

Geoengineering activities on the African continent

January 12, 2021



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The [interactive geoengineering map](#), generated by ETC Group and the Heinrich Böll Foundation, documents geoengineering projects and experiments worldwide. An analysis of the data shows that on the African continent the topic „Geoengineering“ has received little attention so far. Nevertheless, about 70 geoengineering projects, 5 % of the total documented projects, were executed on the African continent. The majority of these projects are research projects and have been initiated and funded by public and private donors from North America, Europe and Australia. Very few programs are known to have been launched by African institutions, and very few researchers stationed in Africa participate in geoengineering discussions. In recent years, the number of active geoengineering projects on the African continent has declined. In contrast, interest in African land for geoengineering activities has grown. This article describes the various geoengineering projects on the African continent and their backers. It also looks at proposals from the Global North to use African territories and resources for future large-scale geoengineering projects as well as the risks of such projects and the risks of climate change for the African continent.

Climate change in the African context

Africa is not a significant source of greenhouse gas emissions, but the continent the most vulnerable to the impacts of climate change. Sub-Sahara Africa is producing less than 4% of the global emissions and the per capita greenhouse gas emissions in Sub-Sahara Africa are more than five times lower compared to the emissions in the USA. Although the entire African continent emits less carbon than the U.S. or Japan, Africa is likely to experience the impacts of climate change sooner and more intensely than other regions. Some African regions are already experiencing warming at more than twice the global rate. Despite these severe consequences of the climate crisis on the African continent, African scientists are not well presented in the climate debate, e.g., in the four IPCC assessment reports published between 1990 and 2007, they make up only 3.1 % of the IPCC authors in total.

Marine geoengineering: Tanzania, Morocco and South Africa

The Climate Foundation (TCF), an US-American organization, has made two attempts to establish artificial upwelling projects in Tanzania's coastal areas. The first project was announced for 2017 and planned to use wave-

powered upwelling technology along the shores of Zanzibar. The second project aimed to establish artificial upwelling in Tanzanian marine waters in cooperation with the Medical Care Development's International division. Both project proposals were cancelled, because funding could not be secured.

In 2019, the Australian Ocean Nourishment Foundation Ltd (ONF) announced plans to fertilize the ocean in Moroccan waters and shared, that the addition of nutrients to the ocean was discussed with local fishermen. ONF aims to "*demonstrate to the fishermen of El Jadida in Morocco the techniques of injecting new nutrients into surface waters of the deep oceans*". The project seems to be pending – there have been no further reports on the progress of the project since 2019.

In 2004, the European Iron Fertilization Experiment (EIFEX) was conducted by 53 scientists from seven European countries and South Africa. During the experiment, 13 tons of FeSO_4 have been released into the Southern Atlantic Ocean. The experiment was led by the German Alfred Wegner Institute and financed by the European Union.

Enhanced Weathering in Tanzania, Botswana and South Africa

The Dutch 'The Olivine Foundation' proposed a field trial with olivine in a Tanzanian mining area. Olivine-rich mineral rock was to be crushed and spread onto surrounding rice fields in order to chemically react with and fix atmospheric CO_2 . The project has not been implemented, probably due to a lack of funding.

In Botswana, the Project Minera was conducted at two diamond mines from 2015 to 2019. Both mines, Orapa in north-eastern and Jwaneng in south-central Botswana, are owned by the De Beers Group – the world's largest diamond producer and trader, headquartered in London – and the government of Botswana. Project Minera aimed to examine options to store CO_2 in kimberlite rock, a mine tailing from diamond mining. The project was run in cooperation with scientists from five Canadian and Australian universities and funded by the British Natural Environment Research Council. The research programme covered laboratory trials as well as field trials at mines in Botswana, Canada and South Africa. In South Africa, the Venetia Mine, also owned by the De Beers Group, was chosen for the laboratory-scale and field trials. The Minera research project was completed in 2019.

BECCS in Tanzania, CCUS in South Africa

The Swedish ethanol company SEKAB planned to commission six larger ethanol production facilities in the Rufiji area in Tanzania. SEKAB aimed to capture CO_2 at the plants' smokestacks and to bury the captured CO_2 in a nearby geological formation. The project was never realized, because it was not economically viable.

In 2017, the US-based company LanzaTech signed a Memorandum of Understanding with the South African engineering company Swayana to collaborate on commissioning a commercial-scale CCUS facility, in Mpumalanga province, South Africa. The project planned to capture CO_2 from waste gases produced in the ferroalloy and titanium smelting sectors and convert the captured CO_2 into fuel ethanol. A pilot fermentation unit was shipped to South Africa in 2017/18. The commissioning of the commercial-scale unit was scheduled for 2020, but there are no recent updates – the project activities seem to have ceased.

CCS in Algeria and South Africa

In 2004, a joint venture of BP, Statoil and Sonatrach, announced a Carbon Capture and Storage (CCS) project in Algeria at industrial scale, aiming to inject 17 million tons of CO₂ in the saline Krechba Formation in central Algeria. The CO₂ was captured in the nearby In-Salah-Oil-Field. Of the 17 million tons planned, only 3.8 million tons were injected into the saline formation. In 2011, the project was abandoned, because the storage site was no longer considered safe, after a surface uplift over all three injection wells had been detected. CO₂-leakage from a nearby well was found too. The United States Department of Energy (US-DOE) and the European Union supported the project with funding.

In 2010, the South African Council for Geoscience and the Petroleum Agency of South Africa published the “Atlas on Geological Storage of Carbon Dioxide in South Africa” and identified approximately 150 gigatons of potential storage in deep saline formations, unmineable coal seams and depleted oil and gas reservoirs. SACCCS, the South African Centre Carbon Capture Storage, has been mandated by the South African Department of Energy to explore the technical potential of CCS in South Africa. The SACCCS intends to develop a full-scale CCS deployment beyond 2025. The first CO₂ injections were announced for 2017 and later-on postponed to 2020. At the time being a decision regarding the CCS project site has not yet been taken.

DECIMALS Fund - Research on Solar Radiation Management (SRM)

Since 2011, the Solar Radiation Management Governance Initiative (SRMGI) organized workshops on SRM, e.g., in Senegal and Kenya, with the objective to expand the discussion on SRM around the globe. The SRMGI is coordinated by The Royal Society (UK), Environmental Defence Fund (USA) and The World Academy of Sciences (TWAS, Italy) and financed, inter alia, by Bill Gates' FICER fund. In 2018, SRMGI and TWAS launched the DECIMALS Fund (Developing Country Impacts Modelling Analysis for SRM) to support research on SRM in the Global South. A total grant of US\$ 0,43 million, provided and administered by TWAS, was shared between eight research teams, based in Argentina, Bangladesh, Benin, Indonesia, Iran, Ivory Coast, Jamaica, and South Africa. The program runs for at least two years and research teams are expected to publish their findings by the end of 2020. In South Africa, DECIMALS is hosted by the African Climate and Development Initiative, a university-wide initiative based at the University of Cape Town. The researchers study the impacts of solar radiation management on droughts by modelling climate simulations. In Ivory Coast, the researchers, hosted at the University of Félix Houphouët-Boigny, in Abidjan, study the impacts of SRM on West and Central Africa, by modelling the effects of SRM on temperatures, precipitation and water resources. In Benin, researchers study the impacts of SRM on West African rainfall, temperature and river discharges by modelling injections of aerosols into the atmosphere. The project is hosted at the ICMIPA-UNESCO Chair (International Chair in Mathematical Physics and Applications) and conducted in cooperation with the University of Abomey-Calavi, in Cotonou, Benin.

Biochar

Biochar projects account for more than 50 % of the documented projects on the African continent. The interactive geoengineering map currently documents 37 biochar activities in various African countries. Most of these projects (32) were completed between 2010 and 2015 and conducted within the framework of research projects. With few exceptions, these research projects were financed by institutions in Northern America, Europe and Australia. The only known ongoing research project is led and financed by the Norwegian Geotechnical Institute (NGI). The NGI program combines laboratory work in Norway and field trials abroad, e.g., in Zambia, and aims to investigate the potential of biochar to sequester carbon and to improve soil quality.

The EU-funded Biochar PLUS was conducted from 2014 to 2017. This project initiated the African Biochar Partnership in 2016. The partnership is based in Cape Verde. The website highlights completed biochar projects, e.g., the Biochar for Sustainable Soils (B4SS) project or Agricultural and environmental Benefits from Biochar use in

ACP Countries (BeBi) and gives no information on new developments.

The Biochar Initiative of Nigeria (BIN) was founded in 2015 and organized annual conferences and exchange meetings on biochar in Nigeria until 2018. BIN didn't report on new developments in 2019 & 2020 and its website stopped working.

Proposals for large-scale geoengineering measures from the Global North

Scientists and companies from the Global North propose large areas of African land for geoengineering measures, such as covering almost 20 million square kilometers of desert area with reflective plastic sheets, aiming to reflect more sunlight back to space to lower surface temperatures. Another proposal suggests large-scale Direct Air Capture in combination with Carbon Storage (DACCS) in the Maghreb region of North Africa - thus the region would bear the risks associated with the underground "storage" of CO₂. Further geoengineering proposals such as BECCS or Biochar require large amounts of biomass and land area and could lead to land grabbing and the cultivation of monocultures. Already now, natural resources are being overexploited in many areas to meet the demand for raw materials in the Global North, for example due to the export of charcoal from Somalia. IBI, the International Biochar Initiative stated in its September 2020 Newsletter that "the African region has abundant biomass resources which are available almost throughout the year", proposing the use of crop residues for biochar production. The Soil Atlas of Africa and FAO reports draw a very different picture. Many African agricultural soils are at risk and suffer from severe degradation. Returning sufficient biomass to such soils is an important tool to improve soil structure, e.g., to enhance water storage capacity and nutrient supply. A shortage of biomass through BECCS and Biochar would therefore jeopardise the supply of food on many levels.

Countries in the Global North are also discussing the use of SRM to mitigate climate impacts. SRM measures in the Global North may have unintended consequences in other regions - they could lead to severe droughts in Africa, cut monsoon rains by up to 7 %, affecting the water and food supplies of more than two billion people. Researchers also warn that SRM measures cannot be stopped once they are started - the so-called 'termination effect' would lead to a sudden warming if SRM measures were halted.

Further Information:

Geoengineering Monitor: "***What is geoengineering***", <https://www.geoengineeringmonitor.org/what-is-geoengineering/>

ETC Group and Heinrich Böll Foundation, "***Geoengineering Map***", <https://map.geoengineeringmonitor.org/>