**TerraPlan: Confirmed Data Sources & Their Utility**

To ensure **TerraPlan** delivers **smart land-use intelligence**, we will leverage a mix of **satellite Earth Observation (EO), IoT sensors, and socio-economic datasets**. Below is a **curated list of key data sources**, their descriptions, and how they will be useful to the project.

**1. Earth Observation (EO) & Satellite Data $FREE FOR RESEARCHERS**

**a) Google Earth Engine (GEE)**

* **Description**: A cloud-based platform providing **petabytes of geospatial data** (Landsat, Sentinel, MODIS, etc.).
* **Utility**:
  + Rapid **land-cover change detection** (deforestation, urban sprawl).
  + **Time-series analysis** for drought, vegetation health (NDVI), and flood monitoring.
  + **Machine learning-ready** datasets for predictive modeling.

| **Platform** | **Provider** | **Data Provided** | **Utility in TerraPlan** |
| --- | --- | --- | --- |
| [**Google Earth Engine**](https://earthengine.google.com/) | Google | Landsat, Sentinel, MODIS archives | Time-series analysis of land-cover change, drought/flood monitoring |
| [**Digital Earth Africa (DE Africa)**](https://www.digitalearthafrica.org/) | AU/CSIRO | 10m-resolution cropland, water observations | High-resolution farmland mapping, water resource management |
| [**Sentinel Hub**](https://www.sentinel-hub.com/) | ESA | Sentinel-1/2 (radar/optical) | Real-time flood mapping, urban expansion tracking |
| [**NASA Earthdata**](https://earthdata.nasa.gov/) | NASA | MODIS, VIIRS, SRTM | Fire risk assessment, elevation modeling |
| [**Planet Labs**](https://www.planet.com/) | Planet | 3m-resolution daily imagery | Illegal mining/logging detection |

**b) Digital Earth Africa (DE Africa) $Open source**

* **Description**: Africa-focused **analysis-ready EO data** (10m resolution cropland maps, water observations).
* **Utility**:
  + **High-resolution cropland mapping** (identifying underutilized farmland).
  + **Water body dynamics** (flood risk assessment, irrigation planning).
  + **Coastal erosion & desertification tracking**.

**c) Sentinel-1 & Sentinel-2 (Copernicus Programme) $FREE**

* **Description**: **Radar (Sentinel-1) & optical (Sentinel-2)** satellites providing frequent, high-res imagery.
* **Utility**:
  + **Sentinel-1**: Flood mapping (works in cloudy conditions), urban expansion tracking.
  + **Sentinel-2**: **Vegetation health (NDVI), soil moisture, land degradation** (10-60m resolution).

**d) Landsat 8/9 & MODIS $Free**

* **Description**: Long-running **multispectral satellite programs** (30m-1km resolution).
* **Utility**:
  + **Historical land-use trends** (1984–present).
  + **Thermal imaging** (urban heat islands, drought monitoring).

**2. Socio-Economic & Demographic Data**

**a) WorldPop & UN Global Population Grid (GPW) $Open Access**

* **Description**: High-resolution **population density & demographic datasets**.
* **Utility**:
  + **Urban planning** (identifying informal settlements, service gaps).
  + **Displacement risk modeling** (floods, droughts).

**b) OpenStreetMap (OSM) $Free**

* **Description**: **Crowdsourced** maps of roads, buildings, infrastructure.
* **Utility**:
  + **Real-time infrastructure updates** (road networks, settlements).
  + **Baseline for urban expansion studies**.

**c) Global Forest Watch (GFW) & WDPA $Free**

* **Description**: **Forest loss alerts (GFW) & protected area boundaries (WDPA).**
* **Utility**:
  + **Deforestation alerts** (illegal logging, agricultural encroachment).
  + **Conservation planning** (avoiding development in protected zones).

| **Platform** | **Provider** | **Data Provided** | **Utility in TerraPlan** |
| --- | --- | --- | --- |
| [**WorldPop**](https://www.worldpop.org/) | University of Southampton | 100m population grids | Urban sprawl analysis, service gap identification |
| [**AfriPop**](http://www.afripop.org/) | Malaria Atlas Project | Age-specific demographic data | Health facility planning |
| [**OpenStreetMap**](https://www.openstreetmap.org/) | Community | Roads, buildings, infrastructure | Baseline for informal settlement mapping |
| [**HDX**](https://data.humdata.org/) | UN OCHA | Refugee camps, disaster zones | Crisis response planning |

**3. Soil, Climate & Hydrology Data**

**a) OpenLandMap & SoilGrids $Free**

* **Description**: **Global soil property maps** (pH, organic carbon, texture).
* **Utility**:
  + **Precision agriculture** (best crops for soil type).
  + **Erosion & degradation risk assessment**.

**b) CHIRPS (Climate Hazards Group InfraRed Precipitation) $Free**

* **Description**: **High-resolution rainfall estimates** (1981–present).
* **Utility**:
  + **Drought forecasting** (crop failure risk).
  + **Flood prediction** (extreme rainfall trends).

**c) NASA SRTM & ASTER GDEM**

* **Description**: **Elevation & terrain data** (30m-90m resolution).
* **Utility**:
  + **Slope analysis** (landslide risk, irrigation planning).
  + **Watershed & floodplain mapping**.

| **Platform** | **Provider** | **Data Provided** | **Utility in TerraPlan** |
| --- | --- | --- | --- |
| [**SoilGrids**](https://www.isric.org/explore/soilgrids) | ISRIC | 250m soil property maps | Crop suitability modeling |
| [**CHIRPS**](https://www.chc.ucsb.edu/data/chirps) | UCSB | 5km rainfall estimates (1981–present) | Drought early warning |
| [**GloFAS**](https://www.globalfloods.eu/) | ECMWF | Global flood forecasts | Flood risk zoning |
| [**AfriGEO**](https://afrigeo.org/) | AU/EU | Regional hydrology datasets | Transboundary water management |

**4. IoT & Ground Sensor Data \*\*( Data Sources where not provided, We need Platforms that provides data sources)**

**1) LoRaWAN Networks & Weather Stations**

* **Description**: **Real-time soil moisture, temperature, rainfall sensors.**
* **Utility**:
  + **Hyperlocal climate monitoring** (improves satellite data accuracy).
  + **Early flood/drought warnings** for farmers.

#### a) ****Sensor-based Platforms****

| **Platform** | **Data Provided** | **Coverage** | **Use Case in TerraPlan** |
| --- | --- | --- | --- |
| [**Sigfox Africa**](https://www.sigfox.com/en/coverage) | Low-power soil moisture, temperature sensors | Pan-African (major cities) | Urban heat island tracking, drought alerts |
| [**Loriot**](https://www.loriot.io/) | LoRaWAN-enabled flood sensors | South Africa, Kenya, Nigeria | Flash flood early warnings |
| [**WeatherSTEM Africa**](https://weatherstem.com/africa/) | Solar-powered weather stations | East/Southern Africa | Microclimate data for farming |
| [**Trans-African Hydro-Meteorological Observatory (TAHMO)**](https://tahmo.org/) | 2,000+ low-cost weather stations | 20+ African countries | Rainfall, soil moisture for agriculture |
| [**aWhere**](https://www.awhere.com/) | Hyperlocal agri-weather data | 40+ African nations | Crop disease risk modeling |

#### ****Utility in TerraPlan****:

✔ **Flood early warnings** (e.g., Loriot sensors in river basins).  
✔ **Precision irrigation** (TAHMO soil moisture + satellite fusion).  
✔ **Urban climate resilience** (WeatherSTEM heat stress data).

**2) Crowdsourced Data (e.g., Ushahidi, FieldMaps)**

* **Description**: **Community-reported land-use changes, hazards.**
* **Utility**:
  + **Validates satellite findings** (e.g., illegal mining, erosion).
  + **Engages citizens** in participatory planning.

| * **Platform** | **Data Provided** | **Coverage** | **Use Case in TerraPlan** |
| --- | --- | --- | --- |
| [**Ushahidi**](https://www.ushahidi.com/) | Crisis reports (floods, fires, conflicts) | 30+ African countries | Validate satellite flood/deforestation alerts |
| [**OpenStreetMap (OSM) Tasking Manager**](https://tasks.hotosm.org/) | Community-mapped infrastructure | Continent-wide | Update roads, buildings in informal settlements |
| [**Farm.ink’s Shamba Shape-Up**](https://farm.ink/) | Farmer-reported soil/field conditions | Kenya, Uganda, Rwanda | Ground-truth crop health data |
| [**GeoPoll**](https://www.geopoll.com/) | Mobile survey data (land disputes, needs) | 15+ African nations | Identify underserved areas for planning |
| [**MajiData**](https://majidata.org/)**(Tanzania)** | Water point functionality reports | East Africa | Monitor water access for urban/rural planning |

#### ****Utility in TerraPlan****:

✔ **Slum upgrading** (OSM maps + Ushahidi flood reports).  
✔ **Illegal mining detection** (Ushahidi + Sentinel-1 radar).  
✔ **Farmer advisory systems** (Farm.ink + NDVI anomalies).

### ****3. Satellite-IoT Fusion Platforms****

(For integrated data streams)

| **Platform** | **Role** | **TerraPlan Integration** |
| --- | --- | --- |
| [**IBM PAIRS Geoscope**](https://www.ibm.com/products/ibm-pairs-geoscope) | Merges satellite + IoT sensor data | Flood risk modeling (e.g., Lagos) |
| [**SensorUp**](https://www.sensorup.com/) | IoT data standardization | LoRaWAN + Sentinel-2 fusion |
| [**AfriGIS**](https://www.afrigis.co.za/) | African geospatial IoT hub | Soil + weather API for farmers |

### ****5. Conservation & Infrastructure Data****

| **Platform** | **Provider** | **Data Provided** | **Utility in TerraPlan** |
| --- | --- | --- | --- |
| [**Global Forest Watch**](https://www.globalforestwatch.org/) | WRI | Deforestation alerts | Illegal logging detection |
| [**WDPA**](https://www.protectedplanet.net/) | UNEP-WCMC | Protected area boundaries | Conservation zoning |
| [**AfriSAR**](https://earth.esa.int/web/guest/missions/3rd-party-missions/current-missions/afrisar) | ESA/NASA | Airborne LiDAR data | Carbon stock assessment |

### ****6. Crowdsourced & Community Data****

| **Platform** | **Provider** | **Data Provided** | **Utility in TerraPlan** |
| --- | --- | --- | --- |
| [**Ushahidi**](https://www.ushahidi.com/) | Ushahidi | Crisis reports | Validate flood/fire events |
| [**Farm.ink**](https://farm.ink/) | Farm.ink | Farmer field reports | Ground-truth crop health |
| [**GeoPoll**](https://www.geopoll.com/) | GeoPoll | Mobile survey data | Land dispute monitoring |

**7. Development & Analytical Tools**

| **Tool** | **Use Case** |
| --- | --- |
| **Python (geopandas, rasterio, xarray)** | Geospatial data processing |
| **Google Earth Engine API** | Cloud-based EO analysis |
| **QGIS / GRASS GIS** | Desktop mapping & modeling |
| **React/Flutter** | Interactive web/mobile dashboard |

**How These Data Sources Benefit TerraPlan**

✅ **Precision Land-Use Planning** → Combines **soil, climate, and population data** for smarter decisions.  
✅ **Disaster Risk Reduction** → **Flood/drought forecasting** using CHIRPS + Sentinel-1.  
✅ **Sustainable Agriculture** → **NDVI + SoilGrids** guide crop choices.  
✅ **Urban Resilience** → **WorldPop + OSM** track sprawl & infrastructure gaps.  
✅ **Conservation Alerts** → **GFW + Sentinel-2** detect deforestation in real time.

**Final Thoughts**

By **fusing satellite EO, IoT sensors, and socio-economic data**, TerraPlan becomes Africa’s **first integrated land-use intelligence platform**—bridging the gap between **raw data and actionable insights** for governments, farmers, and developers.