



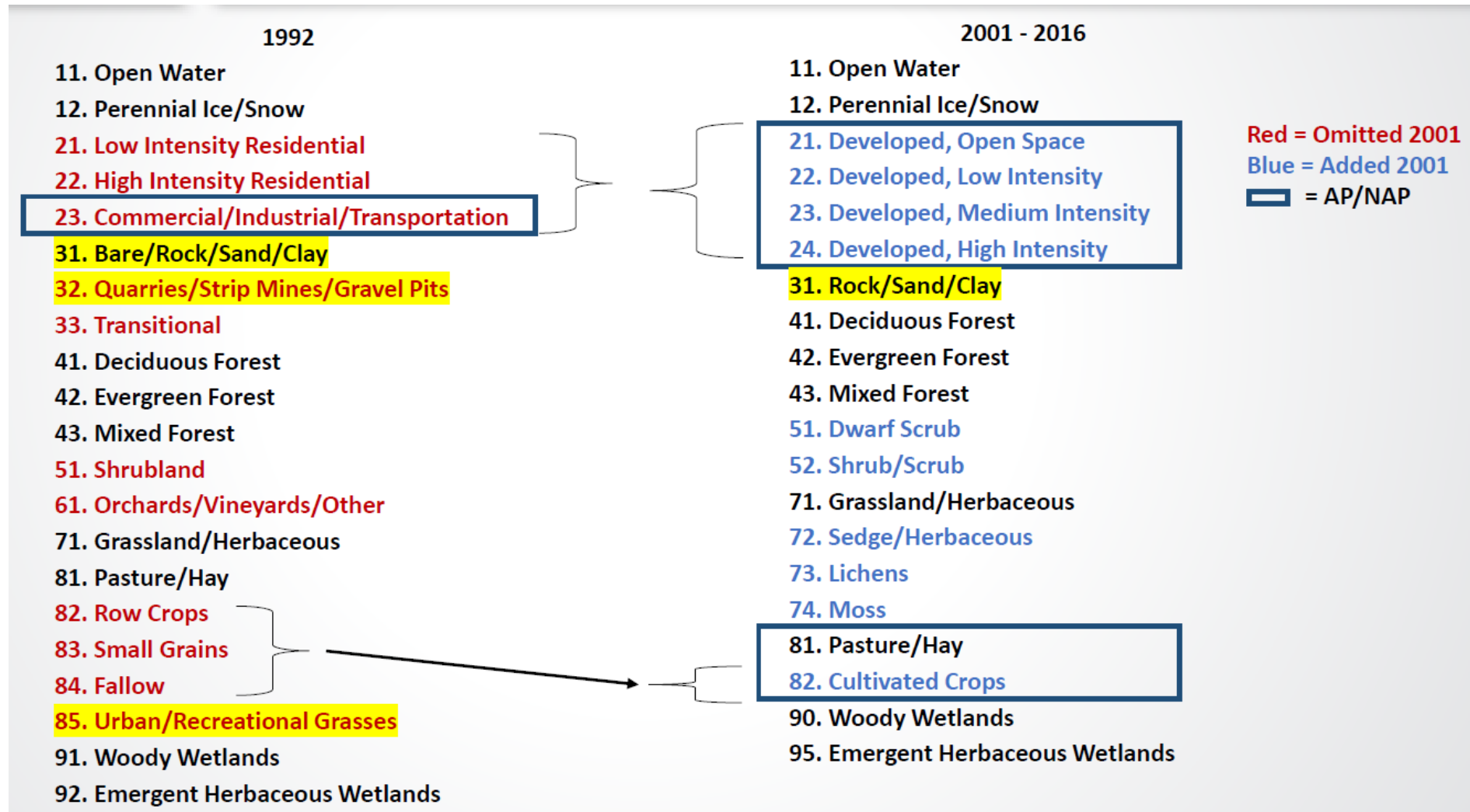
Evaluation of NCLD2016 landuse and AERSURFACE v20060

- MPCA currently updating meteorological dataset (2016-2020)
- AERSURFACE v20060, NLCD 2016
- Changes in land cover characterization
- Present changes in land cover surrounding met stations

- AERSURFACE generates estimates of surface characteristics using land use data from the NLCD
- AERSURFACE v20060 released early 2020
- Updates:
 - Capability to process land cover data from 2001, 2006, 2011, and 2016 NLCDs
 - Land cover data supplemented with concurrent percent impervious and percent tree canopy data

- Updates (continued)
 - Characterize individual wind sectors as airport/non-airport
 - Research grade method (ZOEFF) for determining surface roughness length

AERSURFACE

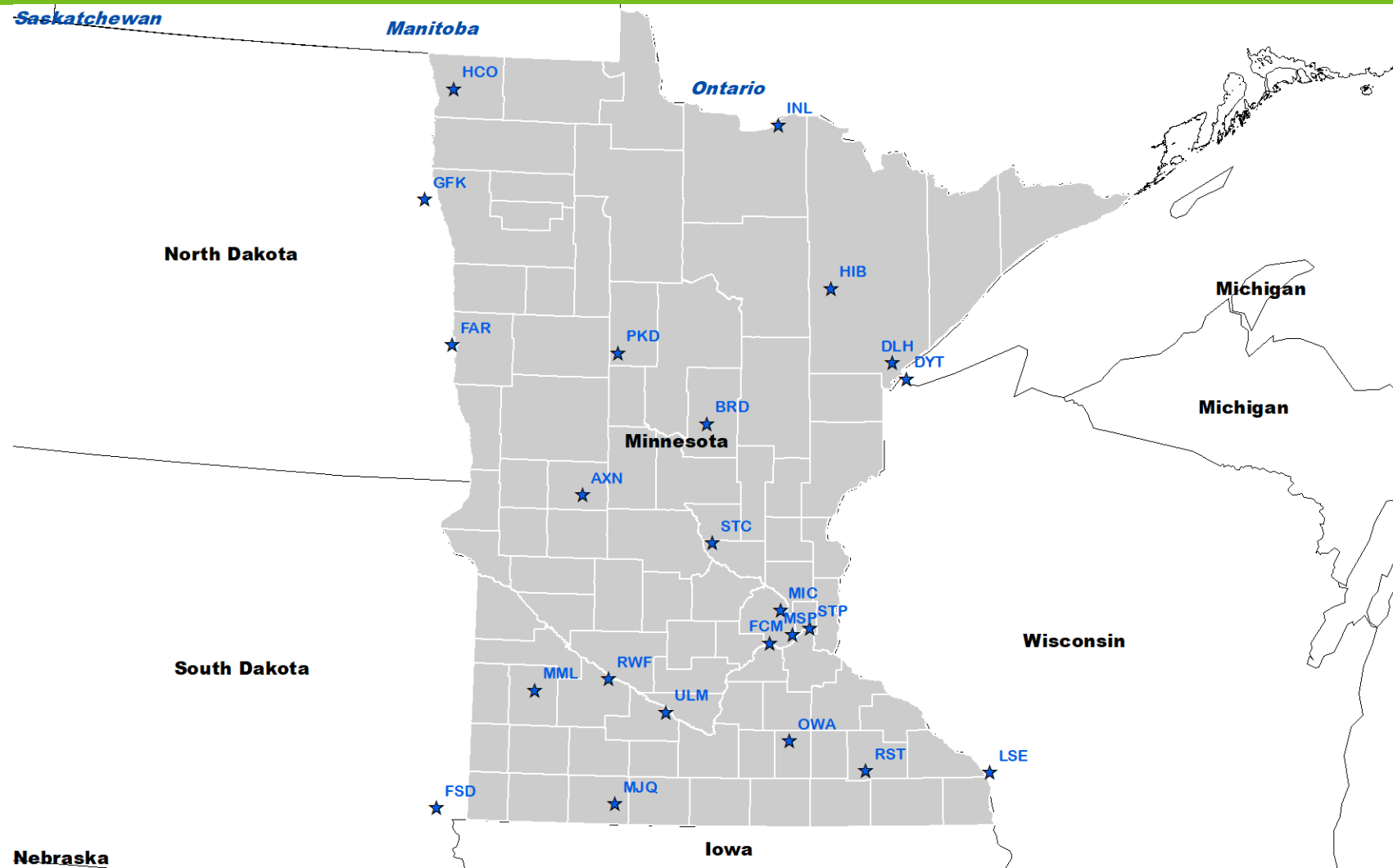


- Assigning roughness values to post-1992 land cover categories presents challenges
 - 1992 Commercial/Industrial/Transportation
 - 2001-2016 Developed categories
 - 2001-2016 Pasture/Hay and Cultivated Crops categories

- Airport/Nonairport flag used to designate “smoother” or “rougher” land cover
 - Developed categories, cultivated crops, pasture/hay
- Flag determined for each sector
- Characterized based on land use within sector rather than whether or not met tower physically located at an airport

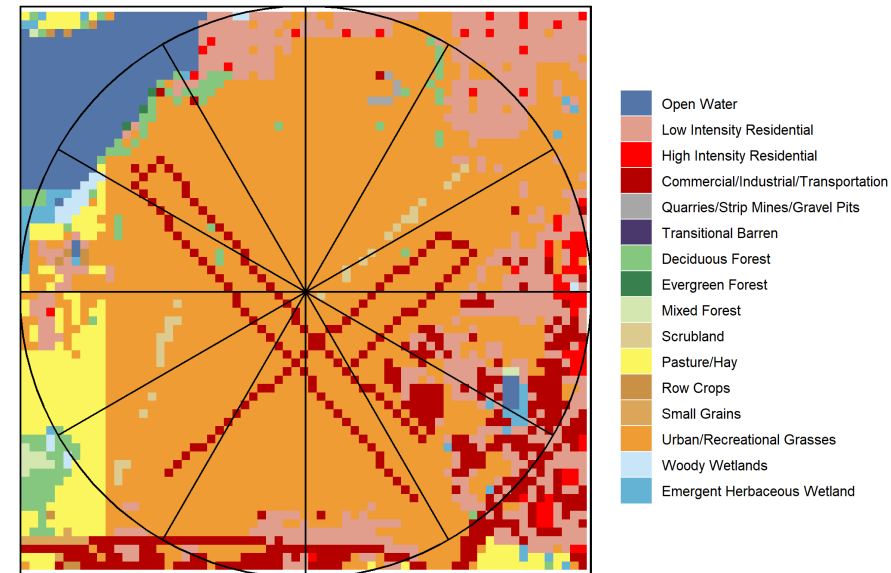
- Roughness for Developed categories (21-24) computed based on mix of NLCD 1992 categories
 - Categories weighted based on % impervious and % tree canopy
 - Weights vary between Airport and Nonairport flags
- Roughness for Woody Wetlands category also weighted based on % impervious and % tree canopy

MPCA Processed Met Sites

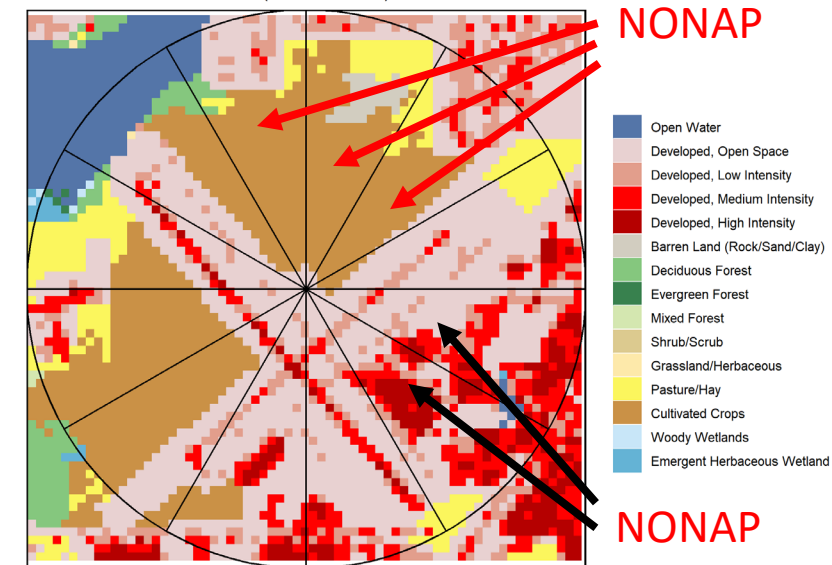




Land Use Classification (NLCD 1992)

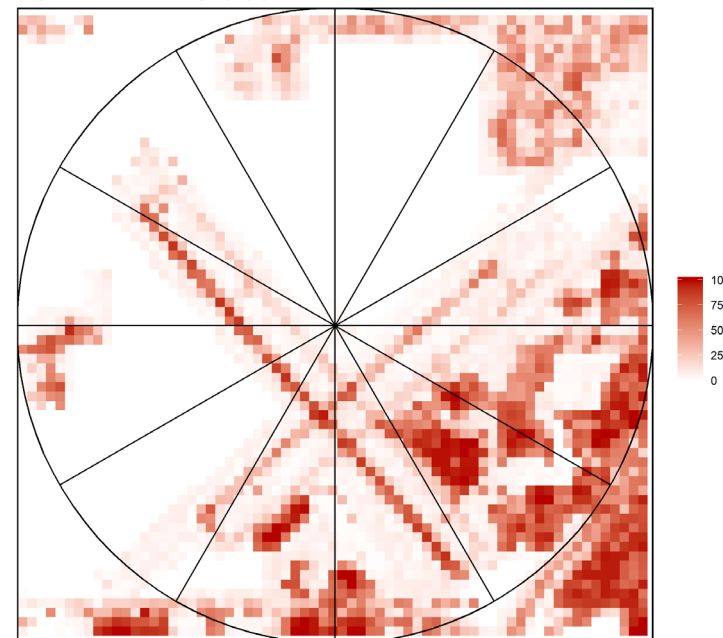


Land Use Classification (NLCD 2016)

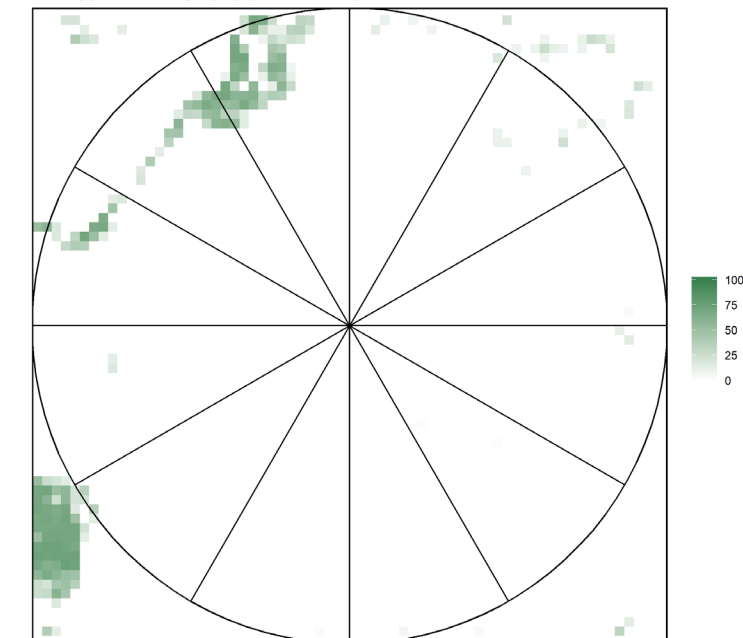


Alexandria Municipal Airport (AXN)

Impervious Percentage (%) (NLCD 2016)

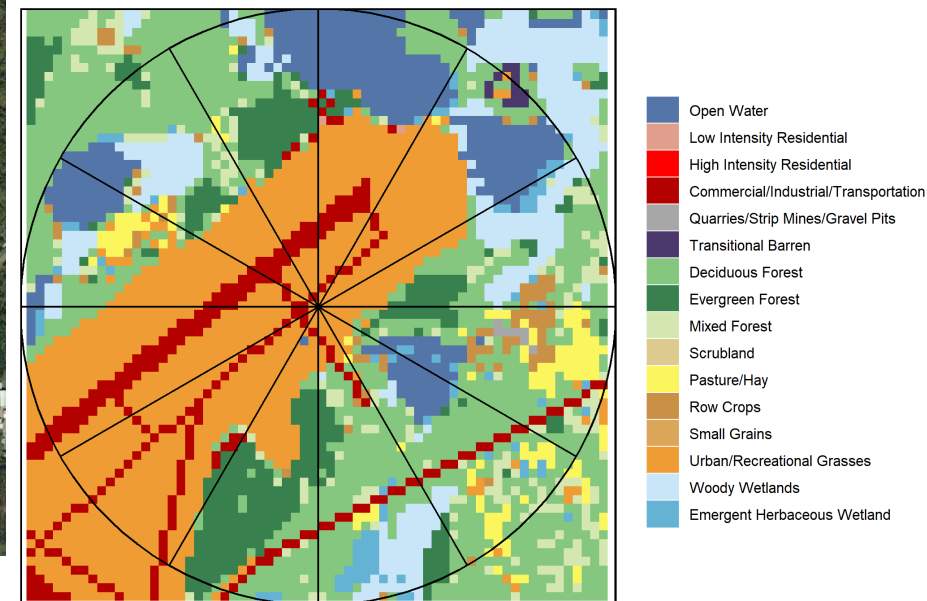


Canopy Percentage (%) (NLCD 2016)

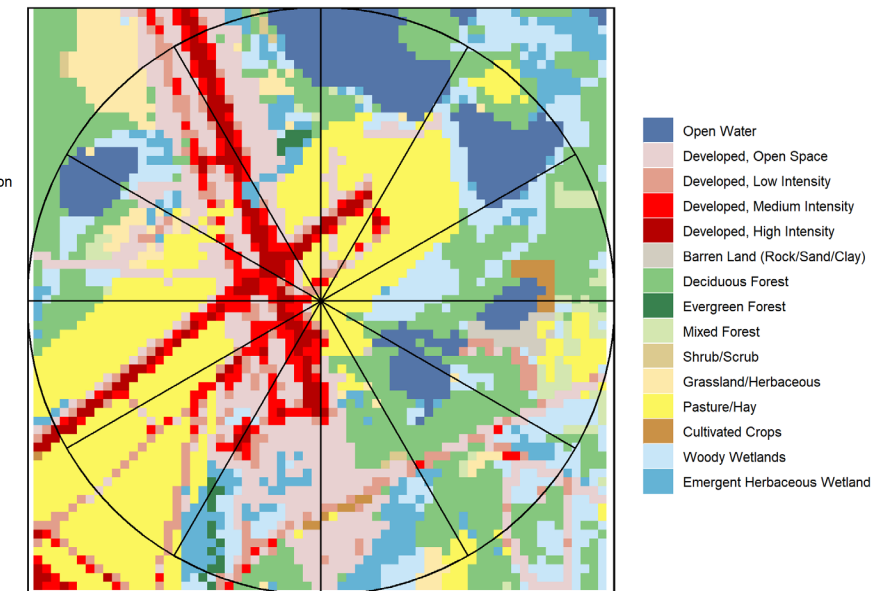




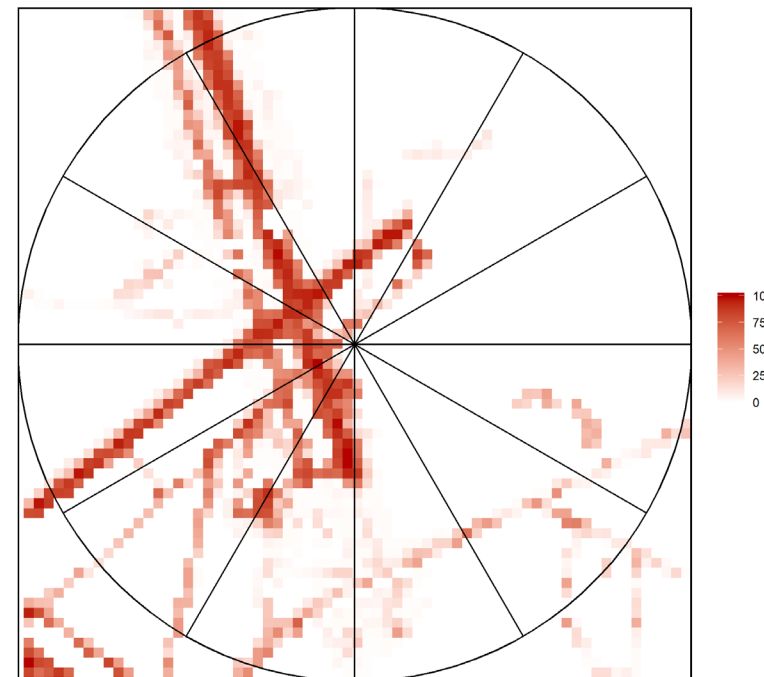
Land Use Classification (NLCD 1992)



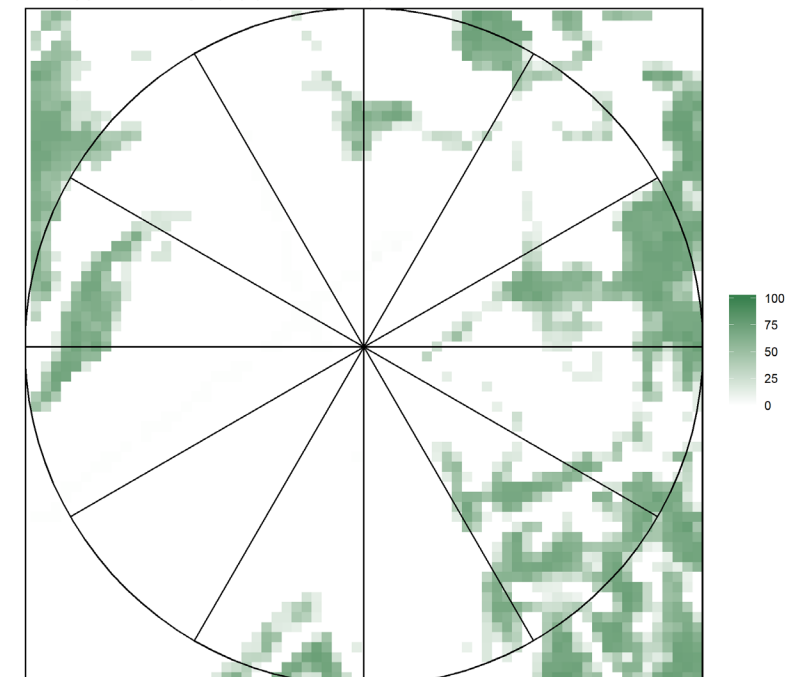
Land Use Classification (NLCD 2016)



Impervious Percentage (%) (NLCD 2016)



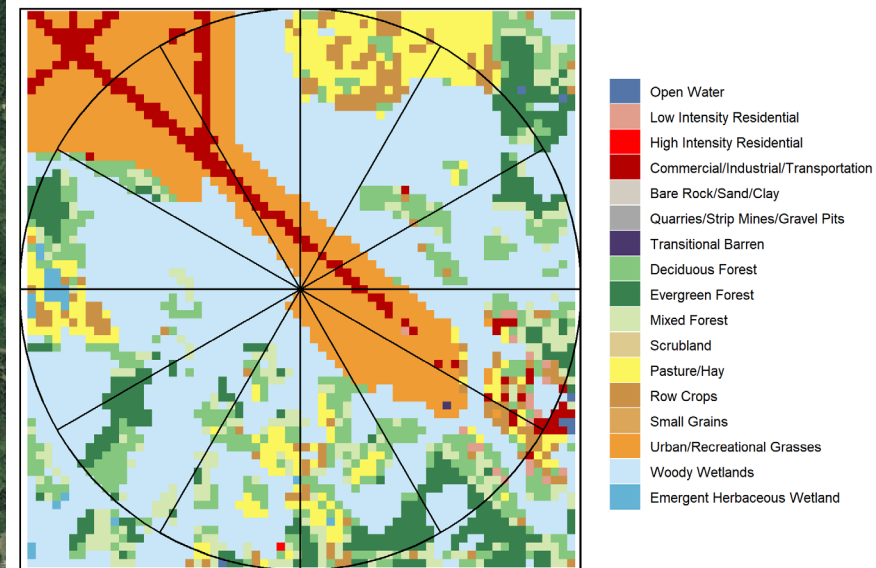
Canopy Percentage (%) (NLCD 2016)



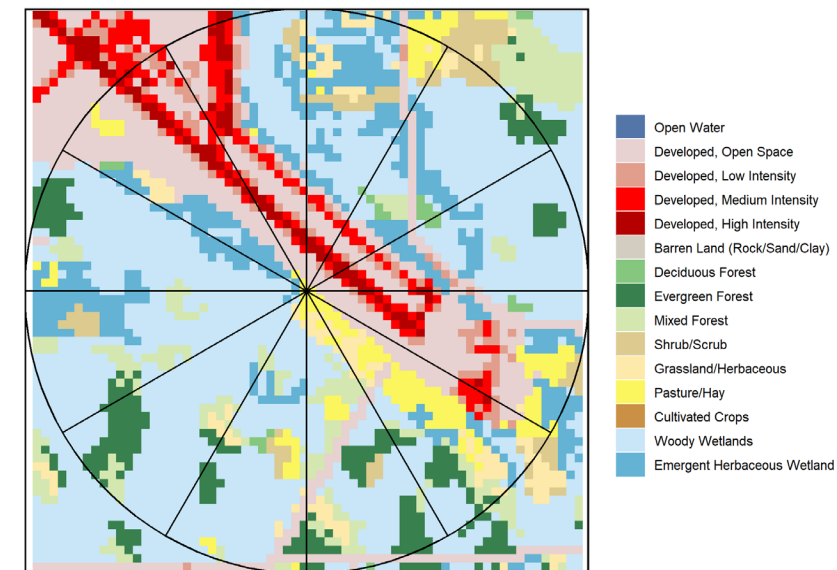
Brainerd Lakes Regional Airport (BRD)



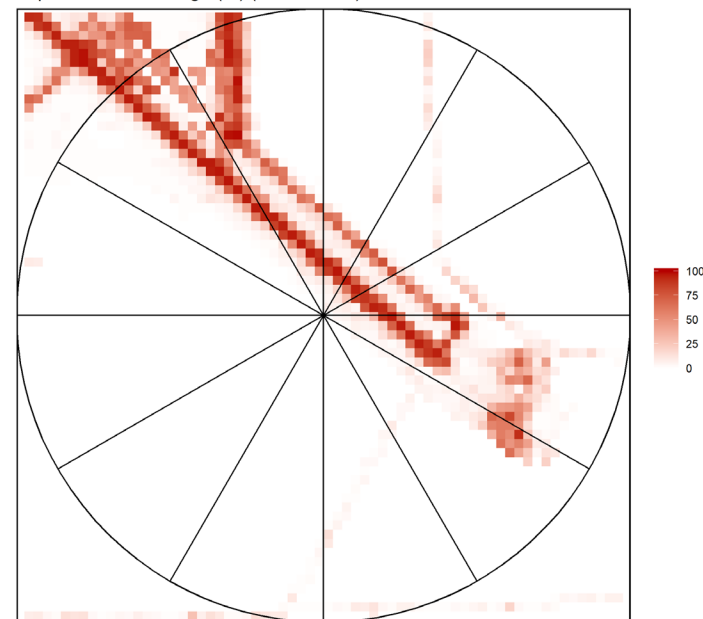
Land Use Classification (NLCD 1992)



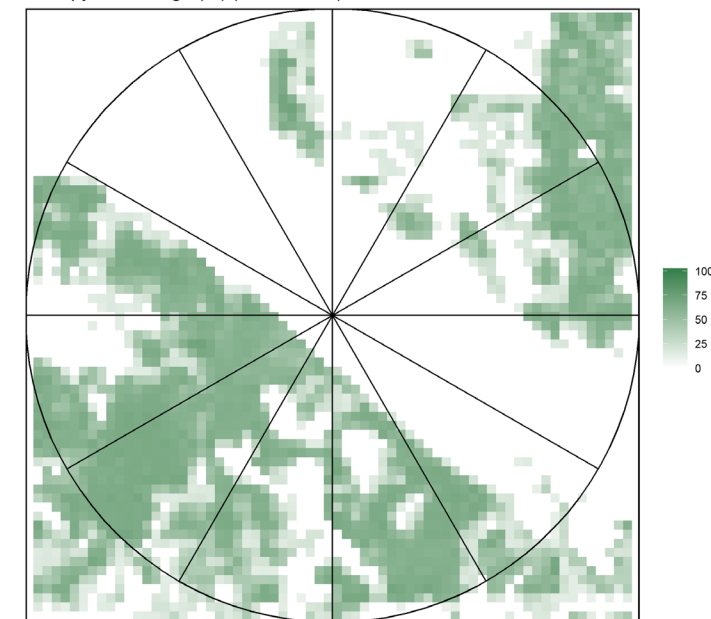
Land Use Classification (NLCD 2016)



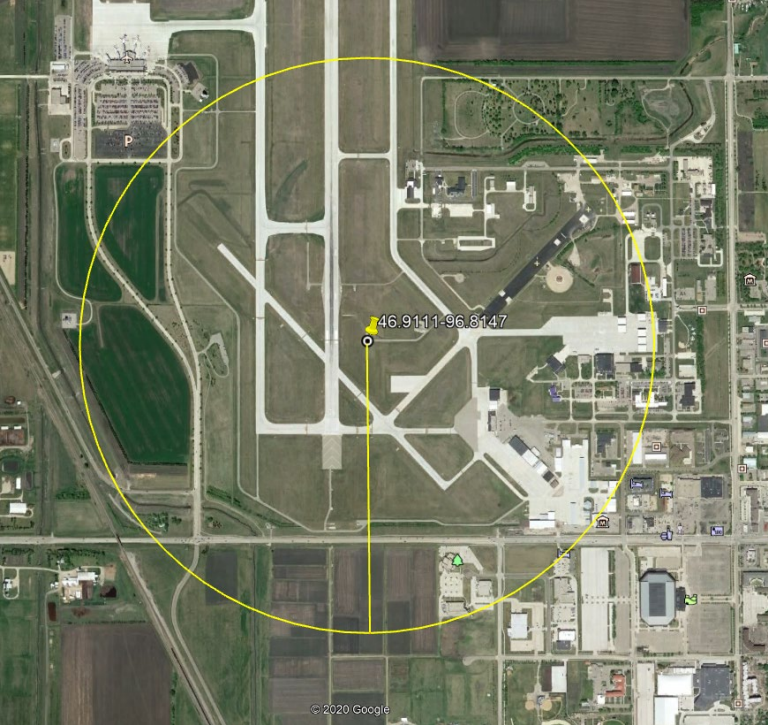
Impervious Percentage (%) (NLCD 2016)



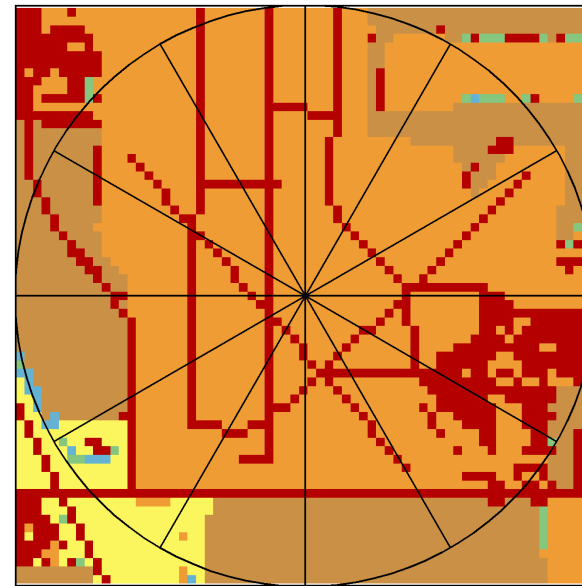
Canopy Percentage (%) (NLCD 2016)



Range Regional Airport (HIB)

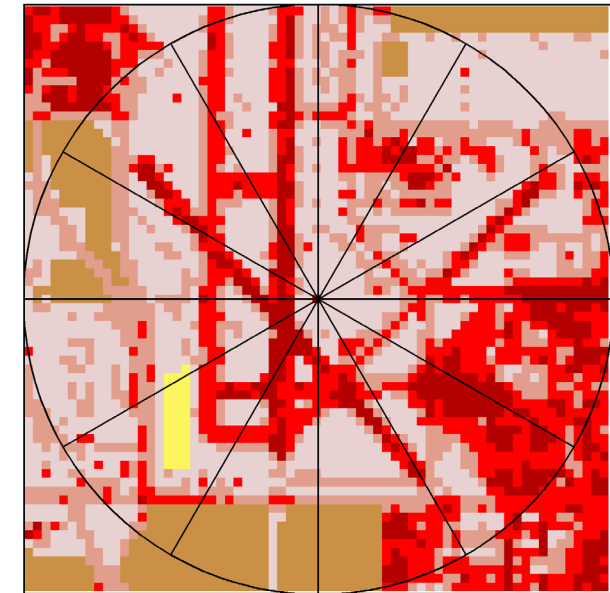


Land Use Classification (NLCD 1992)



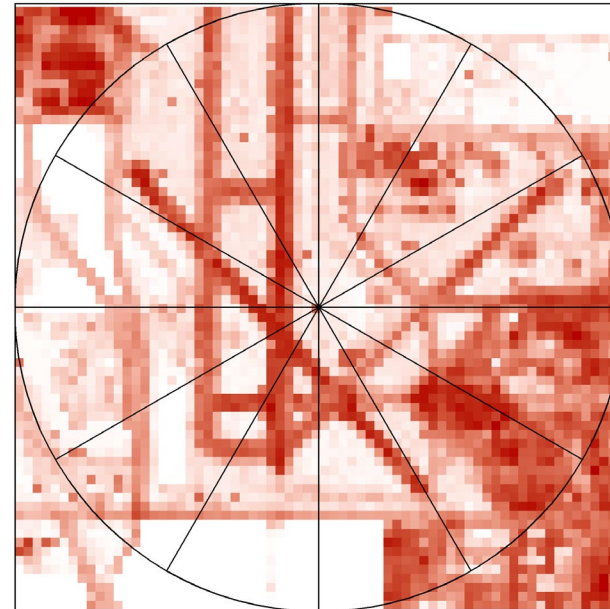
- Open Water
- Low Intensity Residential
- High Intensity Residential
- Commercial/Industrial/Transportation
- Transitional Barren
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Pasture/Hay
- Row Crops
- Small Grains
- Urban/Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetland

Land Use Classification (NLCD 2016)



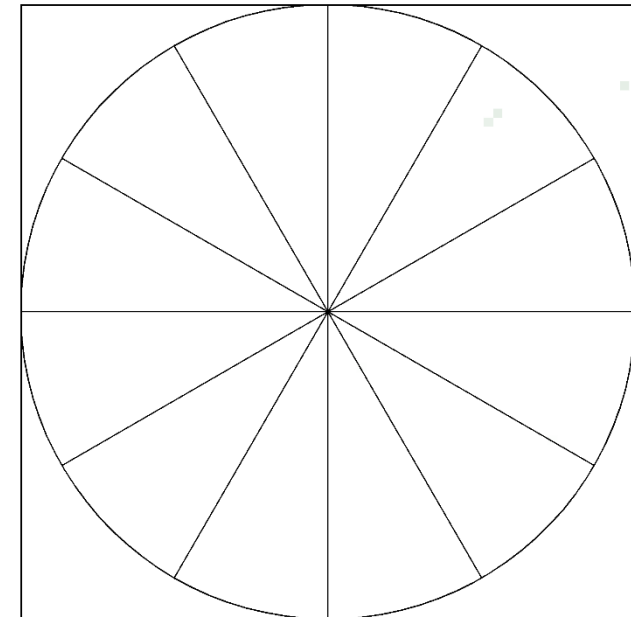
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetland

Impervious Percentage (%) (NLCD 2016)



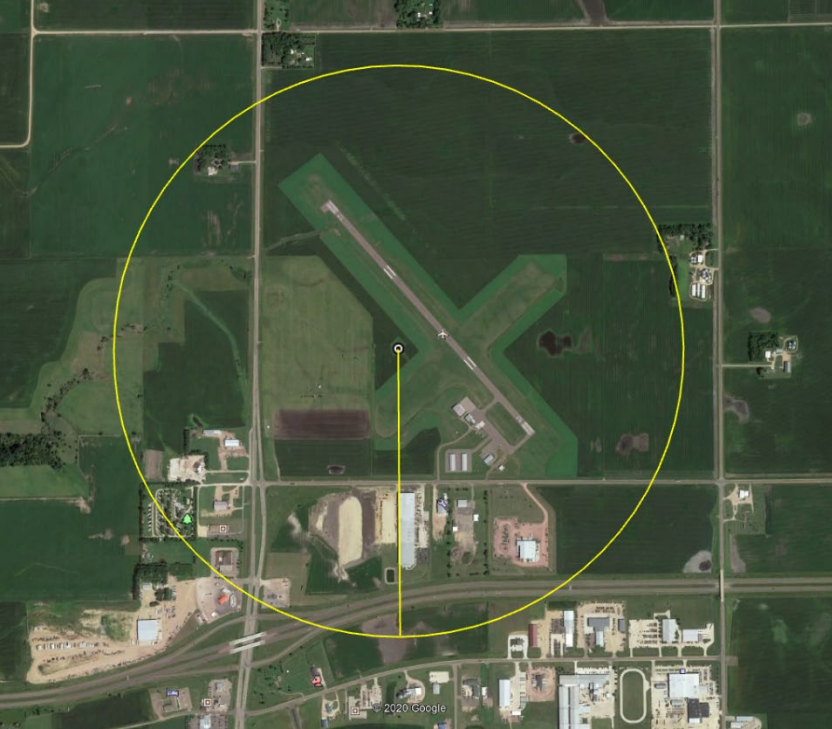
- 100
- 75
- 50
- 25
- 0

Canopy Percentage (%) (NLCD 2016)

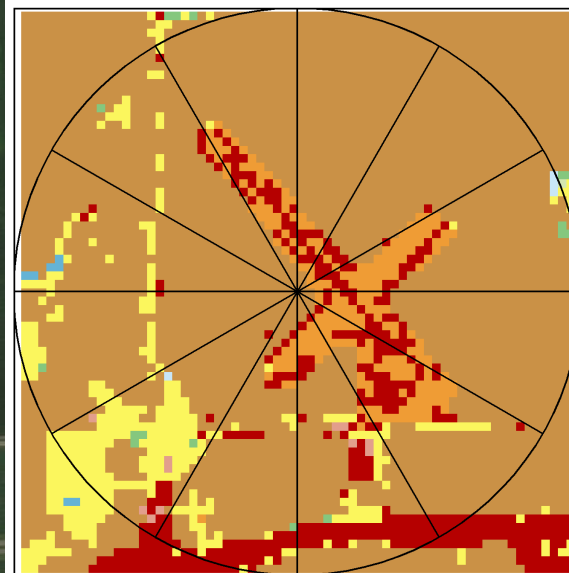


- 100
- 75
- 50
- 25
- 0

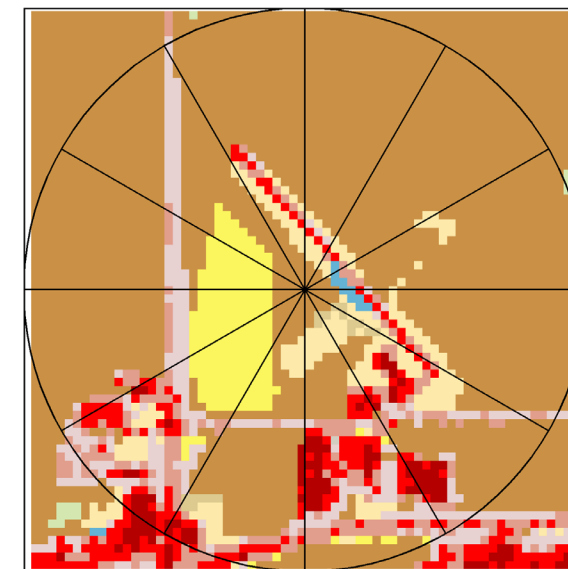
Hector International Airport (FAR)



Land Use Classification (NLCD 1992)

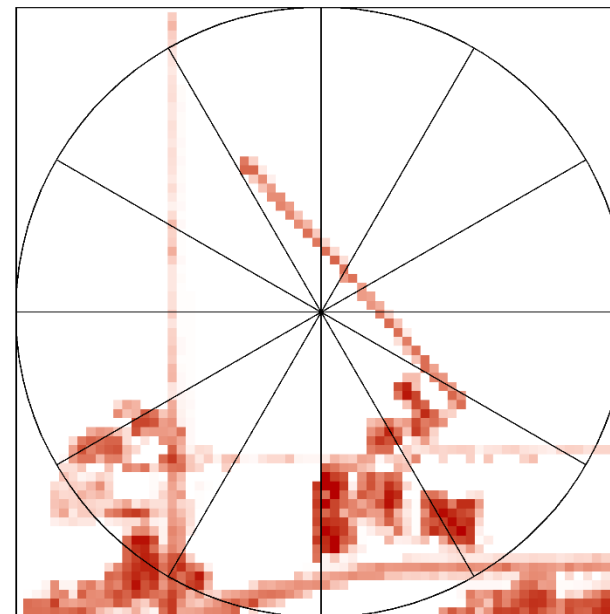


Land Use Classification (NLCD 2016)

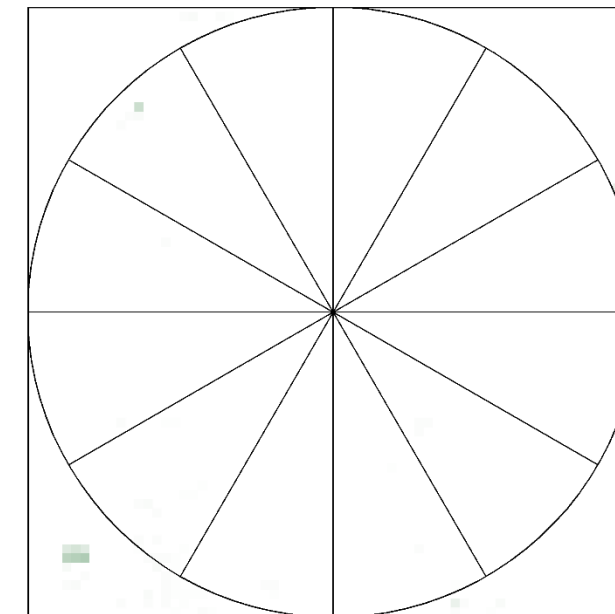


Jackson Municipal Airport (MJQ)

Impervious Percentage (%) (NLCD 2016)



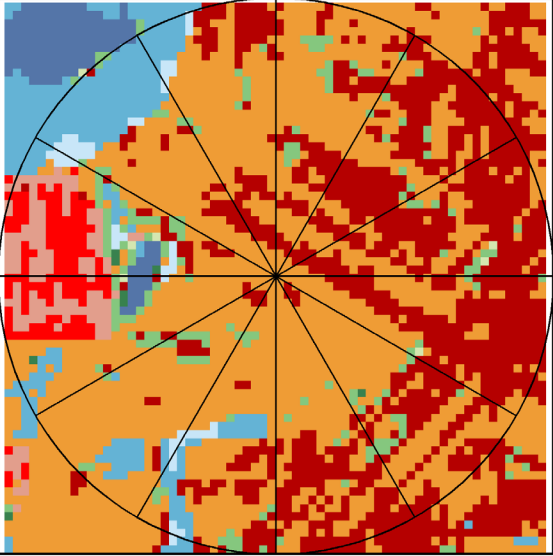
Canopy Percentage (%) (NLCD 2016)





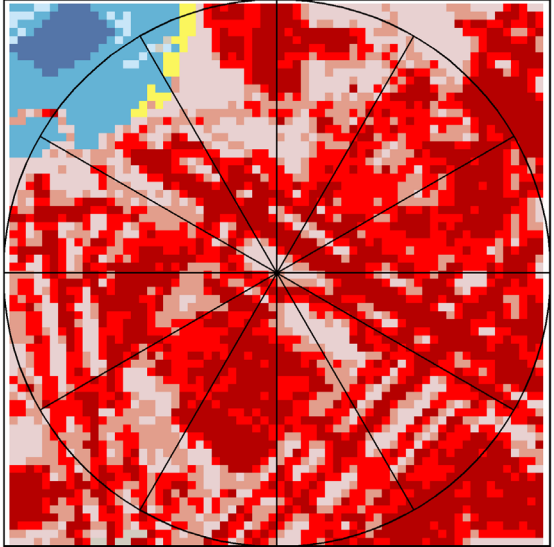
Minneapolis/St Paul International Airport (MSP)

Land Use Classification (NLCD 1992)



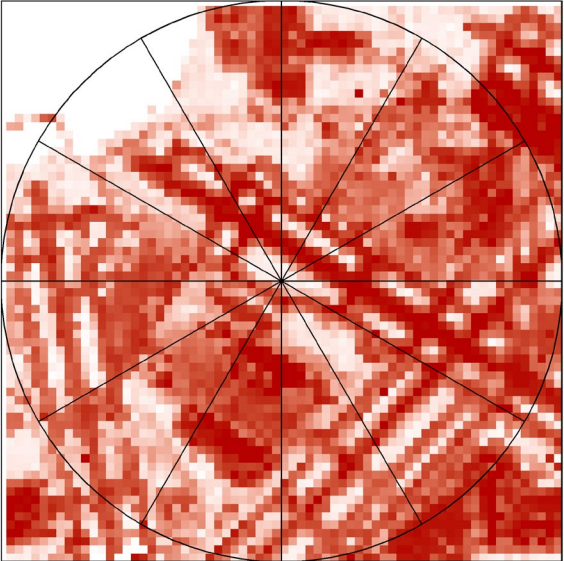
- Open Water
- Low Intensity Residential
- High Intensity Residential
- Commercial/Industrial/Transportation
- Transitional Barren
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Pasture/Hay
- Row Crops
- Small Grains
- Urban/Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetland

Land Use Classification (NLCD 2016)



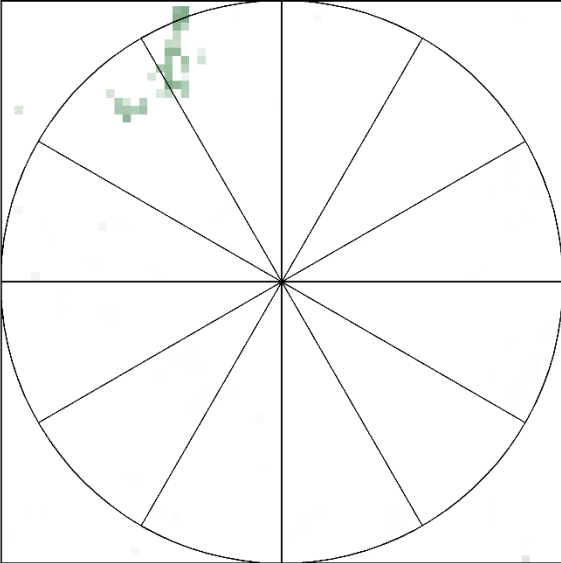
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetland

Impervious Percentage (%) (NLCD 2016)



- 100
- 75
- 50
- 25
- 0

Canopy Percentage (%) (NLCD 2016)



- 100
- 75
- 50
- 25
- 0

Surface Roughness Comparison

HIB

Winter with no snow			
Sector	NLCD1992	NLCD2016	Difference
1	0.079	0.017	-0.06
2	0.158	0.03	-0.81
3	0.164	0.062	-0.62
4	0.054	0.039	-0.28
5	0.042	0.024	-0.43
6	0.181	0.114	-0.37
7	0.232	0.084	-0.64
8	0.44	0.099	-0.78
9	0.329	0.027	-0.92
10	0.391	0.02	-0.95
11	0.091	0.025	-0.73
12	0.05	0.026	-0.48

Winter with continuous snow			
Sector	NLCD1992	NLCD2016	Difference
1	0.05	0.01	-0.80
2	0.11	0.017	-0.85
3	0.115	0.035	-0.70
4	0.034	0.024	-0.29
5	0.025	0.015	-0.40
6	0.127	0.075	-0.41
7	0.166	0.05	-0.70
8	0.343	0.06	-0.83
9	0.242	0.015	-0.94
10	0.293	0.01	-0.97
11	0.061	0.017	-0.72
12	0.032	0.018	-0.44

Midsummer with lush vegetation			
Sector	NLCD1992	NLCD2016	Difference
1	0.189	0.028	-0.85
2	0.249	0.047	-0.81
3	0.248	0.095	-0.62
4	0.097	0.057	-0.41
5	0.078	0.038	-0.51
6	0.328	0.158	-0.52
7	0.407	0.135	-0.67
8	0.588	0.138	-0.77
9	0.515	0.049	-0.90
10	0.528	0.036	-0.93
11	0.136	0.037	-0.73
12	0.078	0.037	-0.53

Surface Roughness Comparison

MSP

Winter with no snow			
Sector	NLCD1992	NLCD2016	Difference
1	0.02	0.031	0.01
2	0.027	0.036	0.01
3	0.035	0.037	0.00
4	0.024	0.034	0.01
5	0.018	0.028	0.01
6	0.018	0.033	0.02
7	0.026	0.031	0.01
8	0.02	0.035	0.02
9	0.039	0.032	-0.01
10	0.116	0.032	-0.08
11	0.036	0.025	-0.01
12	0.025	0.028	0.00

Winter with continuous snow			
Sector	NLCD1992	NLCD2016	Difference
1	0.013	0.023	0.01
2	0.027	0.029	0.00
3	0.028	0.03	0.00
4	0.017	0.027	0.01
5	0.014	0.02	0.01
6	0.011	0.025	0.01
7	0.012	0.023	0.01
8	0.011	0.027	0.02
9	0.019	0.025	0.01
10	0.065	0.024	-0.04
11	0.015	0.017	0.00
12	0.014	0.02	0.01

Midsummer with lush vegetation			
Sector	NLCD1992	NLCD2016	Difference
1	0.034	0.041	0.01
2	0.039	0.046	0.01
3	0.047	0.046	0.00
4	0.036	0.044	0.01
5	0.031	0.038	0.01
6	0.03	0.043	0.01
7	0.044	0.041	0.00
8	0.035	0.044	0.01
9	0.063	0.042	-0.02
10	0.16	0.042	-0.12
11	0.055	0.036	-0.02
12	0.04	0.038	0.00

- Airport/Nonairport flags determined for 12 sectors at each MPCA-processed met station
- 16 stations have mix of Airport/Nonairport sectors
- 11 stations have all sectors defined as Airport

- Only 7 sites showed land cover changes due to new/expanded development
- Significant land cover changes due to refined classification
 - Urban/rec grasses -> cultivated crops, devel open space, pasture/hay
 - Comm/Ind/Trans -> devel med intensity, devel high intensity
- Generally more spatially refined and representative land cover

- Large differences in surface roughness at HIB
- Small differences in surface roughness at MSP
- Need to evaluate more met stations

- Challenges
 - How to classify sectors with cultivated crop landuse
 - Subjective airport/non-airport determination at rural airports
 - Inverse distance weighting

- Future work
 - Quantify changes in amount of developed landuse
 - Quantify percentage of pixels reclassified from old categories
 - Quantify changes in surface roughness and effect on modeled concentrations

Thank you!

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