**

The principal wetlands are riverine. Precipitation is highly seasonal over the southern catchments and almost all the southern rivers flood. Small floodplains are, found on the rivers of the Senegal system, and on the affluents of the Niger. The major wetland occurs where the Niger crosses the bed of a prehistoric lake and because of the flatness of the terrain, divides into many channels and lakes in what is often referred to as the 'inland delta'. Elsewhere, daias, zones of moist soil and waterholes, are found along fossil watercourses, while others appear to occupy isolated depressions.

## **List of Wetlands Described**

1. The Internal Delta of the Niger River
  - (a) The Delta
  - (b) Tributary Rivers
2. Minor Wetlands
  - (a) Wetlands of the Senegal River System
  - (b) Daias
3. Artificial Impoundments
4. Oases

### **1. The Internal Delta of the Niger River**

## (a) The Delta

**Country:** Mali

**Coordinates:** 13°34 ' -16°51 'N/2°28 ' -5°45 'W (delta + lakes)

**Area:** 3 200 000 ha (main delta + associated wetlands)

**Altitude:** 263-271 m asl

**Nearest Towns:** Bamako (325 km SW); Tombouctou (on N delta)

**General:** The delta proper is 425 km long, oriented SW-NE, with a mean width of 87 km. The gradient of the delta plain is greater than 1:50 000, i.e. it drops only 8 metres over its entire length. It ends at Tombouctou, where the river swings eastwards and the floodplain is reduced to a width of 10 km. The area comprises a network of river channels with levees, and low clay-based inter-distributary floodplains between. On these areas there are numerous ponds of varying permanence. There is also a system of marigots, small channels in which water is carried to the floodplain in the rainy season and back to the rivers in the dry season. At this time the marigots frequently dry out to a series of stagnant pools. Levees are not pronounced along marigots.

The plateau of Dogonland lies along the southeastern flank of the delta and to the north and west are the huge dune areas of late Pleistocene age, the Erg Ouagadou, which obstructed the ancient course of the Niger, causing it to flow north and east instead of west through Senegal. The delta consists of Pleistocene and Recent alluvium overlying Palaeozoic sandstones. These latter rocks dip under the delta and emerge on the western side in low hills. Lake Faguibine, mentioned later, lies in another parallel fold farther to the northwest.

In the southwestern part of the delta both the Niger and Bani Rivers divide into several channels. Those from the Bani join the main channel of the Niger on its south bank, while those from the Niger leave its north bank. The main channel of the Niger flows obliquely across the delta towards its northeastern edge, while the distributaries from the north bank meander towards and along the northwestern part of the delta. In the lower half of the delta there are several lakes, and two external lake systems, one along the southeastern flank and one along the northwestern flank. Beginning on the northwestern flank, Lake Faguibine is a triangular expanse of water, 75 km long, oriented almost due SW-NE parallel with the delta. It has an open water surface of 45 000 ha at high water, a maximum depth of 15 m, and reaches 12 km in width at the northeastern end. From here it connects through a permanent swamp running N-S, with Lake Tole near Goundam (16°25'N/3°40'W). From Lake T616 an intermittent drainage system connects with the delta. A series of ephemeral lakes lies to the south of Lake Faguibine, known as daounas, e.g. Daouna Beni and Daouna Keino. Several other lakes, partially enclosed by the delta, lie along the northwestern flank. These are found below Goundam, and are Lakes Kande, Kabara, Oro and Fati.

Lake Debo is situated in the central delta, and is the largest of the lakes enclosed by the delta, while along the southeastern margin, partially enclosed by the delta, are Lakes Korientze, Aougoundou and Garou. Lakes Niangay, Do and Haribomo are separate from

the delta on the southeastern side, and are situated in dune swales. They are partly filled by runoff from Dogonland and partly from a high ground water table, but at high water they are in connection with the delta.

Topography within the delta is complex. The flood dominated lower areas contrast visually with the higher unflooded, areas known locally as *tougerès*, in a mosaic of wet and dry patches. The delta is a network of meandering creeks, especially in the south, with coarse sands forming the river beds and levees, and finer grained alluvium the interdistributary flats. Lake Debo is really a widening of the main river channel which expands and contracts as river levels fluctuate. Some way north of Lake Debo, the Erg of Niafounko, a system of wind-blown sand dunes, crosses the delta obliquely, obstructing waterflow and causing the delta to widen.

Below the delta, from Tombouctou to the border with Niger, a river distance of 550 km, the river has a braided course and has a floodplain of varying width on either bank. At maximum it is 10 km wide, at minimum less than 1 km wide.

**Hydrology & Water Quality:** Every year the Niger inundates an area between Ke Macina (13°58'N/5°22'W) and Tombouctou (16°46'N/3°01'W). In a wet year the total area of inundation may exceed 3 200 000 ha, including peripheral lakes, and during the dry season some 1 600 000 ha of lakes and permanent swamps remain, mainly in the northern half of the delta. Some lakes are replenished regularly, e.g. Fati, Horo, Kabara and Tanda, but others fill less regularly and may even dry out in dry cycles, e.g. Faguibine and Niangay. The inundation commences in the south, in August-September, and watercourses overflow progressively from south to north as the flood crest moves towards Tombouctou which it reaches in December.

The flood waters are contributed by the Niger and its principal affluent the Bani, and numerous short streams which drain the Dogonland Plateau. The Niger contributes 50 billion m<sup>3</sup> of water to the delta each year, with a mean discharge rate at Segou of 1585 m<sup>3</sup>/sec, with peak flows of c. 5000 m<sup>3</sup>/sec in August and 70 m<sup>3</sup>/sec in October. The Bani contributes about 20 billion m<sup>3</sup> with a mean discharge rate of 634 m<sup>3</sup>/sec, but also with peak rates of 5000 m<sup>3</sup>/sec in August. The contribution of the Dogonland streams to the delta is insignificant, but they do serve to fill the southwestern lakes. The largest of these rivers, the Yame contributes 250-500 million m<sup>3</sup> of water/yr to the system. Because of the vagaries of rainfall over the catchments, annual variations in riverine inflow are great, as in consequence, are the total areas flooded each year and the depth and duration of the floods. Of the mean annual riverine influx of 70 billion m<sup>3</sup>, almost half is lost by evaporation and infiltration during the transit of the delta. Class A Pan evaporation has been estimated at 2300 mm/yr in the north of the delta.

Direct precipitation over the delta varies from year to year and place to place, with annual totals ranging from 200-600mm. The rainy season usually begins in July and lasts until mid-October in the south, and from mid-July to mid-September in the north. Mean annual precipitation is 750 mm over 53 days at San (13°18'N/4°54'W) at the southeastern extremity of the delta, but this is reduced to 300 mm/yr at Niafounke (15°56'N/4°00'W) and

to less than 250 mm/yr in the far north of the delta.

The flood is slowed on entering the delta and the crest proceeds northwards at a rate of approximately 5 km/day. It takes a month to travel from Ke Macina to Mopti (14°30'N/4°12'W), another month to reach Lake Debo, another month to reach Goundam and yet another month to reach Tombouctou. Discharge from the delta is 35 billion m<sup>3</sup>/yr giving a mean flow rate of 1110 m<sup>3</sup>/sec in the Niger below Tombouctou. However, dry season flow falls as low as 60 m<sup>3</sup>/sec and the river surface may, at such times, drop below the water table in the delta.

The chemistry of the water and its temperature varies from place to place in the delta, and fluctuates through the year. The temperature of affluent Niger water ranges from a maximum of 30°C, which may be reached between April and October and a minimum of 19°C, which may be reached in December-January. Temperatures over 32°C have been measured in stagnant delta pools. The incoming waters carry fine clay particles and are moderately turbid throughout the year, giving Secchi depths of around 90 cm. The pools of the delta are very turbid with Secchi depths of only 3 cm. The affluent waters are low in minerals.

**Flora & Fauna:** *Typha* swamps are common on the Niger above and below the delta. The southern half of the delta is mostly low lying floodplain, with low river levees. The floodplain is covered by typical floodplain grasses such as *Acroceras amplexans*, *Echinochloa pyramidalis*, *E. stagnina*, *Eragrostis atrovirens*, *Oryza barthii*, *Panicum anabaptistum* and *Vetiveria nigritana*, with *Andropogon gayanus*, *Cynodon dactylon* and *Hyparrhenia dissoluta* dominant on the much grazed outer fringes. Along the rivers a scrubby gallery of *Mimosa asperata* and *Salix chevalieri* occurs, with an undergrowth of *Cyperus maculatus*. In the south, sparse gallery forest penetrates the delta along watercourses in places, and here trees such as *Diospyros* sp. and *Kigelia africana* are to be found on higher levees, their existence in many places probably due to human activity. Permanent pools contain *Ceratophyllum demersum* and *Nymphaea* spp., but pools in the channel beds, which dry out or shrink dramatically during the dry season, are often too turbid to support macrophytes. They may however, become fringed by *Echinochloa stagnina* and *Polygonum senegalense* during periods of low water. The lakes are fringed by *Typha australis*, and sometimes by *Phragmites mauritianus*, frequently with species such as *Echinochloa pyramidalis*, *E. stagnina* and *Vossia cuspidata*. Algal blooms are common in the lakes and greatly reduce the transparency of the water. The northern half of the delta has many emergent sand ridges on which the palms *Hyphaene thebarca* and *Borassus aethiopum* are common, particularly in the vicinity of villages. Other common trees or shrubs of elevated areas are *Acacia nilotica*, *Guarea senegalensis*, *Mimosa asperata* and *Ziziphus mauritiana*. The dune swales in the north are flooded at high water, and retain moisture during the dry season so that they contain sedges, reeds and other hygrophilic grasses.

Although over 100 fish species have been found in the delta, there are few endemics. On 3 of these however, is remarkable in being a *planktivorous clupeid*, *Microthrissa miri*. Many typical swamp fish are present including *Clarias* spp., *Gymnarchus niloticus*, *Heterotis*

*niloticus*, *Polypterus ansorgei*, *P. senegalus* and *Protopterus annectens*. The avifauna is very important in the ecology of the delta. Owing to its geographical position, in the Sahelian zone on the edge of the Sahara, the delta provides a winter habitat for vast numbers of palearctic migrants. Over 350 bird species have been identified in the delta, 108 are of palearctic origin. Some species are present in very large numbers, e.g. 1 000 000 *Anas querquedula* may be present, and over 400 000 *Anas acuta* have been recorded. Numbers of ruff are known to have exceeded 300 000. The delta is also an important breeding ground for pelicans, herons, cormorants and pratincoles. At least 13 species of heron have been recorded in the delta, and *Comatibis eremita*, an endangered species, has been recorded from both Lakes Faguibine and Oro. Curry & Sayer (1979) and Lamarche (1980) give details of palearctic migrants in the delta. Among mammals, *Hippopotamus amphibius* and *Trichechus senegalensis* still survive in the delta, but they are both now rare and in danger of extinction. The small mammals associated with Soudanian-Sahelian wetlands are common, but other large mammals have been hunted out and their place taken by domestic cattle.

**Human Impact & Utilisation:** The delta is quite densely populated with an estimated resident population of 580 000. This gives a mean population density of 16 persons/km<sup>2</sup>, or 2.7 times the national average. Semi-nomadic Peuhl cattle herders comprise about 35% of the population, and some 1 200 000 cattle and 1 500 000 sheep and goats use the pastures for 7-8 months of the year. Occasionally Touaregs bring their cattle to the delta as well. There is an agro-pastoral system in operation which is becoming increasingly important, whereby resident farmers growing rice and millet also own cattle. Traditional crop production is mainly carried out by the Bambara and Marka people who comprise about 33% of the delta population. Approximately 120 000 ha of land is used for rice production (1985), using both rain fed and flood dependent methods. Certain herbivorous fish, e.g. *Alestes baremose*, *Distichodus brevipinnis* and *Tilapia zillii*, have however, wreaked havoc on young rice crops in newly flooded fields and have caused serious reductions in harvests. Other rain fed and flood dependent crops include sorghum and manioc. With the spread of irrigation agriculture there has come an additional spread of bilharzia, and as much as 90% of the delta population is affected. Malaria is another major health hazard.

Fishing in the delta is almost exclusively in the hands of the Bozo and Somono people. The delta produces 90% of the national catch, which itself accounts for 3% of the gross national product and 8% of its exports. Fish is exported from Mali to Niger and Burkina Faso. The mean annual catch is close to 100 000 tonnes, but annual deviations from this figure are large. Fish concentrations vary enormously from place to place in the delta and from season to season and the fishermen who follow the fish are semi-nomadic. The catch has declined considerably since 1969, and this is to be attributed in part to the series of drought years in the Sahel and thus diminished flooding, but also to over-fishing, as is evident from the fact that the size of the individual fish has also declined. Traditional methods of catching and trapping fish are still widely used, especially during the dry season when the fish are concentrated in the channels and lakes, but modern gear, including nylon nets, is beginning to become common.

Water is carried from the barrage at Markala to Niono (14°15'N/6°00'W), in canals and an old channel of the river, and is then used to irrigate rice fields in the ancient delta at Niono. Drijver

& Marchand (1985) discuss socio-economic conditions in the delta and plans for the development of the delta, together with an assessment of problems which may arise upon the implementation of the plans.

**Conservation Status:** Unprotected.

### **(b) Tributary rivers**

**General:** A floodplain occurs on the Niger all the way from the Guinean border to Bamako ( $12^{\circ}40'N/7^{\circ}59'W$ ), but most of this has now been converted for the cultivation of rice. The channel of the Niger is divided by numerous islands both above and below Bamako, and a natural floodplain again appears below Bamako where the slope of the land flattens about 100 km south of Segou ( $13^{\circ}27'N/6^{\circ}16'W$ ). In this section the floodplain is up to 5 km wide, but is at first discontinuous. The river continues, with many large islands in its channel, until the barrage at Markala ( $13^{\circ}39'N/6^{\circ}04'W$ ), some 60 km downstream of Segou. The barrage raises the level of the Niger 4.3 m, and from here the Canal du Sahel takes water to an ancient course of the river leading to the fossil delta and rice fields at Niono. The Niger enters its internal delta at a point 88 km below Segou and 10 km above the town of Kotongotomo.

To the southeast of the Niger there are numerous tributary streams with floodplains. There is a floodplain on the Lolio River north of Sikasso ( $11^{\circ}19'N/5^{\circ}40'W$ ) for 60 km, to the confluence with the Ngorolaka River. Another floodplain occurs upstream of the confluence on the Ngorolaka, and at the junction the inundated area spreads 3.5 km on either side of the river, which is then known as the Banifing River. The Ngorolaka floodplain extends upstream for 61 km above the confluence, but is thereafter discontinuous. It nevertheless extends for a further 40 km along the border with Burkina Faso. Minor floodplains also occur on affluents of the Ngorolaka, e.g. on the Groumbo, Selecloga and Longo Rivers.

A floodplain occurs on the Bafini River, and on its two affluents, the Niè and Boin Rivers to the south of Sikasso between the co-ordinates ( $10^{\circ}38' - 10^{\circ}55' N/5^{\circ}33' - 6^{\circ}00'W$ ). The total length of the floodplains is 70 km and the total area 21 000 ha. The Bafini then joins the Bagoé River at a point  $10^{\circ}53'N/6^{\circ}12'W$ . The floodplain on the Bagoé is 150 km long and 0.5-9 km wide above its confluence with the Baoulè River ( $12^{\circ}36'N/6^{\circ}35'W$ ), with a total flooded area exceeding 40 000 ha. A small floodplain also occurs on the Baoulè, about 40 km long and 1 km wide, some way upstream of the confluence ( $12^{\circ}00' - 12^{\circ}16'N/ 7^{\circ}05' - 7^{\circ} 10'W$ ). The Bagoé then flows on for 25 km when it joins the Banifing to form the Bani River ( $12^{\circ}44'N/6^{\circ}23'W$ ), the other major affluent of the internal delta.

It is 250 km from the Bagoé/Banifing confluence to the beginning of the delta, and over this distance the floodplain on the Bani is continuous. Locally it is better developed on one bank than the other, and about 60% is to be found on the right bank. From a point 50 km southeast of Ségou, the Bani flows northeastwards in parallel with the Niger, and over this last section the floodplain is 8-12 km wide, until it merges with the inundated zone of the delta. There are close to 125 000 ha of floodplain on the Bani in this final sector.

## 2. Minor Wetlands

### (a) Wetlands of the Senegal River system

**General:** Some wetland exists in the lowlands in the extreme west of Mali which drain to the Senegal River. In the past, in times of more pluvial climates, large rivers with broad floodplains traversed these valley lowlands, depositing great tracts of alluvium. Today however, the streams which flow through the ancient floodplains are small and the modern floodplains narrow. There is such a floodplain on the Kolinbine River above its confluence with the Bafing River at Kayes ( $14^{\circ}27'N/11^{\circ}26'W$ ). Another floodplain, situated  $14^{\circ}29'-15^{\circ}13'N/10^{\circ}35' -11^{\circ}14'W$ , includes several small lakes. These are known collectively as the Mare de Magui if they become continuous during the rains, but with the recent drying of the Sahel this has not happened for several years. The floodplain is 6 km wide locally and stretches upstream for 135 km, beginning 30 km up stream of Kayes. It also spreads for short distances up two affluents of the Kolinbine and covers, in total, some 24 000 ha.

Another small floodplain ( $15^{\circ}22'N/9^{\circ}29'-9^{\circ}42'W$ ) with some permanent swamp land is situated on the border with Mauritania, immediately to the north of the town of Nioro du Sahel ( $15^{\circ}15'N/9^{\circ}35'W$ ). The wetland area is at the head of a valley, less than 100 m asl, below the source of an ephemeral stream which flows into Mauritania and then loops back into Mali to join the Kolinbine River.

Yet another narrow and discontinuous floodplain occurs on the Karakora River, which flows SSW from Mauritania through Mali and joins the Bafing River on the Mali/Mauritania border, just 25 km above the confluence of the Bafing and Senegal Rivers. This floodplain is 3 km wide locally and extends across the border into Mauritania. Another small floodplain, 22 km long and up to 2 km wide, is situated  $15^{\circ}23'N/11^{\circ}30'-11^{\circ}41'W$  on an affluent of the Karakora River.

Small floodplains occur on the Baoule River, and its affluent the Darooma River, in the 'Boucle du Baoule' region, e.g. at  $13^{\circ}53'N/9^{\circ}50'W$  on the Darooma and at  $13^{\circ}47'N/9^{\circ}25'W$  on the Baoule. This is another region where more water flowed in the past and it has been suggested that a former course of the Niger, which was certainly to the sea via the Senegal River, was through the Baoule Valley.

### (c) Daias

**General:** Areas of wet sand occur in troughs between dunes and along fossil watercourses where the water table reaches or approaches the surface for part of the year. These areas are known locally as daias and they are common in three principal areas. Some large daias occur in parallel with the internal delta of the Niger, along its northwestern flank. The largest of these measures 25 km in length and 10 km in width, and in wet years some contain ephemeral ponds known as douanas.

In the far east of Mali, the great Vallee de l'Azaouagh, the site of a fossil watercourse, crosses a corner of the country from SW-NE ( $15^{\circ}30' - 17^{\circ}19'N / 3^{\circ}28' - 4^{\circ}16'E$ ). The valley is 250 km long in Mali and decreases in width from 14 km in the northeast to 2 km in the southwest. It is floored by humid sands. Other daias are found in a crescent 50 - 125 km west of the valley in the Tidarmene ( $16^{\circ}34'N / 2^{\circ}17'E$ ) district. The nine largest of these each covers approximately 4000 ha.

Yet other daias, oriented NE-SW, occur on the fringes of the Adrar des Iforas Massif, and others in the far north of Mali, north of latitude  $22^{\circ}N$  in two major lowland depressions. These latter daias are saline.

### 3. Artificial Impoundments

**General:** There is a dam ( $13^{\circ}13'N / 10^{\circ}29'W$ ) on the Bafing River in southwest Mali, which provides an open water surface of 69 000 ha. The lake is 67.5 km long and has a mean width of 10 km.

### 4. Oases

**General:** There is an oases at Tessalit ( $20^{\circ}11'N / 0^{\circ}59'E$ ), the natural vegetation of which includes *Acacia nilotica*, *Hyphaene thebaica* and *Tamarix africana*, but this has largely been replaced by groves of *Phoenix dactylifera*.