COPERNICUS DATA IN SUSTAINABLE DEVELOPMENT GOALS USING IMAGE MAPS

A3 Large Maps

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Olomouc, 2023

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COPERNICUS MASTER IN DIGITAL EARTH

PARIS LODRON UNIVERSITÄT SALZBURG

Palacký University Olomouc

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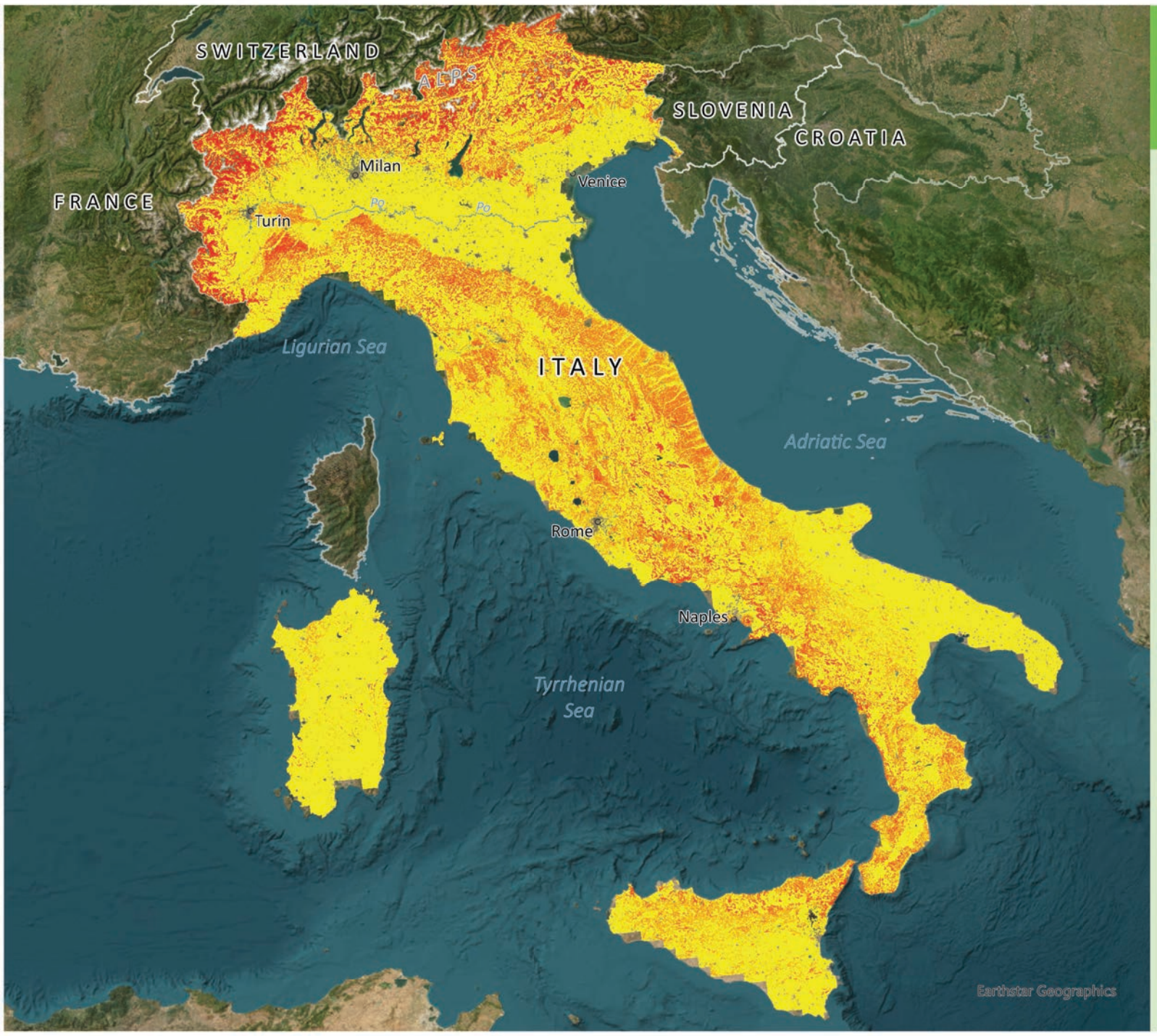
Soil loss is the loss or reduction in the amount of soil particles from land surface. It is often used interchangeably with soil erosion and is mainly caused due to climate change, rainfall, deforestation, overgrazing, forest fires, mining and construction activities. Although natural forces like wind and water are usually responsible for soil loss, this can be intensified more by human activities on land. Soil loss up to 10 t/ha/yr is generally acceptable (Matthee and Schalkwyk, 1984) but when soil loss exceeds this value, it is considered as a critical environmental problem. Higher level of soil loss leads to land degradation, low productivity, desertification and biodiversity loss. This problem is more prominent in the Caribbean countries, Brazil, Central Africa and Southeast Asia.



SOIL LOSS
Italy, 2021-2050

IMAGE MAP TYPE: Double Thematic

Image Component:
Thematic Content: Soil Loss Raster
Data Source: Copernicus Climate Change Service
Spatial Resolution: 500 m
Topographic Base: ESRI World Imagery

Symbol Component:
Labeling, Country boundary, Cities

Soil Loss (t/ha/yr)

0 5 10 20 100 max 1227

Map Projection:
Albers Equal Area Conic

0 100 200 km

Copernicus data for soil loss of Italy reveals that soil loss is considerably higher in the Alps and the Apennine mountains. The area around the Po River has a very minimal soil loss. Also, the island of Sardinia and other plain areas are safer in terms of soil loss. The average value of soil loss in Italy for the reference period 2021-2050 is 8.57 t/ha/yr which falls within the acceptable limit. It can be inferred from the data that the lowlands that are usually suitable for agriculture are less likely to be affected by soil loss. However, the high mountains that serve as the potential touristic destinations encounter severe effects of soil loss. This could be due to the slope of the terrain as greater steepness can lead to higher amount of runoff during heavy rainfall. Copernicus soil loss data allows the users to identify the potential areas of higher soil loss and thereby implement prevention strategies. For instance, plantation and can be done in the erosion prone areas. Also, terrace farming can be recommended in the hills and mountain regions.

SDG RELEVANCE

15 LIFE ON LAND

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Target 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

Indicator 15.3.1: Proportion of land that is degraded over total land area.

COPERNICUS DATA

Dataset	: Soil Erosion Indicators for Italy from 1981 to 2080
Provider	: Copernicus Climate Change Service
Data type	: Gridded
Horizontal coverage	: Italy
Horizontal resolution	: 500 m
Vertical coverage	: Surface
Vertical resolution	: Single level
Temporal coverage	: 1981-2080 (2011-2020 excluded)
Temporal resolution	: 30-year period
File format	: NetCDF-4

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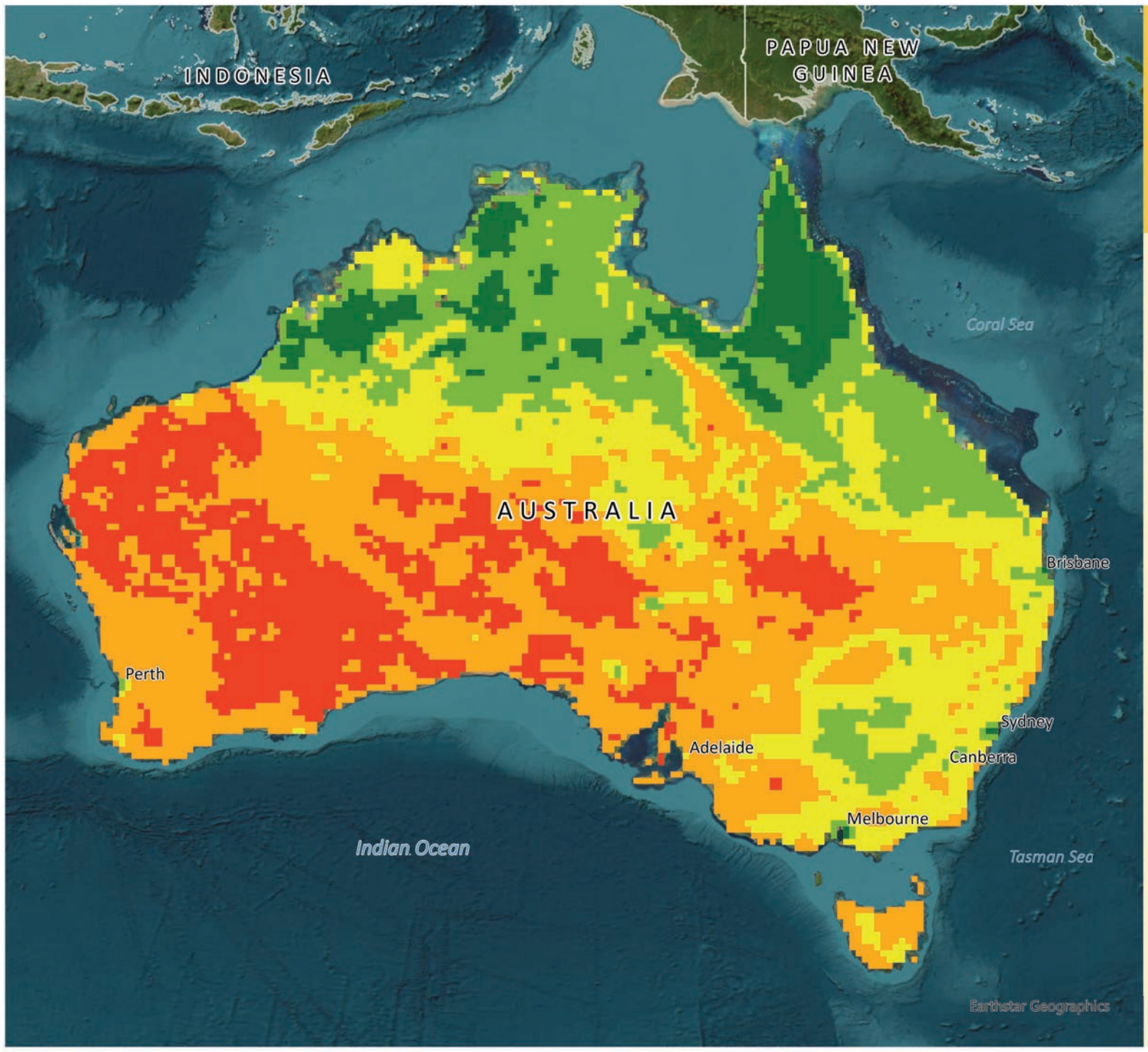
#02

Surface soil moisture is the amount water content present at the topmost level of soil. It is usually measured for a soil layer of 2 to 5 cm depth and is expressed as the percentage of total saturation. Soil moisture is an important factor for crop growth. It helps to regulate the soil temperature and serves as the medium through which plants acquire their nutrients. Surface soil moisture is affected by climate change as well as human activities. The optimum level of surface soil moisture for most of the crops is usually 20% - 60% (EOS, 2023). It is necessary to maintain such level of soil moisture as the deficit or excess can lead to poor crop health, reduced productivity and food scarcity.



Copernicus data for surface soil moisture of Australia reveals that the continent has an excessive moisture content in its northern extent while its central and western parts face deficit in soil moisture. This can be directly related to the topography of the continent as it is composed of deserts its center, plateau towards the west and basins in the north. The surface soil moisture seems to be moderate in the southeastern part of Australia creating a favorable condition for crop growth and productivity. The average value of surface soil moisture of Australia as of January 2023 is 48.5% which falls within the optimum level. The regions having optimum level of soil moisture as indicated by the Copernicus data should be utilized for agricultural purpose as it helps to ensure higher level of crop production. Such regions will require a minimal effort for drainage or irrigation in order to maintain and preserve the moisture content. It can also be recommended that the arid and the damp regions of the continent to be filled with certain crop types that are suited for that particular moisture conditions.

SDG RELEVANCE

2 ZERO HUNGER

Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Target 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

Indicator 2.4.1: Proportion of agricultural area under productive and sustainable agriculture

COPERNICUS DATA

Dataset	: Soil Moisture Gridded Data from 1978 to Present
Provider	: Copernicus Climate Change Service
Data type	: Gridded
Projection	: WGS 1984
Horizontal coverage	: Global
Horizontal resolution	: 0.25° x 0.25°
Vertical coverage	: Surface
Temporal coverage	: 1978 to Present
Temporal resolution	: Daily, 10-day, Monthy
File format	: NetCDF

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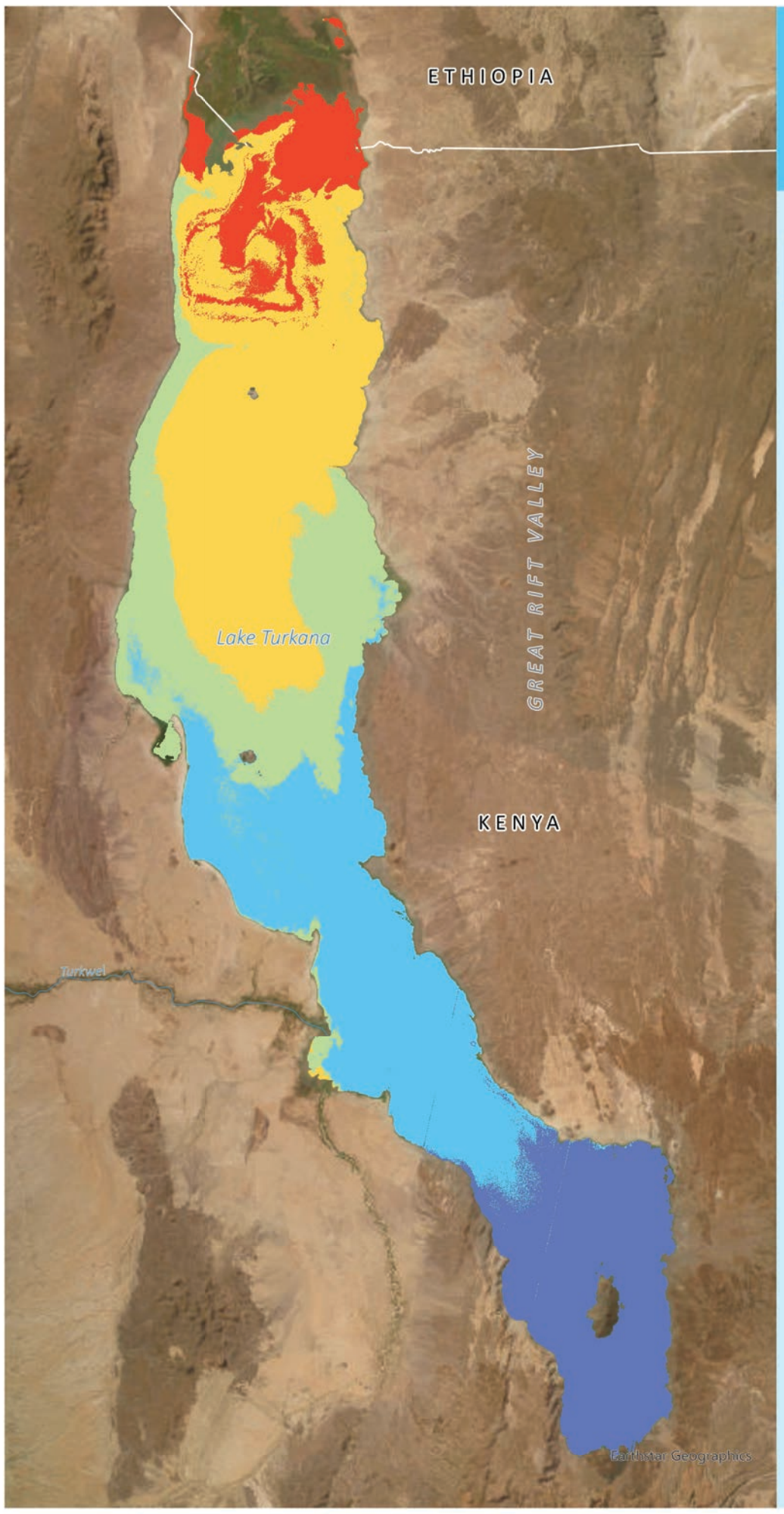
#03

Turbidity refers to the cloudiness or haziness of liquid. It is characterized with the presence of suspended particles that prevent sunlight from penetrating into the deeper parts of water. Turbidity of a water body is usually caused due to the growth of phytoplankton including algae or cyanobacteria, dissolved organic compounds or other elements like slit and clay. Turbidity is an important indicator for measuring water quality. Higher level of turbidity not only makes water unsuitable for drinking but also fosters the growth of pathogens and reduces the aesthetic quality of water. Lake water with turbidity up to 10 NTU is generally acceptable, up to 50 NTU is considered moderately turbid while greater than 50 NTU is harmful for aquatic plants and animals (DataStream, 2021).



TURBIDITY

Lake Turkana

21 January 2023

IMAGE MAP TYPE: Double Thematic

Image Component:
Thematic Content: Turbidity Raster
Data Source: Copernicus Global Land Service
Spatial Resolution: 100 m
Topographic Base: ESRI World Imagery

Symbol Component:
Labeling, Country boundary

Blended Mean Turbidity (NTU)

max 753
50
20
10
5
min 1

Map Projection:
WGS 1984

0 10 20 km

SDG RELEVANCE

6 CLEAN WATER AND SANITATION

Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Indicator 6.3.2: Proportion of bodies of water with good ambient water quality.

COPERNICUS DATA

Dataset	: Lake Water Quality
Provider	: Copernicus Global Land Service
Sensor	: Sentinel-2 MSI
Data type	: Gridded
Horizontal coverage	: Europe and Africa
Horizontal resolution	: 100 m
Vertical coverage	: Surface
Temporal coverage	: Jan 2019 - present
Temporal resolution	: 10 days
File format	: NetCDF-4

Copernicus data for lake water quality reveals that lake Turkana has clear and less turbid water in its southernmost spatial extent while the level of turbidity significantly increase as we move northwards. The lake is characterized with extreme values of turbidity towards the boundary between Kenya and Ethiopia. The average value of turbidity of lake Turkana on 21 January 2023 is 20.32 NTU, which implies that the lake water is moderately turbid. The Omo river wetland situated in the northern boundary of the lake seems to be the major contributor for its higher turbidity towards the north. This could be due to the heavy surface runoff from the catchment area of the river that flow into the lake. Based on Copernicus data, it can be said that the water in the northern part of the lake is totally unsuitable for utility. Proper treatment such as disinfection, filtration or use of chemical additives is necessary prior to the lake water consumption. Alternatively, wetland vegetation can be increased in order to naturally reduce the turbidity that result from heavy surface runoffs flowing into the lake.

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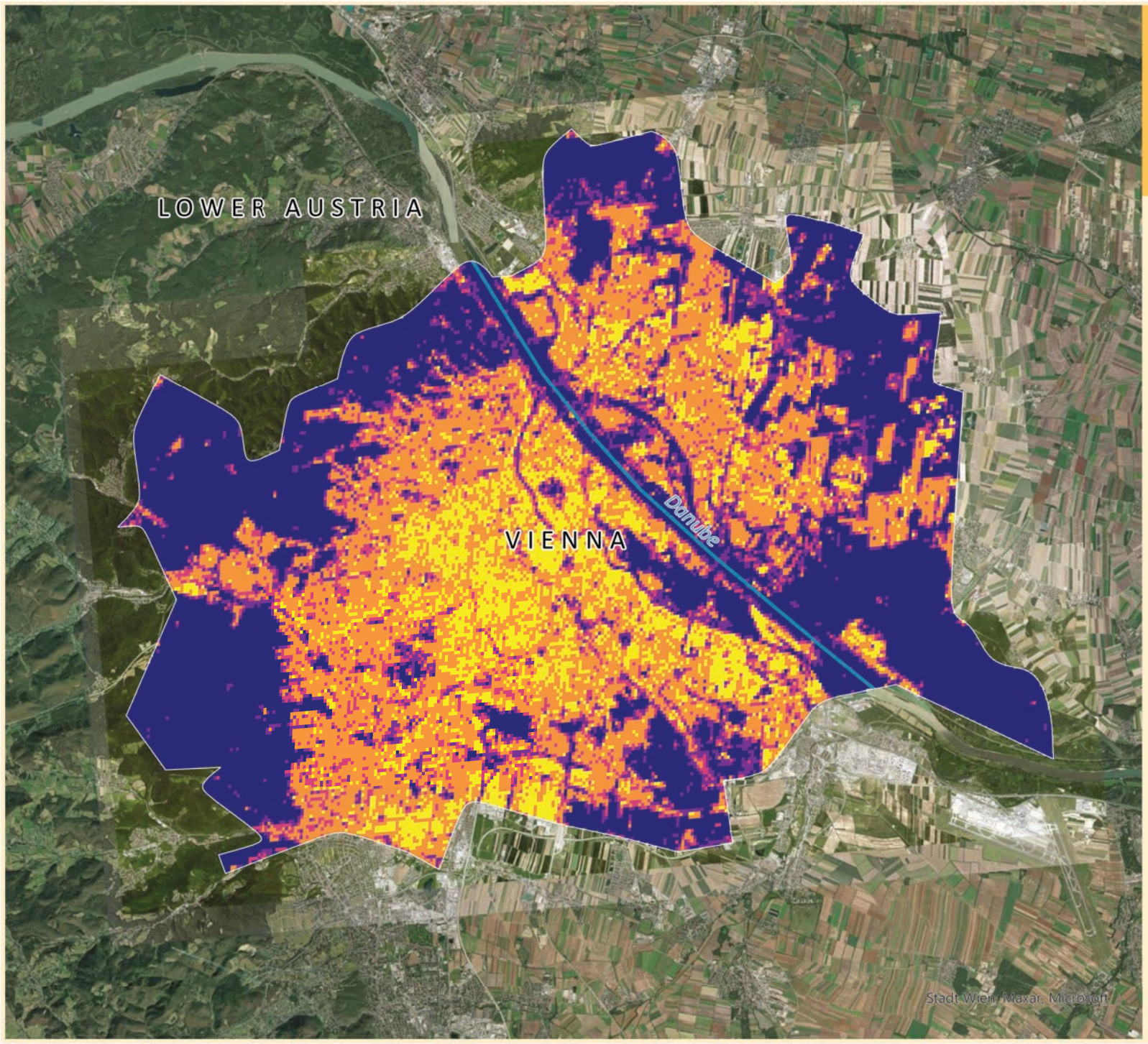
#04

Built-up surface is the area defined by the presence of buildings or roofed structures. It excludes the area occupied by pavements, streets, parks and open spaces. The level of built of surface determines the quality or habitability of a city. A city with highly dense built-up surface not only looks aesthetically unpleasant but also has problems with urban mobility, social interaction, public health, safety and security. Cities are generally considered as more inclusive and sustainable when they follow a settlement pattern with higher proportion of area dedicated to open public spaces. To ensure an adequate foundation for a well-functioning and prosperous city, the UN-Habitat recommends an average of 45 - 50% of urban land be allocated to streets and open public spaces.



BUILT-UP SURFACE
Vienna, 2020

IMAGE MAP TYPE: Double Thematic

Image Component:
Thematic Content: Built-Up Surface Raster
Data Source: Global Human Settlement Layer [Copernicus Emergency Management Service]
Spatial Resolution: 100 m
Topographic Base: ESRI World Imagery

Symbol Component:
Labeling, State boundary, River

Built-Up Surface (m²)

0 100 1000 2000 4000 *max 10000*

Map Projection:
Albers Equal Area Conic

0 2 4 km

Copernicus data for built-up surface of Vienna reveals that the city is marked with the presence of a very dense urban fabric in its core central region. The built-up density decreases gradually as we move away from the center towards the city outskirts. The average value of built-up surface for Vienna city in the year 2020 is 1687.31 m², which can be considered quite an ideal value for human settlement. Some small patches visible in dark blue color in the central part as well as along the periphery of Danube river indicate the presence of parks and other green spaces within the city. The parts of the city bordering to Lower Austria in the eastern and western extents have almost no built-ups due to the presence of forests, meadows, croplands and cemeteries. Copernicus built-up surface data confirms that the affluence of open public space in Vienna city makes it highly suitable for urban livelihood. The share of public space in the city can be enhanced further by creating boulevards and green corridors particularly in the core central area that are overwhelmed by dense built-up surfaces.

SDG RELEVANCE

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

Target 11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

Indicator 11.7.1: Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities

COPERNICUS DATA

Dataset	: Global Human Settlement Built-Up Surface
Provider	: Copernicus Emergency Management Service
Data type	: Gridded
Projection	: World Mollweide
Horizontal coverage	: Global
Horizontal resolution	: 100 m
Vertical coverage	: Surface
Temporal coverage	: 1975 to 2030
Temporal resolution	: 5-year interval
File format	: TIFF

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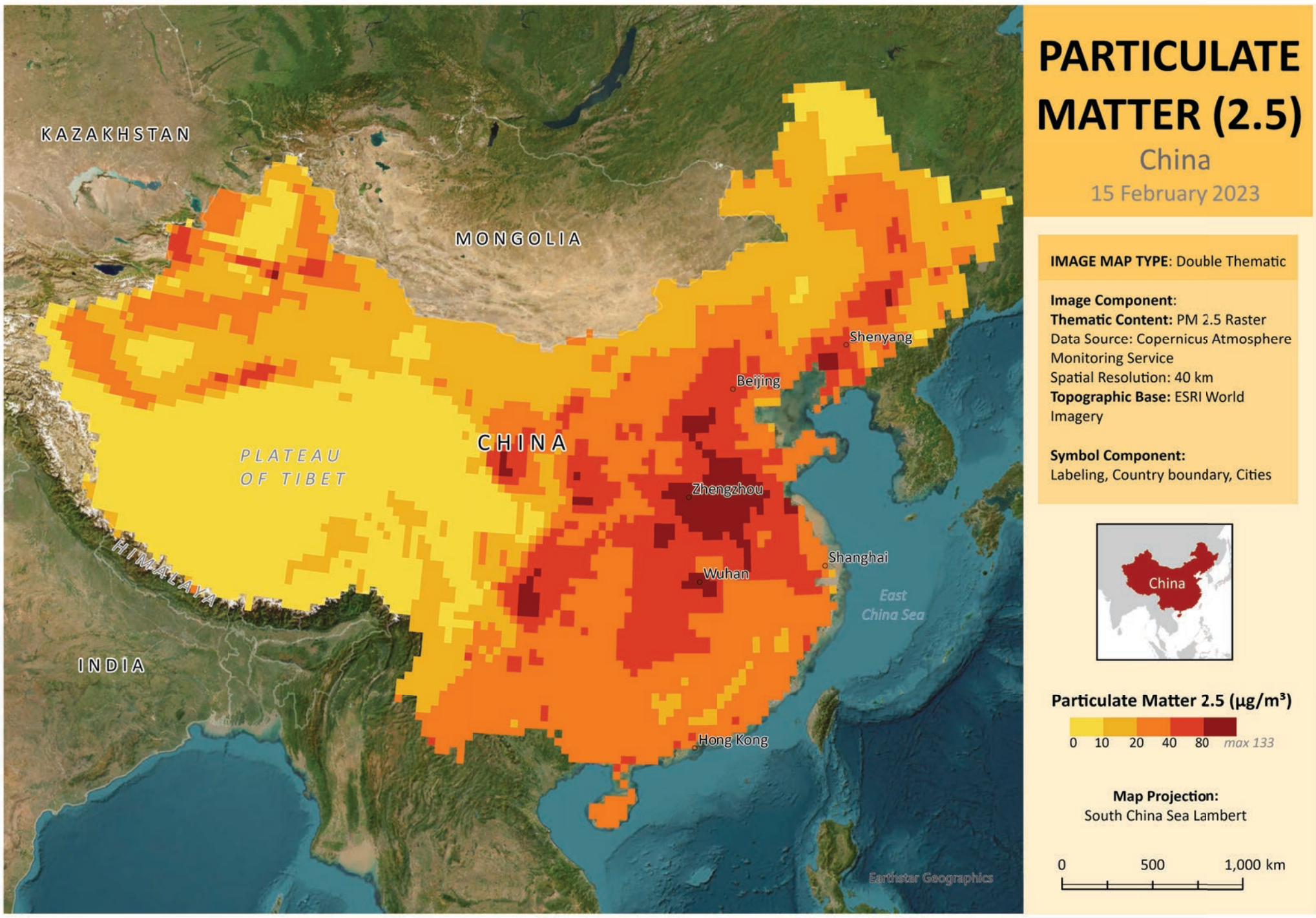
COPERNICUS SUPPORTS SUSTAINABLE DEVELOPMENT GOALS #05

Particulate matter are the tiny particles of solid or liquid suspended in the air. Such particles usually include dust, dirt, soot, smoke or drops of liquid. They have different shape, size, composition and may result from both natural as well as anthropogenic sources. The particulate matter found in the atmosphere can be broadly categorized into PM10 and PM2.5, or sometimes even finer. Particulate matter block the incoming solar radiation and lead to poor visibility. They cause adverse health effects related to eyes, skin and lungs. Such pollutants are primarily responsible for lowering the air quality in the cities and deteriorating the urban infrastructure. As per WHO Air Quality Guidelines, the 24-hour average concentration of PM2.5 in the cities should not exceed 15 µg/m³.



Copernicus data for particulate matter 2.5 reveals that the concentration of PM2.5 in China is very high in the urban areas. The cities of Zhengzhou and Wuhan have extreme level of particulate pollution whereas the Plateau of Tibet and the region near the Himalaya exhibit a very minimal level of particulate pollution. The average value of PM 2.5 concentration in China as of 15 February 2023 is 23.23 µg/m³ which is outside the acceptable level as specified by WHO. Copernicus data helps to discover that human activities are primarily responsible for the particulate pollution in China as the cities with dense human settlements have much higher particle concentration than the natural regions that are untouched by human settlement. This could be due to higher industrial production, fuel combustion, vehicle exhaust and smoking in the cities. The data serve to monitor the air quality of China by identifying the core regions of higher particulate pollution. Some immediate actions are suggested to be undertaken in the cities to control particulate pollution such as the minimization of anthropogenic emissions and the use of air filters.

SDG RELEVANCE

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

Target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

Indicator 11.6.2: Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)

COPERNICUS DATA

Dataset	: CAMS Global Atmospheric Composition Forecasts
Provider	: Copernicus Atmosphere Monitoring Service
Data type	: Gridded
Horizontal coverage	: Global
Horizontal resolution	: 0.4°x0.4°
Vertical coverage	: Total column
Vertical resolution	: Single level
Temporal coverage	: 2015 to present
Temporal resolution	: Hourly
File format	: NetCDF-3

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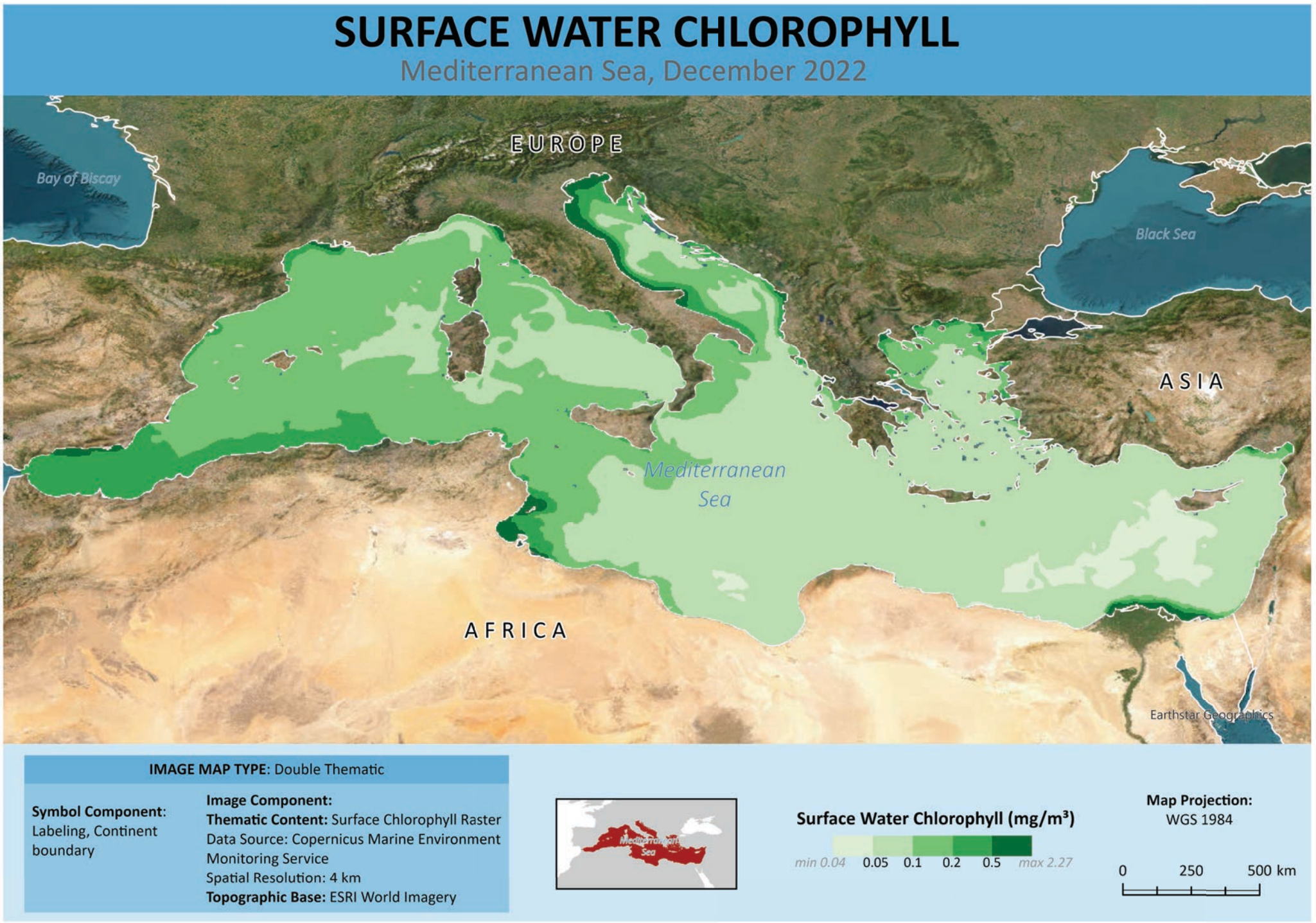
#06

Surface water chlorophyll is an important indicator of coastal eutrophication and marine pollution. Chlorophyll is a common pigment found in the living cells of plant species, algae and cyanobacteria that supports the natural process of photosynthesis. Excessive concentration of chlorophyll in phytoplankton can lead to the accumulation of nutrients such as nitrogen, phosphorous and silica in water. Such over enrichment of nutrients in water bodies fosters algal growth, kills fishes, depletes oxygen levels and increases the toxicity of water. The amount of chlorophyll concentration varies depending on the season, depth, temperature and nature of water bodies. As per the guiding standard for marine water quality, for a healthy and ambient marine water, the concentration of chlorophyll-a should not exceed 4 mg/m³ (MOCCAEUAE, 2020).



Copernicus data for surface water chlorophyll in Mediterranean Sea reveals that the chlorophyll concentration is quite higher in the western extent of the sea than the eastern part. Typically, the coastal regions of Italy, France, Spain, Tunisia and Egypt are more concentrated with the presence of chlorophyll. The average value of surface water chlorophyll in Mediterranean Sea as of December 2022 is 0.12 mg/m³ which falls within the acceptable limit of marine water quality. The distribution of chlorophyll values indicates that the surface water of Mediterranean Sea is fairly ambient and very low in nutrient pollution. It can be visualized from the Copernicus data that the concentration of surface water chlorophyll is much higher in the coastal water than the offshore water. This could be due to the result of high nutrients supply from the mainland region to the coastal area through river runoffs. Copernicus data helps to monitor the coastal eutrophication and tropic state of marine resources by determining the level of chlorophyll concentration and thereby recommends to lower the nutrient pollution through the reduced use of fertilizers and proper sewage disposal.

SDG RELEVANCE

14 LIFE BELOW WATER

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

Indicator 14.1.1: Index of coastal eutrophication

COPERNICUS DATA

Dataset	: Mediterranean Sea Biogeochemistry Reanalysis
Provider	: Copernicus Marine Environment Monitoring Service
Data type	: Gridded
Horizontal coverage	: Mediterranean Sea
Horizontal resolution	: 4 km
Vertical coverage	: 125 depth levels
Temporal coverage	: July 2021 to present
Temporal resolution	: Daily, Monthly, Yearly
Projection	: WGS 1984
File format	: NetCDF-4

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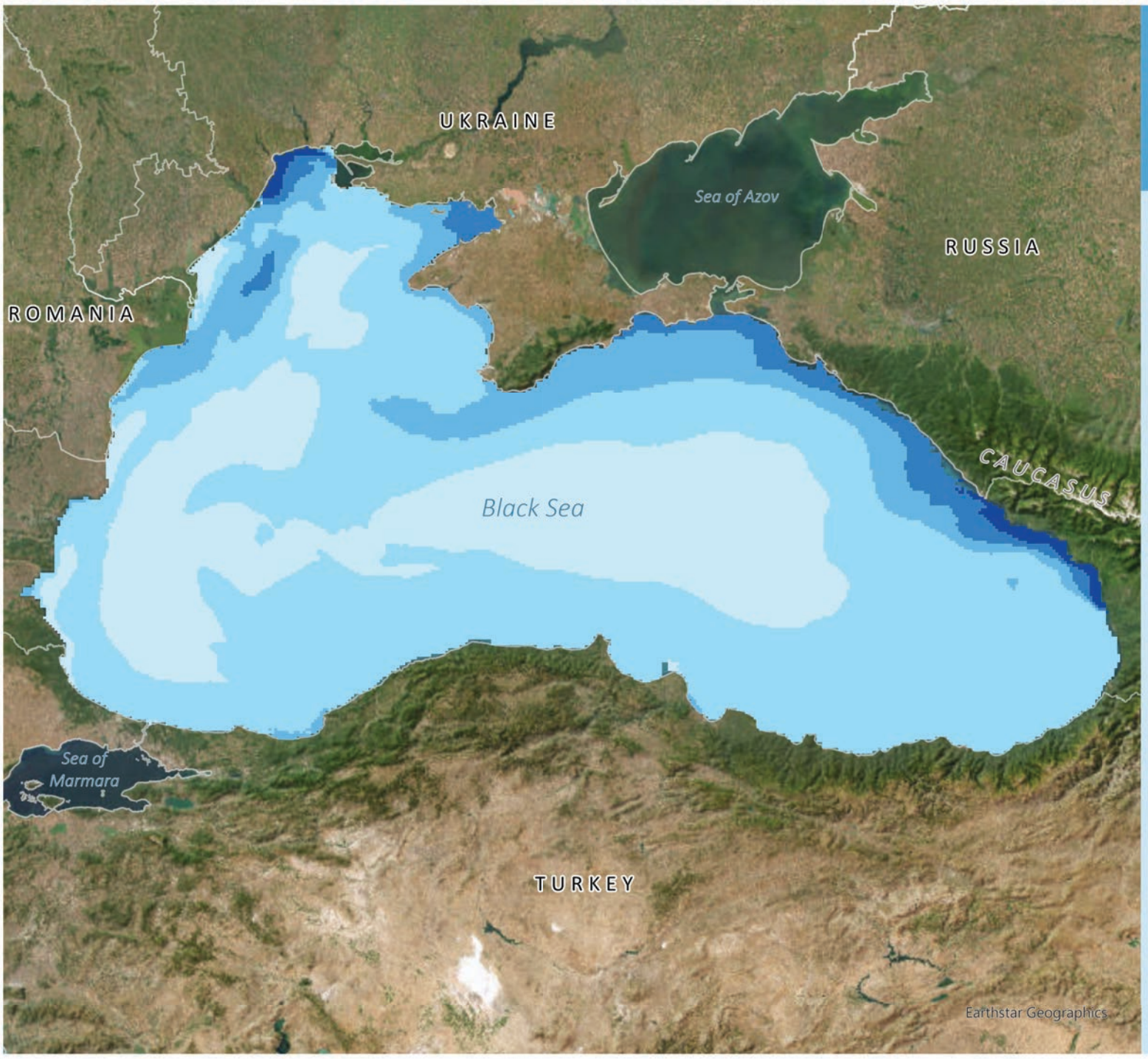
#07

Sea Water PH gives the measure of acidic or alkaline nature of marine water. It plays an important role in the carbon cycle of oceans and helps to monitor the process of ocean acidification. Ocean acidification occurs when the excess of carbon dioxide is absorbed by the oceans. Increase in acidity of sea water has negative impacts on growth and reproduction of shell fish and skeletal creatures. It also affects food web and causes disruption in marine ecosystem. Sea waters are usually slightly alkaline due to the higher concentration of dissolved salts and minerals but their pH can vary with temperature, salinity and depth. Depending on the local conditions, the pH of sea water is expected to range between 7.5 and 8.5 (BBWW, 2021).



SEA WATER PH

Black Sea

January 2023

IMAGE MAP TYPE: Double Thematic

Image Component:
Thematic Content: Sea Water pH (7.5 m depth)
Data Source: Copernicus Marine Environment Monitoring Service
Spatial Resolution: 3 km
Topographic Base: ESRI World Imagery

Symbol Component:
Labeling, Country boundary

Sea Water pH

min 8.23 | 8.28 | 8.30 | 8.32 | 8.34 | max 8.41

Map Projection:
WGS 1984 Web Mercator

0 100 200 km

Copernicus data for sea water pH of Black Sea at 7.5m depth reveals that the sea water is alkaline with slight variations in pH values within its spatial extent. It can be observed that the coastal regions of the sea are more alkaline than the offshore areas. Higher pH values are concentrated near the coastal waters of Ukraine and Russia in the north and Georgia in the east while the coastal areas of Turkey in the south and Bulgaria and Romania in the west have water with low pH values. The average value of sea water pH at 7.5m depth of Black Sea as of January 2023 is 8.29, which falls within the acceptable limit. Copernicus data reveals some signs of ocean acidification in the central part of the sea where lower pH values are evident than the surrounding regions. This implies that the deep waters of Black Sea are more acidic than surface waters. In order to regulate the acidity of marine resources, it can be recommended to reduce the anthropogenic emissions of carbon dioxide that acts as the main driver for ocean acidification.

SDG RELEVANCE

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

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

Indicator 14.3.1: Average marine acidity (pH) measured at agreed suite of representative sampling stations

COPERNICUS DATA

Dataset	: Black Sea Biogeochemistry Reanalysis
Provider	: Copernicus Marine Environment Monitoring Service
Data type	: Gridded
Horizontal coverage	: Black Sea
Horizontal resolution	: 3 km
Vertical coverage	: 31 depth levels
Temporal coverage	: January 2021 to present
Temporal resolution	: Daily, Monthly
Projection	: WGS 1984
File format	: NetCDF-4

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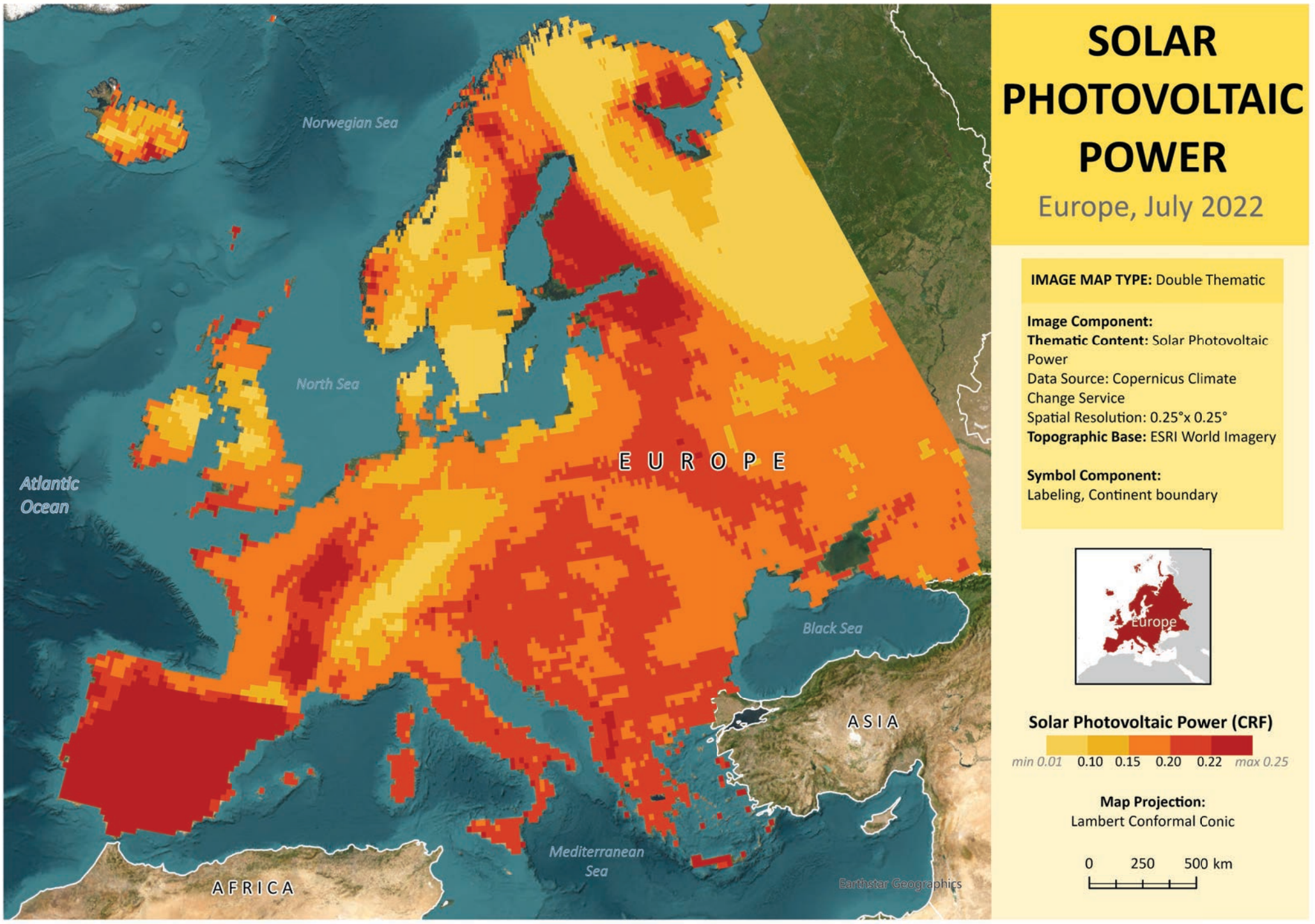
#08

Solar photovoltaic power expressed as capacity factor is the ratio of actual generation of solar power to the installed capacity. Solar energy is the form of renewable energy that is clean, sustainable and totally inexhaustible. The increased use of solar energy helps to reduce carbon emissions and lowers the impact of global warming and climate change. Solar photovoltaics use solar cells to convert sunlight directly into electricity through photovoltaic effect. The capacity factor of solar photovoltaic cells depend on how long the cells are operational or how much of solar energy the cells produce. Higher value of capacity factor indicates better performance of the system. The optimal value of capacity factor for solar energy usually ranges between 0.1 and 0.25 (SolarSena, 2022).



Copernicus data for solar photovoltaic power generation for Europe reveals that the capacity factor for solar power generation is greater in the southwestern region of the continent. Spain and Portugal have the maximum capacity factor ratio while the Alps region, Nordic countries and Russia have the least values. The Balkan region and the Central Europe exhibit moderate values of solar capacity factor. The average value of solar photovoltaic power as capacity factor ratio for Europe in July 2022 is 0.16, which seems to be quite low for the summer observation. This could be possibly due to the geographical extent of Europe as it is situated higher than the equator and has fewer sunshine hours. Copernicus data on solar photovoltaic power helps to identify the regions with higher capacity factor and thereby suggests to establish more solar plants in those regions for maximum power generation. This helps to promote clean energy and minimize the excess of carbon emissions from the burning of fossil fuels. The generation of solar power can also be maximized through proper adjustment of size and inclination of the photovoltaic cells.

SDG RELEVANCE

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix

Indicator 7.2.1: Renewable energy share in the total final energy consumption

COPERNICUS DATA

Dataset	: Climate and Energy Indicators for Europe from 2005 to 2100
Provider	: Copernicus Climate Change Service
Data type	: Gridded
Horizontal coverage	: Europe
Horizontal resolution	: 0.25° x 0.25°
Vertical coverage	: 0 to 100 m
Vertical resolution	: Single level
Temporal coverage	: 2005 to 2100
Temporal resolution	: 3-hourly, daily
File format	: NetCDF

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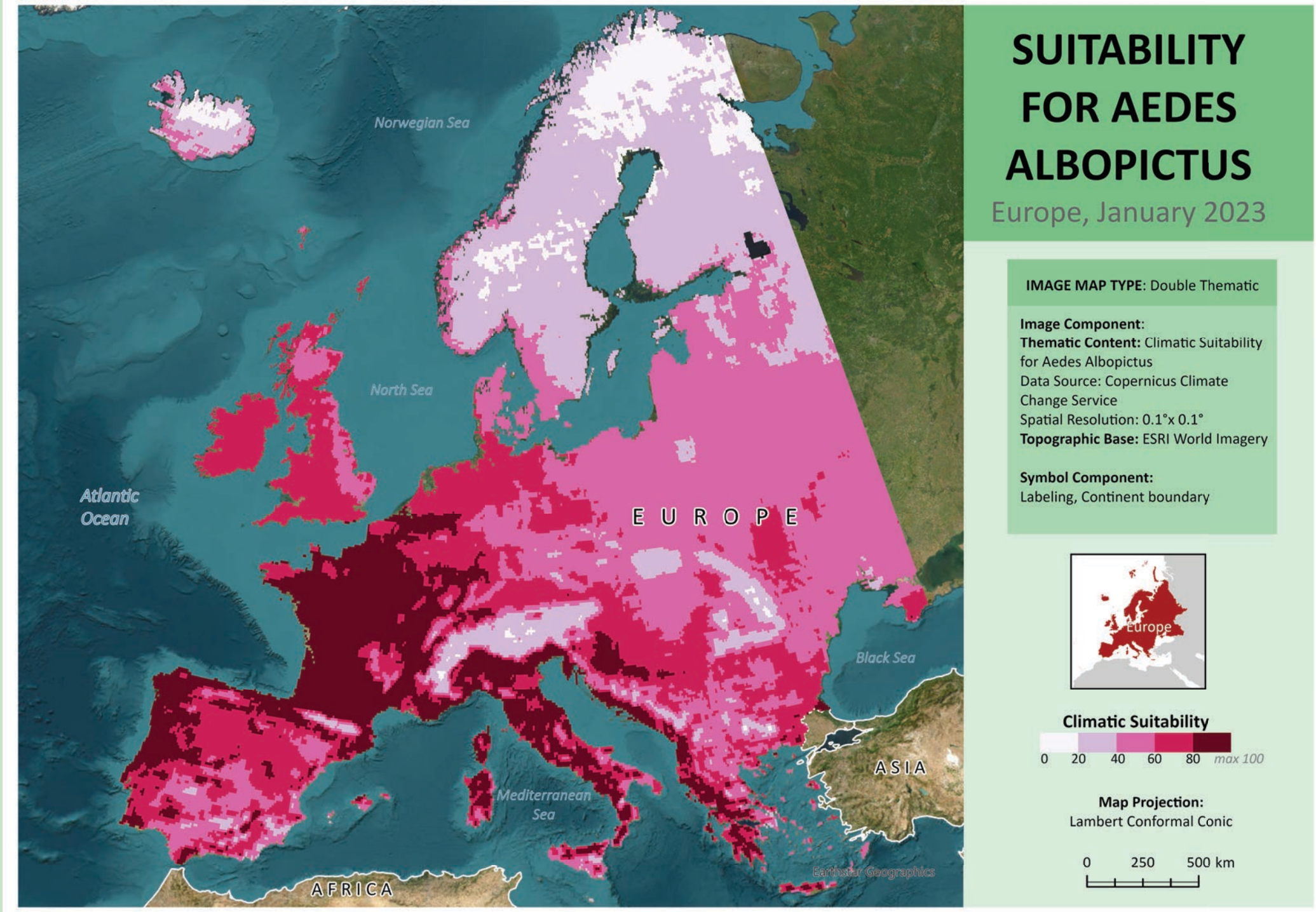
#09

Aedes Albopictus, also known as tiger mosquito is an important transmitter of vector-borne diseases like yellow fever, dengue, Zika and Chikungunya. These species of mosquito were originated from Southeast Asia and are commonly found in tropical and subtropical regions with warm and humid climate. They usually breed in wetlands including swamps and marshes and are capable of multiplying significantly in suitable climatic conditions. The tiger mosquito causes a number of casualties and deaths every year posing a serious threat to health and well-being. Climatic suitability for tiger mosquito depends on various factors such as rainfall, temperature, humidity, etc. It is measured on a scale of 0 to 100 where 0 means the least suitable and 100 means the most suitable climatic condition (C3S, 2019).



Copernicus data on climatic suitability for Aedes Albopictus in Europe reveals that the Southwestern region of Europe has the most suitable climatic conditions for the mosquito. France exhibits the highest climatic suitability than any other country. Italy, Portugal, Croatia and Belgium are also marked with a greater climatic suitability. The Alps region and the Nordic countries are the least climatically suitable regions for the adaptation of the mosquito. The average value for climatic suitability for Aedes Albopictus in Europe as of January 2023 is 50.54 which indicates that Europe is moderately suitable for the breeding of tiger mosquito. Copernicus data helps to identify and confirm that the regions with higher summer temperature, mild winter temperature and sufficient amount of rainfall are at a greater risk for the spread of mosquito. It also supports the evidence that the mosquitoes are lethargic to lower temperatures and suggests the need to uptake necessary measures to prevent the warming of the continent. The suitability for Aedes Albopictus can also be controlled naturally through the elimination of swamps, proper garbage disposal and the growth of mosquito repellant plants.

SDG RELEVANCE

Goal 3: Ensure healthy lives and promote well-being for all at all ages

Target 3.3: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

Indicator 3.3.3: Malaria incidence per 1,000 population

COPERNICUS DATA

Dataset	: Climatic Suitability for the Presence and Seasonal Activity of Aedes Albopictus
Provider	: Copernicus Climate Change Service
Data type	: Gridded
Projection	: WGS 1984
Horizontal coverage	: Europe
Horizontal resolution	: 0.1° x 0.1°
Vertical coverage	: Surface
Temporal coverage	: 1986-2085
Temporal resolution	: Seasonal, yearly
File format	: NetCDF

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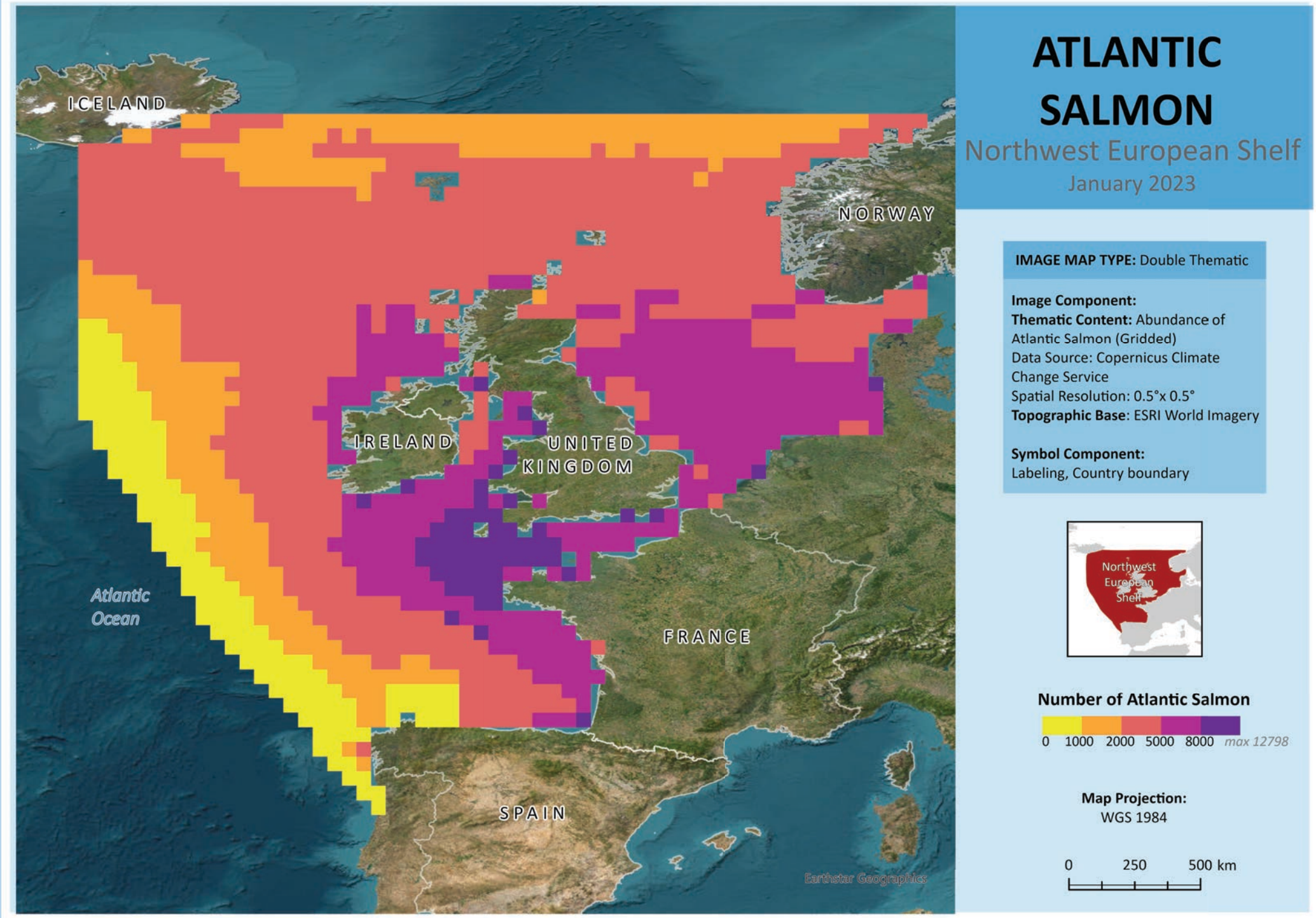
COPERNICUS SUPPORTS SUSTAINABLE DEVELOPMENT GOALS

#10

Sustainable fishing is a practice that helps to maintain healthy and productive fish population. Such practice ensures that the abundance of fish does not decline over time due to fishing activities. Changes in the aquatic environment such as warming, acidification, deoxygenation and human activities such as overfishing can pose a serious threat to the fish stocks. Fish species like Atlantic Salmon are highly demanded for human consumption due to their richness in protein and omega-3 fatty acids. Unregulated and illegal harvesting of such fishes can lead to the declination in their number or may even cause permanent extinction in some species. For the North Atlantic Ocean, the abundance of Atlantic Salmon above 5 million can be considered as a sustainable stock (NASCO, 2019).



Copernicus data on abundance of Atlantic Salmon in the Northwest European Shelf reveals that the fish stock is maximum along the English Channel between the boundary of France and the United Kingdom. The North Sea and the Celtic Sea are also identified with higher abundance of Atlantic Salmon. The number of Salmon declines considerably as we move away from the coastal region of United Kingdom towards Atlantic Ocean in the West and Norwegian sea in the North. The average number of Atlantic Salmon per 0.5° grid in the Northwest European Shelf as of January 2023 is 3530, which indicates not much abundance of the fish stock. The decline in the number of fishes could be possibly due to overfishing activities, marine pollution, climate change and habitat degradation. Copernicus data on fish abundance helps to monitor the population of fish species and thereby support to regulate overfishing and other illegal practices that threaten the fish stock. It recommends the need for the maximum sustainable yield which can be achieved through habitat restoration, water quality management and reduction in overexploitation of marine resources.

SDG RELEVANCE

14 LIFE BELOW WATER

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Target 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

Indicator 14.4.1: Proportion of fish stocks within biologically sustainable levels

COPERNICUS DATA

Dataset	: Fish Abundance and Catch Data for Northwest European Shelf
Provider	: Copernicus Climate Change Service
Data type	: Gridded
Horizontal coverage	: Northwest European Shelf
Horizontal resolution	: 0.5° x 0.5°
Vertical coverage	: Full water column
Vertical resolution	: Single level
Temporal coverage	: 2006 up to 2050
Temporal resolution	: Yearly
File format	: NetCDF-4

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Palacký University Olomouc

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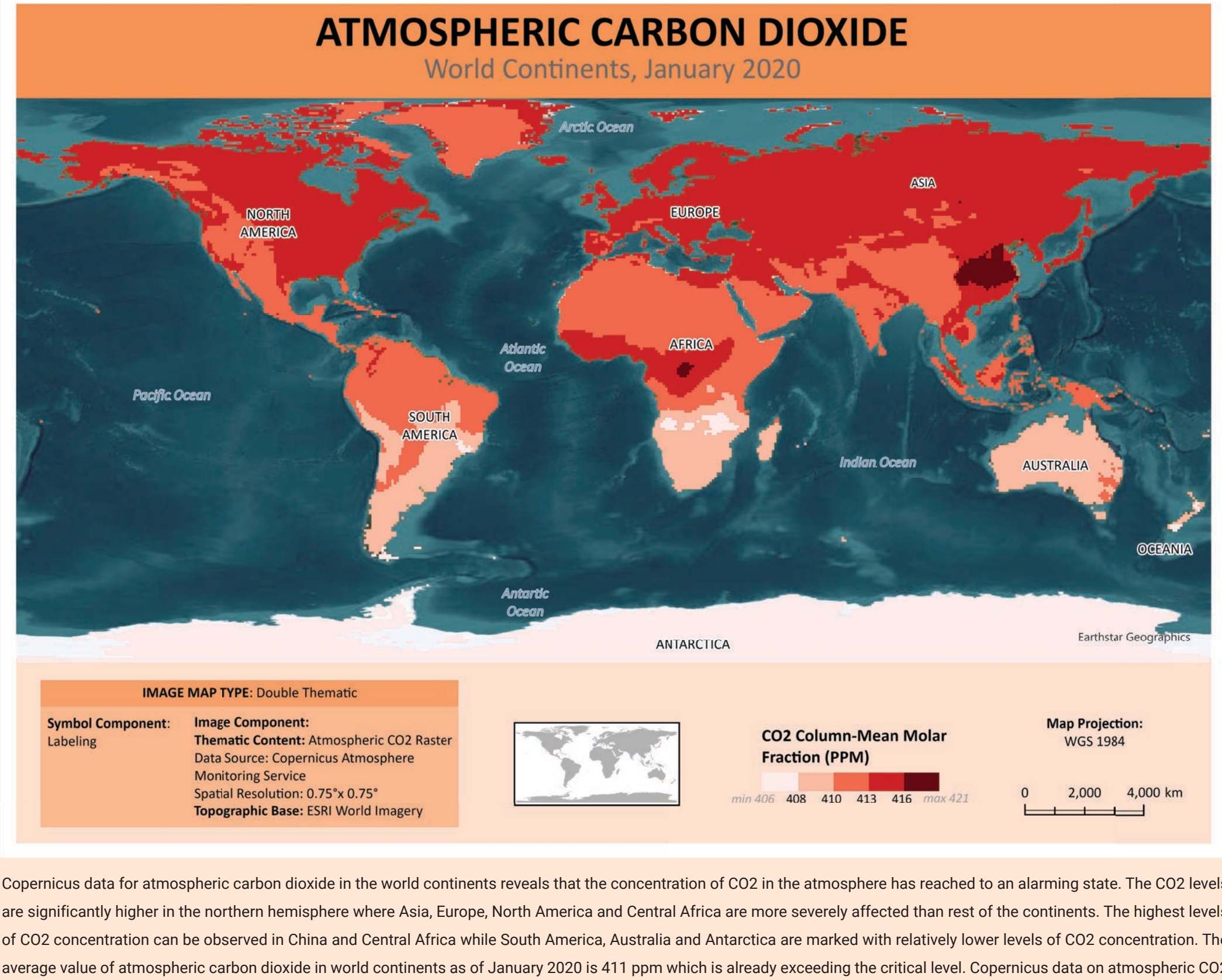
Olomouc, 2023

COPERNICUS SUPPORTS SUSTAINABLE DEVELOPMENT GOALS #11

Carbon Dioxide is a greenhouse gas primarily responsible for global warming and climate change. It occurs naturally through the process of cellular respiration as well as through anthropogenic emissions such as fossil fuel combustion, deforestation, vehicle exhaust, etc. Rapid industrialization is the primary reason for the recent increase in levels of carbon dioxide in the atmosphere. With the rise in the concentration of atmospheric carbon dioxide, heat gets trapped inside the earth surface and it starts to warm up. This can lead to severe weather conditions, extreme temperatures and irregular precipitations. As per IPCC, the level of CO2 concentration in the atmosphere should be ideally maintained within 350 ppm. Any concentration exceeding 400 ppm is considered as a potentially dangerous driver for inducing climate change.



Copernicus data for atmospheric carbon dioxide in the world continents reveals that the concentration of CO2 in the atmosphere has reached to an alarming state. The CO2 levels are significantly higher in the northern hemisphere where Asia, Europe, North America and Central Africa are more severely affected than rest of the continents. The highest levels of CO2 concentration can be observed in China and Central Africa while South America, Australia and Antarctica are marked with relatively lower levels of CO2 concentration. The average value of atmospheric carbon dioxide in world continents as of January 2020 is 411 ppm which is already exceeding the critical level. Copernicus data on atmospheric CO2 concentration confirms that our planet is highly vulnerable to the devastating effects of climate change. It points out the urgency to cut down the carbon emissions as soon as possible through the practice of sustainable industrialization. The excessive concentration of carbon dioxide resulting from the combustion of fossil fuels can be minimized by using low carbon alternatives or switching to renewable energy sources such as solar energy, hydropower, wind energy, geothermal energy, etc.

SDG RELEVANCE

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

Indicator 9.4.1: CO2 emission per unit of value added

COPERNICUS DATA

Dataset	: CAMS Global Greenhouse Gas Reanalysis
Provider	: Copernicus Atmosphere Monitoring Service
Data type	: Gridded
Horizontal coverage	: Global
Horizontal resolution	: 0.75°x0.75°
Vertical coverage	: Total column
Vertical resolution	: Single level
Temporal coverage	: 2003 to 2020
Temporal resolution	: 3-hourly
File format	: NetCDF

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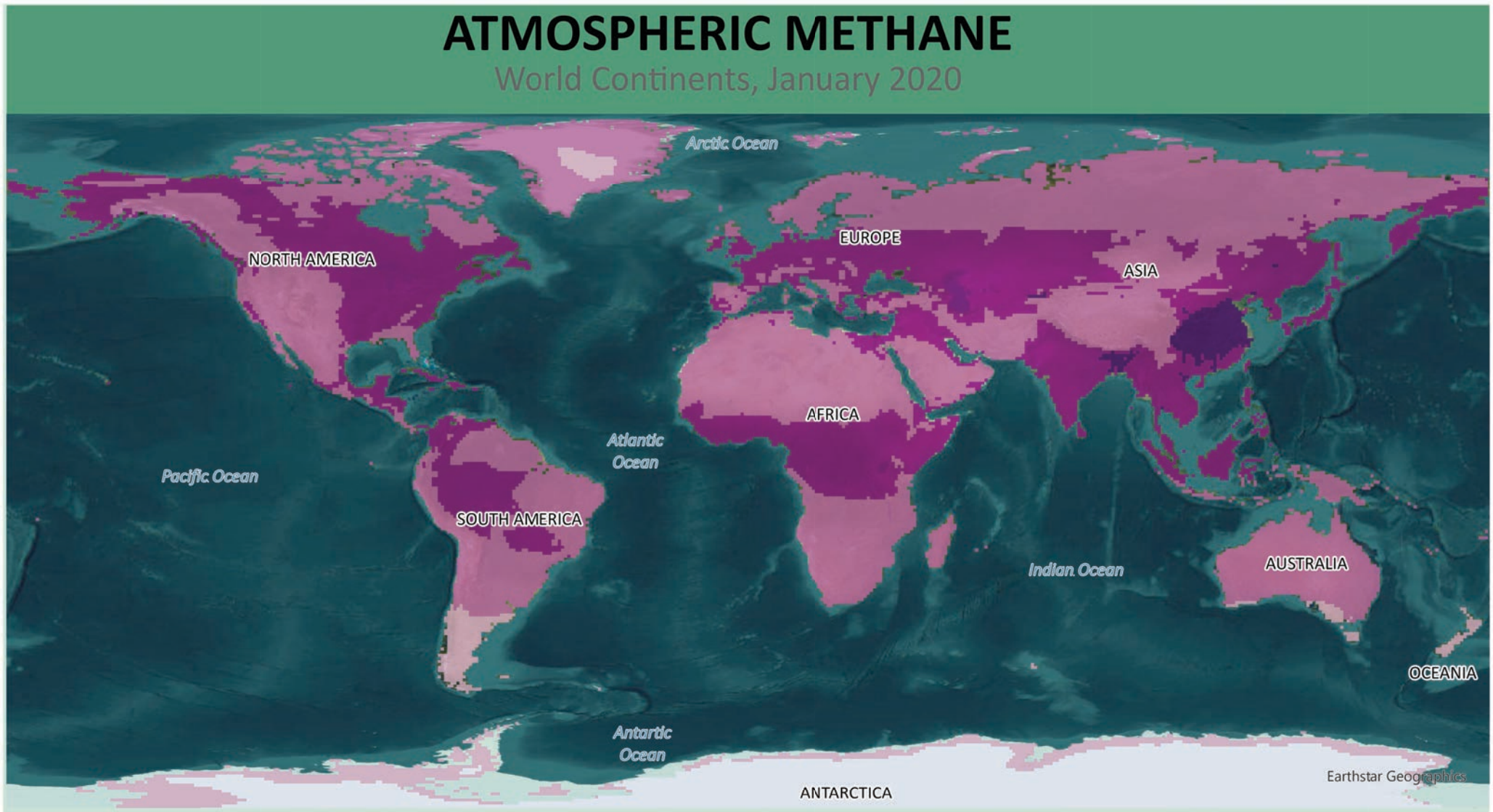
COPERNICUS SUPPORTS SUSTAINABLE DEVELOPMENT GOALS #12

Greenhouse gases are the gases that cause greenhouse effect by trapping the incoming solar radiation and slowing the rate at which the energy escape to the space. The most common greenhouse gases occurring in the atmosphere are carbon dioxide, methane, water vapour, nitrous oxide and ozone. These gases help to keep our planet warm and habitable but their excessive concentration in the atmosphere can lead to global warming. Atmospheric methane is stronger and has higher potential of trapping heat than the same volume of any other greenhouse gases. Methane is mostly released from oil and gas extractions, biomass burning, livestock fermentation, landfills, agriculture and industries. As per IPCC, methane concentration in atmosphere above 1900 ppb can be considered as highly critical for our planet.



Copernicus data for atmospheric methane in world continents reveals that Asia has significantly higher concentration of atmospheric methane than any other continents. Typically, China and Bangladesh exhibit critically higher levels of methane concentration. Other regions like Central Africa, Europe, Eastern part of North America and Northwestern part of South America are also distinguished with higher levels of methane concentration while Australia, Greenland and Antarctica appear relatively safer. The average value of atmospheric methane in world continents as of January 2020 is 1828 ppb which is not so far away from approaching the critical level. The higher concentration of methane in the atmosphere can be a signal for global warming and climate change. Copernicus data helps to monitor the critical levels of methane and other greenhouse gases in the atmosphere and thereby suggest the immediate need for reducing their emissions. The excessive concentration of greenhouse gases can be reduced by switching to clean and green energy sources as early as possible. The emissions can also be reduced through the recycle of waste products as well as through the adoption of climate friendly agriculture and industrial practices.

SDG RELEVANCE

Goal 13: Take urgent action to combat climate change and its impacts

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

Indicator 13.2.2: Total greenhouse gas emissions per year

COPERNICUS DATA

Dataset	: CAMS Global Greenhouse Gas Reanalysis
Provider	: Copernicus Atmosphere Monitoring Service
Data type	: Gridded
Horizontal coverage	: Global
Horizontal resolution	: 0.75°x0.75°
Vertical coverage	: Total column
Vertical resolution	: Single level
Temporal coverage	: 2003 to 2020
Temporal resolution	: 3-hourly
File format	: NetCDF

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#13

Forests are important natural resource that constitute the terrestrial ecosystem. They support life and provide food, shelter and protection to a variety of wild creatures. Forests regulate the water cycle, release oxygen into the atmosphere as well as play a crucial role in absorbing the excess of carbon emissions. Forests are increasingly being destroyed due to residential, agricultural, industrial and commercial purposes. Rapid deforestation can lead to the occurrence of natural disasters like landslide, flood, drought, erosion, etc causing a serious threat to the biodiversity. Forests once destroyed take a long time to regenerate and might never recover to the same state as before. The problem of deforestation is highly prominent in the tropical rainforests of Southeast Asia, Latin America and Africa.

FOREST COVER

Venezuela, 2019

IMAGE MAP TYPE: Back/Rear Thematic

Symbol Component:
Thematic Content: Forest Cover, Country boundary, Labeling
Data Source: Copernicus Global Land Service
Spatial Resolution: 100 m

Image Component:
Topographic Base: ESRI World Imagery

Forest

Total Area: 47,426,889 ha

Map Projection:
WGS 1984

0 100 200 km

Copernicus data on global land cover provides spatial information on various land cover categories across the globe. The map visualizes Copernicus data on forest cover in Venezuela which reveals that the country has an abundance of forest particularly in its Southern extent. The Amazon rainforest contributes to a major share of the forest area in the country. The total area covered by forests in Venezuela in the year 2019 is 47,426,889 hectares, which indicates 52.01% of total area of the country. This represents a fairly good proportion of forest area in the country, although the forest in Venezuela is found to decline rapidly each year. This is probably resulted from the ongoing deforestation in Venezuela due to mining activities, intensive agriculture, forest fire and overgrazing. The Amazon rainforest in the South undergoes a rapid decline in its area each year due to the mining of gold, coltan, diamond and bauxite in the region of Orinoco. Copernicus data on forest cover helps to monitor the status of forest and thereby suggests the need to take urgent action against deforestation for sustainable forest management.

SDG RELEVANCE

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Target 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

Indicator 15.1.1: Forest area as a proportion of total land area

COPERNICUS DATA

Dataset	: Global Land Cover
Provider	: Copernicus Land Monitoring Service
Data type	: Gridded
Thematic classes	: 23
Horizontal coverage	: Global
Horizontal resolution	: 100 m
Temporal coverage	: 2015-2019
Temporal resolution	: Yearly
Projection	: WGS 1984
File format	: GeoTIFF

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COPERNICUS SUPPORTS SUSTAINABLE DEVELOPMENT GOALS

#14

Water ecosystem constitute of water bodies such as rivers, lakes, seas, oceans, ponds, reservoirs, wetlands, etc. They occur in various shapes and sizes and can be permanent as well as seasonal. Water ecosystems not only provide water for drinking and utility purpose but also support the entire aquatic and marine life. The abundance of healthy water ecosystem helps to enhance the freshness and aesthetics of natural environment. Water ecosystems are increasingly being degraded due to their over exploitation from human intervention. Human activities affect both the quality and quantity of water ecosystem resulting to pollution, turbidity, acidification and oxygen depletion. Unsustainable management of water ecosystem can lead to abnormal surface water dynamics causing the unnatural rate of expansion or shrinkage of water bodies.

WATER ECOSYSTEM

Minnesota, 2019

IMAGE MAP TYPE: Back/Rear Thematic

Symbol Component:
Thematic Content: Water bodies, State boundary, Labeling
Data Source: Copernicus Global Land Service
Spatial Resolution: 100 m

Image Component:
Topographic Base: ESRI World Imagery

Water Body
Total Area: 1,203,013 ha

Map Projection:
NAD 1983

0 50 100 km

Copernicus data on global land cover provides spatial information on various land cover categories across the globe. The map visualizes Copernicus data on the spatial extent of water ecosystem in the state of Minnesota, which reveals that the state has an abundance of inland water bodies including rivers, lakes, reservoirs ponds, wetlands, etc. The total area covered by water bodies in Minnesota in the year 2019 is 1,203,013 hectares, which indicates a fairly good distribution of water bodies in the state. Copernicus data supports the fact that water ecosystems are subject to spatial dynamics i.e., their spatial extent changes over time. The overall area of water bodies in the state of Minnesota is found to increase slightly each year. Such expansion in the surface area could be the result of excessive precipitation or flooding while in some cases, drying out of wetlands and floodplains can also occur due to reduced precipitation or warming. Copernicus data on water bodies help to monitor the status and spatial dynamics of water ecosystem and thereby suggest the necessary measures for their conservation and sustainable management.

SDG RELEVANCE

Goal 6: Ensure availability and sustainable management of water and sanitation for all

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

Indicator 6.6.1: Change in the extent of water-related ecosystems over time

COPERNICUS DATA

Dataset	: Global Land Cover
Provider	: Copernicus Land Monitoring Service
Data type	: Gridded
Thematic classes	: 23
Horizontal coverage	: Global
Horizontal resolution	: 100 m
Temporal coverage	: 2015-2019
Temporal resolution	: Yearly
Projection	: WGS 1984
File format	: GeoTIFF

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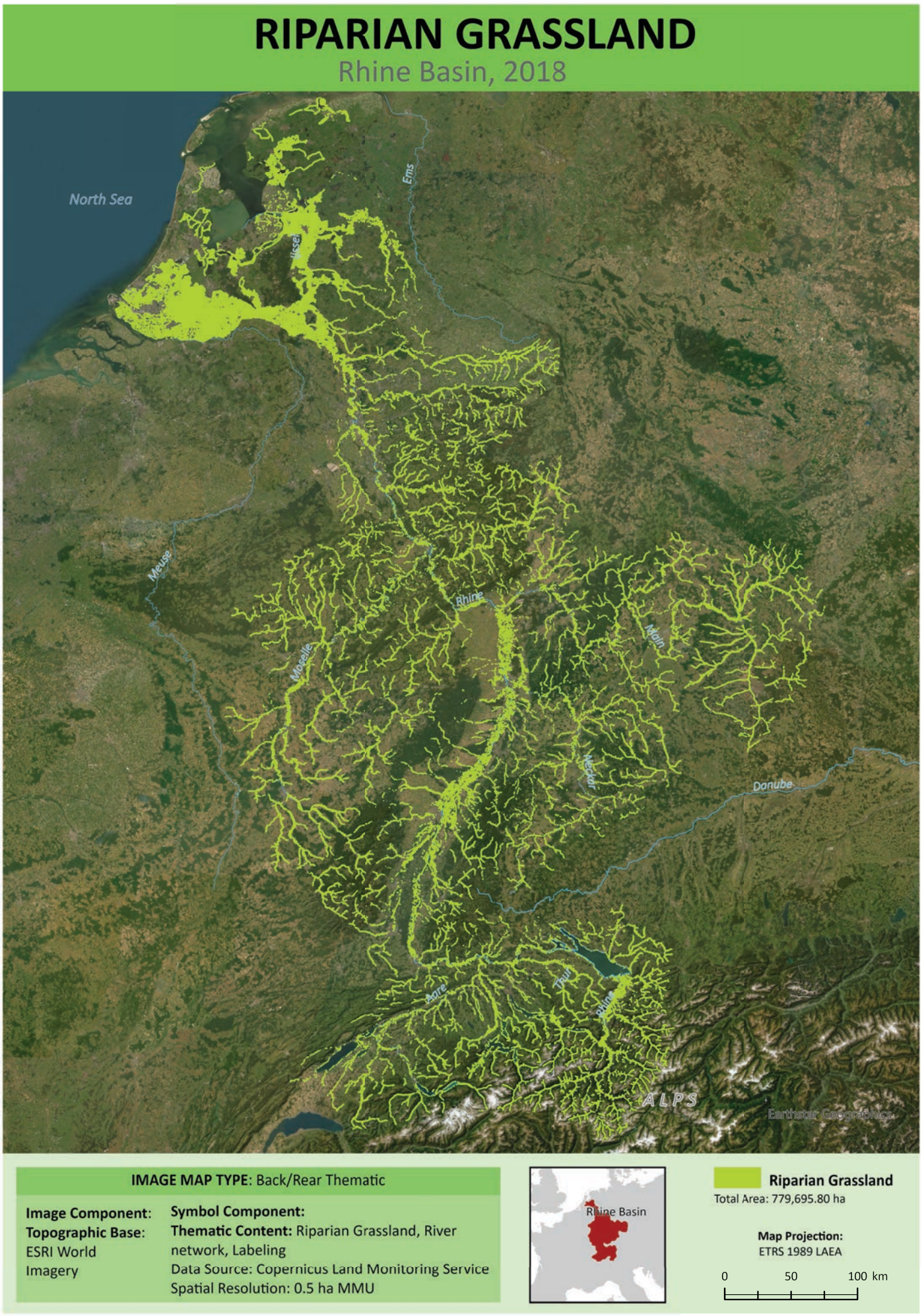
COPERNICUS SUPPORTS SUSTAINABLE DEVELOPMENT GOALS #15

Riparian grassland are the green, ecologically important zones along the rivers, streams and freshwater bodies. They play a crucial role in soil conservation, chemical filtration, flood control and protection of aquatic ecosystem. Riparian grasslands provide food to herbivorous creatures and shelter to insects, invertebrates and microorganisms. They also help to maintain natural greenery and regulate the water and nutrient cycles. Riparian grasslands are being increasingly destroyed due to human interventions such as agricultural and residential expansion, use of pesticides and chemical fertilizers, overgrazing, irrigation, fishing, etc. Destruction of riparian grasslands can cause serious threats to both the terrestrial and aquatic ecosystem. Some negative impacts of grassland deterioration include disruption in food web, loss of soil moisture, excessive runoffs, dust storms and desertification.



SDG RELEVANCE

15 LIFE ON LAND

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Target 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

Indicator 15.1.2: Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type

COPERNICUS DATA

Dataset	**: RZ Land Cover/Land Use**
Provider	**: Copernicus Land Monitoring Service**
Data type	**: Vector**
Thematic classes	**: 55**
Horizontal coverage	**: Europe**
Horizontal resolution	**: 0.5 ha MMU**
Temporal coverage	**: 2010-2013, 2017-2020**
Reference years	**: 2012, 2018**
Projection	**: ETRS 1989 LAEA**
File format	**: Shapefile**

Copernicus data on riparian zone land cover/ land use provides detailed information on the state and characteristics of riparian zones across the European continent. The map visualizes Copernicus data on riparian grassland in Rhine basin which reveals the richness of grassland along the Rhine River and its tributaries. It can be observed that the grassland is denser particularly in the northern extent of the basin. The total area covered by riparian grassland in Rhine basin in the year 2018 is 779,695.80 hectares, which indicates the presence of a substantial amount of grassland in the basin. However, the grassland area in the Rhine basin is found to decline considerably than in the reference year 2012. Copernicus data on riparian grassland helps to monitor the status of grasslands in the riparian zones and illustrate how they have changed between the reference years. It recommends the need for the conservation, restoration and sustainable management of grassland in the Rhine basin in order to prevent it from further deterioration. This can be achieved by minimizing the overexploitation of grasslands and by controlling human intervention on natural resources.

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