APPENDIX 1-6. Use Site Footprints for Atrazine

1. Agriculture Uses

Use site footprint layers represent the application sites for agricultural and non-agricultural label uses. The best available data to spatially characterize specific agricultural crops in the continuous United States (ConUS) is the Cropland Data Layer (CDL), produced by the U.S. Department of Agriculture. Several methods have been employed to minimize data errors within the CDL. The CDL is a landcover dataset that has over 100 cultivated classes that were grouped into 13 general classes (see **APPENDIX 1-5**). Lumping classes reduces the likelihood of errors of omission and commission between similar crop categories. In selecting how to group crops from the CDL, EPA referred to the grouping used by the U.S. Geological Survey (Baker and Capel, 2011[[1]](#footnote-2)) and the Generic Endangered Species Task Force (Amos et al, 2010[[2]](#footnote-3)). This information considers environmental factors that influence the location of crops and the error matrices provided by USDA with the original CDL data. By considering these agronomic factors in addition to the error matrices it is possible to improve the accuracy and year-to-year matches for these UDLs while retaining agronomic similarities. This categorical aggregation into the UDL crop groups does not account for changes in agricultural practices but the temporal aggregation does. The UDLs used in this assessment include 5 years of the CDL, 2013-2017, aggregated to account for changes year to year such as crop rotations. Anywhere a class occurs within those 5 years would be represented in the footprint layer. These temporally aggregated and categorially grouped layers generated from the CDL are referred to as Use Data Layers or UDLs.

The agricultural classes were further refined by comparing county level National Agricultural Statistics Service (NASS) 2012 Census of Agriculture (CoA) acreage reports to county level UDL acreages (additional detail can be found in the tool documentation, section “**Processing the Census of Agriculture Data”** section). The UDL acreages represent the temporally aggregated and categorically grouped processing steps previously described, summarized at the county level. If a county’s UDL acreage for a given class was lower than the NASS acreage, the UDL extent was expanded within cultivated areas until the UDL acreage matched or exceeded the NASS CoA. Using the temporally and categorially aggregated UDL as an input, a script was developed that compares each UDL in each county to the corresponding NASS CoA acreage report. If the UDL acreage was less than NASS, the raster was expanded in 1 pixel iterations until the NASS acreage value was reached, exceeded, or the area within the cultivated mask was built out. Region growing was restricted using the UDL Cultivated Layer from the last year of the CDL as a mask (2017). This avoids buffering into any non-agricultural landcover types. This method reduced landcover mapping errors by adjusting the extent of each category to the CoA values, in this case, 2012. Additional details and the python scripts for this process can be found in with the tool documentation, **Generating Use Data Layers**, “**CDL to UDL Processing and Action Area Python Scripts**” section.

Every assessment begins with cross-walking registered uses into a landcover category. Chemicals are often not represented by all 13 UDL. Some chemicals specify geographic restrictions for a given use (i.e., application on wheat is limited to the state of Idaho). Geographic limitations for registered uses are imposed on the dataset downstream in the data processing workflow. The geographic restriction should be extracted from the use layer before it is aggregated with all other chemical uses to generate the action area for the chemical. Atrazine’s agricultural uses are crossed to 9 of the UDLs classes with geographic restrictions on most of them. A complete crosswalk for the atrazine agricultural uses is provided in **Table 1** generated from **Attachment 1-4.** This crosswalk includes the label use name, the name(s) from the Census of Agriculture, SUUM use site (**APPENDIX 1-4**), and the UDL.

In addition to the potential use site each UDL is buffered in all directions using ESRI ArcGIS the Euclidean distance tool. This buffered area represents the potential exposure area associated with drift.

The CDL is not available for areas outside of the contiguous United States (ConUS). The CoA is often unavailable outside of ConUS as well. The Agricultural UDL Data Sources section describes how agriculture was spatially modeled by regions outside of ConUS, referred to as the non-lower 48 (NL48).

1. Non-Agricultural Uses

Non-agricultural label uses include a wide range of landcover and land use categories. Each label use was carefully considered and cross-walked with the best available landcover data. Where available, the 2011 National Land Cover Dataset (NLCD) was used to represent many non-agricultural label uses. Where NLCD wasn’t available, the NOAA C-CAP dataset and corresponding landcover classes were used. Details on the data sources for each non-agricultural UDL are provided in the Non-Agricultural UDL Data Source section. A complete crosswalk for the atrazine non-agricultural uses is provided in **Table 2**. This crosswalk includes the label use name, SUUM use site (**APPENDIX 1-4**), and the UDL data sources used to generate each layer are provided in the UDL data source section.

1. Action Area

To create the action area for atrazine all pertinent agricultural and non-agricultural UDLs are combined. This is completed by placing the UDLs on top of each other and combining them into one footprint. The resulting layer includes all locations found in each of the UDLs and buffered areas represented as minimum distance to a potential use across UDLs. This sets the exposure area for atrazine related to drift. For additional detail on how the action area is generated see the tool documentation, “**CDL to UDL Processing and Action Area Python Scripts**” section.

1. UDL Data Sources

* 1. Agricultural UDL Data Sources
* ConUS
	+ Corn, Soybeans, Other Grains, Other Orchards, and Vegetables and ground fruit, UDLs generated from the Cropland Data Layer (CDL) 2013-2017. See **APPENDIX 1-5** for details on the specific crops found in each UDL. National layers were used for all crops except soybeans which was geographically restricted to Kansas (KS) based on the label.

Wheat Corn Fallow, Wheat Sorghum Fallow, and Wheat Fallow Wheat UDLs were generated by combining the individual UDLs for each crop found in the rotations. Individual crop UDLs were refined using geographical restriction boundaries specific for the use. Wheat Corn Fallow was geographically restricted to CO, KS, ND, NE, SD, WY and Wheat Sorghum Fallow was geographically restricted to AR, CO, GA, IL, KS, LA, MS, MO, NE, NM, NC, OK, SD, TX. Wheat Fallow Wheat has two geographic restrictions: one where Wheat Fallow Wheat was geographically restricted to CO, KS, ND, NE, SD, WY, OK (excluding panhandle, OK) and another Wheat Fallow Wheat UDL was geographically restricted to ID (panhandle only) and OR. In both Wheat Fallow Wheat UDLs, panhandle areas were defined using counties. After restricting each layer, the individual crop UDLs were combined into the fallow UDL using the Combine tool, available under ArcGIS geoprocessing toolbox for the ArcGIS Spatial Analyst extension in ArcMap.

4.2 Non-Agricultural UDL Data Sources

There were some geographic restrictions applied to turf grasses from residential facilities, institutional facilities, and golf courses. Since, atrazine can only be used on warm season turfgrass species without causing turf injury, work was needed to determine which area in the CONUS were areas where warm season turf grasses could be grown. These warm season turf grass species are typically grown in the warm season region and the transition zone region of the United States. The USDA defines these zones known as Plant Hardiness Zones (PHZ) based on long term temperature data. It was assumed that Warm Season Grasses are grown in approximately Zone 8 to 11, and transition grasses are grown in approximately Zone 6 to 7. The USDA PHZ 6-11 were combined into a single boundary that was used to refine the range of where atrazine and simazine could be used on warm season grass.

Additional supporting information was provided from an industry group about where simazine is applied to turf on golf courses. This information generally, corresponded to zones USDA PHZ6-11.

* **Developed**

Developed landcover is used to spatially represent certain non-agricultural label uses, see **Table 2** for specific uses. For atrazine this layer was geographically restricted to the warm season grass boundary, based on the label.

* + **ConUS**
		- NLCD class 22-24
* **Open Space Developed**

Open Space Developed (OSD) is used to spatially represent certain non-agricultural label uses, see **Table 2** for specific uses. For atrazine this layer and geographically restricted to the warm season grass boundary, based on the label.

* + **ConUS**
		- NLCD class 21
* **Right-of-Ways**

NLCD developed classes are sufficient for most scenarios. NLCD developed classes are insufficient in cases of rural minor roads, rural transmission lines, and rural pipelines. This layer is limited to Oklahoma (OK) only based on the label.

* + **ConUS**
		- All NLCD developed classes everywhere (21-24)
			* *\*\* For generating Euclidean distance for ConUS Right-of-Ways (ROW), NLCD Developed classes do not have Euclidean distance algorithms applied. NLCD Developed classes are included in the footprint as a zero value in the final Euclidean distance file. The other component ROW classes do have Euclidean distance algorithms applied.*
		- ESRI Railroads
		- United States Census Bureau’s Topologically Integrated Geographic Encoding and Referencing database (TIGER) transmission (MAF/TIGER Feature Class Code (MTFCC) code L4020) and pipeline (MTFCC code L4010) data
		- Bonneville Power Administration’s (BPA) Right-of-Way data
		- Navteq roads
* **Conservation Reserve Program**

Conservation Reserve Program is spatially represented using all cultivated land as identified in USDA’s Cropland Data Layer, and the Pasture UDL (see **APPENDIX 1-5** for the specific crops from the CDL used to generate the Pasture UDL). For atrazine this layer is limited to Iowa only based on the label and commitment letters received from the registrant.

* **Other Crops (Turf-Sod farms)**

Sod farm are captured in the USDA Cropland Data Layer and included in the Other Crops UDL (see **APPENDIX 1-5** for details on the individual crops found in the Other Crops UDL). For atrazine this layer is geographically restricted to the warm season grass boundary, based on the label.

Table 1. Crosswalk of atrazine agricultural uses across crop sources

| **Use (From Label-Use)** | **Crop Reported in SUUM** | **Census Of Agriculture** | **ConUS UDL** | **Notes UDL** |
| --- | --- | --- | --- | --- |
| Corn, field | Corn, field | CORN, GRAIN; CORN, SILAGE | CONUS\_ Corn |   |
| Popcorn | Corn, pop | POPCORN, SHELLED | CONUS\_Atrazine Vegetables and ground fruit |   |
| Corn, field | Corn, silage (forage-fodder) | CORN, GRAIN; CORN, SILAGE | CONUS\_Atrazine Corn |   |
| Corn, sweet | Corn, sweet | SWEET CORN | CONUS\_Atrazine Vegetables and ground fruit |   |
| Fallow, post-wheat | wheat-corn-fallow | CORN, GRAIN; CORN, SILAGE; WHEAT | CONUS\_Atrazine Wheat Corn Fallow | Geo-restriction: CO, KS, ND, NE, SD, WY |
| Fallow, post-wheat | wheat-sorghum-fallow | SORGHUM, GRAIN; SORGHUM, SILAGE; SORGHUM, SYRUP; WHEAT | CONUS\_Atrazine Wheat Sorghum Fallow | Geo-restriction: AR, CO, GA, IL, KS, LA, MS, MO, NE, NM, NC, OK, SD, TX |
| Fallow, post-wheat | wheat-fallow-wheat | WHEAT | CONUS\_Atrazine Wheat Fallow Wheat | Geo-restrictions: CO, KS, ND, NE, SD, WY, OK (excluding panhandle, OK) |
| Fallow, post-wheat | wheat-fallow-wheat | WHEAT | CONUS\_Atrazine Wheat Fallow Wheat IDOR |  Geo-restrictions: ID (panhandle only) and OR |
| Guava | Guava | GUAVAS | CONUS\_Other orchards |   |
| Macadamia Nuts | Macadamia Nuts | MACADAMIAS | CONUS\_ Other orchards |   |
| Sorghum | Sorghum (milo) | SORGHUM, GRAIN; SORGHUM, SILAGE; SORGHUM, SYRUP | CONUS\_ Other grains |   |
| Sorghum | Sorghum (forage-fodder) | SORGHUM, GRAIN; SORGHUM, SILAGE; SORGHUM, SYRUP | CONUS\_ Other grains |   |
| Fallow, soybean | Soybeans (stubble) | SOYBEANS | CONUS\_Atrazine Soybeans | Geo-restriction: KS |
| Sugarcane | Sugarcane (FL) | SUGARCANE, SUGAR | CONUS\_Other grains |   |
| Sugarcane | Sugarcane (LA) | SUGARCANE, SUGAR | CONUS\_Other grains |   |
| Sugarcane | Sugarcane (CA) | SUGARCANE, SUGAR | CONUS\_Other grains |   |
| Sugarcane | Sugarcane (TX) | SUGARCANE, SUGAR | CONUS\_Other grains |   |
| Sugarcane | Sugarcane (Other states) | SUGARCANE, SUGAR | CONUS\_Other grains |   |

**Table 2. Crosswalk of atrazine non-agricultural uses.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Use (From Label-Use)** | **Crop Reported in SUUM** | **Census Of Agriculture** | **ConUS UDL** | **Notes UDL** |
| Turf, Bermudagrass; Turf, St. Augustine grass | Grass/Turf (Lawn Care Operators) | NA | CONUS\_Atrazine Developed | Limit to the warm season grass boundary  |
| Turf, Bermudagrass; Turf, St. Augustine grass | Grass/Turf (Institutional Turf) | NA | CONUS\_Atrazine Open Space Developed | Limit to the warm season grass boundary  |
| Turf, Bermudagrass; Turf, St. Augustine grass | Grass/Turf (Consumer (residential)) | NA | CONUS\_Atrazine Developed | Limit to the warm season grass boundary  |
| Turf, Bermudagrass; Turf, St. Augustine grass | Grass/Turf (Golf Courses) | NA | CONUS\_Atrazine Open Space Developed | Limit to the warm season grass boundary  |
|   | Grass/Turf (Sod Farms) | NA | CONUS\_Atrazine Other crops | Limit to the warm season grass boundary  |
| Roadside | Roadside Rights-of-Way | NA | CONUS\_Atrazine Right of Way | Geo-restriction: OK (SLN) |
| CRP | Conservation Reserve Program (CRP) | NA | CONUS\_CRP | Geo-restriction: IA (SLN) |

1. References
* **ESRI StreetMap North America Railroads**
	+ ESRI, StreetMap North America, Redlands, CA 20100531
	+ EPA Access ftp://cook.rtp.epa.gov/data/ESRI\_DATA\_AND\_MAPS/
* **NAVTEQ Street Data**
	+ NAVTEQ 2013 Streets, Chicago, IL, 20131001
	+ EPA Access ftp://cook.rtp.epa.gov/data/NAVTEQ/2013/
* **National Land Cover Dataset (NLCD) 2011**
	+ Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354
* **United States Census Bureau’s Topologically Integrated Geographic Encoding and Referencing database (TIGER)**
	+ 2015 TIGER/Line Shapefiles (machine readable data files) / prepared by the U.S. Census Bureau, 2015, <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-geodatabase-file.html>
* **United States Department of Agriculture Cropland Data Layer (CDL) 2013-2017**
	+ United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS), Research and Development Division (RDD), Geospatial Information Branch (GIB), Spatial Analysis Research Section (SARS), Cropland Data Layer for the United States, <https://www.nass.usda.gov/Research_and_Science/Cropland/SARS1a.php>
* **USDA Plant Hardiness Zones -** United States Department of Agriculture. 2012. Plant hardiness zone map. Accessed on May 14, 2019 at <https://planthardiness.ars.usda.gov/PHZMWeb/>
1. Baker, N.T., and Capel, P.D., 2011, Environmental factors that influence the location of crop agriculture in the conterminous United States: U.S. Geological Survey Scientific Investigations Report 2011–5108, 72 p. [↑](#footnote-ref-2)
2. Amos, J.J., C.M. Holmes, C.G. Hoogeweg, and S.A. Kay. 2010. Development of Datasets to Meet USEPA Threatened and Endangered Species Proximity to Potential Use Sites Data Requirements. Report Number: 437.01-Overview. Prepared by Waterborne Environmental, Inc. for the Generic Endangered Species Task Force. [↑](#footnote-ref-3)