

Time-Series Analysis on the Urban Growth of Denver City

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Background:



Population of Denver as of 2010: **599,825**

- According to 2019 U.S. Census Bureau, Population Estimates Program (PEP)

As of 2019: **727,211**

- According to 2019 U.S. Census Bureau, Population Estimates Program (PEP)

Actual Population of Denver as of 2010: **600,158**

- According to the 2010 Decennial Census of Population and Housing

Based on PEP, population has increased by 21.2% in just the last 10 years.

This is likely due in large part to Amendment 64 of the Colorado State Constitution, which legalized the use Cannabis for recreational purposes in 2012.

Objective

Create Time-Series Analysis

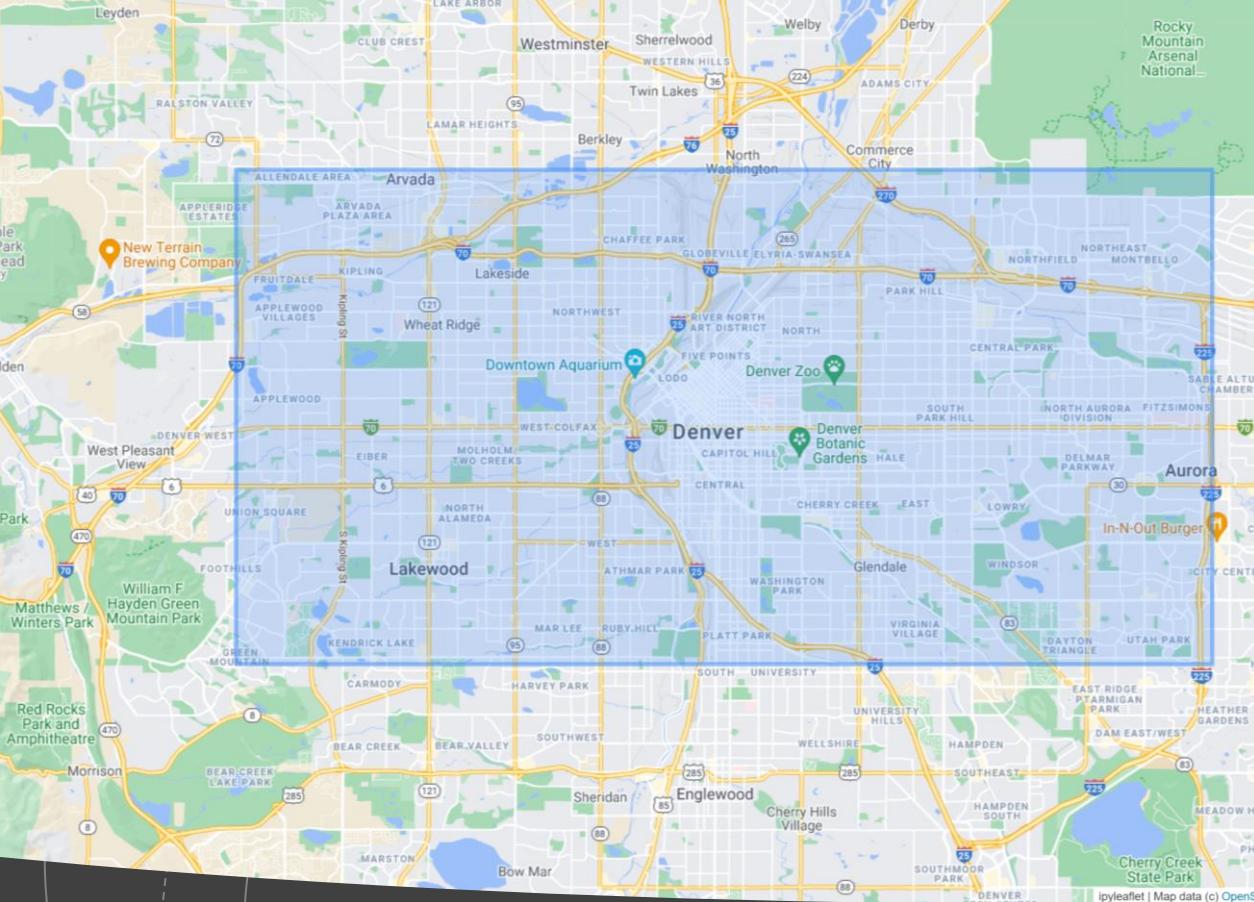
Utilize Google Earth Engine

Track the growth of the Denver area using:

Landsat
Imagery

Supervised
Classification

Change
Detection

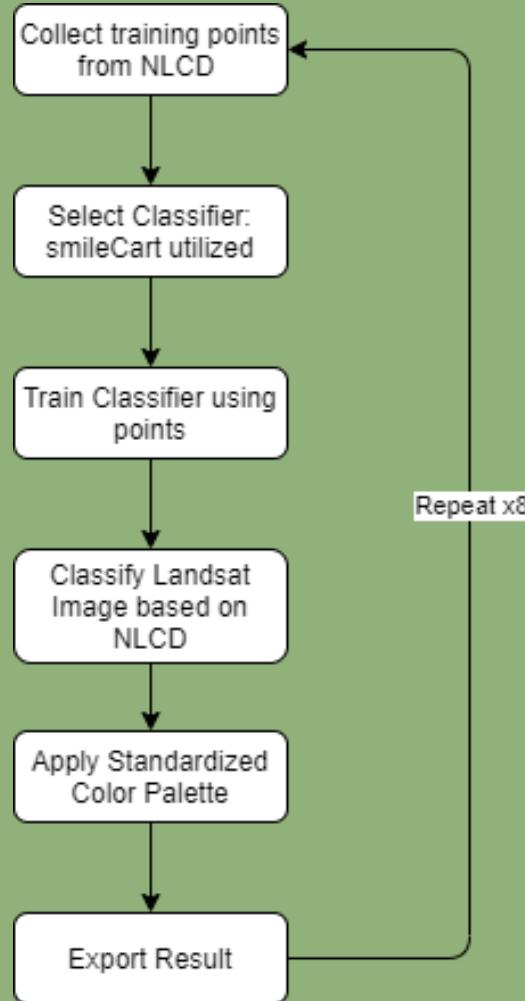


Study Area

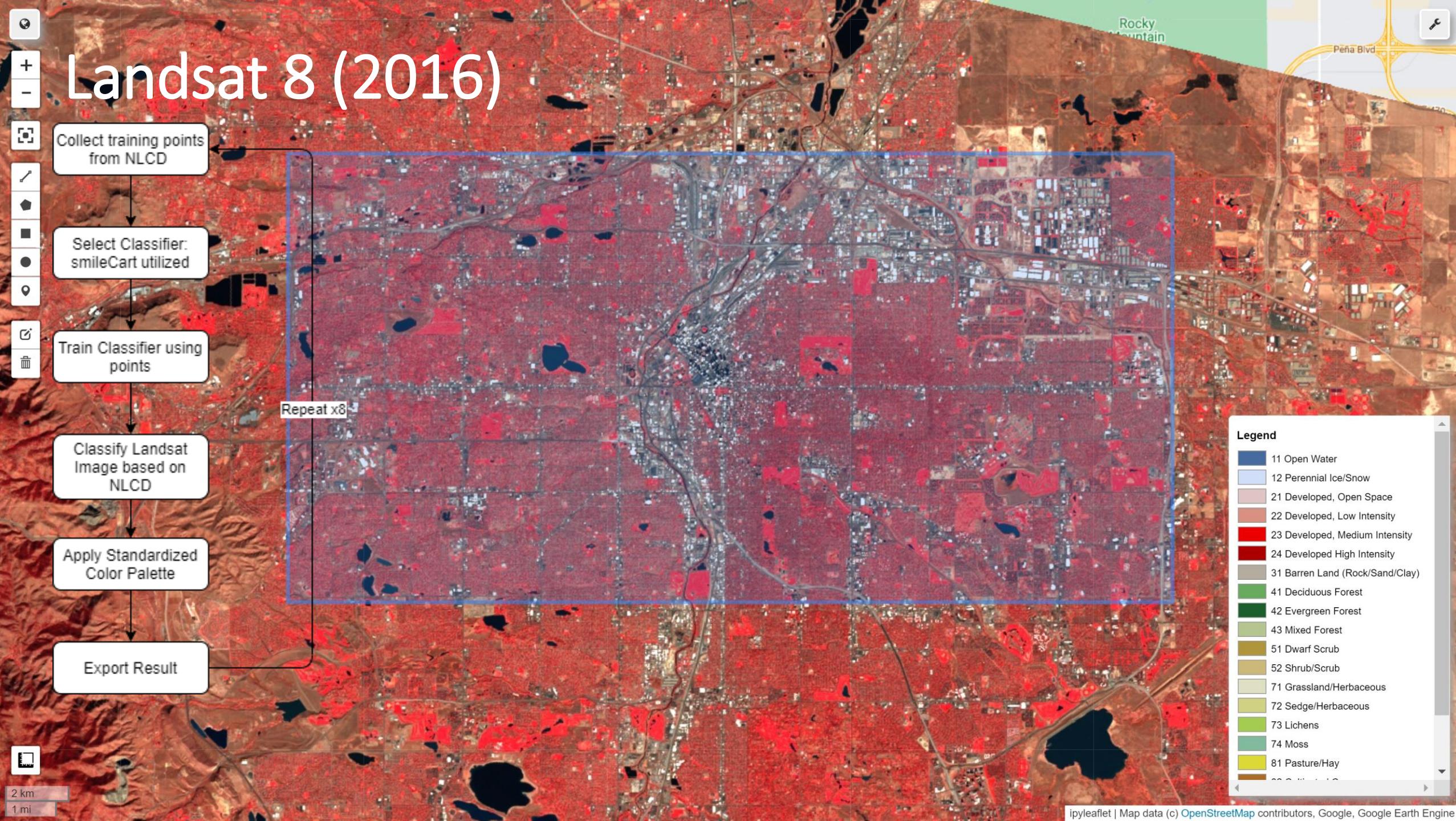
- Greater Denver area bounded by Lakewood to the West, Aurora to the East, Commerce City to the North and Englewood to the South



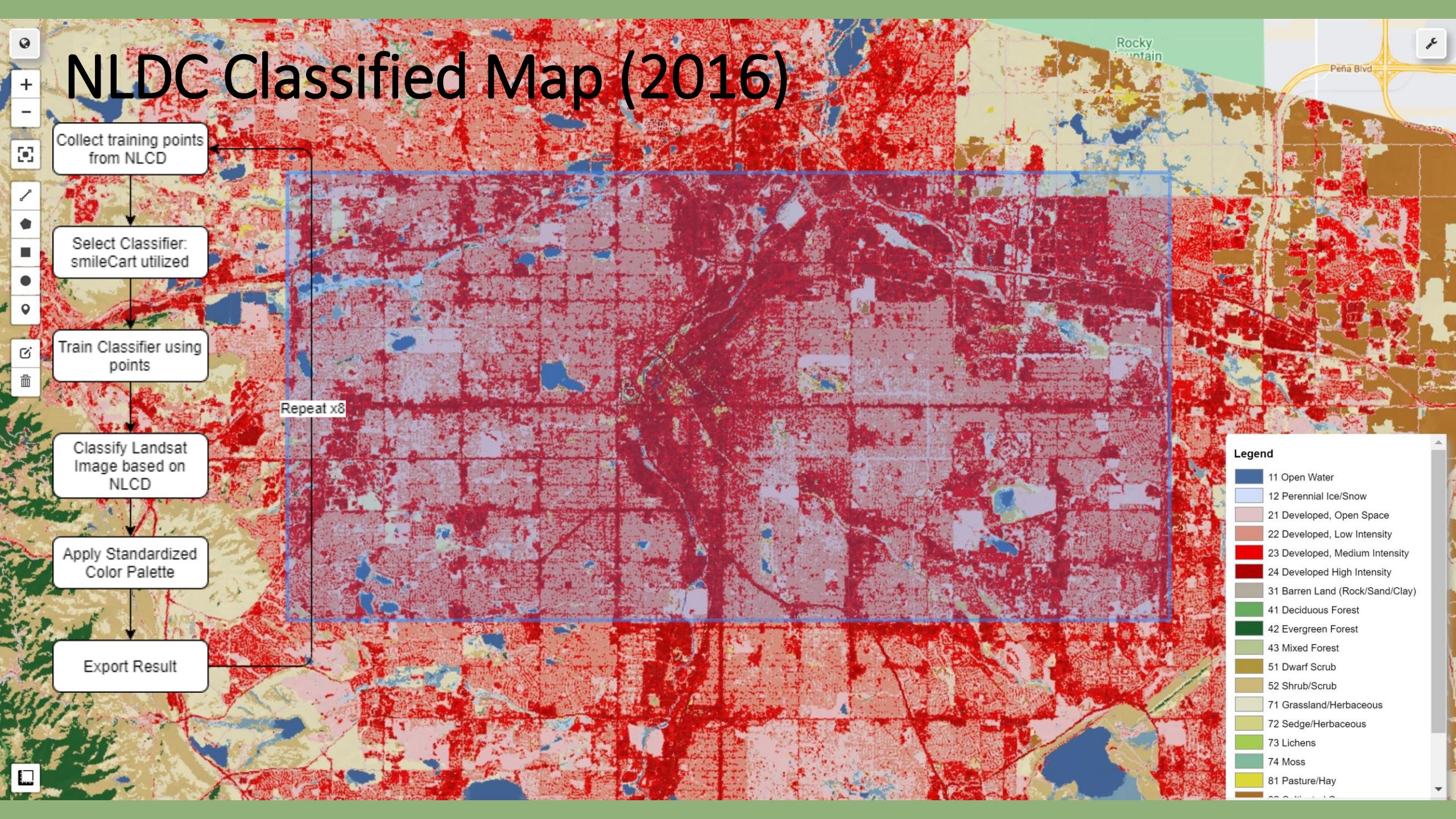
Methodology:

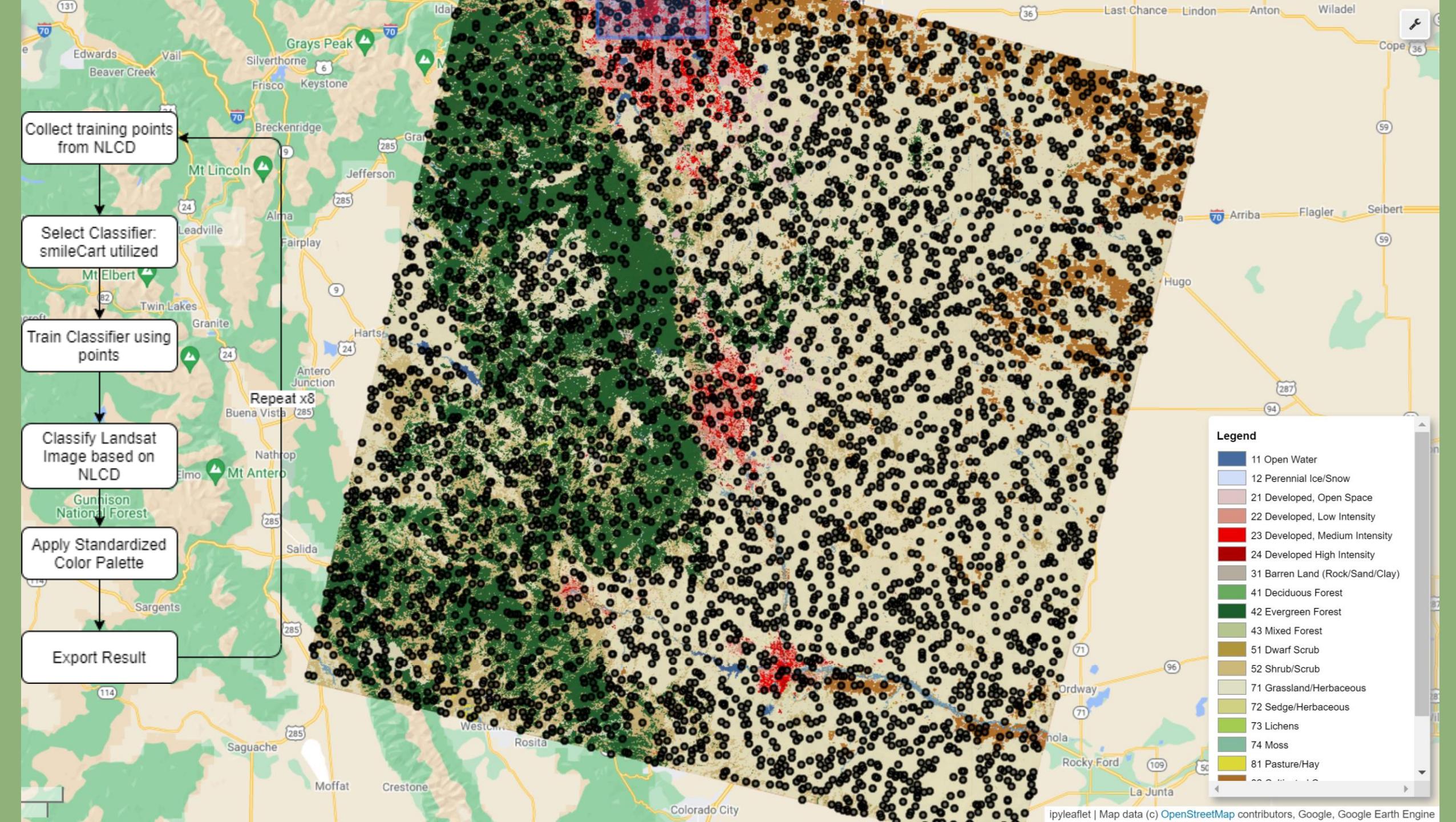


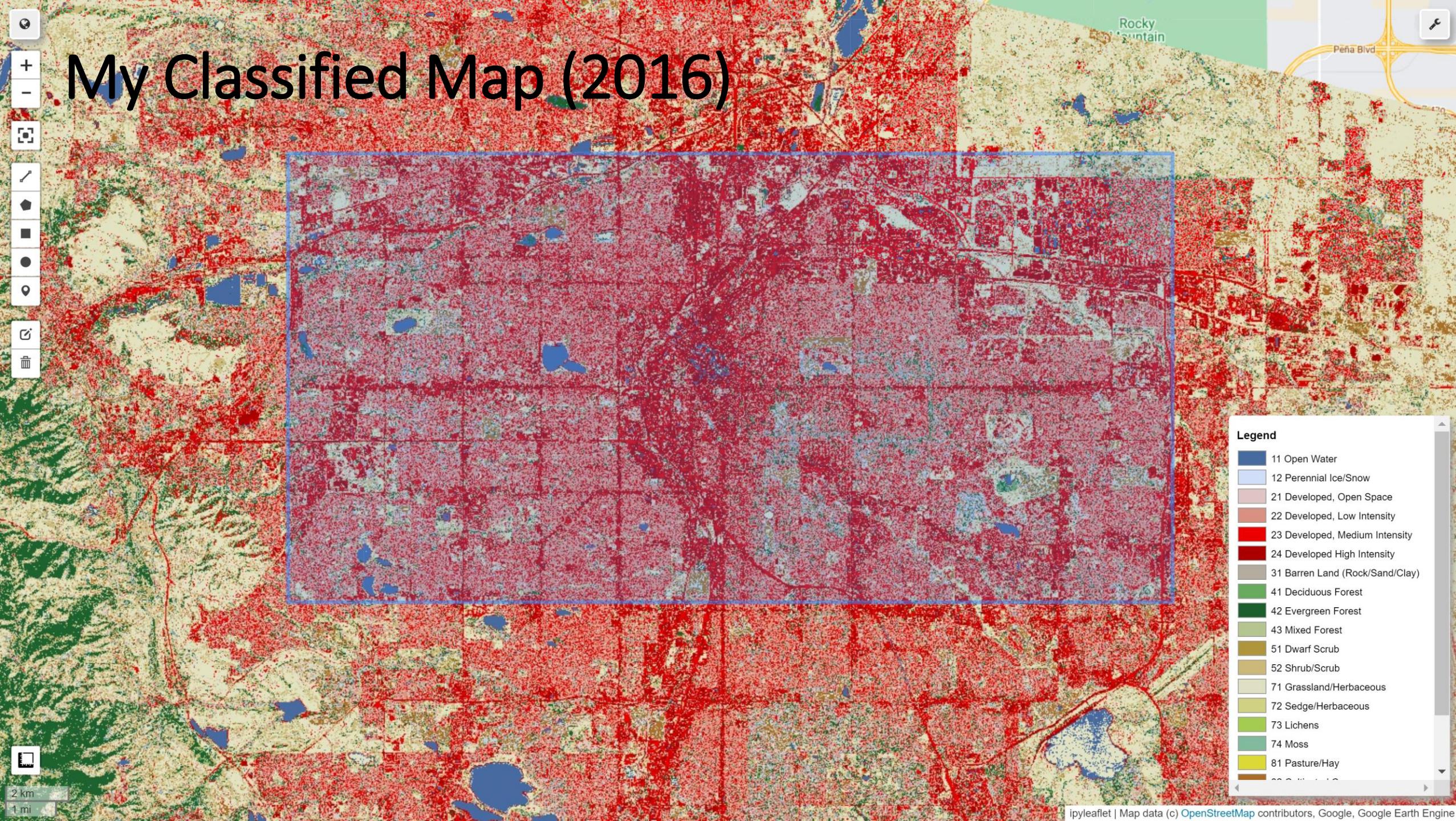
- Use False Color Landsat images to capture the physical growth of the city
- Total of 8 images from 1986-2021, spaced every 5 years
- Corroborate findings using population data from Census



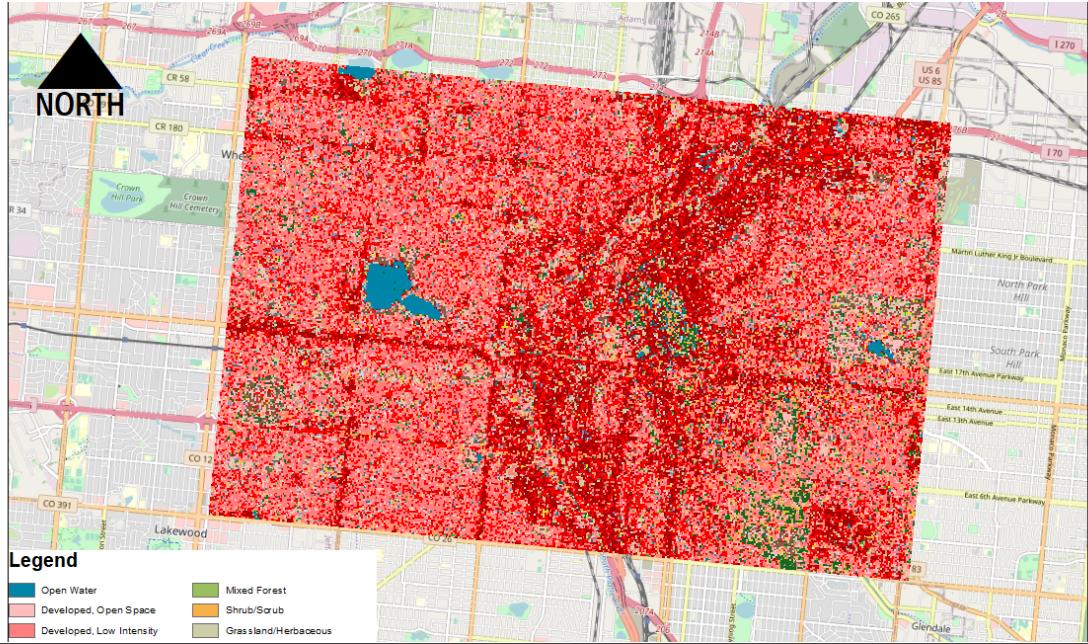
NLDC Classified Map (2016)



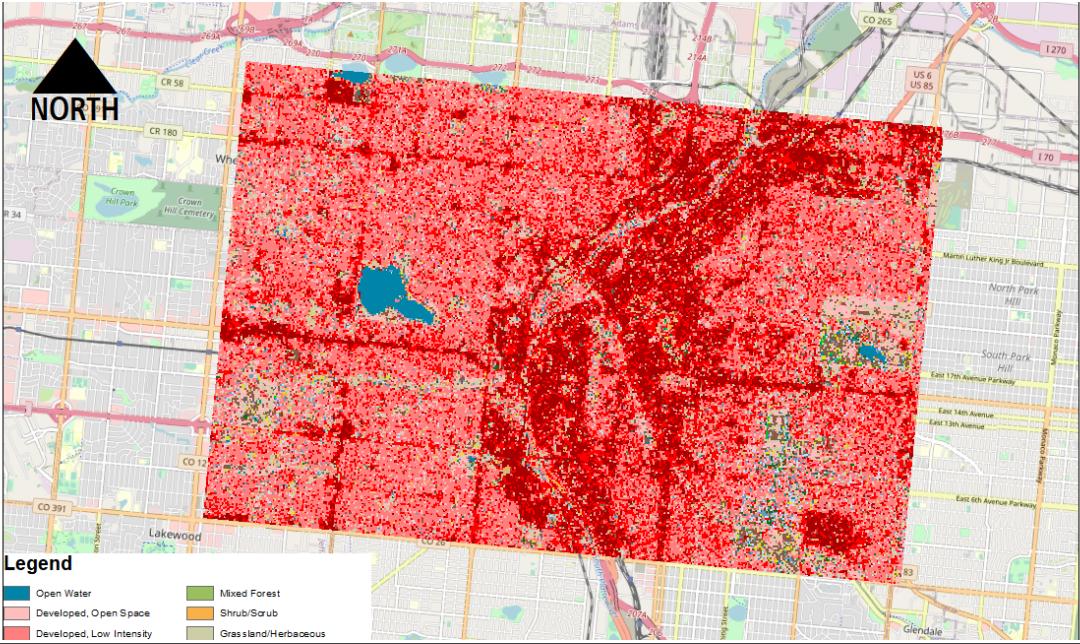




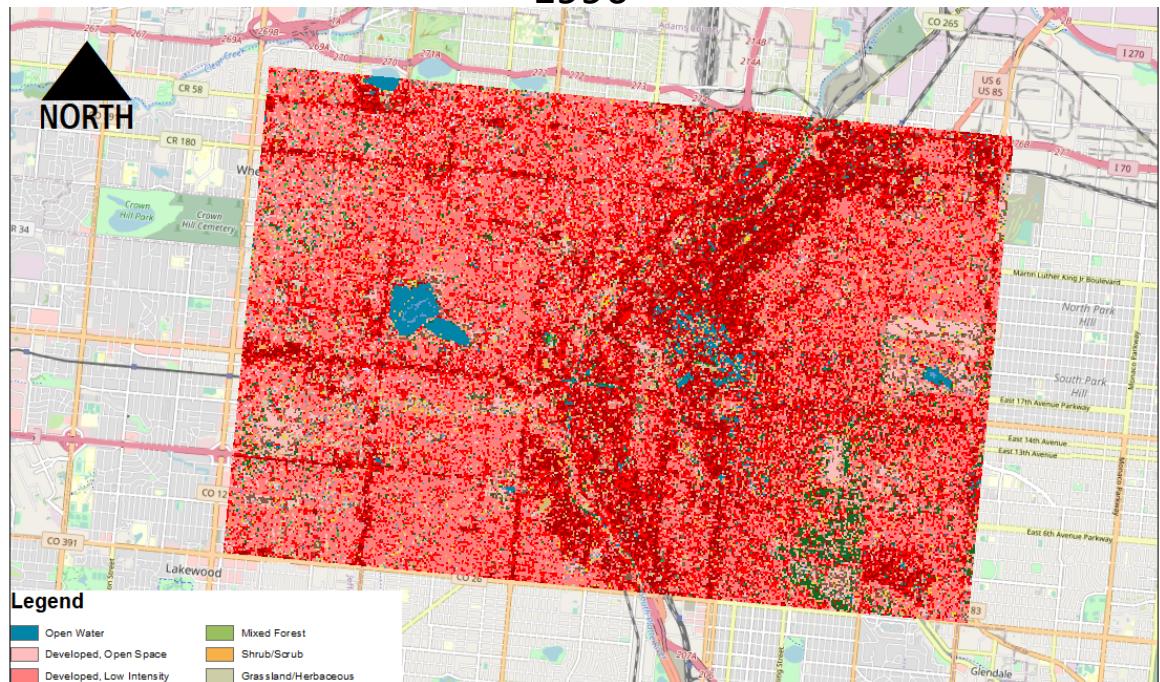
1986



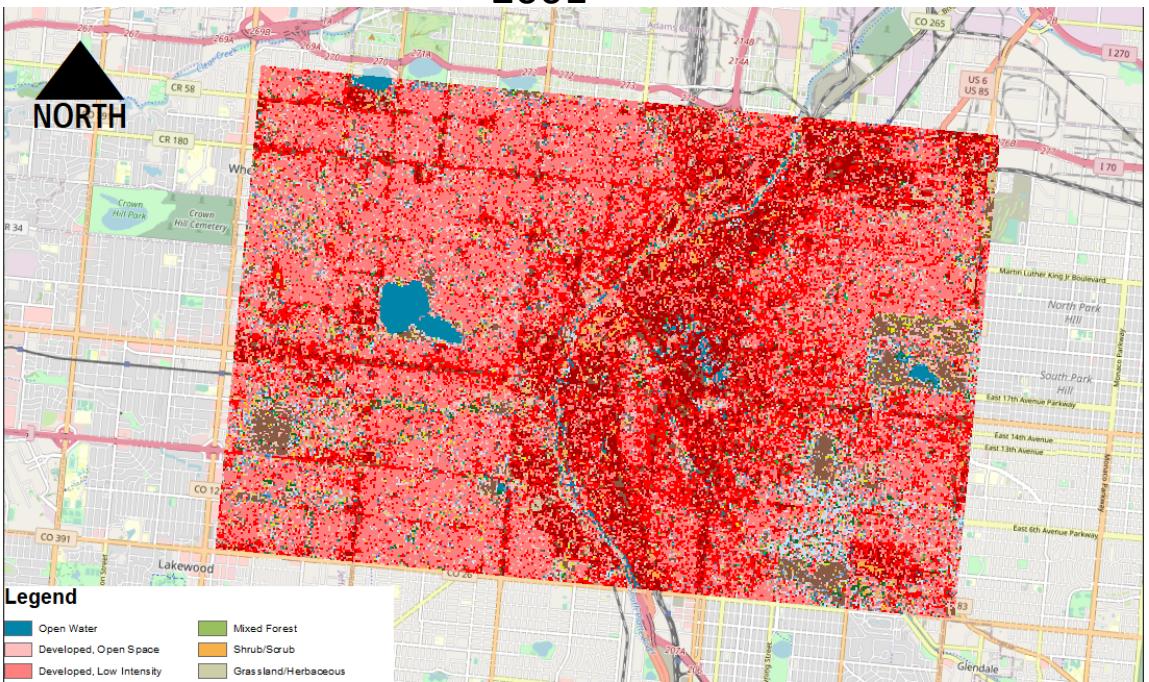
1991



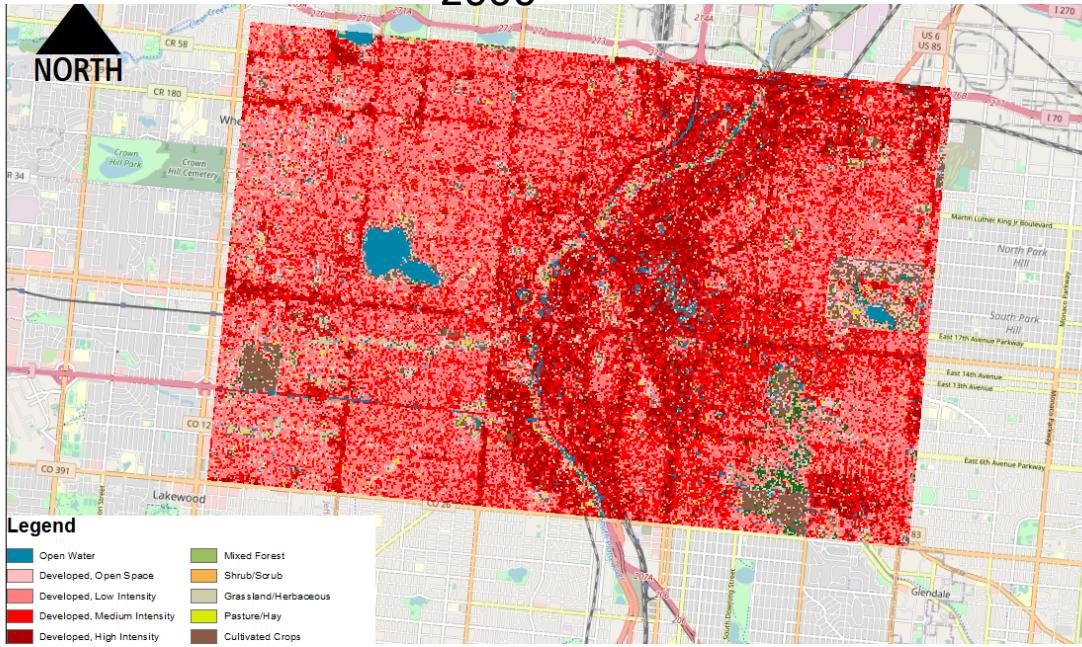
1996



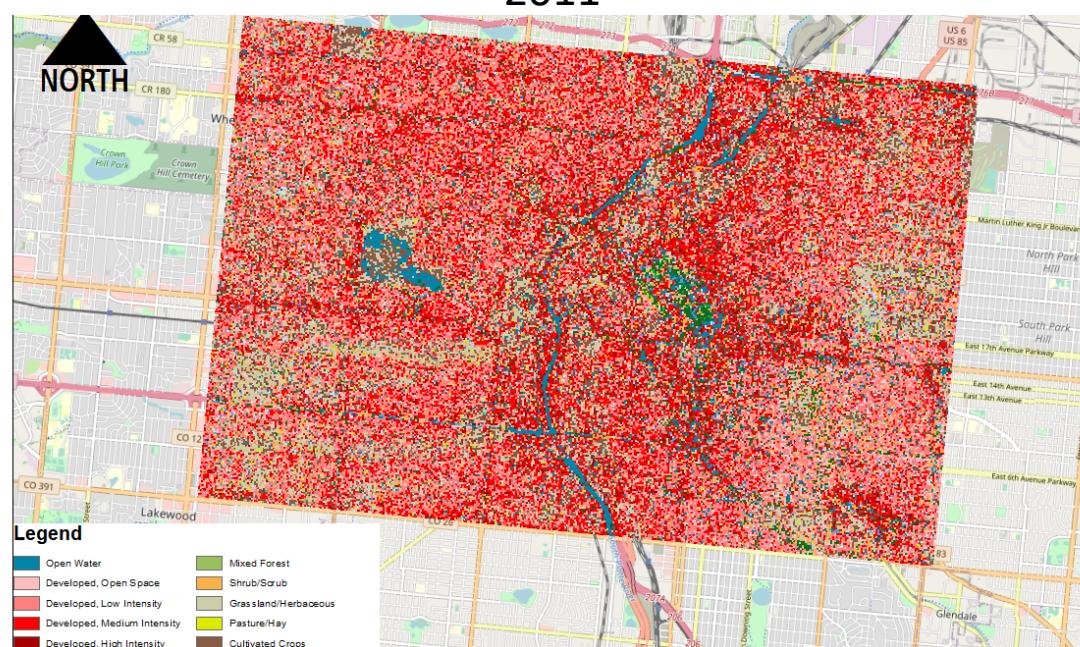
2001



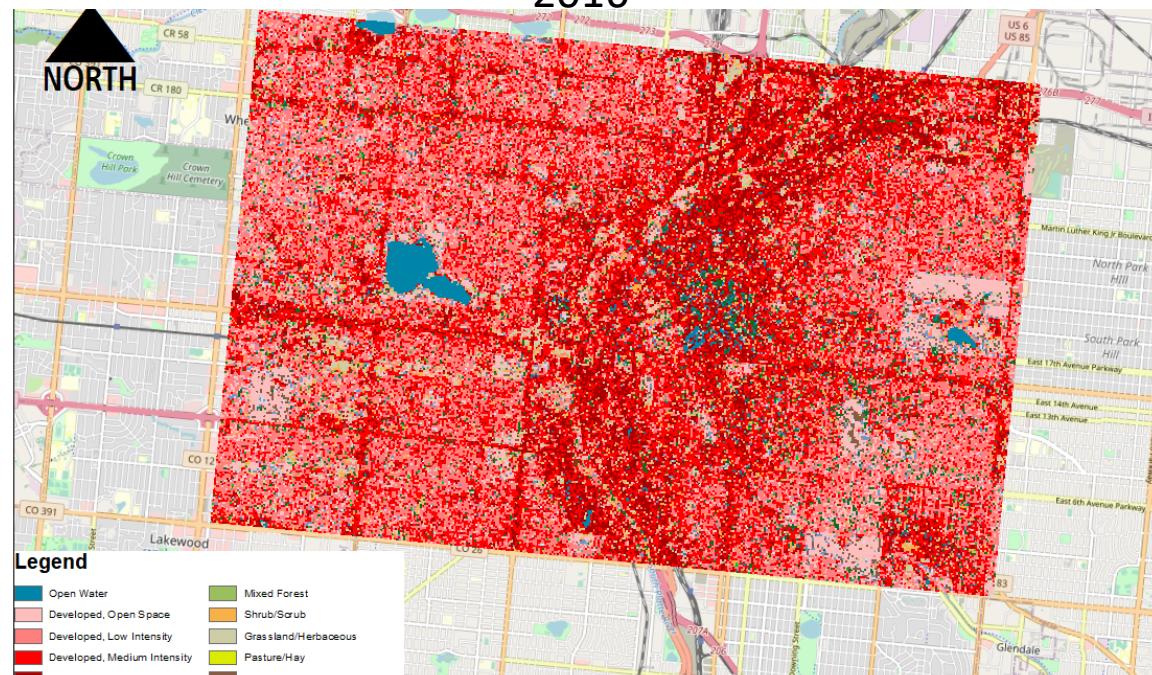
2006



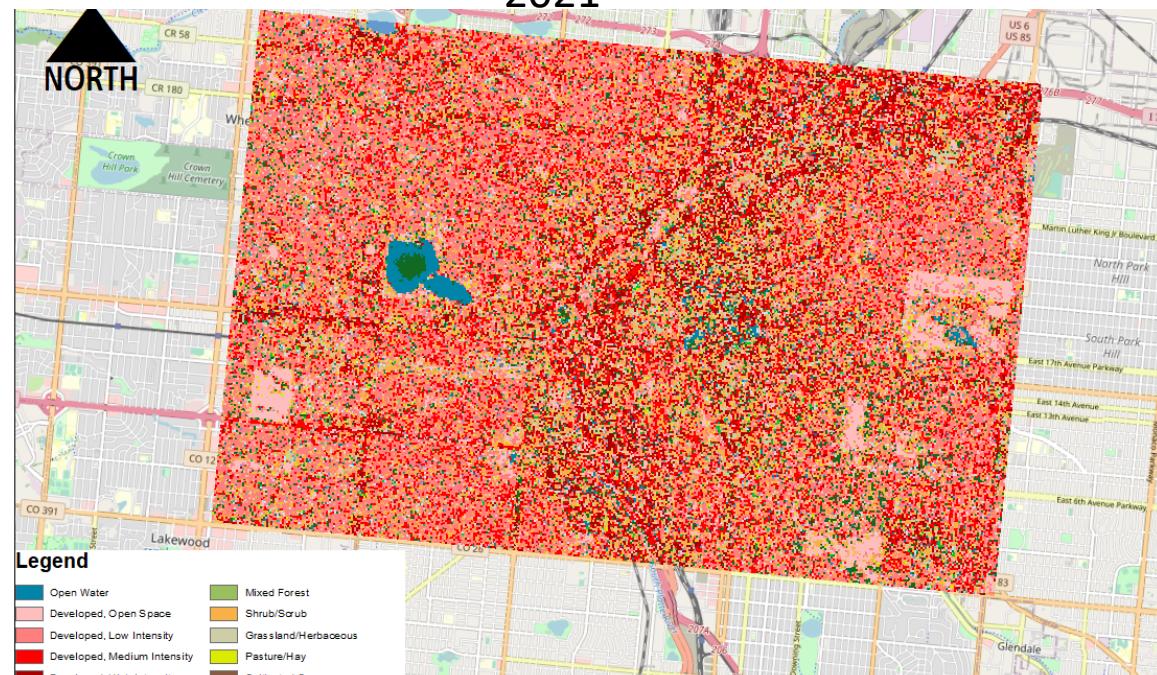
2011



2016



2021

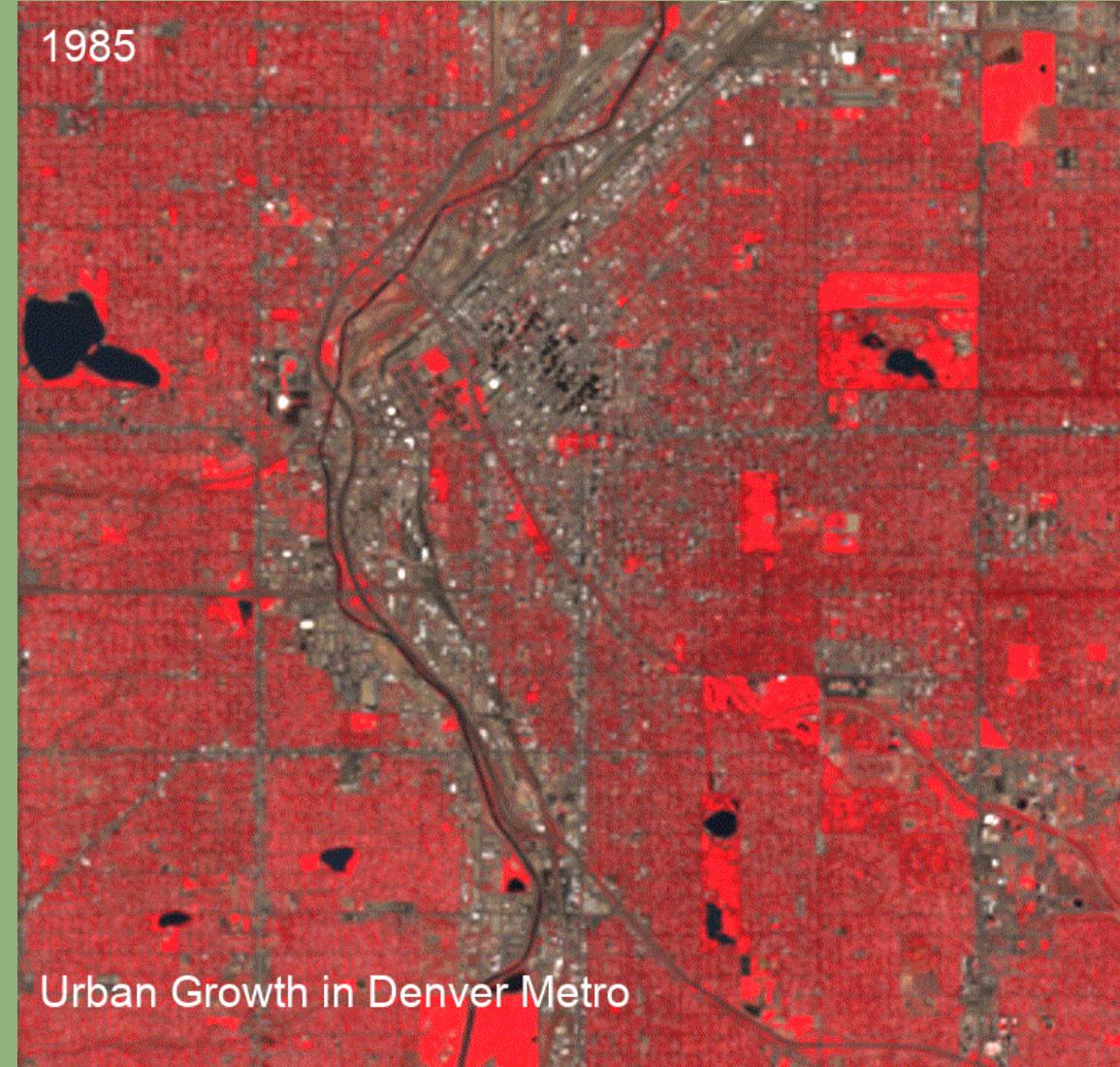


Change Detection

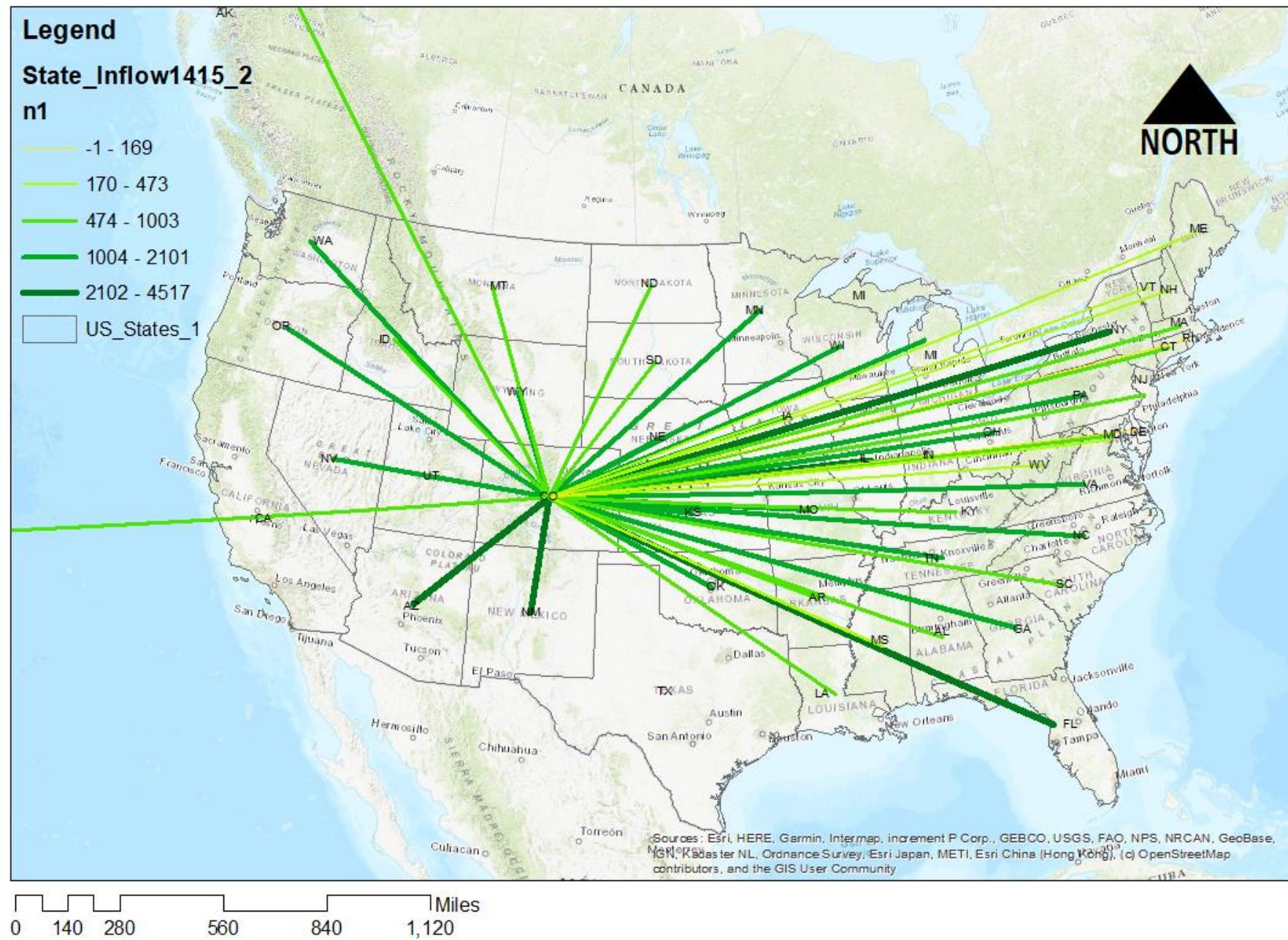
- Significant changes:
- Major increase in Medium & High Intensity Urban
- Increase in Barren Land
- Massive decrease in Pastures & Crop land

Value	Landcover	Count 1986:	Count 2001:	Count 2016:	Change from 1986-2016:	% Change '86-'16:	Change from 2001-2016:	% Change '01-'16:
11	Open Water	2329	1894	2015	314	-15.583127	-121	6.0049628
21	Developed, Open Space	6441	8133	9520	-3079	32.342437	-1387	14.569328
22	Developed, Low Intensity	40595	36218	31580	9015	-28.546548	4638	-14.68651
23	Developed, Medium Intensity	23945	26181	32326	-8381	25.926499	-6145	19.009466
24	Developed, High Intensity	10592	14595	13870	-3278	23.633742	725	-5.2271089
31	Barren Land (Rock/Sand/Clay)	99	78	256	-157	61.328125	-178	69.53125
41	Deciduous Forest	464	445	433	31	-7.1593533	12	-2.7713626
42	Evergreen Forest	1087	2298	3068	-1981	64.569752	-770	25.097784
43	Mixed Forest	6	1	7	-1	14.285714	-6	85.714286
52	Shrub/Scrub	2715	4485	3741	-1026	27.425822	744	-19.887731
71	Grassland/Herbaceous	3812	4496	3549	263	-7.4105382	947	-26.683573
81	Pasture/Hay	761	254	11	750	-6818.1818	243	-2209.0909
82	Cultivated Crops	6282	2842	941	5341	-567.58767	1901	-202.01913
90	Woody Wetland	2667	729	822	1845	-224.45255	-93	11.313869
95	Emergent Herbaceous Wetlands	1916	1062	1572	344	-21.882952	-510	32.442748

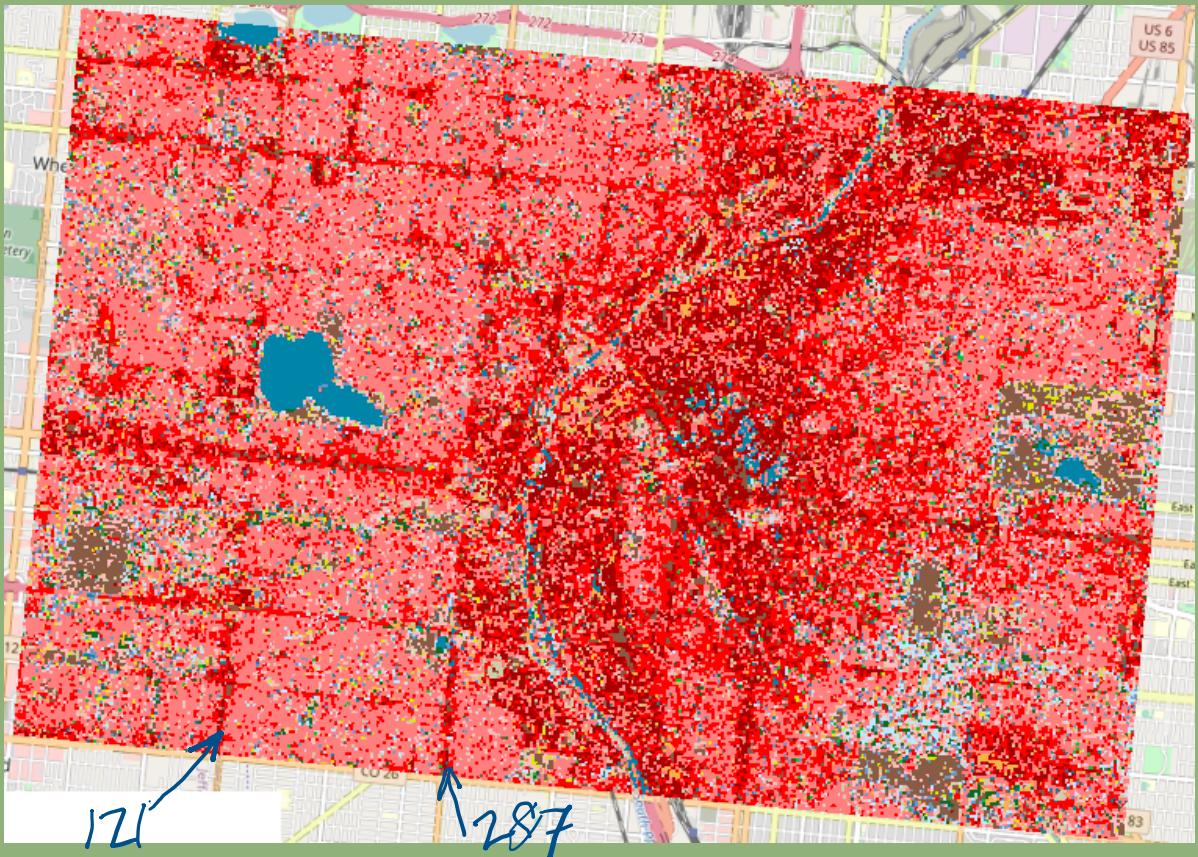
Time Series



Intra-US Migration to Colorado



1986



2016



- Major development along the Major Highways that run N-S
 - HWY 121 & 287

Conclusions:

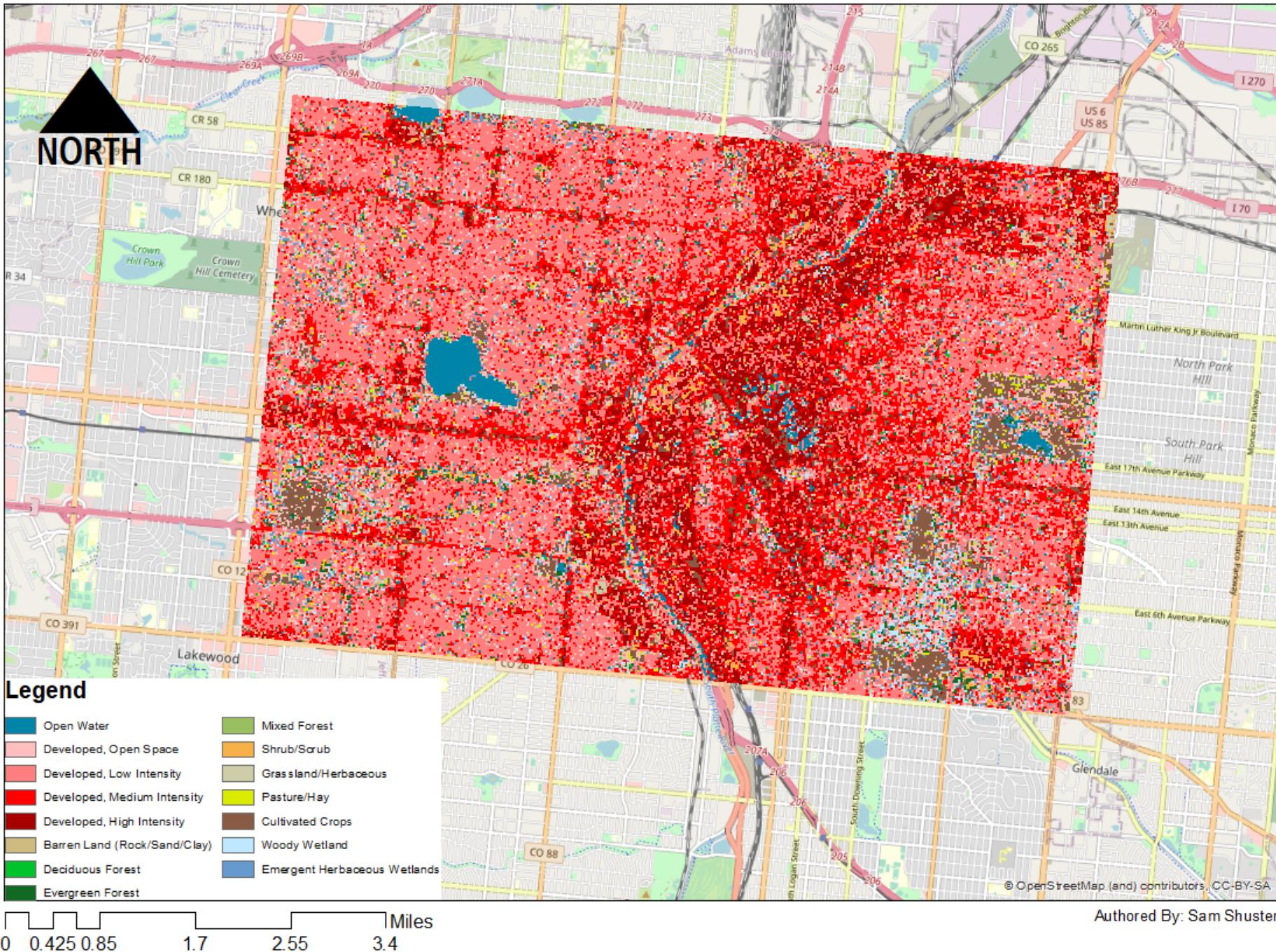
Denver has experienced a massive population explosion in the last decade due in large part to new legislation implementation.

There have been significant developments in the urban center – amounts of high-density housing and other large buildings have increased.

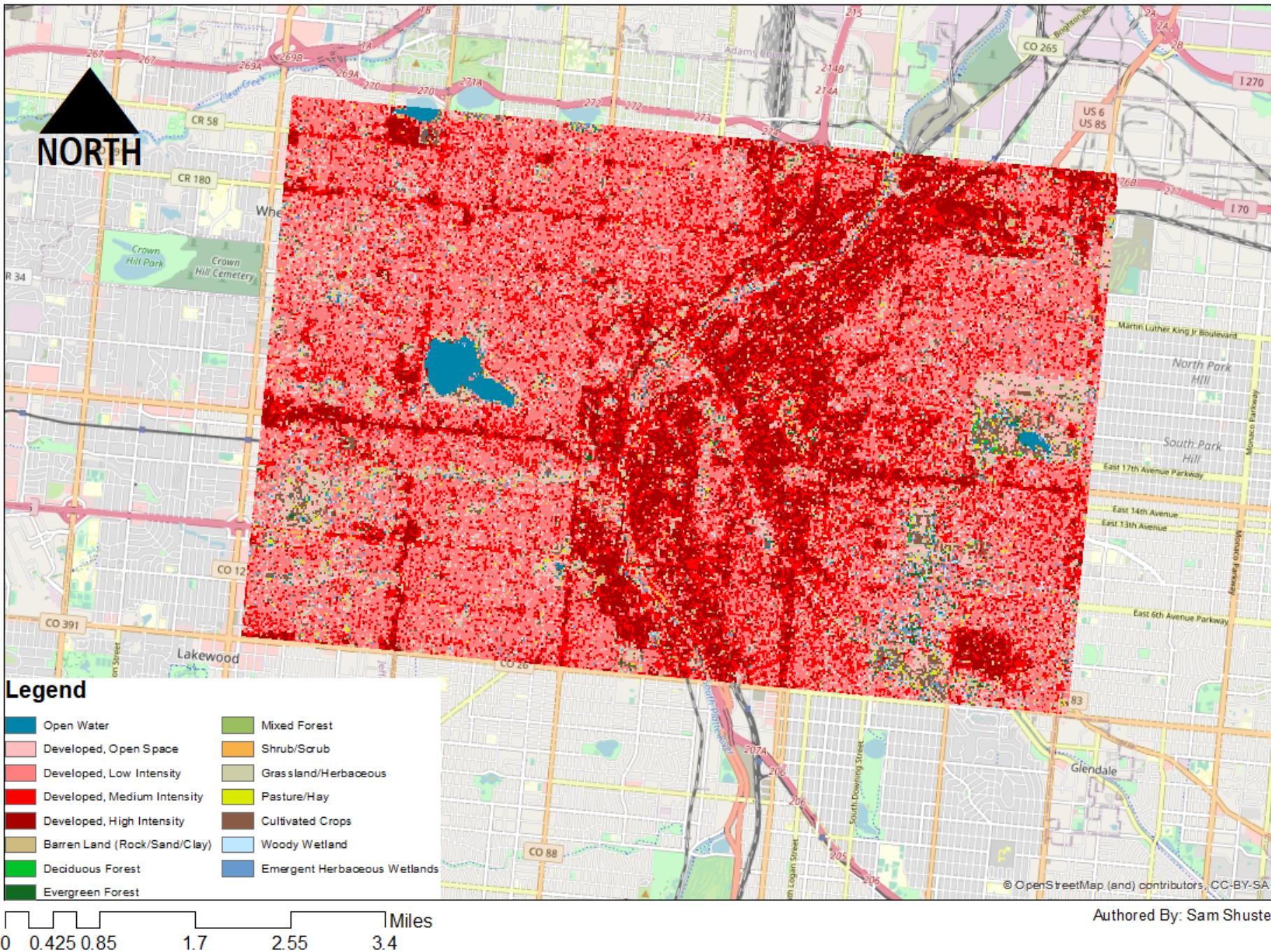
In future, accuracy assessment should be conducted in order to ensure the integrity and accuracy of the model.

Questions?

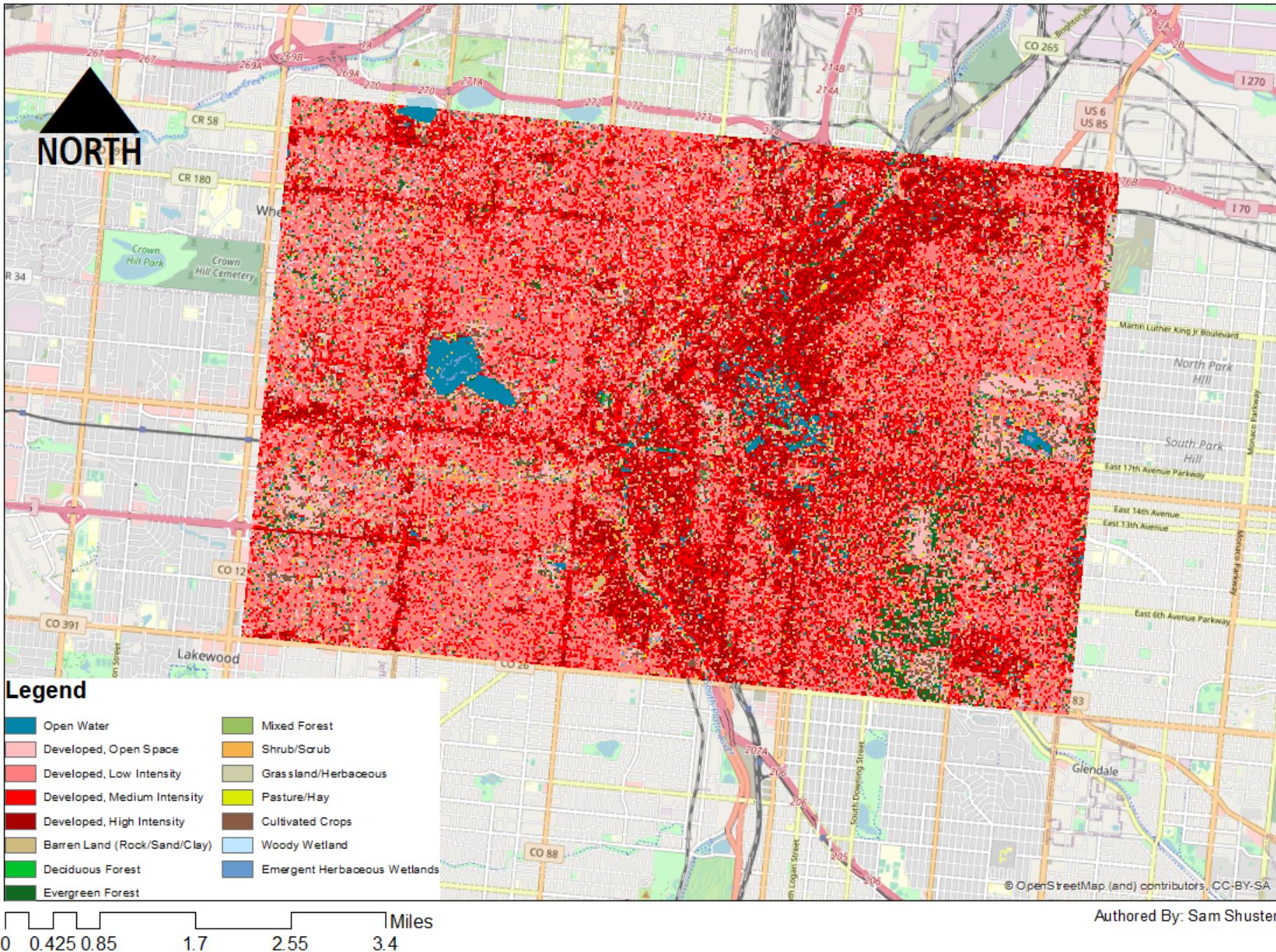
Landcover 1986



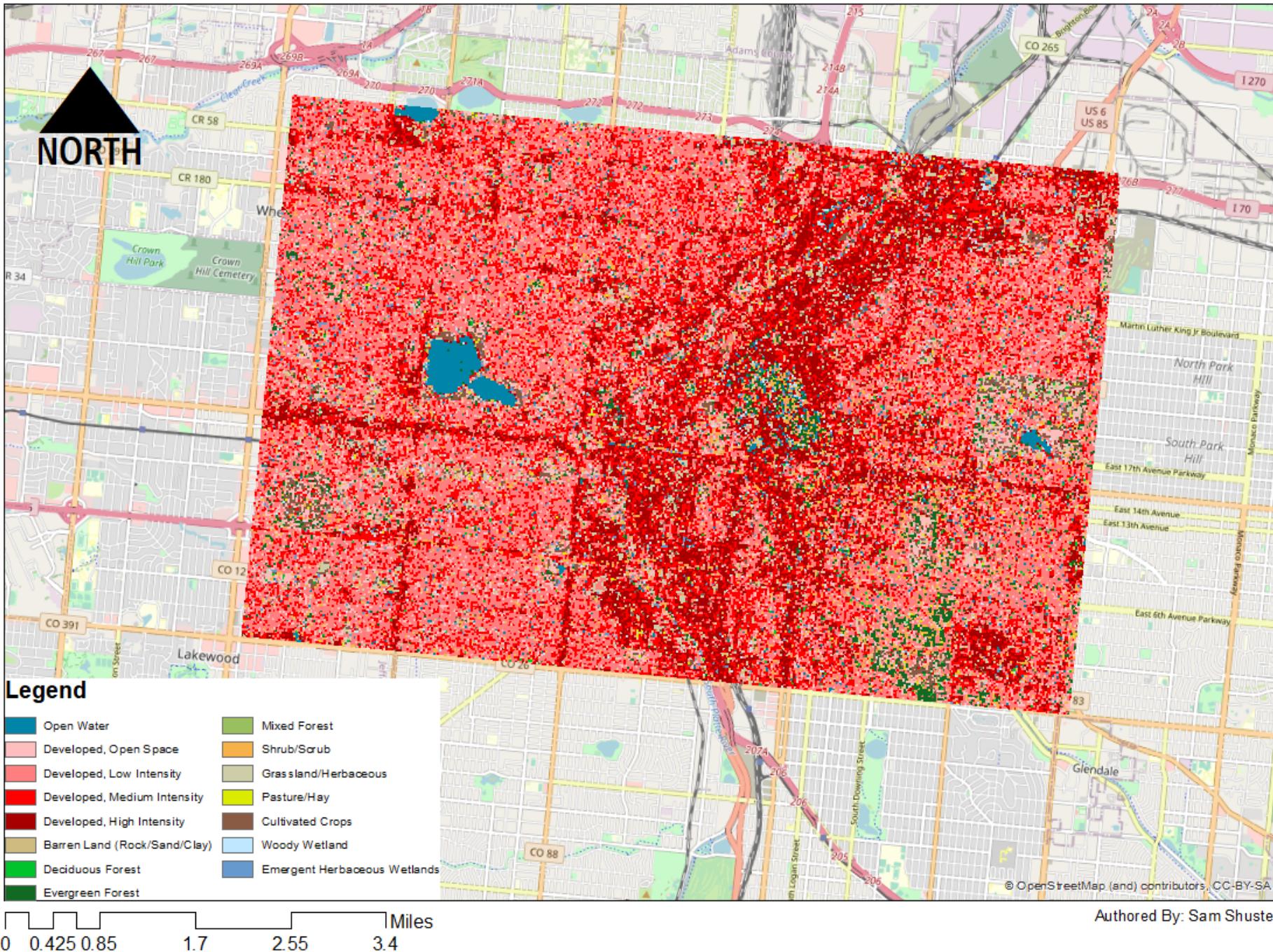
Landcover 1991



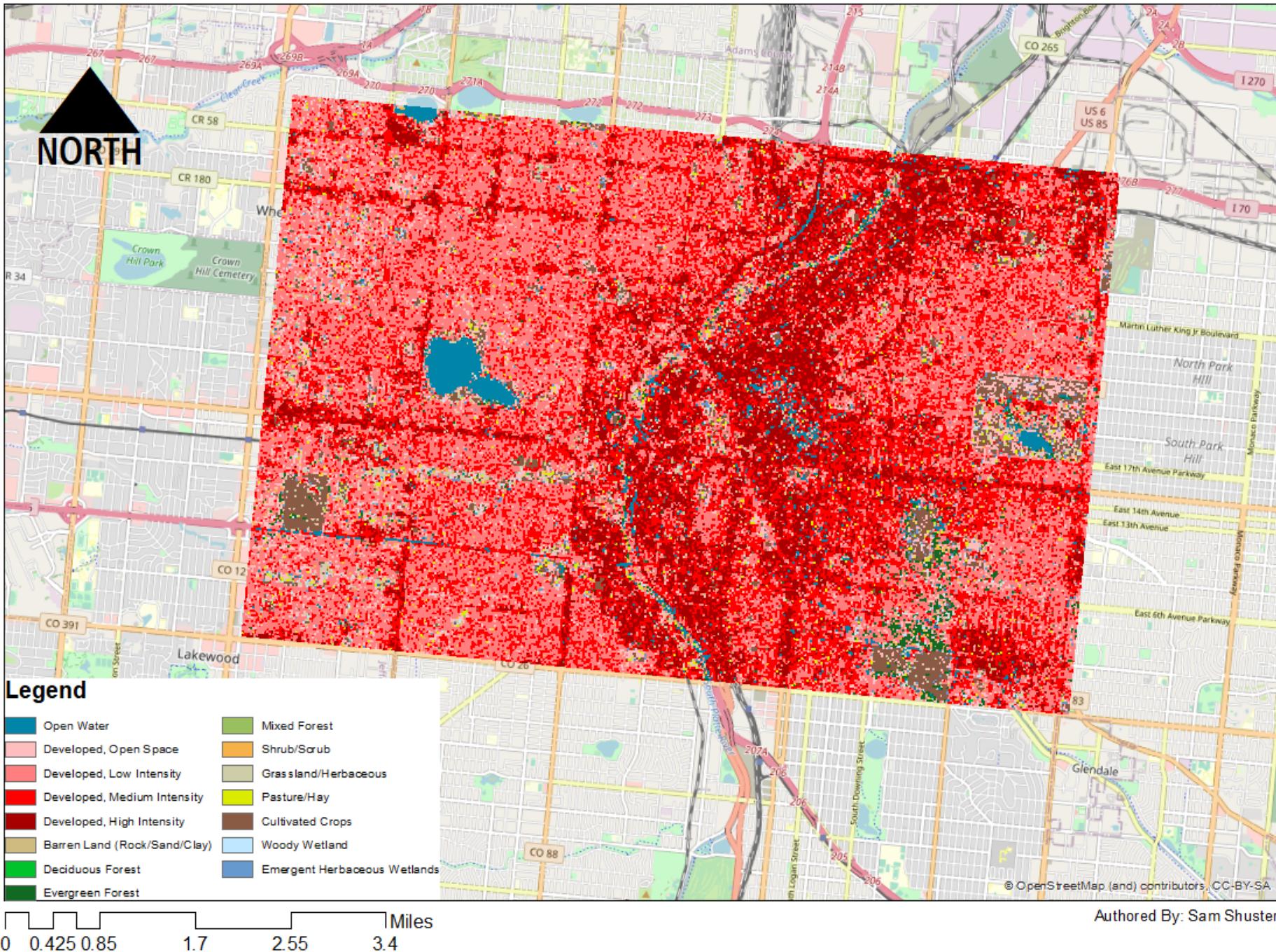
Landcover 1996



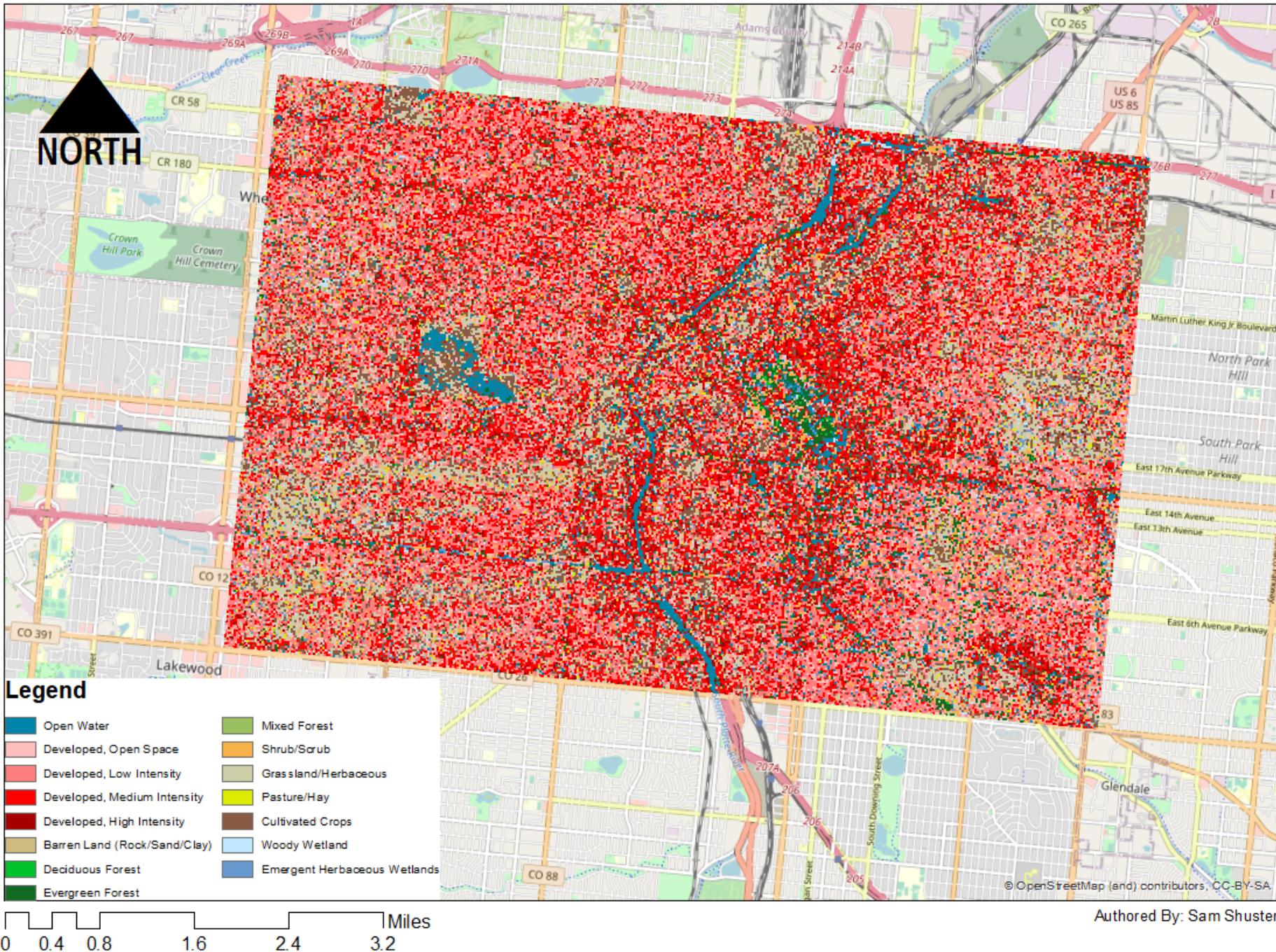
Landcover 2001



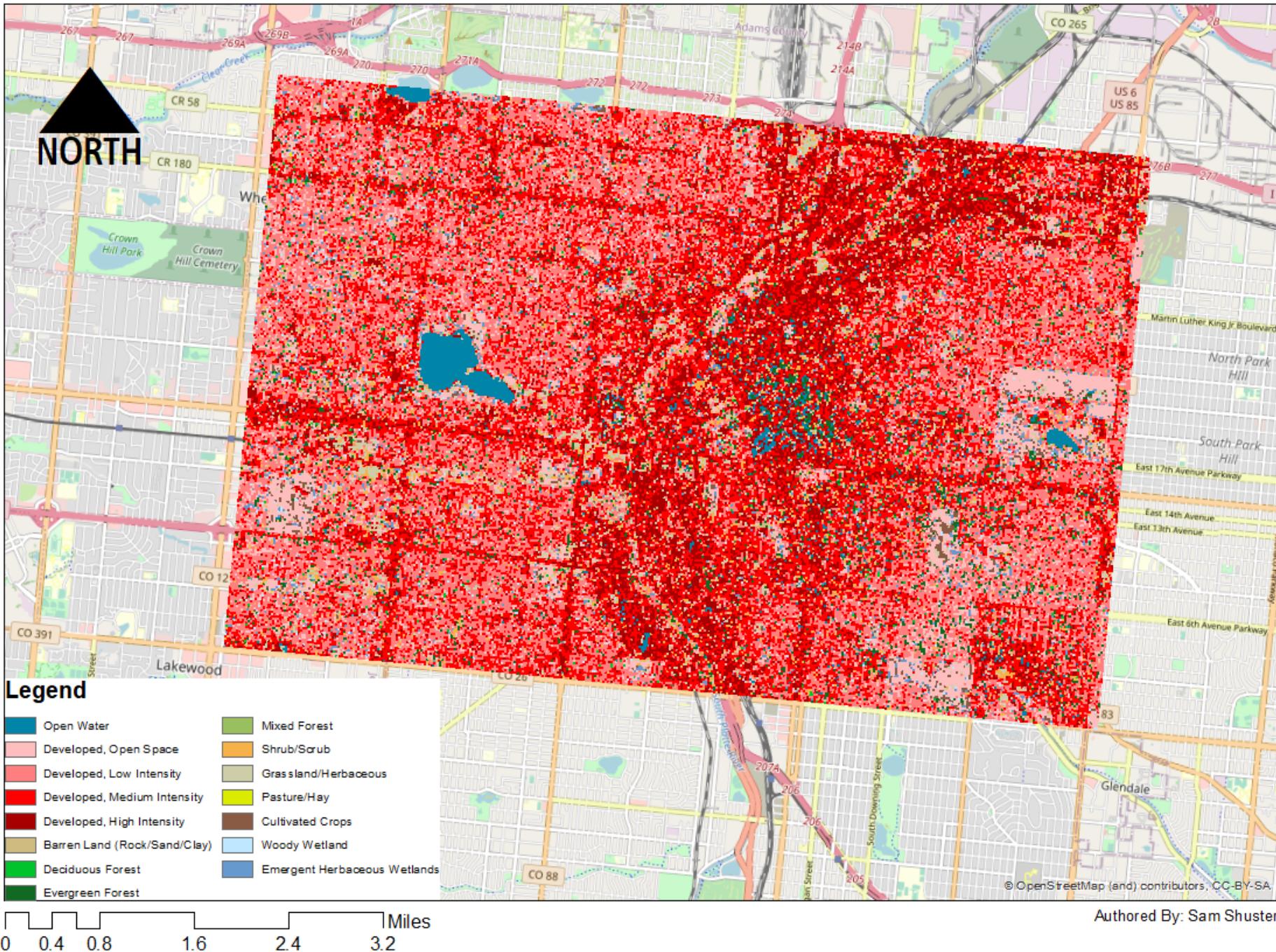
Landcover 2006



Landcover 2011



Landcover 2016



Landcover 2021

