**1. NDVI (Normalized Difference Vegetation Index) — Green Cover**

* **Satellite**: Sentinel-2
* **Sensor**: MSI (MultiSpectral Instrument)
* **Bands Used**:
  + **Band 8 (NIR)**: Near Infrared (842 nm)
  + **Band 4 (Red)**: Red (665 nm)

**Formula:**

NDVI=(NIR−Red)(NIR+Red)\text{NDVI} = \frac{(NIR - Red)}{(NIR + Red)}NDVI=(NIR+Red)(NIR−Red)​

**Interpretation:**

* NDVI ranges from **-1 to +1**
* Values closer to **+1** indicate **dense green vegetation**
* Values near **0 or negative** indicate **non-vegetated surfaces** (urban, water, bare soil)

**2. Urban Heat Index (UHI Proxy using Land Surface Temperature) — Thermal Discomfort**

* **Satellite**: Sentinel-3
* **Sensor**: SLSTR (Sea and Land Surface Temperature Radiometer)
* **Bands Used**:
  + TIR1 (10.85 µm) and TIR2 (12.0 µm) — for thermal infrared

**Formula (Simplified LST Calculation):**

Use **Split Window Algorithm** (SWA):

LST=a⋅T10.85+b⋅(T10.85−T12.0)+c\text{LST} = a \cdot T\_{10.85} + b \cdot (T\_{10.85} - T\_{12.0}) + cLST=a⋅T10.85​+b⋅(T10.85​−T12.0​)+c

Where:

* T10.85T\_{10.85}T10.85​ and T12.0T\_{12.0}T12.0​ are brightness temperatures from SLSTR channels
* a,b,ca, b, ca,b,c are empirical coefficients (depend on land cover & atmospheric conditions)

**Urban Heat Index (UHI) Proxy:**

UHIproxy=LSTurban−LSTrural\text{UHI}\_{\text{proxy}} = \text{LST}\_{\text{urban}} - \text{LST}\_{\text{rural}}UHIproxy​=LSTurban​−LSTrural​

**3. Air Quality Score — Pollution Level Estimate**

* **Satellite**: Sentinel-5P
* **Sensor**: TROPOMI (Tropospheric Monitoring Instrument)
* **Pollutants Measured**:
  + **NO₂**, **SO₂**, **O₃**, **CO**, **CH₄**, **Aerosol Index**

**Air Quality Index (AQI) Proxy:**

Air Quality Score=f(NO2,O3,CO,SO2)\text{Air Quality Score} = f(NO\_2, O\_3, CO, SO\_2)Air Quality Score=f(NO2​,O3​,CO,SO2​)

You can use a **weighted index or standard AQI conversion** (e.g., US EPA AQI system), depending on local policy:

AQI=max⁡(AQINO2,AQIO3,AQICO,AQISO2)\text{AQI} = \max \left( AQI\_{NO\_2}, AQI\_{O\_3}, AQI\_{CO}, AQI\_{SO\_2} \right)AQI=max(AQINO2​​,AQIO3​​,AQICO​,AQISO2​​)

Where each pollutant's sub-AQI is computed based on concentration and EPA-defined breakpoints.

**4. Noise Proxy — Using Nighttime Lights**

* **Satellite**: VIIRS-DNB (from NOAA’s Suomi NPP satellite) or **Landsat/VIIRS** fused data
* **Sensor**: VIIRS Day/Night Band

**Assumption:**

Higher **nighttime light intensity** often correlates with **higher urban activity** and potentially **higher noise levels** (as a proxy in the absence of direct noise data)

**Formula (Noise Proxy Score):**

Noise Proxy Score=Normalized Radiance of Nighttime Lights\text{Noise Proxy Score} = \text{Normalized Radiance of Nighttime Lights}Noise Proxy Score=Normalized Radiance of Nighttime Lights

* Normalize radiance values (0–1) based on area-wide minimum and maximum

**5. Water Access Score — Proximity to Water Bodies**

* **Satellite**: Sentinel-2
* **Sensor**: MSI
* **Bands Used**:
  + Band 3 (Green) – 560 nm
  + Band 8 (NIR) – 842 nm

**Water Masking using NDWI:**

NDWI=(Green−NIR)(Green+NIR)\text{NDWI} = \frac{(Green - NIR)}{(Green + NIR)}NDWI=(Green+NIR)(Green−NIR)​

* Values > 0 typically indicate **water presence**

**Water Access Score:**

Water Access Score=1−ddmax\text{Water Access Score} = 1 - \frac{d}{d\_{\text{max}}}Water Access Score=1−dmax​d​

Where:

* ddd = Euclidean distance from each pixel to nearest water body
* dmaxd\_{\text{max}}dmax​ = maximum distance in the study area (for normalization)

**6. Built-in Density Score — Urban Congestion**

* **Satellite**: Sentinel-2
* **Sensor**: MSI
* **Approach**:
  + Use supervised classification (e.g., SVM, Random Forest) or spectral indices like **NDBI**

**NDBI (Normalized Difference Built-up Index):**

NDBI=(SWIR−NIR)/(SWIR+NIR)

**Band 11 (SWIR)**: 1610 nm

* **Band 8 (NIR)**: 842 nm

**Built-in Density Score:**

Built Density Score=Built-up AreaTotal Area (or per pixel classification)\text{Built Density Score} = \frac{\text{Built-up Area}}{\text{Total Area}} \text{ (or per pixel classification)}Built Density Score=Total AreaBuilt-up Area​ (or per pixel classification)

**Summary Table**

A screenshot of a computer

AI-generated content may be incorrect.