

2.6 RWANDA

Introduction

Rwanda has an area of 26 330 km², a population of 5 580 000 ((1983), and the highest mean population density of any African state, 212 persons/km². It is a mountainous country situated on the eastern margin of the Western Rift Valley and bounded by Uganda in the north, Tanzania in the east, Burundi in the south, and by Zaire in the west. It stretches 185 km from north to south between latitudes 1°04' and 2°51'S, and 225 km from west to east between longitudes 28°51' and 30°54'E.

The western third of the country is dominated by the N-S chain of mountains along the rim of the Rift Valley. In the northwest these rise to 4507 m asl at Mt. Karisimbi (1°30'S/29°27'E) and to 4127 m at Mt. Muhavura (1°24'S/29°40'E) on the Zaire border. West of the mountains the land slopes steeply down to the surface of Lake Kivu (1460 m asl) on the floor of the Rift Valley, while to the east it slopes more gently to the dissected eastern plateaux. However, the eastern slopes in the middle of the mountain chain do fall steeply, to the deeply cleft valley of the Nyawarungu (Nyabarongo) River, the floor of which is oriented N-S at about the same altitude as Lake Kivu. The middle third of the country is a high plateau, 1500-1750 m asl, while the eastern third is another plateau, set at 1200-1400 m asl, but with many hill ridges rising above it to heights of 1600- 1800 m.

The western slopes of the mountains drain by torrential streams, full of waterfalls and cataracts, either to Lake Kivu, or to the Ruzizi River, by which Lake Kivu drains southwards to Lake Tanganyika. Both the eastern slopes of the mountains and most of the high central plateau drain to the Nyawarungu River, which after receiving the Akanyaru as a tributary, flows along the Rwanda/Burundi border to join the Kagera River at the southeastern extremity of the country. From here the Kagera delimits the Rwanda/Tanzania border all the way north to Uganda, after which it swings east to enter Lake Victoria. Thus, run-off from Rwanda finds its way, either to the Atlantic Ocean via Lake Tanganyika and the Zaire River, or to the Mediterranean Sea via Lake Victoria and the Nile.

Climate

Despite the proximity of Rwanda to the equator, the climate is mild, being moderated by altitude. The high peaks experience almost permanently inclement weather, cool or cold and very rainy. The high plateau is temperate, but still comparatively wet, while the eastern third of the country has a tropical rather than an equatorial climate. Mean annual rainfall may reach 2800 mm on

the western faces of the highest peaks, but is probably no more than 2400 mm/yr over most of the western dorsale. It averages 1200 mm/yr in central districts but declines eastwards with loss of altitude to as little as 650 mm/yr in stations on the Tanzanian border. Over most of the country there are 4 seasons, two warm and wet, and two warm and dry. The short rainy season lasts from October to December, the short dry season from January to February, the long rains from March to May, and the long dry season from June to September. The eastern half of the country experiences 2200-2400 hours of sunshine each year, with a maximum in July and a minimum in January. During the long dry season relative humidity may fall to 20%. Wind speeds are usually light, 3-6 km/hr during the wet season, but higher during the dry. The SW monsoon brings thunderstorms, and most of the rain.

Mean annual rainfall is 1001 mm at Kigali (1°57'S/30°04'E), 1552 m asl, and 1116 mm at Rubona (2°29'S/29°46'E), 1650 m asl. April is the wettest month at both stations (137 and 161 mm respectively) and July the driest month (6 and 8 mm respectively). The mean annual temperature at Rubona is 19.5°C, with mean annual maxima and minima of 25.7 and 13.3°C. Absolute maxima at this centre are close to 32°C each year while absolute minima are close to 6°C. Frosts occur in the high mountains during the dry seasons.

Vegetation

The eastern half of Rwanda supports evergreen Afro-montane vegetation and the western half a mosaic of evergreen bushland and secondary grasslands with *Acacia* spp. Within these broad vegetational zones most valley floors and parts of the western dorsale carry edaphically determined vegetation.

Wetlands

There are two great swamps in Rwanda. These are the Mugesera-Rugwero Swamps in the south and the Kagera Swamps along the Tanzanian border in the east. There are other minor swampy areas in flat places in the high valleys, and many very extensive bogs on the mountainous dorsale and on the high central plateau. There are several natural lakes of very different characters.

List of Wetlands Described

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1. The Nyawarungu/Akanyaru River System

General: The Nyawarungu has several sources in southern Rwanda in forested country at 2600-2750 m asl, chief among which are the Birurume and Lukarara/Mwogo Rivers. Below the confluence of these major headwater tributaries the Nyawarungu flows east, through much boggy highland country, before descending to 1500 m and entering a deep and narrow valley oriented N-S. It continues in this valley for 80 km before swinging SE at Muramba (1°43'S/29°36'E). From here it meanders over its narrow valley floor, receiving first the overspill from Lake Mohasi via the Nyabugogo River on the left bank, and then, some 35 km farther on, the Akanyaru River on the right bank.

The Akanyaru is the most important tributary of the Nyawarungu. It has sources at 2°45'S/29°26'E and 2°46'S/29°26'E, close to 2300 m asl in the south of the country, but the Mugere, an important headwater tributary, rises in Burundi at 2450 m asl. In its lower course the river flows sluggishly through a broad belt of permanent swamps, up to 7 km wide and 82 km long immediately above its confluence with the Nyawarungu. The swamps cover some 25 000 ha, of which the lower 7000 ha are in Rwanda. The Akanyaru descends from 1465 m asl at the head of the swamps in Burundi (2°47'S/29°50'E), to 1400 m asl at the confluence with the Nyawarungu (2°05'S/3°01'E) where the swamps end. Above this, in the swamp belt in Rwanda, it receives overspill from the two Tshohoha Lakes on the right bank. The boundary between Rwanda and Burundi runs through Lake Tshohoha South for 22 km, and about 25% of the lake surface is in Rwanda. The lake is described in section 2.1.2. Below this the river receives the seasonal overspill from Lake Tshohoha North, described in section 2.6.8. Many of the higher tributary valleys are choked by papyrus, with seasonal swamp forest behind. This latter is dominated by *Syzygium guineense*, but with *S. owariense* in the wettest sites, and often with *Ficus verruculosa* and *Myrica kandiana* as associates. Seasonally inundated savannas, with *Acacia polyacantha* var. *campylacantha*, *A. sieberana* and *Bridelia nzicrantha* occur on the margins of Lake Tshohoha and around the permanent swamps.

Below the Akanyaru/Nyawarungu confluence the swollen river flows due east in a broad valley which soon becomes swampy again. At first it carries galleries of forest flooded only seasonally, but *Ficus verruculosa*, *Myrica kandtiana*, *Phoenix reclinata* and *Cyperus papyrus* become progressively more common at the riverside in passing downstream. Then, after turning SE again, the river traverses the Mugesera/Rugwero Swamp, dominated by floating islands of *Cyperus papyrus*, with great beds of *Miscanthidium violaceunz* rooted on the margins. This swamp is described in section 2.6.10. After leaving the swamps the river flows 35 km eastwards to a confluence with the Ruvuvu River, forming the Kagera River, which is the principal affluent of Lake Victoria.

The Nyawarungu/Kagera River system descends with a mean gradient of 1:2326 in traversing Rwanda between the head of the high valley at 1500 m and the Tanzanian border. The floor of the high valley of the Nyawarungu is inundated in the wet seasons but is intensively cultivated in the long dry season. There are mine workings along it at several points. Swamps in some tributary valleys along its upper course have been drained, more or less completely, with attendant problems of increased erosion, and decreased soil fertility because silt is no longer deposited. Along the swampy middle course, some areas are being used for rice cultivation, and many drier sites have been converted for the cultivation of sugar cane.

There is a rich avifauna in undisturbed parts of the river system, especially in the Mugesera/Rugwero Swamps, while in developed areas some water birds still survive, including *Balearica pavonina*. Very many of the animals listed for Eastern Equatorial Africa in the regional introduction are present in undisturbed areas, but only the smaller species survive in densely populated areas. No part of the valley is protected.

2. Lake Kivu

Wetland Name: Lake Kivu

Country: Rwanda

Coordinates: 1°35'-2°31'S/28°49'-29°20'E

Area: c. 260 000 ha (excluding islands; c. 165 000 ha in Zaire)

Altitude: 1460 m asl

Nearest Towns: Kibuye (on central lakeshore); Gisenye (at N end)

General: Lake Kivu lies in the Western Rift Valley, enclosed on three sides by land which rises steeply from the lake to altitudes of over 2000 m, and to 4507 m just to the north. The lake is 100 km long, and has a

maximum width of 50 km almost exactly along the parallel 2°S. There are 68 islands in the lake, most small, and most in Rwanda, but Idjwi Island, 40 km long and with an area of 69 000 ha is in Zaire.

Hydrology & Water Quality: The lake receives run-off from the surrounding mountains, with no less than 30 rivers entering it along the highly indented Rwandan shore. In addition it is believed that warm water is injected into the lake from submerged hot springs, and that the effluents from the small group of Mokoto Lakes (in Zaire) reach Lake Kivu underground. Rainfall in the catchments exceeds 2400 mm and is not markedly seasonal. The lake is deep, c. 480 m, meromictic, and the most firmly stratified lake in Africa. Water density increases towards the bottom, but not as a steady gradient; there is a series of discrete layers. The surface water has a salinity of 1‰, and the top 70 metres are mixed, but it seems that below this the hypolimnion is completely stagnant, highly saline, and very rich in nitrogen and phosphorus. The pH of the surface waters is about 9.1. It appears that natural phenomena, other than earth movements and the pouring of hot lava into the lake, do not cause upwellings of the bottom water, which is highly nutritive but contains much dissolved sulphide and methane. The temperature at the surface is close to 25°C, decreasing with depth to about 22°C at 70 m, but then increasing again to 25°C at 375 m depth. The 70 m contour is very close to the shore, and since only the upper 70 m of the water column is oxygenated, it has been estimated that only 12% of the lake floor receives any oxygen. This is the most saline lake in the Western Rift Valley.

Flora & Fauna: There is little information regarding the phytoplankton, but it is neither diverse nor abundant. The macrophyte flora, which extends down to a depth of 8 m is extremely poor, and there is only a narrow fringe of lake bottom above this depth. The deep lake floor is covered by an organic ooze, although towards the shores the bottom is quite sandy, but encrusted with calcareous scale. Here *Cladophora* sp. is the dominant plant. Higher up there are beds of *Ceratophyllum demersum*, *Najas marina* and *Potamogeton pectinatus*, the latter species being most abundant. Around the shallowest margins there are beds of *Phragmites mauritianus* and species of *Cyperus* and *Scirpus*. The fish fauna is poor, comprising just 16 species. Of these, 3 also occur in Lake Tanganyika, namely *Barbus serrifer*, *Barillus moori* and *Clarias mossambicus*. The first and last have wide distributions and were possibly introduced, but *Barillus moori* is found only in these two lakes. There are 6 species of *Haplochromis*, all endemic, and a distinct subspecies of *Oreochromis niloticus* ssp. *regani*, which suggests that speciation has occurred in the lake over the last 20 000 years. There is no large predatory species in the lake. Birds and otters are the principal piscivores, and the lake supports many birds of passage.

Human Impact & Utilisation: *Limnothrissa miodon* was introduced some years ago, and a small sardine fishery has developed, but prior to this there was no commercial fishery of significance.

Conservation Status: Unprotected. However, the high mountain catchments to the north are protected in the Virunga National Park.

Wetland Name: The Mushaka Swamp

Country: Rwanda

Coordinates: 2°38'S/28°55'E

Area: c. 1250 ha

Altitude: 1580-1620 m asl

Nearest Towns: Cyangugu (17 km NW); Kigali (145 km NE)

General: This small swamp is situated south of the village of Mushaka on a west-facing plateau above the Ruzizi River. It is fed by two streams from the highlands above, and is drained by a single stream to the Ruzizi River. We have no specific information regarding its flora and fauna. It is not protected.

Wetland Name: The Kamiranzovu Swamp

Country: Rwanda

Coordinates: approximately. 2°29 ' S/29°15 'E

Area: 1300 ha

Altitude: 2300 m asl

Nearest Towns: Cyangugu (40 km W); Butare (55 km ESE)

General: This swamp is situated in an area receiving some 2200 mm rain/yr in the Afro-montane vegetational zone on the high dorsale of southern Rwanda. The centre of the swamp is dominated by clumps of *Cyperus* and *Lobelia* spp. The margins are fringed by a swamp forest dominated by *Anthocleista grandifolia*, *Podocarpus latifolius* and *Syzygiunz guineense*. Animals present include *Aonyx capensis*, *Cephalophus niger*, *Tragelaphus scriptus* and some snakes, birds and rodents. The swamp is an important natural reservoir near the source of the Lukarara River, a headwater tributary of the Nyawarungu River. It is protected in the Nyungwe Forest Reserve.

5. Crater Lakes & Swamps of the Virunga Volcanoes

General: There are two lakes. One is in the crater of Mt. Bisole (1°27'S/29°29'E), 3711 m asl, and the other is in the crater of Mt. Muhavura (1°24'S/29°40'E), 4127 m asl. There is a *Sphagnum* bog in the crater of Mt. Gahinga (1°23'S/29°39'E), 3474 m asl, and a swamp on the southeastern shoulder of Mt. Karisimbi, at an altitude of 3800 m (1°31'S/29°28'E). The swamp covers 400 ha. All are situated in the Volcanoes National Park, which has been a protected area since 1929 when it was part of the Albert National Park. This was subdivided upon the independence of Zaire in 1960. It was accepted as a Biosphere Reserve in

Wetland Name: The Rugezi Swamp

Country: Rwanda

Coordinates: 1°22'-1°36'S/29°50'-29°59'E

Area: 12 000 ha

Altitude: c. 1950-2150 m

Nearest Towns: Biumba (9 km E); Ruhengeri (25 km W)

General: This high altitude swamp is situated immediately east of Lakes Bulera and Luhondo below the high peaks of the Virunga volcanoes. It is 30 km long, oriented NW-SE in the valley of the Hondo River, and reaches a maximum width of 6 km at the southeastern end. It drains via the Hondo River, from its northwestern end, over two waterfalls, into Lake Bulera. It contains *Cyperus papyrus*, *Miscanthidium violaceum*, and several lesser species of *Cyperus* and *Scirpus*. Part of it has been drained and cultivated in recent years, and it is not protected. The fauna includes an abundance of amphibians, a variety of water birds including herons, egrets, ducks, warblers and weavers, and *Aonyx capensis*, *Lutra inaculicollis* and some rodents among the mammals. It is an important reservoir, buffering inflows to lake Bulera to which it drains.

7. Lakes Bulera & Luhondo

General: These lakes are situated on the southern slopes of Mt. Muhavura in NW Rwanda. Lake Bulera (1°23'4" S/29°45'-29°49'E), 1862 m asl, is 12 km long and reaches 8 km in width. It contains two small islands and is fed by 6 streams. The largest affluents are the Kabga and Kageri Rivers, and the Hondo River which drains the Rugezi Swamp. The lake has a maximum depth of 173 m and an open water surface of approximately 3500 ha. It drains from its southwestern extremity to Lake Luhondo (1°28' S/29°42' -29°46' E), 1764 m asl. This latter lake is shaped like an inverted 'V'. Its eastern arm is 9 km long and reaches 3 km in width, and the lake has an area of 2800 ha. In addition to the overflow from Lake Bulera, it receives water from 4 other streams, of which the Gasura is the most important. There is a 500 ha swamp at the northern end of the lake, i.e. at the apex of the 'V'. It drains to the southwest via the Mukungwa River, a tributary of the Nyawarungu, and a hydroelectric power station has been constructed where the Mukungwa leaves the lake. Both lakes are very young, a fact reflected by their poor floras and faunas. They both contain *Clarias* sp., while tilapias have been introduced and now constitute the basis of a local fishery.

8. The Tshohoha Lakes

General: The Rwanda/Burundi border runs through Lake Tshohoha South (2°20'-2°32'S/ 29°59'-30°10'E) which covers some 7000 ha at high water, and of this about 2000 ha is situated in Rwanda. The lake is 30 km long, about 1.3 km wide, oriented SE-NW, and has a highly indented perimeter with several long narrow arms. It is situated on the floor of a forested basin at about 1460 m asl, between two low hill ridges rising in parallel to 1531 m on the southwestern side and to 1510 m on the northeastern side. It is fringed by papyrus and *Miscanthidium* swamps, with scattered patches of swamp forest. It is fed at the southeastern end (in Burundi) by the Muburiba River, and drains to the Akanyaru River some 3.5 km distant from the northwestern end in Rwanda. The lake is fished but is not protected.

Lake Tshohoha North is situated entirely in Rwanda (2°14'-2°19' S/30°05'-30°09' E). The lake is fed at its southern end by a river from Burundi, and drains from its northeastern end through 10 km of permanent swamps to the Akanyaru River. The lake occupies the floor of a triangular basin about 1450 m asl, situated between two low undulating ridges oriented SW-NE and NW-SE. Its effluent river passes between these hills at the narrow western end of the basin. The shallow lake is 12 km long and about 1 km wide, with an open water surface of 1200 ha at high water. It is fringed at the waterside by papyrus, and peripheral vegetation similar to that described in section 2.6.10. Agriculture is locally intensive on the floodplains of the affluent and effluent rivers, and in places around the lake margin where it has been possible to drain the swamps. The system is not protected.

Wetland Name: Lake Mohasi

Country: Rwanda

Coordinates: 1°49' -1°54' S/30°11' -30°30' E

Area: 3450 ha

Altitude: 1480 m asl

Nearest Towns: Kigali (22 km ENE); Kibungu (31 km SSE)

General: This lake is 40 km long and has a mean width close to 1 km, with a maximum width of 2 km. It occupies the floor of a system of valleys, tributary to a main valley aligned E-W, and extends into the tributary valleys as a series of 13 narrow arms. Much of the lake shore is swampy and there are swamps at the heads of all 13 arms. The lake is fed by the Mohagumbo River at the eastern end, and by 13 other small streams, and drains from the western end via the Nyabugogo River to the Nyawarungu River.

Wetland Name: The Mugesera/Rugwero Lake/Swamp Complex

Country: Rwanda

Coordinates: 2°04'-2°28'S/30°12'-30°27'E

Area: 55 500 ha (including open water)

Altitude: c. 1300 m asl

Nearest Towns: Kigali (33 km NW); Kibungu (18 km W)

General: The system occupies the lowest part of a very flat valley, 35 km wide, aligned NNW-SSE. The Nyawarungu River meanders through this, overtopping its banks, filling depressions which contain lakes, and inundating a zone of permanent swamps and a peripheral floodplain. The permanent swamps occupy a central zone up to 14 km wide, but are best developed on the right (west) bank of the river. There are 4 lakes on the left (east) bank. From north to south these are Lake Mugesera, an unnamed lake, and Lakes Birira and Sake. The left bank lakes are, also from north to south, Lakes Gashaga, Murago, Rumira, Milay, Kilimbi, Gaharwa, Rugwero and Kazigiri. The last is situated entirely within Burundi, while Lake Rugwero is mostly in Burundi.

The largest lakes are Mugesera (2°04 ' -2°13 ' S/30°18 ' -30°27 'E) and Rugwero (2°21 ' -2°28 ' S/ 30°16'-30°23'E). Lake Mugesera (4000 ha) at the upper (northeastern) end of the system is fed by the Bubindi, Gitinga, Mwambu, Nyaruvoma and Rwazurasu Rivers and ten other minor streams, which are all in spate twice a year. These rivers originate on hilly ridges to the north, east and south of the lake, north of Kibungu, while the southern swamps near Lake Rugwero receive several similar streams from hills in the east, south of Kibungu. Lake Mugesera comprises a main basin oriented NNE-SSW, with 4 arms running roughly eastwards separated by ridges of low hills. Lake Rugwero (10 000 ha) is fed by streams from the central plateau of Burundi, and by overspill from Lake Kanzigiri which finds its way northwards through the swamps, either to Lake Rugwero or directly to the Nyawarungu River. The other lakes, none of which is known to exceed 5 metres in depth, are much smaller, each a few hundred hectares in extent in the dry seasons. Flood waters which are not dissipated in the main swamp basin collect back into the Nyawarungu which leaves the southeastern end of the basin and flows through a narrow swamp belt to a confluence with the Ruvuvu River immediately above the Rusumu Falls (2°23'S/30°47'E).

Hydrology & Water Quality: Water levels rise 1-2 m twice a year, corresponding with the rains. Mean water temperatures in the lakes are 24-26°C and the level of oxygen is generally high, but the bottoms may become anoxic during the long dry season. The mean pH of Lake Gaharwa is 10.0, that of Lake Rugwero is 7.5, and that of Lake Gashanga is 7.0, while the others have a range of 7.7-8.2. Transparencies vary between 30-90 cm, depending upon the season, with the lowest figures during the long rains.

Flora & Fauna: The central swamp is essentially a papyrus swamp with many islands of floating vegetation, and these are especially

well developed on Lake Rugwero. The papyrus grows 4-5 m tall, with an understory of *Dryopteris gongylodes* up to 1.5 m, and *Ipomoea fragrans* climbing to 4 m. *Polygonum* spp. are also common associates, while *Echinochloa crusgavonis*, *Hydrocotyle ranunculoides*, *Leersia hexandra*, *Utricularia inflexa* and *Vossia cuspidata* occur in the water along the outer margins of the papyrus. Islands of papyrus occur in the lakes, and are especially abundant in Lake Rugwero. Extensive stands of *Miscanthidium violaceum* are rooted in the shallower parts of the swamp. There are also groves of *Phoenix reclinata* and thickets of *Aeschynomene elaphroxylon*, *Dissotis incana*, *Ficus verruculosa* and *Myrica kandiana* on the margins, on levees, and on island shores. Permanent deep water is covered by carpets of floating-leaved or free floating plants, principally *Lenzina paucicosta*, *Ludwigia stolonifera*, *Nynzphaea caerulea*, *N. nouchalii*, *Pistia stratiotes* and *Trapa natans*, and it supports dense beds of submerged aquatics, including *Ceratophyllum denzersunz*, *Myriophyllum spicatum*, *Potamogeton pectinatus*, *Utricularia* spp., and *Vallisneria spiralis*.

Savannas surrounding the lakes, subject to seasonal inundation, are dominated by *Acacia campylacantha* and *A. sieberana*, with *Boerhaavia plumbaginea*, *Bridelia micrantha*, *Cordia abyssinica*, *Crassocephalum bojeri*, *Panicum deustunz*, *Securinega virosa*, *Setaria kagerensis* and *Sorghum verticilliflorum*. Peripheral floodplain supports the grasses *Hyparrhenia filipendula* and *H. rufa*, or *Bothriochloa insculpta* and *Themeda triandra*.

The phytoplankton and zooplankton are abundant, if not very diverse, and there is a high mollusc biomass. Some 30 species of fish have been identified belonging to 9 families, and of these, 22 are also found in Lake Victoria. *Alestes*, *Clarias* and *Oreochromis* are well represented, and some cichlids have been introduced, reputedly *Oreochromis esculentus* and *O. macrochir*. No less than 173 birds have been identified, of which 30 are piscivorous and 50 feed on insects and molluscs. There are a number of European migrants, e.g. *Hippolais icterina*, *Hirundo rustica*, *Motacilla flava*, *Phylloscopus trochilus*, *Riparia riparia* and *Sylvia borin*. Other species of interest include *Anhinga rufa*, *Ardea goliath*, *Ardeola ralloides*, *Balearica regulorum*, *Ceryle rudis*, *Haliaeetus vocifer*, *Pandion haliaetus*, *Phalacrocorax africanus*, *P. carbo*, *Plectropterus gambensis* and *Quelea erythrops*. There are water turtles (*Pelusios*), crocodiles, monitors, snakes, otters and rodents. *Hippopotamus amphibius* is now scarce.

Human Impact & Utilisation: The lakes and swamps are fished, mainly from canoes, with yields of up to 125 kg/ha/yr, comprising some 60% cichlids and 20% clariids. Population density of the swamp margins is locally very high.

Conservation Status: Unprotected.

Wetland Name: The Kagera Swamps & Lakes

Country: Rwanda

Coordinates: 1°19'-2°11'S/30°33'-31°01'E

Area: 144 400 ha (50 000 ha lake surfaces)

Altitude: 1270-1300 m asl

Nearest Towns: Kigali (69 km W); Kibungu (20 km W)

General: The wetland lies in a N-S anticline on the Rwanda/Tanzania border between two ridges of low hills, below Rusumu Falls. The Kagera River, which delimits the Rwanda/Tanzania border, meanders along the centre of the the flat bottomed valley for about 110 km, spilling over to inundate a swamp belt 2-18 km wide. This is lined on each margin by a series of substantial lakes, 20 on the right bank being situated in Tanzania. These are, from north to south, Lakes Gwelu, Nyakatale, Nyaruwale, three un-named, Lubuga, Ishaka, Duko, Kashani, Twamwala, Mujunju, un-named, Kashanga, Weru Kwa Kalambi, three un-named, Katabi-Kazinga and Bisongo. The swamp belt is more extensively developed on the left bank, in Rwanda, where there are 21 lakes, and from north to south these are Lakes Feringo, Rwanye-Kizinga, Mihindi, un-named, Kishandju, two un-named, Muhari, Hago, Nkelenhe, Kivumba, Sekama, five un-named, Ihema, Rwakibale, Nasho, Rwehikama and Rwampanga. The lakes lie partly in and partly out of the permanent swamp belt. Outside the permanent swamps some are fringed by seasonally inundated savannas. The river descends about 40 m from the foot of the Rusumu Falls to an altitude of 1270 m asl at the northern end of the swamp complex.

The largest lakes are Ihema (9100 ha), which measures 20 km in length and is 7 km wide in places, Mujunju (2250 ha), which is 11 km long and up to 3 km wide, and Bisongo (c. 2000 ha). Lake Mujunju is the deepest, with a maximum depth of 11 m and a mean depth of 5.9 m; the others have maximum depths between 7.8 and 4.3 m and mean depths between 5.2 and 2.6 m (Rwanye-Kizinga). Very few of the lakes have permanent connections with the Kagera River, and in the past 30 years, the river has changed course and lost connection with lakes with which it formerly had continuity.

Hydrology & Water Quality: Many small seasonal streams feed the lakes or swamps directly and flow twice a year, but the bulk of the riverine inflow is provided by the Kagera River, which also rises in response to seasonal rains. Direct precipitation contributes some 650-900 mm/rain/yr, and the water level in the system has an annual amplitude of 1-1.5 m. During the dry season several of the lakes are isolated from the river. The water of the lakes tends to become stratified during the dry season when temperature differences as great as 4°C have been observed between the top and bottom waters of an individual lake. Mean pH values are 6-7.5 at the lake bottoms, and 7-9 at the surfaces.

Flora & Fauna: The flora and fauna is very similar to that described in

the previous section for the Mugesera/Rugwero Swamps, but with the difference that a variety of large mammals survive in the Kagera National Park covering the northern half of the swamp complex. These include *Hippopotamus amphibius*, *Hippotragus equinus*, *Kobus ellipsipryinnus*, *Loxodonta africana*, *Panthera pardus*, *Phacochoerus aethiopicus*, *Redunca arundinum*, *Sylvicapra grimmia*, *Syncerus caffer* and *Tragelaphus spekei*. Amphibians, crocodiles and water turtles are abundant.

Human Impact & Utilisation: A controlled fishery operates on Lake Ihema, but otherwise, outside the National Park, fishing is uncontrolled, and overfishing occurs locally. Fishing in the Kagera National Park is illegal but this fact does not prevent it from occurring. Many channels through the vegetation, connecting the lakes with the river, are kept open by local fishermen.

Conservation Status: Some 60 000 ha of swampland is protected in the Kagera National Park, but the remainder is unprotected and subject to intense hunting and fishing pressures.

12. The Northeastern Rivers

General: Long strips of permanent swampland occur along the three major rivers which flow across the northeastern extremity of the country to join the Kagera River north of its Lake/Swamp Complex. Swamps occur on the Kamababa River above its confluence with the Kagera, and also on its headwater tributaries in patches up to 10 km long and 1.5 km wide. North of this, swamps extend for over 40 km up the Kalangaza River, beginning about 18 km above its confluence with the Kagera. In the far NE, other swamps occur on the Kakitumba River, and on its two affluents, the Muvumba and Kalungeri Rivers. In total there are close to 19 000 ha of permanent swamp on these rivers, together with narrow peripheral floodplains. The flora and fauna of these rivers is similar to that along the Akanyaru/Nyawarungu/Kagera system.