Landscapes of West Africa

A Window on a Changing World

Back of cover

Landscapes of West Africa

A Window on a Changing World

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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.

Source: NASA, Lunar Reconnaissance Orbiter

Preface

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.

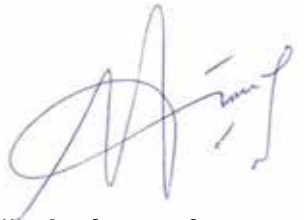
The West Africa Land Use Dynamics (LULC) Project is emblematic of this cooperation. Initiated in 1999, the LULC project has had several phases including training national experts to extract pertinent information from satellite images to characterize vegetation cover and producing tools and supporting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



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FROM THE AMERICAN PEOPLE


Alex Deprez

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.

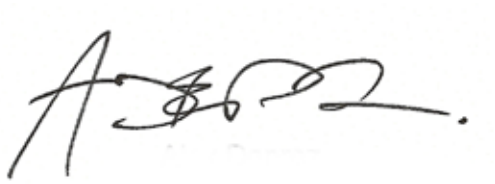
Rapid changes are occurring across West Africa's natural and human landscapes and balancing the need to preserve natural ecosystems with the need to grow more food, together with ensuring resilience in the same ecosystems, is a challenge. USAID West Africa's (USAID/WA) Environmental Threats and Opportunity 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.



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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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In Memory

Our thoughts are with three colleagues and friends who are no longer with us. All three contributed significantly to the success of the West Africa Land Use Dynamics Project, including major content contributions to this atlas:

Yendouhame John Kombaté, Responsable Suivi Evaluation et Communication, Agence Nationale de Gestion de l'Environnement, Ministère de l'Environnement, Togo;

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Richard Julia, friend and pilot based in Ouagadougou who made it possible for the project team to acquire thousands of aerial photographs in numerous countries of West Africa, and for his own photography of landscapes, wildlife and cultures of the Sahel.

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.

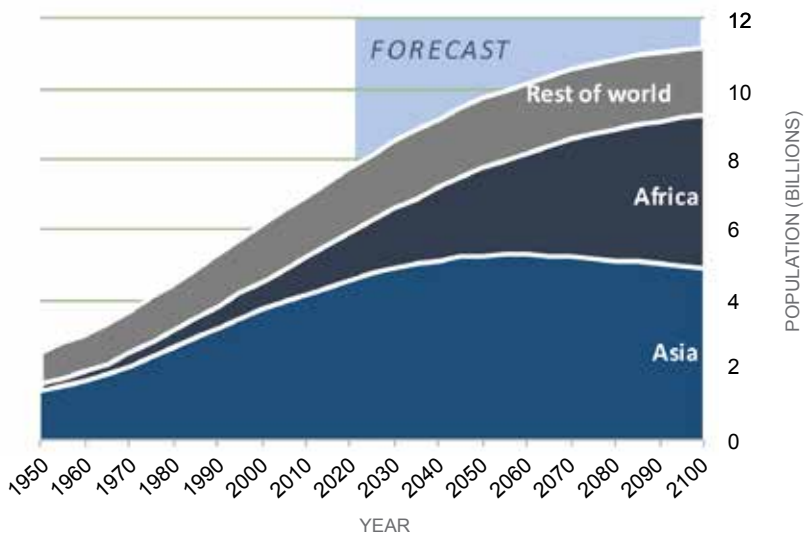
When humankind appeared on Earth around 200,000 years ago the influence of human activity on the environment must have been small and localized. The influence of scattered small groups of people on the global ecosystem would have been overwhelmed by the forces of natural systems (Steffen and others, 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.

"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



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)!

PHOTO (OPPOSITE PAGE): SUZANNE COTILLON / SGT

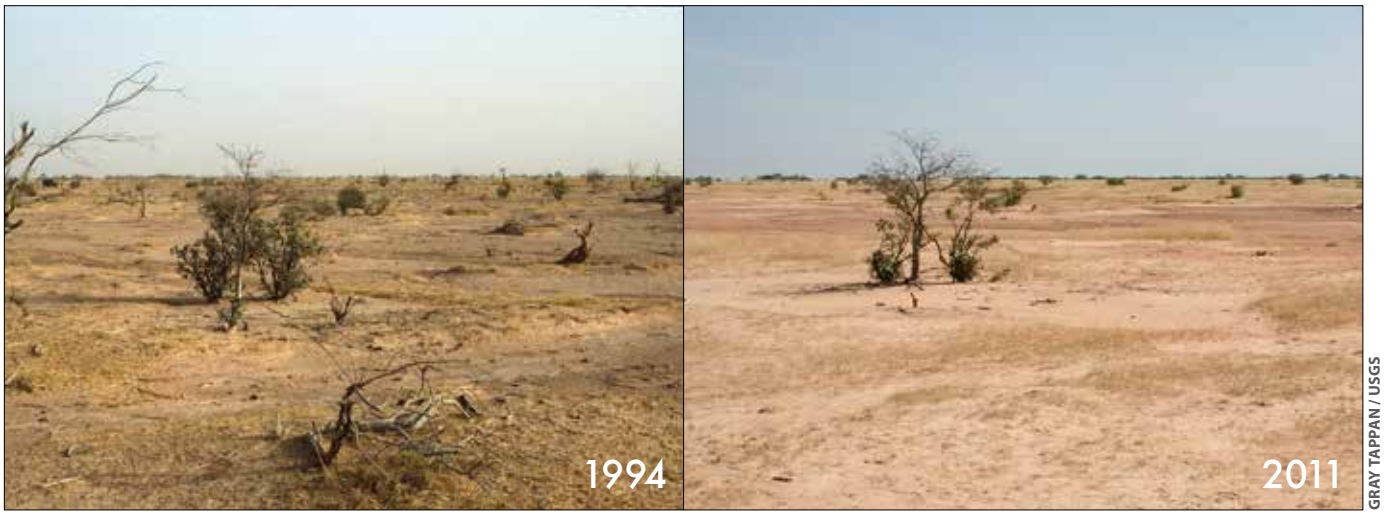
Wooded landscape fragmented by agriculture expansion in western Burkina Faso

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.

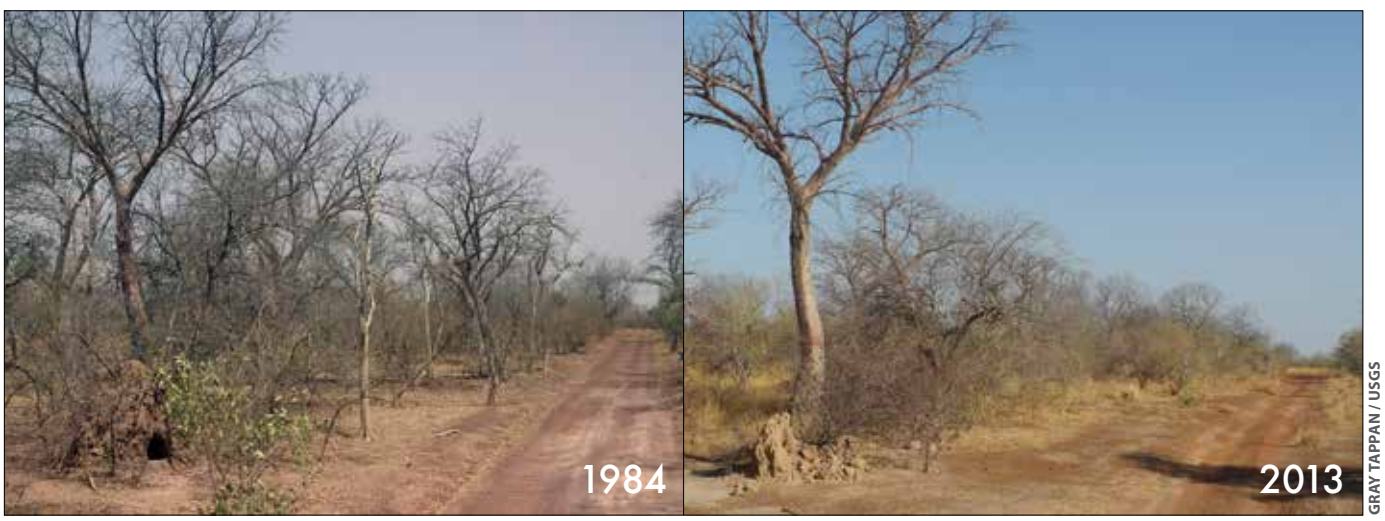
Conversion of the natural landscapes of West Africa to agriculture greatly reduces the natural biodiversity, and exposes the soil to wind and water erosion. The savanna, woodland, forest, and wetland ecosystems that are lost have some relatively tangible impacts such as the loss of natural ecosystem 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



GRAY TAPPAN / USGS

Decline in vegetation cover and biodiversity in east-central Senegal

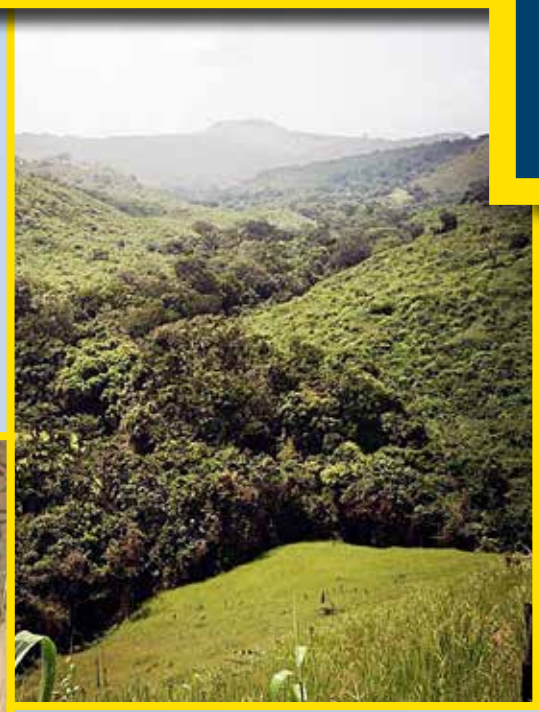


GRAY TAPPAN / USGS

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 II

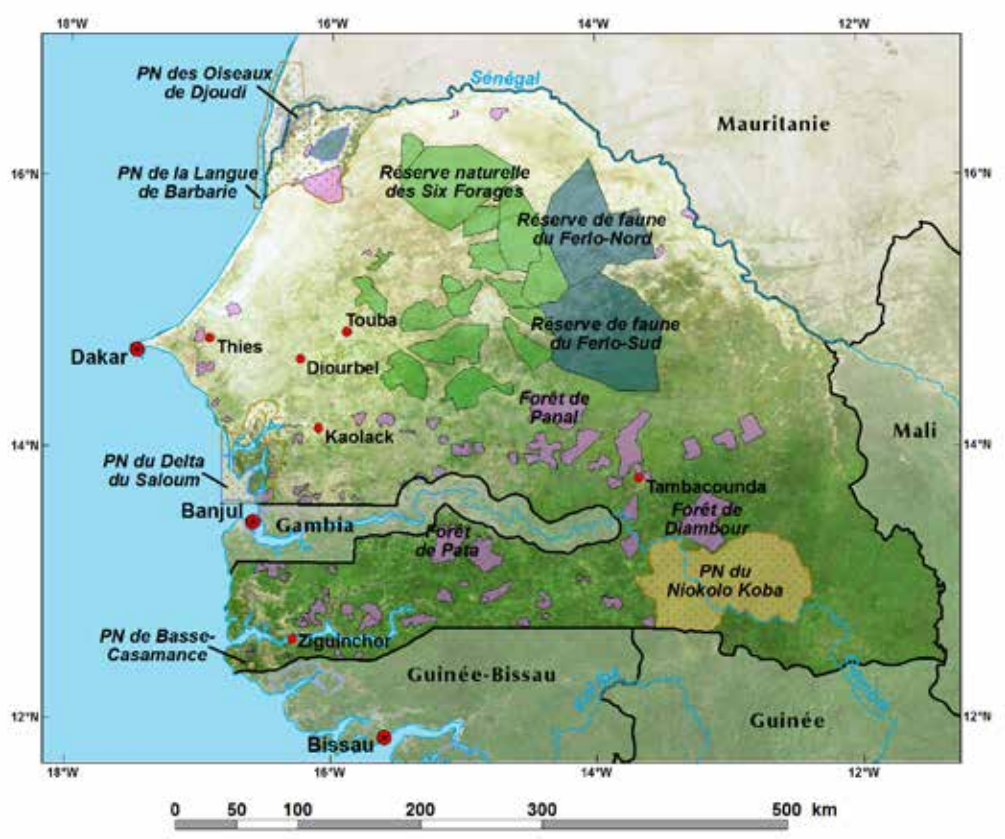
Country Profiles, Land Use and Land Cover, and Trends

Republic of

Senegal

Total Surface Area: 196,722 km²
Estimated Population in 2013: 14,421,000

Senegal is the westernmost point on the African mainland, and its capital, Dakar, has historically served as the gateway to West Africa. Senegal's economy is based primarily on agriculture, particularly the production of peanuts and cotton, but this sector has been hurt by drought and low commodity prices. A rapidly growing population is placing enormous stress on Senegal's limited land resources, agricultural production, and forest resources. Over 80 percent of the population lives in the western half of the country; nearly 70 percent are farmers, but the urban population is steadily increasing. Senegal has a wide range of bioclimatic regions. The semiarid Sahel in the north is home to pastoral societies. The Sudanian region in the central and southern part of the country has a mix of settled farming communities and wooded savannas. In the sub-Guinean region of the southwest, rice-producing peoples live among forests and mangrove-fringed estuaries. Many of the woodlands in the central and southern regions have been degraded by charcoal production and overharvesting of timber for export. The large Niokolo-Koba National Park in the southeast still preserves diverse landscapes, flora and fauna once found across much of West Africa.



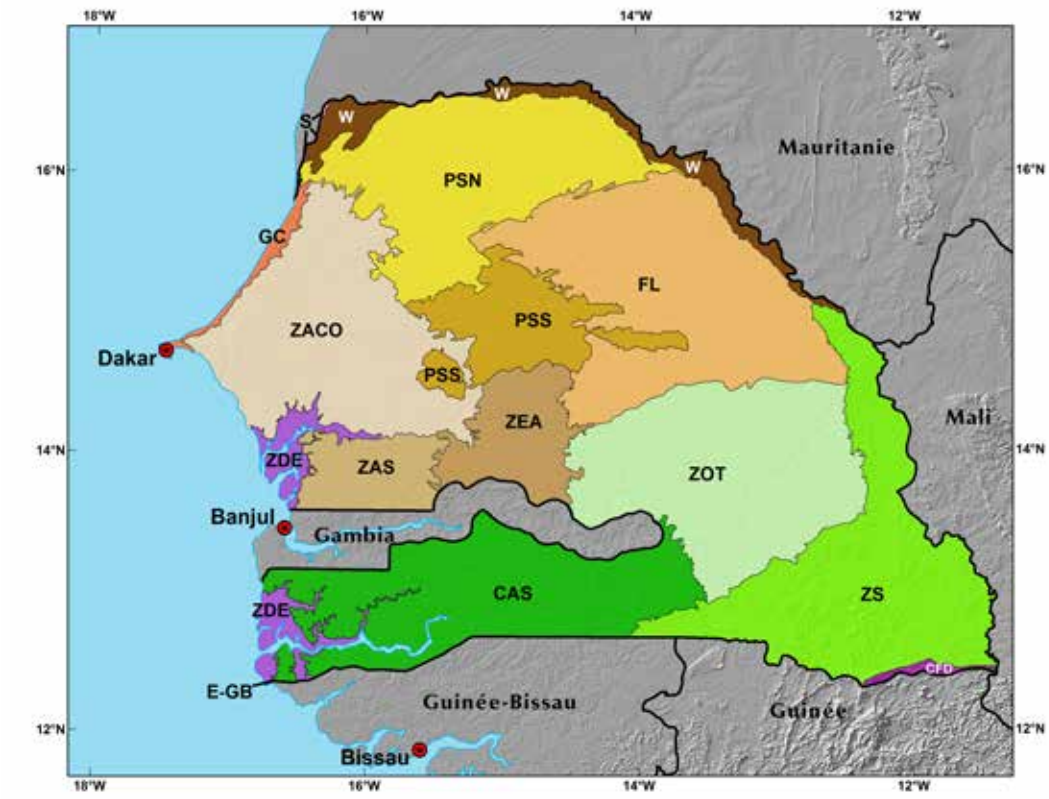
NASA BLUE MARBLE NEXT GENERATION

Environmental Highlights:

- Deforestation
- Desertification
- Large number of protected areas
- Extensive use of agricultural parkland

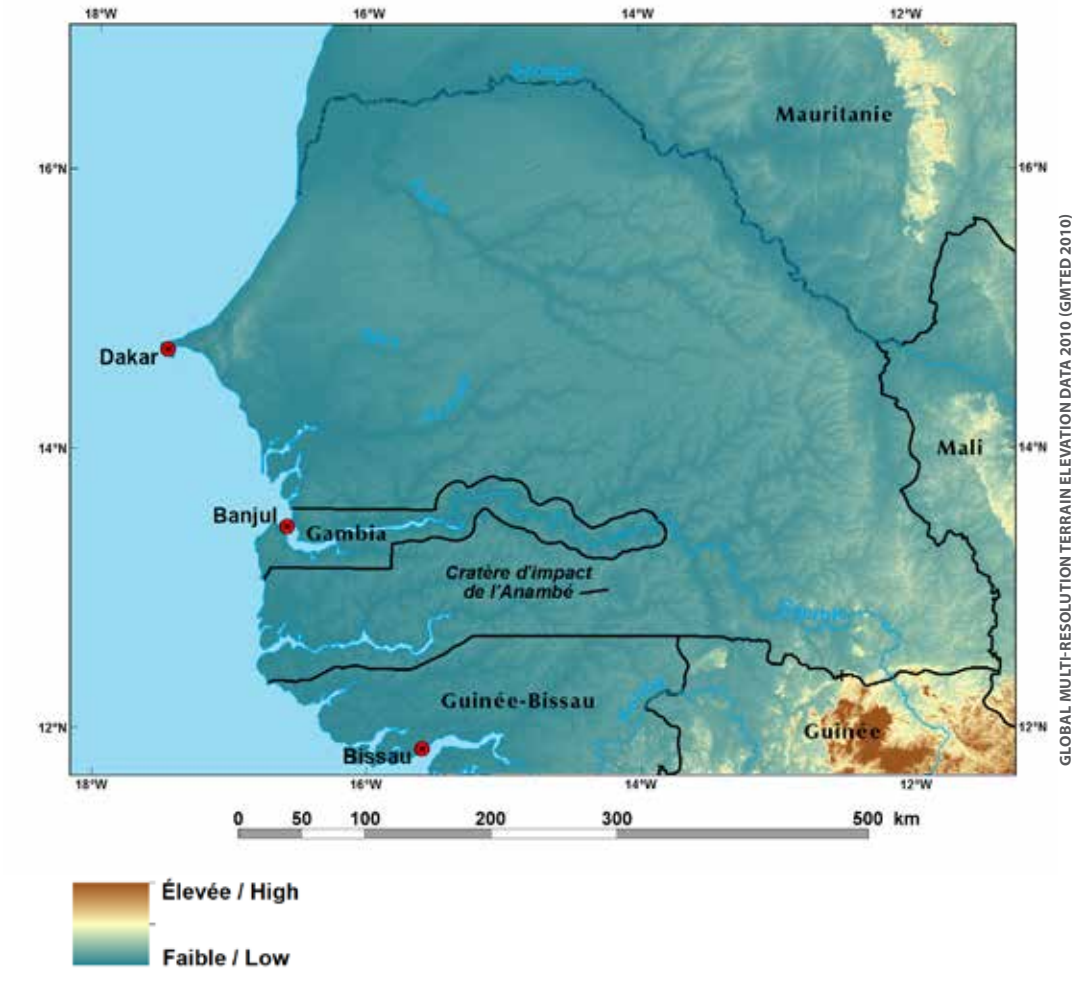
Wet season landscape along the Thiès escarpment

Ecoregions



CAS	Casamance	W	Vallée du Fleuve
CFD	Contrefort du Fouta-Djallon	ZACO	Zone Agricole du Centre-Ouest
E-GB	Zone des Estuaires de Guinée-Bissau	ZAS	Zone Agricole du Saloum
FL	Zone Pastorale Ferrugineuse	ZDE	Zone des Estuaires
GC	Grande Côte	ZEA	Zone d'Expansion Agricole
PSN	Zone Pastorale Sableuse du Nord	ZOT	Zone Orientale de Transition
PSS	Zone Pastorale Sableuse du Sud	ZS	Zone du Socle
S	Littoral		

Shaded Relief



GLOBAL MULTI-RESOLUTION TERRAIN ELEVATION DATA 2010 (GMTED 2010)

Senegal is fairly flat, and is drained by several large rivers, including the Gambia and the Senegal. Its geological structure is a sedimentary basin of sandstones covered by more recent wind and water deposited sediments, and intermittent plateaus capped with lateritic hard pan. The ecoregion map depicts Senegal's landscape diversity. The pastoral semiarid regions in the north are typical of the Sahel climatic zone. The wetter southern areas are part of the Sudanian climatic zone. Other regions, such as the Zone Agricole du Centre-Ouest (ZACO – West-Central Agricultural Zone), also known as the Peanut Basin, or the Zone Agricole du Saloum (ZAS – Saloum Agricultural Zone), are densely settled areas characterized by high rural population density which has completely transformed the original wooded savannas. The ecoregions in the east and southwest (ZOT – Zone Orientale de Transition and ZS – Zone du Socle), dominated by lateritic plateaus, have been spared from much of the agricultural expansion in the west, but are being subjected to extensive exploitation of their forest resources. In the south, the Casamance Region is well known for its woodlands, gallery forests, palm-fringed wetlands and valleys, and rice paddies.

GRAY TAPPAN/USGS

Suspension bridge over the Niokolo Koba River.

PHOTO (OPPOSITE PAGE): GRAY TAPPAN/USGS

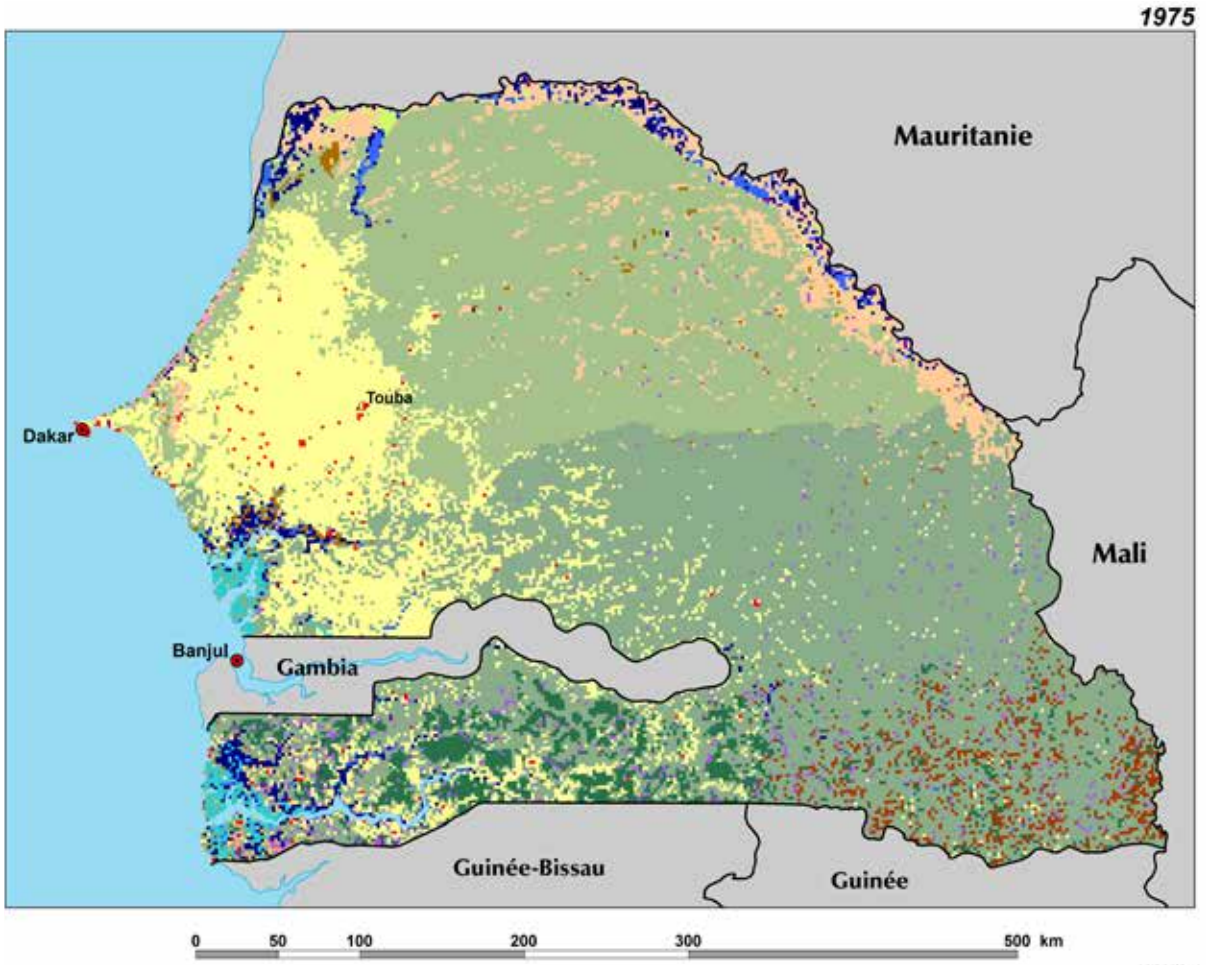
Land Use, Land Cover and Trends

The most significant change in Senegal is the evolving extent of cultivated areas. The overall expansion of cropland is relatively small, from 32,600 sq km in 1975 to 32,900 sq km in 2000 and 41,000 sq km in 2013, or a 26 percent increase between 1975 and 2013. However, the recent pattern and extent of cropland is profoundly modifying Senegal's landscapes. Agricultural expansion has resulted in fragmentation of the savannas and woodlands, replacing unbroken expanses of natural habitat with a mosaic of tilled fields and natural landscapes, eroding the quality of remaining natural ecosystems. Furthermore, the speed of agricultural expansion has increased between 2000 and 2013 compared to the previous 25 years. While the average annual increase of cultivated areas was modest between 1975 and 2000 (about 10 sq km per year), it rose dramatically between 2000 and 2013, to 630 sq km on average per year. This trend, however, masks much of the internal variation within the agricultural class.

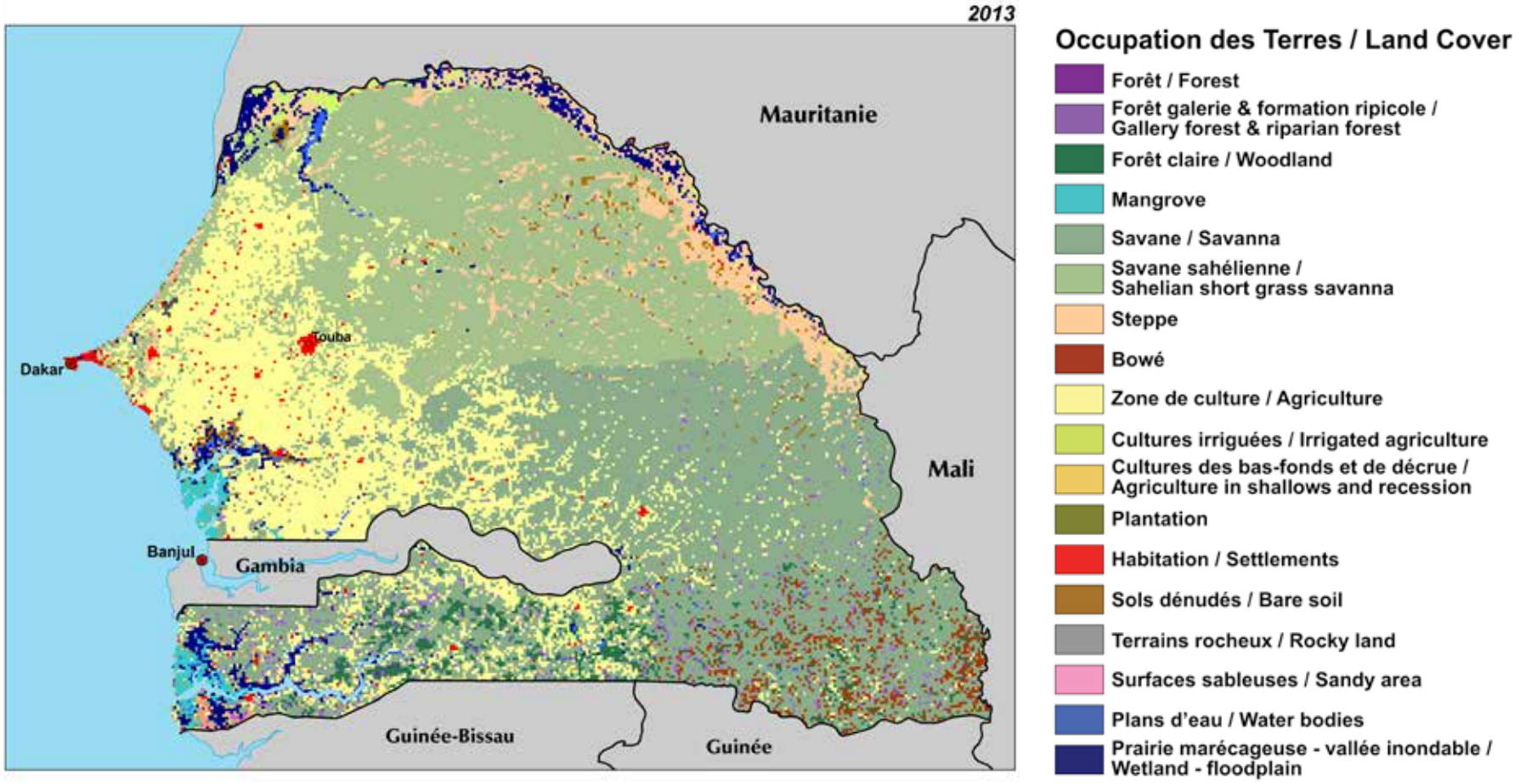
In contrast to other regions of Senegal, the Peanut Basin experienced abandonment of agricultural lands in the 1980s. In the Peanut Basin, land devoted to rainfed crops remained fairly stable between 1975 and 2000. While agricultural expansion continued to make inroads in the east, in the west cropland was being abandoned, reverting to grasslands that were mapped as savannas in 2013. This conversion of cropland back to grassland in the Peanut Basin hides the actual magnitude of rapid agricultural land increases in central Senegal. The very low price of peanuts forced many farmers to abandon their fields and turn to other economic activities, which often meant migrating to Dakar, Touba, or other cities.

As in central Senegal, most of the south experienced major gains in agricultural area at the expense of savannas and woodlands, especially in the Casamance. As a result of agricultural expansion, Sahelian and Sudanian savannas have decreased by 8,200 sq km, or a 6.3 percent reduction of their 1975 area. Woodlands decreased by 42 percent, or 3,160 sq km. Gallery forests, which are found along much of Senegal's drainage network and known for their biodiversity, registered a decrease of 19 percent (or 570 sq km). However, most of the reduction of gallery forests appears to have occurred before 1975 (Tappan and others, 2004).

Wetlands and floodplains increased by 17percent, due mainly to the recovery of wetlands from the severe drought of the 1970s, which dried out many wetlands. Since the end of the 1990s, rainfall



GRAY TAPPAN/USGS

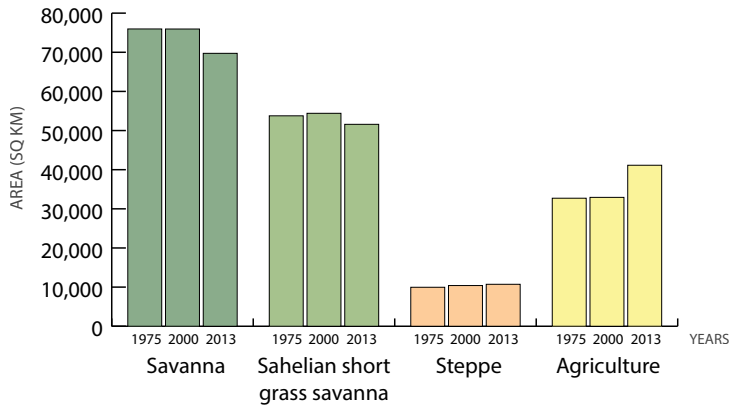


continues to fluctuate annually, but it has returned to levels more consistent with the longer term norm.

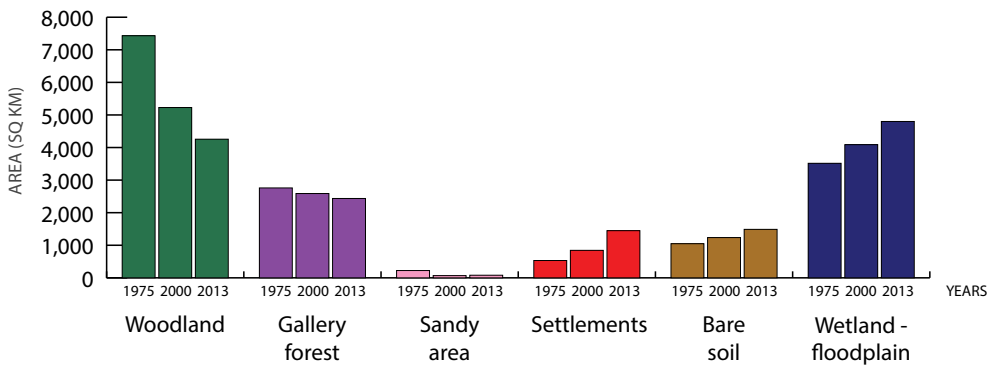
In the north, there are many local instances of savannas taking on steppe-like characteristics as years of drought, intensive grazing, and loss of topsoil combine to degrade the savanna structure, vegetation cover, and productivity. The maps reflect this process, with steppes replacing local areas of savanna in agro-pastoral regions (a 760 sq km gain between 1975 and 2013). Similarly, in more extreme cases of drought-induced loss of vegetation cover, overgrazing, and soil erosion, savannas or steppes become bare and unproductive, even in the rainy season. These areas are mapped as bare soils. The area of bare soil increased significantly, by 42 percent between 1975 and 2013, especially in the Pastoral Ferruginous Zone. This trend was confirmed by field studies, which also documented the expansion of the badlands along fossil valleys where severe erosion has removed the topsoil. On a positive note, the decrease of sandy surfaces (–144 sq km between 1975 and 2013) can be explained by the success of coastal dune reforestation and stabilization efforts.

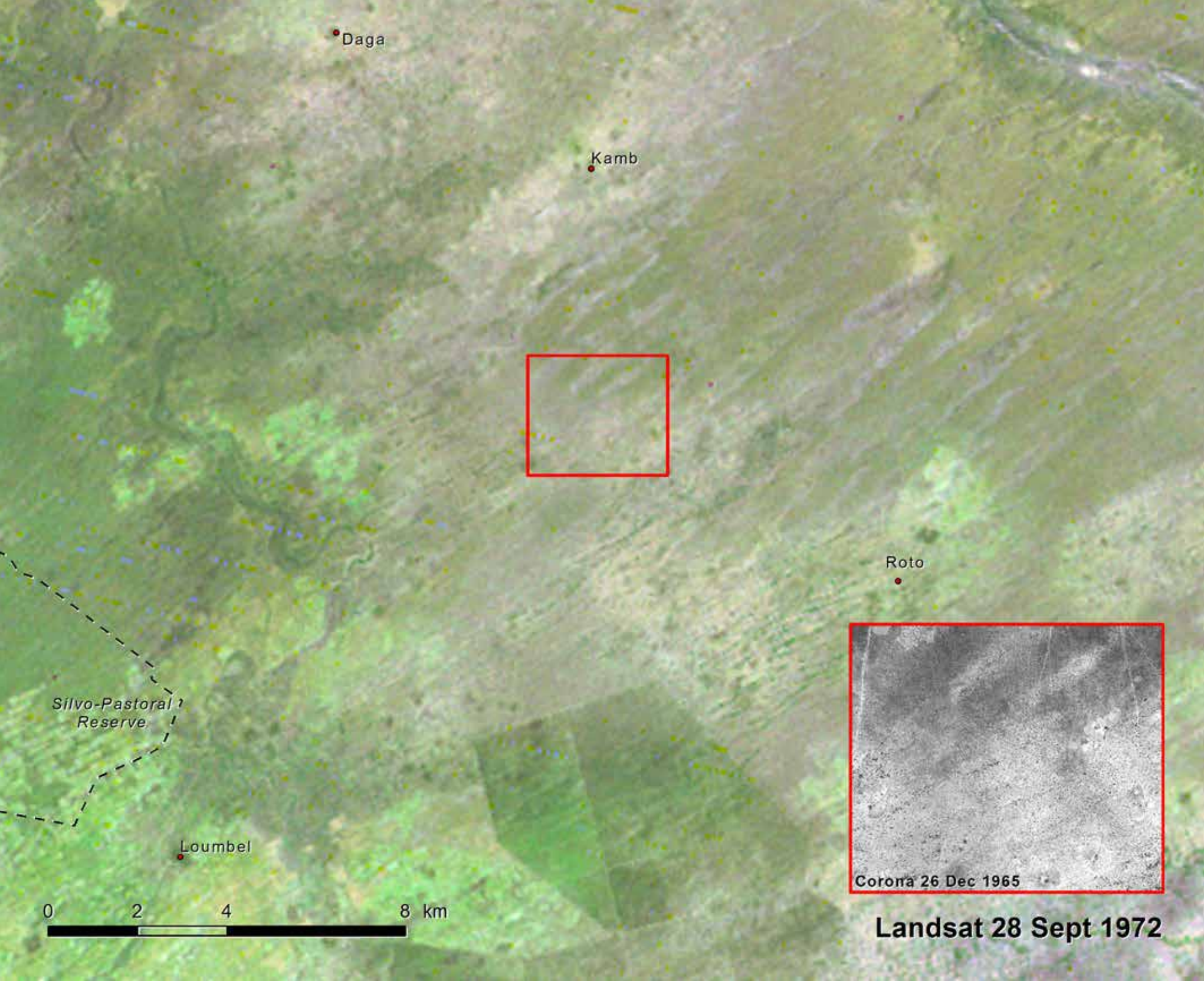
Finally, the large expansion of settlements — villages, towns and cities — illustrates the rapid population increase in Senegal, particularly in the big cities of Dakar and Touba. While the population tripled between 1975 and 2013, the area occupied by towns and cities grew from 530 sq km in 1975 to 850 sq km in 2000 and to 1,450 sq km in 2013, or a 172 percent increase over 38 years.

Large area classes



Small area classes

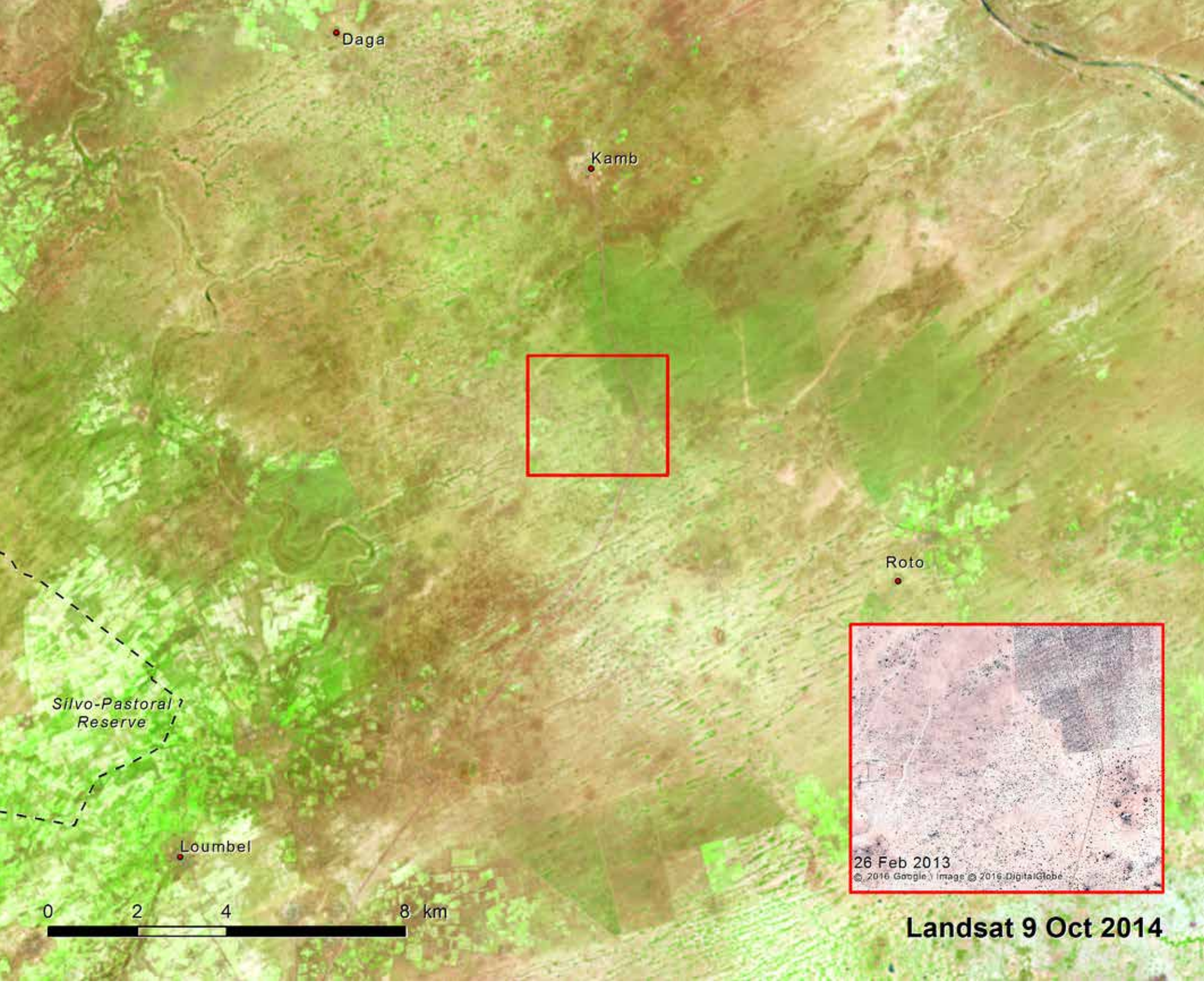




The re-greening of degraded land in Kamb in Senegal's northern pastoral region

Located in the Northern Pastoral Sandy Region of the Ferlo Region in Senegal, the Kamb site covered about 25 sq km. The Ferlo's climate is similar to much of the Sahel and characterized by two main seasons: a dry season that lasts nine months from October to June, and a rainy season of three months. Total annual rainfall is both low and highly variable, with an average of 422.6 mm per year from 1951–2004 (Ndiaye and others, 2014).

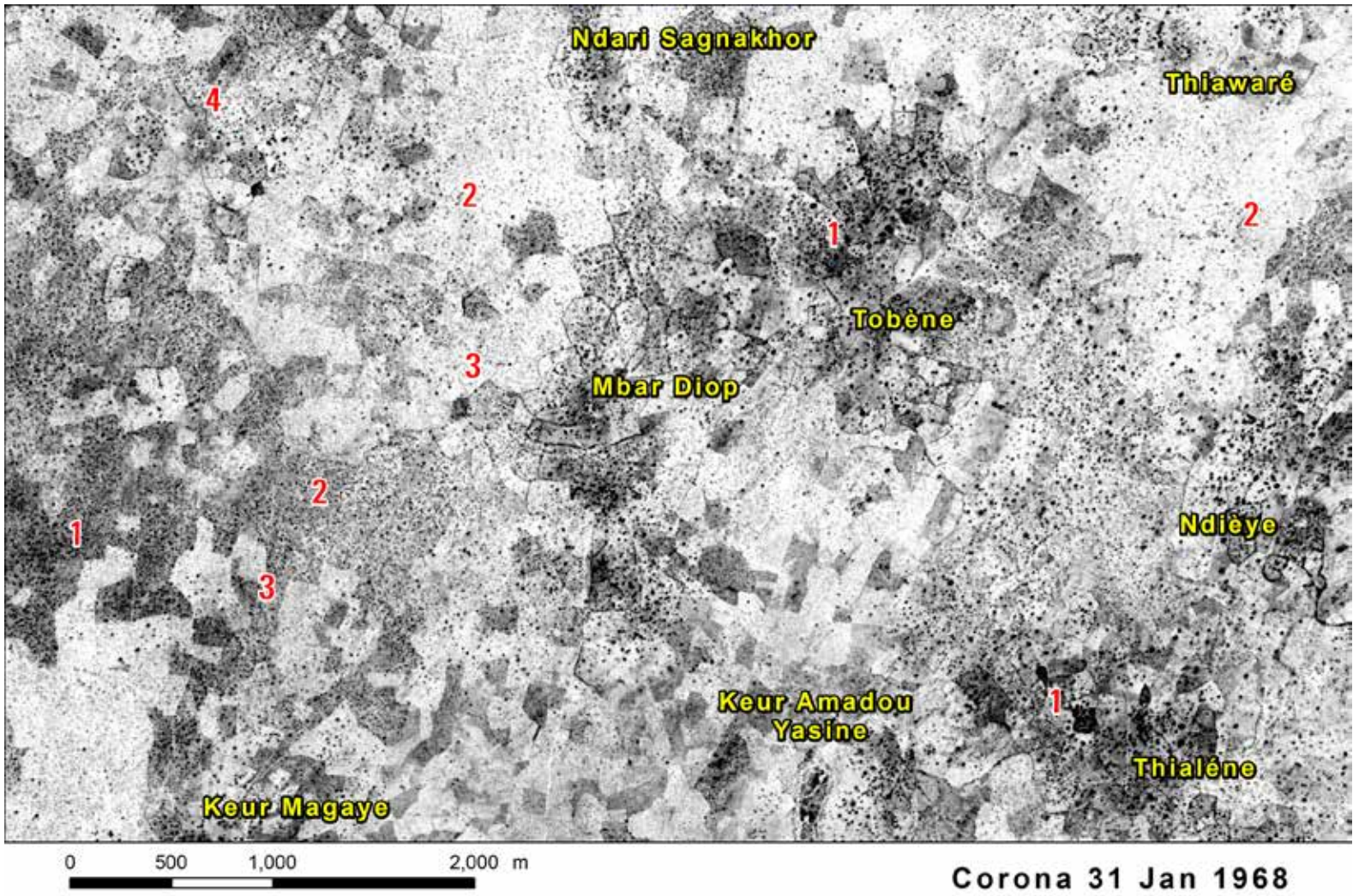
Before the droughts of the 1970s and 1980s, this sylvo-pastoral area used to be covered with a relatively dense wooded savanna. Most local inhabitants confirmed this and attributed the loss of woody vegetation not only to overuse by humans but also to droughts, lack of rain, and unfavorable soils (Tappan and others, 2004). Once vegetation is lost, soils become susceptible to erosion. The sandy soil loses its structure and becomes more mobile, prone to wind erosion. The 1972 satellite image confirms the loss of vegetation and the increase of degraded barren land subject to erosion in the Kamb area, shown in white patches on the image. One of the early fenced plantations can be seen 15 km south of Kamb to restore some degraded land.



Recent high-resolution imagery shows significant re-greening south of Kamb. Supported by several afforestation projects, thousands of *Acacia senegal* (gum arabic tree) have been planted in large fenced areas, which in some cases are partly used for harvesting by the responsible village. Herders are allowed to graze livestock at the end of the dry season for a fee, which is used to maintain the protected area (Brandt, 2015). Even though the 2013 image shows a positive impact on the land from the re-greening resulting from tree planting, it does not translate directly into a positive picture of ecological recovery. The planted trees create a large monoculture, which lacks diversity. Fauna and flora biodiversity is much lower than it was before the degradation of the wooded savanna, and the population still speak of soil erosion and a lower water table.

SUZANNE COTILLON / SGT

Plantation of *Acacia senegal*



Corona 31 Jan 1968

Agroforestry with increasing field tree densities in the community of Mbar Diop

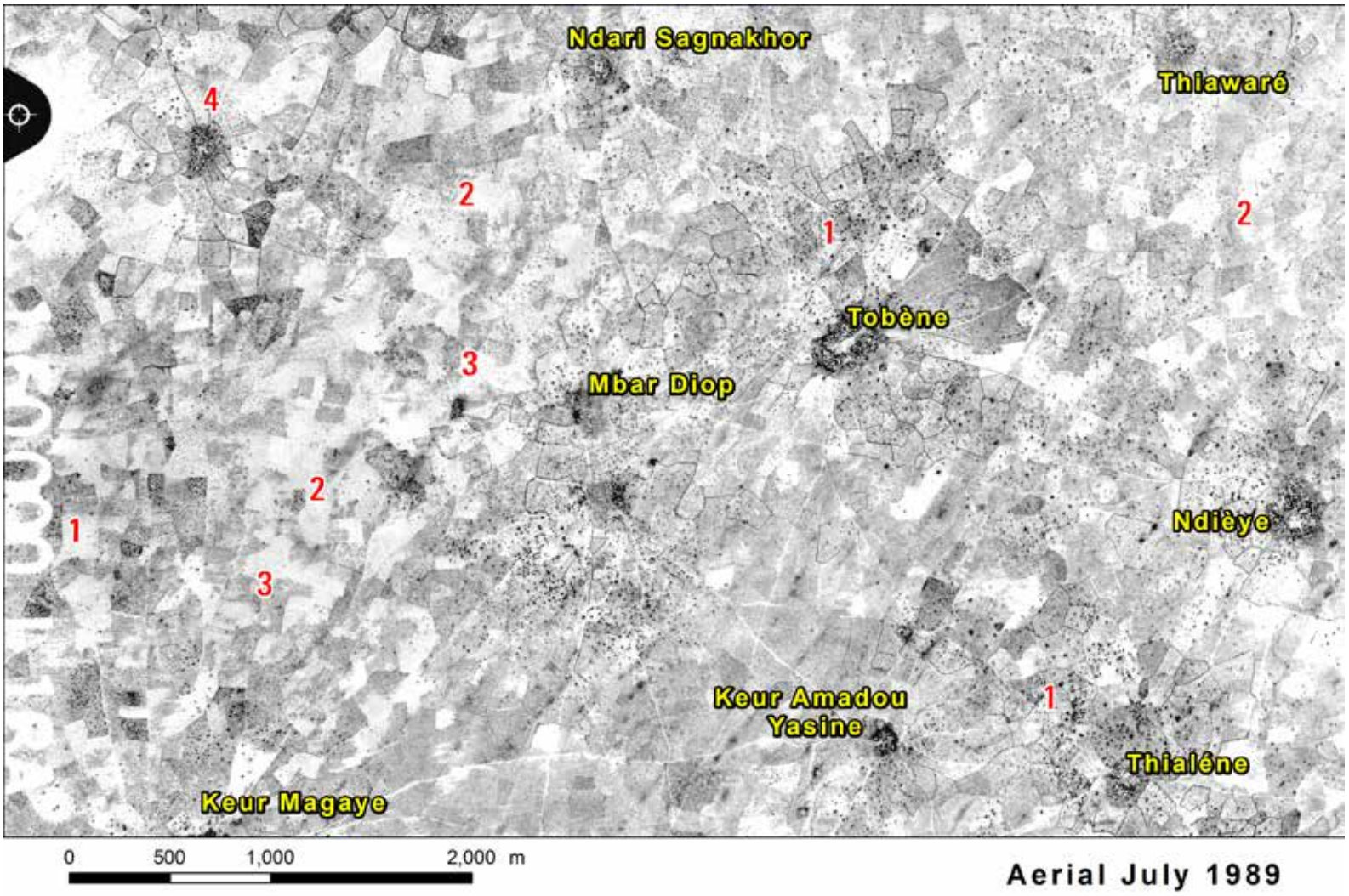
The Peanut Basin of west-central Senegal is an agricultural region that has been under intense cultivation since the 19th century. The last remainders of the original woody savannas in this region were cleared in the early 1900s, leaving in its place an agricultural parkland dominated by *Faidherbia albida*. Mechanization of the peanut production required farmland to be cleared of trees, which resulted in dwindling tree densities in (parts of) the parkland. The reduced tree cover combined with meteorological droughts brought about soil erosion, dust storms, and decreasing crop yields (Hirai, 2005).

The community of Mbar Diop, in the coastal part of the old Peanut Basin, has managed to turn this negative trend around. The Projet de Reboisement Villageois dans le Nord-Est du Bassin Arachidier (PREVINOBA – Village Afforestation Project of the Northwest Peanut Basin) began working in the area in 1987, promoting agroforestry activities with awareness campaigns on the importance of tree cover for sustainable farming. The tenure situation — trees belong to the farmer who plants them — was favorable in that it encouraged individual investments in afforestation. As a result, since the intervention of PREVINOBA, many orchards have sprung up, and the tree densities increased visibly.

A series of high-resolution images illustrates the land cover dynamics over time. A Corona space photograph from 1968 (see above image) shows remnants of relatively dense tree and shrub cover among the cultivated area (1). By 1989, the region had undergone a series of drought years, which, combined with increasing population pressure and the prevailing agricultural strategy of totally clearing field trees for the ease of mechanized agriculture, resulted in a noticeable decimation of the tree cover (2) (see top adjacent image). The OrbView satellite image from 2012 (see bottom adjacent image) shows the recovery of field trees, notably in the PREVINOBA intervention area around Mbar Diop (3). In addition to field trees, live hedges have contributed to the overall woody cover and act as windbreaks. Orchards increased from 27 percent of the cultivated area in 1989 to 58 percent in 2012. In the highest density orchards, up to 140 trees per hectare can be counted.

The population of Mbar Diop is well aware of the multiple benefits they draw from the trees. Dust storms have become less frequent and there is more shade. Some of the plant and animal species that had disappeared have returned to the area. They also attribute the fact that rainfall has improved recently to the increased tree cover. The economic benefits from the afforestation are also considerable. The sale of wood, nuts and fruits is estimated to generate a revenue of 1,500 to 2,400 US$ per hectare per year. In addition, yields of field crops have improved.

However, the success of the afforestation investments is threatened by a mining operation, which can be seen to encroach the area from the northeast (4). It has already



Aerial July 1989

OrbView 20 Feb 2012

displaced villages and continues to expand toward the densest orchards, causing great concern to the population of Mbar Diop. Not only do they fear for the existence of the village and its territory, but they already feel the impacts of the chemical pollution coming from the phosphate mining. A discussion and settlement of the land use competition between farmers and the mining concession is urgent.

GAMBIA
SENEGAL

Pata Forest

Guimara Forest

Corona 26 Dec 1965

0 5 10 20 km

Landsat 22 Dec 1979

The Pata Forest Reserve in the Casamance: a window on a disappearing forest

The Pata Forest Reserve was once part of a vast, unbroken Sudanian woodland that stretched from the Gambia River to the Casamance River, with narrow gallery forests following the watercourses. At least 20 species of woody plants are common throughout, with many more species of Guinean zone affinity found in the gallery forests (Stancioff and others, 1986). These woodlands are by nature very heterogeneous in floristic composition, which also makes them remarkably uniform in structure (Pélissier, 1966). Besides their value as a woodland ecosystem, they also serve as extensive grazing land for cattle.

Charcoal production

GRAY TAPPAN / USGS

Covering 640 sq km, the Pata Forest Reserve is the largest forest reserve in southern Senegal. From the 1930s to the early 1970s, the integrity of the forest reserve was respected. In the Landsat image from 1979, we can see

GAMBIA
SENEGAL

Pata Forest

Guimara Forest

30 Oct 2014
© 2016 Google \ Image © 2016 DigitalGlobe

0 5 10 20 km

Landsat 3 Dec 2015

that the woodland is still intact within and outside the reserve, although a few minor incursions of cropland are visible. The situation changed dramatically in the late 1980s when Wolof farmers from the Saloum agricultural region, seeking new land, began moving into the valleys in and around the Pata Forest. By 1999, 28 percent of the Reserve had been cleared for agriculture, fueling tensions between the local agro-pastoralists and the recent migrants (Tappan and others, 2004).

As seen in the 2015 Landsat image, the Pata Forest Reserve has almost ceased to exist as a forested landscape. Unchecked agricultural expansion surrounding numerous new settlements, tree harvesting for charcoal production, and selective logging for valuable timber have combined to decimate the woodland (see inset). In 2013, focus group discussions were conducted by AGRHYMET's national team in Senegal in several villages surrounding the Pata Reserve to capture local perspectives on landscape changes. Local inhabitants cite the increase in population, increasing the demand for farmland. They also point to the significant in-migration and settlement of families from the Saloum. As secondary factors, they cite environmental change, particularly the decrease in rainfall and increasing temperature which, combined with bush fires, have accelerated degradation of the forest. They also spoke of the commercialization of valuable wood, with strong demand and flow of timber to The Gambia for export to China.

GRAY TAPPAN / USGS

Aerial view of Pata Forest Reserve