

■ CopernicusLAC Chile services workshop

Applications of the Urban Atlas service

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CopernicusLAC Chile





Urban Atlas

Today's LCLU Workshop Agenda

Technical Presentation Session:

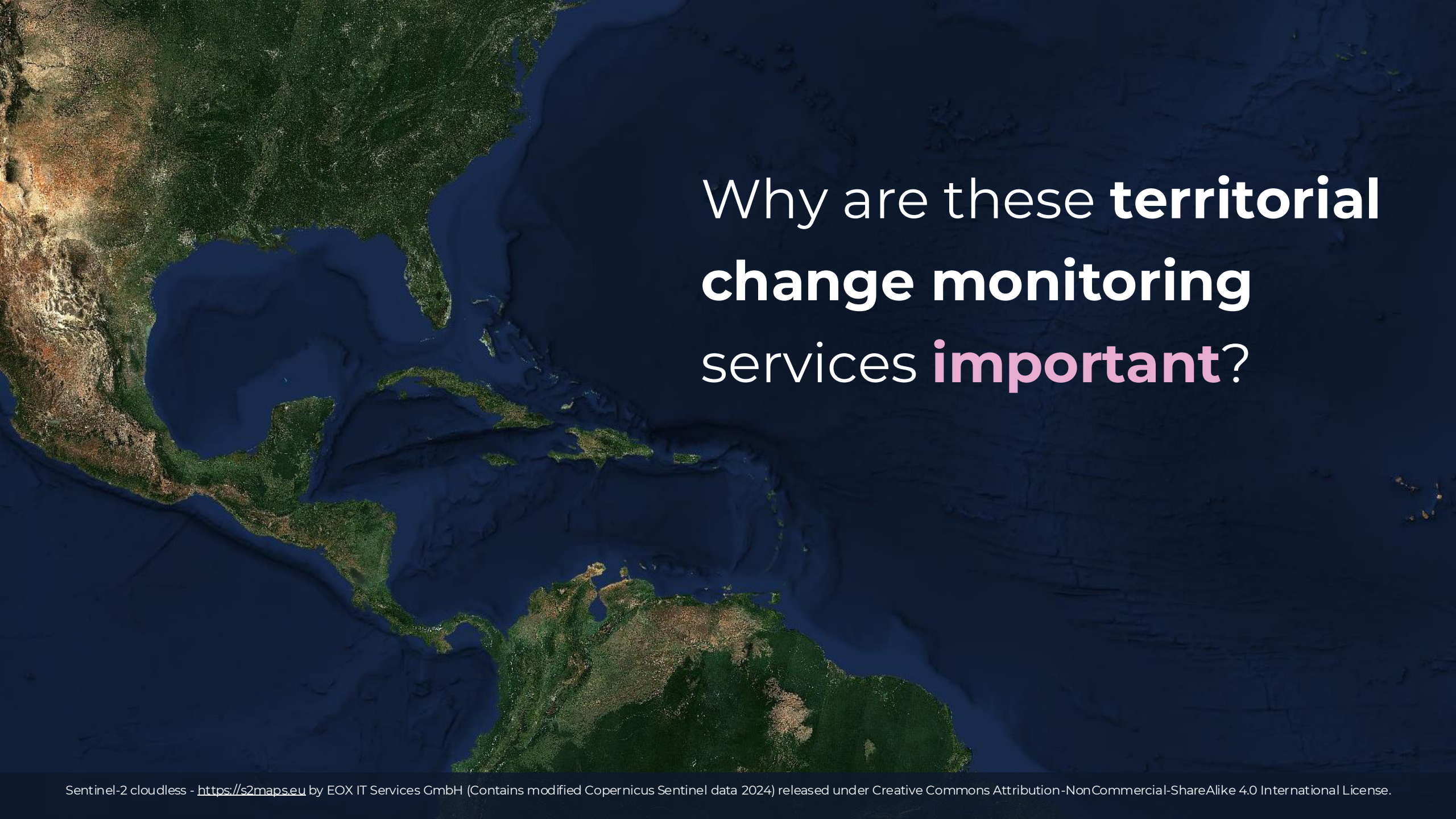
01. Introduction

02. The service:

- Global Urban products
- Development of Urban Atlas
- Results
- Future Challenges

03. The service's platform



A satellite map showing the Americas, including North and South America, surrounded by the Atlantic and Pacific Oceans. The land is green with some brown patches, and the water is dark blue.

Why are these **territorial
change monitoring
services** **important**?

Regional Center Copernicus for America Latin America and the Caribbean

Storage, processing and distribution of satellite data
of the Program Copernicus

Image: Tabasco, Mexico >



Land cover and
land use

Direct access >



Urban Atlas

Direct access >



Coastal
monitoring

Direct access >



Sentinel image
repository

Direct access >



Private cloud

Direct access >

Regional Center Copernicus for America Latin America and the Caribbean

Storage, processing and distribution of satellite data
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Land cover and
land use

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Urban Atlas

Direct access >



Coastal
monitoring

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Sentinel image
repository

Direct access >



Private cloud

Direct access >



Urban Atlas

The Urban Atlas Service

A geospatial platform that represents urban land use in capital cities in Latin America and the Caribbean, based on satellite data and remote sensing models.



To offer a robust and highly useful land use data standardized for the region for local authorities, urban planners and other stakeholders interested in the sustainable development of cities in Latin America and the Caribbean.





Urban Atlas

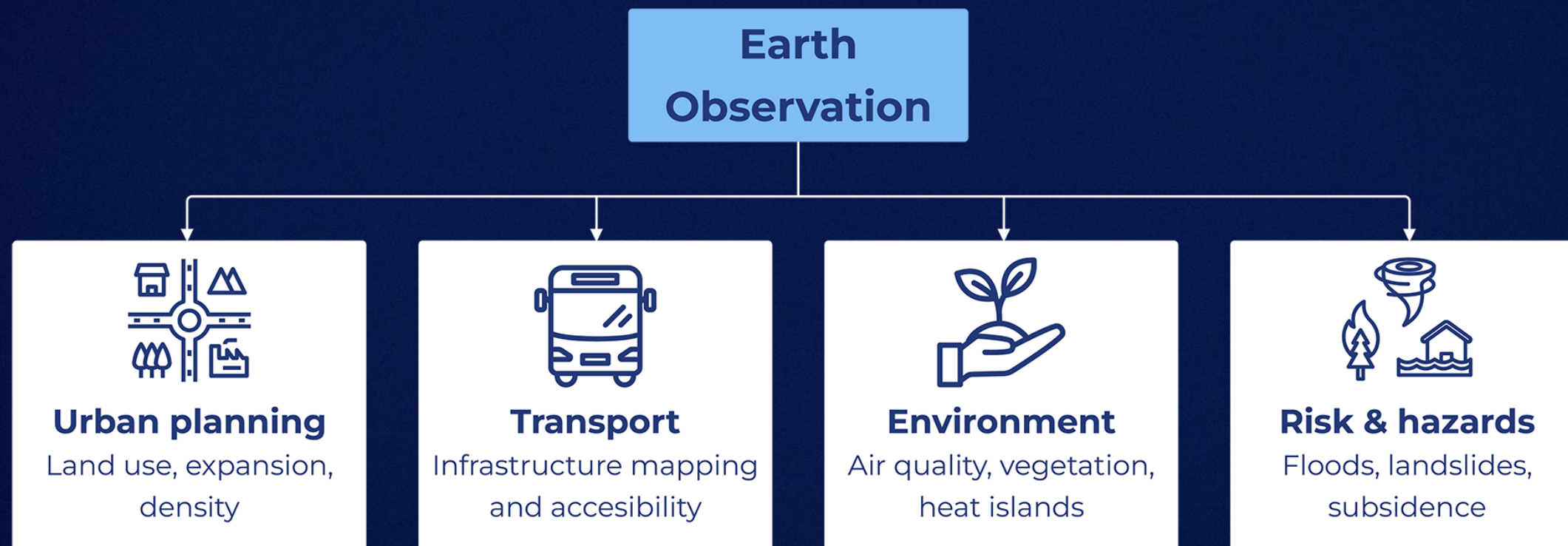
■ 02. Development

**What this service is
in detail**



Urban Atlas

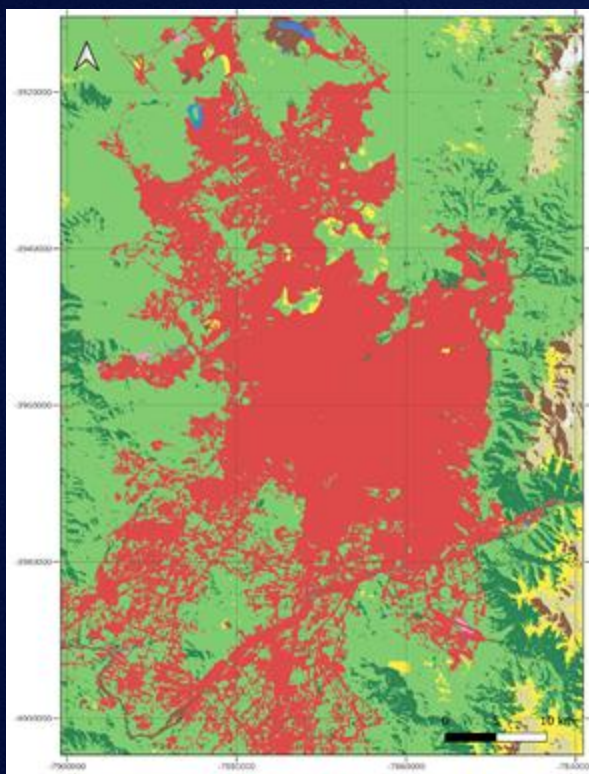
Why does urban change monitoring matter?





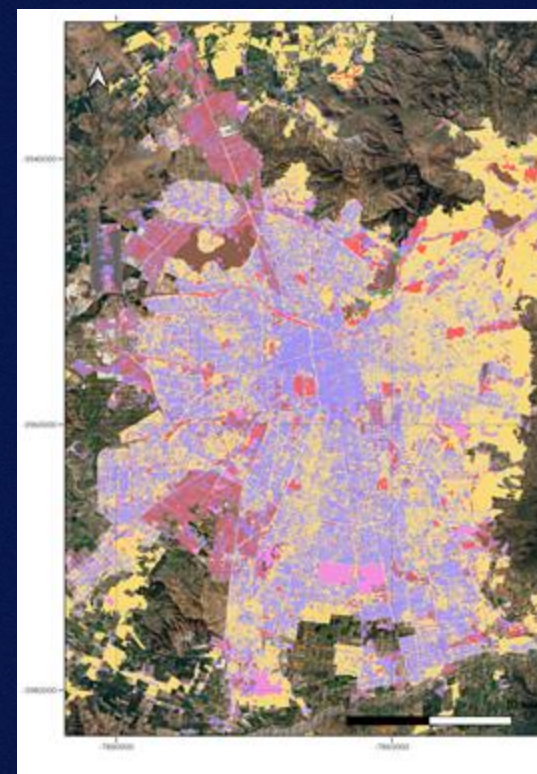
Urban Atlas

Current version of Urban Atlas CRCLAC Chile



LCLU classes	
4096	- Artificial surfaces
8192	- Cropland
12288	- Grassland
16384	- Tree covered area
20480	- Shrubs covered area
24576	- Herbaceous vegetation, aquatic or regularly flooded
28672	- Mangroves
32768	- Sparse vegetation
36864	- Bare soil
40960	- Snow and glaciers
45056	- Water bodies

The LCLU service has a regional scale and represents all artificial surfaces.



Urban Atlas classes	
4368	- Residential
4384	- Commercial/Industrial
4400	- Buildings
4624	- Roads and railways
4640	- Airports
5136	- Wooded vegetation
5152	- Agriculture
5168	- Recreation
5184	- Other open spaces
37120	- Quarry
45056	- Water bodies

The **Urban Atlas service** has a local scale and describes 11 land use classes in the national capitals of the region.

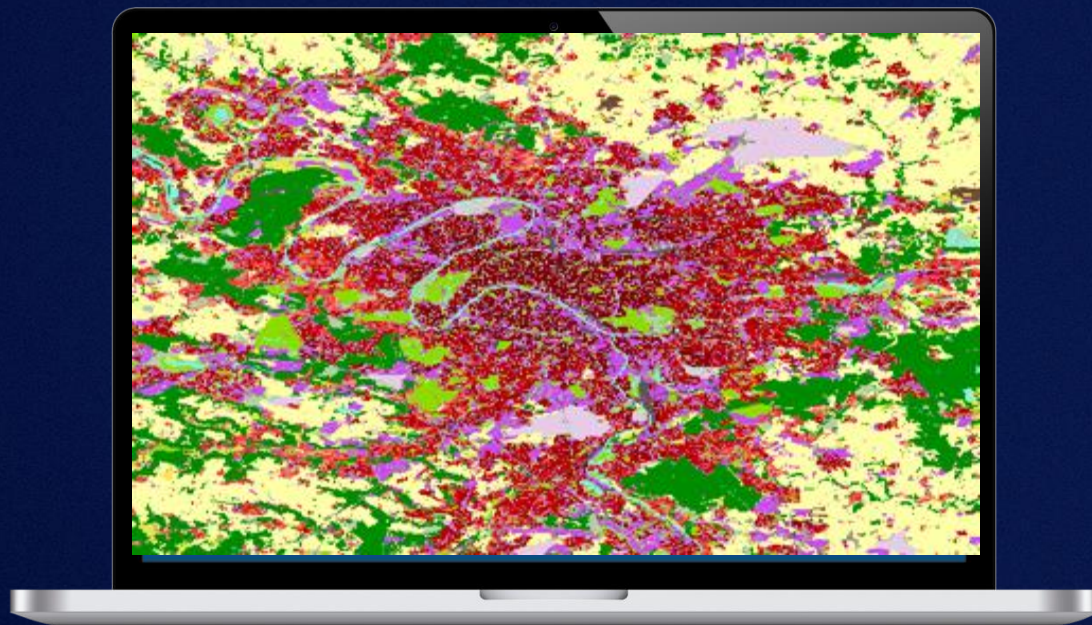




Urban Atlas

How does our Urban Atlas compare to similar offerings

Urban Atlas EU



The Urban Atlas Land Use / Land Cover classification is derived from CORINE Land Cover and is composed of 19 classes distributing among 5 thematic groups, namely:

- Artificial surfaces, Agricultural areas, Natural and (semi-) natural areas, Wetlands, Water
- It is produce every 3 years update
- Is based in Sentinel-2 and VHR Resolution images, providing a product of 2-4m. Spatial Resolution

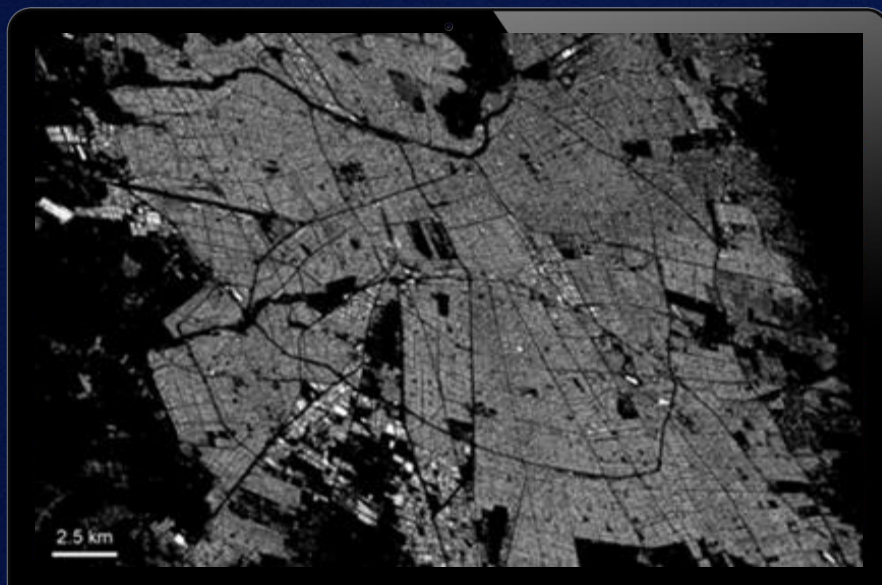




Urban Atlas

How does our Urban Atlas compare to similar offerings

Global Human Settlements Layer



- This project is part of the Copernicus Program and its Emergency Management Service, the aim is to produce global spatial information, evidence-based analytics, and knowledge describing the human presence on the planet.
- Combines satellite imagery, census data and administrative data.

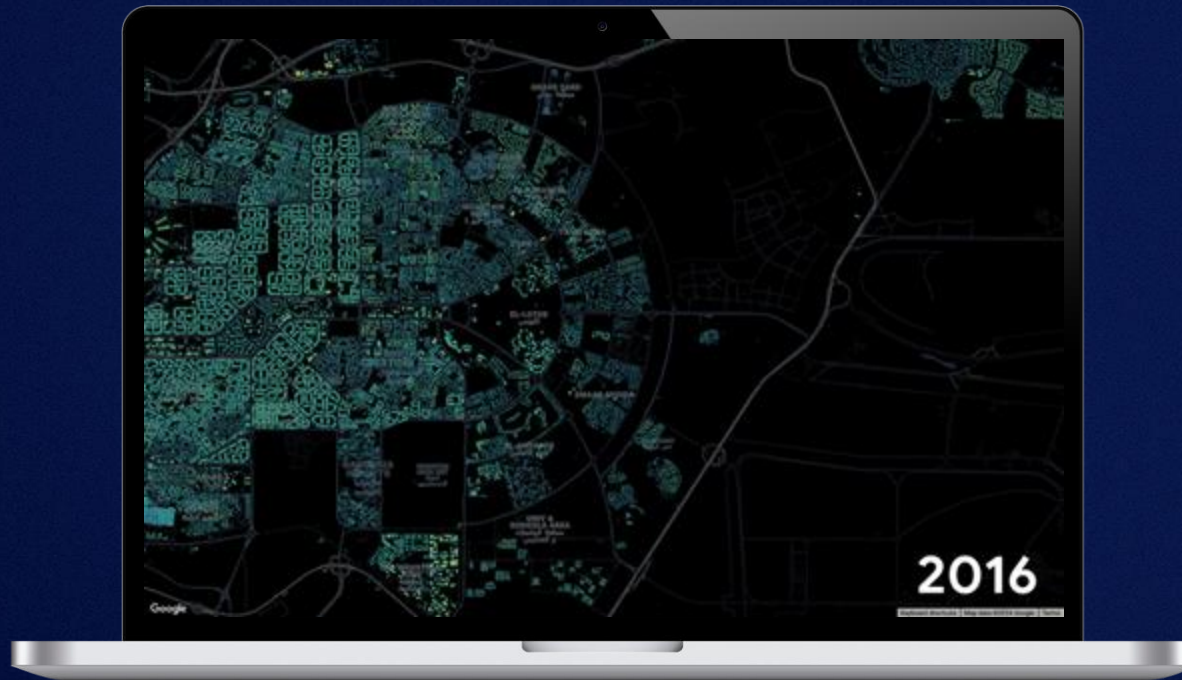
Source: Pesaresi, M., Schiavina, M., Politis, P., Freire, S., Krasnodębska, K., Uhl, J. H., ... Kemper, T. (2024). *Advances on the Global Human Settlement Layer by joint assessment of Earth Observation and population survey data*. International Journal of Digital Earth, 17(1).





How does our Urban Atlas compare to similar offerings

Open Buildings



This large-scale open dataset contains the outlines of buildings derived from high-resolution satellite imagery to support these types of uses.





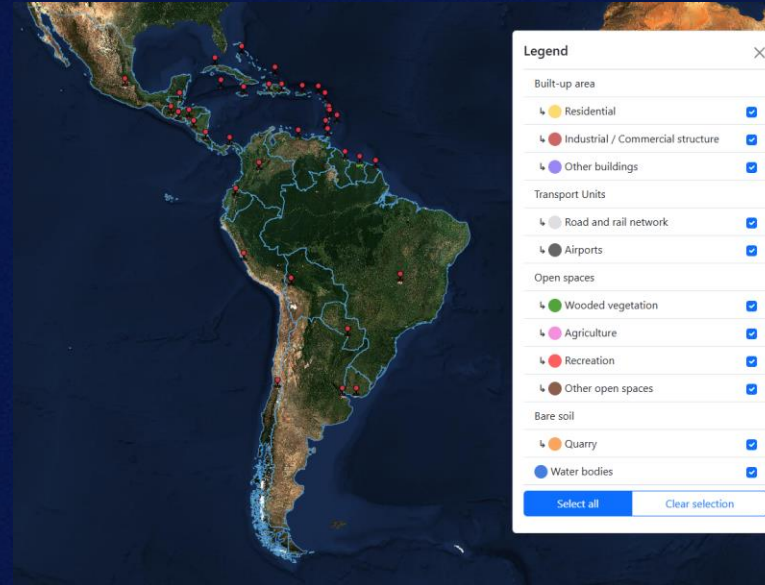
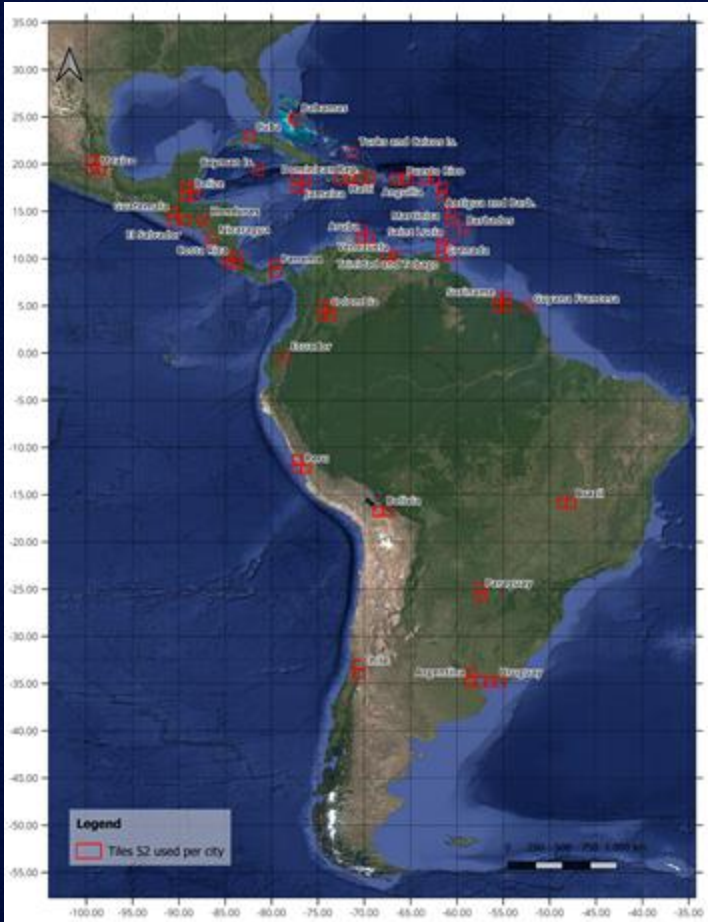
Urban Atlas

■ 02. Development **Development of Urban Atlas**



Urban Atlas

Current version of UA



- 10 meters resolution.
- It has 11 land use classes, with growth potential for future versions.
- This CopernicusLAC Chile product is the first to describe urban land uses in the region.



11 classes

for Urban Atlas product



Residential



Road and
Rail Network



Recreation



Industrial/
Commercial
Structure



Airports



Wooded
vegetation



Other
Buildings



Quarry



Agriculture



Other Open
Spaces



Water
Bodies





Urban Atlas

Selection criteria for training cities



The selection of training cities focused primarily on regional capital cities due to the greater availability of geospatial data.



In addition, intermediate cities from Chile, Brazil, and Miami were included to improve the representation of minority classes and strengthen the model input data.





Urban Atlas

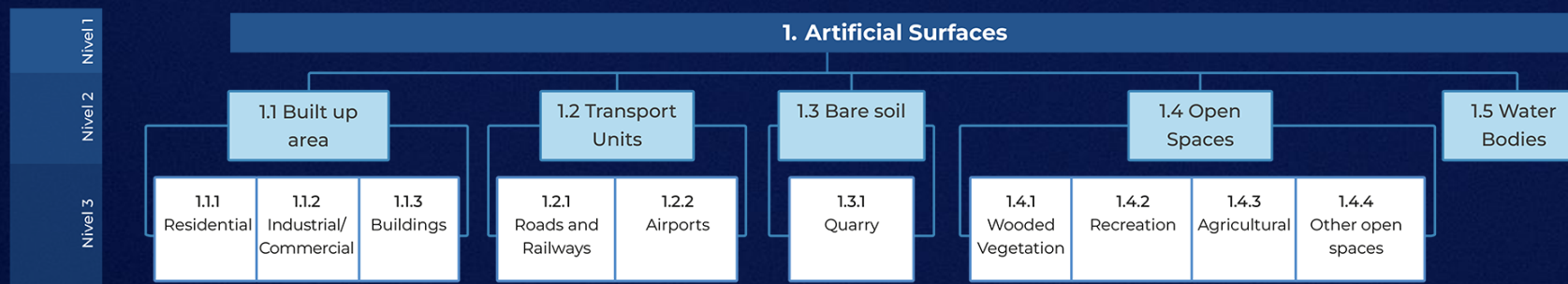
How our service has evolved

First version



- Machine Learning algorithm
- 6 training cities
- 4 class detection and roads provided from OSM

Current version



- Deep Learning algorithms
- 30 training cities
- 11 classes detected

In progress

Available

2016

2017

2018

2019

2020

2021

2022

2023

2024

2025

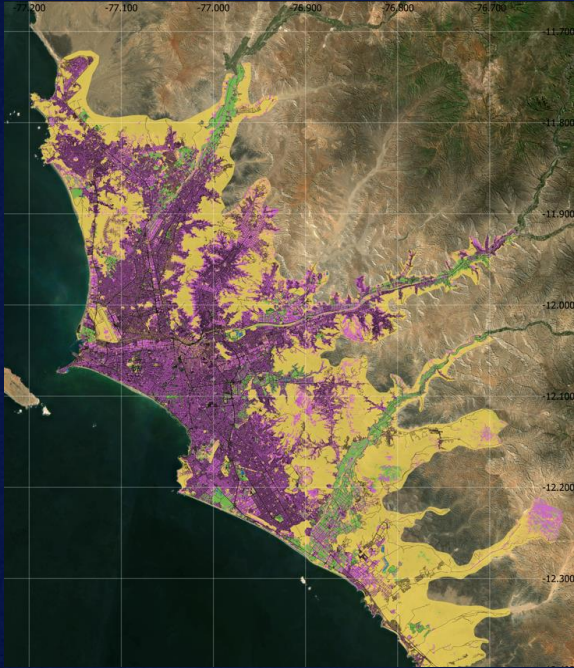




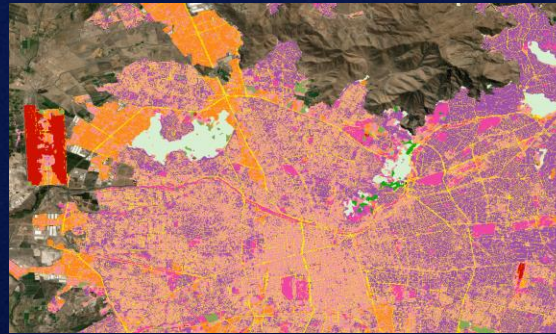
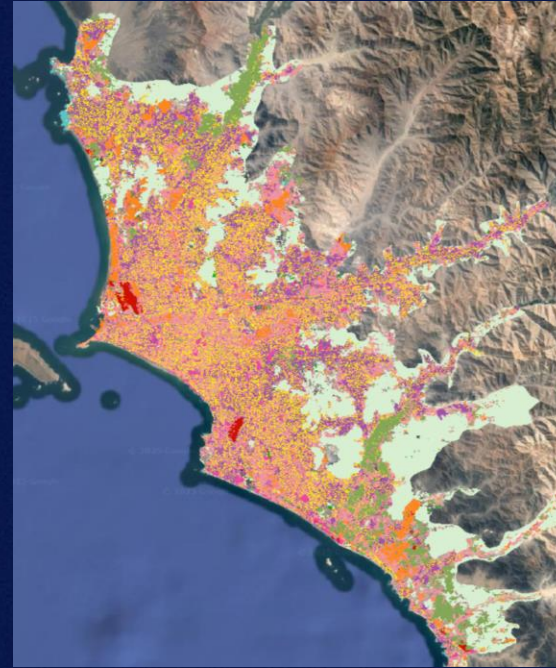
Urban Atlas

How our service has evolved

First version (2023) | 5 classes



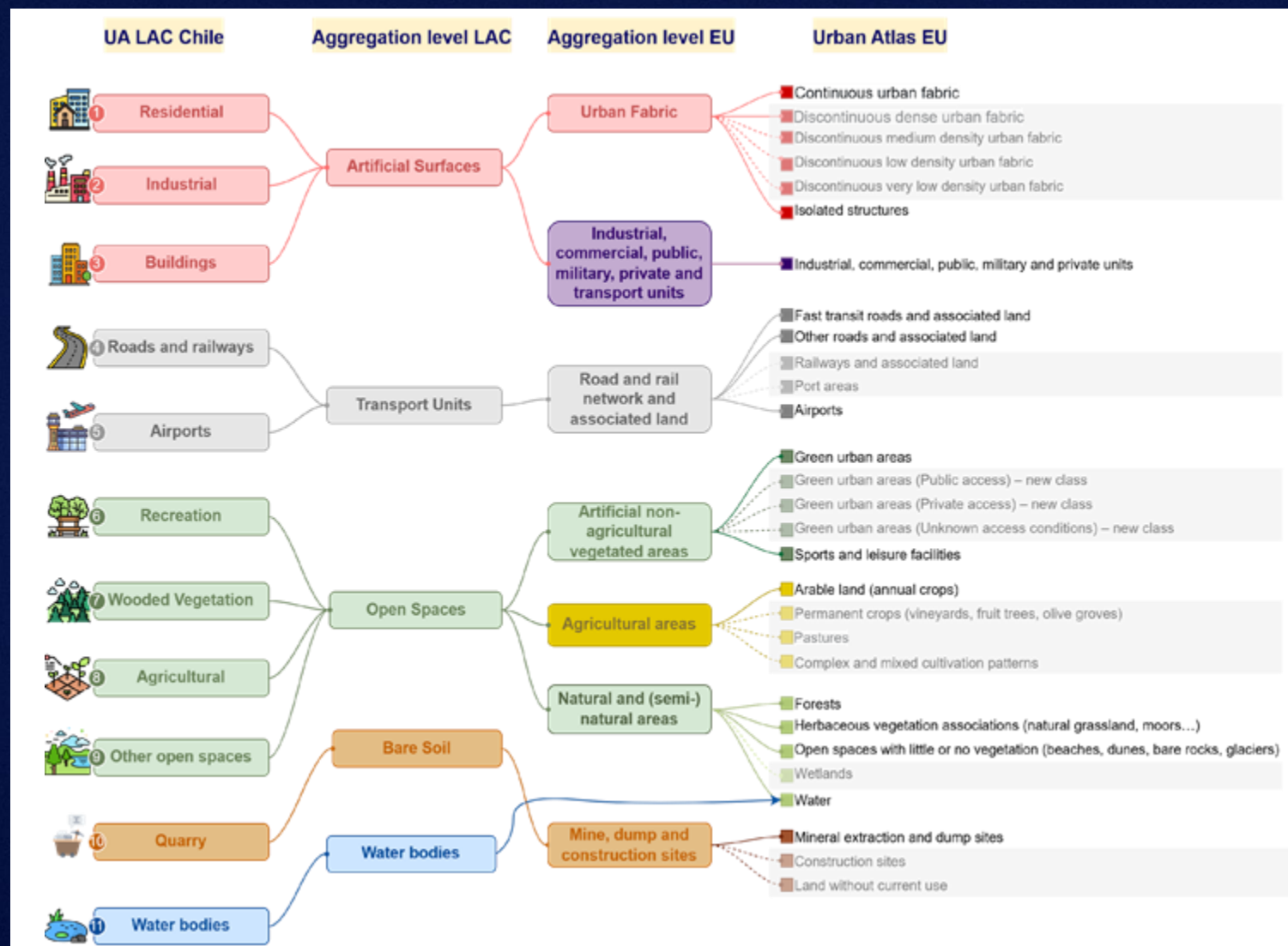
Current version (2023) | 11 classes





Urban Atlas

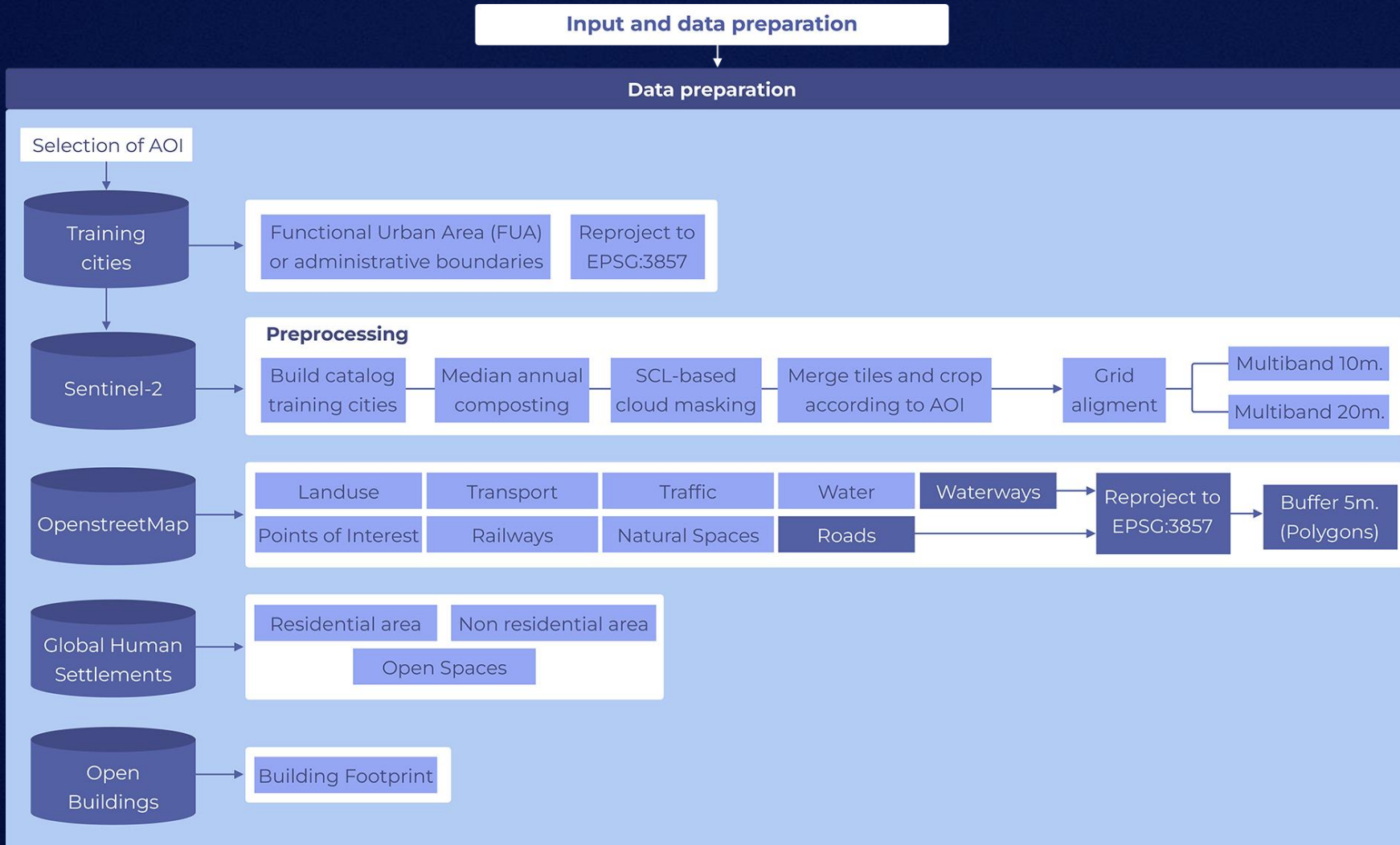
How are the Urban Atlas from CLMS and the Urban Atlas from Copernicus LAC Chile related

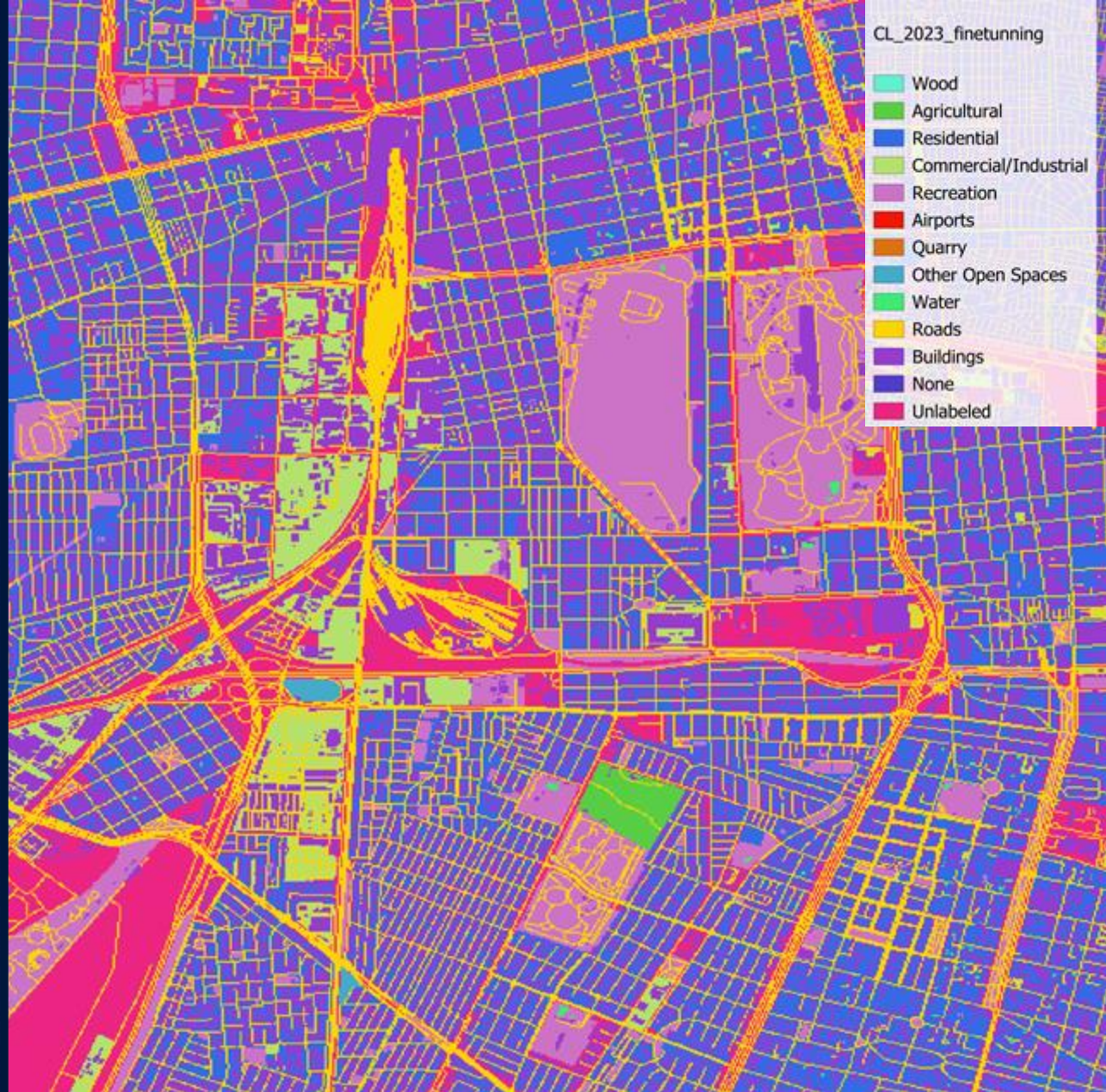
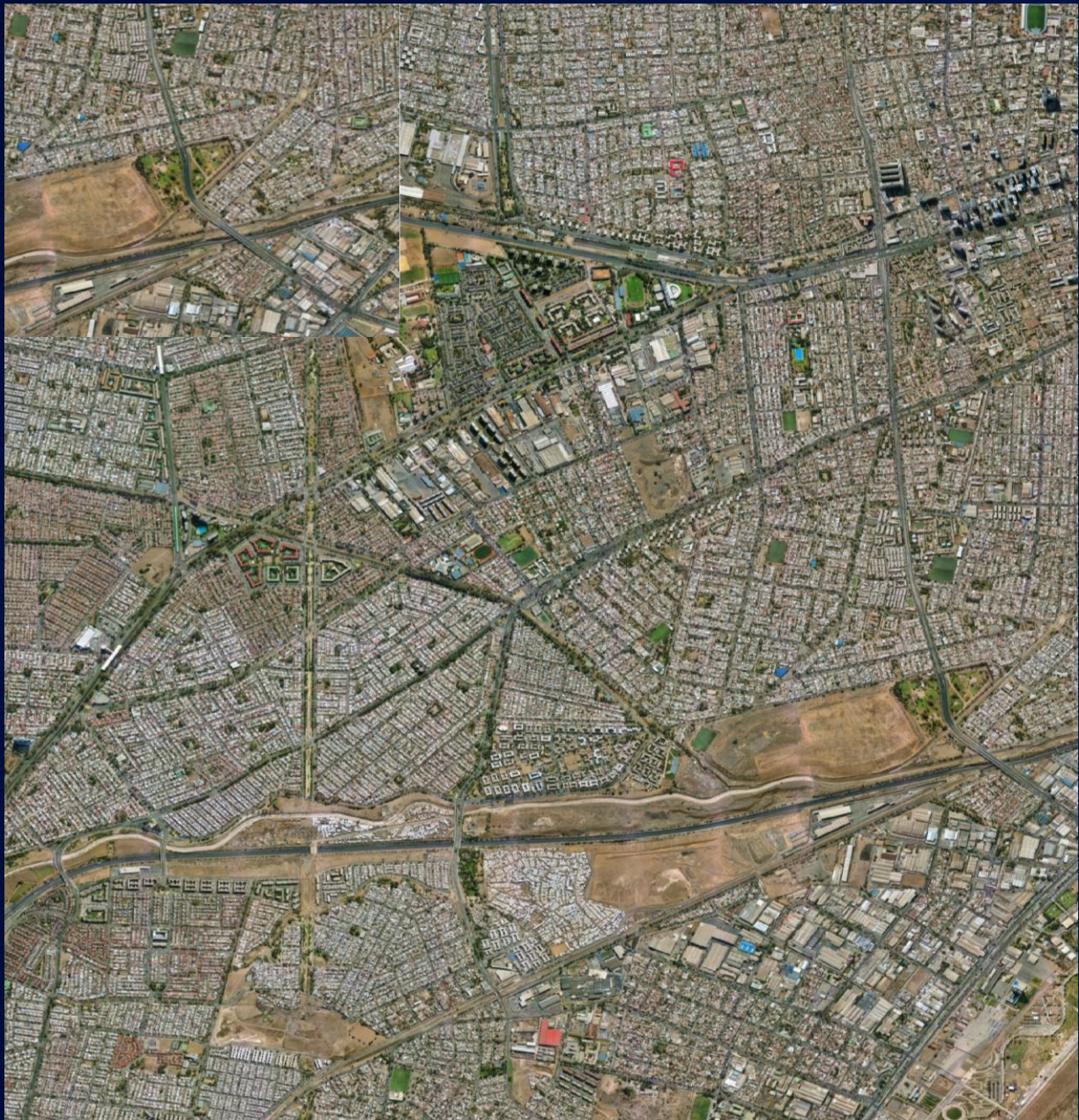




Urban Atlas

Training Data

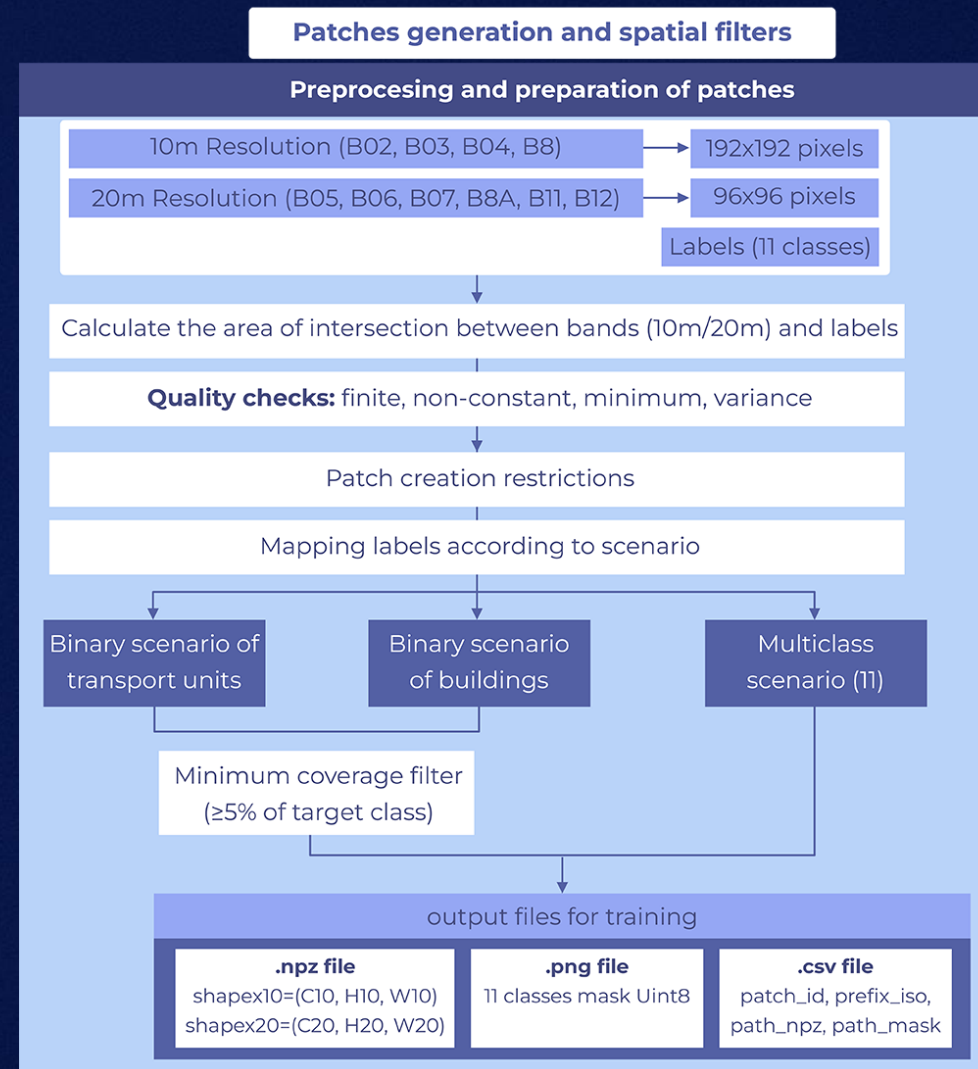






Urban Atlas

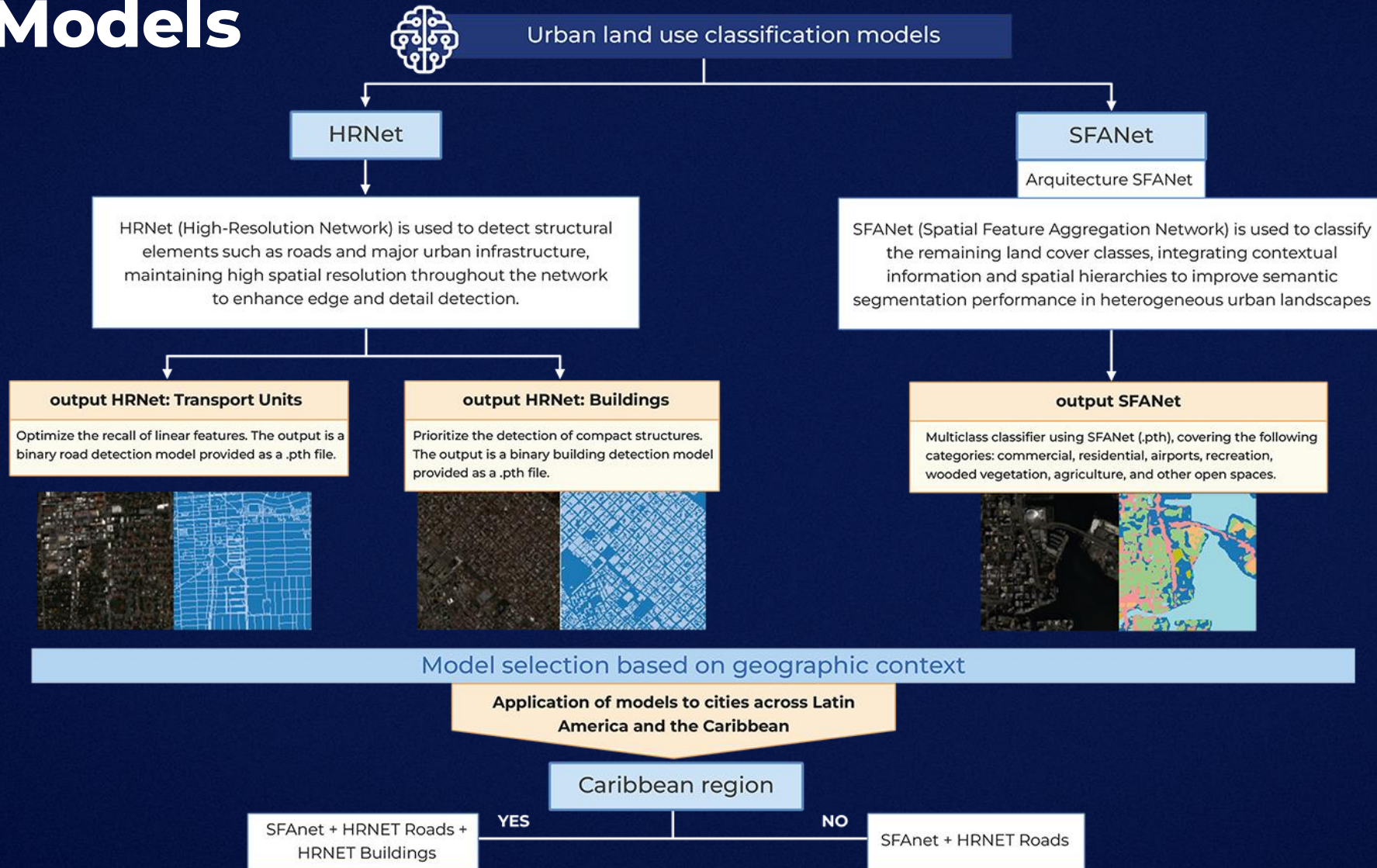
Preprocessing





Urban Atlas

Models





Urban Atlas

■ 02. Development

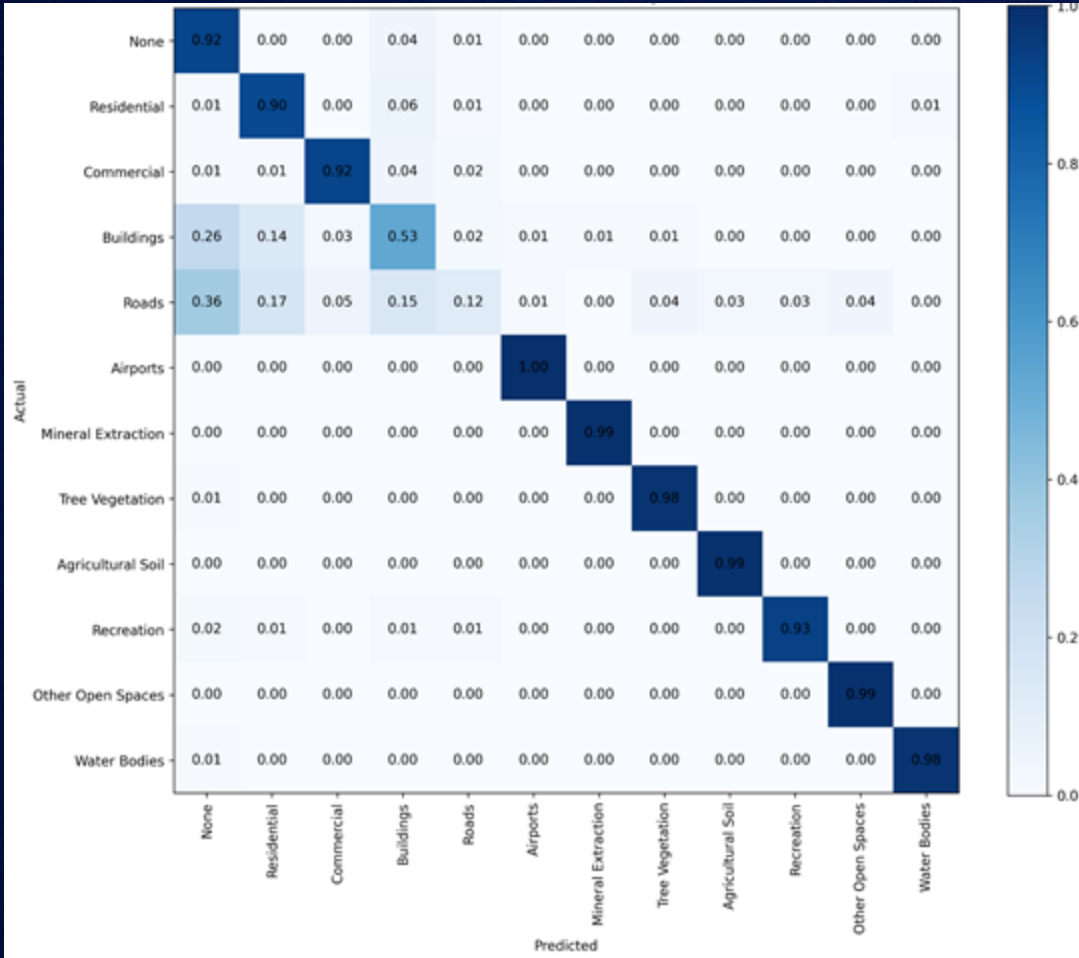
Results





Urban Atlas

Model SFANet Results



Highest accuracy of classification for:

- Airports
- Mineral Extraction, Agricultural Soil, Other Open Spaces
- Tree Vegetation and Water Bodies

High accuracy in urban classes:

- Residential
- Commercial

Main source of error:

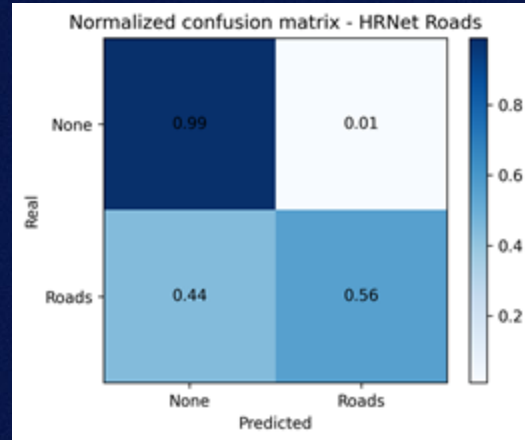
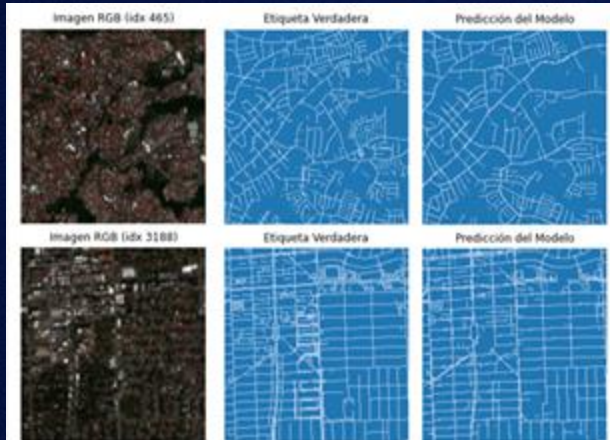
- Confusion among urban-related classes (Buildings, Residential)
- Expectable for their spectral similarity and spatial proximity





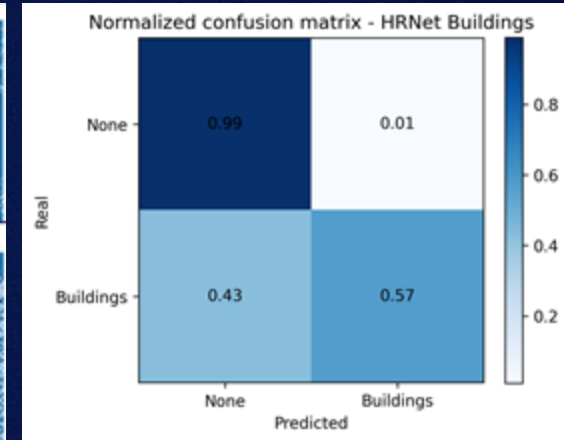
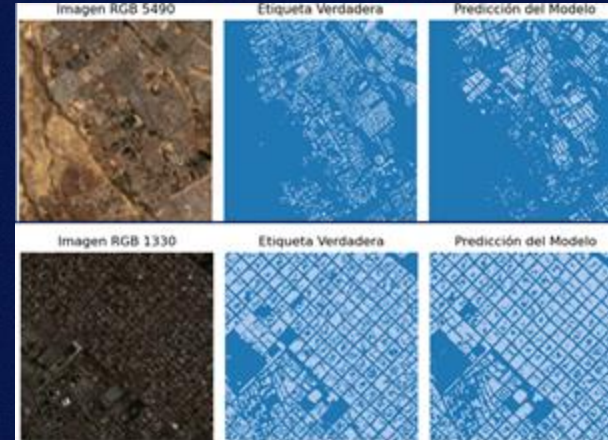
Urban Atlas

Model HRNet Results



Normalized Confusion Matrix:
Model HRNet (Roads)

🏆 Mejor modelo - IoU: 0.9547, F1: 0.9783, Pérdida: 0.0443



Normalized Confusion Matrix:
Model HRNet (Buildings)

🏆 Mejor modelo - IoU: 0.9533, F1: 0.9727, Pérdida: 0.0415

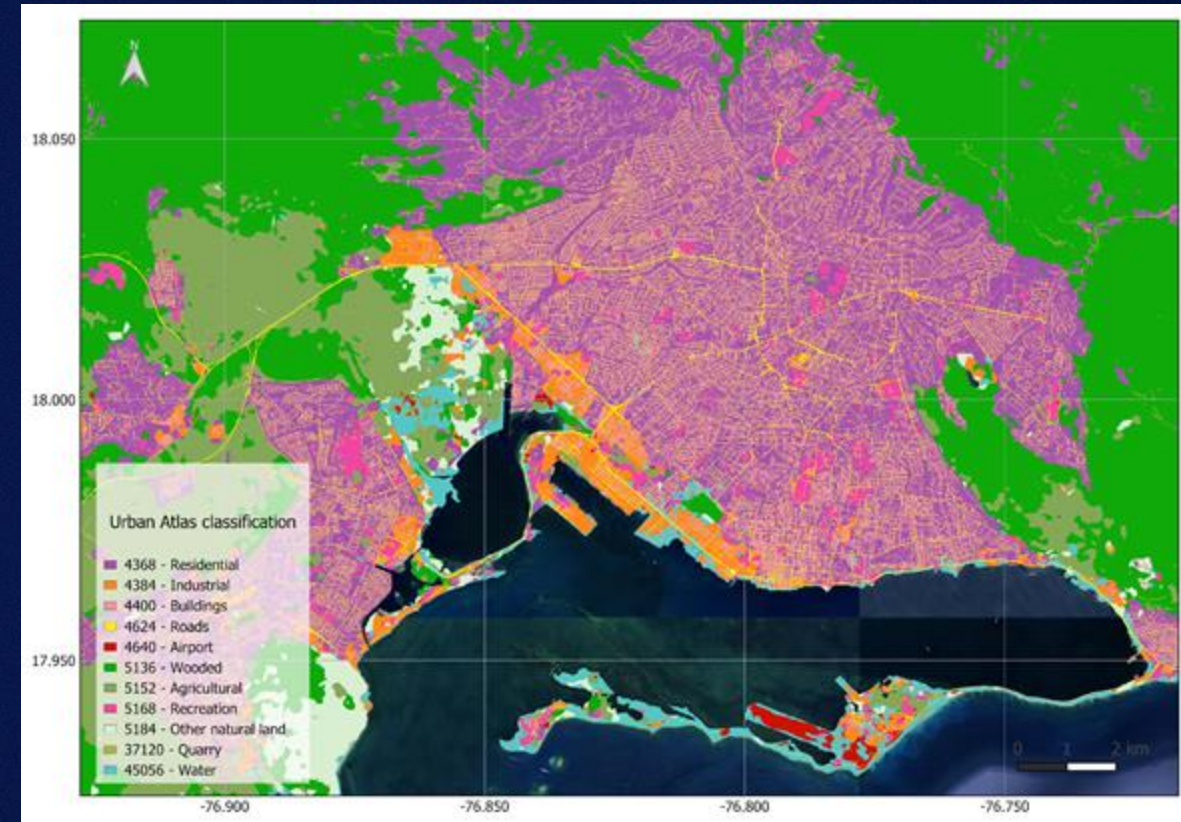




Urban Atlas

Integration of SFAnet and HRNet

- The inference process is based on the SFAnet classification model to detect most of the classes (9), and is subsequently complemented with the inference from the HRNet model specialized in buildings and streets.
- **The combination of both models enables the capture of a wider range of urban land-use characteristics.**



Urban Atlas Copernicus LAC Chile classification for 2025 in Kingston, Jamaica

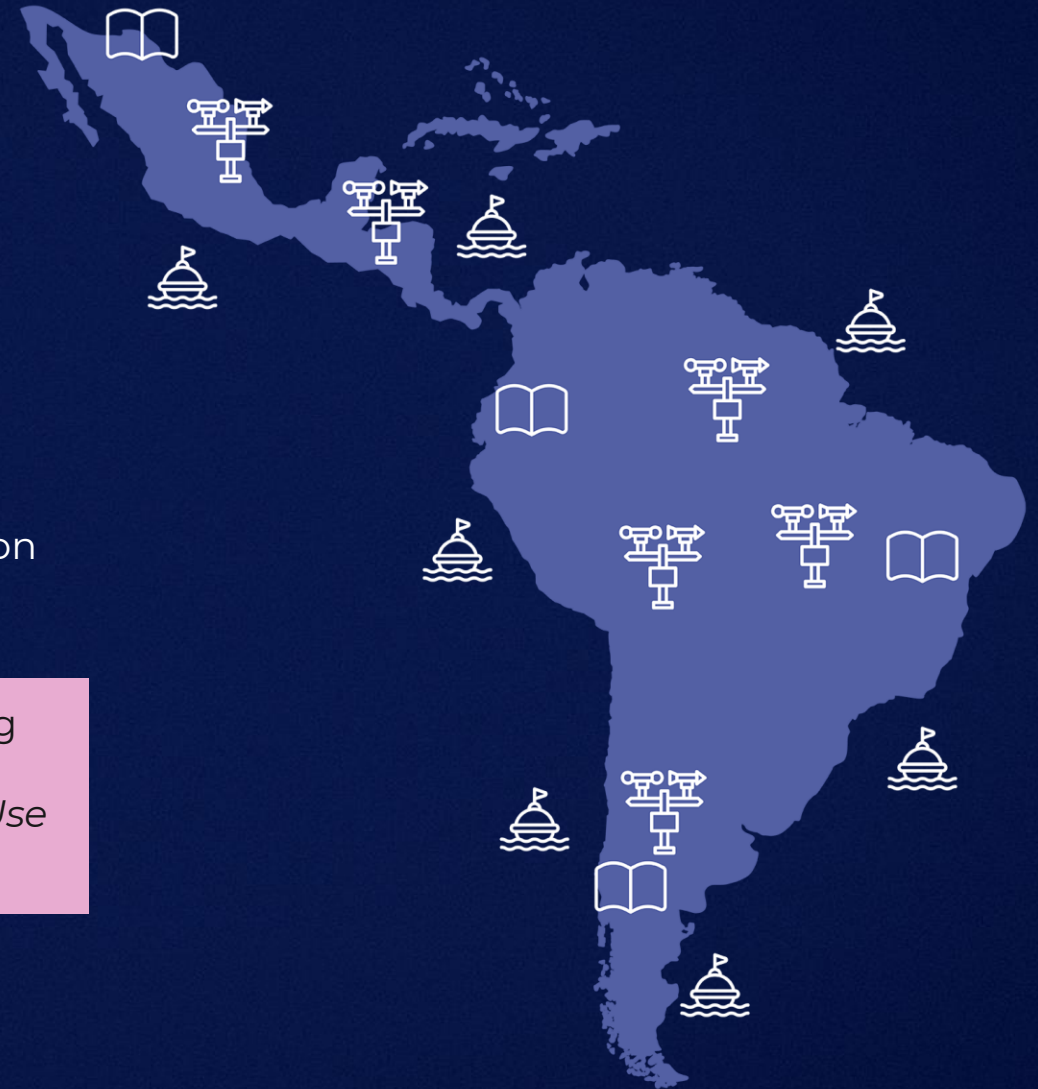




Urban Atlas

In Situ Data

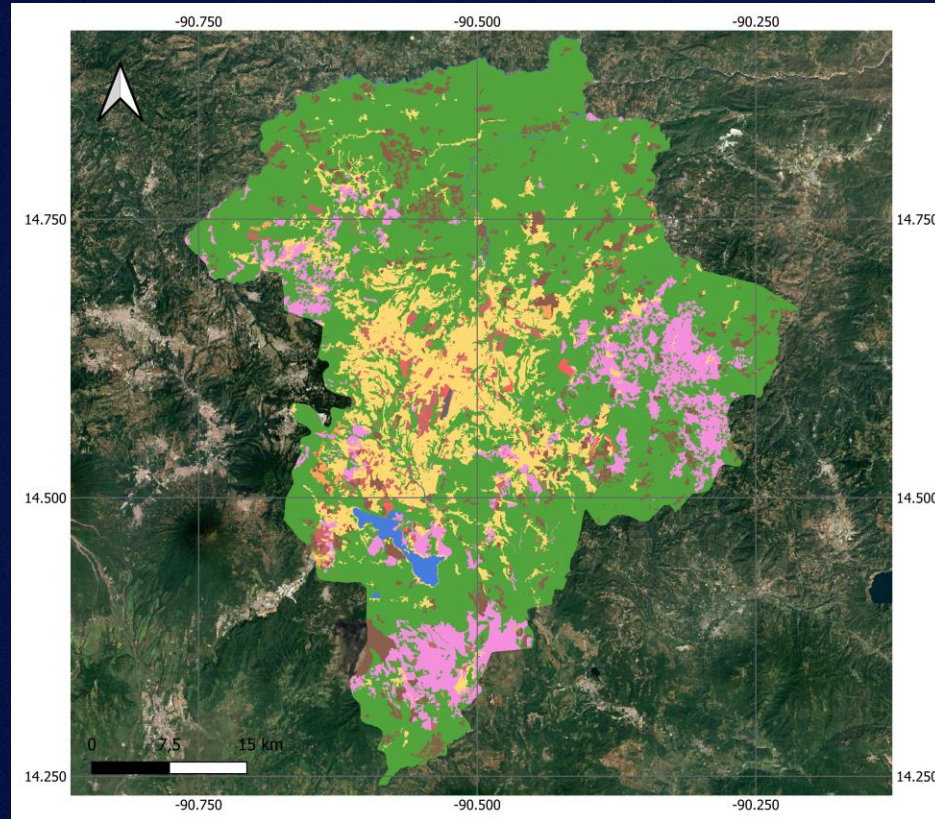
- Currently, cities concentrate fragmented and outdated information.
 - For the Urban Atlas, the in-situ information received has been used for training the models.
 - The new collaboration agreements currently being established will enable progress in the local validation of the Urban Atlas services, as well as in the adjustment of results at the local scale.
- To date, there are two important datasets describing urban land use that are currently being used to evaluate our product: *Guatemala Cover and Land Use (2020)* and *Colombia Land Cover (2020)*.



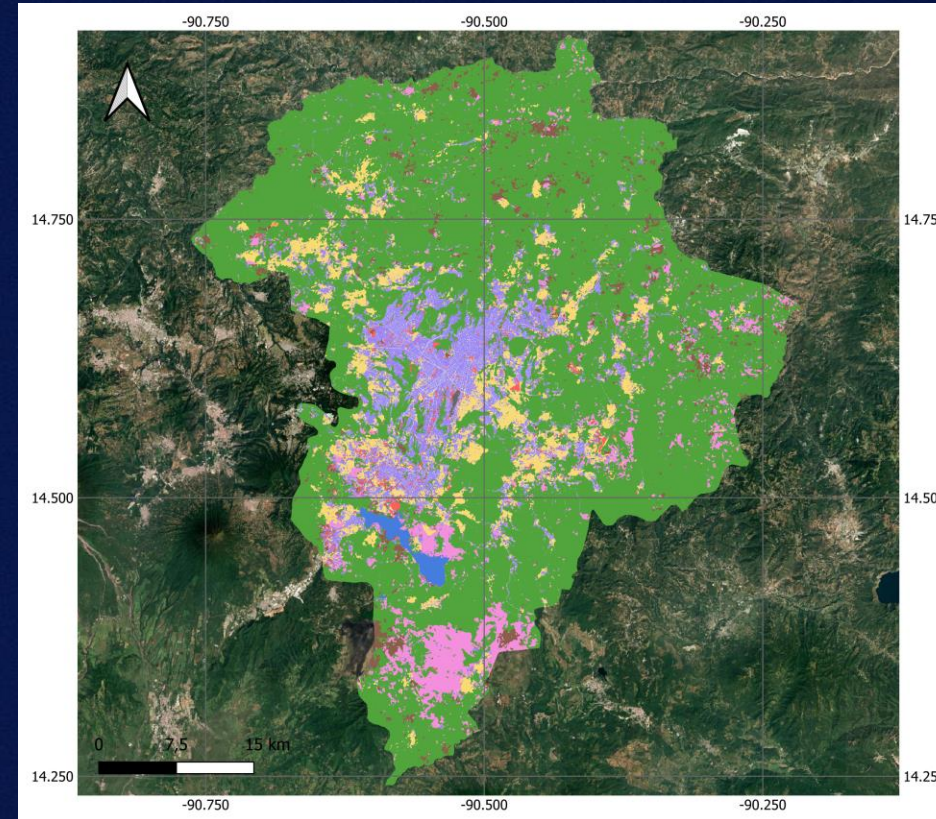


Urban Atlas

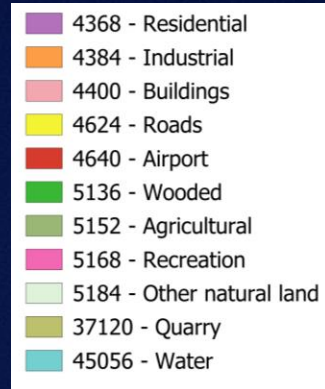
Field Application



Guatemala Land Cover and Use (2020)
Equivalence with Urban Atlas



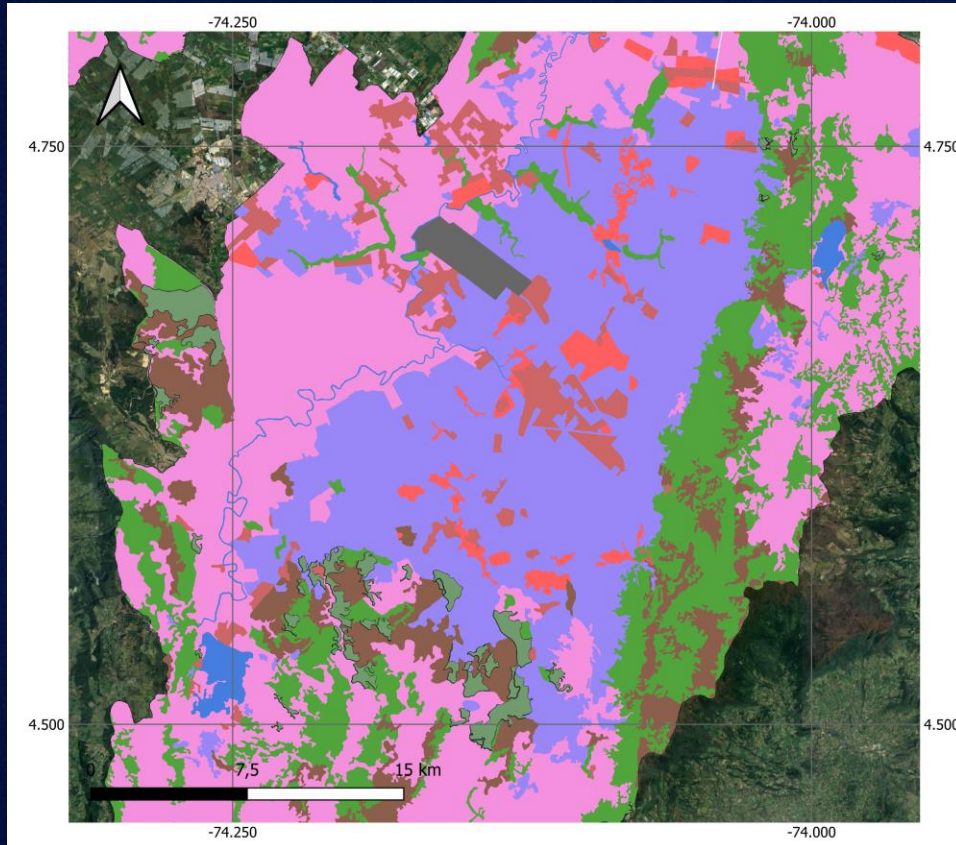
Urban Atlas Guatemala (2024)



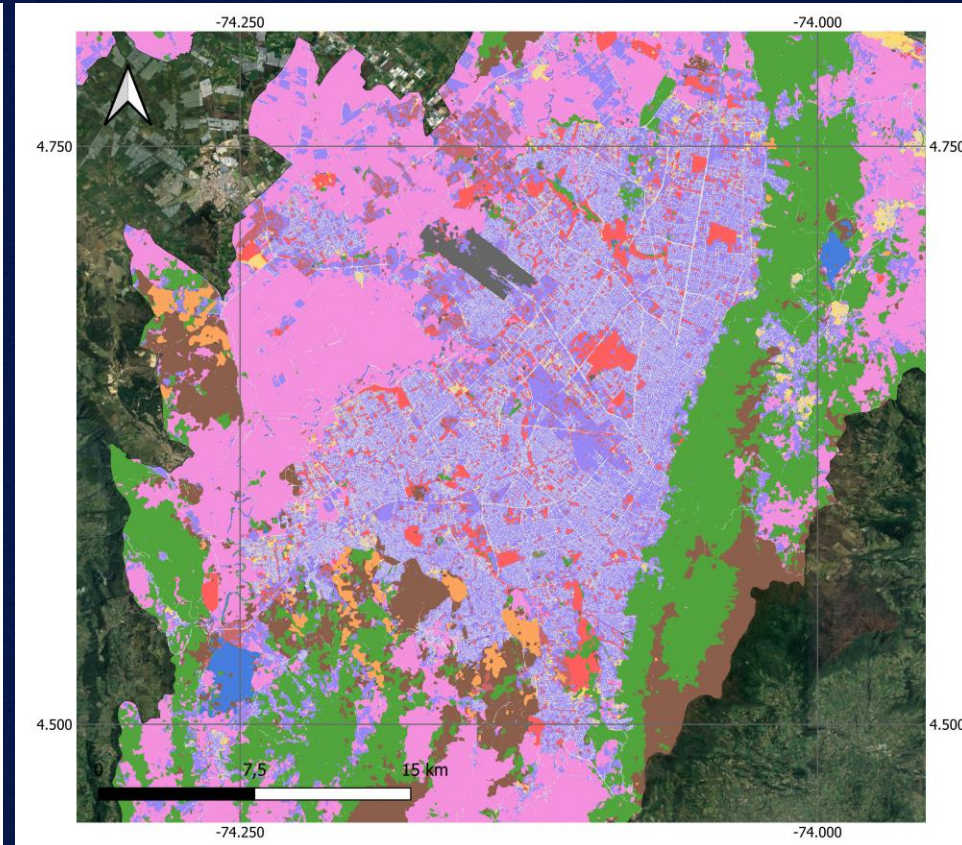


Urban Atlas

Field Application



Bogotá Land Cover and Use (2020)
Equivalence with Urban Atlas



Urban Atlas Bogotá (2024)

4368	- Residential
4384	- Industrial
4400	- Buildings
4624	- Roads
4640	- Airport
5136	- Wooded
5152	- Agricultural
5168	- Recreation
5184	- Other natural land
37120	- Quarry
45056	- Water





Urban Atlas

■ 02. Development **Future Challenges**



Urban Atlas

Projections of the Urban Atlas Product

- Add more classes of interest: Detection of primary and secondary roads, include bare soil subclassification (land without current use or construction sites).
- **Expand the classification to intermediate cities.**
- **Explore the idea of informal settlements detection to support urban planning.**
- Strengthen the in-situ data strategy for access to local data and validation with experts of the region.
- **Incorporate local census data.**
- Systematic feedback from the scientific committee.





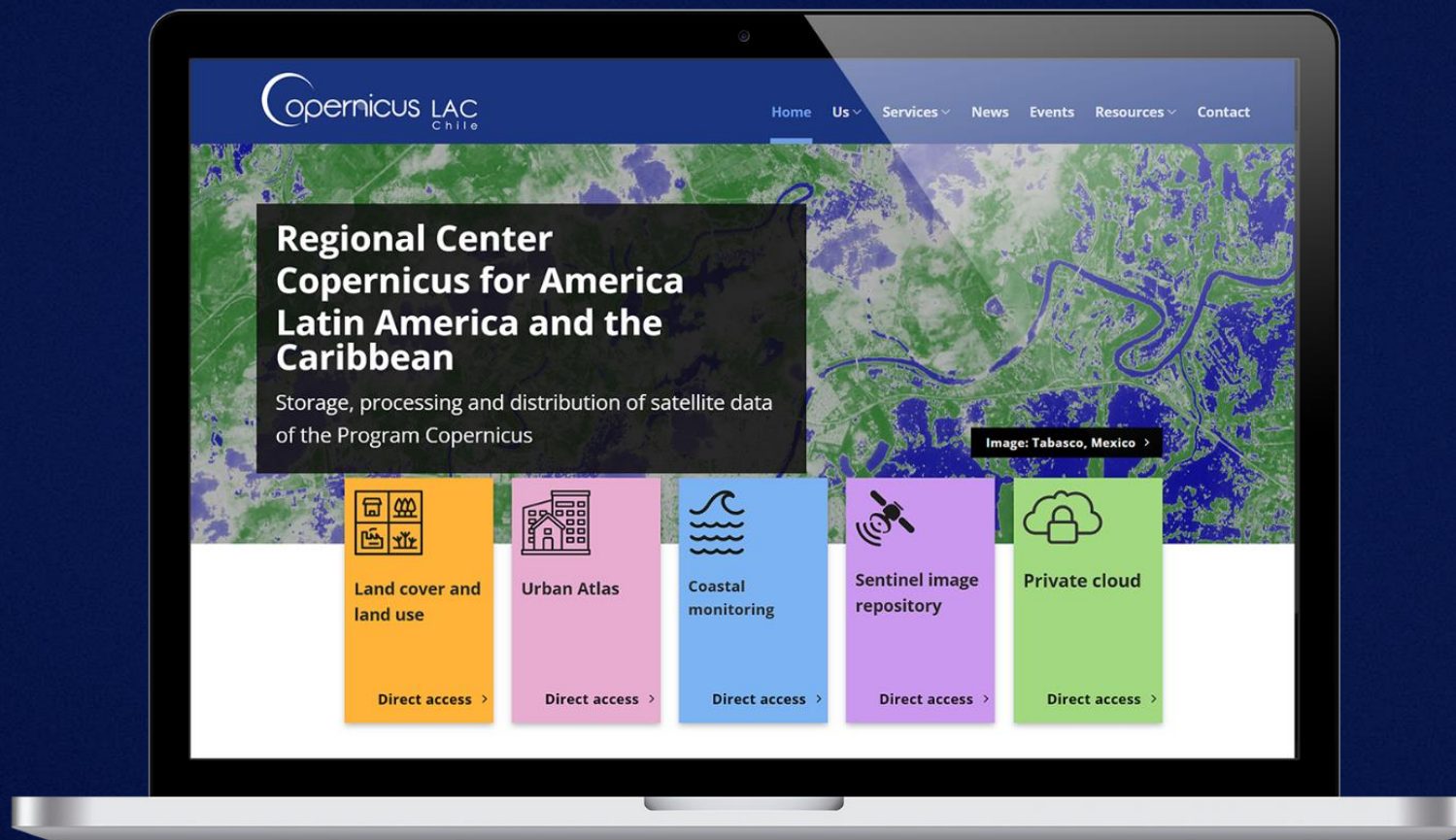
Urban Atlas

■ 03. The Service's Platform



Urban Atlas

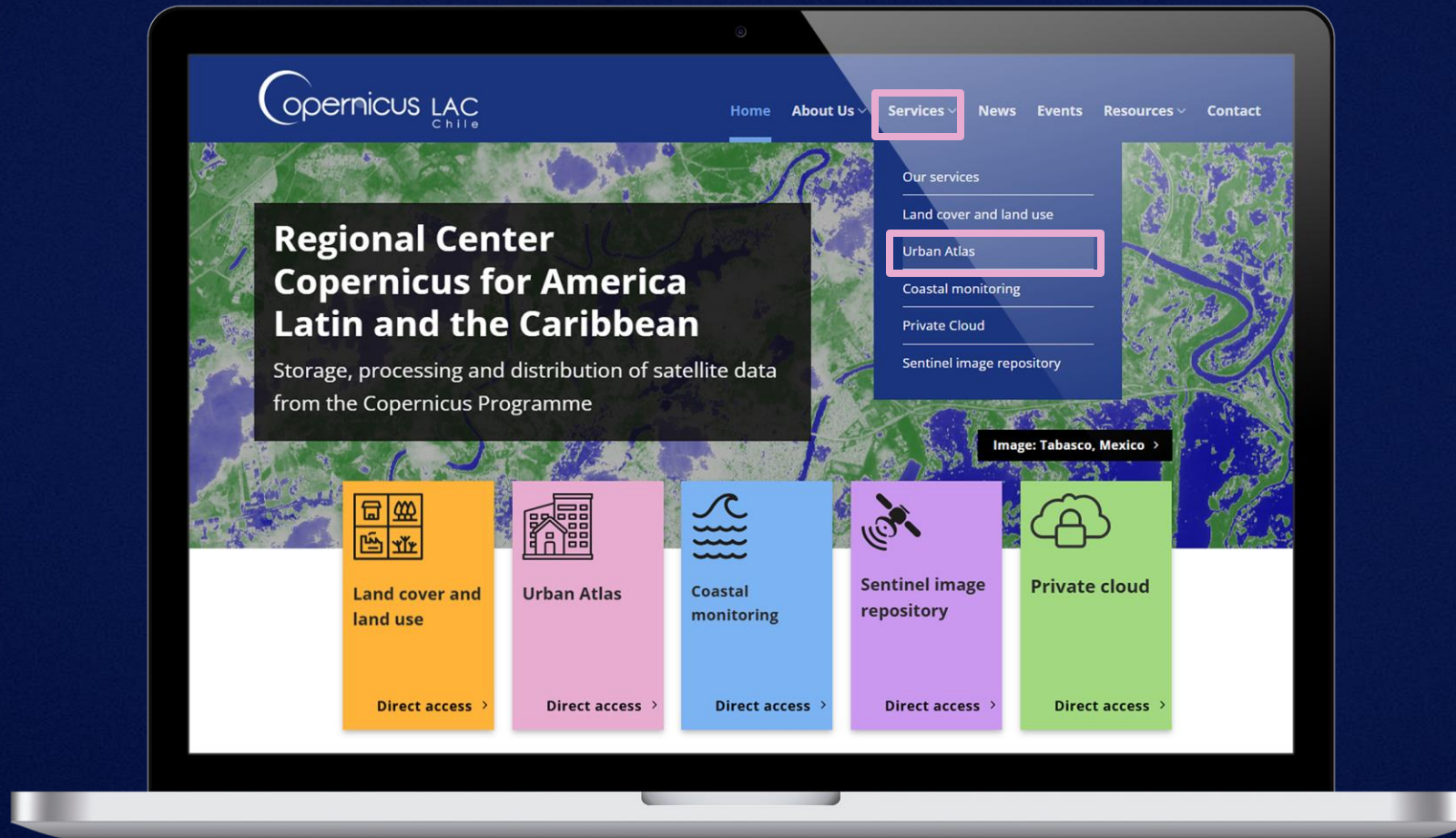
The platform of the Urban Atlas service





Urban Atlas

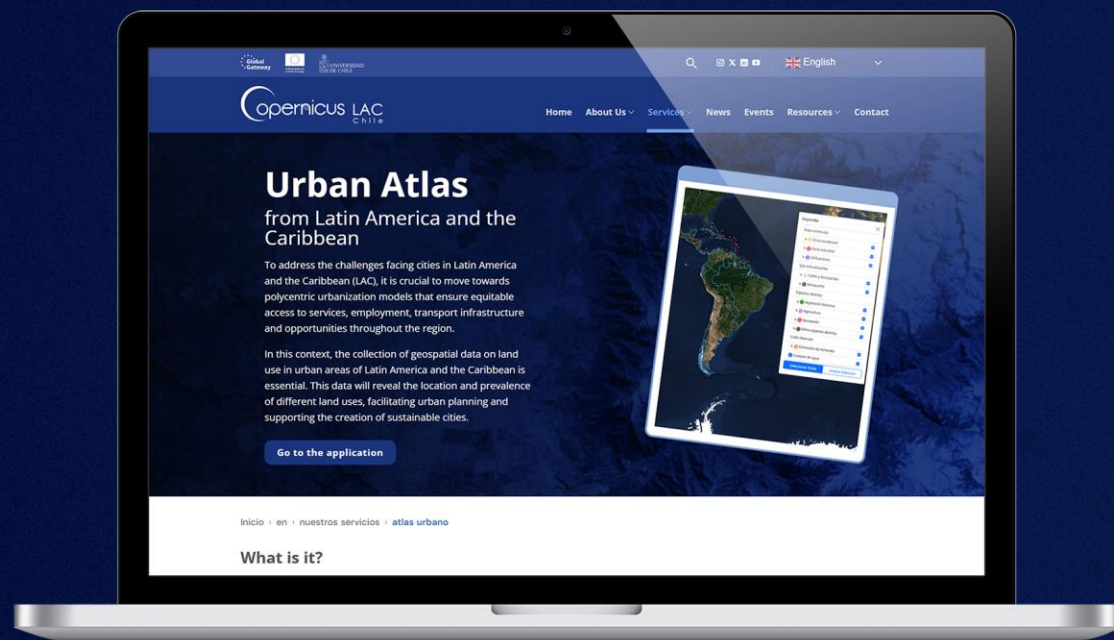
Details of the Urban Atlas Service



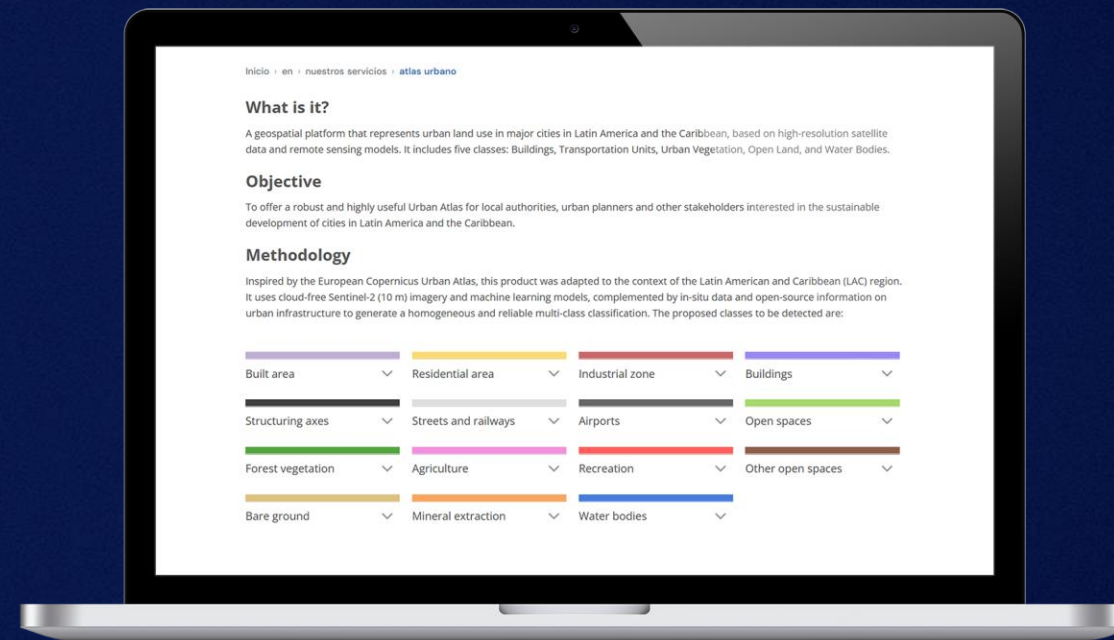


Urban Atlas

Details of the Urban Atlas Service



Access to the app and
description of the product



Details and description
of the classes





Urban Atlas

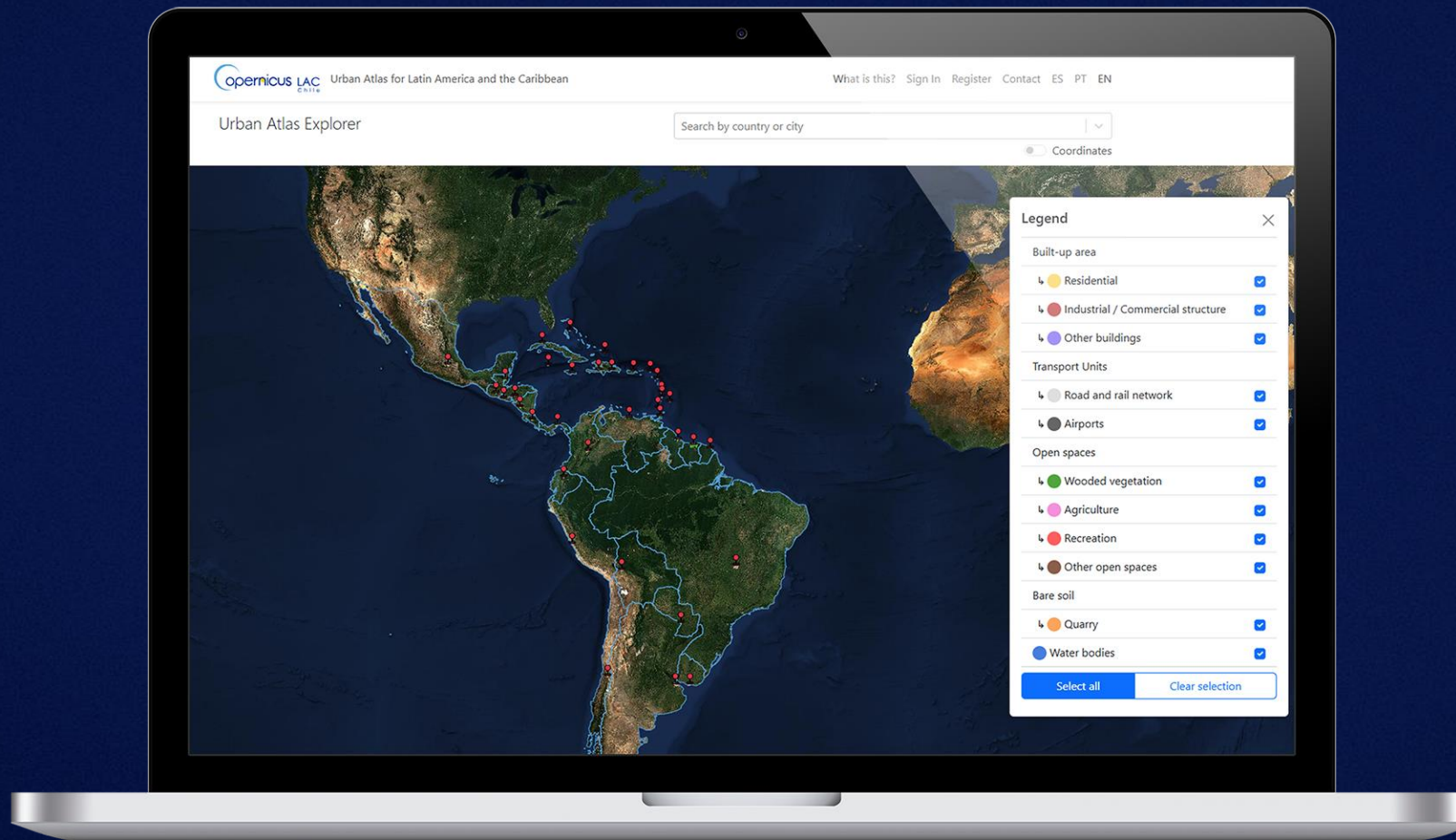
Direct access of the Urban Atlas service





Urban Atlas

Urban Atlas service

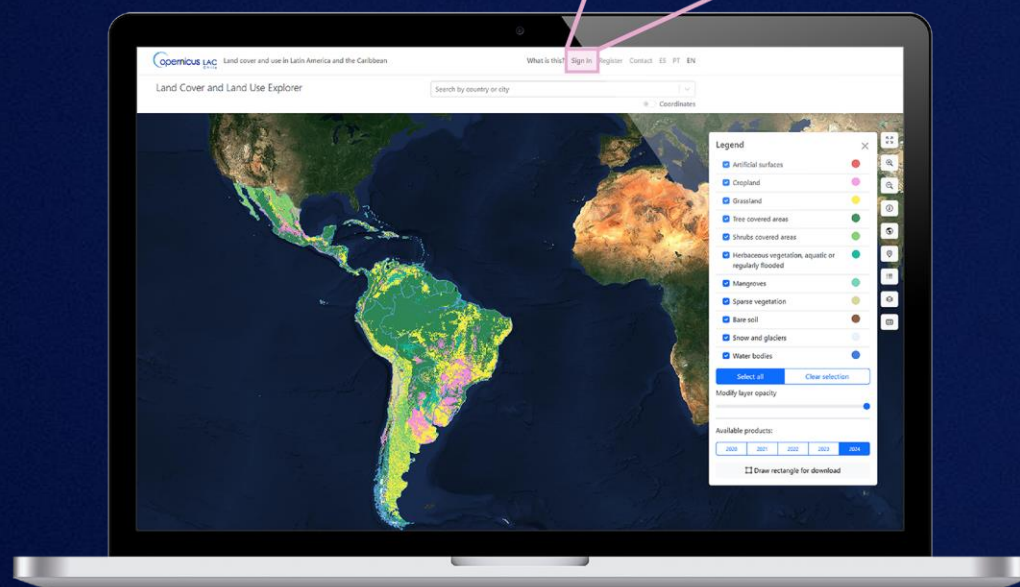




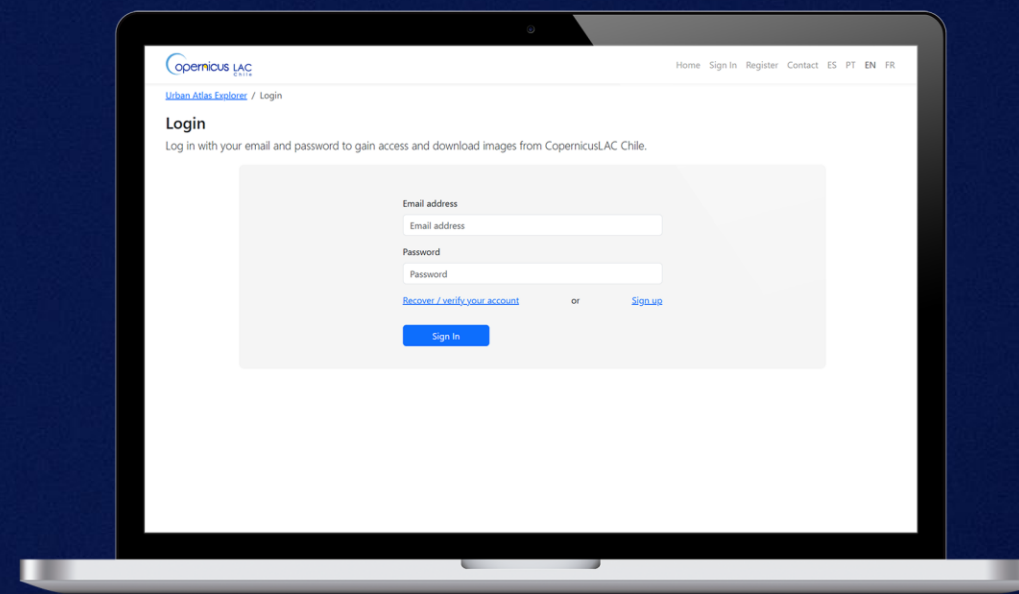
Urban Atlas

Details of the Urban Atlas Service

is? Sign In R



Registration required to
interact with the platform



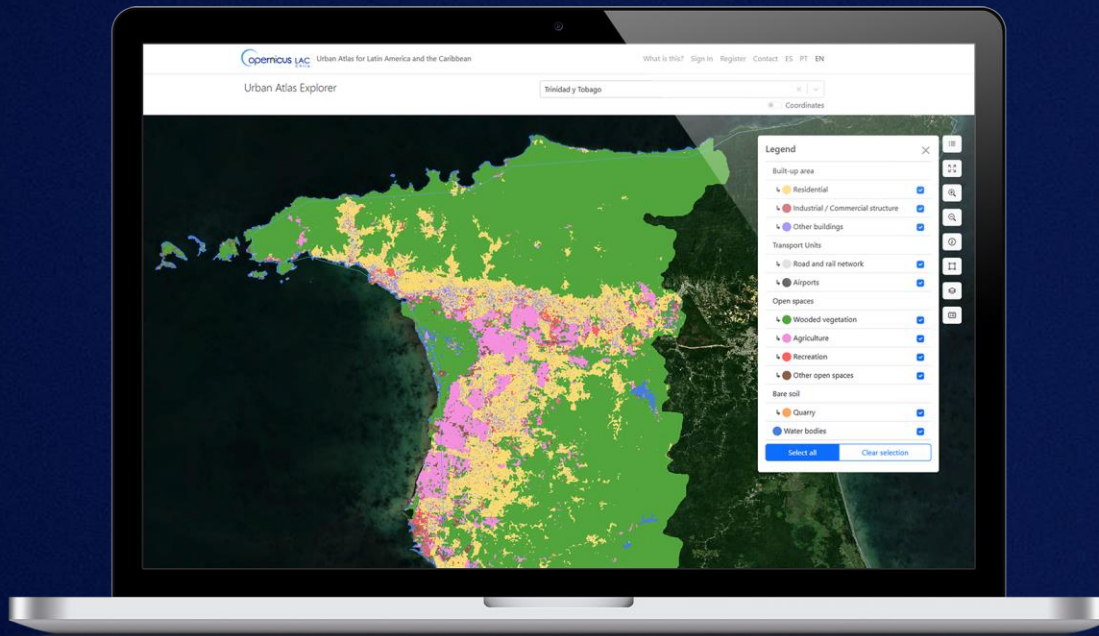
Log in with your email and password
to gain access and download images
from CopernicusLAC Chile



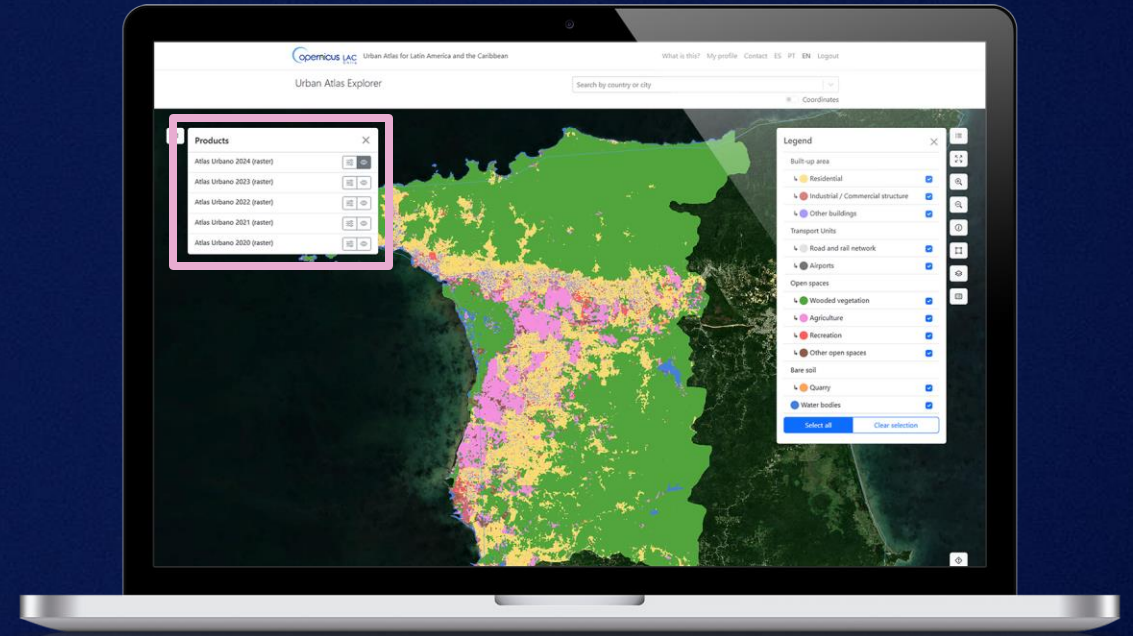


Urban Atlas

Details of the Urban Atlas Service



Explore the results of a city.
In the example Trinidad and Tobago



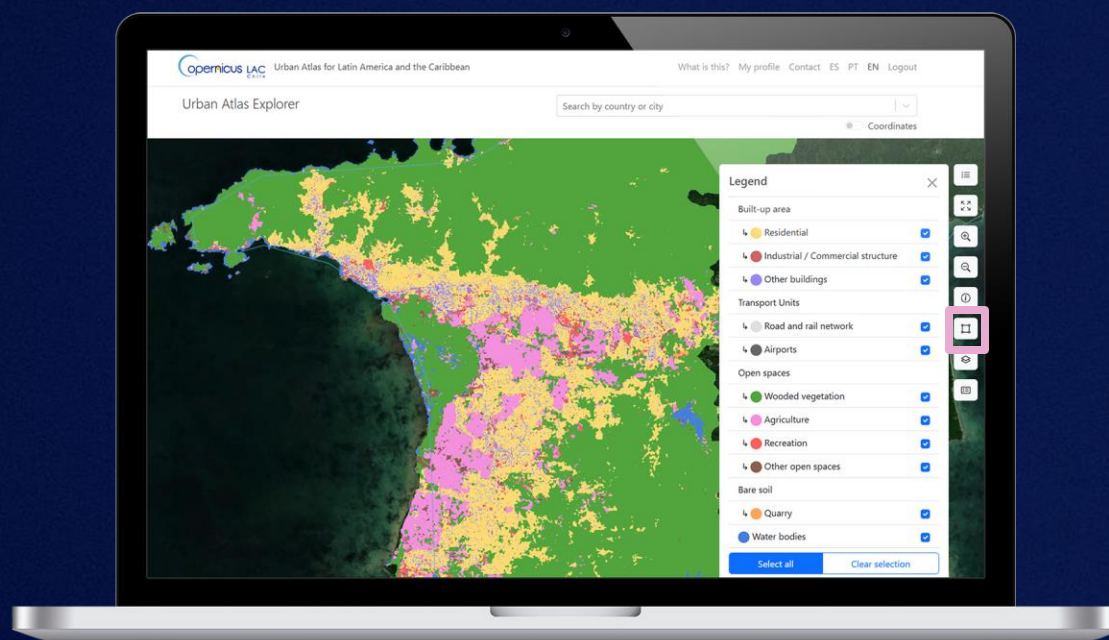
Available years of the
Urban Atlas product



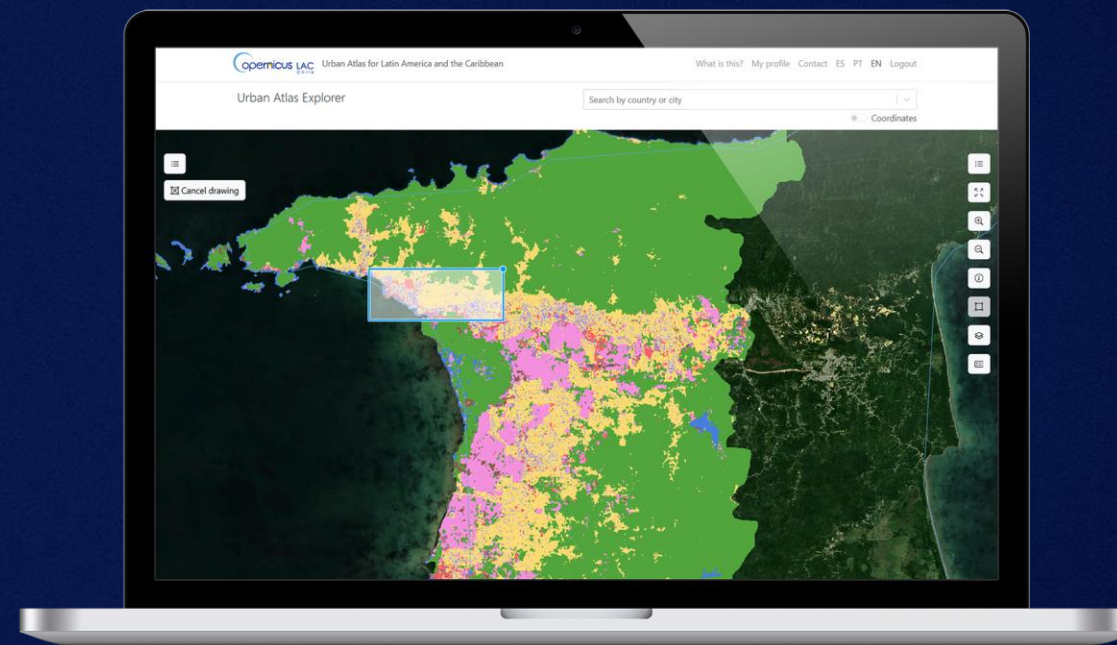


Urban Atlas

Details of the Urban Atlas Service



Among the functionalities, there is a button to select the area of interest



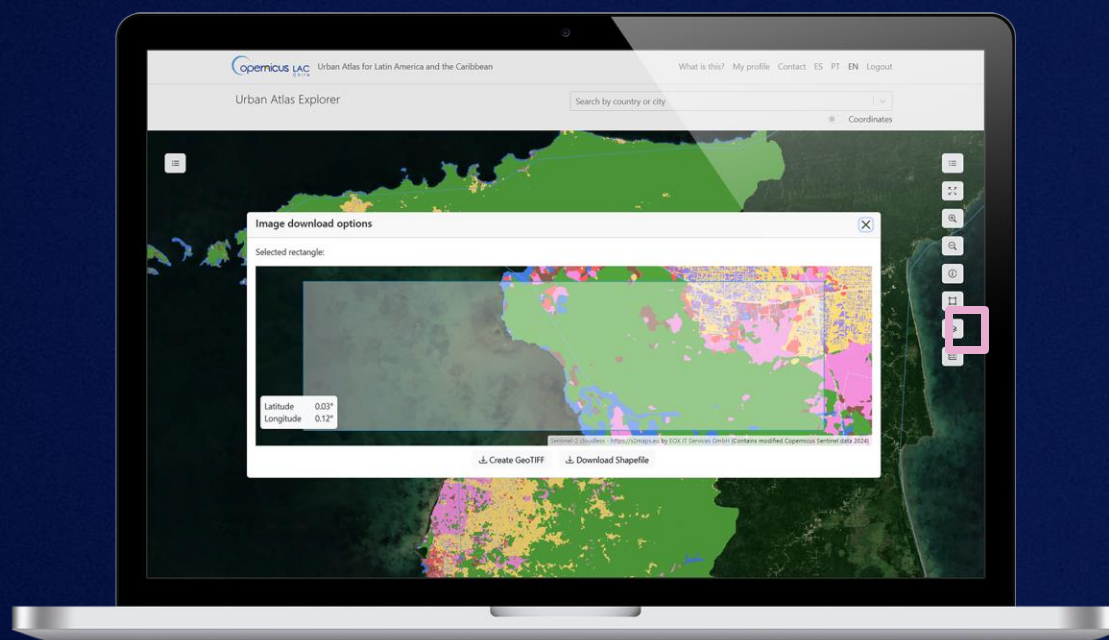
Draw a rectangle for download



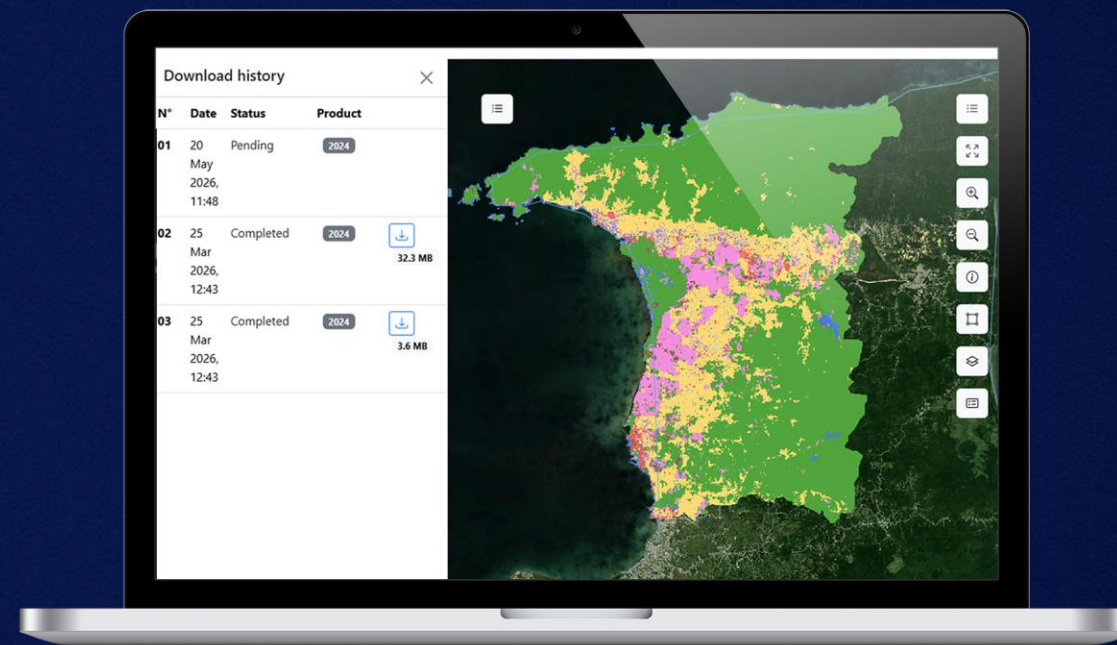


Urban Atlas

Details of the Urban Atlas Service



Choose Classes Year Format
Shapefile (.shp) or Geotiff (.tif)



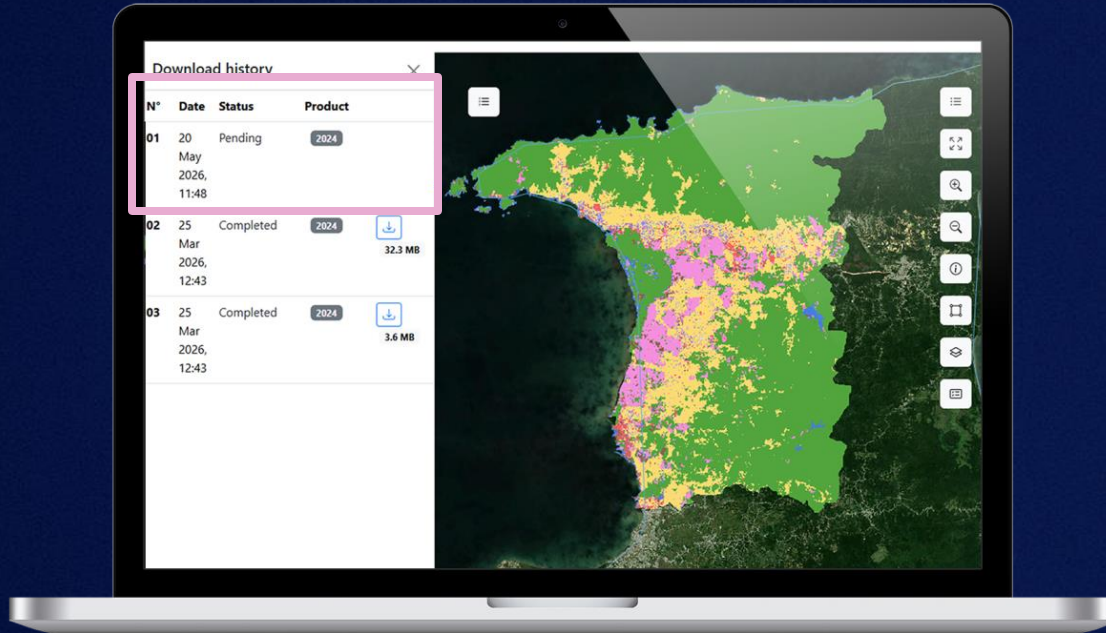
Check the Download History



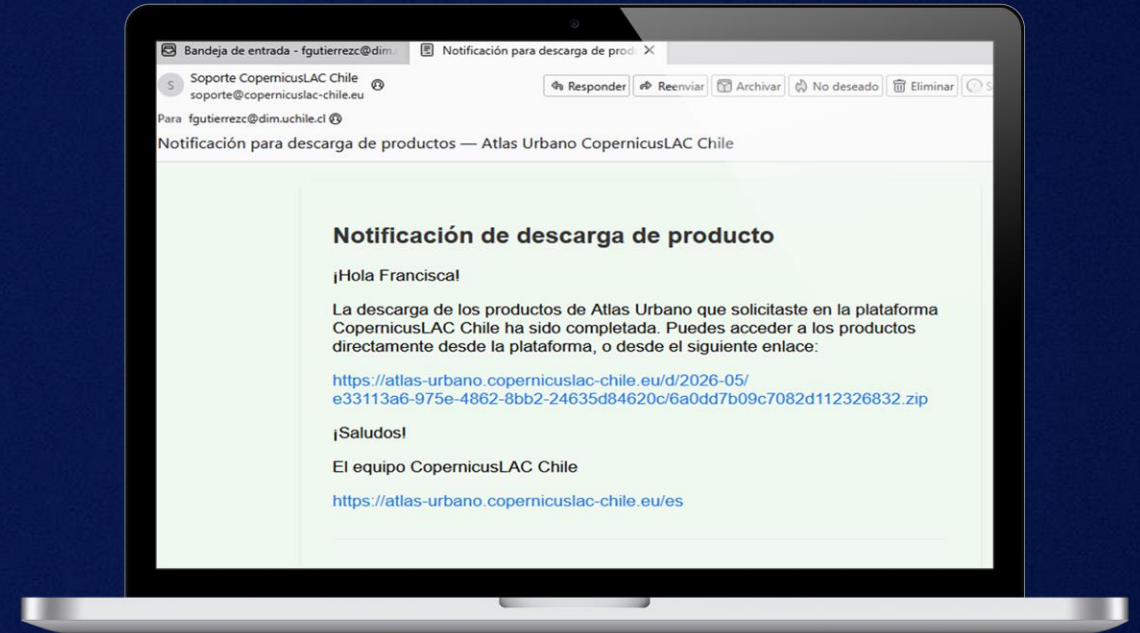


Urban Atlas

Details of the Urban Atlas Service



Once completed, you will be able to start downloading a .zip file containing the required formats and the legend



Email notification





Urban Atlas

■ 03. Part One Recap



Urban Atlas

Today's LCLU Workshop Agenda

Technical Presentation Session:

01. Introduction

02. The service:

- Global Urban products
- Development of Urban Atlas
- Results
- Future Challenges

03. The service's platform





Urban Atlas

Urban Atlas Workshop Agenda

Hands on session:

- What you'll need
- What to expect
- How we'll work together





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