

LULC Web GIS

User Handbook

10 m annual land cover from Sentinel-2 (Esri / Impact Observatory)
Yearly trends, change matrix and print-ready map composer



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01 Overview

LULC Web GIS is a browser-based tool that turns any study area into a complete land use / land cover (LULC) analysis. Load a boundary, choose the years, and the tool downloads annual 10 m land cover, calculates the area of every class, tests trends, builds a change matrix and lets you compose a print-ready map with legend, scale bar, north arrow and statistics. Everything runs in your browser; no software installation is needed.

Annual 10 m land cover	Sentinel-2 based product (Impact Observatory / Esri / Microsoft), clipped to your study area.
Area statistics	Hectares per class and per year, with data coverage and source for each year.
Trend analysis	Mann-Kendall test (two-sided, 5%) and Sen's slope for every class (needs 4 or more years).
Change matrix	From-to class transitions between any two years, with gain, loss and net change chart.
OSM enrichment	Roads, railway, rivers/streams and farmland merged into the land cover and reported in legend and statistics.
Map composer	A4, A3, A2 or Letter layouts; exports PNG, JPG, PDF and a georeferenced PNG with world file.
Shapefile to KML	Converter for zipped shapefiles and GeoJSON, with reprojection from the .prj file.

Requirements

- A modern browser (Chrome, Edge or Firefox) with an **internet connection**. The Esri land cover service, map tiles, OpenStreetMap and several script libraries are loaded online.
- A study area as KML, GeoJSON, zipped shapefile, or the files .shp + .dbf + .prj together.
- Keep the *image* folder (logos) next to the HTML file so the header logos display.

Good to know

The land cover is a modelled product. Small year-to-year changes can be classification noise, so read trends together with local knowledge.

02 Quick start

1

Load your study area

Drop a KML, GeoJSON or zipped shapefile on the Study area box (step 1). The yellow outline appears on the map.

2

Choose the years

In step 2 select **Time series** with a start and end year, or **Single year**. Click **Run analysis**.

3

Wait for the download

A progress bar shows each year being fetched. OSM features are added automatically afterwards if the option is ticked.

4

Explore the results

Use the year slider and Play button on the map, then the tabs: Area by year, Trend analysis, Change matrix.

5

Compose and export the map

Open **Map composer**, set title, paper, years and options, then export PNG, JPG, PDF or a georeferenced PNG.

Tip

For a first test use a small area (a village or sub-watershed) and 3 to 4 years. Large areas are processed at a coarser pixel size to stay fast.

03 The screen at a glance

Header

Application title with the LULC and ROOTPIXIN logos.

Left panel (steps 1 to 4)

Study area, analysis settings, other years, OSM features and scale/MMU options, plus the class style editor. The panel scrolls independently.

Map

Satellite or OpenStreetMap base map (layer switch, top right) with the land cover overlay for the selected year.

Year bar

Play/Stop animation, year slider and an opacity slider for the land cover layer.

Tabs

Area by year, Trend analysis, Change matrix, Map composer, Shapefile to KML.

04 Step 1: Study area

Drag files onto the dashed box, or click it to browse (multi-select is allowed). Accepted inputs:

- **KML** or **GeoJSON** in latitude/longitude (WGS 84).
- **Zipped shapefile** (.zip) - recommended, the projection is read automatically.
- **.shp + .dbf + .prj** selected together. Include the .prj if the data is not in lat/lon so it can be reprojected.

Only polygons can be a study area. Points and lines are rejected with a message. After loading you can press **Download as KML** to save the boundary.

Coordinates error?

If you see "Coordinates are not in lat/lon", add the .prj file or upload the shapefile as a .zip.

05 Step 2: Analysis

Time series (every year)

Pick a start and end year. Every year in between is downloaded and analysed. Enables trends, change matrix and year animation.

Single year

One year only, for a quick map or area statement.

- The available year range is read from the service (typically 2017 onwards).
- The tool tries two ways of requesting each year and keeps the one with better coverage. If a year covers less than 98% of your area, a warning lists the coverage; uncovered pixels are shown as **No data**.
- Areas wider than about 4,500 pixels are processed at a coarser pixel size. A note tells you the effective size; split the area for full 10 m detail.

06 Step 3: Add other years

Land cover before the service range (for example 2000 or 2010) can be added from your own polygons - KML, shapefile or GeoJSON of one year.

1

Select the file

Choose the layer for a single year. The year is guessed from the file name if it contains four digits.

2

Pick the class field

Select the attribute that holds the class name or code. The tool suggests a likely field.

3

Match values to classes

Each distinct value is matched to a class automatically (water, crops, built, forest ...). Correct any value or set it to **Skip**.

4

Add this year

Enter the year and press **Add this year**. The year joins the time series, charts and composer.

Compare with care

Imported years come from a different source and method. Differences with the 10 m series may reflect method, not real change.

07 Step 4: OSM features, scale and MMU

Roads, railway, rivers and small farm plots are too narrow or too mixed for the 10 m model. This step adds them from OpenStreetMap (OSM) so they appear on the map, in the legend and in the statistics. The same current geometry is applied to all years, so it never creates false change.

OSM features

Roads	Highways except footways, paths, steps and similar. Drawn with a width by road class; bridges and tunnels excluded.	Length in km
Railway	Rail lines (not bridges or tunnels).	Length in km
Rivers / streams	All waterways, drawn over land (kept as water where the land cover is already water).	Length in km
Farmland (Agricultural land)	Farmland, orchard, vineyard, plantation and farmyard polygons. Converts Crops, Rangeland, Bare ground and Flooded vegetation pixels.	Area in ha

- Tick the features you want, then press **Add selected features from OSM**. Each type is downloaded separately with automatic fall-back to backup servers, and the message under the button shows how many features were found.
- Changing a tick afterwards updates the map without downloading again (unless that type has not been downloaded yet).
- **Add OSM features automatically after each run** repeats the download whenever you run an analysis.

If the download returns nothing

Busy servers, very large areas or an ad-blocker can block the download. Try a smaller area, or use **Load your own OSM extract**: choose the class (Roads, Railway, Rivers/streams or Farmland) and select a GeoJSON, KML or zipped shapefile exported from OSM or QGIS.

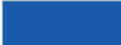
Other options

Replace Cloud pixels using other years	Cloud pixels take the class of the nearest year that is cloud-free at that location.
Merge Crops into "Agricultural land"	Crops and OSM farmland are reported as a single class. Untick to keep Crops separate.
Scale 1 : N and Min. unit (mm2)	Defines the minimum mappable unit (MMU) in hectares on the ground. The value is shown below the options and printed on the composed map.
Generalise map to the MMU	Merges patches smaller than the MMU into their largest neighbour. Roads, rail and rivers are exempt.

The scale also drives the composer when *Scale: Fixed ratio* is chosen, so printed maps carry an exact ratio.

08 Class styles

The **Class styles** card lists every class with a colour picker and an editable name. Changes apply instantly to the map overlay, charts, tables and the composed map. **Reset styles** restores the defaults.

Colour	Class	Meaning
	Water	Open water
	Trees	Tree cover
	Flooded vegetation	Seasonally flooded vegetation
	Crops	Cultivated crops
	Built area	Settlements, roads, structures
	Bare ground	Bare soil, sand, rock
	Snow/ice	Snow and ice
	Clouds	Cloud-covered pixels
	Rangeland	Grass, shrub, open vegetation
	No data	Outside coverage
	Agricultural land	Crops merged with OSM farmland
	Roads	From OSM
	Railway	From OSM
	Rivers / streams	From OSM

09 Result tabs

Area by year

A stacked bar chart and a table of hectares per class and year, plus classified total, study area, data coverage and source for each year. **Download CSV** saves the table.

Trend analysis

A line chart and a table with every year as a column, the change in ha and %, the Mann-Kendall trend (Increasing, Decreasing or No significant trend), the p value and Sen's slope in ha per year. At least 4 years are needed for the test.

Change matrix

Select a start year and an end year and press **Compute**. Rows are the earlier class, columns the later class, values in ha; darker cells mean larger transitions. The bar chart shows gain, loss and net change per class. Pixels with no data in either year are excluded.

Shapefile to KML

Select a .zip shapefile (or .shp + .dbf + .prj), choose the field used as the placemark name, then download KML or GeoJSON. **Use as study area** sends the layer to step 1.

10 Map composer

The composer builds a print-ready layout that updates live as you change any control. The scale bar and ratio are exact for the chosen paper size.

Page	Paper (A4, A3, A2, Letter), orientation, page colour, outer border on/off, border colour and thickness.
Title	Title and subtitle text, font, size, colour and alignment.
Map	Single or multiple years, year selection, frame fill, study-area outline (colour, width), coordinates (none, ticks or grid) and size, columns, row label for multi-year layouts, scale mode (fit to page or fixed ratio).
Statistics	Year table under the legend, table layout and a statistics strip under the map (ha, %, or both).
Elements	North arrow (compass or arrow), scale bar, legend with title and values (none, ha or %), study area in legend, body font and legend size.
Notes	Credits text and a "Prepared by" line. The date is added automatically.

Multi-year layout and the year table

- Set **Layout** to Multiple years and tick the years (All, First + last or Clear shortcuts). The maps are tiled automatically; set **Columns** for a custom grid.
- Under the legend a **year table** can be shown. It adapts to the available space without shrinking the map. **Table layout** switches between features as columns with years as rows, and features as rows with years as columns.
- Under **Year-table feature names** you can type a shorter or different name for any feature; leave blank to use the class name.
- OSM features appear in the legend and tables: linear features in **km**, farmland in **ha**.

Fixed scale

Choose *Fixed ratio* and set the scale in step 4. If the map does not fit the page at that ratio, it is drawn at fit scale and a note suggests a suitable ratio or a larger paper.

11 Exporting

PNG / JPG	Choose 150, 300 or 600 dpi first. 300 dpi is right for most prints; very large papers at 600 dpi are capped automatically for browser memory.
PDF	Same layout in the selected paper size, with the map embedded as a high-resolution image.
Georeferenced PNG + world file	Downloads the land cover image with .pgw and .prj files (WGS 84 / Pseudo-Mercator) so it opens correctly in QGIS or ArcGIS.
CSV tables	Area by year, Trend and Change matrix each have a Download CSV button.

Every composed map carries the line **Powered by ROOTPIXIN Solutions Pvt. Ltd.** at the bottom of the page; it is part of the layout and is included in all exports.

12 Troubleshooting

Run analysis is greyed out	Load a study area first (step 1).
"No data loaded"	Check the internet connection and that the area is inside the service coverage; try a different year.
Some pixels show No data	The service does not cover the whole area for that year. Coverage is listed in the status and in the Area table.
OSM features are missing or 0	Read the message under the OSM button. Try a smaller area, press the button again, or upload your own extract.
Logos are missing in the header	Place the <i>image</i> folder (LULCLogo.png and Logo.png) next to the HTML file.
PDF button says library could not load	The PDF script is loaded online. Check the connection and reload the page.
Map looks blocky	This is correct at 10 m: pixels are shown without smoothing. Large areas use coarser pixels.

13 Data notes and credits

- **Land cover:** Sentinel2_10m_LandCover ImageServer (Esri Living Atlas), data by Impact Observatory / Esri / Microsoft, derived from Sentinel-2. A modelled product; validate locally before critical decisions.
- **Features:** roads, railway, waterways and farmland from OpenStreetMap contributors, current geometry only.
- **Projection:** processing and maps use WGS 84 / Pseudo-Mercator; areas are corrected for latitude.
- **Privacy:** your boundary is processed in the browser. Only the map extent is sent to the Esri and OSM services to fetch data.

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