




Iraq's Earth Map: An Innovative Tool for Quickly Conducting Enhanced Land Monitoring and Climate Assessment

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Abstract:

The current paper cites the Food and Agriculture Organization's (FAO) Earth Map application as a major development in data analysis and environmental monitoring in Iraq. The article outlines the urgent environmental issues that the nation faces, such as water scarcity, land degradation, and desertification, which all need efficient monitoring and assessment techniques. Without the need for coding expertise, Earth Map is a web-based geospatial application that gives users quick access to a variety of geospatial data and analytic tools. The software successfully visualizes and analyzes geographic layers by grouping data into over 15 subject areas such as biodiversity, land use, climate, and greenhouse gas emissions. The application makes use of the Google Earth Engine (GEE) API to provide high-resolution visualizations and real-time information, allowing users to do in-depth analysis and dynamically monitor environmental changes. The study highlights the tool's capacity to retrieve time series data and generate zonal statistics, both of which are essential for comprehending the dynamics of environmental parameters over time. Furthermore, Earth Map has tools like the Imagery Compare tool that let users monitor locations using different Earth observation sources in near real time. Although the Earth Map tool has many advantages, the article also points out some of its drawbacks, such as the requirement for certain technical know-how, possible gaps in the data quality, and difficulties in combining information from remote sensing and ground-based data. To optimize the tool's efficacy, the authors advise strengthening data integration, assuring frequent updates, and augmenting user training. To sum up, the Earth Map tool is a revolutionary method for environmental monitoring in Iraq that offers the public, scholars, and policymakers invaluable information. Earth Map seeks to assist evidence-based decision-making, promote sustainable development, and increase climate resilience in the area by making vital data and analysis tools more accessible.

Keywords:

Earth Map, Remote Sensing, Climate Assessment, Geospatial Analysis, Environmental Data.

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1. Introduction

Understanding environmental issues and the effects of climate change in Iraq requires a greater and greater reliance on Earth observation data. Significant issues facing the nation include desertification, lack of water, and land degradation, which all call for careful observation and evaluation. For instance, dust storms in Babylon Governorate exacerbate air quality degradation and particulate matter pollution driven by desertification, land degradation, and climate change (Hilal and Manii, 2021) The accessibility and analysis of Earth observation data have been transformed by developments in cloud computing

and open data policies making geospatial analysis accessible to a wider variety of users (Morales et al., 2023; Gorelick, 2017). Even with their great capacity, products like Google Earth Engine can still be difficult for beginners to use. The demand for climatic and environmental data has increased as a result of this paradigm change in Earth observation, supporting evidence-based policymaking and sustainable development in Iraq (Global Environment Facility, 2022; Green Climatic Fund, 2022). The nation is susceptible to the effects of climate change; thus, developing adaptation and mitigation plans needs access to accurate data. Accessible environmental monitoring technologies are also necessary to track

progress towards the Sustainable Development Goals and ecosystem restoration targets (Nepstad, 2014; United Nations, 2015). In light of this, the Food and Agriculture Organisation of the United Nations (FAO) created Earth Map, a cutting-edge software programme available for free that expands upon Google Earth Engine to offer an intuitive user interface for processing, analyzing, and visualising data related to land and climate. Without requiring any coding knowledge, Earth Map seeks to democratize access to Earth observation data and analysis capabilities for a broad spectrum of users, from the general public to politicians. An extensive description of Earth Map's software architecture, design, features, and datasets is given in this research paper. Additionally, it demonstrates the tool's ability to support land use, land cover, and climate change effect monitoring and assessment, as well as to inform investments connected to climate change and sustainable development initiatives. The tool is presented in a variety of ways in Iraq. The research illustrates the special qualities and potential of this innovative application by contrasting Earth Map with other free land, biodiversity, and climate assessment tools.

2. Iraq Topographical Features

Iraq is a nation located in the central Middle East, within Southwest Asia. It shares borders with Syria and Jordan to the west, Turkey to the north, Iran to the east, and Saudi Arabia and Kuwait to the south. The country's geography is characterized by diverse features that significantly influence its climate, ecology, and human settlement patterns (Central Intelligence Agency, 2023; Johnson, 2019). Below are the main geographical features of Iraq:

1. Desert: The western and southwestern regions of Iraq, along with its borders with Jordan and Saudi Arabia, are dominated by desert terrain. This area forms part of the larger Arabian Desert, which extends across the Arabian Peninsula. These arid zones are characterized by low rainfall, sparse vegetation, and extreme temperatures, making them largely unsuitable for agriculture or dense human habitation (Gaznayee et al., 2024).

2. Tigris-Euphrates Alluvial Plains: Central and southeastern Iraq is home to the fertile Tigris-Euphrates alluvial plains, which are among the most significant geographical features of the

region. These plains are irrigated by the Tigris and Euphrates rivers, which provide essential water resources for agriculture and support the majority of Iraq's population. This region has historically been referred to as the "Cradle of Civilization" due to its role in the development of ancient Mesopotamian societies (FAO, 2015; Gaznayee et al., 2024).

3. Highlands: The northern and northeastern regions of Iraq are marked by highland areas including parts of the Zagros Mountain Range. These highlands form part of an alpine system that stretches from the Balkans through southern Turkey, northern Iraq, Iran, Afghanistan, and into the Himalayas in Pakistan. The elevated terrain influences local climate patterns and provides critical water resources through snowmelt and river systems (Johnson, 2019; Wulder et al., 2019).

4. Marshlands: A significant portion of southern Iraq is covered by extensive marshlands, formed at the confluence of the Tigris and Euphrates rivers as they discharge into the Arabian Gulf. These wetlands are ecologically important, supporting diverse flora and fauna, and have cultural significance for local communities. However, they have faced environmental degradation due to drainage projects and upstream dam construction (United Nations Environment Programme, 2018).

5. Coastline: Iraq has a limited coastline of approximately 58 kilometers along the Arabian Gulf, making it nearly landlocked. This restricted access to maritime resources has implications for trade, fishing, and economic activities (Central Intelligence Agency, 2023).

6. Mountains: Western and northwestern Iraq, particularly along the borders with Iran and Turkey, features the Zagros Mountains and their foothills. These mountainous areas rise abruptly from the surrounding landscape and play a crucial role in shaping regional hydrology and biodiversity (Wulder et al., 2019), as shown in Fig. 2.



Fig. 1: Physical map of Iraq
https://www.worldometers.info/img/maps/iraq_physical_map.gif.

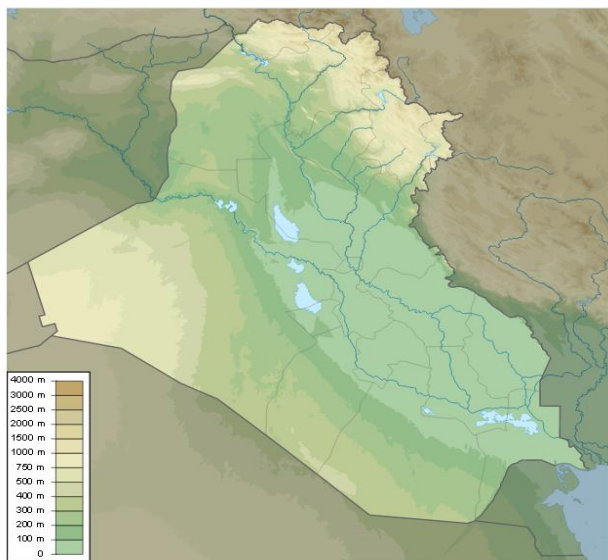


Fig. 2: Digital elevation model map of Iraq
https://upload.wikimedia.org/wikipedia/commons/a/a1/Iraq_physical_map.svg.

3. Material and method

Overview of the platform

Earth Map is a web-based programme consisting of a map with a graphical user interface that makes it simple to display geographic layers and create data instantly. The data on Earth Map are divided into over 15 subject groups covering land use/cover, satellite imagery, soil, vegetation, water, fire, forestry, biodiversity, climate, greenhouse gas emissions, agriculture, hydrology, geophysical, geosocial, and hydrology. Thematic portions or layers particular to a continent or region only become visible after the user has chosen an

area of interest (AOI). Take the FAO Water Productivity through Open-access of Remotely sensed Derived Data (WaPOR; https://wapor.apps.fao.org/home/WAPOR_2/1).

By displaying the layers (maps) along with the legends for each, the tool lets the viewer see a high-resolution background map from Google Maps. More crucially, by creating zonal statistics on the AOIs that complement the visual data on the maps, the user may conduct a more in-depth study. For each of more than 100 layers that are available, the user can quickly access the data description and the data source. Certain layers, like the Global Forest Change Tree Cover Loss map and the Climate Change Initiative (CCI) land cover map from the European Space Agency (ESA), include a time series that makes it possible to emphasize the dynamics of the parameters being studied. Thus, Earth Map provides users with both a spatial (visualizing maps) and a temporal (accessing data time series). Earth Map can now provide real-time statistics on a variety of parameters including temperature, precipitation, burned areas, tree-covered area, aridity index, and more, thanks to GEE. Regardless of the computational capacity of the device, these statistics can be processed on any device in a matter of seconds. A variety of time periods and time frames (yearly, monthly averages, and monthly time series) can be used to aggregate statistics. Information at the global, regional, or custom level can be retrieved because statistical analysis is done on the fly. In order to monitor areas in semi-real time, Earth Map also comes with a GEE program called Imagery Compare (<https://earthmap.org/compare.html>), which enables quick access to several EO sources like Sentinel 1 and 2, Landsat 7-8-9, Moderate Resolution Imaging Spectroradiometer (MODIS), and others. This is especially helpful for keeping an eye on extreme situations or natural disasters. The user can access over 20 global examples of the land before and after significant occurrences (often natural disasters like fires or flooding) as well as over ten data sets derived from various satellite pictures (radar and optical images) through the Imagery Compare tool.

4. Demand for environmental and climatic data at the policy level

The demand for enhanced accessibility and availability of climate and environmental data has grown significantly to support the design and

baseline assessments of projects funded by the Green Climate Fund (GCF) and the Global Environment Facility (GEF). Additionally, there is a critical need for a user-friendly interface within Google Earth Engine (GEE) that facilitates the overlaying of thematic layers (maps) and enables real-time statistical analysis. Such tools are essential for improving the efficiency of environmental monitoring and supporting data-driven decision-making processes (Gorelick et al., 2017; Morales et al., 2023). The GEF and GCF are two key financial mechanisms established to support the implementation of the three Rio Conventions of 1992. These conventions include the United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC), and the Convention on Biological Diversity (CBD), which were adopted during the Rio Earth Summit. The GEF was created in 1992,

just before the Rio Earth Summit, as a financial mechanism to address pressing global environmental challenges (Global Environmental Facility, 2022). Similarly, the GCF was established later to mobilize significant funding for climate adaptation and mitigation efforts in developing countries, aligning with the objectives of the UNFCCC (Green Climate Fund, 2022). To meet these growing demands, innovative tools like Earth Map have been developed to provide advanced land monitoring and climate assessment capabilities. Earth Map integrates planetary-scale geospatial analysis through platforms such as GEE, enabling users to overlay thematic maps and generate on-the-fly statistics (Morales et al., 2023). These advancements play a crucial role in facilitating the design and implementation of projects under the Rio Conventions, ensuring that they are grounded in robust scientific data.

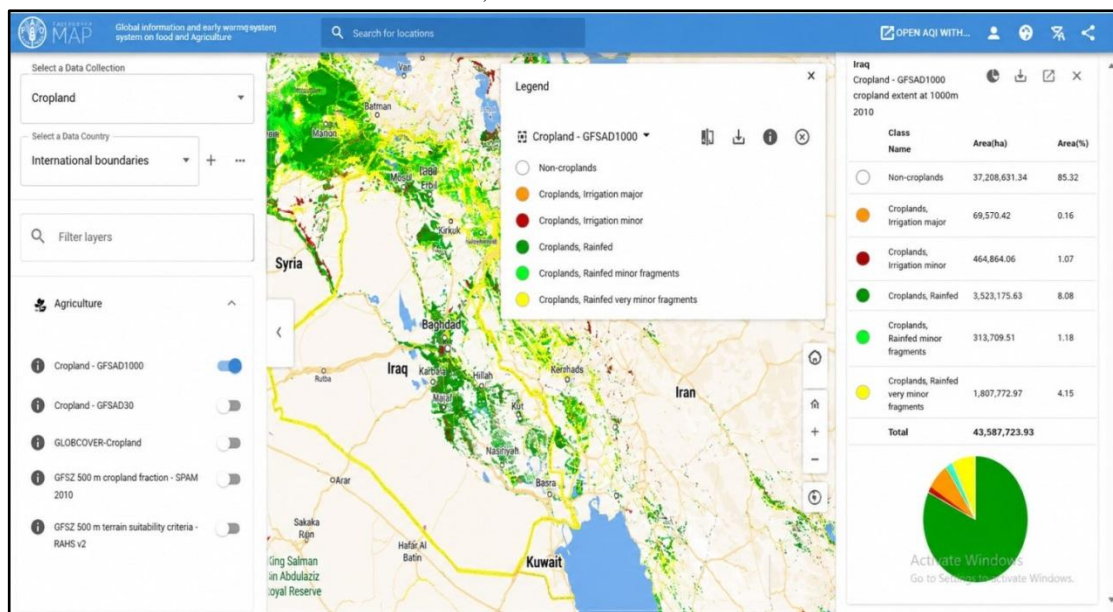


Fig 3. Calculation of Cropland Extent GFSAD1000—in Iraq with Earth Map

5. Cropland Extent in Iraq Using the GFSAD1000 Dataset

The GFSAD1000 dataset provides an estimation of cropland in Iraq through a combination of field-plot observations and remote sensing data. The Global Food Security-Support Analysis Data (GFSAD) initiative, funded by NASA, aims to enhance global food security by delivering high-resolution global cropland data. The GFSAD products are generated from various multi-sensor remote sensing sources, including

MODIS, AVHRR, and Landsat. Specifically, the GFSAD1000 dataset is a five-class product that distinguishes between rainfed and irrigated cropping systems, offering insights into global cropland areas. However, it lacks detailed information on specific crop varieties or their dominance. To analyze cropping intensity, the GFSAD1000 dataset employs time-series remote sensing data, categorizing cropping systems into single, double, triple, and continuous cropping. This methodology is vital for understanding agricultural practices and improving food security

strategies in the region. The nominal 2010 product of the GFSAD1000 dataset was constructed using data from 2007 to 2012 as part of the GFSAD project's efforts to document cropland area and water usage for global food security in the 21st century. Figure(1) Based on the GFSAD1000 dataset, the agricultural extent map for Iraq shows that the total area is about 43,587,723.93 hectares. A total of 37,208,631.34 hectares (85%) are non-cropland regions, and the remaining 15% are different types of cropland. The farmland breakdown consists of:

-The largest area under irrigation is 69,570.42 hectares (0.16%).

A small area of 464,864.06 hectares (1.07%) is under irrigation.

-Small portions of croplands that receive rain: 513,709.51 hectares (1.18%)

-Tiny portions of croplands that are rainfed: 1,807,772.97 hectares (4.15%)

Understanding farming practices and strengthening local food security programs requires an understanding of this comprehensive taxonomy

6. Software architecture

Without the need for coding knowledge, Earth Map is a web-based geospatial application that gives users simple access to geospatial data and analysis tools. It has a graphical user interface and is open source. Earth Map is not a Google Earth Engine (GEE) application, even though it makes use of the GEE API. Along with the program, there is a Help Centre available at (<https://help.earthmap.org/>) that provides users with video lessons, documentation, and user guides to assist them in grasping the tool's different functions. As seen in Fig. 4 (Teluguntla et al., 2014). Earth Map's software architecture is split into two primary parts: a web-based client and a backend built on Firebase. Firebase is a Google "backend as a service" technology that is used to build the backend and manage user authentication, hosting, and data storage. Additionally, Firebase Cloud Functions, a serverless framework, is offered. User interactions inside the Earth Map client initiate these Cloud Functions. When enabled, the Cloud Functions use the GEE JavaScript API to interact with the GEE and deliver the data required for the application's display. Despite using the GEE API, Earth Map is a web-based, freely accessible program with a

graphical user interface; it is not a GEE app. Accessing and analysing geographical data doesn't require any coding ability. You can view Earth Map at earthmap.org. A Help Centre featuring video demonstrations, information, and user manuals may be accessed at <https://help.earthmap.org/>, enabling users to gain a comprehensive understanding of the tool's various capabilities and application mechanisms. As shown in Fig. 3, Earth Map is separated into a web-based client and a Firebase-based backend. As shown in Fig. 3, Earth Map is separated into a web-based client and a Firebase-based backend. Firebase, a Google "backend as a service" platform, serves as the foundation for the Earth Map backend. It manages hosting, user authentication, data storage, and offers a serverless framework known as Firebase Cloud Functions. The Earth Map client invokes Firebase Cloud Functions in response to user interaction. Through the GEE JavaScript API, these functions interface with the GEE and retrieve the data required to display the maps or statistical findings on the Earth Map client. Hosted by Firebase Hosting, the Earth Map client is a JavaScript online application built on Material UI and React. This area of Earth Map is in charge of showing the user the geospatial data, or the layers and statistics. Google Maps API is the primary interface element that it uses.

Three sections comprise the client:

1-AOI/Layers: To begin the analysis, the user can choose an AOI (project, area, continent, etc.) in this section. When an AOI and its corresponding layers are chosen, Earth Map loads the AOI and the layers into the map by retrieving data from the Firebase database. The bounds are then loaded from Firebase storage in the form of a GeoJSON.

2-Map: This is a Google Maps-based component that manages how the user-loaded layers and the AOI boundaries are shown. Additionally, it offers fundamental base maps (satellite or map) and labels (waterbodies, roads, administrative units, etc.). A Google Cloud Function is called with the layer ID when the user chooses a layer, and the function produces a URL that Google Maps uses to load the tiles from GEE. The backend code of Earth Map is accountable for carrying out the essential operations required to configure the layer visualisation.

3-Statistics: After choosing an AOI, the user can click it to perform zonal statistics using one of the available scripts. The user can also utilise the

pixel inspector to view the values of pixels at a specific position if layers are loaded. Using the chosen polygon or location and the ID of the chosen script, the Earth Map client calls a Firebase function, which returns a JSON data structure containing the zonal statistics. Chart.JS is used by the Earth Map client to visualise data.

The user has two options for accessing Earth Map: they can register anonymously or build a user profile by logging in using a Google account or email address. Uploading and saving AOIs (like GeoJSON, KML, or Shapefiles) through the user profile makes it easy for recurring visitors to access. Additionally, Earth Map offers an API <https://earthmap.org/EarthMap-PIESTING.html> that enables other apps to leverage the Earth Map backend capabilities for communication with GEE.

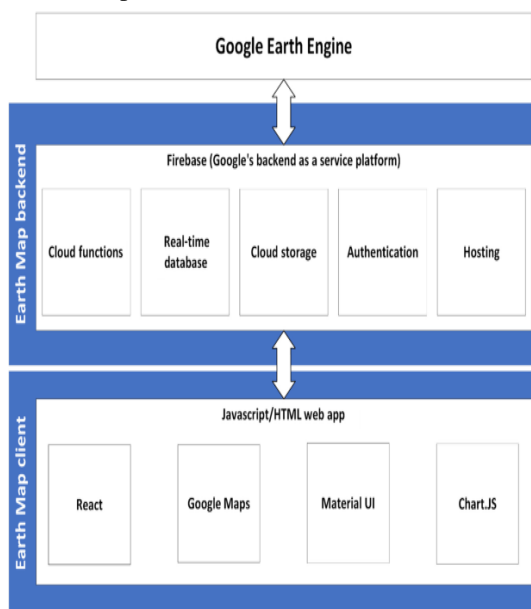


Fig. 4: Software Architecture of Earth Map split into a web-based client and a Firebase-based backend that communicates with GEE.

7. Soil Texture Classifications and Properties in Iraq

Several classifications of soil texture exist, each with its own limitations. The proposed Airborne Soil Particle Density (ASPD) system is a non-destructive method that requires no sample pretreatment and provides insights into soil texture and mineral nutrient values, making it suitable for various applications (Smith et al., 2020). In the study area, understanding the different soil types and their fundamental physicochemical properties is crucial. A soil map obtained from the Earth Map of Iraq (Fig. 5) reveals that soil texture

classifications in the region are based on the FAO soil categorization, identifying eleven distinct types (Figure 3, A and B). The eleven soil texture classes identified in Iraq include clay (Cl), silty clay (SICL), sandy clay (SaCl), clay loam (CILO), silt (SI), silt loam (SILO), sandy loam (SaLO), loam (LO), silt and sand (SISA), sandy clay loam (SaCLO), and loamy sand (LOS) (FAO, 2015).

8. Types of Soil in the Research Area

The study region in Iraq has revealed three primary classes of soil: sandy soil, low activity clay soil (LAC), and high activity clay soil (HAC). Each type exhibits unique characteristics that significantly impact land use, ecological balance, and agricultural practices.

High Activity Clay Soil (HAC):

High-activity clay soils cover a substantial portion of the land and are characterized by high plasticity and swelling potential due to minerals such as montmorillonite. These soils span approximately 35,179,333 hectares, with an activity rating of 1.25 or higher, indicating a strong capacity to retain water and nutrients. While HAC can be very productive, it may present drainage and management challenges, especially during wet seasons (Ramadhika et al., 2018). The tendency of these soils to shrink and swell with moisture changes can complicate construction and agricultural activities. Nevertheless, their ability to store significant amounts of nutrients and organic matter makes them advantageous for crops requiring high nutrient availability (Finch et al., 2014).

Low Activity Clay Soil (LAC):

Low activity clay soils, covering about 673,352 hectares, typically have activity values below 0.75. These soils are characterized by lower plasticity and swelling potential, leading to better drainage compared to HAC, making them easier to manage despite being less fertile. Their mineral composition often includes kaolinite and illite, which results in lower nutrient retention capabilities (Neliti, 2023). While LAC can support various crops, they often require organic matter supplementation to enhance fertility and moisture retention. Their improved drainage qualities make them particularly valuable in agricultural settings where water management is critical (Byjus, 2023).

Sandy Soil:

Sandy soils, which cover approximately 1,605,085 hectares, are recognized for their coarse texture and excellent drainage capabilities. Composed mainly of larger particles, these soils facilitate rapid water movement but generally exhibit limited nutrient retention. Due to their warm, light, and dry characteristics, sandy soils are well-suited for root vegetables and certain cereals, as well as other crops that thrive in well-drained conditions (MasterClass, 2023). However, they often require frequent fertilization and irrigation to support crop growth, as they can quickly dry out and lose nutrients. Incorporating organic matter can enhance their moisture and nutrient retention, thereby improving agricultural productivity (Finch et al., 2014).



Fig .5: IPCC Soil classes in the soil map obtained from the Earth Map of Iraq.

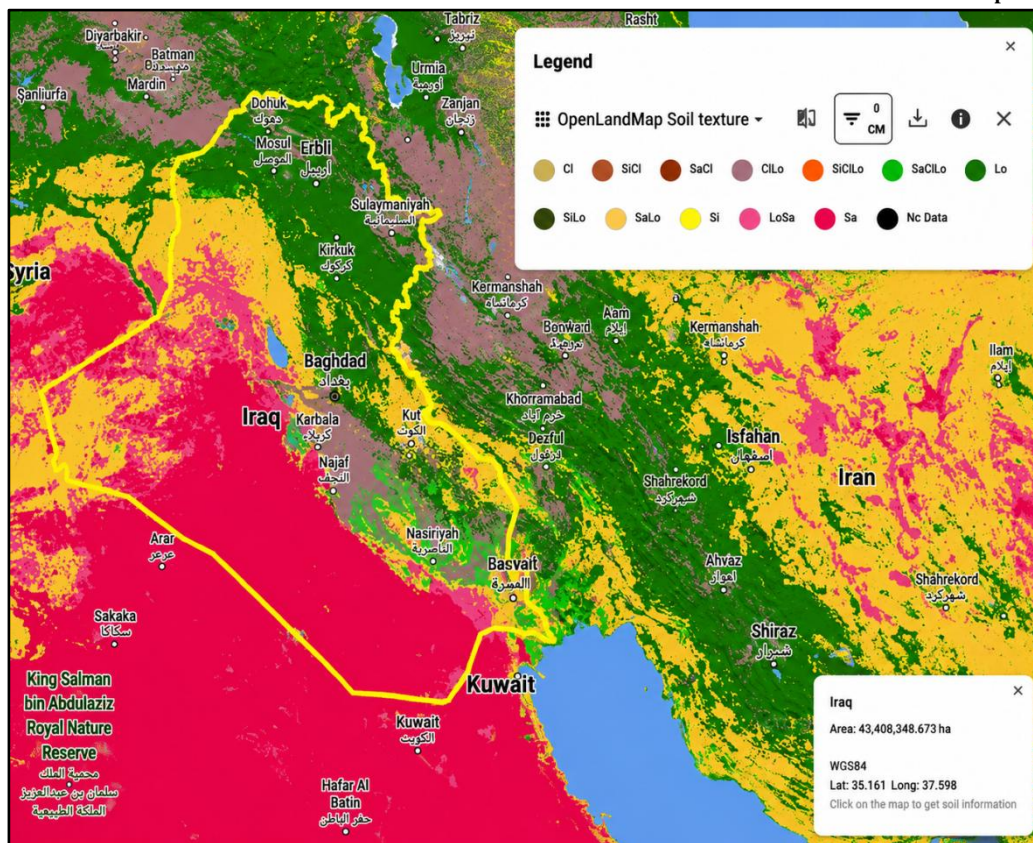


Fig. 6: Iraq open land map.

The IPCC Soil Classes are a classification system used in the context of climate change and carbon accounting. The HWSO (Harmonised World Soil Database) 2.0 is a dataset that provides precise soil information on a global basis. It is used in a variety of environmental assessments, including those based on the Intergovernmental Panel on Climate Change (IPCC) Guidelines (FAO, ISRIC et al., 2020).

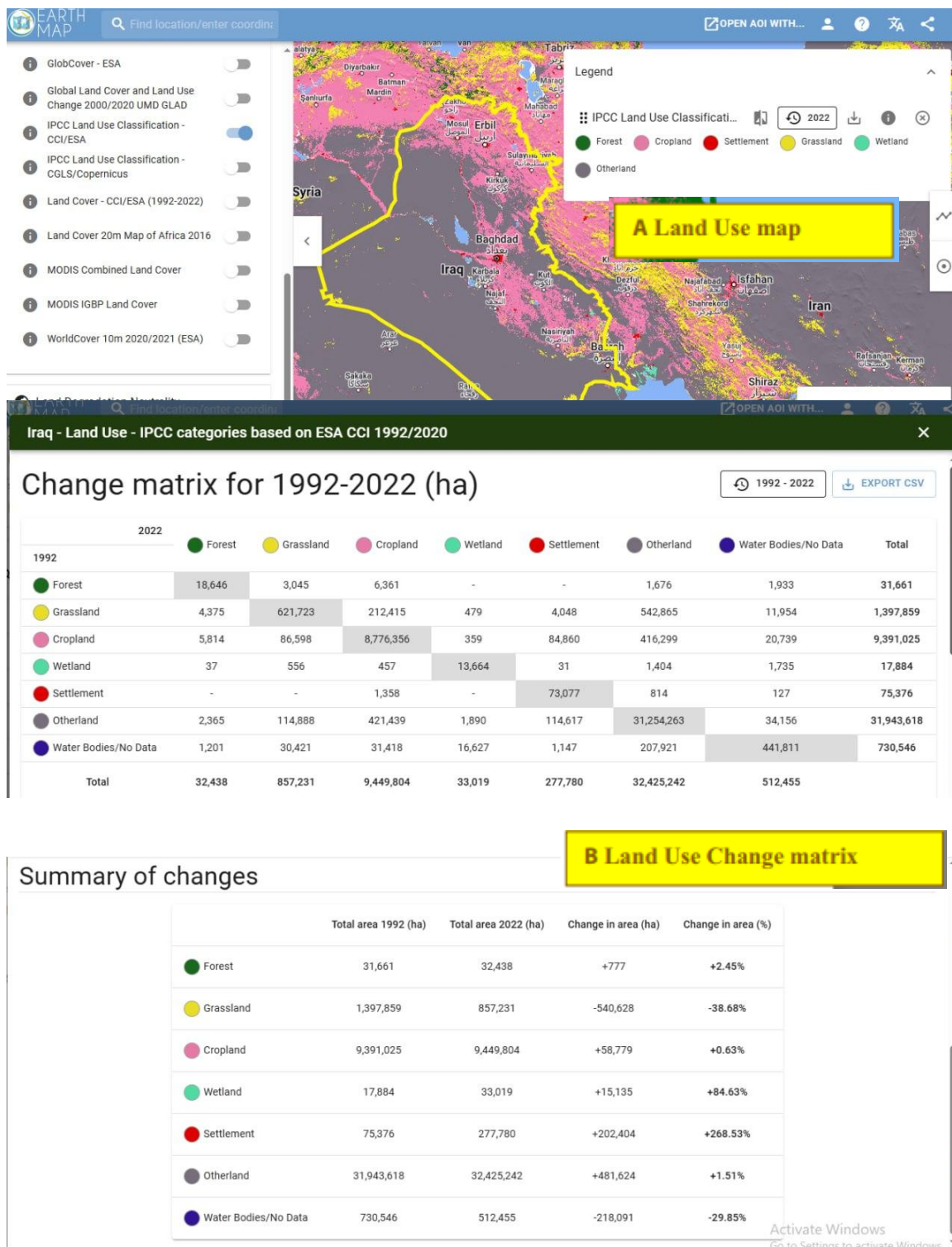


Fig. 7: (A) Land use change map and (B) matrix for Iraq calculated with Earth Map and the CCI dataset from the ESA. The land use change matrix shows land use changes for all IPCC land use categories between 1992 and 2022, with a 2.45% gain in Forest Land.

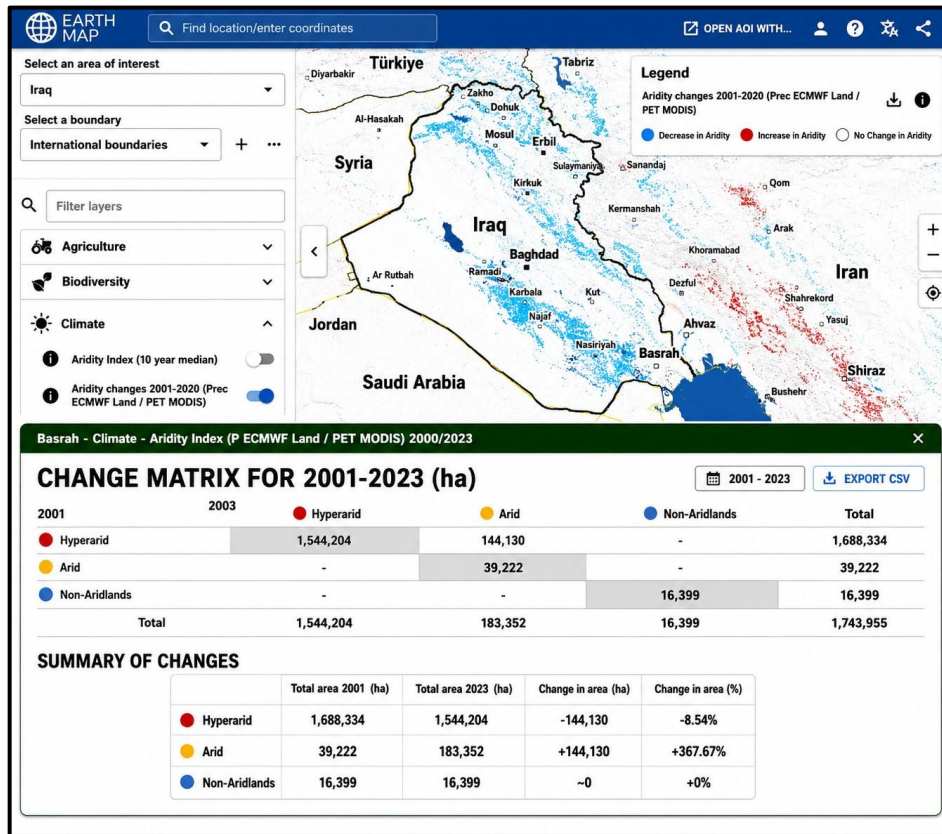


Fig. 8: (A) Aridity changes 2001-2020 (Prec ECMWF Land / PET MODIS) in Iraq (B) Iraq - Climate - Aridity Index (P ECMWF Land / PET MODIS) Change matrix for 2001-2023 (ha) with an 8.54% loss in hyperarid.

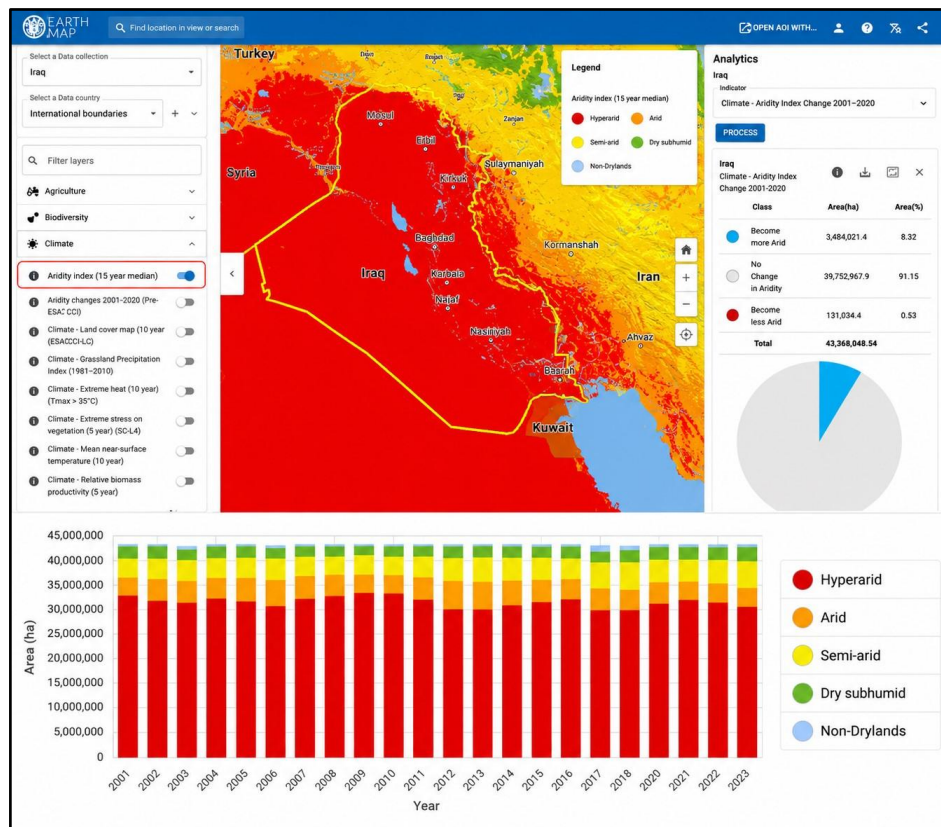


Fig 9: Climate Analytics IRAQ- Aridity Index (10-year median) -Aridity Index Change 2001-2020.

9. Analyzing Aridity Changes in Iraq Insights from the Aridity Index (2001-2020)

The changes in Iraq's Aridity Index (AI) from 2001 to 2020 show a considerable decrease in aridity of 8.2% (Fig. 8), indicating a trend towards somewhat wetter conditions in many places. The AI, which calculates the balance of precipitation and potential evapotranspiration, is critical to understanding the country's environmental concerns, such as climate change, desertification, and water scarcity. Despite the overall decrease in aridity, there has been a 0.03% increase in arid areas, particularly hyper-dry zones, which continue to be vulnerable to climate variability. The geographical distribution of aridity reveals that hyper-arid conditions prevail across Iraq, particularly in the western and southern regions,

which are prone to desertification. The study emphasises the significance of these findings for ecological and agricultural dynamics, as well as the relevance of continuous monitoring and adaptive management solutions to handle climate problems. To summarise, while the decrease in aridity is a welcome achievement, the modest increase in arid areas emphasises the importance of sustained investment in climate analytics and earth observation tools, such as the Earth Map, to support sustainable land and water management practices in Iraq. Understanding aridity dynamics is critical for developing policies that encourage resilience to environmental change

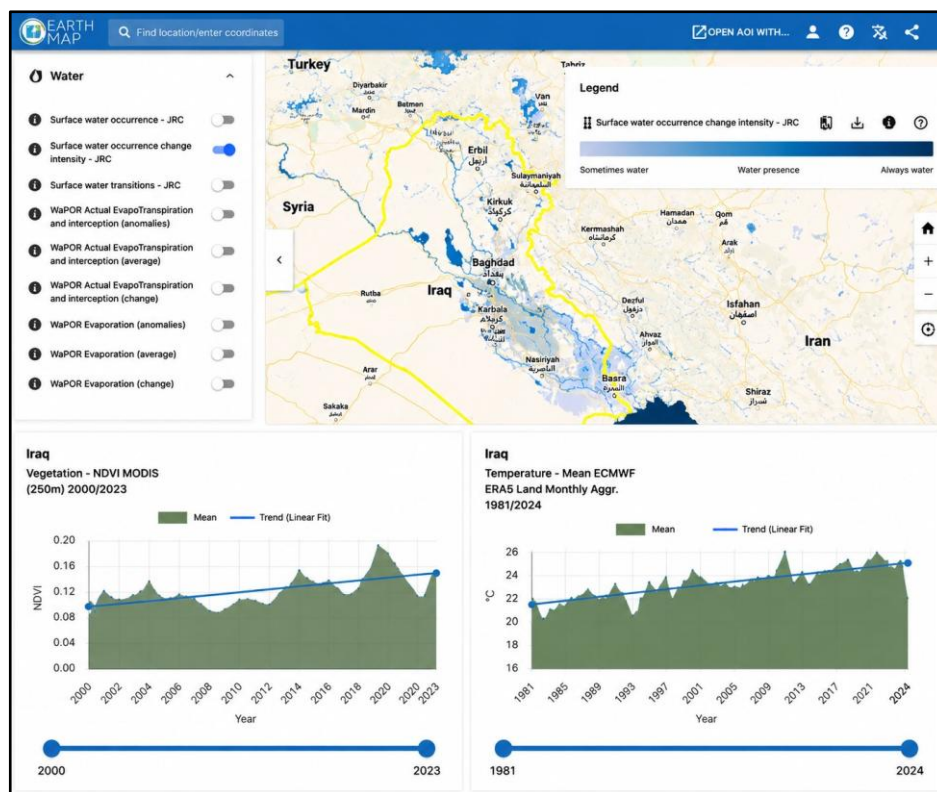


Fig. 10: Surface Water Occurrence Change (JRC), changes in temperature (ERA5), NDVI parameters (Landsat 3m).

10. Conclusions

The field of environmental monitoring and analysis has seen a substantial transformation with the introduction of new technologies and open data rules. This is especially true in areas like Iraq that are facing severe climate issues. The Food and Agriculture Organisation (FAO) created the Earth Map tool, which is a key breakthrough in

democratising access to earth observation data. This essay has examined the features and uses of Earth Map, emphasising how it could improve climate assessment and land monitoring in Iraq.

Earth Map is a big step forward for Iraq's analysis and accessibility of earth observation data. It supports a wide spectrum of users—from

researchers to policymakers—by offering an intuitive interface and an abundance of data, enabling them to interact with important environmental concerns. The real-time monitoring and data visualisation capabilities of the application are highly beneficial in tackling the pressing issues related to resource management and climate change in the area. To maximise the tool's influence going forward, it is imperative to solve the highlighted shortcomings. To improve the Earth Map's usefulness, it will be essential to integrate ground data, make sure that datasets are updated continuously, and improve user support and training. Iraq will need to use tools like Earth Map to guide evidence-based decision-making and promote a deeper knowledge of the intricate environmental processes at play as it works towards sustainable development and climate resilience. In the end, Earth Map's effective deployment can act as a template for other areas dealing with comparable issues, showcasing the ability of data and technology to inform sustainable environmental policy and management.

10. Discussion

The results show that Earth Map provides an extensive platform for environmental data localization and analysis. Through the integration of more than 100 layers of data, such as biodiversity indices, climate factors, and land use, the tool enables users to do comprehensive analyses localized for particular areas of interest. This skill is especially important for Iraq, where problems like land degradation, water scarcity, and desertification require timely and reliable data for resource management and policymaking. The capacity of Earth Map to deliver real-time data and visualisations by localizing the processing power of Google Earth Engine (GEE) is one of its most notable features. With the help of this feature, users can keep an eye on environmental changes in real time, which makes it easier to manage natural resources and deal with climate-related issues. Time series data adds even more value to the research by enabling stakeholders to see patterns and trends over time, which is crucial for comprehending the long-term effects of climate change. The technology does have certain restrictions, though. Despite Earth Map's efforts to be user-friendly, some users may find it difficult to navigate due to the intricacy of the data and the

requirement for some technical know-how, especially if they have no prior experience with remote sensing or data processing. Furthermore, depending too much on data from remote sensing could leave out localized environmental changes that are invisible in satellite photos. Incorporating techniques for gathering data from the ground could improve the tool's efficiency and offer a more thorough grasp of the local environment.

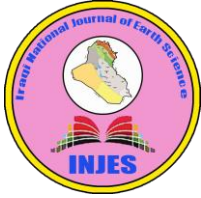
11. Data Availability

Datasets can be found at <https://help.earthmap.org/>

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خريطة الأرض في العراق: أداة مبتكرة لإجراء مراقبة سريعة للأراضي وتقييم المناخ بسرعة

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الملخص:

تشير الورقة البحثية إلى تطبيق خريطة الأرض لمنظمة الأغذية والزراعة (الفاو) باعتباره تطوراً رئيسياً في تحليل البيانات والرصد البيئي في العراق. يتناول البحث القضايا البيئية الملحة التي تواجهها البلاد مثل ندرة المياه وتدهور الأراضي والتصحر، وكلها تحتاج إلى تقنيات مراقبة وتقييم فعالة. وبدون الحاجة إلى خبرة في الترميز، فإن خريطة الأرض Earth Map عبارة عن تطبيق جغرافي مكاني قائم على الويب. يتيح ذلك للمستخدمين الوصول السريع إلى مجموعة متنوعة من البيانات الجغرافية المكانية والأدوات التحليلية. يقوم البرنامج بنجاح بتصوير وتحليل الطبقات الجغرافية من خلال تجميع البيانات في أكثر من 15 مجالاً موضوعياً مثل التنوع البيولوجي واستخدام الأراضي والمناخ وانبعاثات الغازات الدفيئة. يستخدم التطبيق واجهة برمجة تطبيقات Google Earth Engine (GEE) لتوفير تصورات عالية الدقة ومعلومات في الوقت الفعلي، مما يسمح للمستخدمين بإجراء تحليل متعمق ومراقبة التغيرات البيئية بشكل ديناميكي. وتسلط الدراسة الضوء على قدرة الأداة على استخراج بيانات السلاسل الزمنية وتوليد إحصاءات المناطق، وكلاهما ضروري لفهم ديناميكيات المعلومات البيئية مع مرور الوقت. علاوة على ذلك، تحتوي خريطة الأرض على أدوات مثل أداة مقارنة الصور التي تتيح للمستخدمين مراقبة المواقع باستخدام مصادر مراقبة الأرض المختلفة في الوقت الفعلي تقريباً. على الرغم من أن أداة خريطة الأرض تتمتع بالعديد من المزايا، إلا أن المقالة تشير أيضاً إلى بعض عيوبها، مثل الحاجة إلى معرفة فنية معينة، والفجوات المحتملة في جودة البيانات، والصعوبات في الجمع بين المعلومات من الاستشعار عن بعد والبيانات الأرضية. لتحسين فعالية الأداة، ينصح المؤلفون بتعزيز تكامل البيانات، وضمان التحديثات المتكررة، وزيادة تدريب المستخدمين. خلاصة القول، إن أداة خريطة الأرض هي وسيلة ثورية للرصد البيئي في العراق والتي تقدم للجمهور والعلماء وصانعي السياسات معلومات لا تقدر بثمن. تسعى خريطة الأرض إلى المساعدة في اتخاذ القرارات القائمة على الأدلة، وتعزيز التنمية المستدامة وزيادة القدرة على التكيف مع المناخ في المنطقة من خلال تسهيل الوصول إلى البيانات الحيوية وأدوات التحليل.

الكلمات المفتاحية:

خريطة الأرض، الاستشعار عن بعد، المناخ، التقييم، التحليل الجغرافي المكاني، البيانات البيئية.

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