Land Cover at National Atmospheric Deposition Sites derived from the National Land Cover Database

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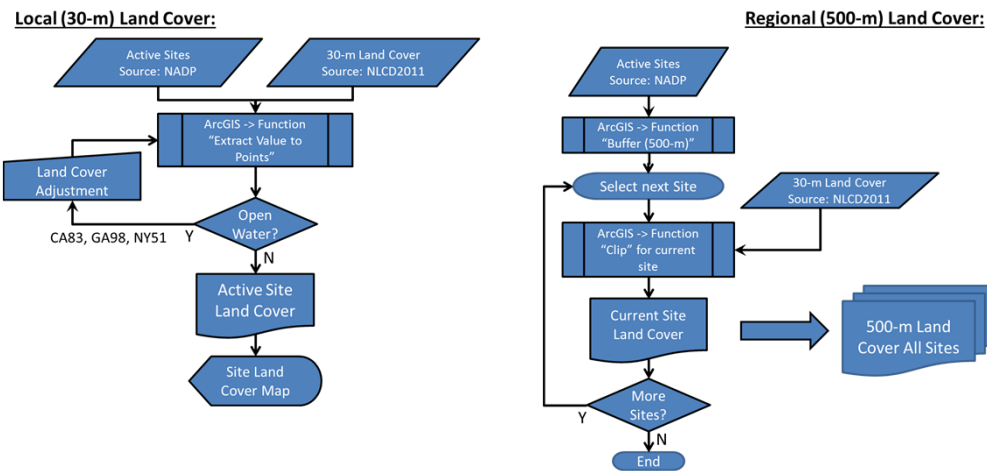
Background:

The National Atmospheric Deposition Program (NADP) coordinates the monitoring of atmospheric deposition at numerous locations across North America. Collectively these individual sites are important components of five unique networks that directly measure atmospheric concentrations and deposition rates at site locations. These observations provide point-source observations on parameters such as acidity content, nutrient levels, and deposition rates of important constituent's such as mercury and ammonia. Regional and other large scale assessments involving atmospheric deposition often utilize land use or land cover as a parameter that controls deposition rates.

Objective:

This investigation evaluated the Land Cover of active NADP sites that are located in the continental United States using the 2011 National Land Cover Database (NLCD, 2011). The NLCD serves as the definitive Landsat-based, 30-meter resolution, land cover database for the US. NLCD provides spatial reference and descriptive data for characteristics of the land surface such as thematic class (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. The classification system used by NLCD2011 is modified from the Anderson Land Cover Classification System (1976).

NLCD Land Cover Classification Legend

- 11 Open Water
- 12 Perennial Ice/ Snow
- 21 Developed, Open Space
- 22 Developed, Low Intensity
- 23 Developed, Medium Intensity
- 24 Developed, High Intensity
- 31 Barren Land (Rock/Sand/Clay)
- 41 Deciduous Forest
- 42 Evergreen Forest
- 43 Mixed Forest
- 51 Dwarf Scrub*
- 52 Shrub/Scrub
- 71 Grassland/Herbaceous
- 72 Sedge/Herbaceous*
- 73 Lichens*
- 74 Moss*
- 81 Pasture/Hay
- 82 Cultivated Crops
- 90 Woody Wetlands
- 95 Emergent Herbaceous Wetlands

* Alaska only

Analysis Workflow:

This evaluation determined Land Cover at each active NADP site (n=444) on a local (30-m) and regional scale (r = 500-m). ESRI® ArcMap™ 10.1 was used to perform land cover analysis. Statistical summaries were performed in Microsoft Excel 2010.
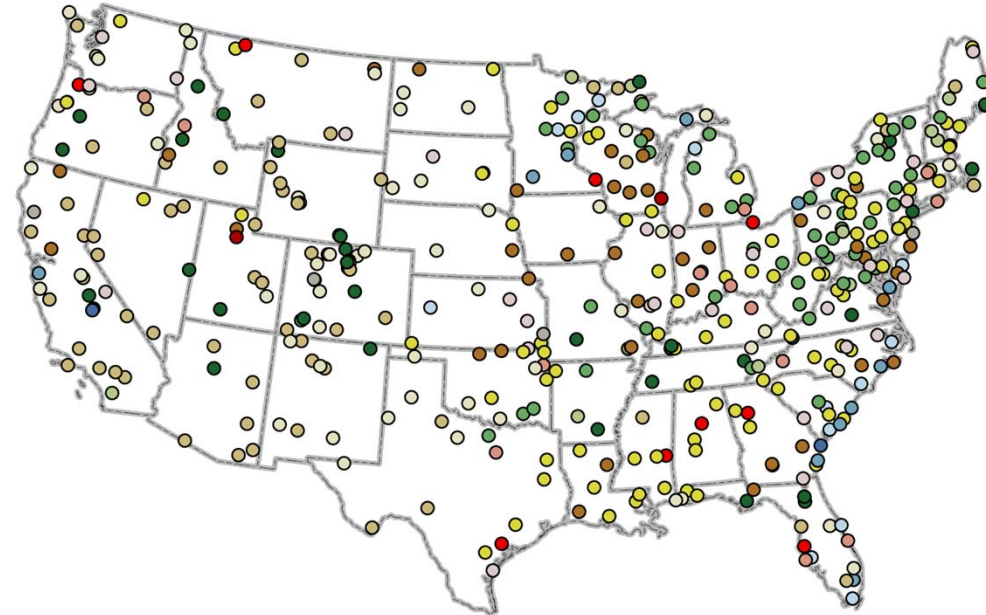

Local (30-m) Land Cover:

Regional (500-m) Land Cover:

Results:

National Atmospheric Deposition Program Sites
Land Cover Classification

- Open water
- Developed, open space
- Developed, low intensity
- Developed, medium intensity
- Developed, high intensity
- Barren land
- Deciduous forest
- Evergreen forest
- Mixed forest
- Shrub/Scrub
- Herbaceuous
- Hay/pasture
- Cultivated crops
- Woody wetlands
- Emergent herbaceuous wetlands

The land cover class containing the greatest number of active NADP sites is _Planted/Cultivated_ with 28.8% (128 of 444 sites). Within this class, the sub-class "Pasture/Hay" represents 68.8 % of the class (19.8% of all the sites, 128 of 444). This land cover sub-class includes grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle.
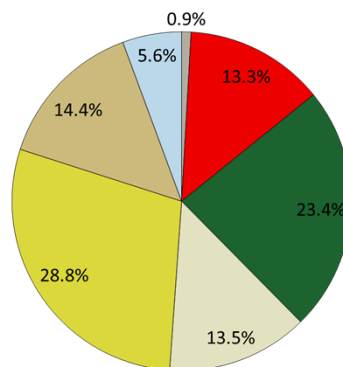
Land Cover Summary for NADP Active Sites (2014)		
Barren	**4**	**0.9%**
Barren Land	4	0.9%
Developed	**59**	**13.3%**
Open Space	32	7.2%
Low Intensity	14	3.2%
Medium Intensity	9	2.0%
High Intensity	4	0.9%
Forest	**104**	**23.4%**
Deciduous	53	11.9%
Evergreen	38	8.6%
Mixed	13	2.9%
Herbaceous	**60**	**13.5%**
Grassland	60	13.5%
Planted/Cultivated	**128**	**28.8%**
Pasture/Hay	88	19.8%
Cultivated Crops	40	9.0%
Shrubland	**64**	**14.4%**
Shrub/Scrub	64	14.4%
Wetlands	**25**	**5.6%**
Woody Wetlands	13	2.9%
Emergent Herbaceous Wetlands	12	2.7%

Results (continued):

The analysis also evaluated the regional land cover of each active site at a scale of 500-m. Exemplar results from this analysis are presented in the adjacent table for NADP Sites Bondville (IL11) and Savannah River (SC03). In this presentation the various sub-classes of the NLCD Land Cover are incorporated along with class totals.

The approach presented provides a consistent classification technique and presentation format describing the regional land cover of each site. The use of national datasets provides a systematic resource for evaluating the land cover across the entire NADP.

The land cover classification developed should be supplemented and verified with local surveys generated during the completion of the NADP Site Information Worksheet and should be reviewed prior to performing periodic Site Surveys.

500-m Land Cover Summary for Sites IL11 & SC03 (2011)	IL11	SC03
Barren		**0.6%**
Barren Land	-	0.6%
Developed	**8.0%**	**61.9%**
Open Space	7.8%	10.6% (1)
Low Intensity	0.2%	10.6%
Medium Intensity	-	25.8%
High Intensity	-	15.0%
Forest		**25.9%**
Deciduous	-	-
Evergreen	-	25.9%
Mixed	-	-
Herbaceous		**0.7%**
Grassland	-	0.7%
Planted/Cultivated	**92.0%**	**-**
Pasture/Hay	13.2% (1)	-
Cultivated Crops	78.8%	-
Shrubland		**6.2%**
Shrub/Scrub	-	6.2%
Wetlands		**4.7%**
Woody Wetlands	-	4.7%
Emergent Herbaceous Wetlands	-	-

(1) Land Use of Site at 30-m Scale

Land Cover coupled with Site Survey Imagery: SC03 (Left) and IL11 (Right)

The local (30-m) and regional (500-m) land cover data is available in digital format.

References:

Anderson, J.R. and others (1976). _A land use and land cover classification system for use with remote sensor data._ U.S. Geological Survey Professional Paper #964, 28 p.

Jin, S. and others (2013). _A comprehensive change detection method for updating the National Land Cover Database to circa 2011_. Remote Sensing of Environment, 132: 159 – 175.

Conklin, A. and D.G. Jackson (2014). _Land Cover at National Atmospheric Deposition Sites derived from the National Land Cover Database._ Technical Report SRNL-STI-2014-00490, Aiken, SC 29808