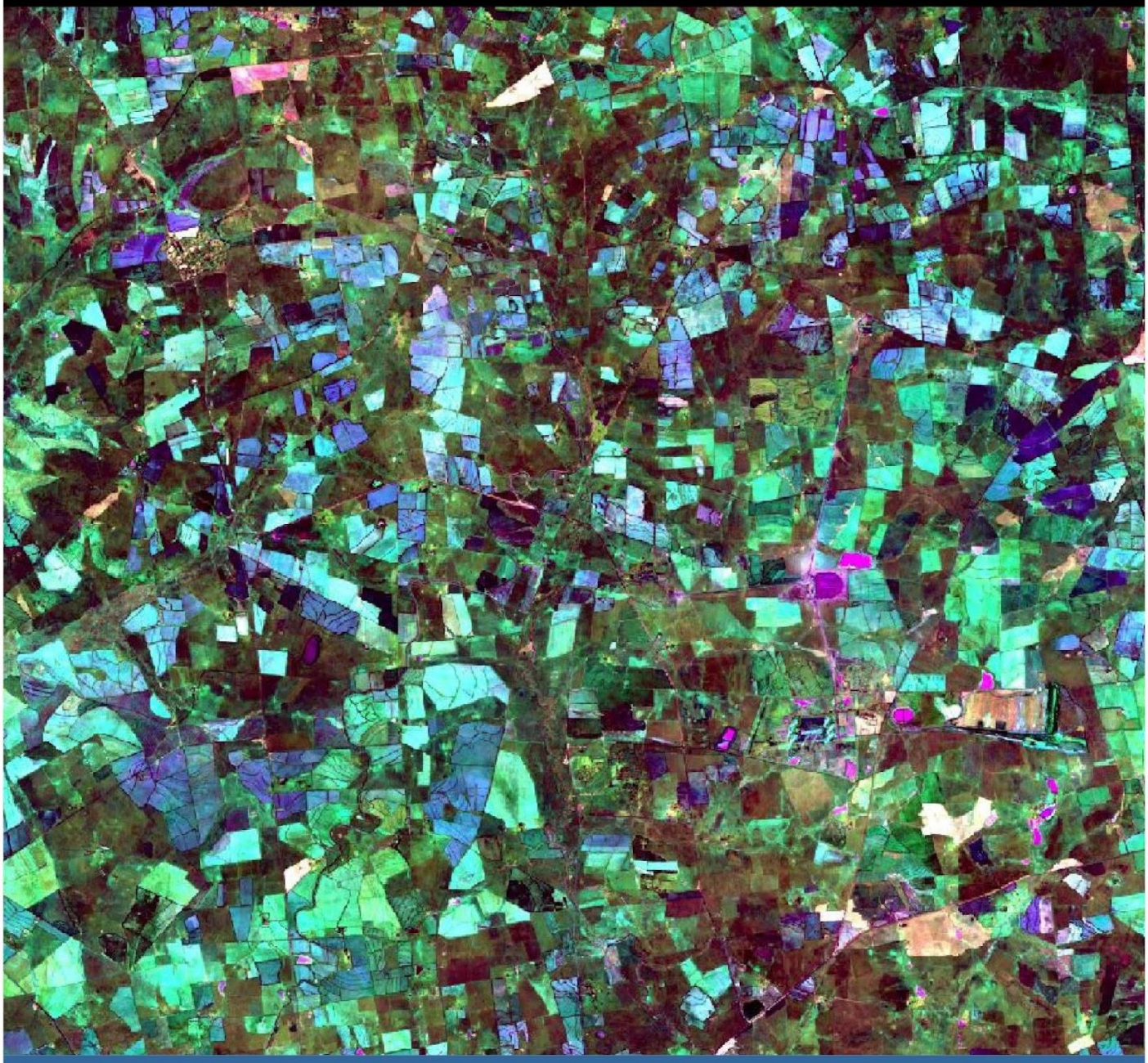
March 2022

Digital Earth AFRICA

2021 Annual Report



Unlocking the Promise of Tomorrow from the Patterns of the Past

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About this Annual Report

This Annual Report covers the period 1 January 2021 to 31 December 2021. The Annual Report has been prepared by the DE Africa Establishment Team for the DE Africa Governing Board, Technical Advisory Committee, funding partners, and other stakeholders. The Report provides a summary of progress made through 2021.

Version Date	17 February 2022	Submitted to DE Africa Governing Board
Version Date	25th February	Approved by the DE Africa Governing Board

Foreword

A message from the Digital Earth Africa Establishment Team Managing Director

2021 has been a significant year for Digital Earth Africa. Our focus on transition and sustainment, outlined in the previous year's Work Plan, has guided our partnership and governance strategies, while an active team has been focused on strengthening relationships with users, building capacity, reaching out to under-represented groups and telling the story of Digital Earth Africa's impact.

This year, we have finalised our Governing Board, with a majority African representation. We marked our 1400th Sandbox user, our 10th Technical Advisory Committee meeting and launched a number of crucial continental scale data services that will continue to strengthen and empower institutions across the continent to harness the power of EO data and services for better decision making.

We are proud of the achievements made this year and are excited for the opportunities that 2022 will bring. None of this would have been possible without the amazing support we have received from our partners and stakeholders. Thank you to everyone who has contributed to Digital Earth Africa's journey so far.

We look forward to a safe and productive year, working together to transition and embed this amazing program in Africa, and to fully realise the potential of Digital Earth Africa for the benefit of everyone across the continent.

Best regards,

Dr Lisa Hall Managing Director, Digital Earth Africa Establishment Team

Sentinel-2 GeoMAD shows a cloud-free composite of Africa in 2020. Processed by Digital Earth Africa.

Executive Summary

Digital Earth Africa (DE Africa) has progressed to become the world's largest Open Data Cube implementation and the only Earth observation platform offering free, readily accessible, open-source data and products for the entire African continent.

With support from our funding partners The Leona M. and Harry B. Helmsley Charitable Trust and the Australian Government Department of Foreign Affairs and Trade, DE Africa is on track to improve the lives of people in Africa by providing planners and policy makers with tailored Earth observation information to support better decision making and enhance sustainable development outcomes.

A snapshot of 2021

DE Africa's governance framework is now fully operational and actively transitioning to become an Africa-based and managed entity.

The DE Africa Governing Board is now fully active, convening three times in 2021 with Ministerial level representation. The Technical Advisory Committee continues to provide strong strategic guidance, meeting 4 times this year. The DE Africa Program Management Office will be hosted by the South African National Space Agency and the transition process is now well underway. In addition, DE Africa updated key program frameworks and strategies including the DE Africa Technical Road Map and Diversity and Inclusion Strategy.

DE Africa's technical infrastructure is now fully operational in Africa, supplying a range of continental-scale and real-time data sets and decision-ready products.

In collaboration with Amazon Web Services' Amazon Sustainability Data Initiative, at the end of 2021 DE Africa stored nearly 3 Petabytes of data at AWS Africa (Cape Town), providing a secure, stable and high performing platform for users across Africa. This includes supporting 3 continuously updated analysis ready data pipelines for the continent accessing data from the Landsat, Sentinel-1 and Sentinel-2 satellites. DE Africa's range of tools and services has grown significantly during 2021, providing enhanced support for planning and decision making around climate action and reporting, agriculture and food security, water resources and flood risk, land degradation and coastal erosion, and urbanisation.

DE Africa is building ownership, strengthening capacity and demonstrating impact as its growing user community applies its Earth observation data and products to address priority development challenges.

Two economic impact studies indicate that, even under conservative assumptions, the socio-economic benefit of DE Africa for the continent could total over $2.54 billion USD per year. DE Africa has established bi-lingual training and user community support services (including online training now completed by more than 250 users), attracting approximately 1400 Sandbox registrations and 7400 unique DE Africa Map users, and driven increased engagement with industry. DE Africa is now demonstrating impact through a growing number of user stories which apply DE Africa to real world development challenges from water and food security, to illegal mining and urbanisation (e.g. AWS Climate Next documentary "Zanzibar: the Essential Mangrove").

DE Africa has established strong partnerships with a diverse range of national, regional and international stakeholders and has developed a trusted and increasingly well known brand.

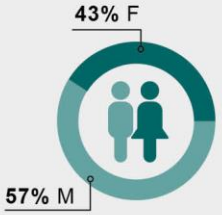
DE Africa has now established a range of technical, capacity support and delivery partnerships that are facilitating program delivery, building buy-in and ownership from partners in Africa and driving uptake and usage of the DE Africa platforms, products and services. It is also establishing the foundation for ongoing inter-regional collaboration, and a distributed delivery model which puts the development and delivery of DE Africa in the hands of its Africa-based users. DE Africa is proud to have developed a strong and trusted organisational brand with a growing global profile.

DIGITAL EARTH AFRICA 2021 OVERVIEW

GOVERNANCE

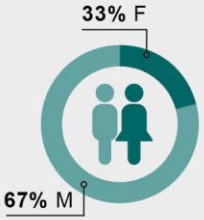
DIGITAL EARTH AFRICA ESTABLISHED FULLY OPERATIONAL GOVERNANCE.

GOVERNING BOARD



70% of the Governing Board members are based in Africa

TECHNICAL ADVISORY COMMITTEE



Representation from **13** African countries.

PARTNERSHIPS AND OUTREACH

ESTABLISHED OVER 17

TECHNICAL, STRATEGIC AND **DELIVERY** PARTNERSHIPS WITH NATIONAL, REGIONAL, AND INTERNATIONAL ORGANISATIONS.

AFRICAN OPERATIONS

- Distributed model now operational
- 6 pan-African partners
- Establishment of Program Management Office

SERVICES AND INFRASTRUCTURE

DATA STORAGE EXPANDED AT AWS AFRICA (CAPE TOWN) REGION

2.9 PETABYTES

OF DATA STORED BY AMAZON SUSTAINABILITY DATA INITIATIVE

THREE OPERATIONAL DATA PIPELINES

LARGEST OPERATIONAL PLATFORM OF ITS KIND IN THE WORLD

- ✓ Analysis Ready Data
- ✓ Continental scale
- ✓ Routine updates to Landsat, Sentinel 2 and Sentinel 1 to cloud optimized format

CONTINENTAL DECISION READY SERVICES

FOUR NEW DATA SERVICES AVAILABLE

- ✓ Water Observations from Space
- ✓ Cropland Extent Map
- ✓ Fractional Cover
- ✓ GeoMAD

VALUE AND IMPACT

POTENTIAL ECONOMIC BENEFITS BY THE NUMBERS

$2.84BN*

Even under conservative assumptions the potential economic benefits of DE Africa could exceed USD 2 billion a year by 2024

$500M EO industry accelerated growth

$900M Agricultural productivity boost

$900M Unregulated gold mining detection and prevention

$212M Marine Observation

$27M Renewable Energies

$74M Disaster Risk Reduction

$15M Oil & Gas

$113M Public Health

$96M Security and Civil Protection

**World Economic Forum and DISAL Consulting*

CAPACITY DEVELOPMENT

USER APPLICATIONS SUPPORTING SDGS

A GROWING PORTFOLIO

14 PUBLISHED USE CASES ADDRESSING AFRICA'S PRIORITY DEVELOPMENT ISSUES AND >60 OPEN SOURCE NOTEBOOKS.

USER ENGAGEMENT AND TRAINING

7400 UNIQUE DE AFRICA MAP USERS

250 COMPLETED TRAINING

1400 REGISTERED USERS IN SANDBOX

AWARDS

NEW DE AFRICA BRAND WON TWO INTERNATIONAL COMMUNICATION AWARDS.

About Digital Earth Africa

Digital Earth Africa (DE Africa) aims to improve lives across Africa by providing planners and policy makers with crucial information to support better decision making, by producing continental Earth observation services and through enhanced access to satellite data to progress sustainable development outcomes.

DE Africa Vision: To provide a routine, reliable and operational service, using Earth Observations to deliver decision-ready products enabling policy makers, scientists, the private sector and civil society to address social, environmental and economic changes on the continent and develop an ecosystem for innovation across sectors.

DE Africa Mission: To process openly accessible and freely available data to produce decision-ready products. Working closely with the AfriGEO community, DE Africa will be responsive to the information needs, challenges, and priorities of the African continent. DE Africa will leverage and build on existing capacity to enable the use of Earth Observations to address key challenges across the continent.

The long-term DE Africa Goal is: DE Africa improves the lives of Africans through access to tailored information for decision making. This encompasses:

- **Livelihood strengthening** – Earth Observation (EO) data will support more informed decision making at government, sectoral and other levels, contributing to direct and indirect benefits for individuals and communities.
- **Development effectiveness** – DE Africa will support enhanced understanding of development challenges and solutions, and in so doing, strengthen collective impact and ability to assess progress towards national priorities, Agenda2063 and the Sustainable Development Goals.
- **Digital transformation** – through industry uptake and innovations, DE Africa will help fuel ongoing evolution of the digital economy in Africa.
- **Economic development and job** creation – through access to data for commercial products and services development, DE Africa will support new business development and employment opportunities.

DE Africa's investment design

Governance

DE Africa's governance framework is now fully implemented with the establishment of the Governing Board in 2021. In addition, the Technical Advisory Committee continued to provide critical strategic advice and support through the year.

In 2021, DE Africa:

- Established the Governing Board and hosted three meetings in 2021.
- Convened four Technical Advisory Committee meetings to continue to build awareness, buy-in, and Africa-based ownership of the program.
- Developed or updated 7 institutional strategies and frameworks.

Governance

DE Africa's governance framework is now fully implemented and we were proud to host our first Governing Board meeting in 2021. The Board ensures that the Program meets its governance requirements and provides strategic direction and expert advice. Since forming, the Board has met three times to **provide guidance on strategy, risks, and performance.**

DE Africa's Technical Advisory Committee (TAC) continues to provide strong guidance and support for the program, meeting for the 10th time in November.

The GEO Trust Fund Financial Steering Committee continues to actively help deliver the DE Africa program.

Inaugural Governing Board Members

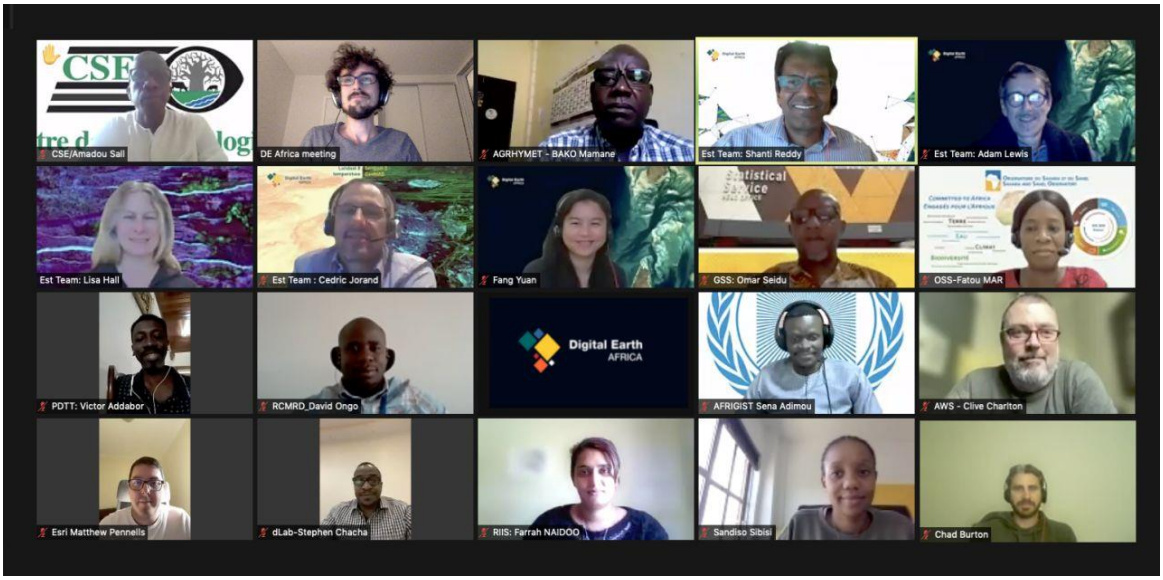
Policies and strategies

The following strategies and frameworks were revised and re-endorsed in 2021:

- Governance Framework, including the Governing Board Terms of Reference
- Technical Road Map
- Communications Strategy
- Diversity and inclusion Strategy
- Partnership and alignment Strategy
- Monitoring, Evaluation and Learning Framework
- Risk Management Framework

DE Africa also continues to implement our annual planning and reporting cycle, including:

- Publishing our 2020 Annual Report and regular Quarterly Reports
- Holding a series of end of year Reflect and Refocus workshops to inform planning for the following year.



Digital Earth Africa Technical Advisory Committee Meeting

Transitioning to Africa

DE Africa is transitioning to be an Africa-based, owned and managed program, with a fit-for purpose 'distributed model' enabling greater and more inclusive engagement with our key African partners.

In 2021, DE Africa:

- Managed 3 DE Africa Working Teams with our key partners aiding program delivery;
- Announced that the DE Africa Program Management Office will be hosted by the South African National Space Agency, and commenced recruitment of the Africa-based leadership team; and
- Grew the Africa-based user engagement team, and increased support for engagement of Francophone countries.

Implementing Partners

Digital Earth Africa continues to work with a strong and established network of Implementing Partners across the continent.

Much of the work of the Implementing Partners is designed and coordinated through 3 Working Teams, with support from the Implementing Partners. These teams met monthly throughout 2021, supporting multiple aspects of program delivery:

- Product Development Task Team
- Communications Working Group
- Diversity and Inclusion Working Group

DE Africa Program Management Office

In 2021 we announced that the Digital Earth Africa Program Management Office (PMO) would be hosted by the South African National Space Agency (SANSA). Establishment of the PMO is now well underway with the announcement of the host in August and launch event in Pretoria during World Space Week in October. Recruitment for key leadership positions is on track to see new team members taking up their positions in March-April 2022.

PMO launch event hosted by the Australian High Commission in Pretoria

Technical infrastructure

DE Africa has successfully established an operational infrastructure in Africa, offering timely and reliable EO data and decision-ready products that are accessible to users from a wide range of technical backgrounds.

In 2021, DE Africa:

- Further developed the platform to be more secure, stable and better performing. By the end of 2021, nearly 3 Petabytes of data were stored at AWS Africa (Cape Town) Region, in collaboration with Amazon Web Services' Sustainability Data Initiative.
- Established and maintained 3 continuously updated analysis ready data pipelines for all of Africa, providing surface reflectance, surface temperature and radar measurements from Landsat, Sentinel-1 and Sentinel-2 satellites.
- Launched or upgraded four continental services that are co-developed and validated with African partners, including operational Water Observations from Space and GeoMAD, along with provisional Cropland Extent Map and Fractional Cover.
- Developed over 60 open source analysis tools and made them available on the DE Africa Sandbox.

Africa-based infrastructure and Analysis Ready Data pipelines

The DE Africa platform has now, at the end of 2021, been operating in the AWS Africa (Cape Town) Region for over a year. Three continuously updated analysis ready data pipelines were established and maintained to produce measurements of surface reflectance, surface temperature, and surface backscatter, accessing data from the Landsat, Sentinel-1 and Sentinel-2 satellite series for all of Africa. The satellite data, captured by the European Space Agency / Copernicus Programme and by the United States Geological Survey, are processed to meet CEOS Analysis Ready Data specifications and are optimised for discoverability and use in the Cloud using the latest industry standards.

Additional complementary datasets were added in 2021 to enhance analysis capability within the platform, including monthly and daily rainfall, from the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS), elevation from the Copernicus Digital Elevation Model, the extent of mangroves as mapped by Global Mangrove Watch, and land use and land cover (LULC) datasets from ESA WorldCover 2020 and the Impact Observatory 2020.

These complementary datasets are important because almost all practical applications of Earth observation information also require the use of other geospatial datasets. Furthermore, adoption of existing operational and accepted information services such as Global Mangrove Watch avoids duplication of effort.

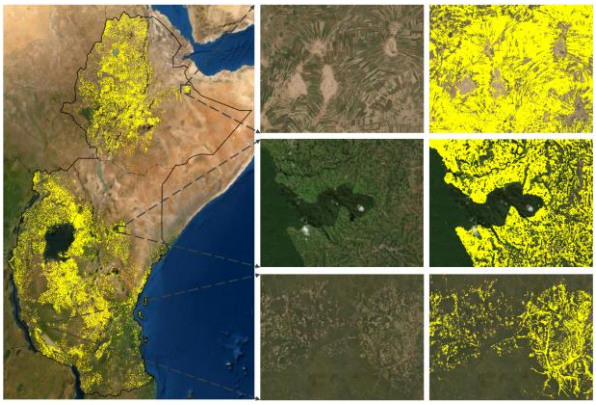
In collaboration with Amazon Web Services Sustainability Data Initiative, DE Africa now provides users free and open access to nearly 3 Petabytes of data.

The infrastructure has been continuously optimized to improve security, stability and user experience. From October 2021, DE Africa started a trial to provide all users free access to double the computational power (up to 4 CPU cores and 32 GB of memory) within the Sandbox.

Continental services

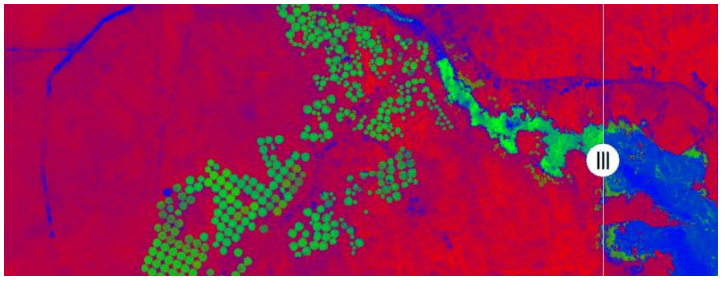
New operational services were released in 2021. DE Africa services are designed to target critical information needs with reliable and ready to use outputs.

- Water Observations from Space (WOfS) provides historical and current information on water presence, absence and where inundation has been observed by satellite. With data back to 1984, WOfS can be used to understand flood risk and climate impact, and to inform policy decisions around water resource management. In 2021 WOfS progressed from a provisional to an operational service.
- Cropland Extent Map shows the presence or absence of crop in 2019 for Eastern, Western, Northern and Sahel regions of Africa, with development of the remaining areas of the continent underway. The service helps users understand the footprint of crop growth across Africa and is expected to underpin models of crop productivity, crop types or watering intensities.



Crop probability in Eastern Africa shown by DE Africa's cropland extent map service

- Fractional Cover provides a measurement of of ground cover directly related to processes of plant growth, agricultural production and land degradation. Fractional cover estimates the proportion of bare earth, green (photosynthetic) vegetation and non-green (dry) vegetation cover at each point (pixel) the Earth's surface, enabling users to understand patterns in the condition and extent of vegetation from 1984.
- GeoMAD condenses satellite images from each year or six month period into a high quality representative view of the ground cover during the time period. Available at 10 meter resolution from 2017 (annually and semi-annually) and 30 meter resolution from 1984 (annually), it is a powerful tool for visualising and analysing year to year and seasonal changes.



Fractional Cover over agricultural areas in Mozambique viewed on the DE Africa Map (maps.digitalearth.africa), highlighting areas of cropping in green. Large areas of red indicate that the ground is often bare in those areas.

Accessible platform, web service and applications

All DE Africa products and services are made available through a range of DE Africa platform interfaces in both English and French, ensuring ease of access by a diverse range of users. Users with low technical expertise can explore and visualise information in the maps interface (maps.digitalearth.africa) whilst highly qualified developers can access live code to create and share their own products.

During 2021, DE Africa significantly expanded the open source catalog of analysis tools (Jupyter notebooks) which enable users to easily build customised analyses using the DE Africa services. There are now more than 60 notebooks readily accessible to the public, covering topics of water resources and flood risk, agriculture and food security, land degradation and coastal erosion, urbanisation and beyond. These tools have been drawn upon by a wide range of users for research, policy and decision making and are informing conservation across Africa.

Access is also possible through third party applications. DE Africa services, including WOfS and GeoMAD, are now made available through the Africa GeoPortal, supported by Esri. Through the GeoPortal, users have access to other free geospatial tools, data and training that will help them work with DE Africa datasets and to use or develop associated apps.

Developing capacity

DE Africa is building ownership, buy-in, and engagement through the implementation of targeted engagement and capacity development initiatives. Our growing community of users are discovering new ways of working together to address Africa's development challenges.

In 2021 DE Africa:

- Established bi-lingual training and user community support, including the DE Africa Learning Platform and 6 week online training course (now completed by over 250 users), DE Africa Help Desk and DE Africa User Guide.
- Hosted weekly online live sessions, with more than 60 sessions held and a maximum of 26 and an average of 15 participants per session.
- Attracted over 1400 registrations in the DE Africa Sandbox, as well as more than 7,000 unique users to the DE Africa Map – two of our key technical platform user interfaces.
- Held over 10 awareness raising sessions involving 160 participants from >20 countries.

Training and support

The DE Africa Help Desk went live and is accessible through both the website and Sandbox at helpdesk.digitalearthafrica.org in both English and French. The Help Desk hosts a growing knowledge base and a community forum that will allow DE Africa users to find information, ask questions, share ideas and help other users.

The DE Africa online Learning Platform was released in 2021. Based on assessments of the needs of end users and Implementing Partners, DE Africa's training materials have been developed to be inclusive of a range of user abilities and languages. Our online 6-week self-directed training program, which supports new users to engage effectively with DE Africa data and products, is now available through the DE Africa Learning Platform in both English and French. The content remains very popular and we now have over 250 Graduates from the training course.

A 'Train the Trainer' module was delivered to key partners, empowering teams from within these organisations to train their audiences in how to use DE Africa services, further broadening reach across Africa.

A DE Africa User Guide was developed to provide comprehensive technical documentation on DE Africa datasets, products and platforms. Instructions for data access and how to use the visualization and analysis tools and a gallery of analysis examples are available in English and French. A growing list of video tutorials are also available through DE Africa YouTube channel.

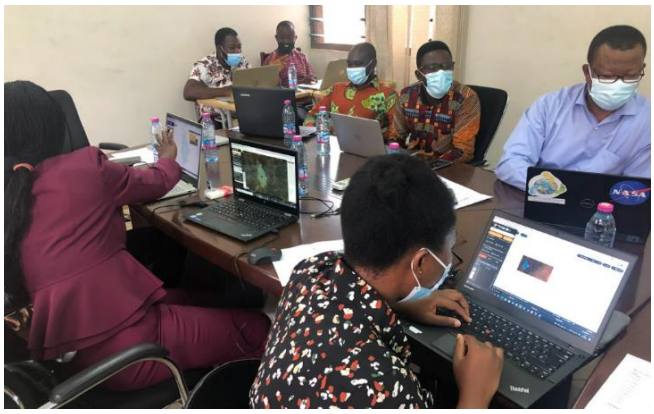
Growing our user community

In 2021, DE Africa achieved over 7000 map users and over 1400 registered users of the technical sandbox. DE Africa's capacity development effort has helped the user community to build new skills and resulted in significant increase in engagement across all platforms, including over 1,400 registrations in the DE Africa Sandbox, as well as more than 7,000 unique users to the DE Africa Map. The continued strong growth in users is indicative of the growing reach, relevance and accessibility of DE Africa, and of increasing impacts through a diverse set of users.

We are continuing to run our increasingly popular weekly 'live sessions', holding our 60th meeting in November. The sessions support user engagement with DE Africa products to address real-world development challenges.

The Establishment Team, Implementation Partners and end users across Africa have hosted, presented and attended a wide range of events throughout 2021. Each one broadened the reach of DE Africa to new audiences.

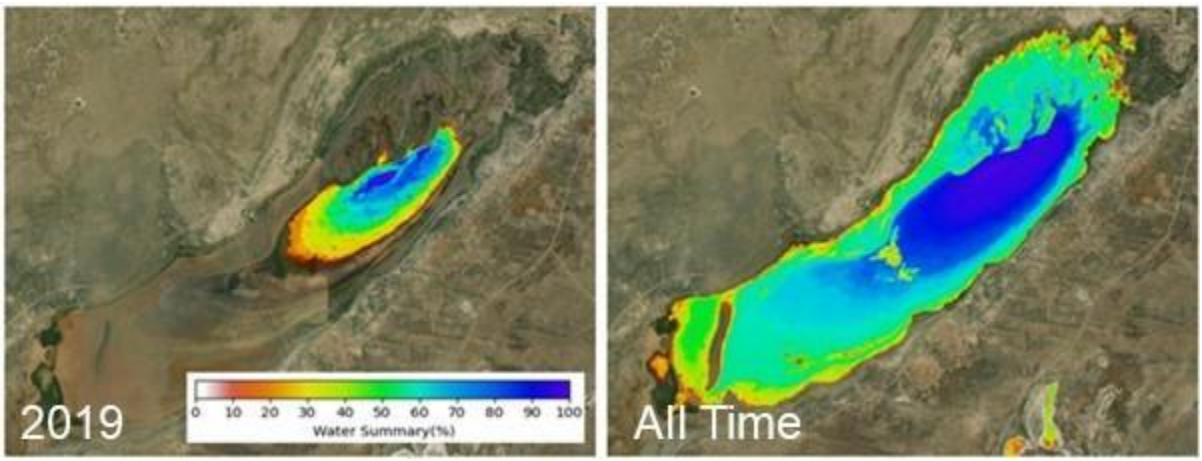
AFRIGIST team at a workshop with staff from Lands Commission in Ghana.



Staff from the University of Energy and Natural Resources, Ghana, training on the DE Africa platform.

Use Case: Water Assessment and Monitoring in the Okavango Delta, Botswana

The Okavango Delta is a dynamic and complex freshwater wetland in Botswana. The Okavango Research Institute (ORI) under the University of Botswana (UB) is mandated to carry out research on the Delta as well as support Okavango Delta Management. Dr Kelebogile Mfundisi from the ORI has been studying Lake Ngami in the Okavango Delta. Lake Ngami is located in the western part of the lower Okavango Delta. It does not naturally drain and therefore becomes an indicator of climate variability of the basin. Dr Kelebogile assessed Lake Ngami using the WOfS service and DE Africa's tools to analyse the changing water extent. The assessment showed the Lake was hit by a historic drought in 2019 and had completely disappeared by the end of 2019. It has only recently been refilling but is yet to recover to earlier levels. Learn more about Dr Kelebogile's research here.



Left: The annual WOfS summary for 2019, showing the diminished extent of Lake Ngami. Right: The 'all-time' WOfS summary showing the long-term extent of Lake Ngami. The colour ramp shows the frequency of water observations; red indicates that water is rarely seen, and deep-blue indicates that water is almost always observed at that point.

Value and impact

In 2021, DE Africa demonstrated the impact of Earth observation data for Africa with exceptional examples from the user community showcasing decision making and changes made due to DE Africa inputs.

In 2021, DE Africa:

- Published 2 economic value studies, estimating EO data could contribute to > $2bn USD a year across multiple sectors.
- Published 14 user driven case studies across countries, demonstrating use of DE Africa products and services to address key issues including climate change, food security, access to water, land degradation and urbanisation, and conservation efforts.
- Accelerated engagement with industry through support for the Africa Earth Observation Challenge and establishment of the DE Africa Innovation Challenge.

Economic value of EO data

The World Economic Forum's report "Unlocking the Potential of Earth Observation to address Africa's critical challenges", published in collaboration with DE Africa, estimates that EO data could contribute over $2 billion (USD) a year from 2024 by contributing towards:

- **A strengthened EO industry,** worth an extra $500 million (USD) in yearly EO sales along with new job opportunities and increased revenue.
- **Boosted agricultural productivity,** worth an extra $900 million (USD) a year, thanks to water savings and productivity gains for farmers.
- **Better regulation of mining activity,** providing a potential savings of at least $900 million (USD) from reduced environmental damage and fiscal evasion.

A follow up study titled, "Broader Perspectives on Digital Earth Africa", demonstrated a further potential socio-economic impact of $540 million (USD) a year from the following sectors:

A further study was commissioned to estimate the value contributed by *Analysis Ready Data*, which we consider to be a vital part of the operations of DE Africa. This report will be released in early 2022.

Industry engagement

Key industry engagement initiatives for 2021:

- Partnered with FrontierSI, COOi Studios and NGIS to undertake an Industry Engagement Study to understand both barriers and opportunities for EO data usage for businesses.
- DE Africa ran an Innovation Challenge, a small-scale incubator program targeted at African businesses. Challenge winners, Big Data Ghana and agriBORA, who use data to improve agribusiness, are now taking part in the 3-month incubator, using DE Africa to help produce open-source data or software to solve problems for users across Africa.
- DE Africa was proud to sponsor the 2021 Africa Earth Observation Challenge, an annual open innovation challenge driving entrepreneurial activity in the African space industry.

Impact stories

Climate action

- How data and community can save Zanzibar's mangroves, Tanzania - see AWS Climate Next documentary " Zanzibar the Essential Mangrove" (premiered 1st Dec 2021; > 1.3m views).

Food security

- Supporting sustainable coffee production, Kenya - 2020 Farming by Satellites Prize winner.
- Data Driven Agriculture - advice on crop poaching and harvesting regimes in support of Kenya's Big Four Agenda on food security.
- Using satellite data to monitor agriculture in Ghana - Big Data Ghana's GAIMS platform.
- Using satellite data to monitor agriculture in Ghana - The GAIMS platform from Big Data Ghana.

Water resources

- Rising Lakes in the Rift Valley in Kenya.
- Monitoring Water Extent Using Earth Observation Data, Ghana.
- Monitoring Chlorophyll in Lake Elmenteita, Kenya.
- Water Assessment and Monitoring in the Lake Ngami, Lower Okavango Delta, Botswana.
- EO for conservation: rehoming giraffes on Lake Baringo, Kenya (video).
- Water quality monitoring to support sustainable agriculture, Kenya.

Land degradation and urbanisation

- Monitoring urbanisation in Gulu City, Uganda.
- Detecting landscape change and unregulated mining, Ghana.
- Burn scarring from fires around Mount Kenya.
- Monitoring Fire Activity in Table Mountain National Park, South Africa.

Use Case: Earth observation for conservation: rehoming giraffes on Lake Baringo, Kenya

Lake Baringo is located in the Great Rift Valley of Kenya within the Ruko Conservancy. In recent years, Baringo has increasingly been subject to flooding which has affected the lives and livelihoods of the local communities. A family of highly endangered Rothschild giraffes became marooned on Longicharo, a peninsular of the lake that had become an island due to the rising water. Using Earth observation data and local knowledge it was determined that the island was steadily shrinking rapidly reducing the space and food available to the giraffes. The giraffes were relocated to the shores of the lake.

This story and the accompanying video and image are produced with thanks to the Global Partnership for Sustainable Development Data.

Foreground - Conservancy Warden James Cheptulel (left) and Ranger Michael Parkei (right). With thanks to GPSDD.

Partnerships

Partnerships are critical to DE Africa and were actively progressed during 2021, including engagement with international organisations, government agencies, regional bodies, the private sector, civil society and development groups.

In 2021, DE Africa:

- Established over 17 technical, strategic and delivery partnerships with national, regional, and international organisations.
- Signed an MOU with the University of Energy and Natural Resources, Ghana, to address environmental and development issues and support capacity building.
- Attained GEO Initiative status and developed a strong brand in EO data that attracts partners in the public and private sector, as well as the diplomatic community.

Partnerships and Aligned Programs

In 2021, DE Africa significantly strengthened its partnerships and continues to build a community of users and partners around Earth observation data and the platform. Key partnerships include:

- Established and sustained the promotion and support for AWS Public Data Program.
- Began a collaboration with the UN-FAO to support country-level land cover mapping and crop classification.
- Continued our cooperation with NASA-SERVIR and explored partnership opportunities with the International Water Management Institute.
- Established an MoU with the University of Energy and Natural Resources, Ghana.

International EO Community

- DE Africa continues to work very closely with the **Group on Earth Observations** (GEO), and in May we were upgraded to **GEO Initiative** status. We are also proud to support GEO's Equity, Inclusion and Diversity working group.
- DE Africa continues to support the **Open Data Cube (ODC) community**, and provided significant support for the ODC conference (22-25th June), featuring Dr Adam Lewis as a keynote speaker and a DE Africa-led Women's Hackathon event.
- DE Africa also continues to actively work with the **Committee on Earth Observation Satellites (CEOS)**, supporting development of Analysis Ready Data.

Public diplomacy

DE Africa links and relationships with key funding partner the Australian Department of Foreign Affairs and Trade have gone from strength to strength over the past quarter, with tailored social media content proving a particular hit. The DE Africa Program has been mentioned by Heads of Mission or Embassies in Ethiopia, South Africa, Egypt, Kenya, Ghana and Nigeria.

Communication

DE Africa has become recognised as an award-winning brand and a leading example of geospatial innovation in Africa. Using a targeted and consistent communications approach across all channels has increased our audience both in Africa and globally.

In 2021, DE Africa:

- Rebranded with a recognisable look and feel - won a Platinum Marcom Award and Gold Muse Creative Award for Communications and Marketing.
- Received coverage via 68 third party communication items that espoused DE Africa as prime provider of EO data, products and services in Africa (see a selection of media here).
- Mentioned in a BBC documentary was an the impact of DE Africa in EO for conservation: rehoming giraffes on Lake Baringo, Kenya – see video story here.
- Featured in the Amazon documentary series Climate Next: The Essential Mangrove - view the series here.
- Refreshed the DE Africa website with 29,902 visitors in 2021.
- Expanded the audience of the social media channels. With 1529 new Twitter followers and 628,100 impressions over 2021; 1700 LinkedIn followers with 80% being new followers in 2021 and 867 mentions from other accounts.

Strategy and brand

In early 2021 we launched a DE Africa brand refresh. The vibrant new brand aims to communicate aspects of the African landscape, culture, people and economy that the program seeks to benefit. Updated logos, factsheets, and postcards can be found here, DE Africa also won international awards: a Platinum Marcom Award and Gold Muse Creative Award for the strategic communications and branding of the program.

Communication highlights

We launched our new DE Africa website to enhance public communication about the benefits of our program and to promote uptake and engagement with our service. The website received 29,000 visitors in 2021.

We have established a Communication Working Group with our Implementing Partners, with meetings held on a monthly basis.

A growing audience

The communications goal for 2021 was to build awareness about DE Africa products and services whilst reaching a wider group of end-users across Africa. In 2021, DE Africa has become recognised as a brand and a leading example of geospatial innovation in Africa. Using a targeted and consistent communications approach across social media and traditional media platforms has increased the audience in Africa as well as globally.

During 2021, the DE Africa Twitter gained 1,529 new followers, doubling the total number from December 2020 to the end of 2021 to a current total of over 3,600. There were also over 628,100 impressions of all the Twitter posts in 2021. The LinkedIn audience also experienced significant growth with over 1,700 followers of the page. Through these platforms, DE Africa posted a range of communication products to showcase events and program milestones through blog posts, virtual events, news articles, tweets, and LinkedIn posts in both English and French, to reach and engage the growing audience.

The DE Africa team is proud of the opportunities offered culminating in a feature in a documentary from AWS launched at the AWS re:Invent conference.

Events

The Digital Earth Africa Establishment Team and a number of the partners attended and presented at events throughout 2021. Towards the end of the year we saw the return of some in-person and hybrid events after a significant hiatus during the COVID-19 pandemic. The events included:

- AWS re:Invent
- COP26
- United Nations World Data Forum 2021
- RCMRD RIC conference
- GEO Week
- AfriGEO Symposium
- AGU 2021
- Data Tamasha
- WASPA Youth and Women Conference
- Women's Open Data Cube Hackathon
- Geospatial World Forum
- Space Futures Forum
- Advances in Geomatics Research conference
- Africa Water Week
- COPERNICEA workshop

The team from CSE attend Africa GIS 2021

Diversity and Inclusion

Diversity and inclusion is a guiding principle of DE Africa's Governance Framework. It commits DE Africa to being an exemplar of diversity and inclusiveness and states that the governance framework will be mindful of gender and geographic diversity in its makeup at all levels.

In 2021, DE Africa:

- Established a Diversity and Inclusion Working Group, which met 6 times in 2021.
- Updated our Diversity and Inclusion Strategy to integrate linguistic diversity.
- Released bilingual training platform, help desk, sandbox environment and user guides.
- Ran a women's hackathon as part of the 2021 Open Data Cube Conference.
- Used its profile and resources to actively promote diversity and inclusion principles, and to showcase women and youth leaders in the Earth observation field.

2021 saw some exciting progress in the implementation of the strategy with workshops and events including diverse opportunities for speakers at all events at which DE Africa was invited. There was also increased emphasis on providing bilingual materials such as training and social media updates to users.

A key focus of work was **establishing a Diversity and Inclusion Collaborative Working Group**. This Working Group is made up of diversity and inclusion focal points from the DE Africa Establishment Team, Implementing Partners, and like-minded partners such as YouthMappers. The Working Group has provided advice on diversity and inclusion issues, and conducted training and awareness-raising sessions.

A further focus has been ensuring that **all DE Africa materials are available in key languages spoken in Africa**, with an initial focus on English and French. Our Diversity and Inclusion Strategy was updated and endorsed by the Governing Board to include greater focus on linguistic diversity. A number of DE Africa materials are already available in French. This includes the majority of the website, learning platform and communication products.

To ensure DE Africa is demonstrating environmental and social impact, the program team **focused on ensuring African women and youth are aware of and able to use the DE Africa platform.** Some of the activities in 2021 included;

- A hackathon for women as part of the 2021 Open Data Cube Conference.
- Implementing Partner CSE, on behalf of the Diversity and Inclusion Collaborative Working Group, delivered two DE Africa introductory sessions (one in French, one in English). These specifically targeted organisations which focus on women, youth and people with disabilities.
- Dr Kenneth Mubea from DE Africa (based in Kenya) presented at four African youth-focussed forums to introduce participants to the DE Africa program.

In 2021 DE Africa also delivered 'training-of-the-trainer' for Implementing Partners. This included a session on diversity and inclusion principles, which aimed to equip trainers to attract and cater to diverse groups in the capacity development activities they will implement.

DE Africa has used its profile and resources to actively promote diversity and inclusion principles, and to showcase women and youth leaders in the Earth Observation field - see Zanzibar case study

below. Dr Kenneth Mubea is a member of the GEO's Equality, Diversity and Inclusion (EDI) group, which provides advice to GEO on improving diversity and inclusion in its work.

As an endorsement of DE Africa's work on diversity and inclusion, the independent rapid review of DE Africa conducted in 2021 found that DE Africa's efforts have led to early changes in knowledge, attitude and behaviour of staff within partner organisations. One stakeholder commented that

"DE Africa has helped me reshape my thinking… I never thought data could be biased… and now I make sure to include everyone. I am more conscious when I am training, conceptualising and executing projects."

Use Case: Data driven community climate action

How data and community can save Zanzibar’s mangroves

Digital Earth Africa is helping Zanzibar fight the effects of climate change and protect the island's precious mangrove habitat. The story is also part of a new documentary series, Climate Next.

Leaders like Massoud Hamad and Raya Ahmada, assistant lecturers at The State University of Zanzibar, access Digital Earth Africa’s data and analysis tools at no cost. They are using the insights from the analyses to inform conservation efforts such as protecting and restoring the mangroves. Local leader such as Iddi Hassan Ali is the chairman of Zanzibar Volunteers for Environmental Conservation (ZAVECO) have been using the data and tools to inform planting and restorations efforts for the mangroves.

Volunteers from ZAVECO survey the site of mangroves in Zanzibar

Securing the future

Securing funding for the next Phase of DE Africa is of the highest importance and implementation of DE Africa's future funding strategy is now underway.

In 2021, DE Africa:

- Completed its sustainment strategy and implementation plan.
- Showcased on the Sustainable Markets Initiative (SMI), a digital hub connecting impactful sustainable projects with the SMI investor community.
- Released an Insight Report: Empowering Country-led Climate Action in Africa.

Future funding strategy

Phase-III will ensure that DE Africa is embedded in the business of government, academia and civil society and will grow the number of DE Africa users and the associated impacts.

A draft report identifying a number of possible funders and how they might be approached has now been completed by DevGlobal, the consulting team supporting DE Africa's sustainment efforts.

Initial Implementation

Initial initiatives supporting the future funding strategy in 2021 include:

To showcase potential future opportunities, Digital Earth Africa held a 'deep dive' on Climate Change, engaging with subject matter experts to discuss the valuable role of Earth observation in climate mitigation, adaptation and reporting. Released an Insight Report: Empowering Country-level led Climate Action in Africa.

DE Africa is featured in the first round of 20 projects showcased by the Sustainable Markets Initiative (SMI), a digital hub connecting impactful sustainable projects with the SMI investor community.

Outlook for 2022

2022 will see a strategic emphasis on embedding operations in Africa, expanding our impact and ensuring sustainment in terms of governance, management and resources.

- **Embed in Africa:** DE Africa must be fully established and operational in Africa by mid-2022. Beyond this time, the new PMO and Implementing Partners will focus on embedding DE Africa products and services into a diverse range of government, industry and NGO activities across Africa.
- **Expand our impact:** With the core infrastructure now fully in place, we need to demonstrate the impact of the services. We need to capture the impacts we are already having and direct effort toward connecting more, and high level, decision makers with information, in particular DE Africa's decision ready services such as WOfS and the Cropland map.
- **Ensure our sustainability:** We need to actively approach funders, implementing our strategy and planning and leveraging the Governing Board and Technical Advisory Committee. We need to attract additional investment, and secure in-kind contributions through our enabling and implementing partnerships. We must also strengthen and leverage relationships with existing funding partners.

To achieve these goals, DE Africa will continue to deliver Earth observation products that meet Africa's development needs and can be applied to development challenges. We will continue capacity development to strengthen African institutions to collaborate and work together to better understand, access and use DE Africa.

The 2022 Annual Plan will be developed with these priorities in mind, and success will be defined by the extent to which we can achieve them. While ambitious, and likely to require ongoing efforts beyond the next 12 months, DE Africa Phase II is committed to delivering this foundation for Phase III and beyond.

Acknowledgements