esa

→ **EO4SD – EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT**

Fragility, Conflict and Security | Service Portfolio
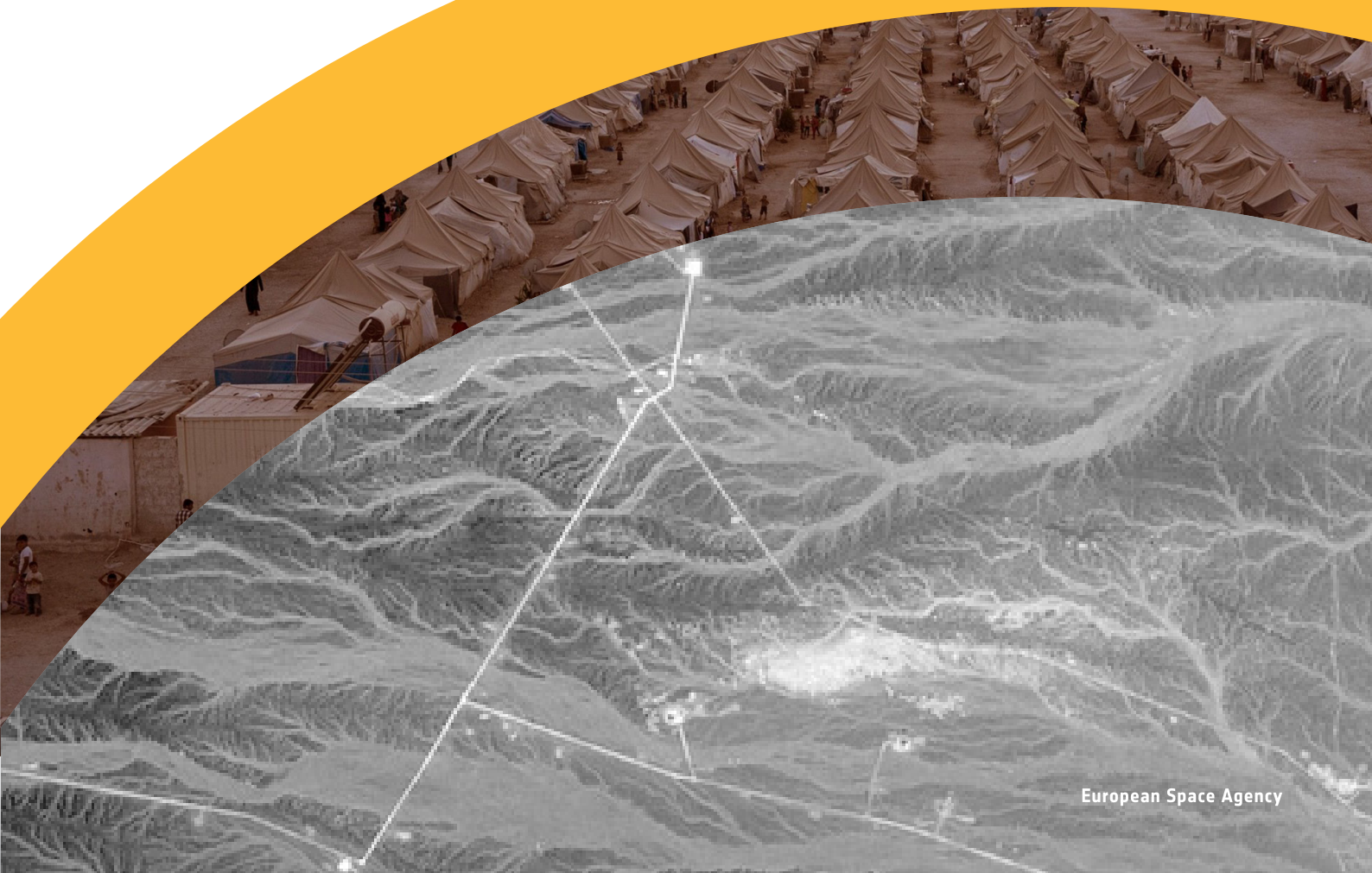
fragility, conflict and security
eo4sd

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In 2017, the number of people displaced from their homes was at its highest since World War II (UNHCR)

FRAGILITY, CONFLICT AND SECURITY

In many parts of the world today, fragility in its many forms is a significant obstacle to environmental and human security. Fragility, conflict, and violence is a critical development challenge and has economic, political, environmental, security and societal dimensions that significantly affect a state's ability to provide security for their citizens and the environment on which they depend.

Fragility is a critical development challenge. Project or program activities in states affected by fragility, conflict, and violence have unique challenges:

› Security concerns limiting access

› A dynamic environment

› Low capacity

Many actors such as NGOs and international financial institutions in the development community aim to address the drivers of conflict and fragility, respond to crises, and develop resilience to climate change, famine, pandemics and other global risks. Finding concrete solutions to the challenges faced is difficult, but companies and organisations specialising in Earth Observation (EO) technology have made considerable progress towards utilising new technology to create cost-effective, flexible and affordable support to fragile states.

This project is a part of the European Space Agency's (ESA) initiative called Earth Observation for Sustainable Development (EO4SD), which aims at increasing the use of information and analysis derived from EO technology in sustainable development efforts. ESA Fragility, Conflict and Security focuses on adressing the information needs of actors working with or within fragile states by capitalizing on new sources of EO data, such as the Copernicus program.

Adressing these needs is important because an increase in the utilisation of EO-based information will provide affordable and effective means to improve environmental and human security in fragile states, even though these contexts are challenging and complex. The following portfolio presents the EO-based services available to organizations working to address challenges in fragile states and to improve the situation for people and the environment.

Definition of fragility:

The Organisation for Economic Co-operation and Development (OECD) defines fragility as "[...] the combination of exposure to risk and insufficient coping capacity of the state, system and/or communities to manage, absorb or mitigate those risks. Fragility can lead to negative outcomes including violence, the breakdown of institutions, displacement, humanitarian crises or other emergencies" (OECD, 2016).

Literature

OECD (2016). States of Fragility 2016: Understanding Violence, OECD Publishing, Paris. Available: http://dx.doi.org/10.1787/9789264267213-en
UNHCR (n.a). Figures at a Glance. Available: https://www.unhcr.org/figures-at-a-glance.html [11.01.19]

SERVICE DESCRIPTION

Detects illegal fishing, mining extraction and deforestation through various appropriate surveillance mechanisms

USE

To improve knowledge of illegal activities and provide support to law enforcement actions

DATA NEEDS

Sentinel-2, SAR imagery and Very High Resolution (VHR) satellite imagery offering sub-meter resolution for precise identification

PRODUCT ACCURACY

30 cm to 1 m for infrastructure, 5 to 10 m for deforestation depending on the sensor

RESOLUTION

From 10 m (Sentinel-2) to 1 m (VHR imagery)

BENEFIT

Will enable stakeholders and policy makers to act against environmental crime

DELIVERY FORMAT

Maps in PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Products should be made available through a secured File Transfer Protocol (FTP) or a web-based portal

FREQUENCY

Initial maps can be produced within a few hours of service activation. Refined analysis can be delivered within 2 weeks

Illegal resource extraction includes illegal fishing, mining extraction and deforestation. Not only are these issues environmentally disastrous, they also negatively affect social and economic development in states that need it the most. Such issues can be difficult to detect and monitor because the areas involved are often small and spread over large distances. This requires the combination of multiple technologies and methods to determine where resources are extracted illegally. Our service providers are joining their expertise and technologies to deliver the following services:

› Detection of illegal fishing through the identification of suspicious ships that are not being tracked by traditional vessel monitoring systems.

› Detection of illegal mining extraction through analysing images and identifying changes after areas of interests have been identified.

› Detection of deforestation by comparing and analysing different types of satellite images.

FOREST COVER CHANGE MAP 2000/2010

REFORESTATION
DEFORESTATION
FOREST
NO FOREST
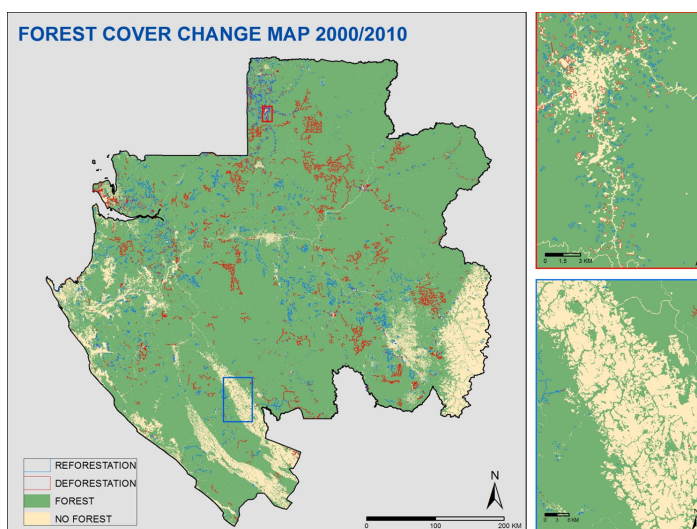
Deforestation map over Gabon (source: SIRS).

→ DETECTING AND MONITORING TRAFFICKING OF ILLEGALLY EXTRACTED NATURAL RESOURCES

Trade of illegal goods is characterised by large volumes of resources being transported from multiple locations to ports and processing facilities around the world, often by maritime shipping. This applies to illegal fishing, mining and logging. Even small volumes of wildlife goods are transported at sea because there is less risk of interception and arrest.

This service tracks shipping vessels by satellite and gives a unique opportunity to record and reveal illegal networks. EO products and satellite-based Automatic Identification Systems (AIS) can help fragile states to monitor and reduce such illegal activities. When AIS and Earth Observation (EO) data are combined, ships with switched-off AIS transmitters can be identified and alarms can be sent to state authorities so that the ship's information and travelling pattern can be inspected.
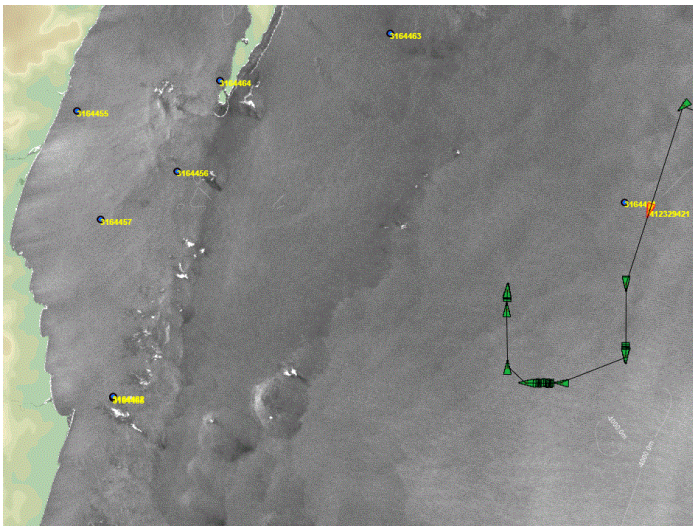
Ship detection using Sentinel-1 radar imagery and AIS vessel tracking along Northeast coast of Madagascar (source: CLS).

SERVICE DESCRIPTION

Maps maritime traffic acquired over long time series, focusing on illegal transport

USE

To identify suspicious ships, routes and destinations and provide sources for marine traffic intelligence and cartography

DATA NEEDS

Sentinel-1 and AIS satellite data

PRODUCT ACCURACY

200 m geometrical accuracy for ship detection with a false alarm rate lower than 10%

RESOLUTION

Depending on needs

BENEFIT

May be used to support regulations, to strengthen patrols or to activate real-time surveillance

DELIVERY FORMAT

Maps in standard output from Geographic Information Systems (GIS) and ship detection reports

FREQUENCY

Can be delivered within one month after the collection of the last satellite data. Quarterly updates should be performed for a sustainable service

SERVICE DESCRIPTION

Identifies land use and land cover through satellite imagery

USE

› Map distribution of specific thematic classes, changes and intensity of changes in space and time, identify spatial and temporal patterns of development and assess structural indicators

› Identify spatial and temporal patterns of development

› Assess structural indicators

› Assess composite indicators (combining EO and statistical data)

DATA NEEDS

Satellite imagery and historical data depending on user needs

PRODUCT ACCURACY

The thematic accuracy should be at least 80%

RESOLUTION

From medium (10 m) to very high (1 m <) resolution imagery according to the level of detail required

BENEFIT

May be used to provide current and historical status reports to create change maps that will support planning activities

DELIVERY FORMAT

Maps publicly or privately shared depending on needs

FREQUENCY

Upon request, possibly at regular intervals

The lack of knowledge of current and past land cover and land use makes it difficult to plan for the future, which is key to addressing fragility. This service analyses generic geospatial data and determines changes and ongoing dynamics. Such knowledge is crucial to identify priority actions, create master plans and plan investments in countries affected by fragility, conflict and a lack of security. Potential areas where this service can be applied include: urban planning and reconstruction, refugee camp detection and monitoring, agriculture land assessment and development, natural resources management, and identification of critical habitats.

Land Use/Land Cover (LULC) mapping provides explicit spatial information regarding what is on the ground. This can include biophysical characteristics such as areas of vegetation, bare soil, hard surfaces, wetlands and water bodies. It can also describe areas in terms of their socio-economic purpose (areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc.). Thematic areas can be defined according to user needs, area of interest, EO data resolution and other contextual parameters. LULC evolves over time and change detection is made possible through satellite imagery.

ESA Climate Change Initiative Land Cover Sentinel-2 Prototype Map of Africa 2016 at 20 meters, Lake Chad overview (http://2016africalandcover20m.esrin.esa.int/).

→ ASSESSMENT OF AGRICULTURE RESOURCES

Over the last decade, food security has become one of the world's greatest challenges. It is ranked second among the 17 Sustainable Development Goals in the United Nations 2030 Agenda. Countries affected by fragility are some of the most vulnerable in relation to food security. To address this challenge effectively, a wide range of timely data and information on food production, agricultural practices and natural resources needs to be available and analysed, and solutions need to be prioritised and designed. This service can contribute by identifying cropped and irrigated areas, monitoring vegetation status over cropped areas, assessing land suitability and identifying crop types.
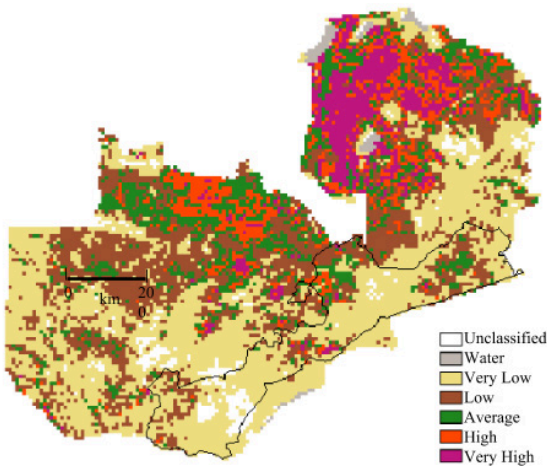
Vegetation Status Maps (Vegetation Productivity Indicator see https://land.copernicus.eu/global/products/vpi) for Zambia (source: SIRS).

SERVICE DESCRIPTION

Assesses different kinds of agricultural resources

USE

To identify cropped areas, irrigated areas and crop types, to monitor vegetation status and map land areas suitable for agricultural practices

DATA NEEDS

Sentinel-2 image time series combined with various types of data depending on user needs

PRODUCT ACCURACY

The thematic accuracy should be at least 80%

RESOLUTION

Resolution depending on the sensor used for satellite imagery (from 0.5 m to 20 m)

BENEFIT

Increases information on agricultural resources that enables better food production assessments and planning

DELIVERY FORMAT

Delivery format can be raster, vector and pdf

FREQUENCY

Frequency can be a 10-day period that is compared to an historical reference

SERVICE DESCRIPTION

Creates time series over water levels/surface areas of large rivers and lakes

USE

To visualise the evolution of water level as well as water presence in the area of interest, creating an input to hydrological modelling

DATA NEEDS

Radar altimetry data (1992 to present, e.g. from Topex/Poseidon to Sentinel-3) complemented by optical and radar imagery (e.g. Sentinel-2 and Sentinel-1)

PRODUCT ACCURACY

10 to 50 cm for water level (depending on river shape and altimetry mission) and 20 m for water presence

RESOLUTION

N/A for water level (not a geographical resolution, but a temporal resolution, ranging from 10 to 30 days) and 10 m for water presence

BENEFIT

Improves the understanding of hydrological processes in large river basins and their influence on climate variability and socio-economic life in fragile states

DELIVERY FORMAT

CSV file for water level and shapefiles or maps for water presence

FREQUENCY

Up to every day for water level operational surveillance

Failure to ensure water security often results in conflict situations and displacement of people, particularly when the water resource is shared between several countries. This service offers assessment of water resources which is essential for sustainable development in general and management of water resources in fragile states in particular. It is crucial to know the availability of drinking water for populations and livestock when planning and operating projects related to irrigation and agriculture. This will aid adaptation to climate change and help mitigate drought.

EO allows you to map the extent and change of water surfaces and the water level, which can be observed by measuring the time it takes for radar pulses to reach the ground and return. Water level is computed as time series over lakes and rivers, at the intersections of the river network with the satellite ground tracks, so-called Virtual Stations.

Many other EO products related to management of water resources can be provided based on the service portfolio developed from past or ongoing ESA initiatives (TIGER, EO4SD Water).
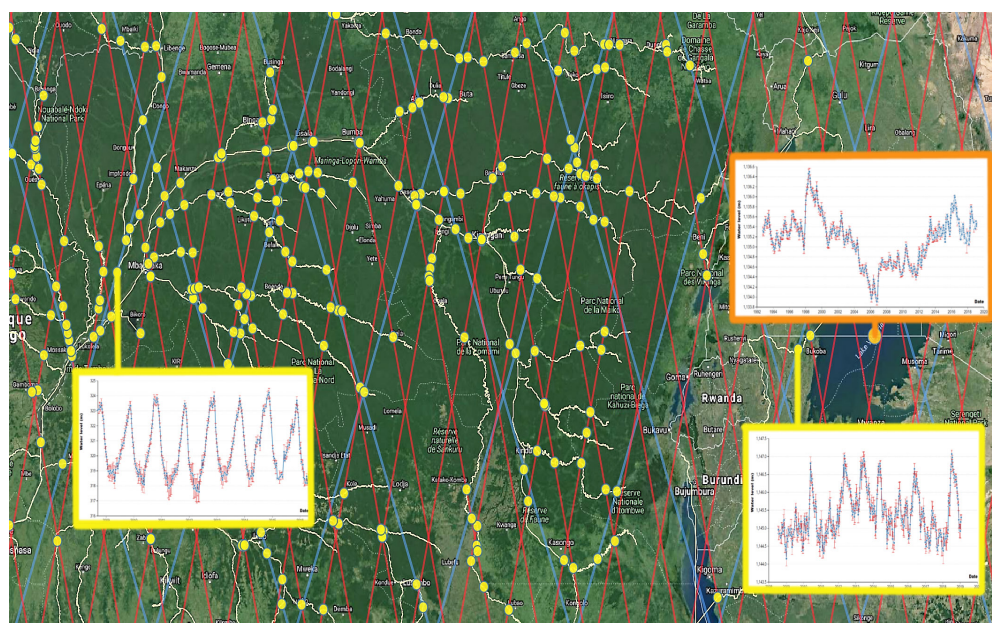
Time series of water level in lake Victoria and Congo river (source: CLS).

In addition to being valuable in itself, a safe and fair democratic process is key to sustainable development. It can help build trust in government authorities and cohesion in the population, thus helping to avoid conflict and instability. Despite this, many elections remain flawed nowadays. Political violence can prevent people from voting according to their opinion and stuffing of ballot boxes may turn political participation into a meaningless exercise.

GIS is a very useful tool to secure credible elections. A custom web map can display various types of information such as administrative boundaries of constituencies, location of poll centres, reported rallies, incidents and detected fires. These elements are essential to adequately monitor the situation and understand the big picture in order to prioritise efforts efficiently, whether before an election takes place, during or even after its implementation.

The information provided by this service can be interactive, with users reporting incidents directly through the UN-ASIGN app and adding pictures to text description. GIS support to election planning and implementation may also include satellite imagery analysis when requested to verify an incident, depending on available sources.

SERVICE DESCRIPTION

Creates elaborative large-scale live maps of countries, displaying information that includes updates on violent events and irregularities

USE

To better document events, coordinate efforts and strengthen surveillance in specific areas

DATA NEEDS

› GIS layers including administrative boundaries, location of poll centres for instance

› Sentinel-1, Pléiades and WorldView images. Other sub-meter sensors on a case by case basis

PRODUCT ACCURACY

5 to 100 m accuracy (manual positioning or automatic geolocation)

RESOLUTION

Sentinel-2 has optical resolutions down to 10 m, WorldView satellites have resolutions down to 31 cm. Pléiades images have resolutions down to 50 cm
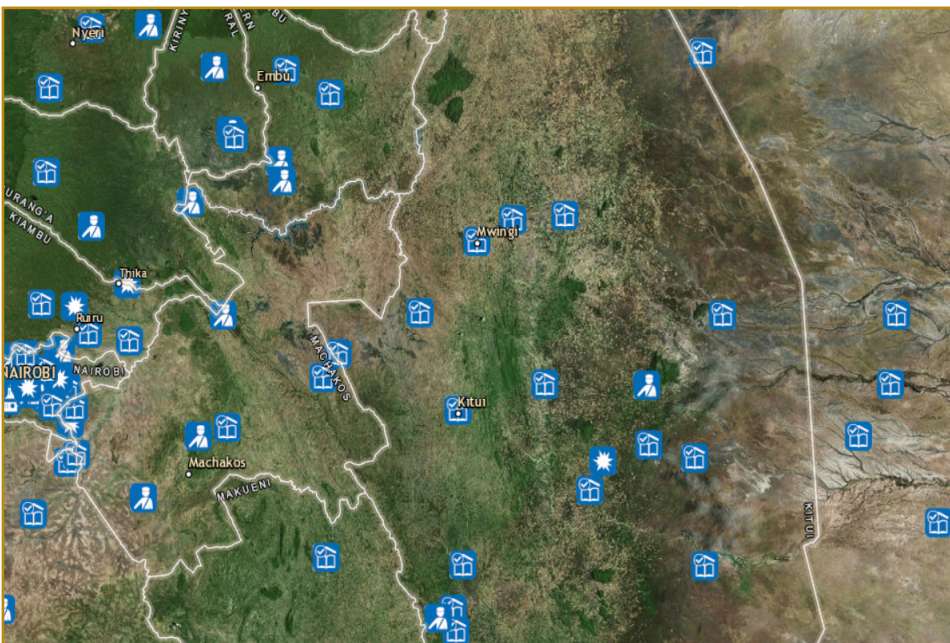
BENEFIT

Provides sources for election monitoring and cartography, and facilitates the prioritisation of efforts by users

DELIVERY FORMAT

Web maps using ArcGIS Online that can be password protected

FREQUENCY

Up to daily, with live updates from users

Extract from a Kenya General elections webmap.

→ DETECTION OF ILLEGAL ACTIVITIES

SERVICE DESCRIPTION

Creates elaborative maps in which various satellites images are analysed to identify proliferation of controlled materials, the production of illicit crops or terrorist camps

USE

To support regulations or to strengthen patrols in given areas for specific periods and to better organise humanitarian and security efforts

DATA NEEDS

Sentinel-2, Pléiades and WorldView images. Other sub-meter sensors on a case by case basis

PRODUCT ACCURACY

30 cm to 10 m depending on the sensor used for satellite imagery

RESOLUTION

Sentinel-2 has optical resolutions down to 10 m, WorldView satellites have resolutions down to 31 cm. Pléiades images have resolutions down to 50 cm

BENEFIT

Allows better detection of illicit crops and other illegal activities upon request

DELIVERY FORMAT

Reports in PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Products should be made available through a secured FTP

FREQUENCY

Can be ordered through the project web portal and delivered within one month after the acquisition of the image, depending on the complexity of the analysis. Products can be privately or publicly shared depending on needs and confidentiality requirements

Illegal activities can have devastating impacts on countries affected by fragility, and might counteract initiatives aimed at sustainable development. This service makes it possible to trace certain illegal activities using EO data including the production of illicit crops, set up of terrorist training camps and proliferation of controlled materials.

This service can also:

› Use near-infrared band to gain knowledge on types of vegetation

› Detect specific vehicle activity and structures

› Use the Normalized Difference Vegetation Index to assess the health of vegetation

› Assess the extent of possible illicit crops

› Detect specific elements such as training structures, people in military formation or unusual vehicle activity

› Identify specific vehicles, weapons, structures, type and amount of damage

Reported location of alleged Khan Shaykhun chemical attack.

→ DETECTION OF CRIMES AGAINST HUMANITY

Crimes against humanity have been widespread in a number of countries in the last few years and fragile states are particularly vulnerable. Such crimes include various acts committed as part of a widespread or systematic attack directed against civilians. Examples may include murder, enslavement or rape.

The investigation of crimes against humanity can prove difficult at times, especially when they take place in dangerous and hard to reach areas, but also because evidence can be tampered with by the perpetrators or their allies. Information from EO can be used to investigate and verify possible crimes against humanity, provided that their effects can be seen from the sky. Satellite images can sometimes be the only means to access evidence long disappeared thanks to the use of archives.

Baseline.

Mass graves detection with satellite imagery.

SERVICE DESCRIPTION

Creates elaborative maps in which various satellites images are analysed to identify crimes against humanity

USE

To support investigations or to strengthen security presence in given areas at specific periods

DATA NEEDS

Pléiades, WorldView images and other sub-meter sensors on a case by case basis

PRODUCT ACCURACY

30 cm to 1 m depending on the sensor used for satellite imagery

RESOLUTION

WorldView satellites have resolutions down to 31 cm. Pléiades images have resolutions down to 50 cm

BENEFIT

Provides sources for the detection of crimes against humanity

DELIVERY FORMAT

Reports in PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Products are made available through a secured FTP

FREQUENCY

Can be ordered through the project web portal and delivered within one month after the acquisition of the image, depending on the complexity of the analysis

SERVICE DESCRIPTION

Allows analysts to digitise camps relatively quickly depicting the location and number (or general trends like growth or reduction) of displaced persons

USE

To create maps depicting the number and location of displaced persons. The types of infrastructures existing in the camps can also be differentiated (administrative building, shelter etc.)

DATA NEEDS

Sentinel-2, Pléiades and WorldView images. Other sub-meter sensors on a case by case basis

PRODUCT ACCURACY

30 cm to 10 m depending on the sensor used for satellite imagery

RESOLUTION

Sentinel-2 has optical resolutions down to 10 m, WorldView satellites have resolutions down to 31 cm. Pléiades images have resolutions down to 50 cm

BENEFIT

Allows humanitarian actors to better coordinate efforts and answer the needs of displaced persons

DELIVERY FORMAT

Maps in PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Products should be made available through a secured FTP

FREQUENCY

Can be ordered through the project web portal and delivered within 2 weeks after the collection of the last satellite image depending on the scale of the analysis

In 2017, approximately 68.5 million people were forcibly displaced, making it the highest number of displaced people since World War II. People being displaced from their home is a clear sign of fragility.

The very precarious condition of many Internally Displaced People (IDP), or refugees, is a hurdle to sustainable development. In order to get a clear overview of the problem it is important to have a clear sense of locations and dynamics at play in each region. This service can obtain such information by using archive imagery that enables analysts to highlight current crises but also draw trends and general movement patterns.
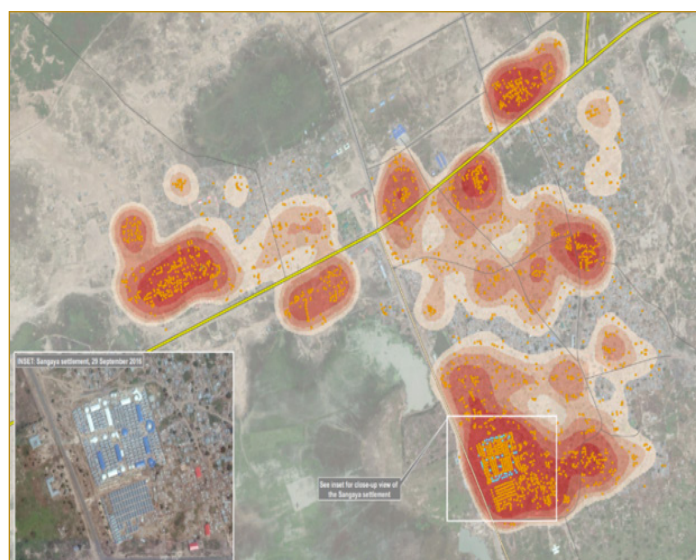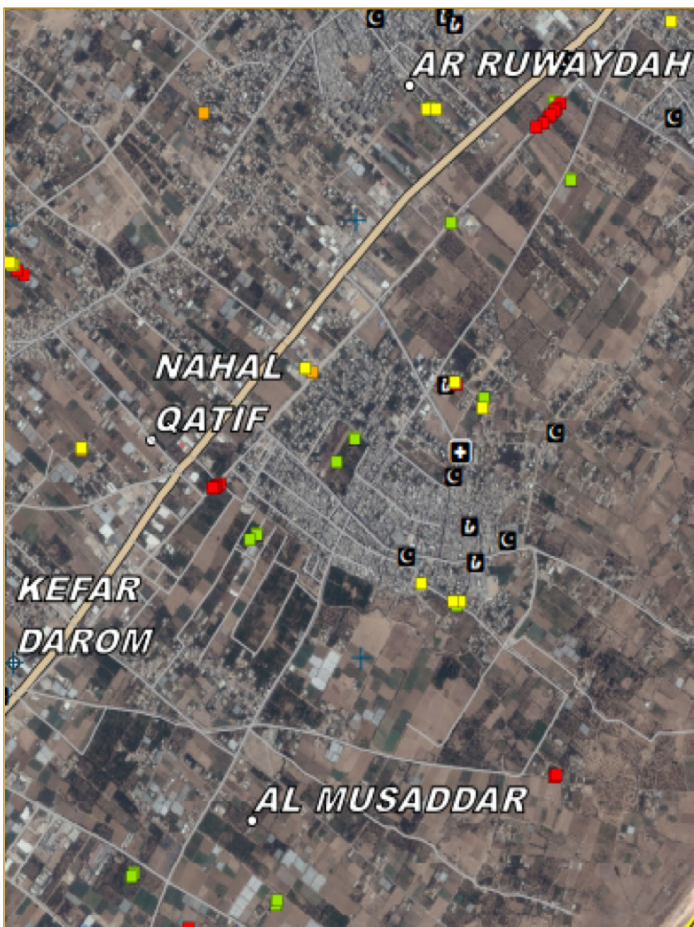

This map illustrates satellite-detected areas of displaced persons shelters in the Sangaya settlement, Borno state, Nigeria, and in the surrounding town of Dikwa on 29 September 2016. © DigitalGlobe, Inc. Source: Department of State, Humanitarian Information Unit, NextView License. Analysis: UNOSAT.

→ ASSESSMENT OF ONSET OF VIOLENCE

Monitoring low-intensity and early stages of violence is a good way to bring about more efficient operations and avoid more severe incidents in the future. Information and analysis based on EO data can be used to identify onsets of violence.

For instance, damaged and looted houses can be recognized using EO. This allows for a quick assessment of the situation in locations that can otherwise be too far away or too dangerous to reach. EO technologies can also be used to directly detect some types of violent events soon after they occurred, and sometimes even when there is no report of the incident thanks to fire detection for example. Early damage and security assessments can be produced as part of this service.

This map extract illustrates satellite-detected damage and destruction between 6 and 12 July 2014 in Nahal Qatif and Al Musaddar, Gaza, due to violence in the area. Image source: © Airbus DS, 2014. Analysis: UNOSAT.

SERVICE DESCRIPTION

Makes it possible to identify several phases of violence before it escalates progressively and regions end up torn in conflict

USE

To create maps in which various satellite images are analysed to assess damages or signs of violence

DATA NEEDS

Pléiades and WorldView images. Other sub-meter sensors on a case by case basis

PRODUCT ACCURACY

30 cm to 1 m depending on the sensor used for satellite imagery

RESOLUTION

WorldView satellites have resolutions down to 31 cm and Pléiades images have resolutions down to 50 cm

BENEFIT

Allows analysts to notify relevant actors of the onset of violence. Aims to create an efficient warning system

DELIVERY FORMAT

Maps in PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Products should be made available through a secured FTP

FREQUENCY

Web-based ordering system through the project web portal with direct notification. Can be updated every day in times of crises. Refined analysis can be delivered within 2 weeks after the onset of violence depending on the complexity of the case at hand

Recent and historical conflicts present risks to human populations in areas contaminated by explosive remnants of war, which includes mines and unexploded ordnance (UXO). Clearance is time-consuming and costly, but EO data and a risk-based approach can support clearance planning, focus it on high-risk areas, and reduce costs to clear land for communities. The process starts with a pre-technical survey and is followed up by clearance operations support.

The first step is to characterize the UXO hazard. Satellite image change detection can identify disturbances that may indicate UXO contamination, such as craters, damaged infrastructure, or building rubble. Risk assessment integrates data such as population density, livelihoods, and land use in hazardous areas.
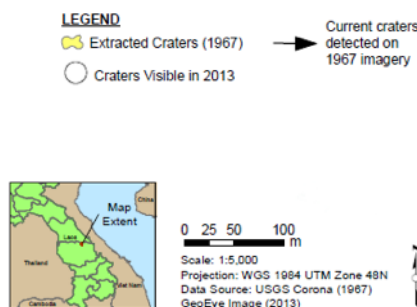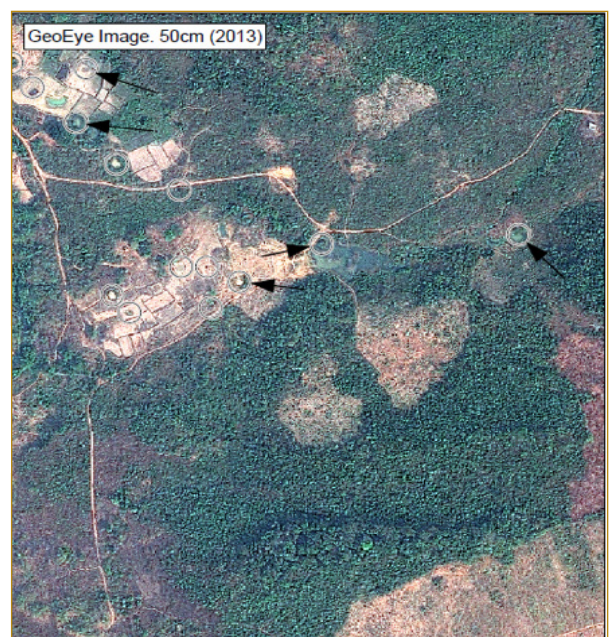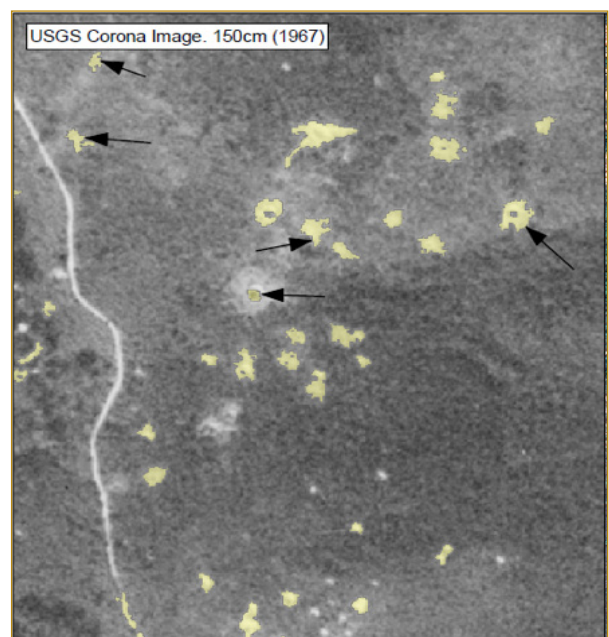

Example of crater extraction from Corona imagery in Laos.

→ DAMAGE CHARACTERISATION AND RECONSTRUCTION PLANNING SUPPORT

Conflict or external shocks such as natural disasters can be direct causes of fragility and violence. In any case, the fragility of a state causes a lack of reliable information on the existing infrastructure and an increased level of social vulnerability to any kind of disaster. Therefore, early characterisation of damages is a prerequisite for relief efforts and reconstruction planning support.

Damage characterisation following a conflict, and/or natural or manmade disasters requires the establishment of a reference prior to the event and a post-event situation to identify the areas that were affected.
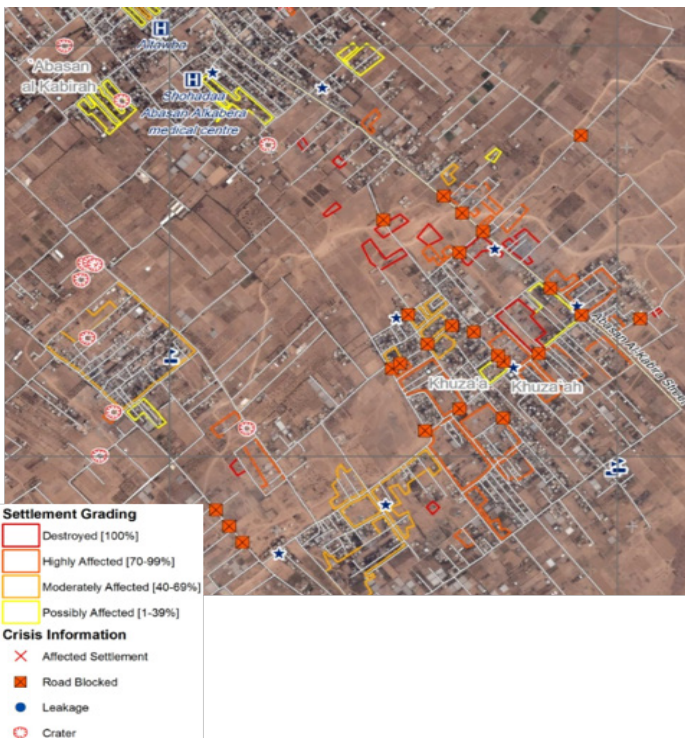
The picture shows an extract of a damage assessment map produced by SIRS for the Copernicus Emergency Management Service – Rapid Mapping. This activation over the Gaza strip was related to a military intervention by the Israeli army during Summer 2014 and was classified as sensitive and provided to end users (UN bodies) only through a secure FTP server without any publication on the service website. It provides damage assessment on buildings and roads and additional crisis information such as craters caused by bomb impact.

SERVICE DESCRIPTION

Creates reference and damage assessment maps pre-and post-conflict

USE

To identify transport infrastructure necessary for reconstruction and assess the degree of damages in order to prioritise and/or adapt reconstruction efforts

DATA NEEDS

VHR satellite imagery. Pleaides, WorldView or equivalent images

PRODUCT ACCURACY

30 cm to 1 m depending on the sensor used for satellite imagery

RESOLUTION

WorldView satellites has resolutions down to 31 cm and Pléiades images has resolutions down to 50 cm

BENEFIT

The identification and grading of the damages inflicted to infrastructure is useful to determine the extent and severity of the infrastructure destruction to start identifying priorities and plan for reconstruction

DELIVERY FORMAT

Maps in selectable PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Data publicly or privately shared depending on needs

FREQUENCY

Initial map can be produced within few hours of service activation. Refined analysis delivered within 2 weeks

SERVICE DESCRIPTION

Supports the establishment of property rights in several regions of the world

USE

To support the establishment of a basis for a land parcel information system and resolving uncertainties regarding property rights. Can also be used to distinguish between different land uses

DATA NEEDS

Pléiades, WorldView or equivalent images. Sentinel-2 could also be relevant for more generic land cover/use information

PRODUCT ACCURACY

30 cm to 1 m depending on the sensor used for satellite imagery

RESOLUTION

Sentinel-2 has optical resolutions down to 10m, WorldView satellites have resolutions down to 31 cm. Pléiades images have resolutions down to 50 cm. VHR imagery will be required most of the time due to the specifications of the product

BENEFIT

Makes it easier to manage land information systems and enables constructive discussions regarding land use and parcel distribution

DELIVERY FORMAT

Maps in selectable PDF format including satellite images, their analysis and a legend. Shapefiles can also be shared. Data publicly or privately shared depending on needs

FREQUENCY

Initial map can be produced within few hours of service activation. Refined analysis delivered within 2 weeks

Establishing and securing property rights can influence economic development and might be key to alleviate poverty. The lack of clarity regarding property rights is also a potential cause of conflict and fragility. An example of this would be the lack of agreement regarding land use between crop farmers and nomadic cattle and sheep breeders in the Sahel which regularly causes conflicts (18 people died last year in Niger).

Establishing property rights can often be very difficult in the absence of any cadastral information or if there are several land registration systems (e.g. in Madagascar where the former colonial system brought by France coexists with the traditional system, resulting in different rights on the same land parcel). This service can support the establishment of property rights by providing up to date information that can be used to form a basis for discussions on property distribution and land information systems.


Detailed land parcel physical boundaries and land cover information including building footprints for Bilma, Niger.

Built-up Area
- Tower
- Building
- Courtyard

Structure & Utilities
- Dish Aerial
- Wall

Transportation
- Local Road
- Cart Track

Land Cover
- Tree
- Bare Ground
- Brush
- Forest

→ INFRASTRUCTURE CONSTRUCTION MONITORING

Many regions around the world are difficult to access due to the lack of infrastructure, high level of conflicts and/or terrorist activities reported. Such situations make it almost impossible to monitor infrastructure construction related to transportation network, water resource management or public buildings. Using satellite images is a cost-effective way to ensure that the money distributed for building strategic infrastructure is invested wisely in fragile states.
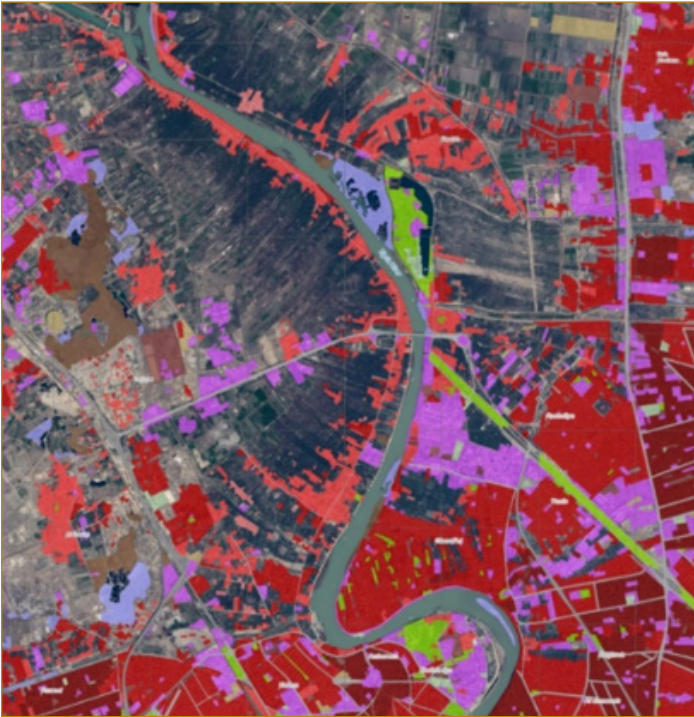
Settlements - Urban Atlas classification

- 11100: Continuous urban fabric (S.L. : > 80%)
- 11210: Discontinuous dense urban fabric (S.L. : 50% - 80%)
- 11220: Discontinuous medium density urban fabric (S.L. : 30% - 50%)
- 11230: Discontinuous low density urban fabric (S.L. : 10% - 30%)
- 11300: Isolated structures
- 12100: Industrial, commercial, public, military and private units
- 12210: Fast transit roads and associated land
- 12220: Other roads and associated land
- 12230: Railways and associated land
- 13100: Mineral extraction and dump sites
- 13300: Construction sites
- 13400: Land without current use
- 14100: Green urban areas
- 14200: Sports and leisure facilities

Land Use / Land Cover

- Wetland

The picture is an example of VHR mapping results of urban areas (level 4 classification) in the northeast of Baghdad, Iraq to support reconstruction work and infrastructure planning (source: SIRS).

SERVICE DESCRIPTION

Monitors infrastructure construction using satellite imagery

USE

To monitor the work progress on infrastructure construction or the extent of urban settlement and survey existing critical infrastructure

DATA NEEDS

Sentinel-1 and 2

PRODUCT ACCURACY

The thematic accuracy should be at least 80%

RESOLUTION

Medium to very high resolution. Due to the specifications of the product, VHR imagery will be required most of the time

BENEFIT

Makes it easier and more cost-effective to make investments to build strategic infrastructure

DELIVERY FORMAT

Reference and change detection maps with associated geo-data. Data publicly or privately shared depending on needs

FREQUENCY

Regular intervals

→ POLLUTION AND CONTAMINATED SITES ASSESSMENT

Conflict, industrial operations, and poor land management may cause pollution and contamination of water, soils, and biological organisms. This service is designed to support approaches for management and prioritisation of interventions to reduce the human health impacts caused by these issues. The approaches include Site Selection and Prioritisation, Conceptual Site Models, and Site Characterisation. Certain incidents may require a rapid response to detect, map, and characterise pollution (e.g. sabotage of oil and gas fields or industrial accidents), which is where this service can play a key role.

The first approach (Site Selection and Prioritisation) aims to identify sites with high likelihood of contamination hazards, while the second approach (Conceptual Site Models) is used to identify human and ecological receptors and to identify exposure pathways. The third approach (Site Characterisation) focuses on producing detailed characterisation of sites by creating elaborate maps using EO data and historical air photos. Furthermore, integration of EO derived information into geospatial modelling supports risk assessments and decision making.


FIGURE 3-2   2014/2015 SOIL AND SEDIMENT SAMPLING RESULTS - Z1 AREA
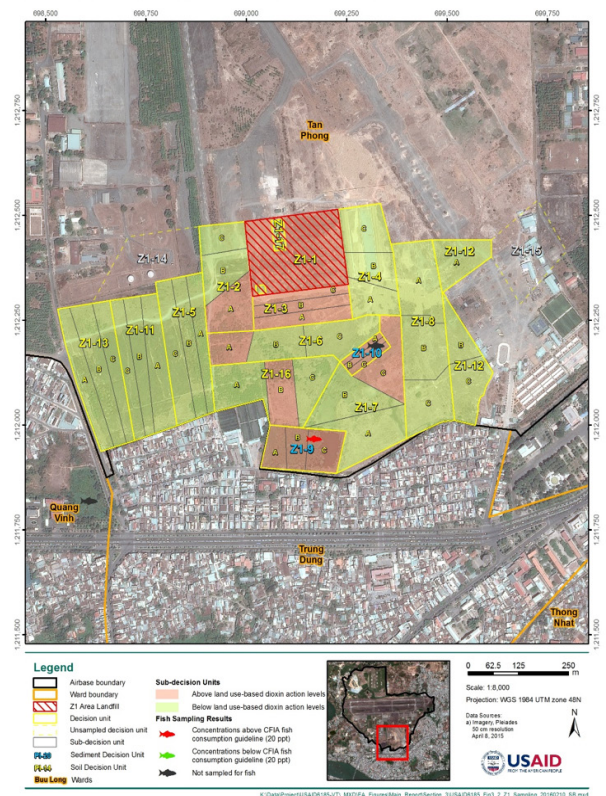
Environmental assessment of dioxin contamination at Bien Hoa Airbase, Vietnam.

→ INFECTIOUS DISEASES

Diseases that severely affect humans, animals, and plants can be significant obstacles to sustainable development and might exacerbate existing vulnerabilities in communities. They are affected by diseases determined by interconnected environmental variables that can affect incidence, transmission, and outbreak.

This service combines EO and image processing to develop maps of disease transmission risk. Information derived from EO can support health interventions for infectious diseases, including risk assessment, surveillance, and early detection. Multiple environmental and climatic indicators for disease can be developed. The EO4SD services support experts that are seeking systematic datasets with improved spatial resolution or temporal frequency to improve models.
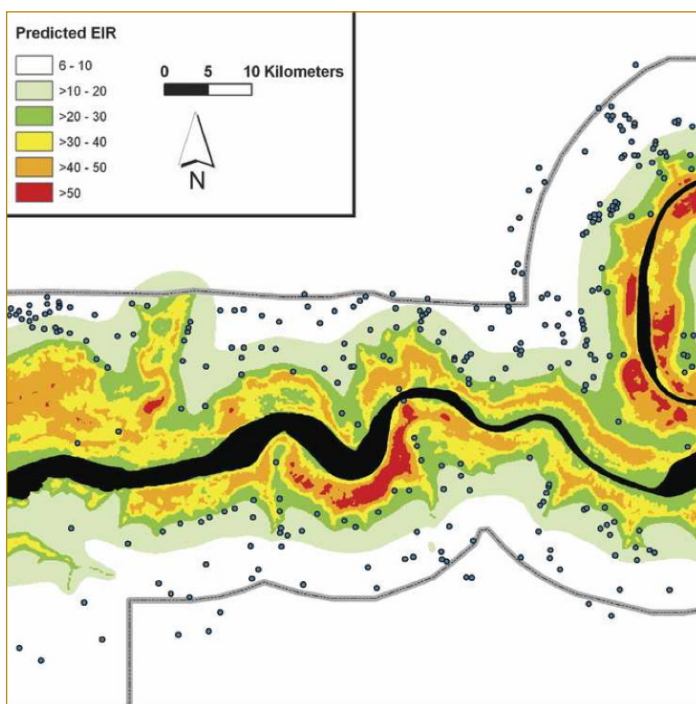
Predicted exposure to infectious mosquitos in the rainy season in central Gambia. The River Gambia is shown in black; gray line is the international border with Senegal; solid circles are villages.

SERVICE DESCRIPTION

Detecs disease outbreak by distinguishing areas that experience epidemic and seasonal transmission from those with more stable or continuous transmission patterns, and by executing a continuous and systematic analysis of relevant data for early detection of disease outbreak

USE

To identify primary and secondary disease reservoir habitats. Applicable to many important human and veterinary vector-borne diseases in Africa

DATA NEEDS

› EO data (e.g. Sentinel-2 or Landsat; Sentinel-1 for hydrological dynamics)

› Elevation and derived drainage data (e.g. SRTM, WorldDEM™)

› Households and population density, livelihoods, outbreak data records and incidents

› Ancillary GIS data: land use, historical vector-based layers, soil type, etc

› Base map and administrative data: administrative boundaries, roads, hydrology, soil type, etc

PRODUCT ACCURACY

Habitat detection with 80 to 90% classification accuracy, depending on the availability of validation data

RESOLUTION

Medium resolution with a spatial resolution ranging from 5 m to 30 m, and high resolution with a spatial resolution of less than 1 m

BENEFIT

Creates fine-spatial resolution maps over large extents to produce risk maps at the appropriate operational scale for public health interventions

DELIVERY FORMAT

Maps and products in standard GIS format

FREQUENCY

› Baseline within 1 to 2 weeks of ordering, depending on size of area and availability of ancillary data and satellite EO data

› Monitoring and change detection in habitat within 24 hours of image acquisition

SERVICE DESCRIPTION

Creates maps of ecosystems to support environmental security planning, conservation planning, risk assessment, and public awareness

USE

To standardise information for park management across themes (security, conservation) and integrate this with standard GIS and Google Earth

DATA NEEDS

› EO data (e.g. Sentinel-2 or Landsat; Sentinel-1 for hydrological dynamics)

› Elevation and derived drainage data (e.g. SRTM, WorldDEM™)

› Biodiversity or other data to develop critical habitat assessment criteria (provided by stakeholder/project partner)

PRODUCT ACCURACY

Land cover classification will be delivered with 80 to 90% classification accuracy, depending on stakeholder requirements and the availability of validation data

RESOLUTION

Medium resolution with a spatial resolution ranging from 5 m to 30 m

BENEFITS

› Increases planning capacity and makes the process to define priorities more efficient

› Provides health and safety benefits through informing the risk assessment process

› Improves preparation and planning for patrol teams

› Makes strong communications materials available for annual reporting and donor engagement

DELIVERY FORMAT

Maps and products in standard GIS format

FREQUENCY

› Baseline within 1-2 weeks of ordering, depending on size of area and availability of ancillary data and satellite EO data

› Monitoring and change detection in habitat with 24 hours of image acquisition

Ecosystems are at risk due to the high demand for the goods and services they provide, poor management, and climate change, a situation that might exacerbate fragility and pose an additional obstacle to improving the lives of people living in fragile contexts.

Satellite EO data can provide information to assess and monitor critical ecosystems to inform decision-makers of potential issues such as degradation and drought that can exacerbate existing social and economic challenges. Critical ecosystem assessment covers diverse environments depending on a project's needs, including terrestrial, freshwater aquatic, and coastal foreshore/intertidal information needs. Satellite EO data can provide specific information useful for assessing ecosystem processes such as land degradation, deforestation and forest degradation, changes to water resources and critical habitats.
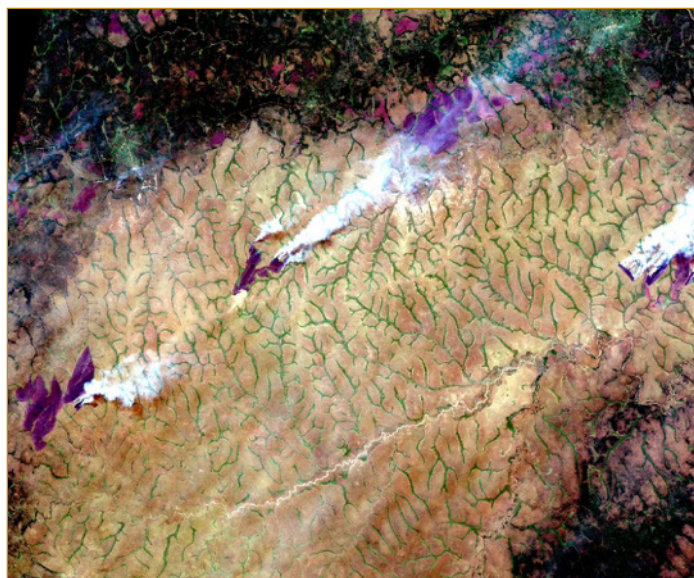
Sentinel-2 image acquired on Dec 28, 2015 depicting wildfires over Garamba National Park in the Democratic Republic of the Congo.

Remote sensing data and analysis provide cost-effective, timely, and flexible support to operations in fragile states across the project cycle, including identification and preparation, implementation and supervision, and evaluation. The following is an overview of how EO service providers can support projects in the different stages of the project cycle:

Identification and preparation

Support to the examination of technical, economic, social, and environmental aspects of a proposed project. EO images and products can identify:

› Status of natural resources

› Status of existing infrastructure

› Status of populations, land use, and the human environment

› Environmental change drivers, e.g. agriculture, water resources

During preparation, project performance indicators can be monitored using remote sensing, potentially reducing supervision and evaluation costs.
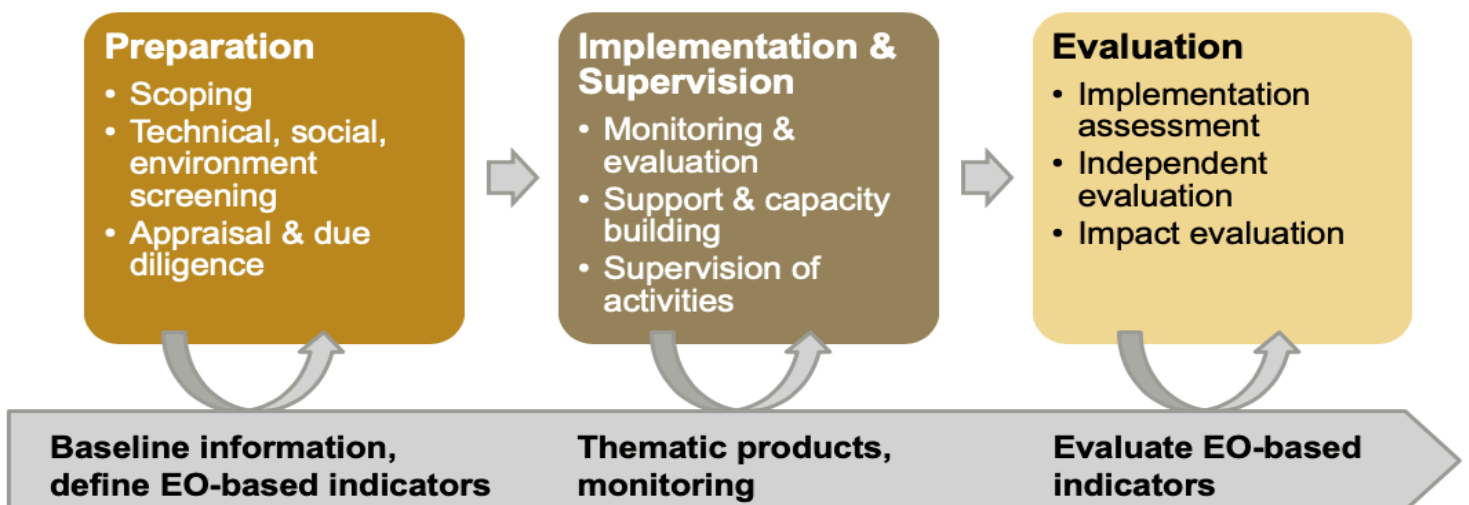
Implementation and supervision

Provision of information on project progress where site visits are challenging and to develop evidence that the project is achieving the intended purpose. EO images and products can monitor:

› Development of land use, e.g. improvement in crop production

› Natural resources development, e.g. enhanced palm oil supply chain

› Ecosystem rehabilitation, e.g. mangroves restoration

› Infrastructure development, e.g. confirm bridge replaced, repaired irrigation, aquaculture

› Urban development, e.g. confirm housing improvements

Evaluation

Provision of data for monitoring and evaluation following project implementation and independent evaluation systems in response to project performance measures. EO images and products provide:

› Compelling visual evidence of project results

› Before and after project comparisons

› Rigorous and transparent information

› Information for areas with access constraints

Preparation
- Scoping
- Technical, social, environment screening
- Appraisal & due diligence

Implementation & Supervision
- Monitoring & evaluation
- Support & capacity building
- Supervision of activities

Evaluation
- Implementation assessment
- Independent evaluation
- Impact evaluation

Baseline information, define EO-based indicators

Thematic products, monitoring

Evaluate EO-based indicators

Partners of the Fragility Cluster

fragility, conflict and security
eo4sd

For more information, please contact:

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http://eo4sd.esa.int/fragility