



Forest Health & Artisanal Gold Mining in Ghana

Gold mining is a central component of Ghana’s economy. An increased amount of illegal artisanal mining in recent years has led to accelerated deforestation, destruction of protected areas, and human health issues due to Mercury used during the mining process. This project addresses Sustainable Development Goal (SDG) 15 (Life on Land) by utilizing in-situ and Earth Observation data to analyze forest health patterns due to artisanal gold mining and urbanization in southwestern Ghana.

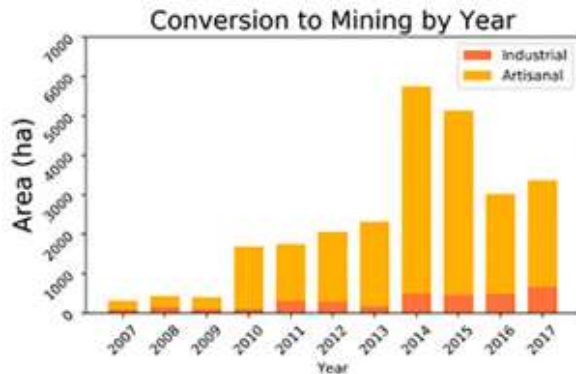


FIGURE 1. LAND CONVERSION TO INDUSTRIAL AND ARTISANAL MINING BY YEAR (2007-2017) USING MAXIMUM DERIVATIVE NDVI. CREDIT: THE LARGE FOOTPRINT OF SMALL-SCALE ARTISANAL GOLD MINING IN GHANA, AUGUST 2021.

OUTPUTS & IMPACT

Creation of a web-based land use analysis method for use by the government of Ghana (SDG 15.1.1 & 15.2.1)

The team developed and published a method to use satellite earth observation data to estimate the transition of vegetation to mining in both large and small scale mines. The tool uses observations from Landsat between 2002 and 2005 to estimate changes in Normalized Differential Vegetation Index, then uses a Machine Learning algorithm to classify areas that have changed from vegetation to water, mines or urban areas. This work has been published in a peer reviewed journal article called “The Large Footprint of Small-scale Artisanal Mining in Ghana,” which is published as a collaboration between the US and Ghanaian collaborators. Additional work is exploring how satellites reveal river water quality impacted due to mining, building on local water sampling efforts. The work is shared via a free online [tool](#) visualizing the study results.

SDG TARGETS

- 15.1.1 - total forest area
- 15.2.1 - sustainable forest management

EARTH OBSERVATION DATA

- Landsat 5 TM
- Landsat 7 ETM+
- Landsat 8 OLI
- Landsat 8 NIR
- TanDEM-X
- SRTM DEM

PROJECT TEAM

- Principal Investigator: Professor Danielle Wood, Director of the Space Enabled Research Group, Massachusetts Institute of Technology
- Co-Investigators: Dr. Temilola Fatoyinbo-Agneh, Research Scientist, NASA Goddard Space Flight Center; Dr. David Lagomasino, Research Scientist, Eastern Carolina University Faculty

KEY PARTNERS

- Omar Seidu, Ghana Statistical Service
- Dr. Kofi Asare, Remote Sensing & Climate Center, Ghana Space Science and Technology Institute



FIGURE 2. NEW FOREST LOSS DUE TO GOLD MINING ACTIVITY AROUND TWO CITIES (KUMASI & ACCRA) BY YEAR (2007-2017). CREDIT: THE LARGE FOOTPRINT OF SMALL-SCALE ARTISANAL GOLD MINING IN GHANA, AUGUST 2021. THE FINDINGS CAN BE EXPLORED ON GOOGLE EARTH ENGINE

Creation of climate vulnerability analysis models for use by the government of Ghana (SDG 15.1.1 & 15.2.1)

The team performed climate analysis to explore how temperature and rainfall are changing. This is accompanied by a national analysis comparing how land use and land cover change between 2015 and 2020. Together these analyses inform how humans are influencing the growth and health of forests in Ghana. The land cover change analysis also uses Landsat imagery and is shared online via Google Earth Engine.

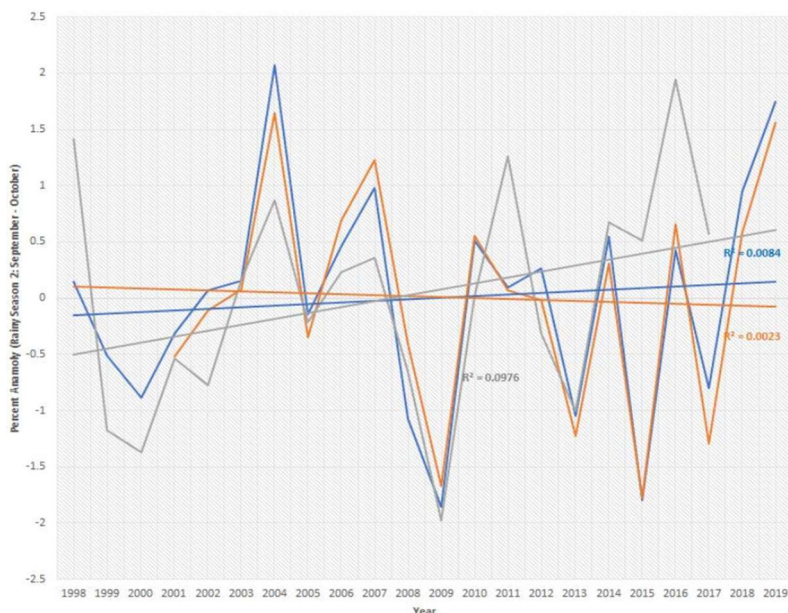


FIGURE 3. RAINFALL ESTIMATES FROM TRMM, GPM, AND A GROUND STATION FOR ONE SEASON IN ACCRA, GHANA ACROSS SEVERAL YEARS (1998-2019). CREDIT: INITIAL ASSESSMENT REPORT FOR "DESIGNING APPLICATIONS TO FOSTER THE HEALTH OF TERRESTRIAL AND WETLAND ECOSYSTEMS IN THE COASTAL ZONE OF WEST AFRICA," SEPTEMBER 2020.

PUBLICATION

- [The Large Footprint of Small-Scale Artisanal Mining in Ghana](#)

FUTURE WORK

- Project outputs to be used in Ghana's SDG 15 reporting
- Study findings and methods published for evaluating national land use and land cover classification
- Further cooperation with local scientists to exchange on technical methods for performing national and regional forest monitoring will take place.