October 2021

Digital Earth
AFRICA

Empowering Country-level Climate Action in Africa

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Cover Image: Betsiboka Estuary, Madagascar, Sentinel2, 2020, False Colour processed by Digital Earth Africa

Introduction

Climate action for Africa

Africa is on the frontline of the climate crisis. With populations across the continent severely affected by drought, flood and rising sea levels, building greater climate resilience is crucial to Africa's future.

According to a recent IPCC Special Report, human activities have caused global warming of approximately 1.0 ºC above the pre-industrial level, and this is likely to reach 1.5 ºC between 2030 and 2052 if it continues to increase at the current rate.

The Paris Agreement is a landmark, legally binding agreement, ratified by 191 countries to limit global warming to well below 2.0 ºC, preferably below 1.5 ºC by 2030. The Agreement provides a framework for financial, technical and capacity building support for countries to take action. For Africa to effectively mitigate and adapt to climate change, finance and technology development and transfer will be critical. Countries in Africa need to build capacity to deal with the challenges brought by climate change.

The urgency of this issue was highlighted at the UN Climate Adaptation Summit in January 2021, where the UNEP's Adaptation Gap Report highlighted the importance of National Adaptation Plans.

> "Annual adaptation costs in developing countries alone are estimated at USD 70 billion currently. This figure is expected to reach USD 140–300 billion in 2030 and USD 280–500 billion in 2050."

An inclusive and multilateral approach must be employed to enable leaders and decision makers across Africa to continue optimising National Adaptation Plans, and to continue working towards Nationally Determined Contributions.

Digital Earth Africa has a unique role to play in enabling acceleration towards a continent that is better adapted to the climate challenges that lie ahead.

Digital Earth Africa — a unique asset for climate action in Africa

Digital Earth Africa is uniquely positioned to empower decision makers across Africa to take climate action.

By providing open, free and accessible Earth observation data on a platform that is completely country-agnostic, industry and policymakers can access the data they need to detect changes to their country's water supply, crop coverage or coastline, land cover changes, and use it to make informed decisions to mitigate and adapt to climate change.

Data inputs from as far back as the 1980's are transformed into services that are ready-to-use thematic products covering the entire continent. Digital Earth Africa provides free access to continental datasets, a cloud computing platform (sandbox), open source algorithms (Jupyter notebooks) and online training, which makes it an ideal platform to build capacity in support of climate action in Africa. The platform is operational and offers cost effective solutions for countries interested in setting up independent, and country-led and owned, national inventory systems for biennial reporting, mitigation and adaptation activities as part of the Nationally Determined Contributions (NDC) under the Paris Agreement.

Digital Earth Africa puts data and insights into the hands of decision makers in Africa. Abiding by principles of accountability, transparency, diversity and integrity, the program is governed by an Africa-led Governing Board, Technical Advisory Committee and a network of Partners operating across the continent.

By measuring and monitoring changes to the natural environment, including coastal erosion and inundation, degradation of water quality in rivers and lakes, monitoring of grasslands, croplands and forest cover, Digital Earth Africa enables insight-driven action on a number of fronts.

The platform is positioned to support country-led action on:

- Mitigation of climate change
- National Greenhouse Gas (GHG) Inventory
- Climate adaptation
- Diversity and Inclusion: core principles for Digital Earth Africa
- Partnerships for success

Mitigation of climate change

Mitigation of climate change is founded on reducing the concentration of greenhouse gases (GHG) in the atmosphere and is at the heart of the Paris Agreement.

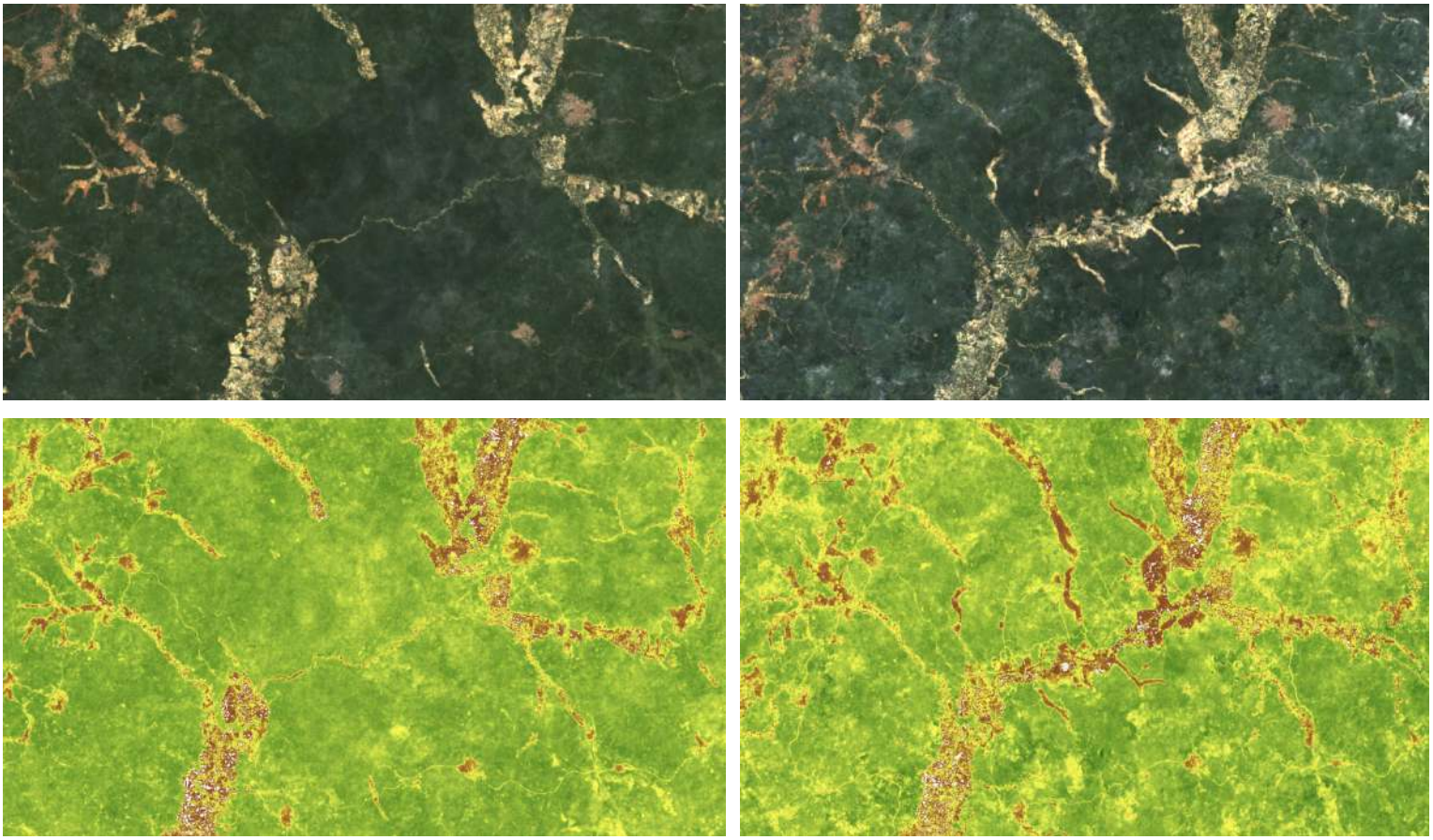
Climate change mitigation depends on more carbon leaving the atmosphere, and less carbon entering it. Much of this plays out in the natural world through the growth and clearing of forests, through fires, and through changes in the use of the land which release or absorb carbon into plant tissues or the soil. Understanding and managing changes in the natural environment and managed lands is essential to calculate carbon emissions and sequestration.

The Digital Earth Africa platform hosts the satellite data that are used globally for forest and land-use land-cover change mapping and therefore is well placed to assist countries to design, implement and account for their domestic mitigation measures, including establishing baselines that demonstrate progression. For example, the platform can be used to measure and monitor the growth, degradation, clearing and regeneration of important sites of carbon sequestration such as forests, plantations, rangelands and mangroves.

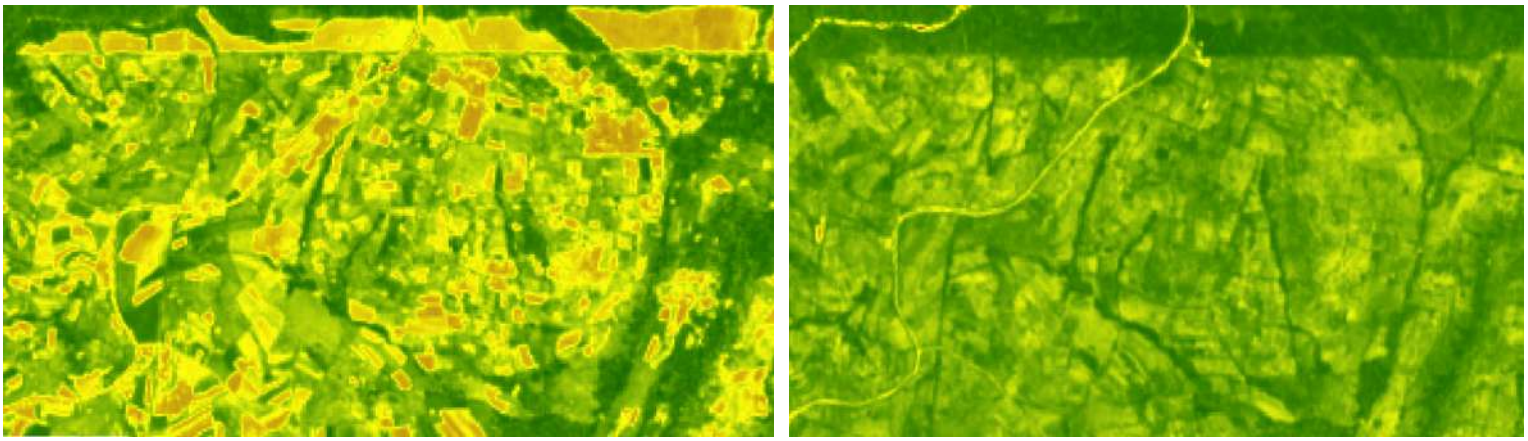
Digital Earth Africa in action

Limiting deforestation and promoting reforestation and afforestation

These are two of the biggest mitigation activities that are expected to contribute a quarter of the pledged mitigation under the Paris Agreement. Data published by FAO indicates deforestation rate of 2.148 Mha per year across Africa during the last five years, whereas annual afforestation rate is only 36.8 Kha for the same period. According to the 2020 Global Forest Assessment Report, the rate of forest loss has been increasing in Africa in the last decade, with a total net loss of forest in the last 30 years being 106 Mha. If the current rate of net loss of forest can be reduced by even 25%, it would abate 249 Million tonnes of CO2 equivalent emissions per year. Digital Earth Africa offers Analysis Ready Landsat data from the 1980s to the present day, along with ALOS SAR and Sentinel-1 SAR products, which are highly useful for forest monitoring. This data being open and accessible makes it perfect for preparing forest reference levels, monitoring annual deforestation, afforestation and reforestation activities for all countries in Africa. Furthermore, the Digital Earth Africa platform offers digital tools, like open source algorithms to prepare country-specific forest cover change maps, or refine existing global datasets, avoiding unnecessary duplication and saving valuable time. Digital Earth Africa is an ideal platform to build country-specific Measurement, Reporting and Verification (MRV) tools and national monitoring systems, at a fraction of cost.



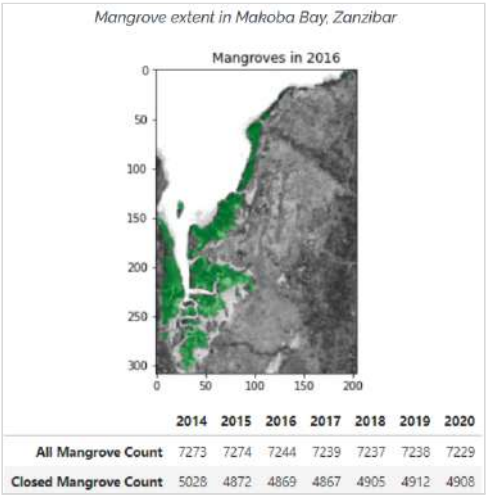
*Sentinel-2 GeoMAD imagery from 2017 & 2020 (**top row**) showing deforestation within Apamprama forest reserve (**centre row**), and corresponding NDVI images (**bottom row**), Ashanti District, Ghana (Digital Earth Africa).*



***Left**, Sentinel-2 GeoMAD NDVI images from 2017; **Right**, 2020 showing reforestation in Maasai Mau Forest Block, Kenya, where native trees were planted in 2019 & 2020 (Digital Earth Africa).*

Digital Earth Africa data and services for rapid assessment of changes in mangrove ecosystems

Digital Earth Africa has been employed to study mangroves in Kenya and Tanzania, which illustrates the power of this platform to undertake such assessments at local to continental scale, pretty quickly, to a consistent quality and accuracy. The technology allows and promotes collaboration between multiple agencies within a country through sharing/editing of datasets and documents in a central location making best use of technical expertise across departments. Mangroves are vital habitat for fish to breed whilst also being carbon sinks - capturing carbon that becomes forever trapped in the mud - safely out of the atmosphere. The Paris Agreement has mechanisms to finance such activities to enhance the ecosystems and reduce GHG emissions. Knowing the extent and condition of mangroves allows countries to make informed decisions about restoration activities and future commitments under the NDC review process.

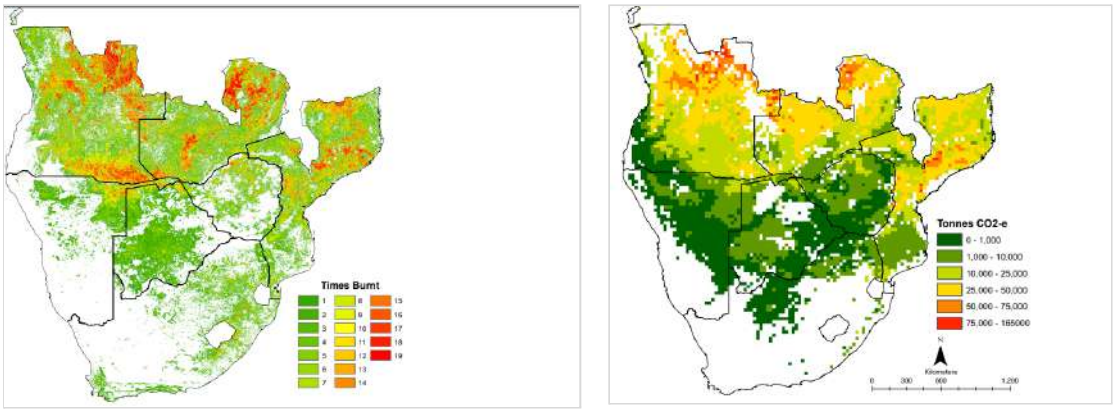


	2014	2015	2016	2017	2018	2019	2020
All Mangrove Count	7273	7274	7244	7239	7237	7238	7229
Closed Mangrove Count	5028	4872	4869	4867	4905	4912	4908

***Left**, Mangrove systems in Zanzibar; **Right**, The State University of Zanzibar used DE Africa tools to develop local scale monitoring approaches that work alongside other products such as Global Mangrove Watch (SUZA / Digital Earth Africa).*

Mitigating emissions though fire management

Savanna fires produce significant global emissions, but if managed effectively they can offer significant mitigation opportunities. For example, according to a paper published in Nature Communications (2018), 29 countries in Africa have the potential to reduce 69 Million tonnes of CO_2 equivalent emissions per year (at an economic value roughly equating to USD 690 million at $10/tonne). This estimate is based on the fire management methodology that has been successfully adopted to reduce emissions from savanna fires in northern Australia, using continental scale satellite data. This methodology is currently being expanded to Africa through International Savanna Fire Management Initiative (ISFMI), in collaboration with local government authorities. Digital Earth Africa products and services are well suited for the rapid deployment of such methods in Africa, combined with other datasets including coarser resolution satellite imagery, annual rainfall data, etc.



Left, *Fire frequency in southern Africa, 2001-2019, using MODIS data;* ***Right,*** *Associated emissions from savanna fires (CO_2 -e), 2003–2019 (source: Russell-Smith, et al., 2021)*

National Greenhouse Gas (GHG) inventory

Transparent reporting is a key component of impactful climate action, and every country has a responsibility to deliver their reports effectively. As part of the Paris Agreement, an enhanced transparency framework has been adopted, which requires all Parties to report their national greenhouse gas inventory, any progress made in implementing their nationally determined contributions (NDC), and climate change impacts and adaptation measures every two to fours years, as appropriate. The first Biennial Transparency Report (BTR) must be submitted by 31 December 2024 by all parties. However, 33 African countries recognised as Least Developed Countries (LDCs) are offered additional discretion in reporting. Having a country specific, custom-built, national MRV system is essential to attract investment for capacity building and climate adaptation activities as part of the global financing mechanism.

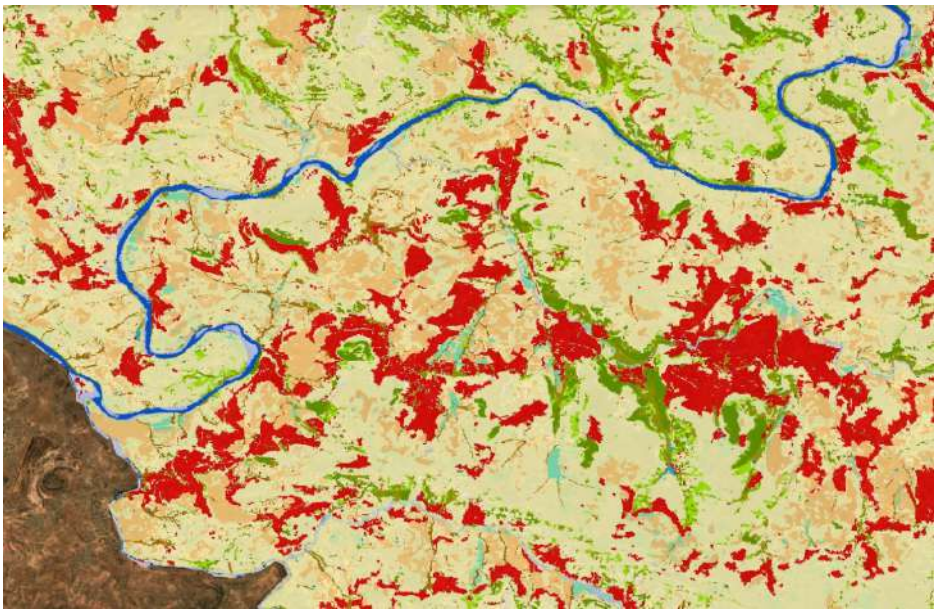
Global datasets on forest and land use are becoming more accurate and reliable and can be the starting point for national climate reporting. Digital Earth Africa can connect to these global datasets providing easy access to African countries from a single location without needing to download data, with transparency and control over national and international reporting processes.

Access to global land cover and forest cover datasets through Digital Earth Africa, along with necessary tools and analysis ready EO data, allows experts to modify/reclassify global datasets to meet country specific requirements, thereby giving AFOLU experts and focal points more flexibility and control in building country specific MRV system and reporting capability to fulfill international obligations such as the UNFCCC Biennial Update Report (BURs), Biennial Transparent Report (BTR), National Communications (NC), etc. and also a number of environmental indicators in support of the UN SDGs, and the African Union's Agenda 2063 can be generated. Digital Earth Africa is partnering with NASA/CEOS and other collaborators to provide additional tools and algorithms to generate activity data on land use conversions, compliant with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Digital Earth Africa in action

Land cover mapping and change detection

Digital Earth Africa and the FAO are exploring the migration of FAO land cover classification algorithms developed for Lesotho onto the Digital Earth Africa platform. This would ensure operational roll out of the capability for Lesotho, and would allow the methods to be rapidly adopted by other African countries. Land cover is mapped from annual satellite data (Sentinel-2 for recent years, and Landsat for historic years), allowing the users to map changes in the landscape. This information will support carbon accounting and reporting against the Sustainable Development Goals. This project is in its early phase and when completed, the software tools and algorithms will be openly available to all countries, allowing FAO methods for mapping of land cover to be reliably and easily re-run by local specialists by any country in Africa, using the Digital Earth Africa.



2020 land cover map of Lesotho using Sentinel-2 data (source: FAO, Office of Chief Statistician).

Digital Earth Africa is collaborating with the Committee on Earth Observation Satellites (CEOS), NASA and African partners in compiling a list of global datasets that are potentially useful for national inventory reporting. Some of the global datasets will be available from the platform directly while others will be accessible seamlessly through digital connectivity, without needing to duplicate data or effort. Global datasets on forests and land cover are becoming more accurate and reliable and can be the starting point for national inventory reporting, provided they are easily accessible with appropriate tools to analyse them consistent with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and applicable Tier 2 and 3 land representation methodologies.

Copernicus' Global Land Cover layers provide annual updates on estimated land cover types at 100 metre resolution from 2015 onwards. The data can be downloaded and could be hosted in DE Africa for use to support national climate accounting and action. Shown here is the 'Built-up' class for the year 2015, over Accra, Ghana. (Copernicus Land Monitoring Service)

Climate adaptation

Adaptation is a global challenge and is a key component of the long-term global response to climate change to protect people, livelihoods and ecosystems. The impacts of a changing climate will only become greater, and their consequences more urgent.

> “All donors and multilateral development banks should commit to the goal of allocating over half of their climate finance to adaptation and deliver on it by 2024.”
>
> **— UN Secretary-General António Guterres.**

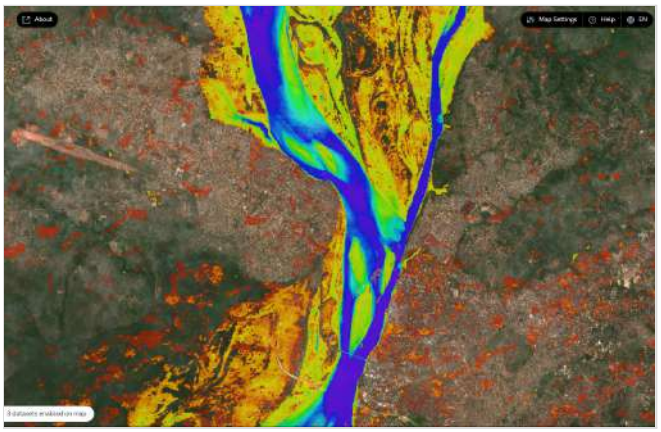
As countries work towards National Action Plans for climate adaptation they will be calling for information to better understand extreme weather events, floods, coastal flooding, erosion, extreme fires, the vulnerability of agriculture and food systems and so on. Understanding the resilience of infrastructure to climate — such as more intense storms and flooding — is one of four initiatives of the Africa Adaptation Acceleration Program under the Global Centre on Adaptation.

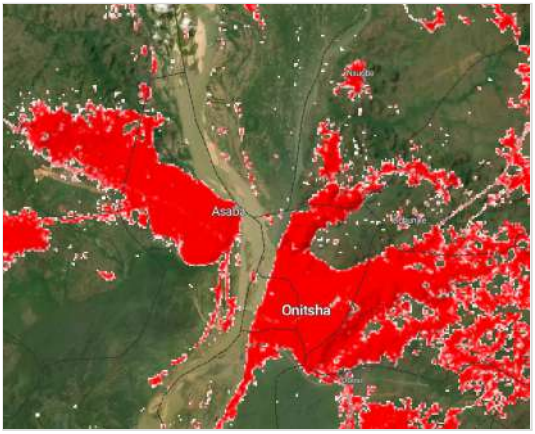
The Digital Earth Africa platform allows access to historic satellite data for the entire continent, providing a consistent record of changes in the landscape over the last three decades. This is an excellent source of data to assess the impact of climate change on coastal systems, infrastructure, water resources, cropping, urbanisation, etc. Further, Digital Earth Africa digitally connects with the global climate datasets which are immensely useful in planning adaptation measures at national and regional level. Availability of water is a key factor for food security. Digital Earth Africa provides high quality consistent water observations from the 1980s to present, spanning more than three decades, which is very helpful in assessing long term trends and planning for the future. This data is analysed and ready to use, therefore, incredibly useful and efficient for countries in planning and adapting to the changing climate.

Digital Earth Africa in action

Flood mapping: Niamey, Niger

Digital Earth Africa produces continental-scale products for Africa, including mapping surface water to reveal flood plains and lakes. Flood hazards affect an increasing number of people in major cities. Digital Earth Africa's water mapping service was first developed in Australia where it won awards as part of a National Flood Risk Information Project.

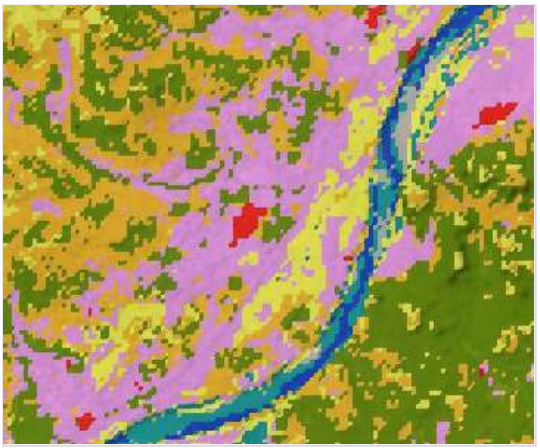




***Left**, Digital Earth Africa maps the floodplains that surround the cities of Asaba and Onitsha in southern Nigeria. **Right**, the Copernicus Land Monitoring Service highlights the proximity of the built up areas to the floodplains.*

Cropland extent map: East and West Africa

Knowing where crops are grown from year to year is a key first step in understanding food production systems and their vulnerability. Digital Earth Africa has mapped the crop area for large parts of Africa at unprecedented resolution.



***Left**, Digital Earth Africa is working with regional partner organisations to produce cropped area maps at 10 metre resolution — 100 times the resolution of globally available products; **Right**, Copernicus Land Monitoring Service. The area shown is north-east Guinea.*

Coastal erosion: West Africa

The coastlines of West Africa are ever changing with dynamic sand-spits off Senegal driven by north-south coastal currents, vast inter-tidal mangrove swamps in the estuaries of The Gambia, through to mobile sands on the Ghanain coastline at Accra where urban flooding is a known hazard. Digital Earth Africa is working with the Centre de Suivi Ecologique (CSE) in Senegal, the West African Coastal Areas Management Program, the international Committee on Earth Observation Satellites and Digital Earth Australia to prove the feasibility of a comprehensive coastline monitoring system for Africa.

Estimated rates of coastal erosion (red) and deposition (blue) south-east of Dakar, Senegal. Units are metres per year. (Digital Earth Africa)

Changes in coastline positions due to erosion and deposition around marine infrastructure, Cotonou, Benin, 2000–2017 (Digital Earth Africa).

Diversity and Inclusion: core principles for Digital Earth Africa

As climate impacts and action accelerate, the principles of transparency, accountability and inclusion will become ever more important. The Paris Agreement notes that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems. Supporting this, Digital Earth Africa pursues diversity and inclusion in all its work and embeds a principle of seeking to be an exemplar of diversity and inclusiveness.

Diversity and inclusion are vital to the global climate response. The climate challenge requires action at all levels across all sectors of society, including the private sector.

The Paris Agreement identifies the need to enhance public and private participation in climate action, and private companies are themselves taking on new charters for Environment, Society and Governance which target sustainability and the planet. Digital Earth Africa is a free and open platform creating opportunities for private sector use of the data and for the development of value-adding services or products.

Some of the groups that are most vulnerable to climate change are those that are already poor and marginalised. Women, for example, make up the majority of the world's poor, and are more likely to depend on natural resources for their livelihoods – with these natural resources being directly under threat from climate change.[1][1]

At the same time, groups such as women and youth are not only vulnerable to climate change, but are also effective agents of change. Women are important drivers of development in Africa as leaders of social and political change, and as entrepreneurs. With around 100 million youth expected to enter the workforce over the next decade, young people offer great potential for Africa's digital and climate transformation if they can be equipped with skills and employment opportunities.

Digital Earth Africa in action

To harness the potential of all people across Africa to address climate change, including groups such as women, youth and people with disabilities, Digital Earth Africa has a strong focus on promoting gender equality and inclusion of marginalised groups across all its work. For example:

- By making Digital Earth Africa a free and open platform, opportunities are created for private sector use of data — including by women and youth entrepreneurs — to develop value-adding services or products
- One of Digital Earth Africa's key principles is that diversity and inclusion should be integrated into all activities. In practise, this means that new products and training opportunities aim to cater to the different needs of different groups, including women, youth and people with disabilities
- Specific gender and inclusion activities, such as targeted training and advocacy, ensure women and youth are able to access and use Digital Earth Africa to drive change.

These actions ensure that Digital Earth Africa is a leader in diversity and inclusion, and that it is actively embodying the Paris Agreement's drive to enhance public and private participation in climate action.

Partnerships for success

Digital Earth Africa is based on open data and science, and partnerships. We use and contribute to the latest open data and science, inviting partnerships and creating opportunities for collaboration across sectors. Our technology partners include Amazon Web Services Public Data Store / Sustainability Initiative, which hosts Digital Earth Africa data, and ESRI, which provides the Africa Geoportal supporting GIS users to readily access and analyse Digital Earth Africa data.

The Digital Earth Africa Phase II has established a unique institution and capability for Africa. The program is fully operational providing services as of August 2021. A core part of the platform is the provision of an operational data store which is now hosted on Amazon Web Services in Cape Town. The program management functions of Digital Earth Africa are also currently being transitioned to Africa (from Australia), expected to be fully in place by mid-2022.

This is a good time for new investors and collaborators to join as we take the next steps to rapidly grow our capability, impact and value to Africa, and to support countries to rise to the challenge of climate change whilst also delivering on the outcomes that our investors want to achieve.

The Digital Earth Africa program is delivered by six regional Implementing partners, coordinated by the Program Management Office (PMO) based in Pretoria. Together, our partners reach more than 40 countries in Africa. Our partners have well developed capability and capacity to support projects to assist countries to rapidly deploy Digital Earth Africa technologies. Working with them, and in collaboration with similarly aligned programs such as SERVIR, GMES and Africa, GEOGLAM, the UNCCD and others we aim to maximise synergies, to avoid duplication of effort, and to implement existing and new programs quickly, cost effectively and sustainably. Further, Digital Earth Africa has reached out to existing climate change programs in Africa such as SilvaCarbon, the International Savanna Fire Management Initiative (ISFMI), the Global Forest Observations Initiative (GFOI) and International Partnerships for Blue Carbon (IPBC) to ensure awareness of the Digital Earth Africa infrastructure and its ability to support implementation of these programs in Africa, where applicable.

Contact us

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