6 – Clean Water

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

EO data offer an invaluable opportunity for better-informing development policies and quantifying various targets. How can EO be used to help countries achieve specific targets? *Source:* ***ESA compendium of EO contributions to the SDG Targets and Indicators***

Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

One of the most essential uses of water is for domestic consumption within households. This purpose is captured in target 6.1, which seeks to guarantee safe and affordable drinking water for drinking and hygiene purposes for all. Households are an important share of total water use and therefore represent a significant sector in achievement of target 6.4 on water use efficiency. "Safe" water is considered to be free of contaminants and is determined by the quality of untreated water prior to human consumption.

The necessity of the target, for a supply of high water quality in the first place, is threatened by conversion of wetlands, forests and woodlands to agr iculture around populated areas and water catchments. This target is therefore linked to the protection of the water catchment which is the focus of target 6.6 and the quality of water in target 6.3. The use of land cover change data, particularly in models to estimate the impact on water supplies in the event of widespread deforestation and land conversion, is a powerful way to show how drinking water becomes both unsafe and unaffordable in the event of a water supply being compromised by the conversion of natural ecosystems which regulate it. As EO-based observations are primary inputs to such models, countries can be supported towards achievement of target 6.1 by implementing such models and to plan for better baseline water quality through regulation of land use in water catchments.

(eo services based on Assess water use efficiency)

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.

Target 6.3 aims to improve ambient water quality, important for protecting both ecosystem health and human health, by eliminating, minimizing and significantly reducing different streams of pollution into water bodies. The main sources of water pollution include wastewater from households, commercial establishments and industries (point sources), as well as run-off from urban and agricultural land (non-point sources). Water quality can be measured in different ways and EO methods of water quality detection differ from those based on in-situ assessment. Therefore EO support to this target will be limited by what can be detected based on current sensor technology. EO is important in ongoing, routine water quality monitoring of large water bodies, ideally in combination with in situ sampling. Yet it is feasible, although challenging, to use EO as a monitoring tool for illegal contamination of water supplies. The release of certain hazardous chemicals and materials, for example, can alter the opacity, turbidity and colour of lakes, rivers or other water bodies, which can be sensed from a multispectral or hyperspectral sensor. Armed with this EO-derived information on sudden declines in water quality, e.g. due to dumping of hazardous materials, water management authorities could track down polluters. However, the spatial resolution of the Sentinel 3 Ocean and Land Colour Imager (OLCI) is likely to be too coarse to accurately detect such events, while the Sentinel 2 Multi Spectral Imager (MSI), although better suited in terms of spatial resolution, is too sparse in terms of revisit time (5 days). A combination of commercial and free sensors (OLCI, S-2, L8, SPOT, RapidEye, IKONOS) could be an option for targeted, local efforts at detection of pollution events. EO can also support countries with the target by assessment of the risk of eutrophication of a country's water bodies by monitoring ambient nutrient pollution in standing waters.

(eo services based on Water quality detection & monitoring. Indicator 6.3.2: Ambient water quality)

Target 6.4: **By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.**

Target 6.4 addresses water scarcity, aiming to ensure there is sufficient water for the population, the economy and the environment by increasing water-use efficiency across all sectors of society. Finding a balance between demands for water from environmental requirements and human demand is essential to maintaining ecosystem health and resilience. An imbalance due to unsustainable levels of demand can result in water stress with negative effects on economic development, increasing competition and potential conflict among users. This requires effective supply and demand management policies and an increase in water-use efficiency.

EO has an obvious – if yet unrecognised – contribution to the monitoring of the target in quantifying surface water changes over time, water consumed by key water-user sector such as agriculture, as well as soil moisture deficits. Therefore EO can help countries achieve water use efficiency gain targets by identify areas of current and future surface water deficits, e.g. through hydrological models, based on EO parameters such as evapotranspiration, soil moisture and surface water, and by modelling supply and demand across sectors based on land use change. In agricultural areas, EO can monitor how effectively water uptake by vegetation is translated into crop yield, using a metric that is referred to as agriculture water productivity (yield/m3 of water consumed). This can ultimately help countries to plan for water deficits in advance of stresses such as climate extremes or when demand is excessive. The number of people suffering from or potentially affected by such water deficits could then be calculated based on demographic statistics A range of options exists for coping with water scarcity that address the supply side or the demand side or a combination of the two, depending on the bio-physical and socio-economic context.

(eo services based on Water user efficiency. Indicator 6.4.1: Water user efficiency & 6.4.2: Water stress)

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

For the purposes of this target, water-related ecosystems are grouped into five categories: 1) vegetated wetlands, 2) rivers and estuaries, 3) lakes, 4) aquifers, and 5) artificial waterbodies. Water-related ecosystems contain and maintain the global stock of freshwater, from which water related services flow to society. They are characterised by high biodiversity and because biodiversity and because they are carbon-rich, are important for climate change mitigation. In terms of services they provide micro climate regulation, e.g. minimising the negative impacts of urban heat islands. They capture and store water and maintain water quality since they can decompose and /or absorb water pollutants. Therefore this target promotes the sustainable management of water catchment ecosystems such as wetlands, rivers, lakes, reservoirs and groundwater, as well as water-related f orests and mountains, which are crucial for provision of these services. The ecosystem based approach is important for flood regulation, public water supply and access to clean drinking water. In this respect, target 6.6 is the starting point for other water-related targets as it aims to protect water at source. As water-related ecosystems are often highly complex and very diverse, management is challenging and monitoring is expensive and time consuming. Therefore EO provides a standardised monitoring approach which can capture the multiple dimensions of change from hydrological to biophysical processes. However as this target is focused on the watershed EO at high spatial resolution, e.g. Landsat and Sentinel-1/-2 (10-30m) should be acquired. For example, high resolution land cover change can be used to track changes in water- related ecosystems, to assess the success of catchment-wide restoration efforts and the effectiveness of protection measures or to identify threats to sensitive habitat. Other EO products such as the extent of water bodies and their temporal dynamics, as well as digital terrain models, are inputs to models that assess the availability of surface and ground water.

(eo services based on Monitoring the extent of water related ecosystems over time. Indicator 6.6.1: Water-related ecosystems)

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- Satellite based oil spill detection and impact assessment – The chronology of the Deepwater Horizon Accident
- EO data services for management of coastal zones
- Sea turbidity monitoring
- Satellite-based oil spill detection
- Satellite based detection of oil spills