# Metadata for remote sensing potential maps shapefile “huc12\_allMaps”

## Description

These files have been created by joining the HUC-12 layer in the National Hydrography Dataset’s watersheds geodatabase database with the analyses layers from the following paper:

Sridharan, V.K., Kumar, S.K., and Madhur Kumar, S. In rev. Can remote sensing fill the United States’ monitoring gap for watershed management?

There are two options for downloading the data layers in the project:

1. A shapefile containing all the layers used in the analysis and the results of the remote sensing potential model already attributed to each HUC-12 subwatershed.
2. A CSV containing all the layers used in the analysis and the results of the remote sensing potential model which must be joined with the HUC-12 subwatershed shapefile layer.

## Shapefile has been downloaded

If you downloaded the **huc12\_FinalSimplifiedMinimal.shp** from the GitHub repo, it will contain all the attributes listed in the table below. Please note that this is a simplified geometry version at a resolution of approximately 2 Km, within a minimal list of attributes needed to visualize the key results in the paper. Please contact the authors if you want the complete shapefile used in the analysis for the paper. The bolded attributes, when visualized, can be used for decision support.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Name** | **Description** | **Source** | **Comments** | **Units** |
| 1 | objected |  | NDHPlus |  |  |
| 2 | states |  | NDHPlus |  |  |
| 3 | huc12 | Primary key | NDHPlus |  |  |
| 4 | Pop | Population | EnviroAtlas |  |  |
| 5 | PopL | Population levels | Synthesis | 0 to 6 in decades from <10 to >1,000,000 |  |
| 6 | Water\_MGAL | Total water demand | Synthesis |  | MGD |
| 7 | WaterL | Water demand levels | Synthesis | 0 to 6 in decades from <10 to >1,000,000 people served with per capital consumption of 1,200 MGD |  |
| 8 | TotProtFra | Total fraction of land protected | Synthesis | Total % of land cover protected by IUCN and US government |  |
| 9 | Outdoors\_D | Outdoor activities demand | Synthesis | Total days in year for big game hunting, bird hunting, migratory bird watching and fishing | Days/yr |
| 10 | NativeVulI | Aquatic species vulnerability index | EnviroAtlas |  |  |
| 11 | wESI | Weights for each index | Synthesis | See Section 2.2 of paper |  |
| 12 | ESI | Ecosystem vulnerability index | Synthesis | See Section 2.2 of paper |  |
| 13 | ESIL | Ecosystem vulnerability levels | Synthesis | 0 to 4 for no ESI, 25th, 50th, 75th and 100th quantile levels |  |
| 14 | Wastewater | Wastewater discharge | EnviroAtlas |  | MGD |
| 15 | Permit\_LbP | Permitted pollution load | EnviroAtlas |  | lb/yr |
| 16 | AgRunoff\_M | Total agricultural runoff | Synthesis | Sum of rows 37, 38 and 39 | mm |
| 17 | Area\_sqKM | Total water surface area | Synthesis | Sum of areal watersurface and area of floodplains designated as streams | km2 |
| 18 | PIL | Pollution index | Synthesis | Levels 0 to 1, but see Section 2.2 of paper |  |
| 19 | imp | Impairment status | Synthesis | 0 or 1 depending on whether watershed has any assessments reported in ATTAINS |  |
| 20 | maxTravelT | Maximum shortest travel time | Malarial Atlas Project | See Section 2.1 of paper | minutes |
| 21 | cloudCover | Mean cloudy days per year | EarthEnv | See Section 2.1 of paper | days per year |
| 22 | **rsPotOACC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis | Name syntax: rsPot[L]A[L]C  [L]: O – optimistic in Table 2  N – Normal in Table 2  C – Conservative in Table 2  A – access, C – cloud  Levels: 0 (unsuitable), 1-3 (low), 4-6 (good), and 9 (excellent) |  |
| 23 | **rsPotOANC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 24 | **rsPotOAOC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 25 | **rsPotNACC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 26 | **rsPotNANC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 27 | **rsPotNAOC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 28 | **rsPotCACC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 29 | **rsPotCANC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 30 | **rsPotCAOC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 31 | **allPot** | Intersection of potential > 4 and all layer conditions | Synthesis | For normal cost-payoff scenario |  |

## CSV has been downloaded

If you downloaded the **huc12\_Final.csv** and its sidecar **huc12\_Final.csvt** from the GitHub repo, then the shapefile would be unavailable.

1. Please first download the Watershed Boundary Dataset (WBD) from here:

<https://www.usgs.gov/national-hydrography/access-national-hydrography-products>

1. Click on the “Download the WBD by the Entire Nation” link:

<https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Hydrography/WBD/National/GDB/>

and download the WBD\_National\_GDB.zip file which is 2.3 GB.

1. Then, in ArcGIS or QGIS, open the geodatabase and load only the WBDHU12 layer.
2. Then, perform a table join with the CSV, with the **huc12** field as the primary key. All the attributes pertain to each HUC-12 unit.

The following attributes will be available in the CSV:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Name** | **Description** | **Source** | **Comments** | **Units** |
| 1 | huc12 | Primary key | NDHPlus |  |  |
| 2 | Pop | Population | EnviroAtlas |  |  |
| 3 | PopL | Population levels | Synthesis | 0 to 6 in decades from <10 to >1,000,000 |  |
| 4 | AWD\_MGAL | Agricultural water demand | EnviroAtlas |  | MGD |
| 5 | DWD\_MGAL | Domestic water demand | EnviroAtlas |  | MGD |
| 6 | IWD\_MGAL | Industrial water demand | EnviroAtlas |  | MGD |
| 7 | TWW\_MGAL | Thermoelectric water demand | EnviroAtlas |  | MGD |
| 8 | Water\_MGAL | Total water demand | Synthesis |  | MGD |
| 9 | WaterL | Water demand levels | Synthesis | 0 to 6 in decades from <10 to >1,000,000 people served with per capital consumption of 1,200 MGD |  |
| 10 | TotProtFra | Total fraction of land protected | Synthesis | Total % of land cover protected by IUCN and US government |  |
| 11 | Outdoors\_D | Outdoor activities demand | Synthesis | Total days in year for big game hunting, bird hunting, migratory bird watching and fishing | Days/yr |
| 12 | NativeVulI | Aquatic species vulnerability index | EnviroAtlas |  |  |
| 13 | wESI | Weights for each index | Synthesis | See Section 2.2 of paper |  |
| 14 | ESI | Ecosystem vulnerability index | Synthesis | See Section 2.2 of paper |  |
| 15 | ESIL | Ecosystem vulnerability levels | Synthesis | 0 to 4 for no ESI, 25th, 50th, 75th and 100th quantile levels |  |
| 16 | Wastewater | Wastewater discharge | EnviroAtlas |  | MGD |
| 17 | Permit\_LbP | Permitted pollution load | EnviroAtlas |  | lb/yr |
| 18 | AgTileSSF\_ | Tile agricultural subsurface runoff | EnviroAtlas |  | mm |
| 19 | AgNonTileS | Non-tile agricultural subsurface runoff | EnviroAtlas |  | mm |
| 20 | AgSF\_MM | Agricultural surface runoff | EnviroAtlas |  | mm |
| 21 | AgRunoff\_M | Total agricultural runoff | Synthesis | Sum of rows 37, 38 and 39 | mm |
| 22 | Area\_sqKM | Total water surface area | Synthesis | Sum of areal watersurface and area of floodplains designated as streams | km2 |
| 23 | PIL | Pollution index | Synthesis | Levels 0 to 1, but see Section 2.2 of paper |  |
| 24 | imp | Impairment status | Synthesis | 0 or 1 depending on whether watershed has any assessments reported in ATTAINS |  |
| 25 | huc\_12T | HUC index | Synthesis | Ignore this |  |
| 26 | maxTravelT | Maximum shortest travel time | Malarial Atlas Project | See Section 2.1 of paper | minutes |
| 27 | cloudCover | Mean cloudy days per year | EarthEnv | See Section 2.1 of paper | days per year |
| 28 | **rsPotOACC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis | Name syntax: rsPot[L]A[L]C  [L]: O – optimistic in Table 2  N – Normal in Table 2  C – Conservative in Table 2  A – access, C – cloud  Levels: 0 (unsuitable), 1-3 (low), 4-6 (good), and 9 (excellent) |  |
| 29 | **rsPotOANC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 30 | **rsPotOAOC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 31 | **rsPotNACC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 32 | **rsPotNANC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 33 | **rsPotNAOC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 34 | **rsPotCACC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 35 | **rsPotCANC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 36 | **rsPotCAOC** | Remote sensing potential for accessibility and acquisition cost-payoff levels | Synthesis |  |
| 37 | popPot | Intersection of potential > 4 and PopL >3 | Synthesis | For normal cost-payoff scenario |  |
| 38 | watPot | Intersection of potential > 4 and WaterL >3 | Synthesis | For normal cost-payoff scenario |  |
| 39 | esiPot | Intersection of potential > 4 and ESIL >1 | Synthesis | For normal cost-payoff scenario |  |
| 40 | pollPot | Intersection of potential > 4 and PIL >1 | Synthesis | For normal cost-payoff scenario |  |
| 41 | accessPot | Intersection of potential > 4 and access >2 | Synthesis | For normal cost-payoff scenario |  |
| 42 | coveragePo | Intersection of potential > 4 and imp=0 | Synthesis | For normal cost-payoff scenario |  |
| 43 | **allPot** | Intersection of potential > 4 and all layer conditions | Synthesis | For normal cost-payoff scenario |  |