The Southern African Development Community (SADC) is an economic, social and cultural agreement to increase self-sufficiency and endogenous development, and create a framework for development and mobilisation of human resources and material between fifteen southern African countries. The member states are Angola, Botswana, the Democratic Republic of the Congo, Lesotho, Malawi, Madagascar, Mauritius, Mozambique, Namibia, the Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. SADC covers an area of 10 million km$^2$ (around 32% of Africa) and has an estimated population of 240 million (2010) with a density of around 30 people/km$^2$ – however, this reflects a range of around 2 people/km$^2$ in Namibia to over 600 people/km$^2$ in Mauritius. There has been notable population growth in Malawi and Mozambique. Per capita GDP is estimated at US$ 3 152 – with South Africa being the economic powerhouse of the region. The FAO has reported that agriculture supports about 85% of the rural population and employs 80% of the labour force. Rural poverty, unsustainable development and land tenure issues are the main causes and consequences of environmental degradation throughout the region.

The SADC area is bordered on three sides by the seas of the Atlantic and Indian Oceans, while the north is characterised by tropical rainforest and savannah. Consequently, a broad range of soil types are to be found. The western half of the region is dominated by the Kalahari and Namib Deserts. The arid and hot conditions give rise to characteristic soil types. The Namib consists of sand seas (Arenosols) near the coast that are interspersed by Leptosols and Cambisols. Unlike the Namib, the Arenosols of the Kalahari support grasses, acacia trees and salt-tolerant vegetation. As in the Sahara, low soil organic matter levels, low water retention, over-grazing and wind erosion are important considerations in this area.

In the more temperate and more humid southern and eastern parts, a mosaic of leached, red Acrisols, clay-rich Luvisols and stony Leptosols are mixed with Plinthosols, Vertisols and weakly developed Cambisols and Regosols. In general, the soils of southern Africa are not characterised by high fertility with waterlogging, drought and high mineral leaching. As a result, saline and sodic Solonchaks and Solonetz throughout Botswana, southern Mozambique, South Africa and Zimbabwe. Lightly leached, clay-rich Luvisols, interspersed with Ferralsols and Leptosols, dominate Malawi, northern Mozambique, southern Tanzania and eastern Zambia, with young Cambisols becoming more prevalent in northern Tanzania. The volcano of Kilimanjaro, the highest mountain in Africa, sits on the northern border of Tanzania.

Western Angola, DR Congo and much of Zambia are dominated by tropical Ferralsols under rainforest (see page 75). While the region is home to the Congo and Limpopo river basins and several large lakes (e.g. Lake Victoria – the largest tropical lake in the world), the huge delta of the Limpopo is highlighted as a large expanse of Fluvisols. The large expanse of Gleysols on the Angola/Zambia border denotes the Barotse wetlands in the Zambezi floodplain. Almost due south in Botswana are the peatlands of the Okavango Delta.
Regional-scale soil maps

Plate 1 | Morocco, NW Algeria

This map shows the soils of Morocco and western Algeria. The major landscape feature in the region is the Atlas Mountain range that separates the slightly wetter and cooler Mediterranean area from the arid and hot Sahara Desert. The mountains manifest themselves as a band of rocky Leptosols and weakly developed Cambisols running NE-SW across the map. Along the coasts, a Mediterranean climate, with mild wet winters and hot dry summers, prevails. While the higher regions of the western part of the Atlas Range can receive more than 2000 mm of precipitation annually (even snow can fall on the peaks of the High Atlas), moisture levels generally decrease away from the coast.

Beyond the Atlas, semi-arid conditions quickly grade into desert, where daytime temperatures are significantly higher. Soils are characterised by pronounced differences in rainfall. Soil organic carbon levels are generally low or very low and droughts are common. Desertification is a key concern throughout the region.

Many are ephemeral in nature (i.e. dry for much of the year). The more humid climate of NW Morocco gives rise to more vegetation and date palm is extensively cultivated in the desert oases. There is little natural vegetation in the arid desert areas although the extensive oak and conifer forests occur. At lower elevations, intensive cereal cultivation in the winter and grazing in the summer. Soils with high levels of calcium carbonate (Calciols) are very evident, especially in drier conditions.

To the south of the Atlas Mountains, conditions are much more arid and daytime temperatures are significantly higher. Soils are characterised by minimal development and low or negligible organic matter contents. Regosols, rocky Leptosols and soils with ‘fossilised’ accumulations of gypsum (Gypsisols) dominate. Amoenosols denote the locations of large sand seas and dunes. Saline soils occur in depressions along the coast and as dry lakes in the desert.

The blue linear features are Fluvisols, demarcating river systems in the region. These soils support extensive cereal cultivation in the winter and grazing in the summer. Many are ephemeral in nature (i.e. dry for much of the year).

The EU supports the efforts by the Secretary General of the United Nations and his Personal Envoy to find a peaceful and mutually acceptable political solution which will allow the self-determination of the people of the Western Sahara as provided for in the resolutions of the United Nations.

The European Commission has taken considerable care in preparing the information which is displayed in these map sheets. However, the European Commission assumes no responsibility or liability for any injury, loss or damage incurred as a result of any use or reliance upon the information and material contained in this atlas.
This map shows the soils of eastern Morocco, northern Algeria, Tunisia, and western Libya. The major landscape features in this region are the Atlas Mountain range and the hot and arid Sahara Desert. The mountains manifest themselves as a band of Frankisch running NE-SW across the map, decreasing in elevation towards the east. Along the coast, a Mediterranean climate, with mild wet winters and hot dry summers, prevails. However, precipitation decreases away from the coast. To the east, the southern edge of the Atlas denotes the beginning of the Sahara Desert where semi-arid conditions yield grades into desert (daily temperatures can rise above 40°C, rainfall is irregular). To the east, the lack of elevation makes conditions hotter and drier. In more humid mountainous areas, extensive oak and cork forests occur. At low elevations, intensive clearance and grazing have produced a distinctive sandy landscape known as amsacs. Olive trees are common in the coastal plains. In the arid desert areas, there is little natural vegetation although the date palm is extensively cultivated in oases.

To the north of the Atlas mountains, soils with high levels of calcium carbonate (Calciolics) dominate the landscape, especially in drier conditions. While many of these soils are regarded as highly fertile, water availability is a key constraint. More humid conditions along the Mediterranean give rise to more vegetation and more developed, clay-rich soils such Luvisols, Kastanozems and Cambisols. Vertisols are quite pronounced along the north-eastern Algerian coast and into Tunisia. These soils support extensive cereal cultivation in the winter and grazing in the summer.

To the south of the Atlas Mountains, conditions are much more arid and daytime temperatures are significantly higher. Soils are characterised by minimal development and low or negligible organic matter content. Regosols, stony Leptosols, and soils with accumulations of gypsum (Gypsipsols) dominate – especially in south-central Tunisia. Aridic soils denote the locations of large sand seas and dunes.

Saline soils occur in depressions across the region. The chotts of Algeria and Tunisia are closed-bottomed basins of salt and clay accumulation that are periodically covered by water which either slowly infiltrates into the groundwater system or evaporates into the atmosphere, causing the deposition of salt. It is here dominated by groundwater inputs; sediment influxes are low and saline crusts dominate. Highly soluble sodium chloride tends to be found in the centre of the chotts with less soluble sulphates and carbonates at the outer margins.

The blue linear features are Ruvicolus, demonstrating more karstic features in the region. Many are ephemeral in nature (i.e. dry for much of the year). In northern regions, many are intensively cultivated.

Where the soils have a well developed structure, and moderate levels of organic matter, clay and water are available, many Mediterranean soils are quite productive. However, excessive lime and the presence of salts can be problematic. Away from the coast, the increasing semi-arid conditions generally lead to poorly developed soils that are vulnerable to degradation by human activities such as overgrazing which can lead to erosion, especially by flash flooding after intense rainfall. Soil organic carbon levels are generally low or very low and droughts are common. Desertification is key concern throughout the region.
This map shows the soils of eastern Tunisia, Libya and western Egypt. This map is dominated by the hot and arid Sahara Desert. The absence of the Atlas Mountains means that desert conditions extend much closer to the coastal regions than in the countries to the west. While a Mediterranean climate with mild wet winters and hot dry summers extends along the coast, precipitation decreases and temperatures rapidly increase inland. A narrow band of semi-arid grasslands extends inland from the Mediterranean coast. However, desert conditions border the sea along the Gulf of Sidra in Libya. In the south of the map, desertlike temperatures can rise above 40°C, while annual rainfall is low and irregular. Droughts, often lasting several years, are common. The world’s highest recorded temperature was recorded in the Libyan Desert. When precipitation levels are higher, the coastal plains and semi- and marginal regions are covered with halophytic vegetation and annual grasses. In the arid desert areas, there is little natural vegetation although the date palm is extensively cultivated in oases.

Soils with high levels of calcium carbonate (Calcareous) dominate the landscape, replaced by soils with accumulations of gypsum (Gypsisols) in dryer conditions. Amosols denote the locations of large salt pans and dunes, especially in south-western Libya and on the border with Egypt. Sarlas occur as salt flats or sabkhas along the Libyan coast. These are formed by the ponding and evaporation of water behind coastal dunes. In western Egypt, they occur in closed depressions in the landscape.

The blue linear features are Fluvisols, demarcating river systems in the region. Many are ephemeral in nature (i.e. dry for much of the year).

Soil organic carbon levels are generally low or very low everywhere. Excessive time and the presence of salts can be problematic in the cultivation of soils in this region. Salinisation due to over-irrigation is damaging some previously fertile soils. Dust and sandstorms are common and wind erosion is a major driver of desertification.

**SCALE 1:3 000 000**

1 CENTIMETRE = 30 KILOMETRES, 1 INCH = 47.3 MILES

PROJECTION: Lambert Azimuthal
The map shows the soils of northern Egypt. As in the previous plate, this map is dominated by the hot and arid Sahara, with desert conditions extending almost to the Mediterranean coast. The area is generally characterised by low annual precipitation and a considerable seasonal and daily temperature range. Alexandria on the coast has a Mediterranean climate with mild winters and hot dry summers. It receives around 175 mm of rainfall annually while Cairo, only a little further inland, only receives 25 mm. Levels decrease even further to the south. While the Sinai Peninsula receives somewhat more precipitation, the Red Sea coastal plain and the Western Desert is almost totally devoid of plant life. The major geographic element on this map is the River Nile and its delta – the longest river in the world. North of Cairo the Nile forms a distinctive delta (denoted on the map as Fluvial). This is a level, triangular-shaped lowland composed of alluvium mainly from the Ethiopian Plateau and comprises some of the most fertile soils in Africa. The Nile splits Egypt in two towards Lībya i.e. the vast Western Desert while to the west are the narrower, rocky Eastern and Sinai Deserts.

As evidenced by the satellite photograph above vegetation outside of the Nile’s floodplain and delta is sparse or non-existent. Where water exists, shrubs, thorny perennials and grasses can be found. The Nile supports many varieties of water plants and grasses while the delta is covered by vegetation in green stand out starkly. This striking image from the MODIS sensor shows almost the entire Nile Delta during the summer season. The green areas are productive marsh, wetland and Mediterranean coastal areas interspersed by bare salty areas. The delta is almost totally devoid of plant life. The soils of the map reflect the dry and hot conditions. Weakly developed, medium textured soils with large gypsum concentrations at shallow depth usually occur in the coastal delta — an important component of desertification. The white objects to the right of the image are clouds. (NASA)
The area is predominantly characterized by flat terrains with weakly developed sterile soils (Regosols, Cambisols and Leptosols) and sand dunes (Arenosols), interpreted as solonchak and gypsum accumulations (Salinafrachts, Gypsisols) and dry ephemeral river drainage systems (Fluvial). Stony or skeletal soils are formed where outcrops of the underlying rock have been weathered in situ and covered with a patina or dust. Solonchaks derived salt flats derived from the evaporation of former lakes. Arenosols cover about half of the total area of the map in Mauritania, long, linear dunes, known as diba, often extend for tens of kilometres and sometimes reach 150 m in height. The area of Cambisols in the northwestern corner of Mali denotes the Tensawat Plateau. Desserted vegetation and surface water, it was once one of the most isolated places on the planet. In the southwest of the map, a slightly more humid winter climate gives rise to more developed vegetation and soil development around the Senegal River. The Gleysois, Vertisols and Fluvisols that denote the western of the Sengal delta and floodplain are highly productive and densely populated. Millet, rice, and vegetables are the main crops although, salinisation is a major problem. Fluctuations of the iron-rich water table gives rise to Plinthosols on the Senegal / Mauritania border. The region displays a distinctive landscapes, due in part to the hardening of plinthosols on exposure to air. Desertification is a key issues in this area – visible by the accelerated expansion of the desert into agricultural land. Drought, together with increasing pressures on fragile soils, contributing to significant soil erosion while deforestation is a severe problem because of slash-and-burn agriculture and the population’s growing need for firewood and construction materials.
This map shows the soils of eastern Mali, southern Algeria and northern Niger. This map is dominated by the Sahara Desert and much of the area is characterized by flat terrain. Aridity and heat are key factors in the northern and central part of this region. Annual precipitation is very low (<100 mm) and irregular. The strength of the sun and lack of humidity give rise to high temperatures. In the summer months, daily temperatures of around 40°C are not uncommon in the interior. A characteristic feature of the Western Sahara is the Hamadas, a hot, dry desert that extends from the northeast or east from late November to June. It carries large amounts of dust, which is transported hundreds of kilometres over the Atlantic Ocean, and often to Europe and North America. In the southern part of the map (i.e., south of 20°N), a Sahelian climate is more pronounced with around 300 mm of rain per year and average temperatures of between 23 and 33°C. As a result, dry season lasts from November to June. The Sahara part of the map is characterized by weakly developed stony or gravelly soils (Regosols, Cambisols and Leptosols) and sand dunes (Arenosols), interspersed by saline and gypsum accumulations (Salinic horizons). Stony or skeletal soils are formed where outcrops of the underlying rock have been weathered in situ and are covered with a patina of dust. Saline soils denote salt flats derived from the evaporation of former lakes. Sandy Arenosols cover much of the northern half of Mali and Niger. The vast expanse of Leptosols in southern Algeria denotes the Ahaggar Mountains, a volcanic highland region with an average altitude of around 1000 m above sea level (Mount Taha peaks at 3,000 m). The extension into northern Niger is the Aïr massif, a group of granitic mountains rising sharply from the Sahara with mean elevations approaching 2000 m. While the surrounding desert is devoid of vegetation, the elevation of these mountain ranges gives rise to slightly higher rainfall and slightly cooler summer temperatures. As a result, dry woodlands and shrublands form a unique and isolated ecosystem. The Gleysols in the south-western corner denote the floodplain and the ‘Great Bend’ of the Niger River. Periodic floods and rich alluvial soils make the Niger floodplain an important agricultural region. To the north of the Niger, shallow iron-rich Phosphosols give rise to a hard, red-crusted landscape. Desertification is a key issue in this area – visible by the accelerated expansion of the desert into the agricultural land in the south, accompanied by drought, famine and intense social upheaval. In the second half of the 20th century, a rapidly increasing population placed tremendous stress on the Sahel. Trees and shrubs were removed to obtain firewood and grow crops while intense overgrazing resulted in bare surfaces. Runoff and the wind then removed the topsoils, creating barren wastelands. To combat the southward expansion of the Sahara, the African Union, supported by the European Union and the World Bank, is developing a ‘Great Green Wall of the Sahara’ (in French the Grande muraille verte) – a green barrier 7000 km long and 15 km wide, stretching from Senegal to Djibouti, where alternative soil-water management practices will aim to combat land degradation. The Green Wall aims to slow down wind erosion and enhance rainwater infiltration into the soil [63b, 63c].
This map shows the soils of eastern Niger, northern Chad, southern Libya and the western part of Sudan. Most of the map is dominated by the Sahara Desert. Aridity and heat are key factors in the northern and central parts of the region. Annual precipitation is very low (<100 mm) and irregular – when no rainfall may occur for several years. The strength of the sun and lack of humidity give rise to very high temperatures. In the summer months, daily temperatures in excess of 40°C are not uncommon. Niger is still affected by the Harmattan, a hot, dry wind. In the southern part of the map (i.e. south of 20°N), a Sahelian climate is more pronounced with around 300 mm of rain per year and slightly cooler temperatures in winter months. A distinct dry season lasts from November to June.

The Saharan part of the map is characterised by weakly developed stony or gravelly soils (Khapsois, Cambisols and Leptosols). Stony or skeletal soils are formed where outcrops of the underlying rocks have been weathered in situ and covered with a patina or dust. Gypsum-rich soils (Gypsisols) cover extensive tracts of southern Libya. The mosaic of saline (Solonchaks) and stony Leptosols in southwestern Egypt is the incised plateau region of the Gulf of Suez. Several large dry watercourses and cave paintings of people swimming are indications of a nilotic, more humid climate. This is confirmed by the large expanses of Solonchaks in the Badia Depression of Chad. This area corresponds to sediments of an extended Lake Chad that reflected much wetter conditions several thousand years ago (see page 151). The remains of algae that used to live in the lake make up a significant part of the soil.

Sandy Arenosols cover much of Niger, Libya and Sudan. The vast expanses of Leptosols on the Chad-Libyan border are derived from the volcanic rocks of the Tibesti Mountains – at 3,415 m above sea level, these are the highest points in the Sahara. To the south, soils with very low levels of organic matter support shrubs and extensive grazing. The Fluvisols in the south-eastern corner of the map denote a seasonal watercourse, or wadi, where water flows only during the wet season, in this case to Lake Chad. Desertification is a key issue in this area – visible by the accelerated expansion of the desert into the agricultural land in the south, accompanied by drought, famine and intense social upheaval (see Plate 6).
This map shows the soils of southern Egypt, northern Sudan and northern Eritrea. The area is bounded to the east by the Red Sea and the River Nile almost divides the map in half, with Lake Nasser/Nubia straddling the Egyptian/Sudanese border. Large parts of the map are dominated by the Eastern Sahara, where aridity and heat are the main factors. The west and Western Desert extends beyond the Egypt/Egyptian border. The narrow, rocky Eastern and Nubian Deserts are bounded by the Red Sea and the Nile and are extensively dissected by dry river channels draining to the coast and the Nile. Annual precipitation is very low (<100mm) and high temperatures are common for most of the year (although winters in the north can be cool). In the summer months, daily temperatures in excess of 40°C are not uncommon in the desert. A hot dry wind known as the Khamsa helps large volumes of sand and dust from the south in the spring. Much of the area on the map is unpopulated.

The European Commission has taken considerable care in preparing the information which is displayed in these map sheets. However, the European Commission assumes no responsibility or liability for any injury, loss or damage incurred as a result of any use or reliance upon the information and material contained in this atlas.

Soil Maps | Soil Atlas of Africa

Annual precipitation is very low (<100 mm) and river channels draining to the coast and the Nile. Egypt/Libyan border. The narrower, rocky Eastern vast, arid Western Desert extends beyond the Egyptian/Sudanese border. Large parts of the map are dominated by the Eastern Sahara, where aridity and heat are the main factors. The west and Western Desert extends beyond the Egypt/Egyptian border. The narrow, rocky Eastern and Nubian Deserts are bounded by the Red Sea and the Nile and are extensively dissected by dry river channels draining to the coast and the Nile. Annual precipitation is very low (<100mm) and high temperatures are common for most of the year (although winters in the north can be cool). In the summer months, daily temperatures in excess of 40°C are not uncommon in the desert. A hot dry wind known as the Khamsa helps large volumes of sand and dust from the south in the spring. Much of the area on the map is unpopulated.

Sandy Arenosols with extensive dune systems cover much of the plains of southern Egypt and northern Sudan. The rugged mountains of the Eastern Desert are characterised by weakly developed stony or gravelly soils (Lapiozeols), overlying weathered gravelly bedrock. Lapiozeols also denote the Uweinat Mountains and Gulf Akab in southwest Egypt, the Nubian sandstone and granite outcrops of southern Egypt and northern Sudan and the metamorphic outcrops of northern Eritrea. To the west of the Nile, extensive Gypsisols have developed on rocks rich in gypsum while large areas of fine-grained saline Solonchaks denote old marine sediments, often covered by wind-blow sand. The saline soils along the coastal plan of the Red Sea have developed on old salt-rich marine deposits that have been raised from beneath the sea by tectonic uplift associated with the northern extent of the Rift Valley. Fluvisols denote soils formed on alluvial sediments and define the Nile Valley and its tributaries from the Red Sea Hills of north-eastern Sudan. The large expanses of fine-textured Luvisols in Sudan is associated with the weathering of granitic rocks. Desertification, low organic matter and erosion are the key issues for soil in this area. Salinisation can be a problem in heavily irrigated areas.
This map shows the soils of Senegal, The Gambia, Guinea-Bissau, Sierra Leone, Liberia, Côte D’Ivoire, southern Mali, eastern Burkina Faso and the islands of Cape Verde. The pattern of soil distribution on the map reflects the boundary between the semi and Sahel and the more tropical climates of West Africa, coupled with rocks of the West Africa Shield, a stable rock formation 3 billion years old composed of granite, schist and gneiss. The Cape Verde Peninsula in Senegal is the westernmost point of the African continent.

The northern half of the map reflects soils of the Sahel. Daily temperatures are high, and the winter months are dry. Precipitation increases from north to south and extensive grasslands give way to open savanna. Weakly developed Regosols and stony Leptosols on flat terrain are covered in many places by extensive sand deposits (Arenosols). As rainfall increases, more alkaline Laterosols with leached, clay-rich subsoils occur in strongly weathered fine textured materials of old erosion or deposition surfaces under natural savannah or open woodland vegetation. The Gleysoils in the wet denote the floodplains of the Senegal and Gambia rivers while the large expanse in Mali is the result of periodic flooding in the inland delta of the River Niger. These soils are highly important for agriculture. In addition, productive Nitisols have developed on scattered gravel deposits in southern Mali and Burkina Faso.

To the south and east, precipitation increases significantly and the climate becomes more tropical. The interior of Liberia receives around 2000mm of rainfall annually. Cultivation without irrigation becomes increasingly possible and the tree density begins to increase, eventually reaching mature tropical rainforests in Côte D’Ivoire and Liberia. At first appearance, the distribution of soil types on the southern part of this map appears complex. In reality, it reflects the interactions between the underlying parent material, the evolution of the landscape, the climate and vegetation. Along the Atlantic coast, montane mangroves and estuarine give way to Fluvisols and Arenosols respectively. Indeed, the flat, sandy coastal plain of West Africa is characterized by Ferralsols, the clay-rich deeply weathered, red or yellow soils of the humid tropics. Clay-rich rock outcrops bordering the plain give rise to a band of thin, stony Leptosols running from Guinea-Bissau to Liberia. Further inland, high humidity and temperatures drive intense chemical weathering of the old rocks of the West Africa Shield giving rise to soils with increasing clay, iron and aluminium content. On granitic material, acid Acriosols develop on undulating topography while Ferralsols are found where the relief is gentler. Laterosols denote slightly less acid soils on old weathered deposits. On more level sites, Alfisols tend to occur on hilly or undulating terrain while Paleosols and Vertisols are found on level ground. A common view is that phosphates are associated with non forest areas whereas phosphatic and podzolic soils are more common in the savannah zone. Droughts and desertification are issues of concern in the semi-arid areas. Soil conservation is extremely important on the more tropical soils. While low fertility, high levels of aluminium and phosphorus fixation affect the fertility of the soil, it can cause serious erosion, especially following forest clearance.
The map shows the soils of Benin, Burkina Faso, Ghana, southern Mali, southern Niger, Nigeria, Togo, and a small part of Cameroon. The pattern of soil distribution on the map reflects the boundary between the semi-arid Sahel and the more tropical climate of West Africa, coupled with parent materials derived from the West African Shield, a stable rock formation 3 billion years old composed of granite schists and gneisses. While precipitation levels for northern and central areas are significantly less than to the west, they do generally increase from north to south with extensive grasslands grading to open savannah and, in places, dense forest.

The northern third of the map reflects the semi-arid soils of the Sahel. Daily temperatures are generally high (>30°C) and a rainy season usually lasts from June to early September (growing around 600mm a year). The flat plains of southern Mali and Nigeria are covered by extensive sand deposits (Arenosols). More undulating topography gives rise to Regosols. The drainage network in the northern-eastern corner, dominated by Fluviosols, flows towards Lake Chad.

As rainfall levels increase, less acid Lithosols with clay-rich subsoils develop in weathered fine textured materials under natural savannah or open woodland vegetation. To the southeast, precipitation levels are significantly higher and the climate becomes more equatorial. Southern Benin and Ghana receive close to 2000mm of rainfall annually supporting dense evergreen and tropical semi-deciduous forests. The soils of Burkina Faso and Ghana reflect the intense chemical weathering of predominantly basic rocks of the West African Shield. This gives rise to extensive clay-rich Lithosols and Vertisols which, in conjunction with Fluvosols, largely denote dense level plateaux or plains. Iron-rich Plinthosols also indicate level or gently undulating landscapes while acid Acrisols reflect stable geological conditions with a slightly undulating terrain. In the alluvium of the coastal plains of Benin, Nigeria and Togo and in the floodplains and delta of the Niger and the Benoué, these often grade into Fluvosols and Gleysols. Iron-rich Planosols also indicate level or gently undulating landscapes while acid Arenosols have developed on granitic parent material in more undulating terrain. In the south-eastern corner of the map, volcanic systems give rise to Andosols while deep, fine-textured soils known as nitoands, more significant ones are denoted as Litosols. Along the coast sandbars and temporary lagoons give rise to Arenosols and Gleysols. In the east and north, soils are almost entirely white due to the Aridic conditions and desertification issues are critical. Because of their intense lack of nutrients, many soils are heavily dependent upon organic matter supplied by the vegetation cover. In this case, there is a fragile balance between vegetation and soil fertility, which may be destroyed by clearance, fire, or overgrazing.
The map shows the soils of eastern Nigeria, southern Chad, western Sudan, northern Cameroon, the northern part of the Central African Republic, and northwestern South Sudan. The pattern of soil distribution on the map reflects a transition from desert conditions in the north to a more humid climate in the south. In addition, the soils in the southern half of the map have formed on the soils of the Congo Craton, a stable rock formation more than 3 billion years old. Precipitation increases from north (annual average of 25 mm, falling infrequently) to south (central Cameroon receives 1,500 mm annually) with desert and semi-arid vegetation grading into grasslands, savannah, and eventually deciduous forests. A major feature of this map is Lake Chad which straddles the borders of Cameroon, Chad, Niger, and Nigeria. Due to high demand for water, the area of Lake Chad has shrunk dramatically since the 1960s.

The northern half of the map reflects and indicates semi-arid conditions. Daily temperatures are generally high (30-40°C) with winter rainfall increasing to around 760 mm a year in southern Chad. Much of the terrains fall and covered by extensive sand deposits (Arenosols). Saline and sodic soils occur in depressions in the landscape and between dunes. The large expanse of Liptosols with intermixed Luvic soils on the Chad/Sudan border marks the northern limit of the Nubian Sandstone, a rugged volcanic mountain range that defines the Nile-Lake Chad watershed (the river is not depicted on the Fluviothols in the northwest flow to the Nile).

The Fluviothols, Gleysols, Vertisols, and Phytosols in the centre and west of the map, define the alluvial and clayey deposits that accumulate on the floor of an extended Lake Chad and the seasonally flooded areas of the Chari and Logone. These rivers, and their seasonal tributaries, flow from the highlands of Cameroon and the Central African Republic to feed Lake Chad. As the climate becomes more Sahelian, increased rainfall and grassland vegetation give rise to dry rich, alkaline Leptosols. To the south of the 11° line of latitude, the influence of the basement rocks of the Congo Craton becomes very evident. Intense chemical weathering over long periods of time has led to the predominance of deep, red and yellow ochreous, lacustrine-rich Xerossols and iron-rich Phaeosols. Acrisols have developed on acidic, granite-like material where the terrain is more undulating, while deep Nitosols with their distinctive nut-shaped structure, develop in similar landscape settings but in more basic parent material. The northern part of the Central African Republic is quite the land features into a trellised, desert-like saharaian landscape dominated by fine sandy deposits (Arenosols).

In the north and north, soils are almost identical white drought and desertification are issues in the semi-arid Sahelian areas. While fertile soils are widespread, current management is a major concern in southern parts of the map.

Drought and desertification are issues in the parent material. The northern part of the Congo Craton becomes very evident. Intense chemical weathering over long periods of time has led to the predominance of deep, red and yellow ochreous, lacustrine-rich Xerossols and iron-rich Phaeosols. Acrisols have developed on acidic, granite-like material where the terrain is more undulating, while deep Nitosols with their distinctive nut-shaped structure, develop in similar landscape settings but in more basic parent material. The northern part of the Central African Republic is quite the land features into a trellised, desert-like saharaian landscape dominated by fine sandy deposits (Arenosols).
This map shows the soils of southern Sudan, north South Sudan, western Ethiopia and southern Eritrea. While the pattern of soil distribution on the western part of the map reflects the transition from desert conditions in the north to a more humid climate in the south, the influence of parent material is much more significant. The major feature of the map is the enormous expanse of Vertisols that characterize the western branch of the Great Rift Valley. The Blue and White Niles meet at Khartoum.

The soils of the north-western quadrant (Sudan) reflect arid and semi-arid conditions and generally flat terrain. Daily temperatures are high (30-40°C) with rainfall ranging from 50-700mm a year. Extensive sand deposits (Arenosols) dominate with Leptosols and Cambisols denote higher ground and the exposure of hard rock. Ryosols demarcate alluvial soils of desert deltas and terraces of the Nile Valley. Many soils display significant calcium carbonate levels (Calcisols).

The soils of the south-western corner of the map reflect the weathering processes on the edges of the Congo Craton, a stable rock formation more than 3 billion years old. Deeply weathered sediments give rise to clay-rich Laterals, Ferralsols and Podzols under grasslands and savannah vegetation.

The dominant feature on the map is the expanses of desert cracking Vertisols of the Central and Southern Clay Plains of Sudan and South Sudan. These heavy, calcic soils, containing a high proportion of swelling clays, reflect the long-term flooding of the area by the Nile over thousands of years. When dry, deep cracks appear in the soil which close on subsequent wetting. The high clay content makes Vertisols sticky when wet and difficult to work. However, Vertisols occur for a small proportion of the cultivated land in South Sudan and about one third in Sudan. Organic-rich Nitisols and Gleysols indicate many conditions in the floodplains of the Blue and White Nile, grading into aridified Rynosols.

To the east, the land rises to the Ethiopian Plateau and highlands of Eritrea which are characterized by Leptosols and Cambisols. Lake Tana in Ethiopia, the source of the Blue Nile, sits on a patch of clay-rich Laterals and Nitisols that have developed on basaltic rocks and tuffs. Vertisols occupy valley floors while extensive Nitisols define outcrops of metamorphic rocks to the south. The rich coffee-growing regions of Ethiopia are found on the Nitisols of the Western Highlands.

The line of Andesols just south of Addis Ababa marks volcanic activity associated with the Great Rift Valley. Most of the lakes in the area occupy collapsed volcanic cones (calderas). The Debera-Caldaras is 8km wide.

In the arid north, drought and desertification are persistent concerns. Gully and sheet erosion are serious problems in northern Ethiopia while nutrient management, sticky and heavy conditions and a limited cultivation window can cause difficulties on Vertisols.
This map shows the soils of Djibouti, southern Eritrea, eastern Ethiopia and northern Somalia – an area commonly known as the ‘Horn of Africa’. The overall pattern of soil distribution reflects two distinct lithological and climatological regions. To the north and the west, slightly cooler temperatures and significantly more rainfall (up to 1000 mm annually) characterise the volcanic highlands of western Ethiopia while to the south and east, increasing aridity and high temperature give rise to soils dominated by soils, gypsum and calcium carbonate. Parts of Djibouti only receive 130 mm of rain per year falling on less than 30 days while the summer temperatures on the northern coast of Somalia average more than 38 °C. At 51°27’52” E, Ras Hafun in Somalia is the most easterly point of the African continent.

The highly weathered material on the mountains of the highlands of Eritrea and the Ethiopian Plateau to the east of Lake Tana are characterised by poorly developed Leposolos and Cambisols. Clayey Luvisols have developed on volcanic rocks but are prone to erosion and display low nutrient retention and crusting.

The line of Andosols just south of Addis Ababa marks the Great Rift Valley which separates the rocky soils of the Djibouti, Eritrea and the Western Highlands in Ethiopia from the Eastern Highlands of Ethiopia and the sediments of Somalia. Many of the lakes in this area occupy collapsed volcanic cones (calderas).

Towards the Red Sea, the floor of the Rift Valley and the Danakil Plain are covered by alluvial sediments (Fluvic), saline soils (Solonchaks) and gravelly leptosols. In the western half of the map, products of Vertisols occupy valley floors while extensive Nitosols define outcrops of alkaline volcanic and metamorphic rocks. The rich coffee-growing regions of Ethiopia are found predominantly on Nitosols.

Towards the southeast of the Eastern Highlands of Ethiopia, the soil pattern changes markedly. The soils of south-eastern Ethiopia and northern Somalia have developed under arid and semi-arid conditions. Crystalline basement rocks in northern Somalia give rise to extensive Leposolos and Cambisols. The soils of the Ogaden region of Ethiopia and central Somalia have developed on relatively flat terrain in sediments derived from the weathering of recently deposited sandstones, limestones, marls, clays and evaporites. Calcium, Gypsums and Solonchaks denote the specific chemistry of the underlying parent material while the Solonchaks along the coast of Eritrea have evolved in uplifted marine sediments.

The linear patterns of Vertisols and Fluvic soils crossing the Ethiopian/Somalian border in the centre of the map denote the fertile alluvial soils on the floodplains of the agriculturally important Jubbah and Shabelle rivers.

In the arid north, drought and desertification are persistent concerns. Gully and sheet erosion are serious problems in northern Ethiopia while nutrient management, sticky and heavy conditions and a limited cultivation window can cause difficulties on Vertisols.

The Horn of Africa is one of the most food-shortage regions in the world with more than 40% of the population deemed undernourished. The FAO estimates that this proportion rises to 70% in Eritrea and Somalia. Drought, conflict, population growth and nutrient-poor soils are all contributing factors.
This map shows the soils of eastern Liberia, eastern Guinea, the Côte D’Ivoire, Ghana, Togo, Benin and southwest Nigeria. The pattern of soil distribution on the map reflects the intense weathering of the rocks of the West African Shield, a stable 3 billion-year-old rock formation, under hot and humid equatorial conditions. The large exposure of water (lying along the Greenwich Meridian in Ghana, Lake Volta, the largest reservoir by surface area in the world (about 8500km²)).

While the south-western part of the map has a tropical hot and humid equatorial climate with extensive evergreen rainforest, the majority of the region has a humid savannah environment. Precipitation levels increase significantly to the south and west with the southern parts of Liberia receiving some of the highest rainfall in Africa (approaching 3000mm annually). Average monthly temperature varies between 25-32°C. To the north and east, the humid savannah climate is characterised by the dry Harmattan wind (which blows from the northeast during winter), a dry season lasting from about November to March and annual precipitation of around 1500mm. The shrublands of the north become more wooded towards the south, eventually grading into forest. The boundary between the savannah and forest is increasingly being cleared for rain-fed cultivation.

The distribution of soil types reflects the interplay between the underlying parent material, topography and climate. In the west, the intense chemical weathering of the West African Craton gives rise to a gently undulating landscape where extensive acidic Acrisols have developed on granite and schists while Alfisols occur on more basic materials. Clay and iron-rich Plinthosols denote more level terrain. On the alluvial sediments of the coastal plain of the Côte D’Ivoire, Liberia and Togo, deep, red or yellow Ferralsols have formed under rainforest. The valley of the River Volta, denoted by alluvial fluvisols, marks the eastern boundary of the West African Craton. To the east, less acid Lithosols with leached, clay-rich subsoils occur in strongly weathered, fine textured materials under natural savannah or open woodland vegetation. Nitisols are found on gentle slopes between the coastal plains and interior plateau of Benin, Nigeria and Togo while iron-rich Plinthosols also indicate level or gently undulating landscapes. In Nigeria, bare, isolated mountains known as inselbergs give rise to individual patches of Leptosols. Along the coastal sands and lagoons or deltas give rise to Arenosols and Gleysoils respectively. The Gleysoils and Fluvisols on the coast at the extreme right of the map denote the beginning of the delta of the River Niger. Soil conservation is extremely important in this region. While low fertility, high levels of aluminium and phosphate fixation affect the use of the soil, heavy rainfall can cause serious erosion, especially following forest clearance.
The climate is classic equatorial, typified by constantly heavy precipitation, high temperatures and high humidity. Precipitation averages more than 2000 mm and in places can be much higher (> 3000 mm). Disturbance at the foot of Mount Cameroon is regarded as the wettest place in Africa with a staggering 10,000 mm of rainfall annually. Seasonal temperatures are relatively stable (22-30°C) with significantly greater variation between day and night, while along the coast the sea has a considerable cooling effect. The average daily humidity is about 80 percent.

The vegetation is almost exclusively broadleaved, evergreen rainforest, grading into deciduous African oak forests where precipitation levels are lower. Dense growths of broadleaved trees form a closed upper canopy over an undergrowth of leafy plants and vines. Coconut palms and mangrove forests grow in the coastal region.

The pattern of soil types on the map reflects the long and intense weathering of the Congo Shield, an ancient, stable rock formation. The dominant soil are Ferralsols, the classic red or yellow deeply weathered soils of the tropics. Ferralsols are coarse-grained soils containing sand and gravel with high levels of iron and aluminium sesquioxides. Organic matter and nutrient levels are low because plant remains are rapidly decomposed by bacterial action in the hot and humid climate before it can accumulate as humus in the soil. Topsoil erosion due to heavy rainfall, and especially after deforestation, is a major problem. Iron- and clay-rich Plinthosols indicate soil formation in level or gently undulating landscapes affected by groundwater movements while Nitisols are found on gentle slopes between the coastal plains and interior plateau of Nigeria. Much of Gabon is affected by groundwater movements while Nitisols are found on gentle slopes between the coastal plains and interior plateau of Nigeria. Much of Gabon is formed from the River Niger in the Gulf of Guinea. Gleysols are heavily dependent upon organic matter supplied by the vegetation cover. In this case, there is a fragile balance between vegetation and soil fertility, which may be destroyed by clearance, erosion, fire or overuse.
The Rift Valley is a vast depression occupied by vast lakes, where large segments of the Earth’s crust have subsided between fault lines. A number of volcanic peaks are associated with the rifting process. Immediately to the west of the Rift Valley, the land rises to a height of several thousand metres (the ice-capped peaks of the Ruwenzori are over 5,000m above sea level); further west, the Congo Basin is a shallow, bowl-shaped structure, gently sloping to the Nile towards the Atlantic coast. To the east of the Rift Valley, the basin of Lake Victoria rises to a high plateau with an average elevation between 1,000 and 1,500m.

The western part of the map has an equatorial climate, typified by constantly heavy precipitation (2,000mm annually), high temperatures (22-30°C) and high humidity (85%). However, to the east of the Rift Valley, annual precipitation is nearly 1,000mm lower while mean annual temperature drops by 5°C – both continue to fall towards the Indian Ocean coast. While seasonal temperatures are relatively stable in the Congo; Uganda has two distinct dry and rainy seasons.

To the west, the vegetation is almost exclusively dense, broad-leaved, evergreen rainforests. The higher elevation and drier climates of the eastern part of the map give rise to deciduous forests and savanna grasslands.

The pattern of soil types on the map reflects the long and intense weathering of the Congo Shield; an ancient, stable rock formation. Extensive Ferralsols, the classic red or yellow deeply weathered soils of the tropics, characterize the Congo Basin. These soils have developed in coarse-grained weathered sediments of the Congo Craton and contain high levels of iron and aluminum. Organic matter and nutrient levels are low because organic matter is decomposed by rapid bacterial action in the hot and humid climate, before it can accumulate in the soil. To the north, iron- and clay-rich Pleistocene indicate soil formation in slightly drier conditions on level or gently undulating landscapes affected by groundwater movements. Nitosols occur on gentle slopes while clay-rich, acid Ferralsols and Umbrepts indicate weathering where relief is more pronounced. Laterites reflect the leaching of certain clays from the soil giving it a higher pH than the surrounding Ferralsols. The other significant feature on the western half of the map is the extensive argillaceous Claypods that characterize the vast area of low-lying, swampy lands adjacent to the River Congo and its tributaries. South Sudan contains extensive plains of Vertisols. These heavy, alkaline soils, containing a high proportion of swelling clays, reflect the long-term flooding of the area by the Nile over thousands of years.

On the plateau of East Africa, Rupelisos denote river systems draining to the lower elevations of the Rift Valley floors. Kyosols and Ferralsols predominate with weathered volcanic sediments giving rise to highly fertile Nitosols on gently sloping ground and dark, clay-rich Vertosols on valley floors.

Volcanic activity along the rift has given rise to numerous lava and ash deposits. These are denoted by Andosols. Rupelisols and yellow soils characterize the floor of the Rift Valley.
This map shows the incredible variety of soils covering southern Ethiopia, Kenya, southern Somalia and northern Tanzania. The major geographical feature of the region is the Eastern Rift Valley that runs north-south through the left-hand side of the map. The diversity of soil types is due to the range of geological and climatic conditions of the area and the topographically uplifted block of eastern Africa.

The Eastern Rift Valley is a vast depression where large segments of the Earth’s crust have subsided between fault lines caused by the separation of Africa and the Arabian Peninsula. The valley floor is occupied by several large, shallow lakes and a number of volcanic peaks are associated with the filling process. Kilimanjaro, at 5,895 m Africa’s highest mountain and volcano, lies just south of the escarpment on the border of Kenya and Tanzania. Either side of the valley, the land rises by around 600 m to a high plateau with an elevation of 1,000 - 1,500 m above sea level. The Kenyan Highlands are one of the most successful agricultural production regions in Africa. To the northeast, the plateau falls swiftly to a low, flat, semi-arid plain that extends from the Ethiopian/Kenyan border to the Indian Ocean. Olkaria Geog, regarded as the birthplace of human beings, is located in volcanic sediments of northern Tanzania.

The climate of the region ranges from humid savannah in the west and dry savannah in the centre to semi-arid in southern Somalia. This is matched by a gradual decrease in vegetation cover. Annual temperatures are generally high in the Rift Valley and coastal plain but are moderated by elevation on the plateau. While the Rift Valley floor is dry, the highlands receive around 700 mm of rainfall annually. While the more tropical Kenyan coast receives slightly higher rainfall, the area between the sea and the plateau is notably dry. To the northeast, the coastal and inland plains of Ethiopia and northern Kenya are quite dry and with irregular annual rainfall (around 250 mm) and annual temperatures in the order of 30°C.

The distribution of soil types on the map can be divided into two regions east and west of the 38E meridian. To the west, the soils reflect the weathering of volcanic and uplifted sediments. Extensive lava deposits have produced fertile and sandy-loam Andossols while Plumbosols interspersed with Quartzosols and productive clay-rich Vertisols (the latter tending to develop on the level ground of valley floors). On the slopes of volcanoes (e.g. Mount Elgon), fertile Nitosols are well known for coffee and tea production while the extensive grasslands of the Serengeti and Mara Plains give rise to organic and lime-rich pasture. To the north, the semi-arid basin of Lake Turkana is characterised by Calcisols. Cambisols and Regosols while increasing temperatures are also indicated by large expanses of sodic Solonetz. To the east of the 38E meridian, the land drops in elevation and a large, predominantly sandy plain extends towards the Indian Ocean coastlines of Somalia and northern Kenya. This coarse-grained material gives rise to Arenosols and red-brown Ferralsols while the evaporation of saline groundwater gives rise to widespread occurrences of Solonetz. Lithosols reflect less acid soils in areas with a pronounced dry season. Pilotisols denote the alluvial sediments of river systems draining from the plateau and dune dark, clayey Vertisols tend to develop on valley floors in sediments derived from the weathering of basaltic material on the plateau.

The linear patterns of Vertisols and Pilotisols crossing the southern Somali coastal plain define the fertile alluvial soils on the floodplains of the agriculturally important Juba and Shabelle rivers; the latter gives rise to the fertile marsh lands and plains around Mogadishu. The Arenosols flanking much of the Somali coastline are a vast belt of ancient dunes that stretch for more than 1,000 km. Many of the soils on this map are subject to widespread erosion largely due to the lack of tree cover, overgrazing, and cultivation. The issue is particularly pronounced in the more arid and semi-arid regions. The Horn of Africa is one of the most food-insecure regions in the world with more than 40% of the population deemed undernourished. The FAO estimates that the proportion rise to 70% in Eritrea and Somalia. Drought, conflict, population growth and nutrient-poor soils are all contributing factors. The very dense soil patterns for Kenya reflects a more detailed soil mapping base. Such a level of information should be the minimum goal for the other African countries (see also Plates 2, 23 and 24).
The map shows the soils of Angola, the southern part of the Democratic Republic of the Congo and north-western Zambia. The major geographical features of the region are the Southern African Plateau and the vast wetlands on the headwaters of the Zambesi on the Angolan-Zambian border from a low, long, narrow coastal plain, the western rim of the plateau rises to a height of over 1,500 m and runs parallel to the Atlantic coast. The coastal Fluvisols and Arenosols on the Angola-Congo border mark the estuary of the River Congo.

While the climate of north-west Angola is tropical or dry savannah, most of the region is much drier with southeastern conditions prevailing over most of the area depicted on the map. Precipitation levels tend to be higher in the northwest while temperatures generally decrease from the equator to the coast and increasing altitude. The average annual temperature at the mouth of the Congo is around 25-30°C, but the drops by 10-15°C on the plateau.

Vegetation grades from deciduous forests in the north to extensive grasslands and shrubs in the south. Numerous flood beds and marshes occur along river valleys.

The main factors underlying the pattern of soil types on the map reflect topographic controls, climate and the long and intense weathering of the southern part of the Congo Shield, an ancient, stable rock formation. The dominant soils of the plateau area are red or yellow Ferralsols that have developed in coarse-grained, deeply weathered sediments. Organic matter and nutrient levels are low. Aplids denote soils formed from the weathering of more acidic parent material while Lithers indicate soils with slightly higher pH values in dryer climates. Lixisols are typical of the slopes of the western escarpments of the plateau. Sandy soils (Arenosols), which are very prone to erosion, have developed on more recent, clastic and carbonate-rich sediments that have accumulated in the basalt-like centres of the highlands. To the south, these soils merge into the northern extent of the Nandi Desert.

Along the coast, soils with high levels of calcium carbonates indicate increasing unidirectional temperatures. The other significant feature on the map is the extensive, organically-rich, deep Gley soils that characterize the vast area of low-lying, swampy lands and impeded drainage of the Cuando River System. This wetland area is an important biodiversity conservation site under the RAMSAR convention. Because of their inherent lack of nutrients, many soils are heavily dependent on organic matter supplied by the explosion cover in the case, there is a fragile balance between vegetation and soil fertility which may be destroyed by cloudburst, erosion, fire or overuse. Plakans is a major land use concern where extensive swamps occur.
This map shows the soils of the eastern Democratic Republic of the Congo, southern Tanzania, northern Malawi, northern Mozambique and Zambia.

The major geographical feature of this map is the Rift Valley with the great African lakes of Tanganyika and Malawi. Lake Tanganyika is the world’s second deepest, second largest (by volume) and longest freshwater lake.

The Rift Valley is a vast tectonic depression where large segments of the Earth’s crust have subsided between fault lines. Extensive volcanic activity is associated with this process and gives rise to Andesols. Either side of the Rift Valley, the land rises steeply. To the west, high mountains drop down to the Congo Basin, while to the east, the terrain is very dissected with deep valleys and plateau surfaces running down to the Indian Ocean coast.

While the Congo Basin and the narrow Indian Ocean coastal plain have a hot and tropical climate, most of the eastern part of the area shown on the map possesses a dry savannah climate, typified by seasonal variations in temperature and precipitation. Summer temperatures range from 25–30°C but drop in winter and significantly with altitude. Rain falls in a single wet season (summer) and is highest over the rift highlands and coastal islands (1,500 mm). However, most of the region receives between 600–1,500 mm, decreasing from north to south in the east.

Where precipitation levels are high, forests grow. However, the plateaus are primarily midmontane woodland, consisting of an open cover of trees and grasses. In areas of less precipitation, bushland and thorny are found giving way to grassland in more arid conditions.

To the west of the Rift Valley, the soil pattern reflects the long and intense weathering of the eastern part of the Congo Shield, an ancient cratonic formation. Extensive Cambisols and Ferralsols, the classic red or yellow deeply weathered soils of the tropics, characterise much of the Congo Basin. Acridic Acrisols denote soil formation on granite rocks in undulating terrain. Leptosols and Lithosols define the soils on the slopes of the high mountains flanking the Rift Valley. Dark, clay-rich Vertisols have formed on flat terrain or valley floors from the weathered sediments of relatively recent volcanic deposits. Gleysoils and Histosols denote low-lying areas where waterlogging is a prominent factor. The Bangweulu Swamp and the Kalah Flats are wetlands of international ecological significance.

To the east of the Rift Valley, soil patterns are a little more complex. The undulating terrain and variation in the chemical make-up of parent material gives a mosaic of soil types. The continuous uplift of the area is reflected in the extensive areas of weakly developed Cambisols. Nitisols occur on gentle slopes, while acidic Acrisols and clay-rich Lithosols indicate soil formation where relief is more pronounced. Sporadic formations of Vertisols reflect soil formation from weathered tuff volcanic deposits. The extensive Fluvisols in central Tanzania denote the floodplains of the Rufiji River and its tributaries. In particular, the ecologically important wetlands of the Great Ruaha River.

To the south, increasing aridity and predominance of grassland savannah give rise to extensive Lithosols.
The map shows the soils of southern Angola, north-western Botswana, northern Namibia and south-western Zambia. The dominant geographical features of the region include the Namib and Kalahari Deserts and, contrastingly, the ecologically important wetlands of the Okavango and Zambezi Rivers. Topographically, most of the area shown on the map is controlled by the Kalahari Basin, a large lowland area occupying most of Botswana and large parts of Angola, Namibia, South Africa, Zambia and Zimbabwe. The seas and Kalahari Deserts occupy the centre of the basin. The mountains on the western rim rise to over 2000 m before dropping to a narrow coastal plain, dominated by the very and Namib Desert.

Lying on the southern edge of the tropical zone gives the climate of the region an increasing seasonality. Generally, from north to south, precipitation decreases while temperatures increase. The coastal plain is cooled by the ocean but is very dry (less than 50 mm of rainfall annually). Inland, the land rises in terraces, sharply before descending in elevation towards the Kalahari (Windhoek in Namibia has an elevation of 1700 m above sea level). The Kalahari has a large daily temperature range of more than 30°C in the summer, dropping to less than 10°C in the winter. Humidity across the area is low and rainfall increases from about 250 mm in the south to about 600 mm in the north. However, rainfall is highly variable and droughts are common.

Vegetation grades from deciduous forests in the north-central part of the map to shrubland savannah and desert in the south. Numerous river beds and marshes occur along river valleys, especially the Okavango and the tributaries of the Zambezi. It is clear that climate, and particularly aridity, is the dominant factor on this map. The Namib extends for more than 2000 km along the Atlantic coast of Angola, Namibia and South Africa, but is only 100 km wide at its greatest extent. Geologically, the map covers the divide between the plateaus of the Congo Craton to the north and the Kaapvaal Craton of southern Africa. A band of very old (pre-Cambrian) rocks runs to a series of gently lying dolomite and limestone ridges running parallel to the coast. Seaward, extensive lime- and gypsum-rich soils are often overlain by wind-blown sand seas (Arenosols). Some dunes reach a height of 150 m and are over 30 km long. The area around Torra Bay is the infamous Skeleton Coast, known for its extreme aridity and numerous shipwrecks. The large extent of saline soils (Solonchaks, Solonetz) on the Angola/Namibian border denote the ephemeral hydrology of the Ecca depression.

Towards the centre of the map, dry and hot conditions give rise to an assemblage of Solonchaks, Calcisols, Regosols and extensive Arenosols. Fluvial and Gleysol deposits from the floodplain of the Okavango River and the notable tributaries of the Zambezi. Many channels are dry for large parts of the year. A significant feature on the map is the large area of post accumulation (Horizons) that reflects seasonal flooding across the vast, flat terraces of the inland delta of the Okavango. To the southeast, the region of saline, calcium carbonate-rich soils denote the Makgadikgadi pans, a broad inland basin that was once occupied by an enormous lake that dried up several thousand years ago when the climate of the region became much drier. The large expanses of Gleysols in the top-right corner of the map is the Zambezi Floodplain, an internationally recognised wetland area.

From an African perspectice, this map contains a rather rare appearance of Podzols, which have developed in the predominantly sandy parent material of southern Angola and Zambia. Here, slightly higher precipitation levels compared to the rest of the map give rise to more wooded vegetation, and lacking can lead to the development of Podzols in freely draining conditions. While much of the soils on this map sheet are rocky or sandy, a lack of water is the primary constraint on agriculture. Where the soils are calcified, overgrazing has led to compacted soils and serious erosion.
This map shows the soils of eastern Botswana, southern Mozambique, the northern parts of South Africa, southwestern Zambia and Zimbabwe. The major geographical features of this map are the eastern expression of the Kalahari, the Zambezi River and southern section of the Rth Valley connecting Lake Kariba and the Victoria Falls. The Rth Valley is a vast tectonic depression where large segments of the Earth’s crust have subsided between fault lines. Most of the land on the eastern side of the map is at a significantly lower elevation than that to the west.

The northern, southern and central portions of the map reflect the weathering of old, stable land surfaces. Course-textured soils have developed on deeply weathered gneisses (Ferralitic, Acrisols), while soils with higher clay content (Luvicols, Lixisols) reflect basement schists and more basic rocks. The distribution of Vertisols tends to mirror the distribution of basaltic rocks and the subsequent redissolution of these sediments along river valleys. Many of these soils are fertile and heavily cultivated. Lineations and sandstone deposits often develop into weakly developed Regosols.

The long linear Lapsotusol feature running through the centre of Zimbabwe is the Great Dyke – a vast intrusion of hard gneissic rocks which has given rise to a line of south-north trending hills. Many of the other Lapsotusol escarpments reflect the weathering of basalt and granite outcrops. The large expanse of Vertisols to the northwest of Lake Kariba reflects the floodplain of the Kafue River, one of the world’s great wildlife environments and a major tributary of the Zambezi.

The soils of lowland southern Mozambique have developed in more recent sedimentary deposits and reflect the drier conditions. Sandy Arenosols with low water retention capacity characterize the coastal zone while strongly alkaline, clay-rich Solonetz are extensive inland. Phaeozems and Vertisols denote the broad expanse of rich alluvial soils along the Zambezi delta and floodplain. In this region, fertility is largely limited to alluvial soils in major river valleys such as the Limpopo and Maputo. Sporadic heavy rain storms associated with monsoons give rise to rapid runoff and high rates of erosion. Many soils have inherently low fertility and, under cultivation, productivity drops rapidly after a few years. High population pressure and a lack of access to machines and mineral fertilizers are major issues in many parts.

The very dense soil patterns for South Africa reflect a more detailed soil mapping base.
from November to April and a cooler, drier season. Madagascar has a hot, wet season which extends proliﬁcally with rainfall ranging from 3000 to 15000 mm, with totals exceeding 20000 mm in the south-western highlands. The weathering of localised volcanic deposits gives rise to Vertisols, that are rich in swelling clays, and fertile Nitisols. Greater aridity in the west is demonstrated by increasing extents of Arenosols, Leptosols and Regosols. The weathering of localised volcanic deposits gives rise to Vertisols, that are rich in swelling clays, and fertile Nitisols. Greater aridity in the west is demonstrated by increasing extents of Arenosols, Leptosols and Regosols.
Podzolic and silicic soils of South Africa

Compared with the rest of the continent, South Africa contains significant amounts of podzolic soils (highly leached, low in lime with subsurface accumulations of iron and organic matter) and soils that are characterized by an accretion of silica (see pages 58-59). In most cases, they do not appear on small scale maps as they are often not the dominant soil types. For this reason, the distribution maps of these two soils are provided in addition to the usual maps. [66a]

This map shows the soils of southern Botswana, northern Namibia, and part of western South Africa. The dominant geological features of the region include the Kalahari and Karoo Deserts and, contrasting, the high plateau known as the Kaapvaal Craton. The eastern part of the map is dominated by the Bushveld Igneous Complex, while to the south, the rocks of the geologically older Karoo Basin and Kaapvaal Craton cover most of South Africa.

The climate of this region is greatly influenced by the surrounding ocean, with a sub-tropical high-pressure belt of descending air producing stable atmospheric conditions over most of the area giving a generally dry climate while temperatures are moderated by the fairly high elevation of much of the terrain. The west coast is cooled by the cold northward-flowing Benguela Current which also contributes to the dryness and stability of the atmosphere over western regions. Most of the area shown on the map is regarded as and with highly variable precipitation ranging from less than 50 mm to 600 mm annually.

Alexander Bay (where the Namib-Namaqua border meets the west coast) receives less than 50 mm of rain annually. Temperatures are strongly determined by elevation and distance from the sea. Summers are generally warm to hot while winters are mostly cool to cold, with higher elevations having lower temperatures.

Vegetation cover increases from north to south and west to east. Grassland savannah adjacent to the Kalahari becomes more woody with the south as rainfall increases. Winter rainfall and coastal fogs in the semi-arid southern and south-western parts of South Africa support the unique floristic diversity of the Karoo and Fynbos biomes.

It is clear that climate, and particularly aridity, is a dominant soil-forming factor on the map. Low soil organic matter is characteristic of most of the region. Both the Namib and the Atlantic Ocean and the inland Kalahari Deserts are characterized by extensive sandy Arenosols and separated by a zone of gravelly Leptaunus and bare rocks running parallel to the coast. Lime-rich Calciults and Solonetz soils reflect old evaporative surfaces, salt pans and depressions in a generally flat landscape.

Soils on the higher plateau of South Africa reflect the weathering of ancient crystalline rocks. Soils are generally weakly developed sandy Cambisols or shallow Leptaunus. Calciults and Solonetz soils denote the accumulation of calcium carbonate and other salts under dry conditions. Soils with a horizon cemented by silica are known as Duripans. Towards the east, changes in the underlying lithology to sedimentary rocks associated with intrusive igneous rocks and increased precipitation give rise to clay-rich Luvisols under extensive grasslands. Luvisols denote soil formation on strongly weathered but less acidic materials.

Between the sea and the Great Escarpment a more humid climate has led to the formation of a mosaic of sandy Arenosols, Podzols and sandy loams (Pennisols) soils intermixed with heavier Luvisols, Gleysols and Solonetz.

The very dense soil pattern for South Africa reflects a more detailed soil mapping based. Such a level of information should be a goal for other African countries (see also Plates 17, 21 and 24).
The vegetation cover is predominantly grassland and uncommon in Lesotho. Temperatures below 0°C are not cool to cold, with higher elevations having lower temperatures being moderated by the fairly high elevation of much of the territory. The Great Escarpment, the site of the world’s largest meteorite impact crater, occurs in the river valleys of the eastern and south-eastern coastal region. This escarpment is the primary feature of the region. The dominant geographical feature of the region is the high plateau lands of southern Africa. A coastal plain runs along the entire coast to southern Mozambique. This narrow plain between the ocean and the Great Escarpment is the most fertile region of southern Africa with well developed soils and moderate to high rainfall. The Great Escarpment is most pronounced at the Drakensberg Mountains along the border of Lesotho and Natal province, South Africa (i.e. denoted by Leptosols on the map).

While the climate of the region is greatly influenced by the surrounding oceans, stable atmospheric conditions give a generally dry climate with temperatures being moderated by the fairly high elevation of much of the territory. The area shown on the map is regarded as semi-arid with highly variable precipitation. To the south and southeast, the maritime influence increases and precipitation levels are slightly elevated. Less than 300 mm of rain falls annually in the northeast corner of the map and southern Mozambique while the highlands of Natal and Lesotho receive around 1,000 mm. Temperatures are strongly determined by elevation and distance from the sea. Summers are generally warm to hot while winters are mostly cool to cold, with higher elevations having lower temperatures. Temperatures below 0°C are not uncommon in Lesotho. While the mountainous belt of the Great Escarpment running parallel to the coast is denoted by shallow Leptosols and weakly developed Regosols, pockets of Pterosols and Vertisols (also in Lesotho and Swaziland) occur on flat or very gently sloping ground on the inland plateau.

The soil cover is predominantly grassland and becomes more shrubby and wooded to the southeast as rainfall increases. Denser woody growth, known locally as ‘thicket’, occurs in the river valleys of the eastern and south-eastern coastal region. Soils on the high plateau of South Africa generally reflect the weathering of sedimentary rocks, interbedded with grasses and occasional dolerite sills and dykes. Sedimentary rocks give rise to soils with high clay content (Luvisols) while dolerite and basaltic rocks weather to produce nutrient-rich Vertisols in semiarid climates. Lixisols denote slightly less acidic soils. Calksols and calcareous Cambisols indicate soil formation in dry climates while the weathering of granitic complexes to the east gives rise to sandy Acrisols and diorite to iron-rich Ferralsols.

While the mountainous belt of the Great Escarpment running parallel to the coast is denoted by shallow Leptosols and weakly developed Regosols, pockets of Pterosols and Vertisols (also in Lesotho and Swaziland) occur on flat or very gently sloping ground on the inland plateau. The very dense soil pattern for South Africa reflects a more detailed soil mapping base. Such a level of information should be a target for other African countries (see also Plates 17, 21 and 23). An interesting observation is that the semi-circular pattern of Leptosols and Solonetz around the town of Parys (west of Klerksdorp, Free State, South Africa) denotes the inner section of the Vredefort Dome, the site of the world’s largest meteorite impact crater.
Examples of medium-scale soil maps