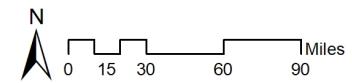
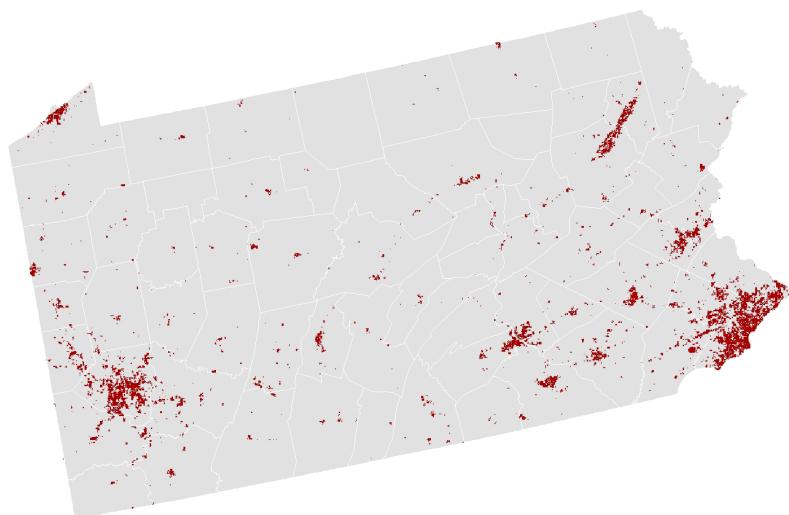


SPATIAL ANALYTICS FOR URBAN & ENVIRONMENTAL PLANNING

HOMEWORK 03
URBAN GROWTH/ENVIRONMENT PROTECTION

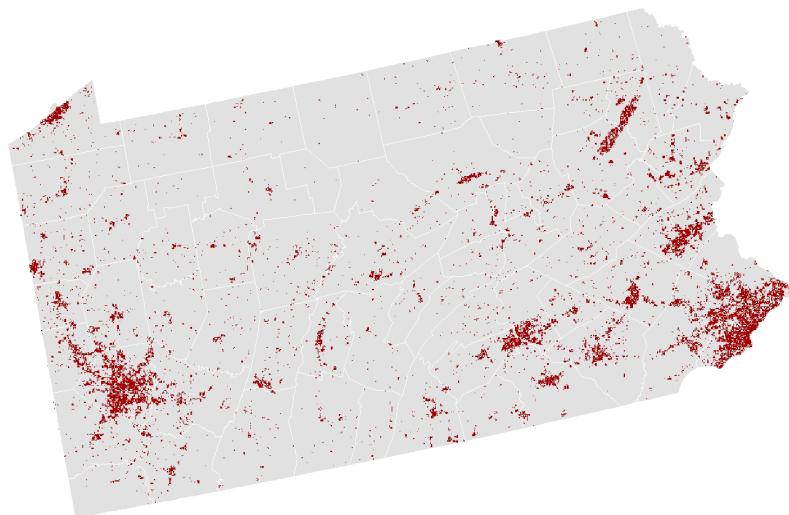
XIAOQI TANG

URBAN LOCATIONS CHANGE BETWEEN 1992 AND 2001



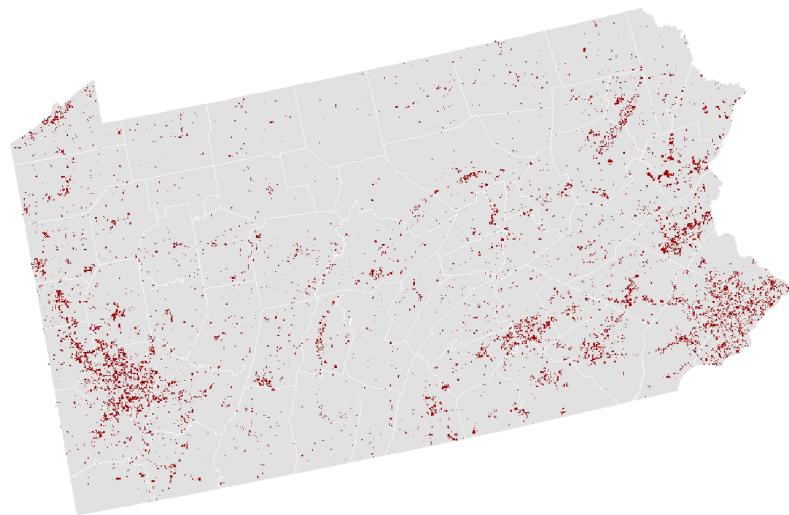
Urbanized locations in 1992

In 1992, the number of grid cells of urbanization is 10393.



Urbanized locations in 2001

In 2001, the number of grid cells of urbanization is 18255.



New urbanized locations between 1992 and 2001

Between 1992 and 2001, there are 12418 grid cells converted to urbanized location.

Urbanized Locations
 PA Counties

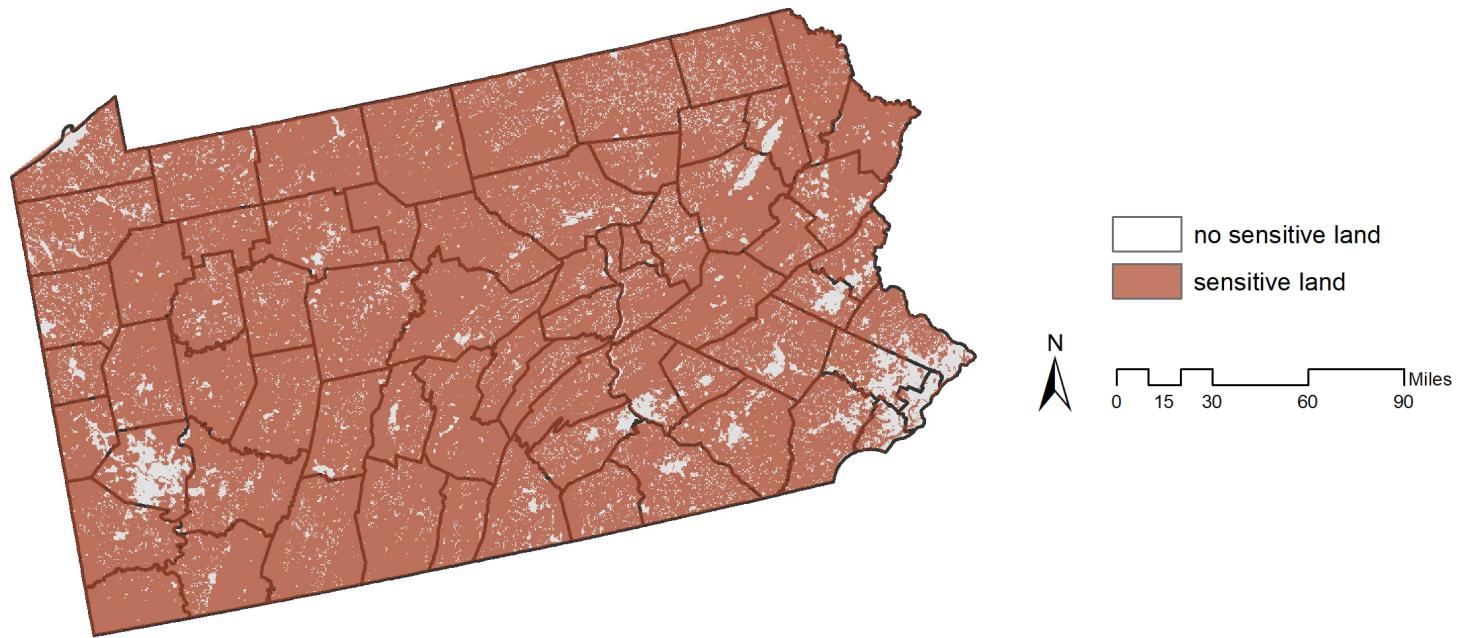
County Name	Population Change	Urban Land Change	Land Conversion Per Resident
York	58042	132	0.0023
Chester	53626	135	0.0025
Lancaster	52055	269	0.0052
Monroe	50065	385	0.0077
Bucks	38793	162	0.0042
Berks	36913	252	0.0068
Pike	30740	120	0.0039
Lehigh	27850	250	0.009
Cumberland	26529	186	0.007
Butler	26479	267	0.0101
Northampton	26018	183	0.007
Montgomery	24762	324	0.0131
Adams	23189	68	0.0029
Wayne	20068	75	0.0037
Centre	19168	174	0.0091
Clearfield	11549	151	0.0131
Lycoming	11148	148	0.0133
Carbon	10812	84	0.0078
Franklin	10485	169	0.0161
Huntingdon	9090	31	0.0034
Dauphin	8754	219	0.025
Union	8583	63	0.0073
Somerset	7903	58	0.0073
Cameron	7270	0	0
Susquehanna	7002	64	0.0091
Bradford	6691	74	0.0111
Columbia	6574	83	0.0126
Erie	5964	199	0.0334
Wyoming	5434	44	0.0081
Warren	5256	49	0.0093
Forest	5016	13	0.0026
Juniata	4797	21	0.0044
Crawford	4786	166	0.0347

County Name	Population Change	Urban Land Change	Land Conversion Per Resident
Fayette	4490	97	0.0216
Montour	4257	24	0.0056
Snyder	4215	61	0.0145
Sullivan	4180	11	0.0026
Mercer	4134	205	0.0496
Armstrong	4132	74	0.0179
Clinton	3883	52	0.0134
Lawrence	3585	167	0.0466
Schuylkill	3280	78	0.0238
Lebanon	2708	116	0.0428
Blair	2357	105	0.0445
Mifflin	2307	44	0.0191
Bedford	2264	47	0.0208
Elk	2086	26	0.0125
Greene	1902	39	0.0205
Venango	1855	84	0.0453
Perry	1743	46	0.0264
Potter	1698	12	0.0071
Tioga	1661	59	0.0355
Fulton	933	34	0.0364
Jefferson	918	80	0.0871
Delaware	697	-12	0.0172
McKean	353	39	0.1105
Northumberland	299	74	0.2475
Lackawanna	59	116	1.9661
Indiana	-111	59	0.5315
Clarion	-390	71	0.1821
Westmoreland	-4974	233	0.0468
Beaver	-5504	191	0.0347
Luzerne	-9359	135	0.0144
Washington	-10436	138	0.0132
Cambria	-12183	139	0.0114
Allegheny	-55123	652	0.0118
Philadelphia	-68940	-46	0.0007

This table illustrate (a) the amount of urban land conversion by county. (b) the amount of population growth by county. (c) the ratio of land conversion to per resident growth.

I have highlight those counties in my table that actually reduce population between 1990 and 2001. As we seen from the table, the most efficient land conversion is the **Lackawanna county**. The most inefficient is the **Cameron County**. Because the ratio stands for the land conversion per new resident, it will reflect the efficiency of the land development. Besides, this ratio reflects the reality of the development according to every individuals. So this ratio is very important, which represent the efficiency of land conversion per new resident.

THE SENSITIVE LANDS IN PA COUNTIES (1992)



The map shows the areas which are sensitive and not sensitive by using the raster calculator to combine the water, farm, pasture and the forest. The sensitive land means the area contains four of these areas(water, farm, pasture and the forest)

The total number of the sensitive land is the 369843.

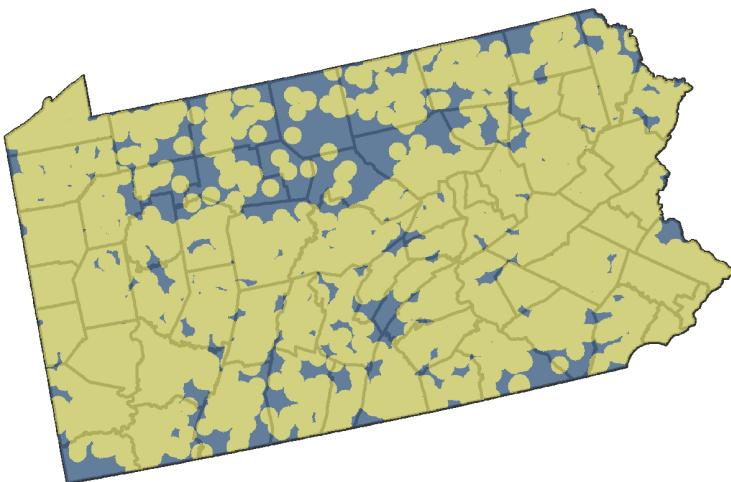
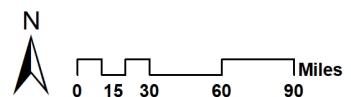
County Name	Amount of Sensitive Land	County Name	Amount of Sensitive Land	County Name	Amount of Sensitive Land	County Name	Amount of Sensitive Land
Montour	1207	Sullivan	4130	Mercer	6238	Warren	8203
Philadelphia	1308	Lackawanna	4243	Venango	6242	Clinton	8217
Delaware	1735	Northumberland	4370	Cambria	6334	Luzerne	8293
Union	2903	Montgomery	4459	Allegheny	6811	York	8329
Snyder	3028	Columbia	4470	Wayne	6854	McKean	8996
Lehigh	3180	Adams	4768	Chester	6946	Lancaster	8998
Lebanon	3316	Blair	4825	Franklin	7063	Bedford	9301
Lawrence	3318	Cumberland	5038	Schuylkill	7168	Westmoreland	9468
Northampton	3453	Perry	5085	Butler	7263	Crawford	9486
Carbon	3542	Dauphin	5094	Fayette	7296	Potter	9887
Juniata	3601	Pike	5182	Erie	7400	Somerset	9887
Cameron	3641	Greene	5289	Elk	7606	Centre	10152
Wyoming	3702	Clarion	5567	Susquehanna	7612	Tioga	10401
Mifflin	3786	Monroe	5652	Indiana	7630	Clearfield	10549
Forest	3948	Bucks	5679	Washington	7872	Bradford	10611
Fulton	4006	Jefferson	6000	Berks	7910	Lycoming	11364
Beaver	4057	Armstrong	6073	Huntingdon	8125	Total Number	414167

County Name	Developed Sensitive Lands	County Name	Developed Sensitive Lands
Cameron	3	Jefferson	62
Forest	8	Lackawanna	64
Sullivan	9	Pike	64
Potter	12	Northampton	66
Juniata	16	Somerset	67
Montour	18	Franklin	71
Wyoming	23	Cumberland	72
Elk	23	Lehigh	73
Union	25	Blair	82
Fulton	28	Delaware	83
Adams	32	Cambria	88
Snyder	33	Chester	89
Mifflin	33	York	91
McKean	34	Fayette	91
Greene	34	Erie	92
Susquehanna	36	Crawford	92
Clinton	36	Schuylkill	92
Huntingdon	37	Mercer	94
Philadelphia	42	Luzerne	94
Warren	44	Bucks	94
Northumberland	44	Dauphin	97
Clarion	45	Centre	99
Tioga	46	Lawrence	100
Columbia	46	Berks	113
Perry	48	Beaver	118
Indiana	50	Clearfield	123
Wayne	51	Butler	124
Bedford	51	Washington	132
Armstrong	55	Montgomery	132
Bradford	57	Monroe	141
Lycoming	58	Lancaster	149
Lebanon	59	Westmoreland	178
Carbon	61	Allegheny	285
Venango	62	Total Number	4677

This table is the developed sensitive land. From the table, we can easily find the Allegheny is the County which has recent urban growth was most threatening to sensitive lands in 1992.

Also the total number of the grid cells that were sensitive lands developed upon in 2001 is the 4677.

FUTURE URBANIZATION INDEX FACTORS

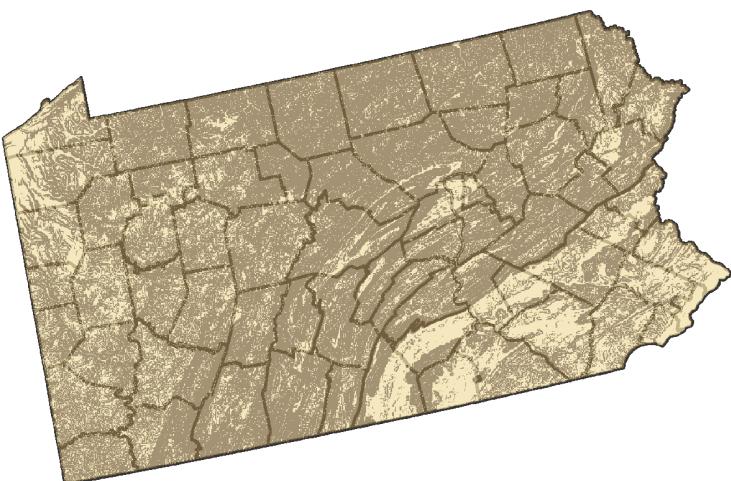


Factor 1 (Weight: 4)

Within 6km of urban development in 2001 in PAcounties

Existing Urban Development

- [Blue square] not within 6km
- [Yellow square] within 6km

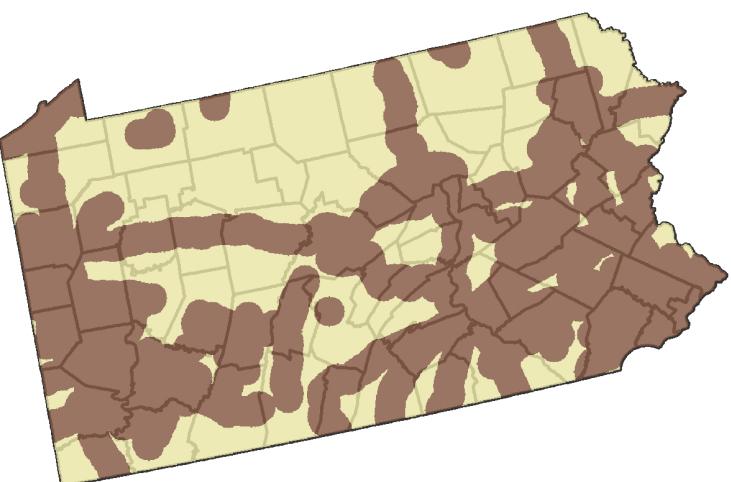


Factor2 (Weight: 3)

slope less than 2% grade in 2001 in PAcounties

Slope

- [Brown square] slope > 2%
- [Yellow square] slope \leq 2%



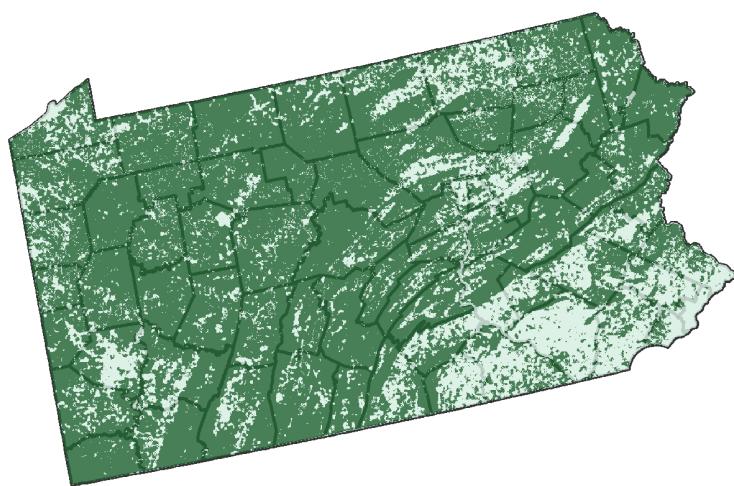
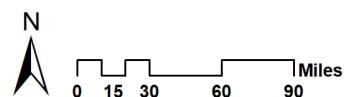
Factor3 (Weight: 2)

within 10KM of 4-lane highways in 2001 in PAcounties

4-Lane Highway

- [Yellow square] not within 10km
- [Brown square] within 10km

ENVIRONMENTAL SENSITIVITY INDEX FACTORS

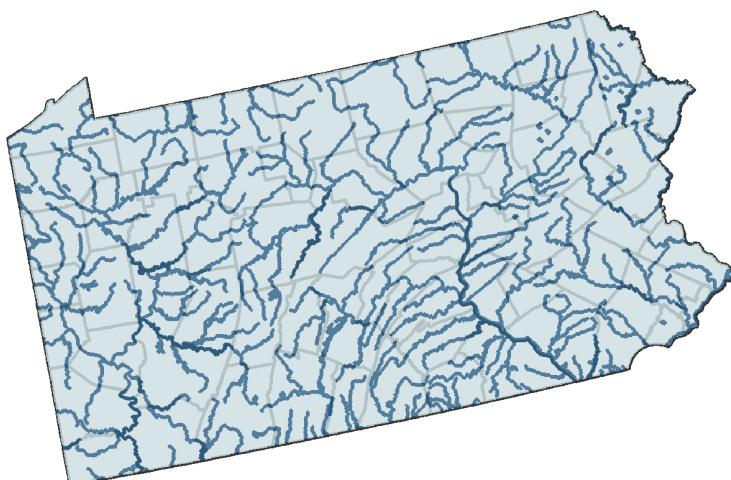


Factor 1 (Weight: 2)

Active farm and forest use in 2001 in PA counties

Farm and Forest

- non farm and forest
- farm and forest

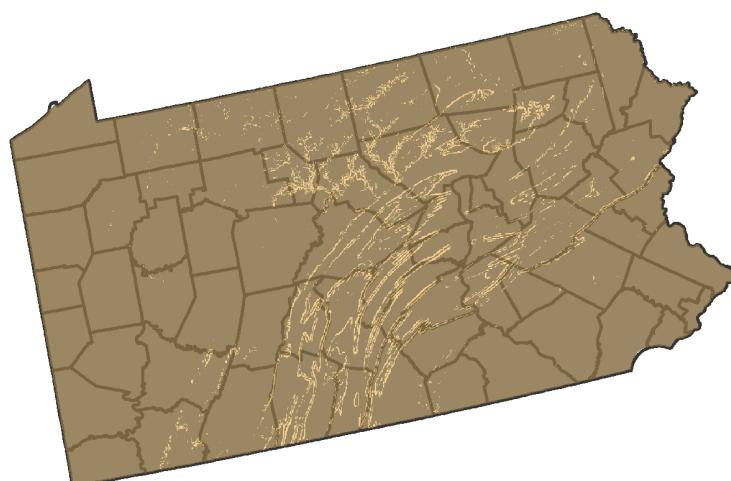


Factor2 (Weight: 3)

Undeveloped sites within 1000 meters of river in 2001 in PA counties

Rivers

- not within 1 km
- within 1km



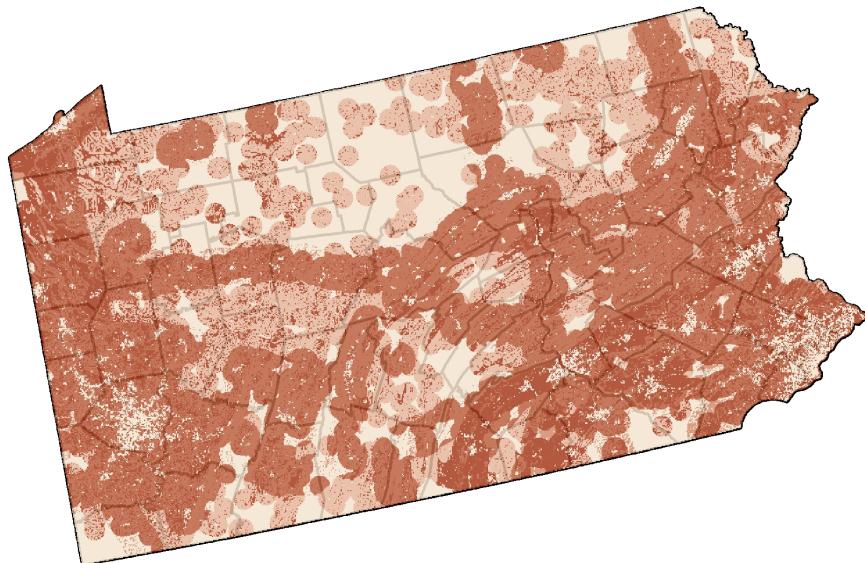
Factor3 (Weight: 4)

Hillsides with slopes of 15% or more in 2001 in PA counties

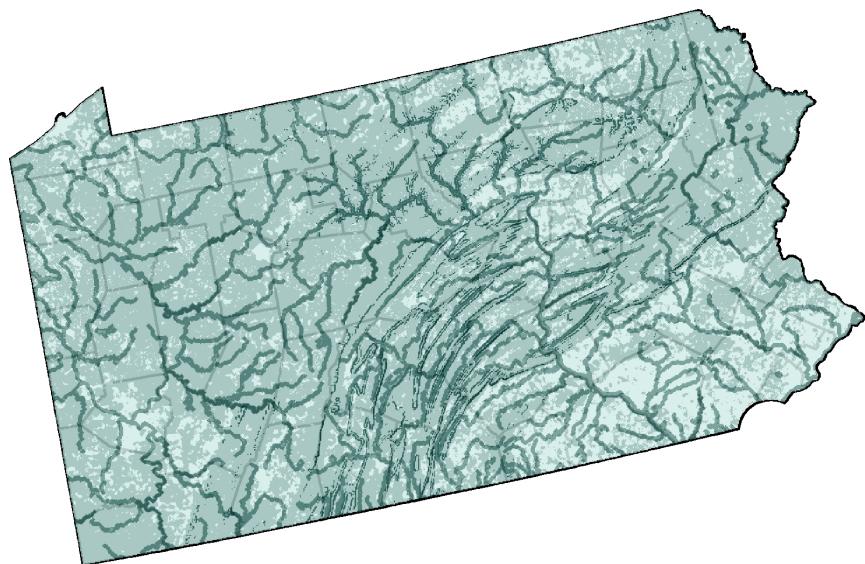
Slope

- slope < 15%
- slope ≥ 15%

FUTURE URBANIZATION INDEX MAP



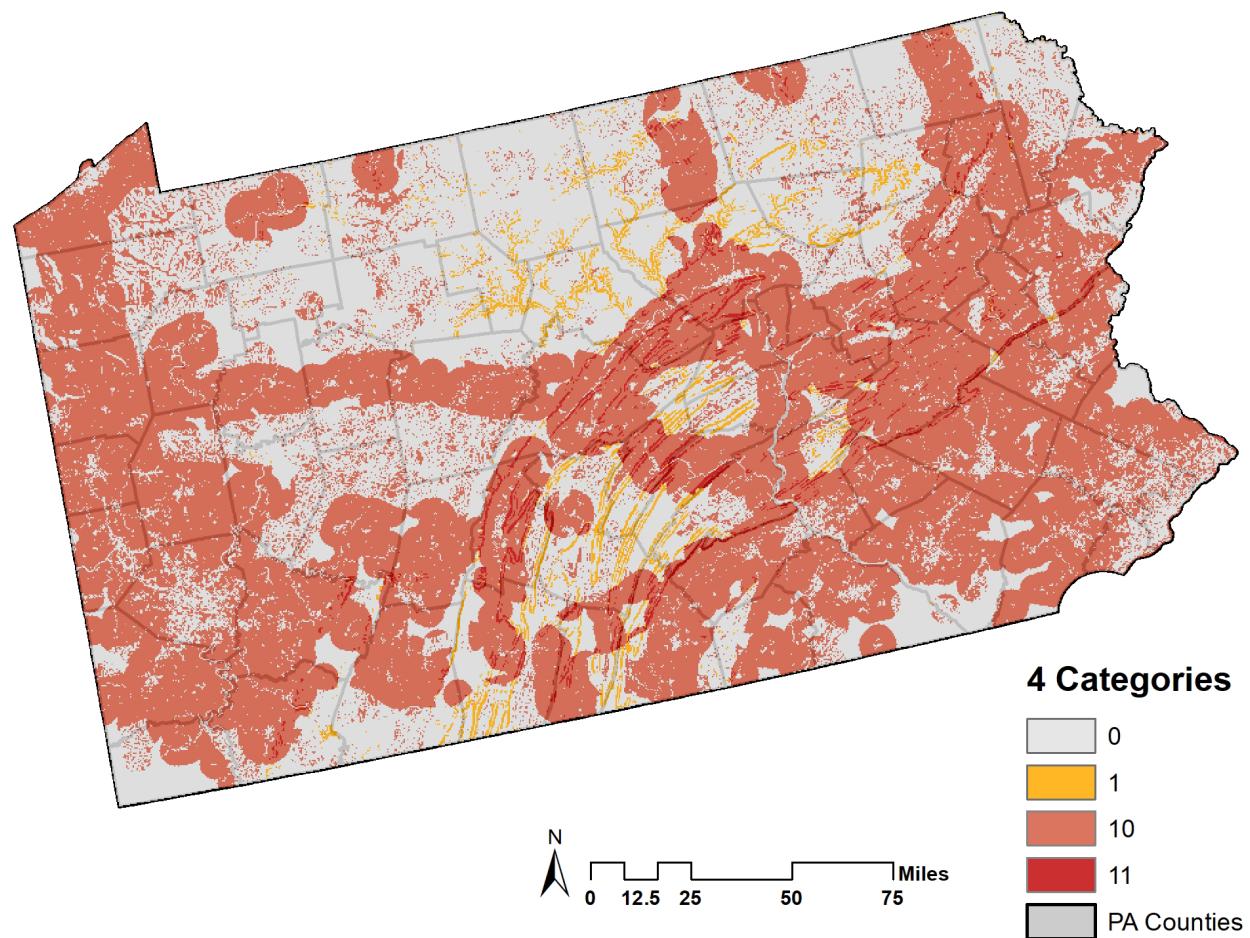
ENVIRONMENTAL SENSITIVITY INDEX MAP



The own weight of my decision factor for Final Environmental Sensitivity Index Map
(1) In active farm and forest use(weight for 4); (2) unenveloped sites within 1000 meters of rivers(-weight for 2); (3) hillsides with slopes of 15% or more (weight for 3)

I used the **raster calculator** (Farm and forest use*2+rivers*3+hillside slope*4).

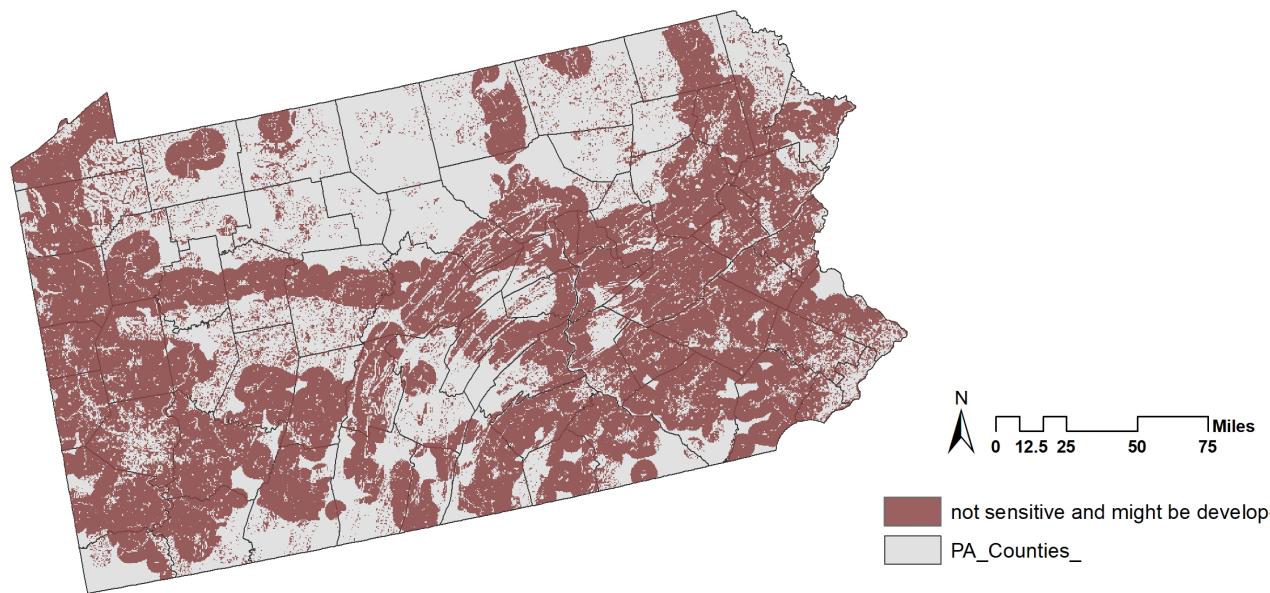
FOUR CATEGORIES OF ENVIRONMENT SENSITIVITY INDEX AND FUTURE URBANIZATION MAP



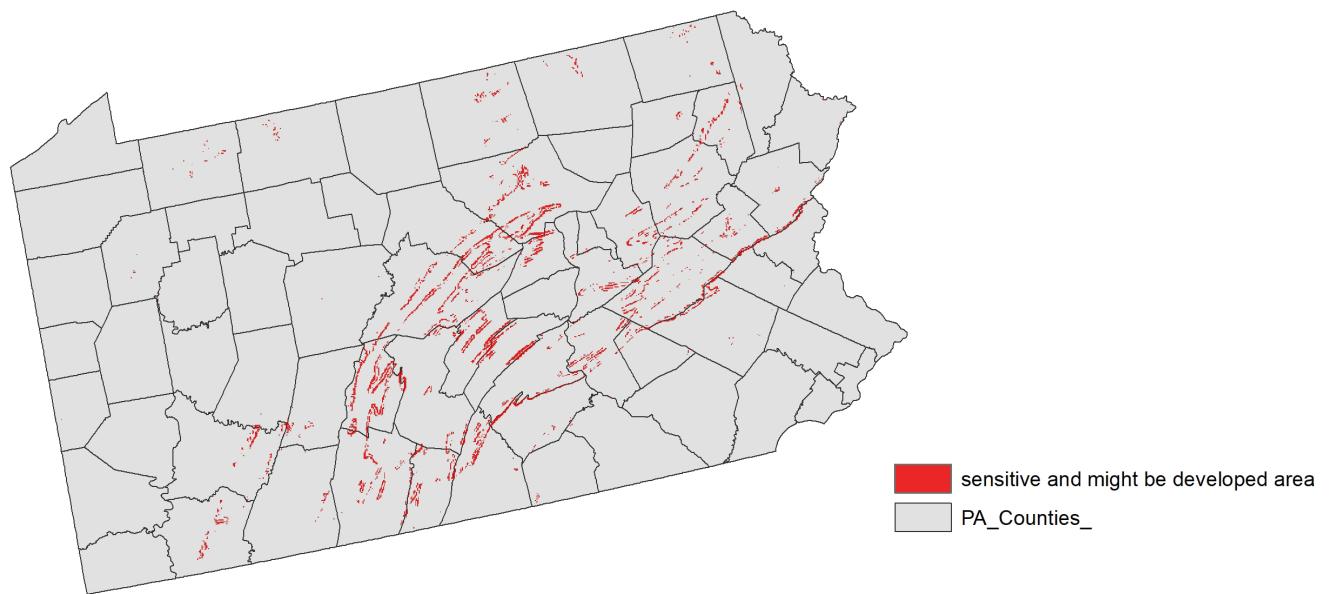
The four categories stands for:

- (0) -Area not environmentally sensitive And might not be developed.
- (1) -Area that are environmentally sensitive And might not be developed.
- (10)-Area that are not sensitive And might be developed.
- (11)-Area that are sensitive And might be developed.

NOT ENVIRONMENTALLY SENSITIVE AND MIGHT BE DEVELOPED AREA



ENVIRONMENTALLY SENSITIVE AND MIGHT BE DEVELOPED AREA



According to this two maps.

The map above shows the area which are suitable for development and not sensitive.

The map below shows the area which are not suitable for development, due to the environmental sensitive.

The trend for the development we can see from the above map is mainly located in the eastern part of PA counties. The trend for the undevelopment we can see from the below map is mainly located in the western and central part of the PA counties.