ECOSTRESS LST Visualization in QGIS

Step-by-Step Tutorial for NASA ARSET Training

ECOSTRESS Urban Heat Product Suite | 70m & 10m Land Surface Temperature

What you will learn

- Import ECOSTRESS 70m LST and 10m sharpened LST GeoTIFFs into QGIS
- Add a Google Satellite base map for spatial context
- Apply a thermal colour ramp and set appropriate display range
- Adjust layer opacity to compare LST with satellite imagery
- Extract zonal statistics for urban vs. rural areas
- Export a publication-quality map layout

Prerequisites: QGIS 3.28 or later installed. Files from GEE export ready in a local folder.

1. Setting Up Your QGIS Project

1.1 Create a new project

1. Open QGIS. Go to

Project → New

2. Save immediately: **Project → Save As →** name it `ECOSTRESS_LST_LA.qgz`
3. Set the project CRS. Go to

Project → Properties → CRS

Search for and select **EPSG:4326 — WGS 84**. This matches the coordinate system of the exported GeoTIFFs.

i Keep all your GeoTIFF files in a single folder before starting. QGIS stores relative paths, so moving files later will break layer connections.

2. Adding a Google Satellite Base Map

A satellite base map provides essential visual context for interpreting LST patterns over urban areas.

2.1 Import Google Satellite basemap

4. **HCMGIS** → **BaseMap** → Google Satellite (or the one of your choice)

3. Loading the ECOSTRESS GeoTIFF Files

3.1 Import the 70m LST composite

5. Go to **Layer** → **Add Layer** → **Add Raster Layer**
6. Click the **...** button next to Source and navigate to your exported GeoTIFF, e.g., `ECOSTRESS_LST_70m_2020-08-14_to_2020-08-14_LST_NDVI_Elev_w3x.tif`
7. Click **Add**, then **Close**

3.2 Import the 10m sharpened LST

8. Repeat the steps above for the 10m GeoTIFF:

`ECOSTRESS_LST_10m_2020-08-14_to_2020-08-14_LST_NDVI_Elev_w3x.tif`

9. Stack the layers in this order (top to bottom in Layers panel):

- ECOSTRESS LST 10m sharpened
- ECOSTRESS LST 70m composite
- Google Satellite

> To zoom in to the tile selected, right-click the layer and click on **Zoom to Layer(s)**
> Make sure the Google Satellite layer sits below the LST raster layer

4. Applying a Thermal Colour Ramp

QGIS defaults to a greyscale display. Apply a thermal palette to make temperature gradients immediately interpretable.

4.1 Open the layer styling panel

10. Double-click the **ECOSTRESS LST 10m** layer in the Layers panel.

11. The **Layer Properties** dialog opens. Click **Symbology** in the left panel.

4.2 Set render type and colour ramp

Setting	Value
Render type	Singleband pseudocolor
Min	Lower 2nd percentile of your data (e.g. 65)
Max	Upper 98th percentile of your data (e.g. 120)
Color ramp	Spectral (reversed) or Inferno or Magma Note: to invert spectral, click the down arrow next to colorbar and select 'Invert Color Ramp'
Mode	Continuous
Interpolation	Linear

12. To set min/max from the data: click **Min/Max Value Settings** → select **Cumulative count cut** → set to **2% – 98%** → click **Apply**
13. For the colour ramp: click the colour ramp dropdown → select **Spectral** → tick **Invert colour ramp** (so blue = cool, red = hot).
14. Click **Apply** then **OK**

* The Spectral reversed ramp (blue → yellow → red) is the most intuitive for thermal data and matches the ECOSTRESS standard colour scale used in published products. Inferno and Magma are good alternatives for print and colourblind-safe figures.

4.3 Apply the same colour ramp to the 70m layer

15. Double-click **ECOSTRESS LST 70m** in the Layers panel.
16. Apply identical settings — crucially, use the **same Min/Max values** as the 10m layer so the two products are directly comparable.

5. Adjusting Opacity for Comparison

Reducing the opacity of the LST layer allows the satellite imagery to show through, making it easy to relate thermal patterns to land cover.

5.1 Set layer opacity

17. Double-click **ECOSTRESS LST 10m** → **Transparency**
18. At the top of the Transparency panel, find the **Opacity** slider.
19. Set to **70%** for a good balance between thermal detail and satellite context.
20. Click **Apply**

5.2 Toggle layers for comparison

- Tick/untick the checkbox next to each layer in the Layers panel to toggle visibility.
- Use the **Ctrl+Alt+F** shortcut (Windows/Linux) or ⌘**+L** (Mac) to open the Layer Panel quickly.
- Switch between 70m and 10m by toggling their visibility — this directly demonstrates the spatial detail added by the sharpening step.

6. Zonal Statistics

Zonal statistics extract summary temperature values for defined areas — for example, comparing LST in urban core vs. park vs. industrial areas.

6.1 Create zone polygons

21. Go to **Layer** → **Create Layer** → **New Shapefile Layer**
22. Set File name to (e.g., `zones`) Geometry type to **Polygon**, CRS to **EPSG:4326**, then click **OK**
23. Right-click on **zones**, Click the **Toggle Editing** pencil icon, then use **Add Polygon Feature** (see icon that looks like golf green with star below) to draw zones of interest, e.g.
    - Urban core (dense development)
    - City park or green space
    - Industrial area
    - Coastal or water-adjacent area
24. When done drawing polygon, right click to add a **name** attribute for each zone when prompted (e.g. id = 1). Right-click **zones** and Click **Save Layer Edits** when done.

6.2 Run Zonal Statistics

25. Go to **Processing** → **Toolbox** → search for **Zonal Statistics**
26. In the dialog, set:
    - Input layer: **zones.shp**
    - Raster layer: **ECOSTRESS LST 10m sharpened**
    - Statistics to calculate: **Mean, Min, Max, Std Dev, Median**
    - Output column prefix: `LST_` (keeps results organised if you run multiple rasters)

27. Click **Run**. Results are added as new attribute columns to the zone layer.
28. View results: right-click **Zonal Statistics** layer → **Open Attribute Table**. You will see columns like `LST_mean`, `LST_min`, `LST_max` for each zone.

6.3 Export zonal statistics to CSV

29. Right-click zones layer → **Export** → **Save Features As**
30. Set Format to **CSV**, choose a file name, and click **OK**

* Run Zonal Statistics on both the 70m and 10m layers using the same zone polygons, then compare mean values in the attribute table. The 10m product should show higher spatial contrast (standard deviation) between zones — this is the key validation of the sharpening benefit.

7. Adding a Legend and Scale Bar

7.1 Open the Print Layout

31. Go to **Project** → **New Print Layout** → give it a name (e.g., **LST Map**) and click **OK**

7.2 Add map canvas

32. Click **Add Item** → **Add Map**, then drag a rectangle on the layout canvas.
33. In the Item Properties panel on the right, set scale to e.g. **1:200 000** for a full-tile view.

7.3 Add essential map elements

Element	How to add
Legend	Add Item → Add Legend. Untick Auto update, then remove unwanted layers.
Scale bar	Add Item → Add Scale Bar. Set units to km, segments to 4.
North arrow	Add Item → Add North Arrow. Choose a simple style.
Title	Add Item → Add Label. Set font size to 24pt bold, colour to NASA blue.
Data credit	Add Item → Add Label. Text: "Data: NASA/JPL ECOSTRESS, Sentinel-2 ESA"

7.4 Export the map

34. Go to **Layout** → **Export as Image** → set resolution to **300 dpi** for print quality.
35. Or **Layout** → **Export as PDF** for a vector-quality output suitable for publications and presentations.

7.5 Simple export image

36. Go to **Project**→ **Import/Export** → **Export Map to Image** set resolution to **300 dpi** and Save

9. Quick Reference

Keyboard shortcuts

Shortcut	Action
Ctrl+L / ⌘+L	Open Layers Panel
F3	Fit map to all layers
Ctrl+Shift+P	Open Processing Toolbox
Ctrl+F3	Fit map to selected layer
R	Toggle Identify Tool
Ctrl+Shift+A	Open Attribute Table

Troubleshooting

Problem	Solution
Layer loads but map is blank	Right-click layer → Zoom to Layer. The data may be far from the current view.
All pixels same colour	Min and Max are equal. Open Symbology → Min/Max Settings → Cumulative Cut 2%–98% → Apply.

No data shows as colour	Open Symbology → set No Data value to match the raster NoData value (usually 0 or NaN).
Google Satellite not loading	Check internet connection. Try a different tile source: Bing Aerial or ESRI World Imagery via QuickMapServices.
CRS mismatch warning	QGIS will reproject on-the-fly. Set project CRS to EPSG:4326 to match the GeoTIFFs and the warning will stop.
Zonal stats returns NULL	Ensure the zone polygon overlaps the raster extent. Check both are in the same CRS.

Data Credit: NASA/JPL ECOSTRESS Team | Sentinel-2: ESA Copernicus | QGIS: Open Source Geospatial Foundation