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Use of satellite imagery to produce regional statistics disaggregated by territory

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In the information age, the production of official statistics has evolved significantly from the traditional approach of classical statistical operations. The use of non-traditional information sources has gained relevance among national statistical offices in the region due to their ability to provide more accurate, timely, and detailed data. Consequently, several efforts have proliferated in the search for new sources of information in addition to traditional ones, including among others:

- » **Satellite images:** Mainly used to monitor changes in land use, deforestation, urban expansion, and agriculture.
- » **Remote sensor data:** Employed to measure air quality, water characteristics, traffic, and other environmental indicators.
- » **Social networks:** Analyzed to understand mobility patterns, consumption preferences, and social trends.
- » **Digital transaction records:** Used to study economic behavior and e-commerce.

1. Advantages of using satellite images for the construction of statistics and indicators

One of these non-traditional sources is satellite imagery, which offers a unique and valuable perspective for building statistics and indicators, especially those based on Earth observation. Some of the main advantages include:

- » **Broad and continuous coverage:** Satellites can capture images of vast geographic areas continuously, enabling monitoring of changes over time.
- » **High spatial resolution:** Satellite images can provide precise details about the terrain, allowing data disaggregation at subnational and local levels.
- » **Access to remote areas:** Satellites can observe regions inaccessible to traditional data collection methods.
- » **Frequent updates:** The ability to obtain regularly updated images enables the creation of dynamic and timely indicators.
- » **Spatial context and territorial analysis:** Geographic data allows analyzing the distribution, relationships, and dynamics of phenomena in space, integrating multiple sources of information (environmental, social, and economic) within the same territorial framework. This provides a more comprehensive understanding of processes and facilitates decision-making oriented toward territorial development.

In Latin America and the Caribbean, the use of satellite images has great potential to improve the quality and accuracy of official statistics in various areas:

- » **Environmental monitoring:** Changes in forest cover, water quality in rivers and lakes, expansion of agricultural frontiers, among others.
- » **Agriculture:** Assessment of agricultural productivity, detection of pests and diseases, and crop planning.
- » **Urban management:** Analysis of urban expansion, land-use planning, and infrastructure monitoring.
- » **Natural disasters:** Use of satellite images in prevention and mitigation stages, preparedness, response, and recovery from disasters. For example, for planning rapid and effective responses and assessing damage caused by earthquakes, floods, and hurricanes.

2. Information obtained from satellites for Earth observation

Earth observations are a set of geospatial data obtained through both remote sensing and surface measurements. They include atmospheric, oceanic, and terrestrial information at a global level and are crucial for assessing various aspects of development. One of the main sources of geospatial information for Earth observations comes from the large number of satellites orbiting the planet.

These data are collected through sensors onboard satellites that capture electromagnetic radiation (mainly in the visible light, infrared, and microwave ranges) emitted or reflected by the Earth (see table 1). This information is used to generate images, maps, and datasets that help understand and monitor various aspects of the Earth's surface and atmospheric phenomena.

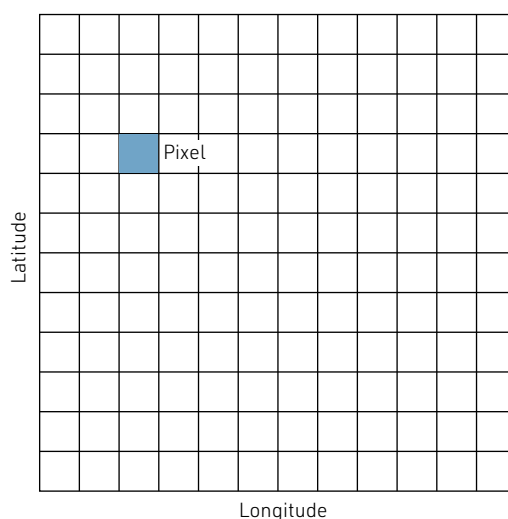
» Table 1. Main ranges of electromagnetic radiation captured by satellite sensors

Range in the electromagnetic spectrum		Characteristics	Use in remote sensing
Visible Light	380–750 nm	Spectrum range visible to the human eye.	Creation of images showing geographic features, vegetation changes, and land cover.
Near Infrared	750–1 400 nm	Captures infrared radiation close to the visible range.	Assess vegetation health, soil quality, and water detection.
Thermal Infrared	1 400–300 000 nm	Detects infrared radiation emitted by objects due to their temperature.	Measure surface temperature, identify heat areas, and study thermal energy.
Microwaves	1 mm–1m	These wavelengths penetrate clouds and the atmosphere, allowing observations regardless of weather conditions.	Detection of soil moisture and topography (surface elevation, changes in topography, and detection of ground movements).

Source: Economic Commission for Latin America and the Caribbean.

Satellite data are presented in the form of a grid or raster (a two-dimensional grid of cells or pixels). Each cell in the grid represents a specific location on the Earth's surface (geolocation) (see diagram 1).

» Diagram 1. Graphic representation of a raster/grid



Source: Economic Commission for Latin America and the Caribbean.

There is a growing variety of satellite images and products available and accessible for analysis and use. Choosing the appropriate sources requires considering image resolution, which refers to the ability of a satellite sensor to distinguish between objects or features on the Earth's surface. There are different types of resolution: spatial, temporal, spectral, and radiometric; however, this document presents the results developed by ECLAC regarding the first two types.

Spatial resolution refers to the size of each cell in the grid, which determines the level of detail that can be captured in the data. Higher spatial resolution means smaller cells and, therefore, the ability to capture finer details on the Earth's surface.

Temporal resolution relates to the frequency with which data are captured over time and is directly linked to the satellite's revisit time (the period between two consecutive passes of a satellite over the same point on Earth). Higher temporal resolution means that more frequent changes on the Earth's surface can be captured as time progresses.

Satellites provide data on a wide variety of geophysical parameters in many formats and at different spatial and temporal resolutions, which are essential to consider when determining the most suitable satellite product for the desired objective. Once the data are obtained in grid format, geographic disaggregation can be performed, meaning breaking down the data into geographic areas of interest. These geographic zones can be administrative units or grids, urban/rural areas, or basins/sub-basins. Geographic disaggregation is necessary to generate a dataset at a relevant geographic scale.

» **Table 2. Example of satellite missions with free data access commonly used in sustainable development topics**

Satellite (Space Agency)	Mission objectives	Revisit time	Spatial resolution
Sentinel 1 (ESA) ^a	Monitoring land in forests, water, soil, and agriculture; emergency mapping in case of natural disasters; marine environment monitoring; sea ice observations and iceberg monitoring; oil spill mapping; maritime vessel detection; climate change monitoring; production of high-resolution ice maps; forecasting sea ice conditions.	6–12 days (depending on orbit configuration and geographic location).	5 × 5 m to 20 × 20 m (depending on acquisition mode).
Sentinel 2 (ESA) ^a	Monitoring agriculture, forests, land-use changes, land cover changes; mapping biophysical variables such as leaf chlorophyll content, leaf water content, leaf area index; monitoring coastal and inland waters; risk mapping and disaster mapping.	5 days.	10–60 m (depending on the band).
Sentinel 3 (ESA) ^a	Sea/land color and surface temperature data; sea surface and land ice topography; coastal zones, inland waters, and sea ice topography; vegetation products.	1 day.	300 m to 1 km.
Sentinel 5 (ESA) ^a	Data on atmospheric gases and aerosols essential for understanding air quality, atmospheric chemistry, and climate change.	1 day.	1 km.
Landsat (NASA) ^b	Monitoring natural resources such as agriculture, forests, and water resources; tracking vegetation cover, detecting land-use changes, and monitoring ecosystem health.	16 days.	30 m.
AQUA/TERRA (NASA) ^b	Observation of the atmosphere (aerosol distribution, temperature and humidity changes), monitoring vegetation, land cover, surface temperature and Earth's reflectivity, water cycle, cloud observation, precipitation, evaporation, atmospheric humidity and ocean circulation, sea surface temperatures.	1–2 days.	Varies by instrument (MODIS sensor: 250 m).

Source: Economic Commission for Latin America and the Caribbean.

^a European Space Agency (ESA, <https://www.esa.int/>).

^b National Aeronautics and Space Administration (NASA, <https://www.nasa.gov/>).

3. Applications of different satellite products in the generation of statistics for Latin America and the Caribbean

As mentioned, the use of satellite data for measuring sustainable development offers notable advantages, such as its availability at a constant frequency, the ability to build time series to assess changes over time, and the possibility of comparing results across different regions/countries, among others. Additionally, the cost associated with accessing these data is relatively low, which facilitates continuity in providing accurate information to drive sustainable development initiatives.

Through the implementation of various processing, analysis, and transformation techniques on the raw data acquired by satellites, it is possible to generate derived products that further enrich the available information. A fundamental advantage of this data enriched with geographic information is that they provide a spatial context that reveals patterns and relationships between variables, enabling understanding and the design of effective sustainability strategies. This allows for disaggregation and the creation of new statistical indicators at a more detailed and precise scale.

To provide more territorially disaggregated statistical and geospatial information derived from satellite image processing, an initial set of indicators and geographic layers has been incorporated into ECLAC's data platforms, CEPALSTAT and CEPALGEO. This initiative makes these data assets available to users, not only to support regional analysis but also so that countries in the region can use and integrate them into their national data repositories.

In this first round of analyzed products for its use, the following were included: nighttime lights, land use and land cover, urban areas, and forest detection. In all cases, the process involved downloading the data, developing a proof of concept (PoC) to determine the appropriate processing routine, creating the final processing routines for indicator calculation to ensure replicability over time, intersecting with vector layers of administrative units of interest, and storing them in ECLAC's databases. These processes involved the use of various geospatial libraries and tools, such as Python spatial libraries, GDAL, GRASS GIS, and the spatial capabilities of PostgreSQL (PostGIS). The Airflow platform was used for the systematic execution of the ETL process for each product.

Below is a detailed description of the processed information, the data sources used, the statistical indicators, and the geographic layers constructed.

Nighttime lights

This satellite product provides valuable information on the distribution of artificial lighting in different regions of the world during nighttime. This type of information has a wide range of applications, such as:

- » **Population distribution analysis:** Areas illuminated at night are often indicators of population presence and human activity. These images can be used to estimate population density in different regions and cities (e.g., Alahmadi et al., 2021; Bagan & Yamagata, 2015).
- » **Urban development monitoring:** Nighttime light images can reveal patterns of urban growth and the expansion of urban areas over time. This is especially useful for urban planning and managing city growth (Zhang et al., 2014; Xu et al., 2020).
- » **Detection of environmental changes:** Changes in nighttime light intensity can indicate shifts in industrial activity, infrastructure, and land use. These images can be used to detect factory openings or closures, road expansions, and other relevant changes (Roberts, 2021).

- » **Economic activity monitoring:** Illuminated areas can also be associated with zones of economic and commercial activity. Analyzing nighttime lights can help assess economic activity in different regions (Liu et al., 2012).
- » **Disaster and crisis response:** Nighttime light images can be used to assess the impacts of natural disasters and humanitarian crises. Changes in lighting can indicate the extent of damage and affected areas (Zhao et al., 2020).
- » **Security and defense:** Monitoring nighttime lights can also be useful for security and defense activities, such as detecting suspicious activities in unauthorized areas, for example, identifying fishing vessels in restricted zones (Zhizhin et al., 2018).
- » **Light pollution studies:** Nighttime light images can also be used to evaluate the degree of light pollution in different areas. This is important for understanding how artificial lighting affects the environment and wildlife (Bagheri et al., 2022).

There are several satellite platforms that offer different types of nighttime light products (with varying spatial resolution, analysis frequency, etc.) for free download (usually requiring registration, but without service cost). From these sources, the Black Marble product from VIIRS/NPP Lunar BRDF-Adjusted Nighttime Lights Yearly L3 Global 15 arc second Linear Lat Lon Grid – VNP46A4 (Suomi-NPP/NASA) was chosen due to its high spatial resolution and various available temporal scales. Additionally, the regular availability of images, ease of download, and accessibility allow for obtaining consistent and updated data for detailed analysis over time, enabling the study of urban lighting patterns and land-use changes.

Based on the available data, it was possible to generate the indicators and geographic layers presented in tables 3 and 4, as illustrated in image 1.

» Table 3. Nighttime lights indicators

Indicator	Description	Territorial disaggregation	Available years	Available at
Annual average radiance of nighttime lights	Average luminosity throughout the year captured by satellite sensors.	Major and minor administrative divisions.	2012–2024	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5412&lang=en
Annual average radiance of nighttime lights in areas with >50 nWatts·cm ² ·sr ⁻¹	Average luminosity throughout the year in areas with more than 50 nWatts·cm ² ·sr ⁻¹ radiance.	Major and minor administrative divisions.	2012–2024	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5413&lang=en
Nighttime development index (NDI)	Dimensionless measure obtained from artificial light data captured by satellite images to estimate the level of economic activity, urbanization, and social development in a given geographic area during nighttime hours of the year.	Major and minor administrative divisions.	2012–2024	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5415&lang=en

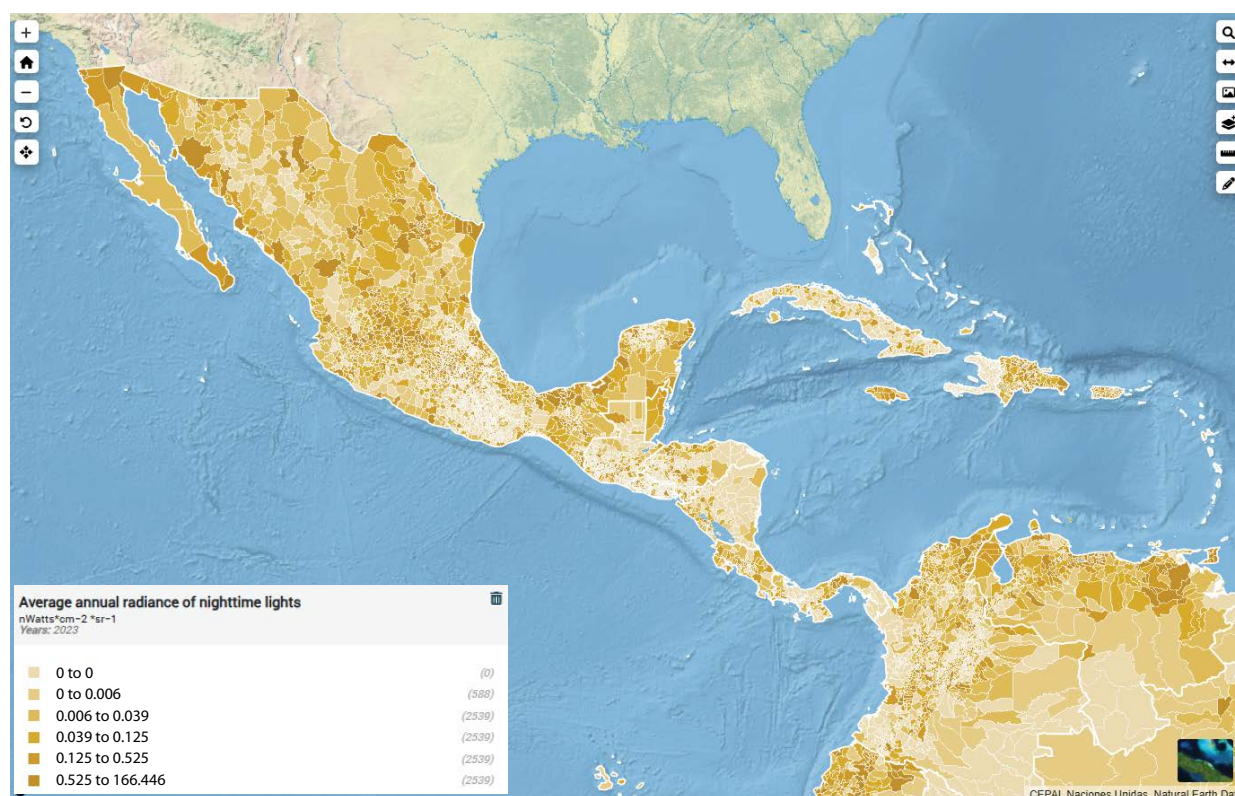
Source: Economic Commission for Latin America and the Caribbean.

» **Table 4. Nighttime lights geographic layers**

Geographic layer	Description	Spatial resolution	Available years	Available at
Average annual radiance of nighttime lights	Average luminosity throughout the year captured by satellite sensors.	15 arc seconds (lat/long grid).	2012–2024	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=VNP46A4_2024_47_ECLAC_Countries_3857&lang=en

Source: Economic Commission for Latin America and the Caribbean.

» **Image 1. Average annual radiance of nighttime lights by minor administrative division, 2023**



Source: Economic Commission for Latin America and the Caribbean, CEPALSTAT.

Land use and land cover

Land cover encompasses the biophysical elements on the Earth's surface, including both the top layer and artificial constructions. Over the past decades, human activity has led to significant changes in this land cover, a phenomenon driven by continuous population and economic growth. These changes in land cover not only affect the structure and functioning of ecosystems but also have consequences for greenhouse gas emissions, atmospheric circulation at both continental and global levels, nutrient and hydrological cycles, biogeochemical cycles, and biodiversity.

Information on land cover and its modifications is essential for understanding the current state, landscape heterogeneity, trends, driving forces, and the effects of various human activities on natural and social processes. Likewise, this information plays a crucial role in planning transitions toward sustainable development by improving the ability to develop more accurate models and simulations.

Land use information obtained from satellite data is derived from processing different bands of the electromagnetic spectrum and classification techniques. Uses of this type of information include:

- » **Monitoring urban expansion (Gaur & Singh, 2023).**
- » **Deforestation monitoring:** Changes in forest cover can be tracked through satellite images, helping prevent illegal deforestation and promote sustainable forestry practices (Matosak et al., 2022).
- » **Climate change monitoring:** Satellite images can reveal changes in glaciers, ice areas, and permafrost, providing crucial information on the impact of climate change.

Several satellite platforms currently offer different types of land cover/land use products that are relevant and freely available for download (usually requiring registration, but without service cost). From these sources, the Global Dynamic Land Cover product (compatible with Sentinel – ESA) was selected due to its high spatial resolution, free use, and download accessibility. This product is generated from optical images (Sentinel-2) and radar data (Sentinel-1). Based on the available data, it was possible to generate the indicators and geographic layers presented in tables 5 and 6, as illustrated in image 2.

» **Table 5. Land use indicators**

Indicator	Description	Territorial disaggregation	Available years	Available at
Proportion of land cover	Percentage covered by each of the 11 land cover categories (tree cover, shrubs, grassland, crops, built-up area, sparse/dispersed vegetation, ice/snow, permanent water bodies, herbaceous wetlands, mangroves, mosses/lichens).	Major and minor administrative divisions.	2015, 2019, and 2023	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5412&lang=en
Landscape heterogeneity index	Adaptation of Pielou's Index, derived from Shannon's Index, with values ranging from 0 (uneven distribution) to 1 (perfectly even distribution).	Major and minor administrative divisions.	2015, 2019, and 2023	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5413&lang=en

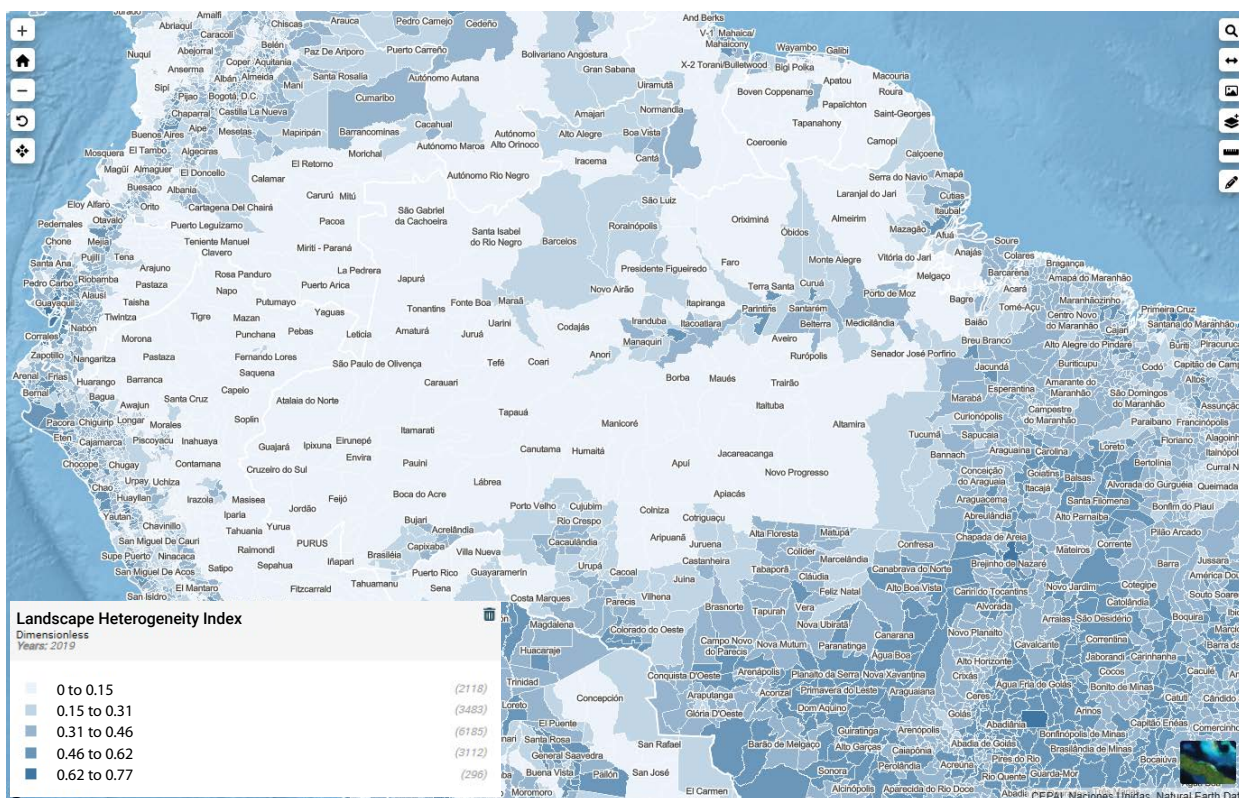
Source: Economic Commission for Latin America and the Caribbean.

» **Table 6. Land use geographic layers**

Layer	Description	Spatial resolution	Available years	Available at
Land use and land cover	Land cover categories (tree cover, shrubs, grassland, crops, built-up area, sparse/dispersed vegetation, ice/snow, permanent water bodies, herbaceous wetlands, mangroves, mosses/lichens).	100 meters	2015, 2019, 2023	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=unido_2023

Source: Economic Commission for Latin America and the Caribbean.

» Image 2. Landscape heterogeneity index by minor administrative division, 2019



Source: Economic Commission for Latin America and the Caribbean, CEPALSTAT.

Urban expansion

Monitoring urban expansion is essential to ensure that city development is sustainable in the long term, promoting a balance between economic growth, social equity, and environmental preservation. Among the impacts of urban expansion, we can mention:

- » Increased consumption of natural resources.
- » Conversion of green and natural areas into urbanized zones, leading to consequences such as loss of natural habitats, decreased biodiversity, and soil degradation.
- » Increased air pollution, accumulation of solid and liquid waste, and depletion of water resources.
- » Changes in mobility and accessibility within the region.
- » Increased social inequality if certain population groups are marginalized or excluded from the benefits of urban development.
- » Greater pressure on public services.

The use of satellite data and modern data analysis techniques offers significant possibilities for monitoring urban expansion, providing detailed and real-time information on city development. These tools facilitate the implementation of sustainable development strategies by enabling the identification of newly urbanized areas, changes in land use, and their evolution over time.

Detecting urban areas and estimating population density using satellite data allows for:

- » **Monitoring demographic growth:** Detecting population density and changes in urban areas provides information on demographic growth in a region.
- » **Sustainable Urban Planning:** Tracking city growth, urban expansion, and identifying zones for future development. This helps prevent uncontrolled urbanization and optimize land use.
- » **Infrastructure Management:** Planning infrastructure such as roads, public transportation, energy systems, and water networks. It enables the design and development of service networks more efficiently to meet the needs of growing urbanization.
- » **Risk and Disaster Management:** Knowing population density and urban distribution is essential for risk assessment and planning responses in case of natural disasters or extreme events.

The selected indicators are obtained from the GHSL-Built product (Copernicus-ESA), part of the Global Human Settlement Layer (GHSL) project by Copernicus (ESA) (Pesaresi M., Politis P., 2023), which is one of the most up-to-date products developed using satellite imagery from Sentinel and modern data analysis techniques with machine learning and artificial intelligence.

Processing the original product to obtain the indicator includes: reprojection to WGS84, intersection with administrative units of interest, calculation of the sum of built-up area, difference between the current period and the previous period (5 years prior) and summing the difference for each administrative unit. Products corresponding to periods after 2020 are based on predictions using machine learning models.¹ Based on the available data, it was possible to generate the indicators and geographic layers presented in tables 7 and 8, as illustrated in image 3.

» **Table 7. Urban expansion indicators**

Indicator	Description	Territorial disaggregation	Available years	Available at
Area covered by built-up surface	Indicates the hectares of built-up surface in each pixel (with a spatial resolution of 100 m ²).	Major and minor administrative divisions.	1975–2030 (every 5 years).	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5419&lang=en
Urban growth	Indicates the sum for each administrative unit of km ² of built-up surface during the period comprising the 5 years prior to the corresponding year.	Major and minor administrative divisions.	1980–2030 (every 5 years).	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5420&lang=en

Source: Economic Commission for Latin America and the Caribbean.

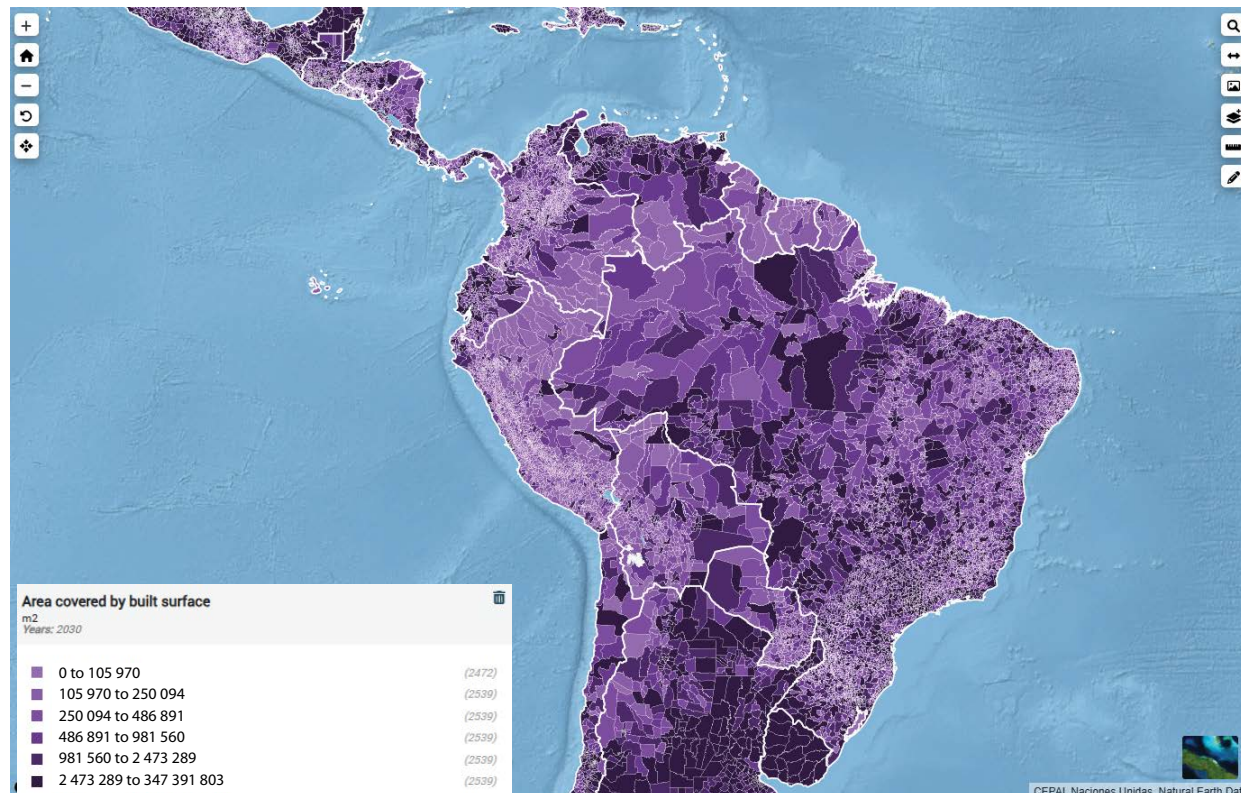
» **Table 8. Urban expansion geographic layers**

Layer	Description	Spatial resolution	Available years	Available at
Area covered by built-up surface	Square meters of built-up surface in each pixel.	100 m.	1975–2030 (every 5 years).	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=sup_construida_2025

Source: Economic Commission for Latin America and the Caribbean.

¹ For details on the methodology, please refer to the available bibliography at <https://ghsl.jrc.ec.europa.eu/>.

» Image 3. Area covered by built surface by minor administrative division, 2030 estimations



Source: Economic Commission for Latin America and the Caribbean, CEPALSTAT.

Forest detection

Detecting forests and understanding the changes occurring in these ecosystems is highly relevant for sustainable development. Preserving forests not only involves protecting biodiversity but is also crucial for maintaining climate balance, ensuring soil quality, and providing essential resources for communities.

Satellite information enables more precise and efficient monitoring of forest conditions, identification of changes in their cover and structure, and assessment of the impact of human activities and natural phenomena. This technology offers the ability to provide global-scale data easily, with widespread accessibility and the capability to identify changes objectively and consistently over time. Access to information on forest detection and its modifications over time improves decision-making and allows for the formulation of policies for forest management, conservation, and restoration.

To create indicators related to forest detection, the available products developed by GLAAD were selected, accessible at <https://glad.geog.umd.edu/dataset/GLCLUC2020>, where the term “forest” refers to the coverage of both wild and planted trees (forest industry). Forest height was mapped globally for woody vegetation with a height greater than or equal to 3 meters. The global forest height model was based on Landsat, calibrated for the year 2019 using GEDI observations. The same model was applied to estimate forest height for the years 2000 and 2020. The available products include forest extent maps for 2000 and 2020, assigning pixels with forest height ≥ 5 m as the forest cover class to ensure consistency with the FAO definition of forest. Changes in forest extent (net loss and net gain) were derived directly from comparing maps from 2000 and 2020. The GLAAD definition of forest differs from FAO’s definition due to the inclusion of trees outside forests (agroforestry, orchards, parks) and the exclusion of temporarily non-wooded forest areas.

Based on the available data, it was possible to generate the indicators and geographic layers presented in tables 9 and 10, as illustrated in image 4.

» Table 9. Forest indicators

Indicator	Description	Territorial disaggregation	Available years	Available at
Forest extent	Indicates the area covered by forests in km ² .	Major and minor administrative divisions.	2000, 2020	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5423&lang=en
Average forest height	Indicates the average forest height in meters.	Major and minor administrative divisions.	2000, 2020	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5422&lang=en
Forest loss extent	Indicates the area in km ² with a reduction in forest height over 20 years.	Major and minor administrative divisions.	2020	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5424&lang=en
Forest gain extent	Indicates the area in km ² with an increase in forest height over 20 years.	Major and minor administrative divisions.	2020	CEPALSTAT https://statistics.cepal.org/portal/cepalstat/dashboard.html?indicator_id=5425&lang=en

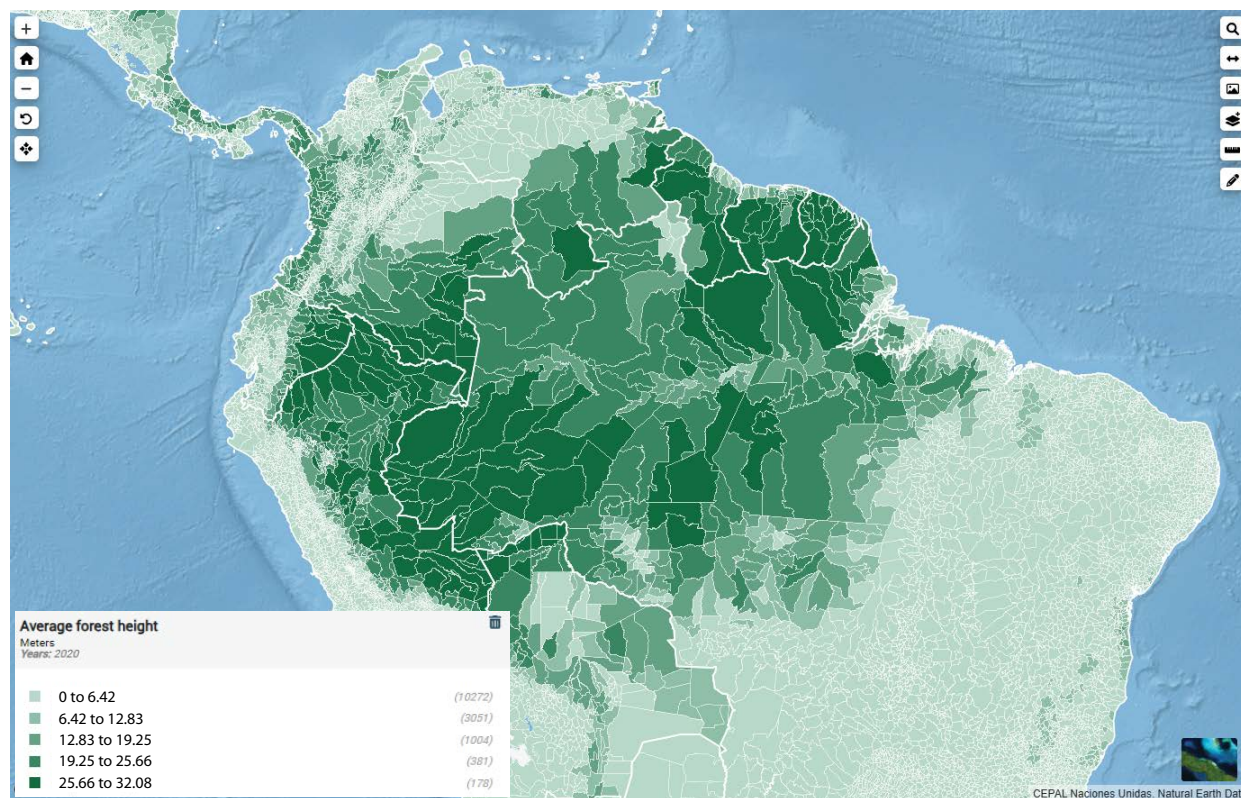
Source: Economic Commission for Latin America and the Caribbean.

» Table 10. Forest geographic layers

Layer	Description	Territorial disaggregation	Available years	Available at
Forest extent	Indicates the area covered by forests in km ² .	Major and minor administrative divisions.	2000, 2020	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=extension_bosque_2020
Average forest height	Indicates the average forest height in meters.	Major and minor administrative divisions.	2000, 2020	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=altura_bosque_2020
Forest loss extent	Indicates the area in km ² with a reduction in forest height over 20 years.	Major and minor administrative divisions.	2020	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=perdida_bosque_2020
Forest gain extent	Indicates the area in km ² with an increase in forest height over 20 years.	Major and minor administrative divisions.	2020	CEPALGEO https://statistics.cepal.org/geo/geo-cepalstat/?geo=ganancia_bosque_2020

Source: Economic Commission for Latin America and the Caribbean, CEPALSTAT.

» Image 4. Average forest height by minor administrative division, 2020



Source: Economic Commission for Latin America and the Caribbean, CEPALSTAT.

4. Opportunities in the use of satellite imagery for the production of official statistics in Latin American and Caribbean countries

Currently, there are numerous resources to automate both the download and processing of satellite products, which allow for access to updated data almost as soon as they become available. The systematization of Earth observation data download and analysis processes enables:

- » Ensuring quick and timely access to images and relevant information, which is of great importance for applications such as environmental monitoring and natural disaster management.
- » Increasing the accuracy and reliability of processed data for critical decision-making.
- » Greater capacity to process large volumes of Earth observation data, facilitating the creation of large-scale products and analyses.
- » Improved integration of data from multiple Earth observation sources, providing a more complete and detailed view of terrestrial phenomena.
- » Optimization of available resources, saving time and costs and allowing human resources to be allocated to more analytical and strategic tasks.

Obtaining indicators from satellite data enables global monitoring, access to real-time or historical data, and broad spatial coverage. These indicators are applied in various fields, from agriculture and environmental management to decision-making and emergency response. They also constitute a cost-effective tool that provides objective and consistent information, facilitating resource management and the formulation of effective policies at different scales (local, regional, national).

For this reason, the international statistical and geospatial communities have proposed several mechanisms for producing statistical information and indicators to monitor international commitments—not only for tracking the Sustainable Development Goals of the 2030 Agenda for Sustainable Development but also for implementing the global climate change indicator framework (UN, 2021).

At the regional level, progress is expected in these developments to provide a greater number of statistical products derived from satellite image processing in other identified areas. The growing capacity and diversity of Earth observation satellites offer a significant opportunity for these data streams to support a wide range of indicators, providing more accurate, spatially explicit, and frequently updated evidence. Among the major thematic groups where statistical and geospatial information from satellite imagery adds value are oceanography, meteorology, agricultural activities, and the energy sector. In this sense, they provide information for: monitoring the temporal evolution of meteorological variables, detecting algal blooms in the ocean, global oil mapping and spill monitoring, drought and flood monitoring, livestock activity tracking, rural and urban cadasters, mineral resource exploration, among others.

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