European Commission

COPERNICUS IN SUPPORT OF THE **UN SUSTAINABLE DEVELOPMENT GOALS**

Copernicus
Europe's eyes on Earth

INTRODUCTION

In 2015, the members of the United Nations adopted a set of ambitious Sustainable Development Goals (SDGs) in the framework of the 2030 Agenda for Sustainable Development. These goals aim to address the world's most pressing challenges over the next fifteen years, such as ending poverty, protecting the planet and ensuring prosperity for all. In order to measure and monitor progress towards the 17 SDGs and 169 associated targets, the UN has established a global list of indicators which will serve as a common benchmark for regular reporting of overall progress.

Copernicus, the European Union's flagship Earth Observation and Monitoring programme, is a powerful instrument to help monitor these indicators and support the implementation of the SDGs. The unprecedented amount of data and information generated by Copernicus supports decision-makers in developing adequate policies to achieve the goals, and facilitates the monitoring of the SDGs. It is available on a full, free and open basis, which contributes to reducing the cost of monitoring indicators and also allows for the development of operational products and services supporting the SDGs.

This factsheet presents some examples of how Copernicus concretely contributes to the monitoring of indicators and to selected SDGs, in particular through its six operational Services. It is purely illustrative and does not account for the wide-ranging opportunities Copernicus can offer in support of the 2030 Agenda for Sustainable Development.

COPERNICUS CONTRIBUTION TO THE SUSTAINABLE DEVELOPMENT GOALS

15 LIFE ON LAND

Land Monitoring Service

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

14 LIFE BELOW WATER

Marine Environment Monitoring Service

Security Service

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

13 CLIMATE ACTION

Climate Change Service

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

11 SUSTAINABLE CITIES AND COMMUNITIES

Emergency Management Service

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage

7 AFFORDABLE AND CLEAN ENERGY

Climate Change Service

Atmosphere Monitoring Service

7.3 By 2030, double the global rate of improvement in energy efficiency

6 CLEAN WATER AND SANITATION

Land Monitoring Service

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

3 GOOD HEALTH AND WELL-BEING

Atmosphere Monitoring Service

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

2 ZERO HUNGER

Land Monitoring Service

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

SDG 2
ZERO HUNGER

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

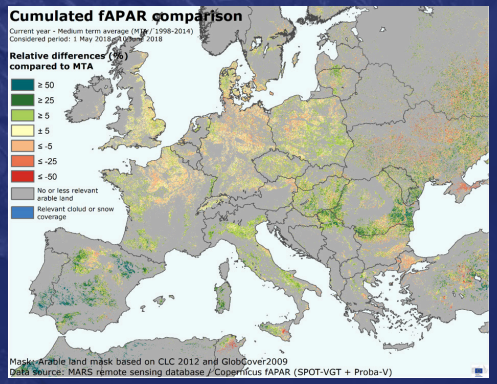
2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilisation of genetic resources and associated traditional knowledge, as internationally agreed

LAND MONITORING SERVICE

Agriculture is a crucial economic activity worldwide, providing livelihoods and employment for many. Rising populations, changing demands and diets as well as environmental changes (e.g. extreme weather, climate change) put increasing stress on the world's food supply. In many countries affected by hunger, there are already significant efforts to address these challenges, such as closing yield gaps (difference between current yields and what might be possible under optimum conditions) and implementing sustainable land management practices.

To monitor and respond to such needs, governments and aid workers need accurate, timely, systematic and comprehensive information. Dedicated products derived from Earth Observation satellites fulfil this requirement more and more.

Data like the one provided by the Global component of the **Copernicus Land Monitoring Service (CLMS)**, help national institutions in monitoring crop conditions, providing early warnings on failing crops and predicting crop yields. Crop indices, Dry Matter Productivity and Soil Moisture information are provided every ten days on a global scale. The NGO, Action Against Hunger, and the Centre de Suivi Ecologique de Dakar are using COPERNICUS indices such as the Dry Matter Productivity for pastoral Early Warning System in West Africa informing pastoral communities and Governments on biomass conditions.



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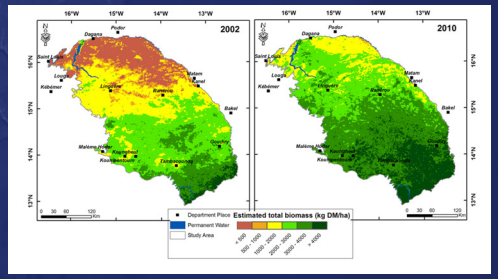


(b)

Top: (a) fAPAR anomalies published in the JRC MARS bulletin - Crop Monitoring in Europe, May 2018. Positive anomalies reflect above average canopy density or early crop development. Bottom: (b) Maps of estimated total biomass in Senegal for the year 2002 on the left (deficit in biomass production), and, on the right, for the year 2010 (surplus in biomass), produced by the Centre de Suivi Ecologique de Dakar, Senegal, and based on fAPAR time series.

SDG 3
GOOD HEALTH AND WELLBEING

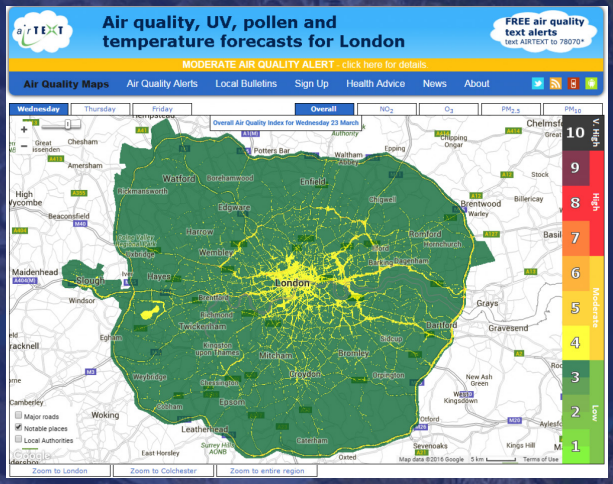
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States

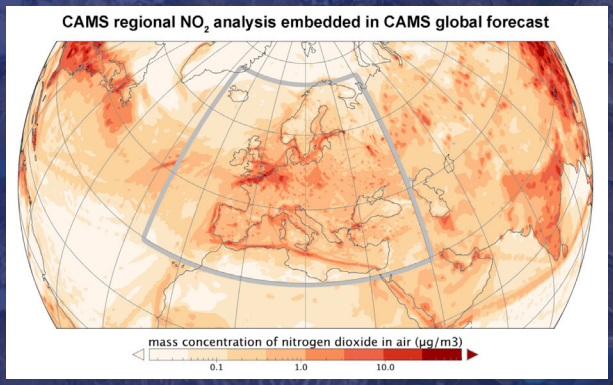
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

ATMOSPHERE MONITORING SERVICE

The **Copernicus Atmosphere Monitoring Service (CAMS)** provides daily air quality forecasts at global scale and, with higher resolution, over Europe. These forecasts, derived from satellite observations, account for routine pollutants' emissions but also for those related to exceptional events such as large wildfires or volcanic eruptions. The forecasts are used daily by a wide range of public and commercial entities for decision-making, smartphone applications and websites, or for downscaling to local areas in order to inform the public or assess health impacts.

For instance, CERC – a company located in Cambridge, UK - provides free air pollution, UV, pollen and temperature forecasts for Greater London and South-East England. Their service, known as AirText, is provided to more than 15,000 subscribers, who can customise the alerts they receive from the service by email, text, voicemail or Twitter. AirText provides local forecasts based on detailed modelling of emissions and atmospheric dispersion over the area, but it relies on CAMS to take into account how much pollution flows into and out of the area. It is essential indeed to include background pollutants concentrations, as provided by CAMS, in order to deliver an accurate service at the local scale: the quality of air which is breathed locally is generally determined by the combination of local pollution sources with distant ones, which can be hundreds or even thousands of kilometers upwind.





Top: The AirText service for Greater London provided by CERC; Bottom: information provided by CAMS on background pollutants concentrations, here for Nitrogen Dioxides

SDG 6
CLEAN WATER AND SANITATION

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

LAND MONITORING SERVICE

Water is life. Water safety and quality are fundamental to human development and well-being. Providing safe access to water, adequate sanitation services and improving hygiene practices are instrumental in preventing the spread of infectious and vector-borne diseases, such as cholera or malaria, improving nutrition levels and healthcare.

The **Global component of the Copernicus Land Monitoring Service (CLMS)** systematically provides in near real time information on global inland water bodies and their seasonal replenishment, lake and river water levels, temperature, turbidity and trophic state, including potential water availability from snow and ice cover. The product supports a wide range of applications in the field of food security, sanitation, energy, health, transport, preservation of biodiversity and natural risk management.

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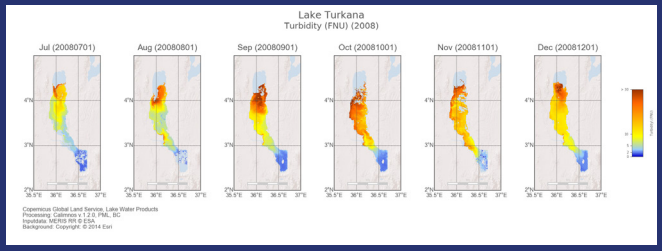
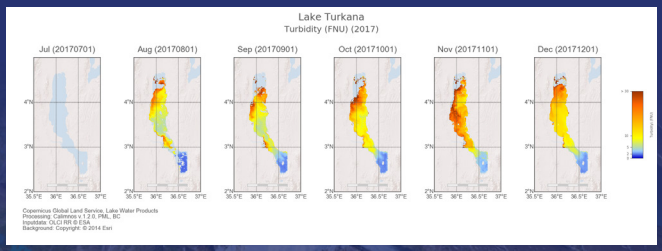
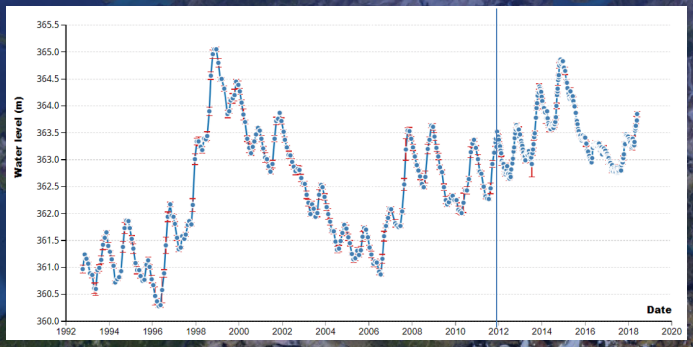






(b)

Top: Lake Turkana (Kenya), the world's largest permanent desert lake, is characterised by very turbid waters in the North and decreasing turbidity in the South. The suspended materials responsible for the turbidity are brought into the lake by the Omo river. Lake Turkana and its livelihoods are threatened by a cascade of major hydropower dams along the Omo River. (a) Seasonal turbidity of Lake Turkana (Formazine Nephelometric Unit) in 2008 and 2017 (Masked areas of the lake are due to cloud cover). The Copernicus Lake Water Quality product allows to monitor the changes in spatial patterns of suspended sediment and changes of their total concentration during the seasons. Left: (b) Water level monitoring of Lake Turkana (Kenya) – Gibe III dam became operational in October 2015.

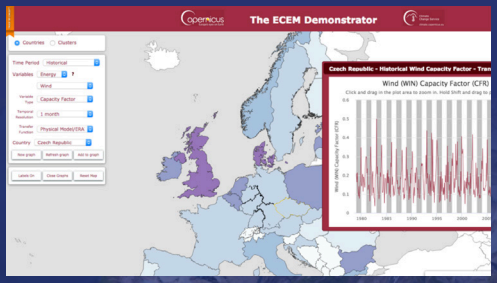
SDG 7
AFFORDABLE AND CLEAN ENERGY

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
7.3 By 2030, double the global rate of improvement in energy efficiency
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

ATMOSPHERE MONITORING SERVICE

CLIMATE CHANGE SERVICE

A serious issue for the productivity of solar power plants and their operators is desert dust. Deposition of dust blocks solar radiation, and this can effect the mirrors or photovoltaic panels, thus significantly reducing their efficiency. Airborne particles, also called aerosols, directly affect the amount of solar radiation reaching the Earth's surface: together with clouds, aerosols are one of the main variables determining the solar energy yield that can be obtained from a solar energy production facility.



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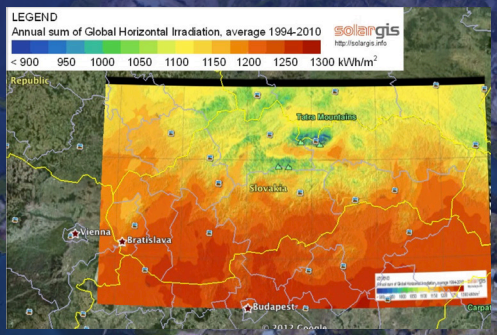


(b)

To prevent power efficiency losses and improve the design and management of solar power plants, the **Copernicus Atmosphere Monitoring Service (CAMS)** provides global 5-day forecasts of desert dust and the other main aerosols (sulfates, sea salts, black and organic carbon). CAMS aerosol information products are routinely used by GeoModel Solar, a Slovak company specialised in providing data for site qualification, planning, financing and operation of solar energy systems.

Balancing the societal demand for energy with the energy production from renewable sources is one of the main challenges Europe will have to tackle in the next two decades. Such a challenge is likely to require significant infrastructure investments. The **Copernicus Climate Change Service (C3S)** provides climate indicators of electricity consumption, alongside estimates of the combined production from all renewable sources at national and sub-national level in Europe. These two sets of indicators help planners and policy makers identify the pros and cons of different energy mix options and optimise investment decisions accordingly.

Top: (a) The plot shows the historical reconstruction of the wind energy production for the Czech Republic for the period 1980-2015. The results are expressed as fraction of the maximum production which would have been possible with perfect wind conditions. The results were calculated using a physics-based model on the reanalysis of ECMWF. Bottom: (b) CAMS has been providing aerosol forecasts to GeoModel Solar, a company specialised in site qualification, planning, financing and operation of solar energy systems. Aerosols directly affect the amount of solar radiation reaching the Earth's surface and therefore are one of the components determining the amount of solar radiation available for solar energy purposes at any one location on the Earth.

SDG 11
SUSTAINABLE CITIES AND COMMUNITIES

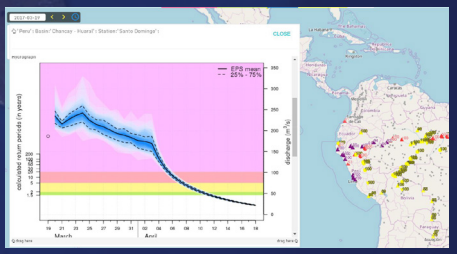
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

EMERGENCY MANAGEMENT SERVICE

One of the goals under SDG 11 is to make cities and human settlements inclusive, safe, resilient and sustainable. Many cities over the world are exposed to natural hazards, such as floods, which presently account for 31% of all economic losses worldwide resulting from natural hazards. As the frequency and magnitude of flood disasters is projected to increase due to climate change, soil sealing and growing population exposure, flooding is one of the key societal challenges of this century. The **Copernicus Emergency Management Service (CEMS)** provides information for emergency response in relation to different types of disasters, including floods, as well as related prevention, preparedness, response and recovery activities. An example of how CEMS supports emergency preparedness and response globally, is the activation of its Rapid Mapping component following floods in Peru in early 2017. These events resulted in more than 100 deaths, caused the evacuation of around 158,000 people and damaged 210,000 homes. The maps produced by Copernicus helped analyse the affected areas and the extent of the floods in real time, allowing the civil protection authorities to target their rescue operations. The Copernicus EMS Global Flood Awareness System (GloFAS) and the CEMS Rapid Mapping component provided local emergency responders, national authorities and international relief operators with essential information on the flooding situation in Peru.



Another goal pertaining to SDG 11 is to strengthen efforts to protect our cultural heritage. Cultural heritage is often affected by natural disasters, in particular earthquakes. The Copernicus programme can contribute to safeguarding cultural heritage by monitoring and documenting the impact of earthquakes. Although damages to historical buildings cannot be reversed, the mapping of the severity of an earthquake and assessment of the resulting damage allows the competent authorities to safeguard the remaining buildings. One of the ways Copernicus can assist in this matter is by assessing the magnitude of the earthquake through interferograms, which depict where the earthquake impact was most severe. This method was used, for instance, to help preserve historical sites hit by an earthquake in Central Italy in August 2016.

Top: High resolution flood extent delineation map from the EMS Rapid Mapping Component for Huaura, Peru. Bottom: GloFAS flood forecast for 19 March 2017 in Peru.

SDG 13
CLIMATE ACTION

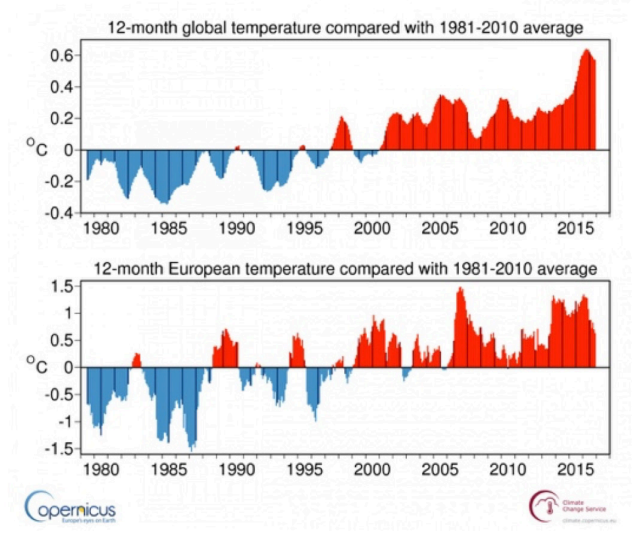
13.2 Integrate climate change measures into national policies, strategies and planning

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

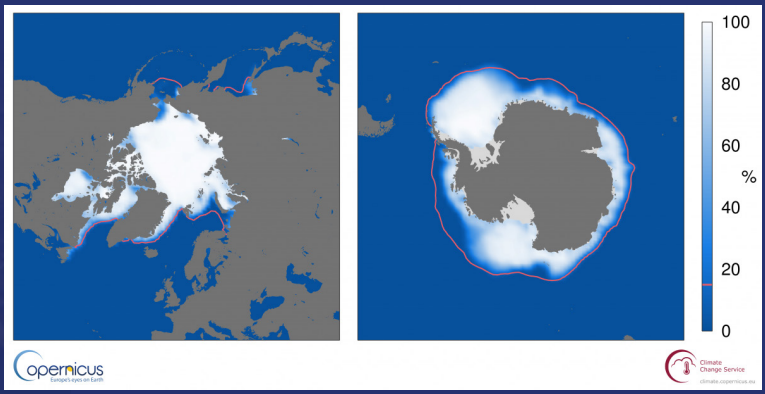
CLIMATE CHANGE SERVICE

Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and even more tomorrow. To address climate change, countries adopted the Paris Agreement at the COP21 in Paris on 12 December 2015, which aims at keeping this century's global temperature rise well below 2 degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Copernicus Climate Change Service (C3S) routinely monitors the Earth's climate and its evolution. It provides routine access to key indicators on a number of Essential Climate Variables (temperature, sea-ice, CO2, etc.) and is therefore a powerful tool to monitor the success of the implementation of the Paris Agreement. These climate indicators will also support European adaptation and mitigation policies in a number of economic sectors.



Top: Running twelve-month averages of global-mean and European-mean surface air temperature anomalies relative to 1981-2010, based on monthly values from January 1979 to May 2017. The darker coloured bars are the averages for each of the calendar years from 1979 to 2016. Source: ERA-Interim. (Credit: ECMWF, Copernicus Climate Change Service)

Bottom: Sea-ice cover for May 2017. The pink line denotes the climatological ice edge for May for the period 1981-2010. Source: ERA-Interim. (Credit: ECMWF, Copernicus Climate Change Service)



SDG 14
LIFE BELOW WATER

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information

MARINE ENVIRONMENT MONITORING SERVICE

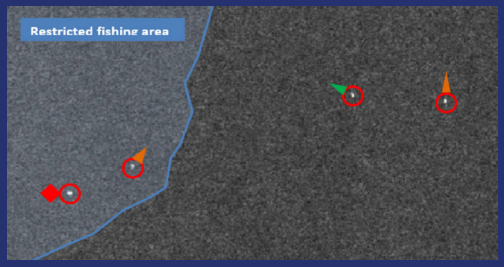
SECURITY SERVICE

The **Copernicus Marine Environment Monitoring Service (CMEMS)** produces ocean monitoring products based on satellite and in situ observations as well as numerical models. By the end of 2018, its in situ and numerical model capacity will be reinforced for an improved monitoring of the oceanic carbon cycle at global and regional scales. Once this milestone is achieved, Eurostat, the statistical office of the EU, will use ocean PH and acidity products from CMEMS for all European regional seas for the development of its new official environmental indicators. Such indicators can be used to monitor and control water quality in Europe through a unified set of parameters.

As part of the **Copernicus Security Service** (CSS) the **Maritime Surveillance** component, managed by the European Maritime Safety Agency (EMSA), provides relevant and targeted information on activities at sea. Activities covered in the scope of the service also include fisheries control, in particular the monitoring of fishing grounds. Effective maritime surveillance can help combat illegal, unreported and unregulated fishing, thereby contributing to sustainable fisheries goals. On request of authorised fisheries control authorities, the Copernicus Maritime Surveillance Service provides a systematic overview of vessels and observable fishing activities at a particular time and place. The service is delivered in near-real-time to the end users, meaning within 30 to 45 minutes depending on the type of imagery.

The figure below shows a SAR satellite image allowing detection of vessels at sea. The vessel detection results can be combined with additional information such as vessel identification and position data from on-board reporting systems or data on fishing grounds and restricted areas. This fused data can draw attention to vessels which are not reporting, help identify discrepancies in records, and alert authorities of unusual vessel behaviour.

Through the Copernicus Maritime Surveillance Service, with the support of the European Fisheries Control Agency (EFCA) as well as EMSA, fisheries control administrations from across the EU can benefit from Copernicus satellite data in their efforts to ensure that fishing is carried out safely and sustainably.



Fishing vessels near and in restricted fishing areas, detected with satellite imagery. RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd [2015] – All Rights Reserved and RADARSAT is an official mark of the Canadian Space Agency

SDG 15
LIFE ON LAND

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

LAND MONITORING SERVICE

As part of the **Copernicus Land Monitoring Service (CLMS)**, the European Environment Agency (EEA) delivers spatially detailed products on pan-European and local land cover and land use information. The local component focuses on areas that are prone to specific environmental challenges and issues in the European Union. Under this local component, EEA offers information on Natura2000 protected hotspots, which is used to assess the preservation and status of these sites, and whether the decline in the grasslands cover is evident. The status of Natura2000 hotspots will ensure that these are accurately mapped, and can be used to draw attention to events that threaten the preservation of the sites.

But what about land degradation, deforestation or loss of biodiversity in other areas of the world? The Global component of the Land Service, is currently also mapping protected areas but in Africa to support the biodiversity strategy. Furthermore and recently the Global component extended its product portfolio to include a Global Land Cover Map in order to provide spatial information about land for applications ranging from global forest monitoring (REDD+), crop area monitoring, biodiversity conservation to land status and climate modelling. The new Land Cover Map is completing the current portfolio of vegetation products that are related to biomass dynamics. These products are clearly earmarked for addressing the SDG 15.3 on land degradation neutrality.

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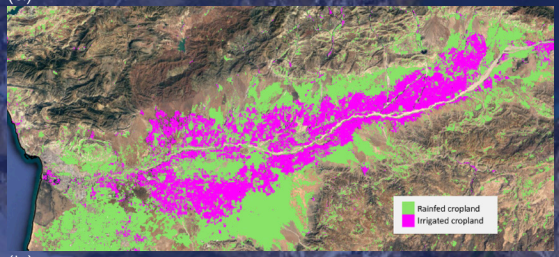

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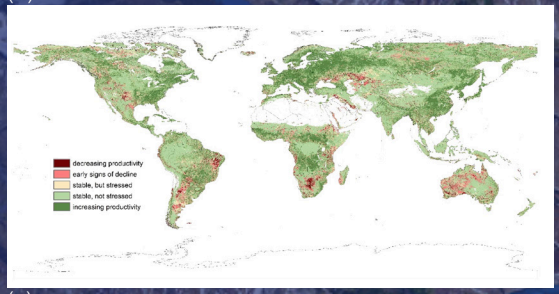

(c)

Top: (a) Classification of grass-land rich protected areas in the Natura2000 network, according to the MAES ecosystem typology (level 1 is shown here) and Corine Land Cover; Middle: (b) Cropland classification around the Sous-river in Southern Morocco. The 100 m cropland classification is from the recently released Copernicus Global Land Cover Map, while an additional irrigation labelling has been performed for UN-FAO's Water Productivity Portal (WaPOR). In the next release,crop types will be added as well. Credit background image: Google Inc.; Bottom: (c) Global Land Productivity Dynamics for 1999-2013 period derived from Copernicus Global Land time series of SPOT VGT data – NDVI and fAPAR indices input. Source WAD3-JRC, Cherlet, M., 2018.


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