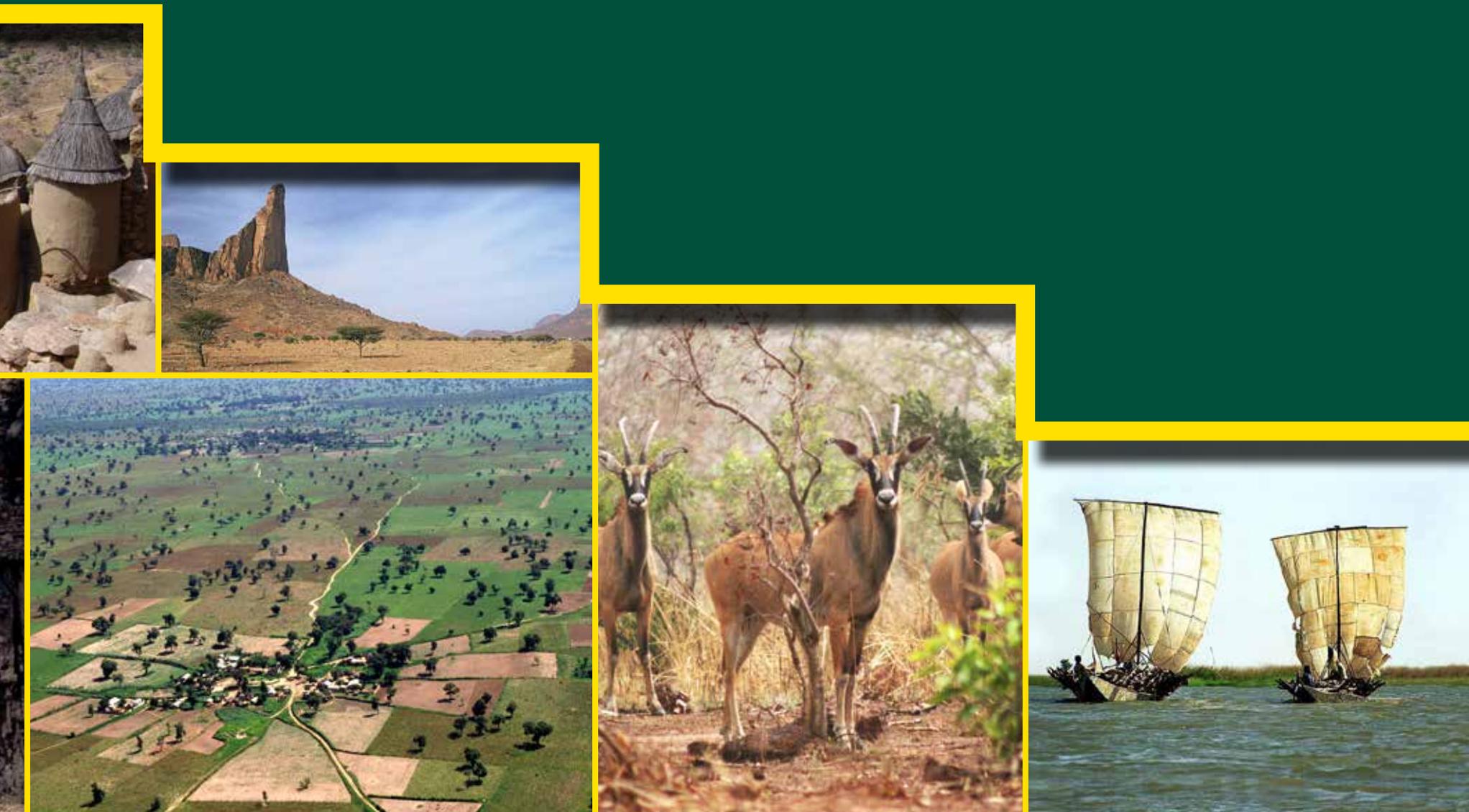


# Landscapes of West Africa

A WINDOW ON A CHANGING WORLD





# Landscapes of West Africa

A WINDOW ON A CHANGING WORLD



**USAID**  
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**USGS**  
*science for a changing world*

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**On October 12, 2015, the Lunar Reconnaissance Orbiter took this striking view of the Earth as it circled 134 km above Compton Crater on the Moon, near the terminator between day and night. The sharp black outline of the lunar horizon is from mountains still on the night side of the terminator, silhouetted against the lower limb of the Earth. This image is reminiscent of the iconic Earthrise photograph taken by the crew of Apollo 8 as they orbited the Moon on December 24, 1968. Many people credit that unique view of our home planet as having sparked the environmental movement that so shaped our thinking about our planet during the 1970s and beyond.**

**Apart from its beauty, this image of the Earth from the Moon shows the African continent quite prominently. A great amount of cloud cover characterizes the blue planet. Several large areas are, however, clear: the deserts of North Africa and the Middle East, and in the Southern Hemisphere, the drylands of southern Africa. The tropical regions of Africa's mid-section are partially covered by belts of clouds that mark the intertropical convergence zone, where the northern and southern circulation patterns merge.**





**Dr. Djimé Adoum**

Since the 1970s, West Africa has experienced many forms of climate stress — heavy rains, floods, and periods of drought. Drought has had a particularly devastating impact on agricultural production, pastoral livelihoods, and natural ecosystems. Economic losses alone are estimated in billions of dollars.

The concerns raised by these climate stressors have translated into initiatives to combat desertification and to adapt to climate change. The Comité Inter-états de Lutte contre la Sécheresse dans le Sahel (CILSS – The Permanent Interstate Committee for Drought Control in the Sahel) and the U.S. Agency for International Development (USAID) have put in place activities to benefit the population of the Sahel and all of West Africa.

The West Africa Land Use Dynamics (LULC) Project is emblematic of this cooperation. Initiated in 1999, the LULC project has had several phases including training national experts to extract pertinent information from satellite images to characterize vegetation cover and producing tools and supporting information on land cover dynamics.

This atlas — *Landscapes of West Africa: Window on a Changing World* — is part of the current phase of the LULC project and provides insights into the changes occurring at national and regional levels through mapping time series data from 1975 to 2013. This work highlights landscapes that have undergone major transformations, and examines the drivers of change and their environmental and socioeconomic impacts.

The atlas showcases the accomplishments of the LULC project, and makes a case for further investment in natural resource management. Aimed at both decision-makers and the general public, the Atlas has a goal of making people aware of the changes taking place in the landscapes of the region.

Beyond raising awareness, the atlas also aims to incite action to protect the environment of West Africa and the Sahelian region. We therefore invite everyone — scientists, students, researchers, teachers, planners, managers of development or research projects, local, national and regional decision-makers, donors, members of civil society organizations, and visitors to the region — to make the most of this work.

Congratulations to the experts at CILSS, U.S. Geological Survey, USAID and the country-level teams of the LULC project for this fruitful partnership. We truly hope that this cooperation will continue and deepen, with the view of regaining the equilibrium of ecosystems. Doing so will constitute a decisive step towards realizing a green economy in West Africa, thereby enhancing the well-being of all West African people.

A handwritten signature in blue ink, appearing to read 'Djimé Adoum'.

**Djimé Adoum, Ph.D,**

*Executive Secretary*

*CILSS*

*Ouagadougou, Burkina Faso*



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FROM THE AMERICAN PEOPLE

At the core of the U.S. Agency for International Development's (USAID's) mission is a deep commitment to work as partners in fostering sustainable development. Environments that are vulnerable to changing climate patterns are often the most reliant on agriculture for food and income, and the least able to financially protect themselves or respond to disasters. As effects of climate change are felt more severely, advanced mitigation and adaptation measures are key to resilience.

Rapid changes are occurring across West Africa's natural and human landscapes and balancing the need to preserve natural ecosystems with the need to grow more food, together with ensuring resilience in the same ecosystems, is a challenge. USAID West Africa's (USAID/WA) Environmental Threats and Opportunity Assessment and its Climate Change Vulnerability Assessment revealed that timely and accurate information, indispensable for good governance in the environmental sector, is scant and barely accessible. Mitigating climate change impacts and conserving biodiversity can support sustainable development, and prevent countries from sliding further into poverty.

USAID/WA worked in partnership with the U.S. Geological Survey (USGS) and the Comité Inter-états de Lutte contre la Sécheresse dans le Sahel (CILSS – The Permanent Interstate Committee for Drought Control in the Sahel), to analyze changes in land use and land cover in West Africa and to better understand trends over the past 40 years with the goal of improving decision-making in land management. Products derived from these analyses include maps that provide a clear record of changes and trends in three periods — 1975, 2000 and 2013 — in 17 West African countries and aggregated to the regional level.

These maps and analyses form the foundation for future landscape scenarios and contribute to a body of best practices for the re-greening of landscapes in West Africa. Application of the atlas and associated data goes beyond informing decision-making on land

use planning. The time series maps provide credible information to help countries account for their carbon emissions to the United Nations Framework Convention on Climate Change and can also be used to quantify carbon emission trends in West Africa for the past 40 years.

This achievement would not have been possible without the U.S. Landsat Program. Landsat satellites have provided the longest-ever continuous global record of the Earth's surface. A partnership of the National Aeronautics and Space Administration and the USGS, the Landsat program provides image data that show the impact of human society on the planet — a crucial measure as the world's population has already surpassed seven billion people. The first Landsat satellite was launched in 1972 and now, 44 years later, Landsats 7 and 8 are continuing to provide an unbroken record of the Earth, providing critical information for monitoring, understanding and managing our resources of food, water, and forests. No other satellite program in the world comes close to providing such a long, unbroken record of geospatial information of the planet.

Knowing that these analyses will be put to use for decision making in natural resource management, I would like to thank all of the teams that worked tirelessly to produce this Landscapes of West Africa atlas. And my sincere gratitude goes to CILSS, the USGS, and the multitude of government institutions in West Africa for their commitment to completing this influential work.

**Alex Depez**  
Regional Mission Director  
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**Alex Depez**



On behalf of the governments and the people of West Africa who have benefitted from the West Africa Land Use Dynamics Project, the Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (CILSS – Permanent Interstate Committee for Drought Control in the Sahel) expresses its profound gratitude to all those who have contributed to the publication of this atlas. In particular, we would like to thank:

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# Introduction

Our global ecosystem is and has always been complex, dynamic, and in constant flux. Science tells us how natural forces of enormous power have shaped and reshaped Earth's surface, atmosphere, climate, and biota again and again since the planet's beginnings about 4.5 billion years ago. For most of the planet's history those environmental changes were the result of the interaction of natural processes such as geology and climate, and were described on the geological time scale in epochs spanning millions of years.

When humankind appeared on Earth around 200,000 years ago the influence of human activity on the environment must have been small and localized. The influence of scattered small groups of people on the global ecosystem would have been overwhelmed by the forces of natural systems (Steffen and others, 2007). Human population would not grow to 50 million (about 0.7 percent of the Earth's current population) for another 197,000 years. Population growth accelerated over the centuries that followed until the planet was adding more than that 50 million people every year. Our planet is now home to roughly 7.3 billion people and we are adding 1 million more people roughly every 4.8 days (US Census Bureau, 2011). Before 1950, no one on Earth had lived through a doubling of the human

population, but now some people have experienced a tripling in their lifetime (Cohen, 2003).

With hunting and the use of fire, later agriculture and urbanization, and eventually the industrial revolution and modern technology, the ability of humans to shape their environment also grew exponentially.

Earth scientists use the geologic time scale to describe time periods where different processes and forces shaped events in the Earth's history, such as ice ages and mass extinction events. They use periods of time they call epochs, which range from 11,700 years (the Holocene) to millions of years (the Pleistocene and Neogene). In about 2000, Earth scientists coined a new word — Anthropocene — to describe

a new epoch where “the human imprint on the global environment has become so large and active that it rivals some of the great forces of nature in its impact on the functioning of the Earth system” (Steffen and others, 2011). Many in the Earth sciences believe that epoch has begun and that humankind with its vast numbers and its power to change the face of the Earth is at risk of putting the Earth system out of balance and causing

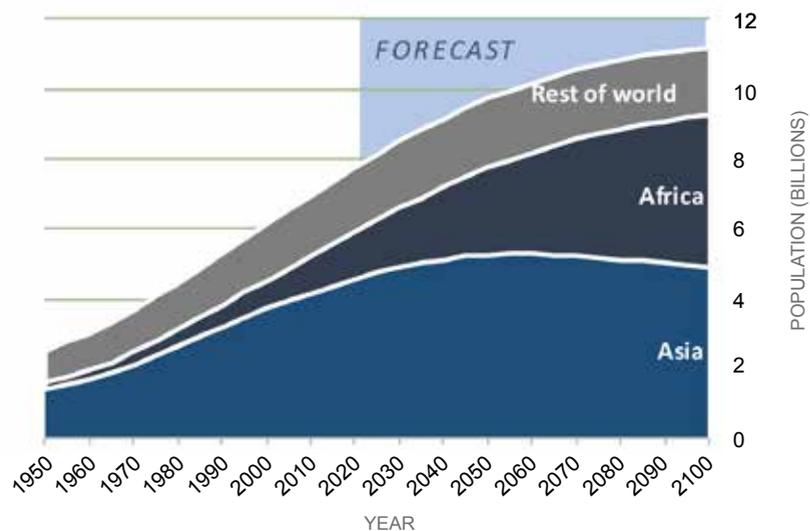
the collapse of natural systems that are essential for humans to thrive, perhaps even threatening the future of all humankind.

In 2015, the 17 countries included in this atlas are estimated to have a total population of over 369 million, representing a nearly 5-fold increase since 1950 — outstripping global population growth, which grew by 2.9 fold during the same time (UN, 2015). The young age structure of the West African population assures continued rapid population growth until 2050 and beyond. If United Nations estimates are correct the 17 countries in this atlas will grow to 835 million people by 2050; that would equate to 11.1 times as many people as lived on the same land in 1950 (UN, 2015)!

**“Mai lura da ice bashin jin yunwa” — He who takes care of trees will not suffer from hunger.**

— Hausa proverb

## Population growth in Africa and the rest of the world from 1950 to 2100



## Wooded landscape fragmented by agriculture expansion in western Burkina Faso



JAMES ROWLAND / USGS

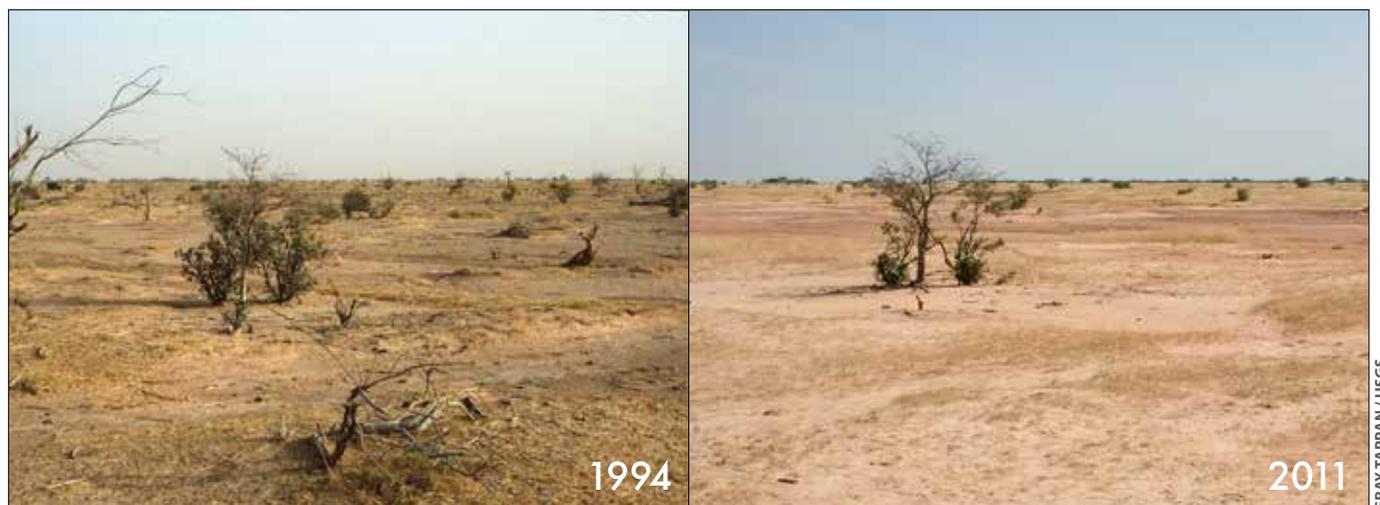
Parallel trends can be seen in the land cover changes of West Africa. With so many new families to feed, West Africa doubled the area covered by farms between 1975 and 2013. Vast areas of savanna, woodland, and forest landscape have been replaced or fragmented by cropland. At the same time villages, towns, and cities have grown in area — taking up 140 percent as much land as they had in 1975. In part to make way for those farms and settlements more than a third of the forest cover present in 1975 has been lost. In savanna and steppe landscapes of West Africa, drought, in some cases made worse by unsustainable land use practices, has degraded the vegetation cover contributing to a 47 percent increase in sandy areas (see top images

pair, opposite page). The future is unpredictable, but the trends of the past four decades projected into the future would be unsustainable.

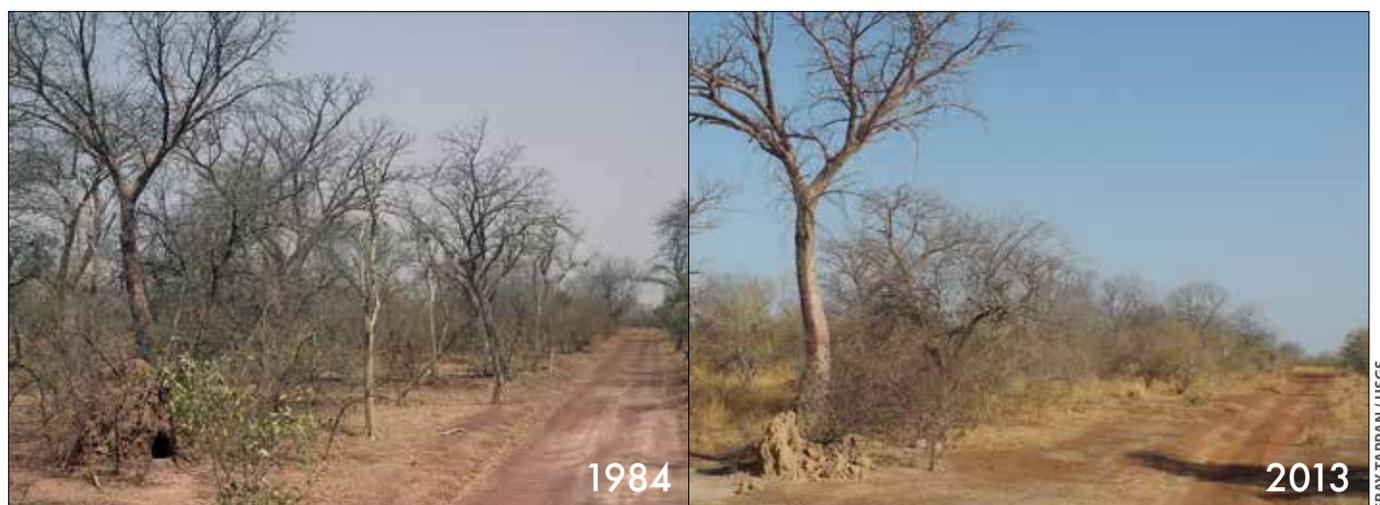
Conversion of the natural landscapes of West Africa to agriculture greatly reduces the natural biodiversity, and exposes the soil to wind and water erosion. The savanna, woodland, forest, and wetland ecosystems that are lost have some relatively tangible impacts such as the loss of natural ecosystem goods and services like wood for fuel and construction, honey, nuts, medicines, game animals, berries, and forage. There are also many important goods and services lost that are less visible such as biodiversity, carbon storage, water quality, water runoff versus infiltration, and regional climate functions.



## Expansion of degraded land in the Ferlo region of Senegal



## Decline in vegetation cover and biodiversity in east-central Senegal



It is in the hands of today's decision makers to formulate wise, well informed choices about how to manage West Africa's land, to ensure that vital ecosystem services and agricultural productivity are able to support tomorrow's people. To make good choices the governments of West Africa need good information about the rapid changes now occurring, the causes of those changes, and the interactions occurring between climate, land use, other human activity, and the environment.

Experts from institutions in 17 countries in West Africa have partnered with the Comité Inter-états de Lutte contre la Sécheresse dans le Sahel (CILSS – The Permanent Interstate Committee for Drought Control in the Sahel), the U.S. Agency for International Development (USAID) West Africa and the U.S Geological Survey (USGS) to map changing land use and land cover and associated factors across much of West Africa through the West Africa

Land Use Dynamics Project. This publication presents the results of that work. The following chapters present maps, graphs, tables, and images detailing the natural environment of these 17 countries and changes that have taken place over the past four decades.

This atlas tells a story of rapid environmental change with both hopeful and worrisome chapters. The story is told with maps and numbers detailing the rate, magnitude, and location of land cover change but also with words and images that seek to make the story more real for the people living in West Africa and around the globe. The hope is that this information helps to build a clearer picture of past and current land use and land cover in order to guide us all in making informed choices that will support the livelihoods and well-being of ours and future generations.



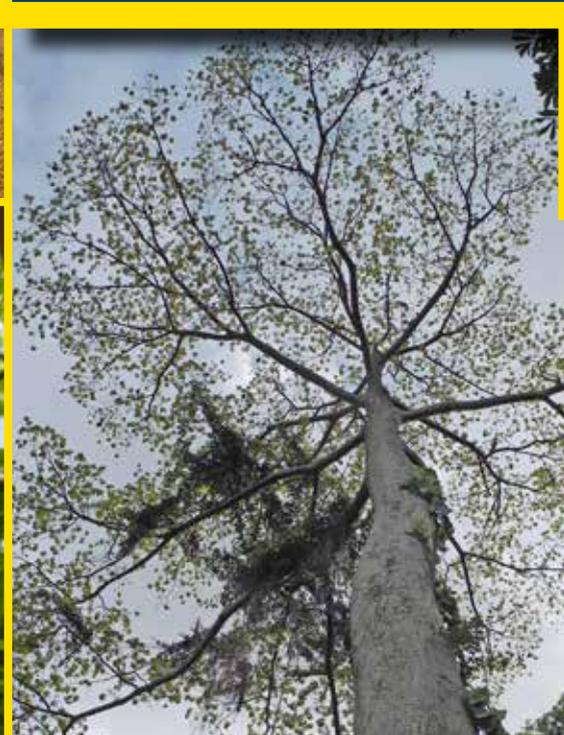




Chapter

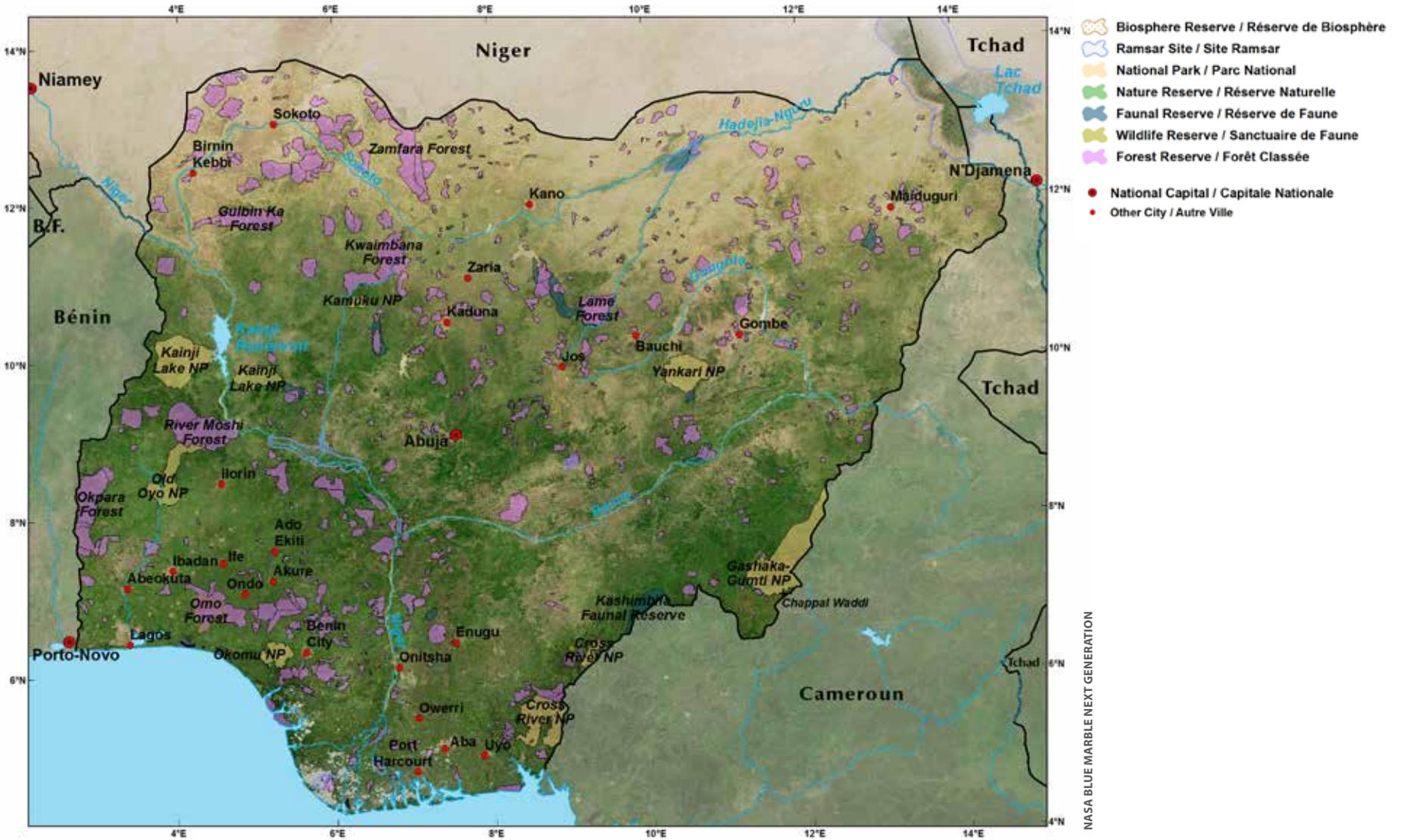
# III

## Country Profiles, Land Use and Land Cover, and Trends





# Federal Republic of Nigeria



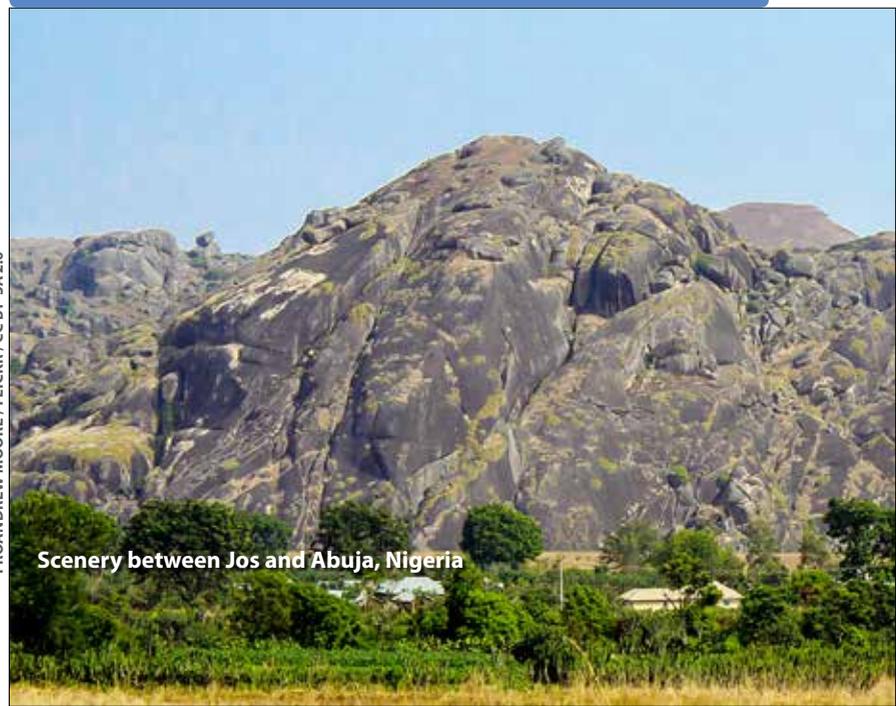
**Total Surface Area: 923,768 km<sup>2</sup>**  
**Estimated Population in 2013: 172,817,000**

Nigeria is the most populous country in West Africa, and currently the seventh most populous in the world. About half of Nigerians are urban dwellers. Nigeria's urban character is unique in Africa, counting 11 cities of over 1 million, and more than 70 cities of over 100,000 inhabitants. Rapid growth in both population and the economy exerts a strong pressure on Nigeria's diverse natural resources, from the tropical coastal plains in the south to the Sahelian savannas in the north. After running 4,000 km from the Guinean Highlands through West Africa, which makes it Africa's third longest river, the Niger reaches the Gulf of Guinea on the Atlantic Ocean in Nigeria, where it ends in a network of channels forming a large coastal delta with extensive mangrove and swamp forests. The Niger Delta, which covers about 70,000 sq km, is a hotspot of plant and animal biodiversity, but it also holds Africa's second largest oil and largest natural gas reserves, which have fueled Nigeria's economy, the second largest in Africa by nominal gross domestic product (GDP). Diversity and extremes characterize Nigeria both culturally and environmentally, making it a microcosm of all Africa's promise and problems.

## Environmental Highlights:

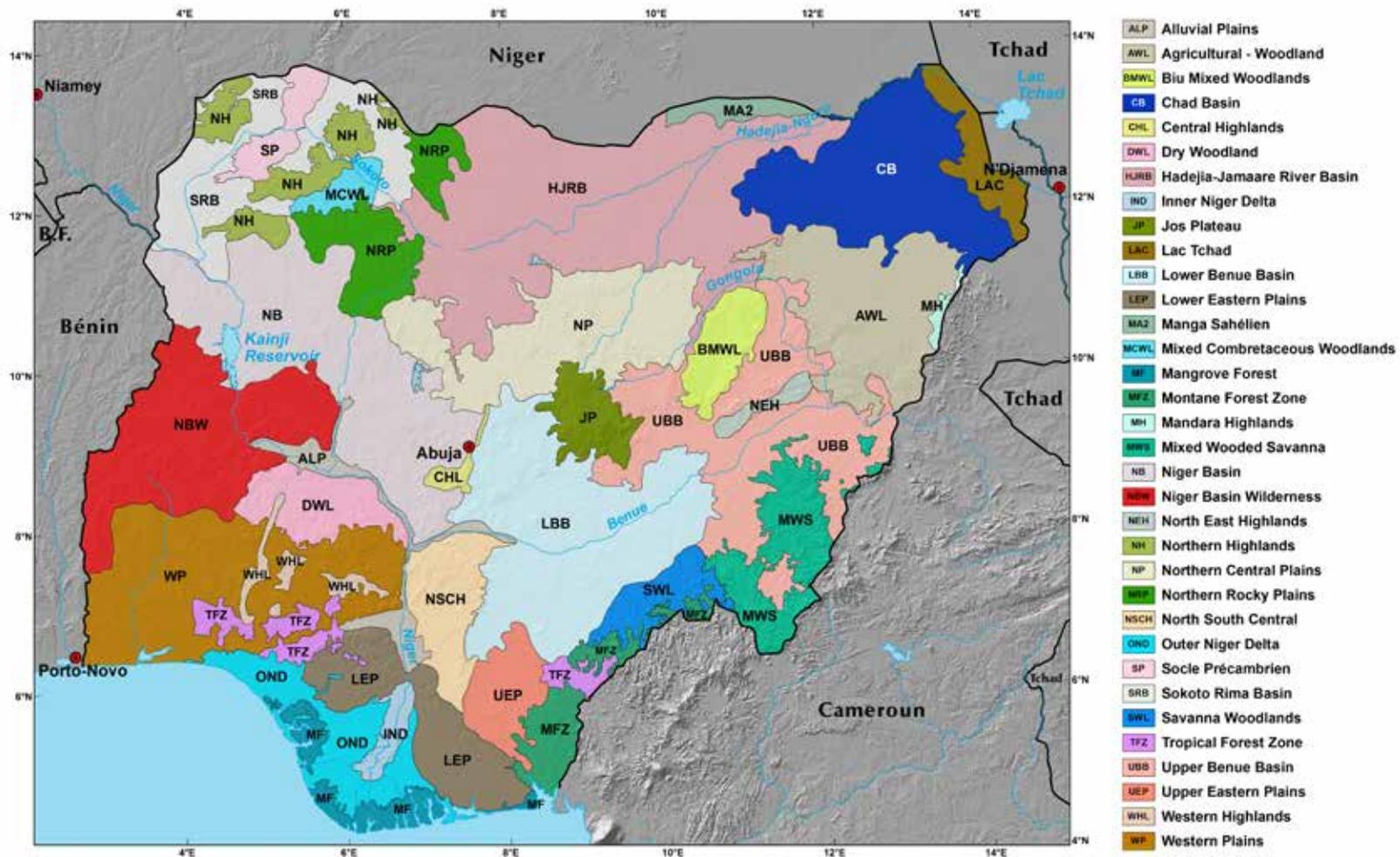
- Deforestation
- Desertification
- Crude oil pollution
- Second largest swamp forest on the continent (after Congolian swamp forest)

PROANDREW MOORE / FLICKR / CC BY-SA 2.0

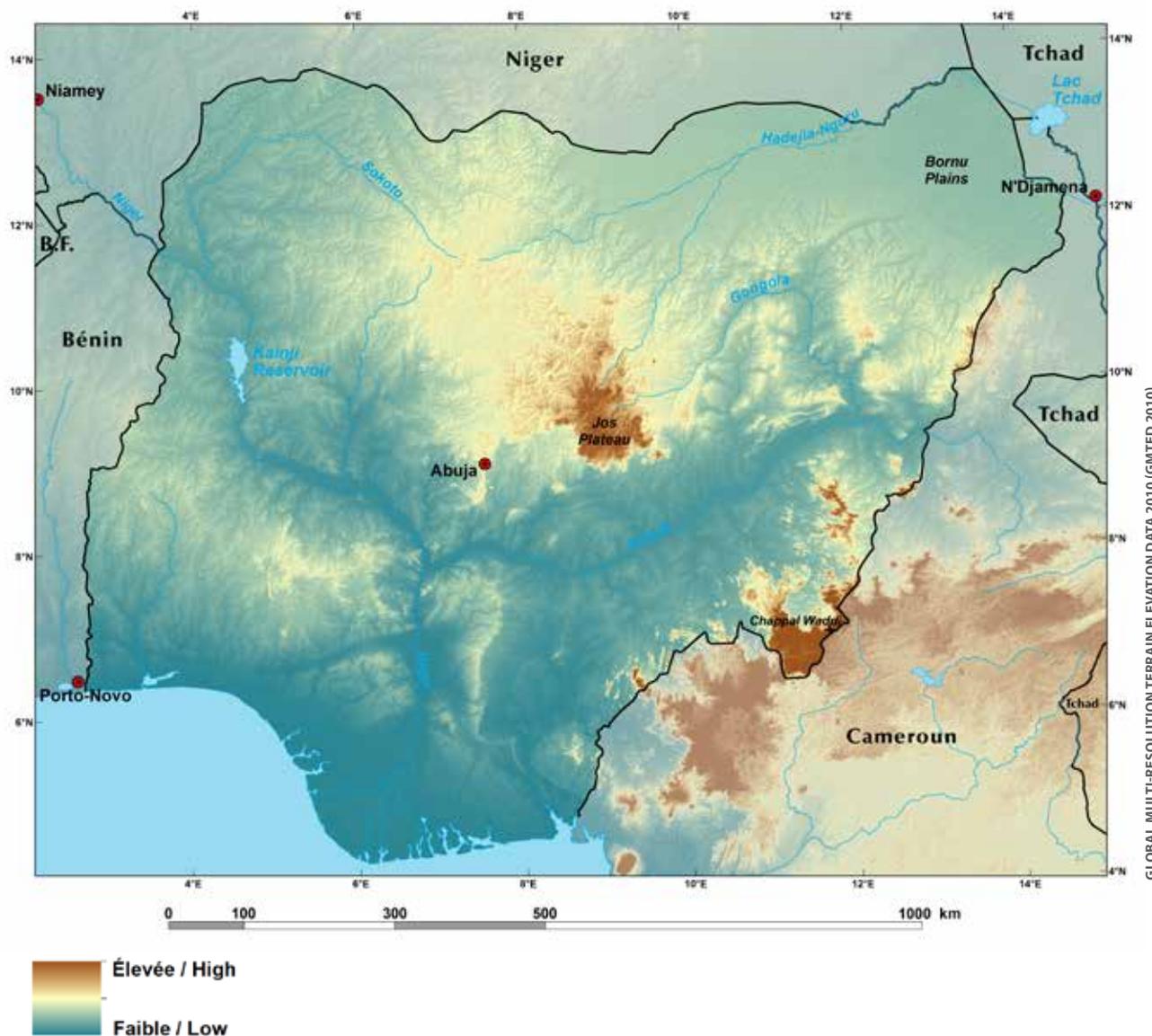


Scenery between Jos and Abuja, Nigeria

## Ecoregions



## Shaded Relief



The majority of Nigeria's heartland is formed by the valleys of the Niger and Benue Rivers, which merge into each other, making a "y-shaped" confluence. The Niger River and its tributaries create a lifeline for Nigeria's agriculture in the semiarid northern and central parts of the country, as they supply water for a variety of food and cash crops. The coastal plains are found in both the southwest and the southeast, mostly covered by swamp and mangrove forests, merging into highly degraded forest inland. To the southwest of the Niger valley lies a rugged landscape defined by the Western Plains (WP) interspersed with the Western Highlands (WHL). The heavily populated Jos Plateau with its semi-temperate climate, Nigeria's largest area above 1,000-m elevation, rises prominently from the riverine plains. The northern part of the country is characterized by somewhat lower elevations, level terrain, and sandy soils, where agriculture dominates.

## Land Use, Land Cover and Trends

Not surprisingly, the country that is home to the largest population of the region also has by far the largest area under cultivation. In 2013, rainfed agriculture accounted for 380,000 sq km in Nigeria, covering over 40 percent of its national territory, up from 20 percent in 1975. From 1975 to 2000, 130,000 sq km of new agricultural land were taken under the plough, with an additional 110,000 sq km from 2000 to 2013. The magnitude of these transitions — together exceeding the size of the entire country of Ghana — is unparalleled in the region. Nigeria is also the only country of the region in which agriculture has traded places with savanna, and doubled its area in 38 years, to make it the largest land cover type.

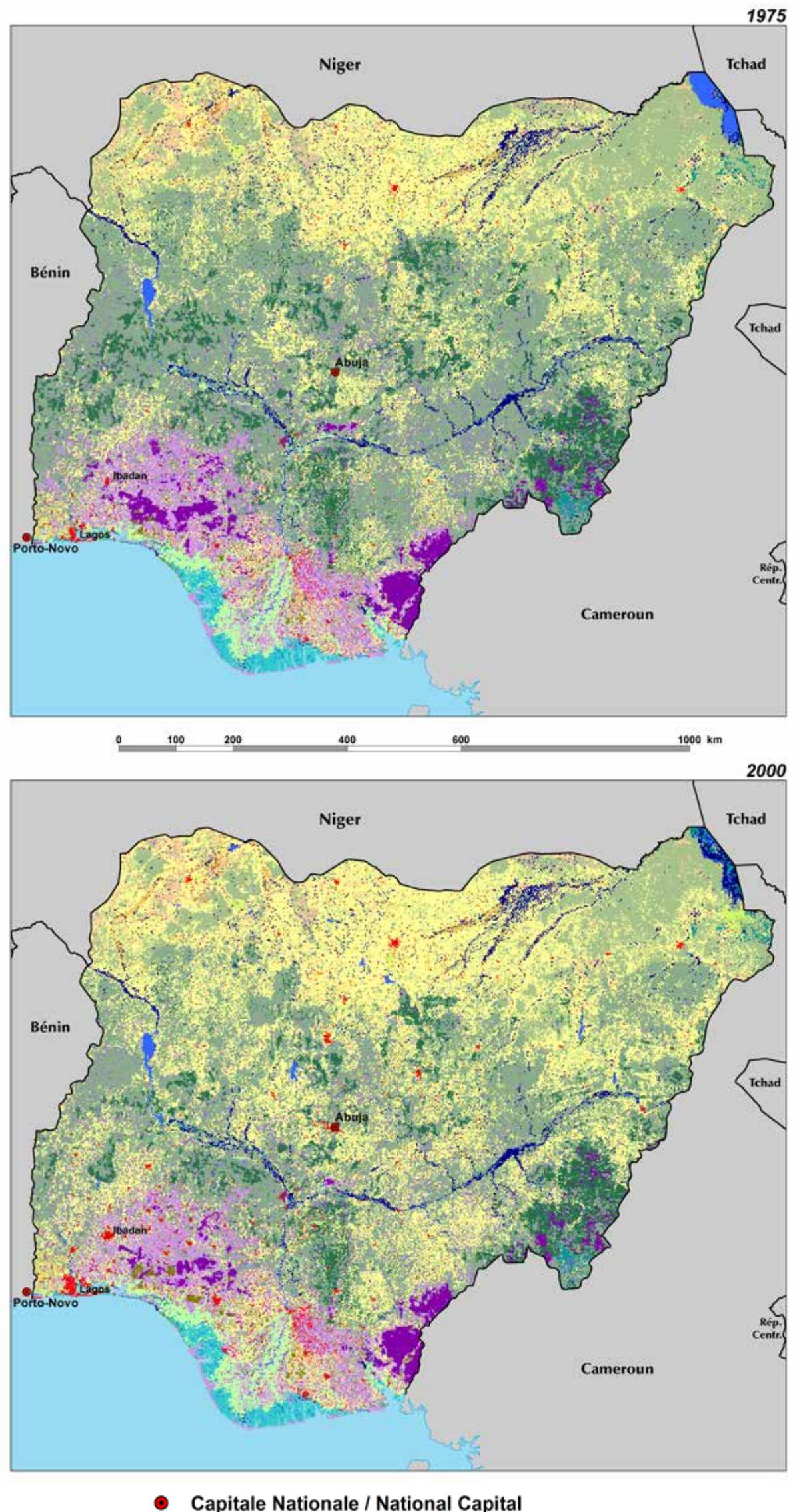
The expansion of agriculture was observed across all ecoregions from the forest zone of southern Nigeria, where root and tree crops dominate, to the forest-savanna transition of the center of the country, where mainly root crops are found, to the grain belt of semiarid northern Nigeria. The Niger and Benue Basins, promoted as a prime agricultural development area and future bread basket since the 1970s, has seen the most prominent encroachment of agriculture into the savanna, sharpening the outlines of the remaining protected areas. Not all protected savanna areas, however, have been spared from the fast agricultural expansion.

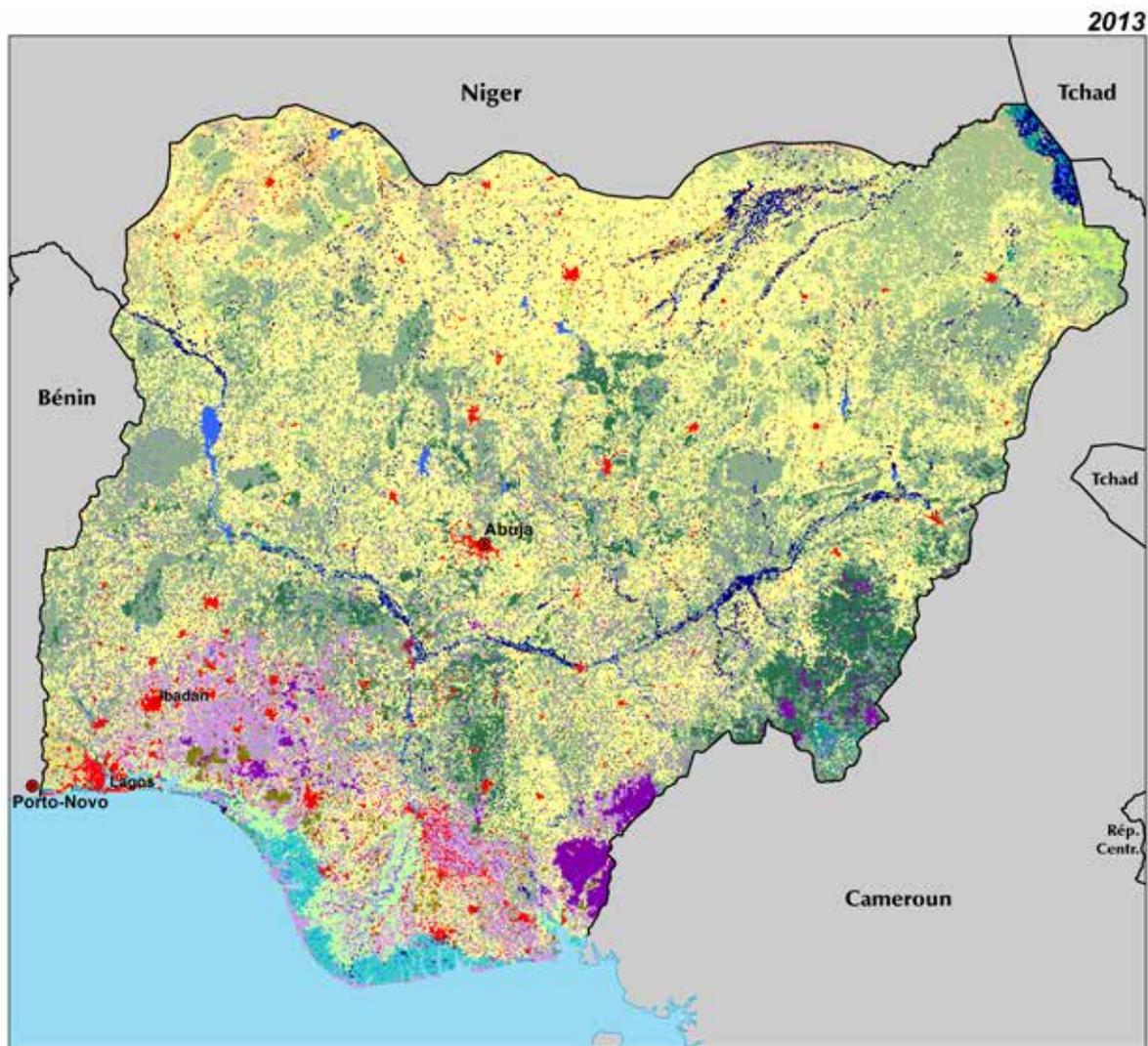
While the transition from savanna to agriculture constituted the largest land cover change in



Ogun state, Nigeria

JBDONDANE / FLICKR / CC BY-NC 2.0





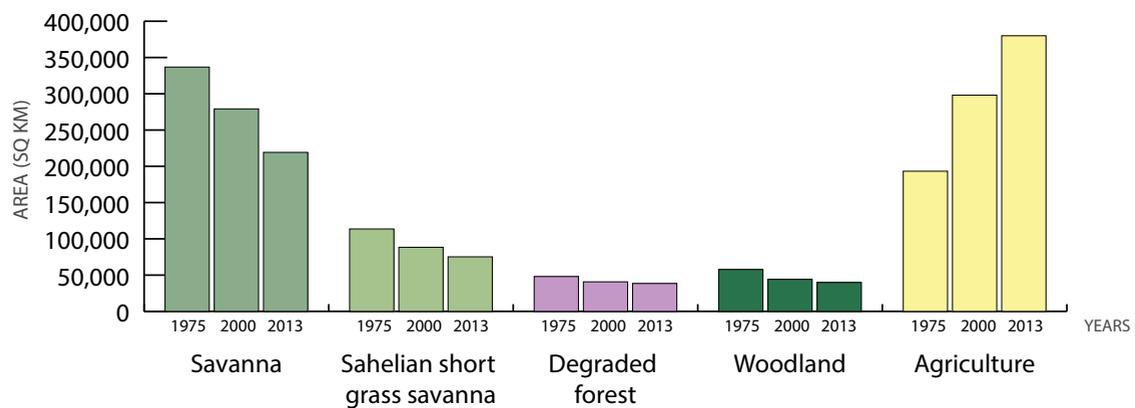
**Land Cover / Occupation des Terres**

- Forest / Forêt
- Gallery forest & riparian forest / Forêt galerie & formation ripicole
- Degraded forest / Forêt dégradée
- Woodland / Forêt claire
- Swamp forest / Forêt marécageuse
- Mangrove
- Savanna / Savane
- Sahelian short grass savanna / Savane sahélienne
- Herbaceous savanna / Savane herbacée
- Steppe
- Bowé
- Thicket / Fourré
- Agriculture / Zone de culture
- Irrigated agriculture / Cultures irriguées
- Agriculture in shallows and recession / Cultures des bas-fonds et de décrue
- Cropland and fallow with oil palms / Cultures et jachère sous palmier à huile
- Plantation
- Settlements / Habitation
- Bare soil / Sols dénudés
- Rocky land / Terrains rocheux
- Sandy area / Surfaces sableuses
- Open mine / Carrière
- Water bodies / Plans d'eau
- Wetland - floodplain / Prairie marécageuse - vallée inondable

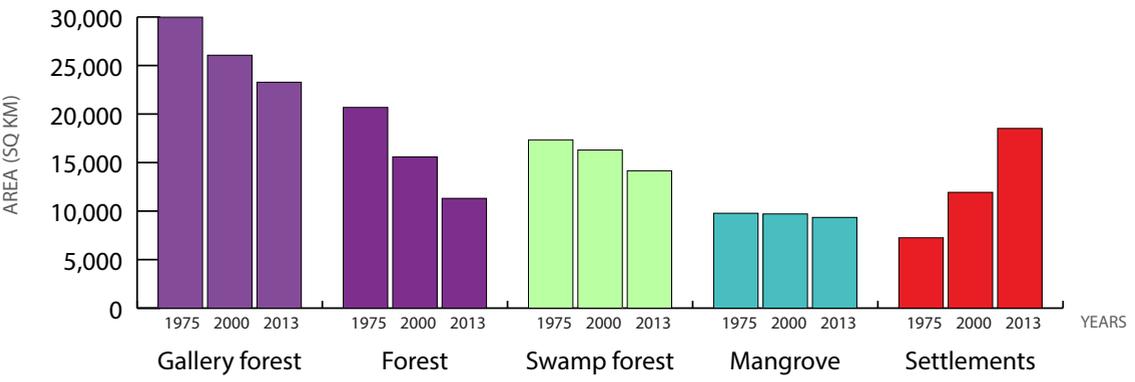
terms of area, some changes in the smaller land cover categories also stand out as important. High rates of change were observed for settlements, irrigated agriculture, plantation, and open mines, with gains accelerating from 1–2 percent per year between 1975–2000 to 2–4 percent per year in the 2000–2013 period. Under the pressures of a rapidly growing population and economy, forests, gallery forests and woodlands, in addition to the savanna land cover types, were all being diminished, with loss rates increasing to over 2 percent per year during the 2000–2013 period. Forest area decreased by 45 percent from 1975 to 2013.

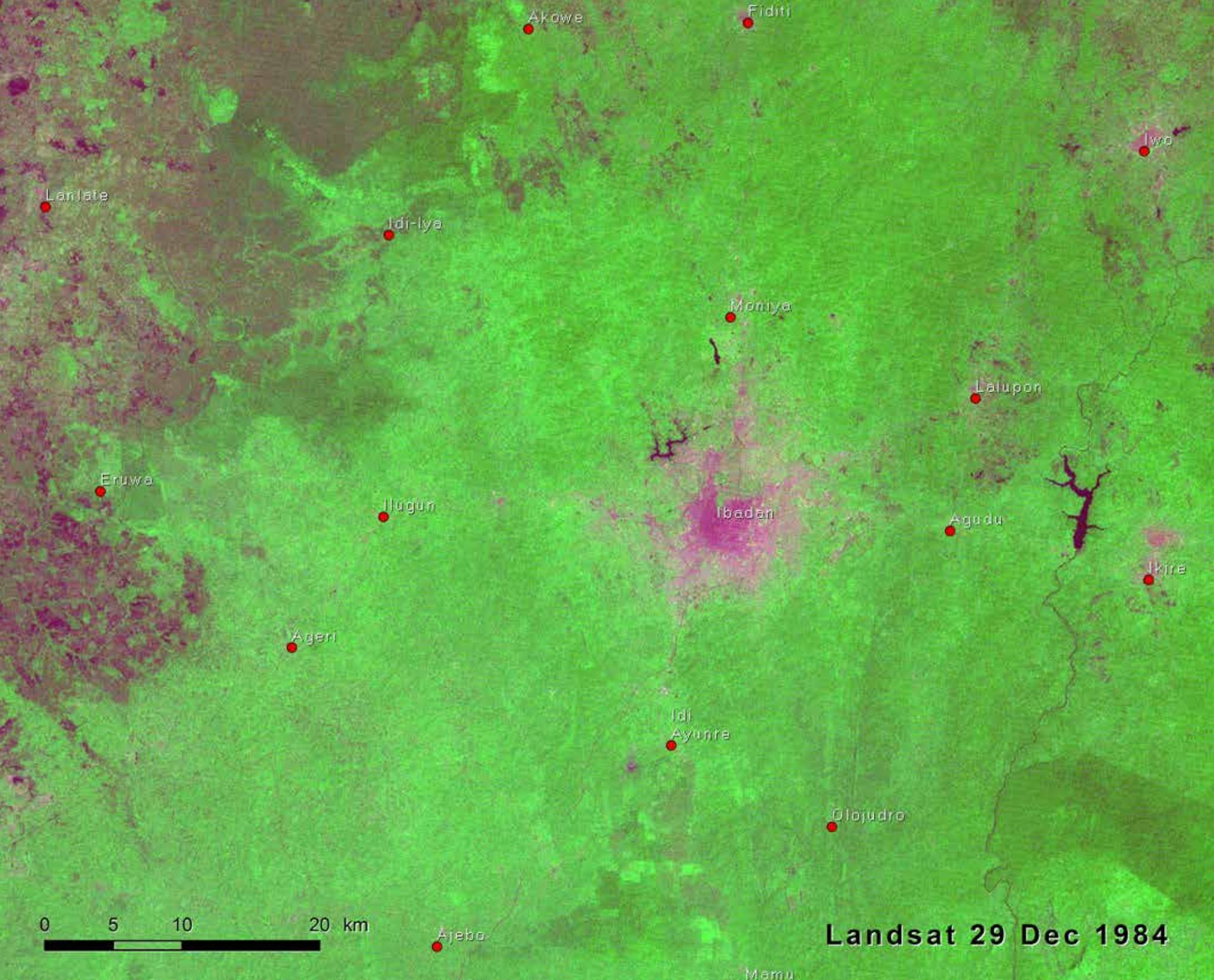
While the area of mangroves and swamp forests along the coast and in particular in the Niger Delta — important hotspots of biodiversity — has decreased less than that of some other land cover types, the health of these ecosystems has been severely damaged by recurrent oil spills caused by accidents, poor maintenance, and sabotage of the large-scale oil extraction infrastructure in the Delta. Environmental regulations are weak and rarely enforced, and there are no effectively protected areas in the Delta, whose forest and animal populations are considered under severe threat (World Wildlife Fund, 2016).

**Large area classes**



**Small area classes**



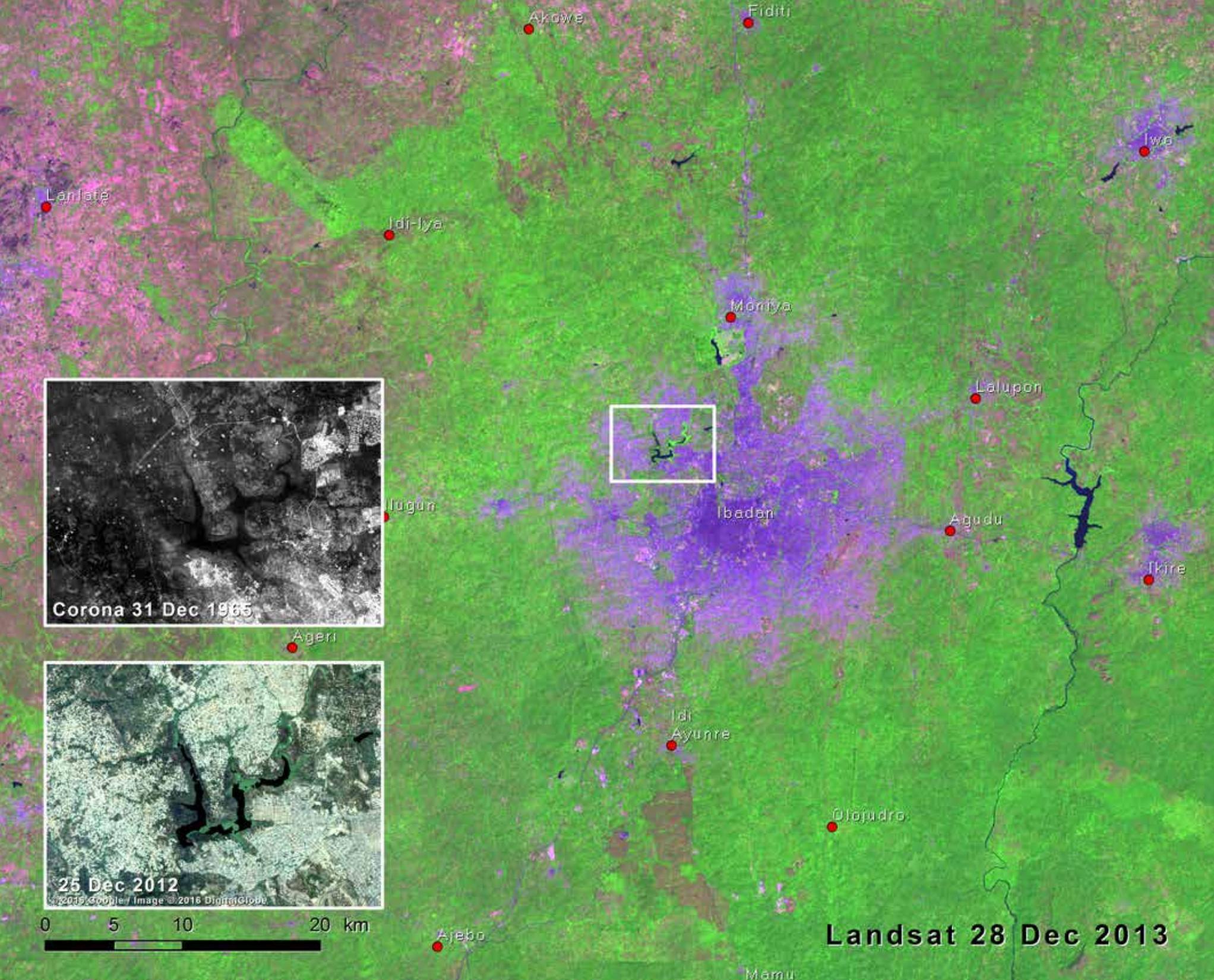


## Urban sprawl of Ibadan into savanna and forest habitat

In pursuit of economic opportunity, many Nigerians have moved from rural to urban areas. As a result, the proportion of Nigerians living in cities has risen from 19 percent in 1975 to 46 percent in 2013, leading to a rapid physical expansion of urban areas (UN, 2015). The growth of the city of Ibadan is a good example of the urban sprawl seen in cities throughout Nigeria.

Ibadan was once a military stronghold of the Yoruba Empire, dating back to the 16th century. Ibadan's growth was spurred by a connection to the railroad in 1901, which cemented its role as a major trading center of agricultural goods produced in the surrounding region, such as cassava, cocoa, cotton, rubber, timber, and palm oil. Today, Ibadan is a vibrant commercial, industrial, and administrative center, which hosts chemical and electronic industries, motor vehicle assembly plants, and a number of other industries, including flour milling, leather working, and furniture making (Fourchard, 2003).

Until 1970, Ibadan was the largest city in sub-saharan Africa (Fourchard, 2003). Population figures are sparse but suggest a population of 847,000 in 1975 rising to about 2,790,000 in 2013 (UN, 2015). According to the land cover maps (see pages 166–167) the city's built-up area increased from 84 sq km in 1975 to 528 sq km in 2013. New development occurred particularly along the major road axes, such as the Ibadan-Lagos expressway to the south of the city and the Eleyele expressway to the northwest. By 2013, the cities of Moniya and Agudu were already parts of the Ibadan metropolis. If the present rate of expansion continues, surrounding towns such as Idi Ayunre



(to the south), Ikire (to the east), Fiditi (to the north), and Ilugun (to the west) will be linked to the built-up area of the sprawling metropolis. The rapid sprawl has eaten into forested areas, savanna, farmland, fallow lands, and river floodplains. Forests and wetlands have been degraded. In the Eleyele wetland — a modified natural riverine wetland in the northwest quarter of Ibadan — an estimated 66 percent of the wetland riparian forests were lost between 1984 and 2014 due to the urban expansion (see inset). Waste effluent discharge from the city also contributed to deterioration in water quality (Tijani, Olaleye and Olubanjo, 2012).

Like other cities in Nigeria and the developing world, Ibadan has been growing at a very rapid rate, but the provision of social services and basic infrastructure has not kept pace. Unmanaged urban growth and haphazard development of informal housing have resulted in a gradual deterioration of the environment and a decline in the quality of life.



Aerial view of Ibadan



## Progressive expansion of agriculture in Niger State, Nigeria

The Middle Belt of Nigeria, which straddles the southern Sudanian and northern Guinean climatic zones, has historically been sparsely populated. In the 1970s, it was seen as the last land frontier and future bread basket of the nation. The area around the Zugurma Sector of the Kainji Lake National Park and the Dagida Forest Reserve exemplifies the significant land use transformation that the Middle Belt has gone through in the past 40 years.

The three Landsat images from 1972, 1986 and 2015 show the dramatic transformation in the area surrounding these two protected areas. In 1972, the darker green of the mostly unbroken wooded savanna has only scattered plots of shifting cultivation (lighter green areas). By 1986 the area north of Zugurma Sector and surrounding some of the villages is being converted to farmland (light tan, light green and pink areas). By 2015 the transformation of the area to farmland is almost complete, with a few islands of wooded savanna inside the protected areas.

The rapid expansion of agriculture in this formerly semi-natural area can be understood in the context of a changing Nigerian political economy. The oil boom of the 1970s and enactment of the Land Use Act of 1978 sparked a rush for land acquisition of formerly communal lands by wealthy private owners. The food crisis of the 1980s and restructuring of the economy along the lines of the International Monetary Fund (IMF) renewed the emphasis on food production. In 1984, the government of Nigeria banned the import of agricultural raw materials by the local bottling, flour and confectionary industries, which pushed these industries to acquire land at a large-scale to grow wheat and other grain crops.



A Kob in Kainji Lake National Park

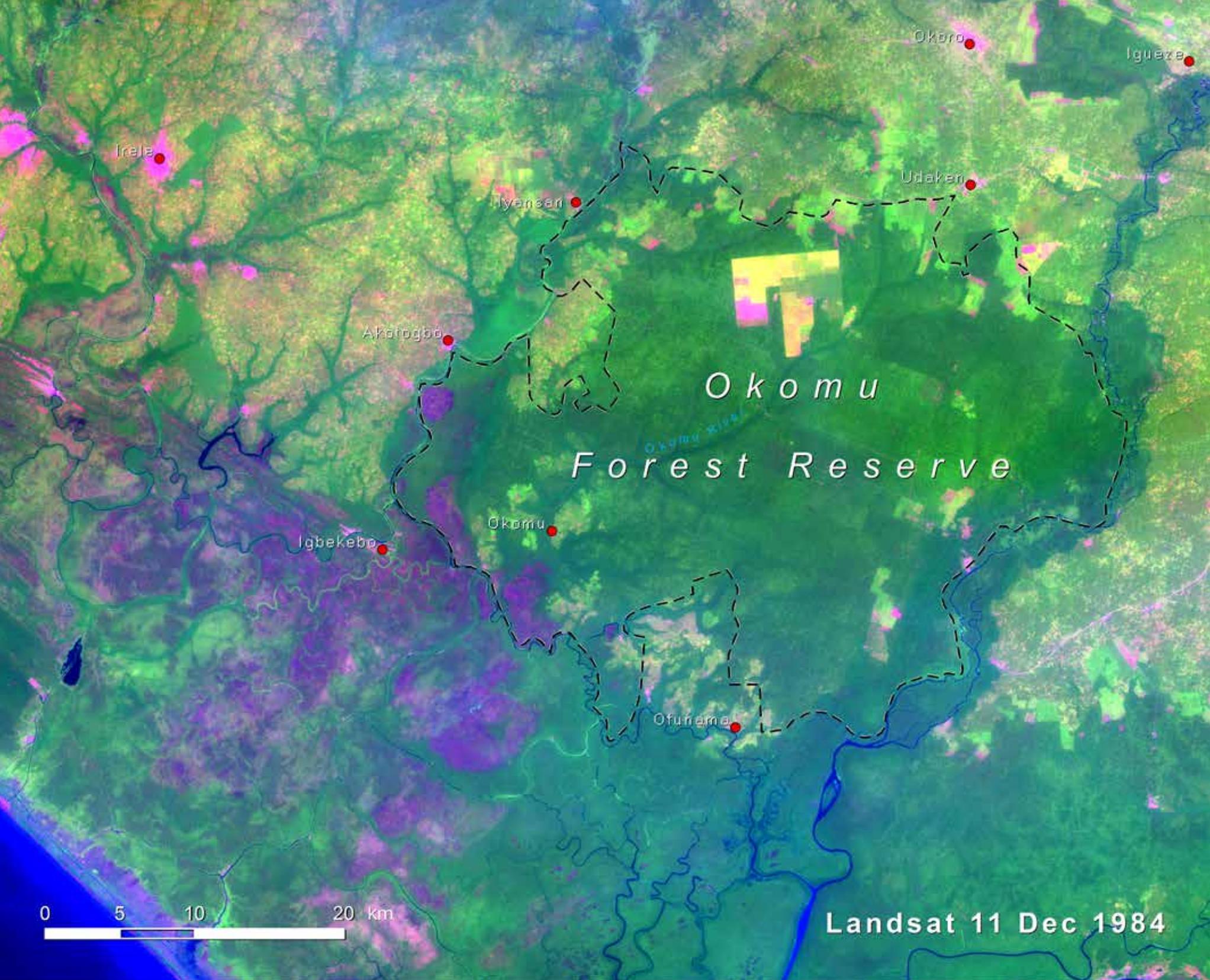
JEREMY WEATE / FLICKR / CC BY 2.0



The land acquisitions by large owners engendered land use competition and conflicts between (1) a small land-owning class and a large class of landless peasants, (2) peasant farmers and migratory pastoralists who have seen their main source of dry season pasture shrink, and (3) peasant farmers, migratory pastoralists and the wildlife and forestry conservation authorities who are faced with increasing land use pressure around the parks as well as grazing and cropland encroachment into the parks.

If left unaddressed, the lack of an integrated policy that regulates access of different user groups to land resources will continue to threaten wildlife and biodiversity conservation within the game reserves in a State which currently records the highest population growth in Nigeria at 3.4 percent per year.



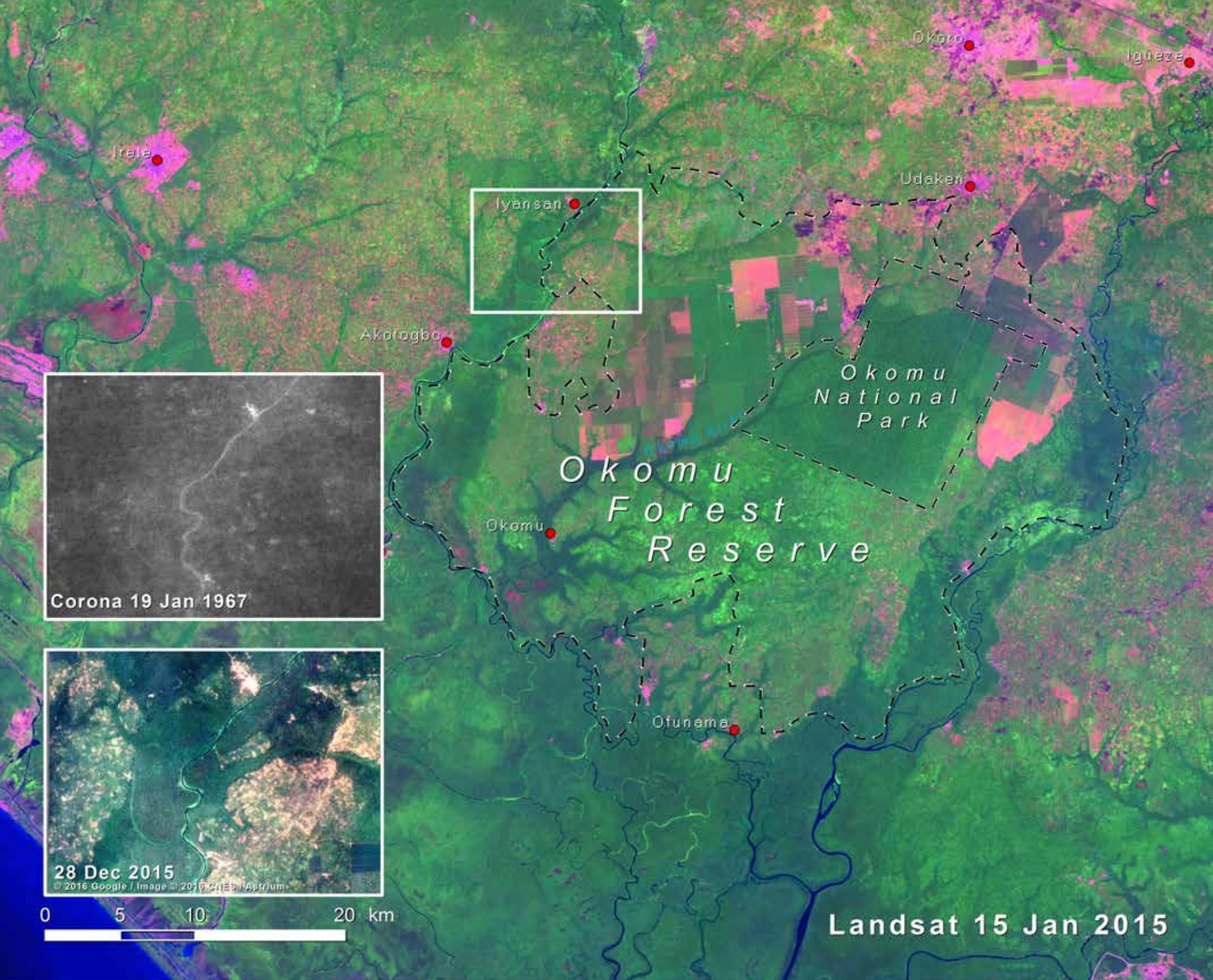


## Tropical forest threatened by human activities in the Okomu Forest Reserve

Closed-canopy tropical moist forest once covered large parts of southern Nigeria, where some of the earliest ecological studies of tropical rain forest were carried out in the 1930s (Ajayi, 1998). Since that time, excessive logging and conversion to plantations and farmland have caused major losses of natural forest. Although no longer a pristine wilderness, the Okomu Forest Reserve still supports a small population of forest elephants and several species of threatened primates, including a viable population of the rare white-throated guenon, a monkey endemic to southwestern Nigeria (Oates, 1995).

The Okomu Forest Reserve was originally established by the British colonial government in 1912. It comprised 777 sq km, to which another 411 sq km were added to the north and east in 1935. From the beginning, it was planned that the reserve would be managed as a source of timber, and it has been exploited for its rich stands of mahogany. Since the 1940s, systematic rotational logging as well as “taungya” farming have been practiced in the reserve. In this forest management system, an area of forest is allocated to local farmers to be cleared and farmed, and subsequently reforested with useful tree species.

The Corona satellite photograph (see inset) from 1967 shows a still-intact forest canopy on both sides of the river, which delimits the northwestern boundary of the reserve. It is likely that the whole Okomu Forest Reserve



was blanketed with a continuous dense forest at that time. By 1984, large parts of the Okomu Forest Reserve had been converted to plantations of oil palm and rubber trees — partly as official concessions, partly illegally or only lightly controlled. A network of roads and settlements, along with farmland encroachment into the reserve, can be seen as well. Each year, a larger area of the reserve was assigned to taungya farmland. Although the taungya scheme had been envisaged to serve the local farming population, it soon attracted immigrant farmers from more densely populated areas of the country, leading to an increase in the overall population pressure on the reserve.

In 1985, a wildlife sanctuary of 114 sq km was carved out of the most intact area of the forest reserve. Poaching was brought under control in the sanctuary, which is a habitat to several endangered species including red-capped mangabeys, white-throated monkeys, chimpanzees, leopards, and the African forest elephant. In 1999, the Okomu Wildlife Sanctuary was designated a national park to increase its protection from the immense

pressure from high rates of exploitation and human settlement expansion on its periphery (Onojeghuo and Onojeghuo, 2015). Okomu National Park remains the only fully protected part of the reserve and stands out against its surroundings in the 2015 Landsat image. The visible impact of rapid plantation expansion can be seen in the northern half of the reserve, which is dominated by large-scale rubber and oil palm plantations, whereas farmland has colonized the southern half.

Efforts have been made to provide sustainable livelihood opportunities to local communities, including controlled logging and hunting, reforestation, livestock rearing, and agricultural practices compatible with forest conservation. However, Okomu's status as a national park has not fully prevented the effects of deforestation within and around the reserve. Multipurpose forest management has been praised by some, but others have criticized it for neglecting protection efforts, arguing that integrating a development component has put Okomu at risk of ecosystem degradation.