

绪言

General Continental Agriculture Activities

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Cereal crop distribution

Cereals are grown in much of Africa except in the deserts and forested areas. The cereal component of agriculture in Africa is about 30% maize, 23% sorghum, 21% millet, 9% rice and 9% wheat. Maize, sorghum and millet are largely grown just below the SAHEL^[1] region. There are more than 3,000 hectares per cell (each cell measures approximately 10 × 10 kilometres or 10,000 hectares at the equator. Maize is also significantly produced in Southern Africa).

Wheat is produced more in Northern Africa with Egypt being a leading producer and exporter of wheat and wheat products. It is produced less in Eastern and Southern Africa. In the last 50 years, and up to 2012, the area under maize, millet and sorghum from a base of 10~15 million hectares to 20~30 million hectares for each doubled. Rice areas have also quadrupled from 2.5 to 9.3 million hectares. Yields have doubled for maize and wheat during the same period, starting at between 700 and 1,500 kg per hectare and increasing to between 200 and 2,500 kg per hectare.

Rice yields have increased by half, from about 1,500 kilogram per hectare to 2,800. Millet and sorghum show little change.

The main reasons for this expansion in cereal production are better use of farming methods, improved access to credit, mechanization, and availability of cheaper inputs like fertilizer and pesticides as well as better mitigation measures against climate change. In addition, there has been improvement in post-harvest management, although the continent continues to lose a lot of cereal in the post-harvest period. Further, much more land has been converted into cereal farming, especially in areas along the fringes of livestock farming zones. The driving force of this expansion is of course the rapid population increase.

Livestock

Livestock producing agricultural systems cover 73% of Africa and stretch

[1] From Arabic 'sahil', it is the eco-climatic and bio-geographic zone of transition in Africa between the Sahara Desert to the north and the Sudanian Savannah to the south.

联合国粮农组织已经把撒哈拉沙漠以南的非洲地区划分出了15种农业系统。

谷物空间分布特征

除了在沙漠和森林地区，谷物种植遍布非洲的大部分地区。非洲农业的谷物构成大约是30%玉米，23%高粱，21%小米，9%水稻，9%小麦。玉米、高粱和小米主要生长在萨赫勒地区^[1]，在每一个单位面积的区域（指赤道附近约10公里×10公里的区域，即每1万公顷）内有3,000多公顷种植高粱和小米。玉米在非洲南部地区种植比较广泛。

小麦在北非生产得比较多，其中埃及是生产和出口小麦最多的北非国家。非洲东部和南部地区生产小麦较少。在2012年之前50年中，种植玉米、小米和高粱的面积各扩大了一倍，从1,000万~1,500万公顷增加到了2,000万~3,000万公顷。而在同时期内，水稻种植面积也扩大了近4倍，从250万公顷增加到了930万公顷。玉米和小麦的产量也翻了一番，从每公顷700公斤和1,500公斤，增加到每公顷200和2,500公斤。水稻的产量也增加了近50%，从每公顷1,500公斤增长到每公顷2,800公斤。小麦和高粱的种植面积及产量变化较小。

谷物生产扩大的主要原因在于农业生产方式的改进，农业生产获得信贷支持的途径改善，农业生产过程机械化水平不断提高，化肥和农药等价格的降低，以及应对气候变化的措施的加强。同时，收获后的管理也有了改进，尽管非洲大陆在收获期间流失谷物的情况继续存在。此外，更多的土地已被转换成谷物种植，特别是在沿牲畜养殖区的边缘地区。谷物种植面积的扩大，其驱动力当然是人口的迅速增加。

牲畜

畜牧业生产的农业系统分布非洲大陆73%的区域，横跨几个气候区。气候带的变化决定了畜牧业的类型以及分布情况。在非洲，畜牧业生产系统分为两个主要类别：牲畜和混合作物牲畜。这两种系统存在于三种常见的非洲气候：干旱/半干旱气候、潮湿/半潮湿气候和温带/热带高原气候。

[1] 源自阿拉伯语“sahil”，指非洲北部撒哈拉沙漠和中部苏丹草原地区之间的生态气候和生物地理过渡地区。

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across several climate zones. The climate zones variably determine what type and the distribution farming. In Africa, livestock production systems are broken into two main categories: livestock and mixed crop–livestock. These two systems are present in the three common African climates: Arid/semi arid, humid/sub humid and temperate/tropical highlands.

Livestock and mixed crop–livestock systems are more prevalent on grazing lands in arid climates that cover large areas of Africa. Mixed crop investment farms are either rain–fed or irrigated; with rain fed systems being much more common (Egypt and the Sudan have important irrigated mixed systems that present different opportunities and constraints).

There are numerous mixed crop–livestock systems throughout western, eastern and some parts of Southern Africa. Compared to the rest of Africa, the Congo basin in central Africa is mostly dense tropical rainforest ringed with some Savannah and cropland at its outer edges. In this place geography and climate limit livestock systems.

Land productivity

About three–quarters of Africa’s harvested agricultural land is devoted to the production of staple food crops, but only about one third of that land generates annual output worth more than \$500 from each cropped hectare. Because most farmers cultivate only half or at the very best up to 3/4 of land for subsistence farming, food insecurity and poverty are common particularly in areas with little off farm opportunities.

Only one percent of the harvest areas, especially areas with access to irrigation produce food crops outputs worth more than \$2,500 per hectare (compared to an average off \$517 per hectare across all over Africa)

While South Africa, the region’s largest maize producer constantly achieves national average yields in excess of four tonnes per hectare (t/ha), the best performing of the remaining countries including major producers, such as Ethiopia, Malawi, Zambia, typically averages only around 2 t/ha. Farmers in such

牲畜和混合作物牲畜系统多见于非洲大面积覆盖的干旱气候地区的牧场。混合作物农场主要靠雨水供养，也有采用灌溉系统的，其中雨养农场更为常见（埃及和苏丹有重要的灌溉混合系统，提供了不同的机会，同时也产生了不同的限制）。

在非洲西部、东部和南部地区遍布着大量的混合作物牲畜系统。与非洲其他地区相比，位于非洲中部的刚果盆地主要是密集的热带雨林，其外部边缘环绕着一些草原和农田。这个地方的地理和气候条件限制了畜牧系统的发展。

土地生产力

非洲约四分之三有收成的农业用地是专门用于生产粮食作物的，但其中只有约三分之一的土地年产值超过每公顷500美元。由于大多数农民只把一半的可耕地（最多四分之三）用于自给农业耕种，因此粮食不安全和贫困在非洲大陆一些农业机会较少的地区非常普遍。

只有百分之一的收获区，特别是有灌溉的地区，其粮食作物的产出价值超过2,500美元/公顷（而整个非洲的平均值是517美元/公顷）（图1参见Jawoo Koo）。

南非作为该地区最大的玉米生产国，其生产能力比远远超过非洲平均水平，能够达到每公顷4吨。其他生产水平较好的国家包括埃塞俄比亚、马拉维、赞比亚等，通常的平均产量为每公顷2吨。尼日利亚、坦桑尼亚和肯尼亚等国的产量相对较低，在每公顷1.3~1.7吨。

在模拟设定的环境中，即使假设土壤养分是不足的，大约55%的当前玉米生产地区也可以达到每公顷3吨的产量——这个模拟阈值代表典型小农家庭的基本谷物需求和典型规模的农场可能达到的净产量。实际产量与潜在产量之间的差距也随不同的生产环境而出现规律性的差异。在干燥的地区（年降雨量小于500毫米的地区，例如萨赫勒地区），产量难以增加的主要原因是降雨不足，即使土壤肥力有所提高。

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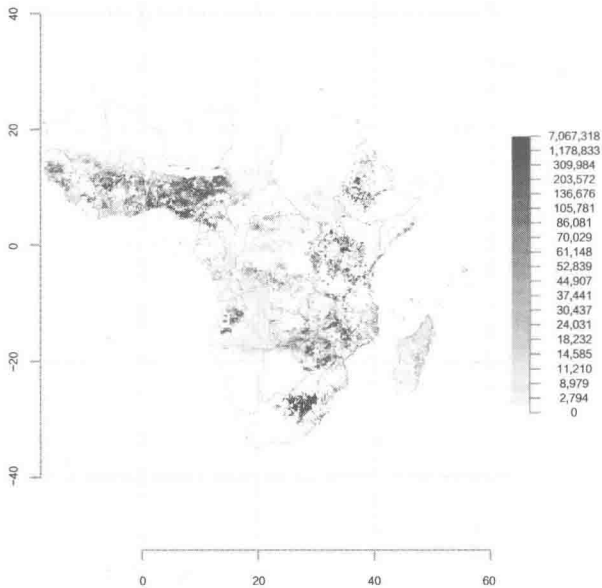


Figure 1: Maize Rainfed Production (Int\$, 2005) (Int\$)-
Sub-Saharan Africa

Source: You, L., U. Wood-Sichra, S. Fritz, Z. Guo, L. Sec, and J. Koo. 2014. Spatial Production Allocation Model (SPAM) 2005 v2.0. ©HarvestChoice/IFPRI, 2015.

producer nations, notably Nigeria, Tanzania and Kenya, have lower yield than the regional average of 1.3–1.7 t/ha.

Approximately, 55% of the current maize production area could attain yields in excess of 3 t/ha, a threshold that signals the basic subsistence threshold showing that the basic subsistence cereal needs of smallholder families can likely be achieved by net producers, assuming typical farm holdings and family size. The gap between actual and potential yields tends to vary systematically by the production environment. In drier regions, (areas with less than 500 mm of rainfall per year, such as the Sahel), yield gaps are often relatively modest because lack of rainfall remains a major constraint to increased yield, even if soil fertility is improved.

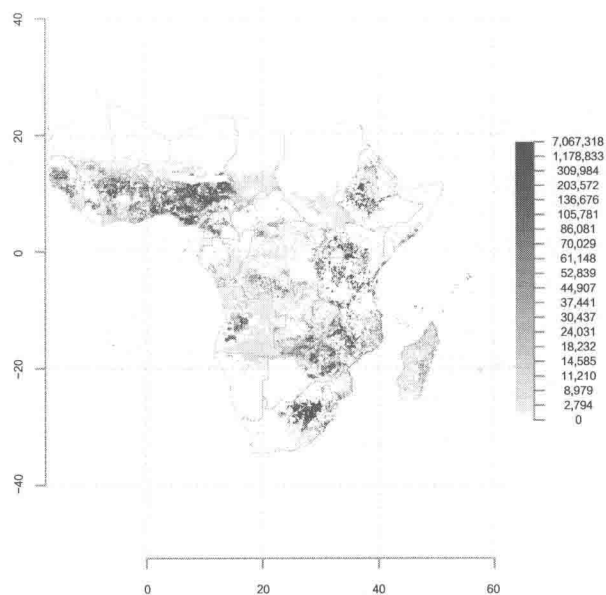


图1 非洲撒哈拉以南雨养型玉米生产情况（美元取整，2005年）

资料来源：You,L.,U.Wood-Sichra,S.Fritz,Z.Guo,L.Sec,and J.Koo.2014.Spatial Production Allocation Model(SPAM)2005 v2.0. ©HarvestChoice/IFPRI,2015.

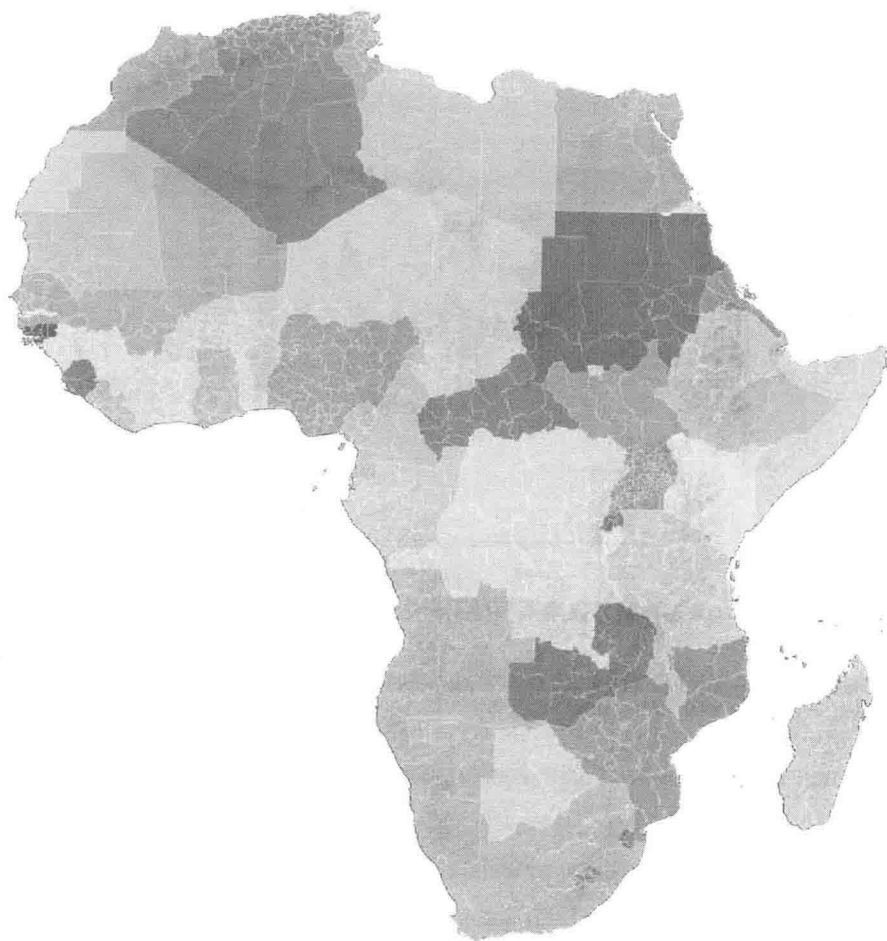


Figure 2: Countries in Africa

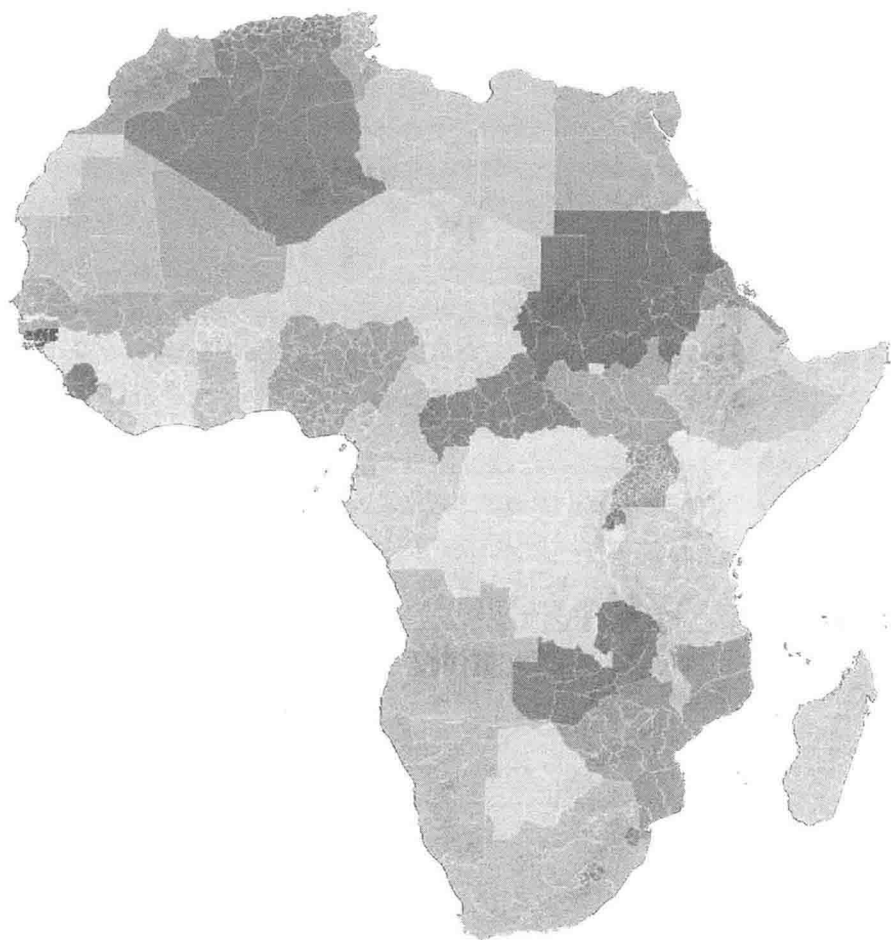


图2 非洲国家

1 西部非洲

CHAPTER ONE: WESTERN AFRICA

General characteristics

With the exception of Burkina Faso, the countries in West Africa border the Atlantic Ocean. The countries are smaller compared to those in Eastern, Southern and Northern Africa. All the countries are located in the Sub-Saharan Africa (SSA). Most of the population lives in the Southern part, along the Atlantic. This population concentration is as a result of long tradition of contact with Europeans dating back to the 1200s.

West Africa consists of plateaus and coastal plains with characteristic tropical climate. Further interior, this changes to savannahs. The savannahs give way to semi-arid and arid climate, the Sahel, which is basically the transition zone from savannah to the Sahara desert. The Sahel stretches from the west to the east of the continent, i.e. generally from Senegal in the extreme west coast of Africa on the Atlantic Ocean to Djibouti in the eastern, on the Indian Ocean.

The countries in the southern and south-eastern Sahara tend to be bigger and have desert climate. The western coastal countries are wetter, smaller and elongated. West Africa has area of high population density separated by very large areas of low density. Several geographers have argued that the land use intensity in this region is a function of population density.

During colonialism and before, Europeans developed the coastal areas for trade. People living along this area became middlemen especially for slaves. People living in the interior experienced less change. This later led to differences in economic development, which caused conflicts between the northerners and southerners. This is best seen in Nigeria.

Other than Liberia, all the other West African countries experienced colonization. The British colonized Nigeria, Gambia, Sierra Leone and Ghana. The Portuguese colonized Guinea Bissau. Togo went to Germany. All the others were French colonies. Major infrastructure like railways were developed only to carry the goods from the interior to the coastal ports for exports.

Predictably, the coastal areas, especially the southern region are densely populated. In 2013, the population of western Africa stood at 220 million people with Nigeria having 123.3 million people.

Types of agriculture systems

Shifting agriculture: This is distinguished by a very long fallow period during which time secondary forest is established to restore fertility. After two or three years of cultivation, the land is abandoned and the settlement itself moved to another area

总体特征

除了布基纳法索以外，西非各国都毗邻大西洋。与非洲东部、南部及北部的国家相比，这些国家的面积相对较小。西非国家都位于撒哈拉以南非洲地区，大部分人口居住在西非南部沿大西洋海岸的地方。人口的这种集中趋势由13世纪就开始与欧洲人接触的久远传统造成。

西非具有明显的高原和沿海平原热带气候特征，靠近内地就出现了草原。从大草原又过渡到干旱和半干旱气候的萨赫勒地区，也就是从草原到撒哈拉沙漠的过渡区。

撒哈拉沙漠南部和东南部地区的国家面积一般较大，而且属于沙漠气候。西部沿海国家多雨，面积较小，地形比较狭长。西非地区的人口密度非常高，但是同时存在大面积人口密度非常低的局部区域。一些地理学家认为，该地区的土地密集利用是造成人口密度高的一个原因。

在殖民主义时期以及之前，欧洲人开发了沿海地区的贸易。居住在这个地区的人大多成了贸易中间人，特别是奴隶买卖的掮客。但是生活在内地区域的人变化不大。这导致了后来的经济发展差异，造成了北方人和南方人之间的冲突。这在尼日利亚表现得尤为明显。

除利比里亚以外，其他西非国家都经历了殖民统治。尼日利亚、冈比亚、塞拉利昂和加纳成了英国殖民地，比绍几内亚成了葡萄牙殖民地，多哥成了德国殖民地，而其他地区则都成了法国殖民地。主要的基础设施建设，如铁路建设，其目的都只是从内地运输货物到沿海港口发展出口贸易。

可想而知，沿海地区，特别是南部沿海地区，人口更为稠密。在2013年，西非总人口为2.2亿，其中尼日利亚就有1.233亿人。

农业系统类型

轮耕农业：轮耕农业的特征是，耕种的土地会有一个较长的休耕期，在休耕期内会培植再生林来恢复土地的肥力。经过两三年的培植之后，这片土地又被闲置，农村生产者又到另一片森林去开垦耕地。这种轮耕农业系统只会在人口密度较低而且存在大量闲置土地的地方出现，因此这种农业形式在西非并不多见。当人口密度达到约每平方公里10人的时候，农民趋于在固定

where another patch of forest is cleared. Such a system is only possible where there is low population densities and abundant land. This is not so common and therefore only practiced in a few places in West Africa. When population densities reach about 10 per km², settlements become fixed and fallowing time becomes much shorter.

Rotational bush fallowing: This has shorter fallows and longer periods in crops. Typical densities for this are from 2–20 per km² in the drier north where cereals are the staple crops, but from 27–77 per km² in the south where root crops, with their higher yields can be grown. This farming type, the most common in West Africa has fallow periods that are longer than the periods in crops. However, unlike shifting agriculture, the land in fallow remains in the possession of the family that cultivated it and the settlement is not moved.

Permanent cultivation: This has longer periods in crops than fallow and is practiced in regions of very high density, such as the Kano area of northern Nigeria. Here land is frequently hoed, and manure applied. Manure is brought from urban areas or Fulani pastoralists are encouraged to graze their stock on the stubble. Other means of helping to increase yield and avoid soil erosion are present in high density lands.

Notably, the spread of commercial agriculture has encouraged farmers to grow crops for profit not just to feed their families, which has led to intensification.

的地方居住，休耕期会越来越短。

休耕与轮作：这种农业生产的特征是，休耕期较短而作物种植期较长，通常出现在人口密度为每平方公里2,020人的以谷物为主食的北方干燥地区，而在人口密度为每平方公里27~77人的南部地区则不多见，这些地区可以种植产量较高的块根作物。这种农业生产类型在西非一些休耕期长于谷物种植期的地区是最常见的，如谷物。然而与轮耕农业不同的是，这种农业生产的休耕土地仍然属于开垦了这些耕地的农户所有，他们不需要另找地方开垦耕地。

永久性耕作：这种农业生产的作物种植期更长，通常出现在人口密度高的地区，例如尼日利亚北部的卡诺地区。在这些地区，农民会经常犁地施肥（肥料主要来自城市），或者鼓励富拉尼的牧民到这些耕地来放牧牲口。在高密度的耕地上还会采用其他一些方式来提高产量，防止土壤流失。

值得一提的是，商业性农业的普及促使更多农民为获取经济利益而不仅仅是为养活自己的家庭而种植农作物，促进了这种农业生产的发展。

1.1 NIGERIA

General

It lies on the Atlantic coast and is bordered by Niger and Chad to the north, Benin to the west and Cameroon to the south. It has two distinct climates. The coastal region has tropical climate, characterized by heavy rainfall and high humidity. The north is dry with dusty winds coming from the Sahara. It covers an area of 923,678 km². Its geography is diverse having a wide range of climatic variations and corresponding variations in vegetation. Starting from the north, the arid plains in the north give way to the savannah in the central hills and plateaux, merging into tropical rainforests in the southern lowlands and mountains to the south-east.

With more than 160 million people, Nigeria is the most populous African country. 1 out of 4 Africans is a Nigerian. Nigerian's population constitute about half of West Africa's population. The country is extremely diverse culturally and religiously with more than 250 ethnic groups.

Agriculture

Agriculture, one of the most important economic activities in the country, contributing about 40% to Gross Domestic Product in the 2000s and employs up to 70% of the country's labour force (and up to 90% in rural areas). The sector is rapidly transforming through commercialization at small, medium and large-scale enterprises. However, farming in Nigeria is carried out with simple tools. Holdings are small and scattered. Large scale production is not common. Agricultural products can be put into two groups. Food crops for subsistence and products for exports. The most important food crops are yams and manioc (cassava) mostly produced in the south and sorghum and millet in the north.

The good soils covering large agri-ecological zones allow for diverse crop and livestock production. The country has 82 million arable hectares out of the total 91 million. Only 42% of this land is farmed. Over the centuries, farming has been through bush-fallow system described above. 18 million hectares are categorized as permanent pasture. Most of the 20 million hectares covered by forests and woodlands are believed to have agricultural potential.

The dry northern savannah is suitable for growing sorghum, millet, maize, groundnuts and cotton, and is the principle livestock-raising areas. In the middle belt and the south, the main food crops are cassava, yam, plantain, maize and sorghum. Rice is grown in the low-lying and seasonally flooded areas. The main cash crops in the south are mainly palm oil, cocoa and rubber. Nigeria is Africa's largest

1.1 尼日利亚

概况

尼日利亚位于大西洋海岸，北接尼日尔和乍得，西及贝宁，南邻喀麦隆。全国有两种不同的气候系统。沿海地区是热带气候，降雨量大、湿度高。北部是干燥气候，时常受到来自撒哈拉沙漠的沙尘暴的侵袭。国土面积为923,678平方公里，地理特征多样，有多种不同气候及相应的植被变化。北部是干旱的平原地带，中部多为丘陵和高原草原，南部是热带雨林，东南部是山区。

尼日利亚人口超过1.6亿，是非洲人口最多的国家。这意味着四个非洲人中就有一个尼日利亚人。该国人口约占西非人口的一半，文化和宗教信仰丰富多彩，有超过250个族群。

农业

农业是尼日利亚的经济支柱，在21世纪初的十年间约40%的国内生产总值由农业贡献，全国70%的劳动力从事农业劳动（在农村高达90%）。大中小企业将农产品商业化，推动农业迅速变革。然而，尼日利亚的农业生产依靠的仍然是简易工具。绝大多数是分散的小农经营，大规模生产并不多见。农产品可分为两类：生存所需的粮食作物和用于出口的产品。最重要的粮食作物是南方的山药和树薯（木薯），以及北方的高粱和小米。

优良的土壤覆盖了尼日利亚大片的农业生态区域，为不同作物的生长和牲畜的繁殖提供了优良的条件。9,100万公顷的国土面积中8,200万公顷是可耕地，但只有42%的土地已被开垦。1,800万公顷的耕地属于永久牧场。森林和林地覆盖的2,000万公顷土地大部分被认为具有农业开发潜力。

干燥的北方草原适合种植高粱、小米、玉米、花生、棉花，也是主要的畜牧区。在中部和南部地区，主要粮食作物有木薯、山药、大蕉、玉米和高粱。水稻生长在低洼和季节性淹水的地区。南方的主要经济作物包括棕榈油、可可和橡胶。尼日利亚是非洲最大的山药和豇豆生产国，也是世界最大的木薯生产国。