**ArcGIS data processing steps taken by Esther Parish during the ARMADA Pilot**

In December, I received a point shapefile from Bhartendu identifying potential solar PV clusters identified through his down-selection of polygons from Brandon’s initial siting analysis with OR-SAGE. Each point identified the centroid of a 0.81 sq km potentially suitable site for PV solar following additional exclusions (e.g., land already occupied by build structures). Through his analysis, Bhartendu identified clusters of suitable polygons that could collectively contribute a range of 160 MW to 400 MW to the overall regional goal of 14 GW. The point records provided to me by Bhartendu each had a cluster label ID (ClustLab).

To create solar PV “footprints” for Tasks 4, 5, and 8, I spatially joined Bhartendu’s clustered points with Brandon’s original polygons ( pv\_all\_criteria\_polygon.shp) and summarized the data fields by the cluster ID (e.g., to select the relevant polygons). I dissolved these into 61 “footprint” polygons using the ClustLab field and joined them to a summary of the original data, summing or averaging the different fields for each cluster as appropriate (e.g., summing capacity, averaging slope…). Through trial and error, I learned that the polygons had to be buffered very slightly (e.g., by 0.0001 m) before dissolving them into single footprint polygons. Otherwise, water could flow through vertices.

I then built out the resulting shapefile of PVC footprints (see ultimate file of 61 sites called PVC\_14GW\_Footprints\_Dec20.shp) with additional attributes of information about land use (derived from my analyses of the 2022 Cropland Data Layer (CDL)) so that we would know how much forested land, agricultural land, and wetland area was going to be covered by each cluster of solar panels.

In January, I followed the same process to create SMR “footprints” for Tasks 4, 5, and 8. For this scenario, I spatially joined Bhartendu’s down-selected points with Brandon’s file of smr\_500\_polygons.shp, i.e., suitable SMR sites initially screened with OR-SAGE. The resulting 13 potential sites had a much smaller footprint than the PVC footprints.

Here is the reclassification of the CDL 2022 data layer that I used for the land use change numbers provided to Bhartendu for the TN Valley Region and for the land use change maps provided to David:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Reclass table used by Esther for TVA land use [TVA\_LU] assignments to the 2022 Cropland Data Layer (CDL)***  This gridded layer is called tvalu2022 | | | | | | | |  |
| Text  AI-generated content may be incorrect.   |  | | --- | |  | |  |  |  |  |  |  |  |  |
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| Here is the reclassification of the CDL 2022 data layer that I used for to provide Task 4 for the POLYSYS modeling: | | | | |  |  |  |  |
| **Agricultural land assignments for downscaling of BT23 POLYSYS results**  This gridded layer is called POLYland | | | | |  |  |  |  |
| **CDL** | **TVA\_LU** | **CDLcat** | **Land Use** |  |  |  |  |  |
| 1 | 1 | Corn | Corn | Note that rows 5-30 have been | | |  |  |
| 2 | 7 | Cotton | Cotton | lumped together as "1" in the | | |  |  |
| 3 | 8 | Rice | Rice | TVA land use grid (tvalu2022) | | |  |  |
| 4 | 2 | Sorghum | Sorghum | and are identified as | |  |  |  |
| 5 | 6 | Soybeans | Soybeans | "Agriculture" in most graphics | | |  |  |
| 21 | 4 | Barley | Barley | and data shared with others. | | |  |  |
| 22 | 5 | Durum Wheat | Wheat |  |  |  |  |  |
| 23 | 5 | Spring Wheat | Wheat |  |  |  |  |  |
| 24 | 5 | Winter Wheat | Wheat |  |  |  |  |  |
| 26 | 5 | Dbl Crop WinWht/Soybeans | Wheat |  |  |  |  |  |
| 28 | 3 | Oats | Oats |  |  |  |  |  |
| 36 | 12 | Alfalfa | Hay |  |  |  |  |  |
| 37 | 12 | Other Hay/Non Alfalfa | Hay |  |  |  |  |  |
| 225 | 5 | Dbl Crop WinWht/Corn | Wheat |  |  |  |  |  |
| 226 | 3 | Dbl Crop Oats/Corn | Oats |  |  |  |  |  |
| 234 | 5 | Dbl Crop Durum Wht/Sorghum | Wheat |  |  |  |  |  |
| 235 | 4 | Dbl Crop Barley/Sorghum | Barley |  |  |  |  |  |
| 236 | 5 | Dbl Crop WinWht/Sorghum | Wheat |  |  |  |  |  |
| 237 | 4 | Dbl Crop Barley/Corn | Barley |  |  |  |  |  |
| 238 | 5 | Dbl Crop WinWht/Cotton | Wheat |  |  |  |  |  |
| 239 | 6 | Dbl Crop Soybeans/Cotton | Soybeans |  |  |  |  |  |
| 240 | 6 | Dbl Crop Soybeans/Oats | Soybeans |  |  |  |  |  |
| 241 | 1 | Dbl Crop Corn/Soybeans | Corn |  |  |  |  |  |
| 254 | 4 | Dbl Crop Barley/Soybeans | Barley |  |  |  |  |  |
| 61 | 20 | Fallow/Idle Cropland | Idle |  |  |  |  |  |
| 176 | 21 | Grassland/Pasture | Pasture |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| **Other CDL category assignments** | | |  |  |  |  |  |  |
| **CDL** | **TVA\_LU** | **CDLcat** | **Land Use** |  |  |  |  |  |
| 121 | 99 | Developed/Open Space | Developed |  |  |  |  |  |
| 122 | 99 | Developed/Low Intensity | Developed |  |  |  |  |  |
| 123 | 99 | Developed/Med Intensity | Developed |  |  |  |  |  |
| 124 | 99 | Developed/High Intensity | Developed |  |  |  |  |  |
| 141 | 40 | Deciduous Forest | Forest |  |  |  |  |  |
| 142 | 40 | Evergreen Forest | Forest |  |  |  |  |  |
| 143 | 40 | Mixed Forest | Forest |  |  |  |  |  |
| 92 | 70 | Aquaculture | Water |  |  |  |  |  |
| 111 | 70 | Open Water | Water |  |  |  |  |  |
| 190 | 80 | Woody Wetlands | Wetlands |  |  |  |  |  |
| 195 | 80 | Herbaceous Wetlands | Wetlands |  |  |  |  |  |
| multiple | 0 | Barren, Shrubland, Pumpkins, etc. | Other |  |  |  |  |  |

For the Task 4 POLYSYS county-scale modeling, I had to intersect the solar footprints with counties and calculate how much of each type of agricultural land area would be taken up by the solar “crop” within each county year by year from 2024 out to 2038 under the Baseline scenario of no bioenergy crops. I prepared that same information for Maggie to use for forest displacement with her FORSEAM model. These calculations are summarized in the file Solar\_Displacement\_Ag\_BaselineCase\_AllCounties.xls (see tabs “forChad” and “forMaggie”).