

## Homework 3 - Environmental Planning

MUSA 507

Spatial Analysis for Urban & Environmental Planning

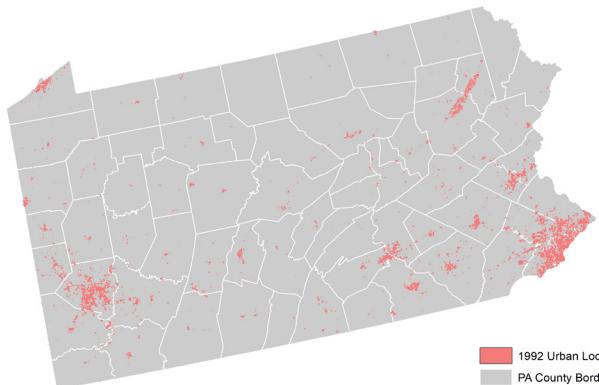
Jiaxin, WU

# Urban Locations

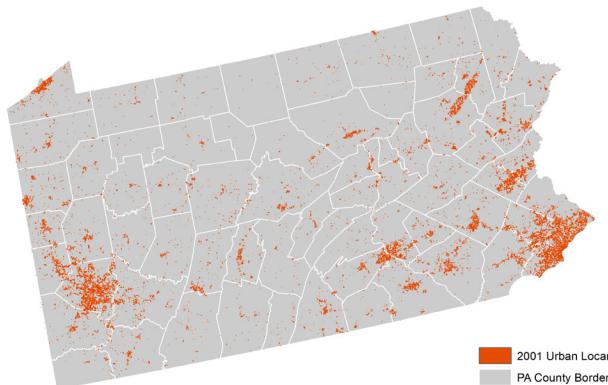


0 10 20 40 60 80 Miles

1992 Urban Locations

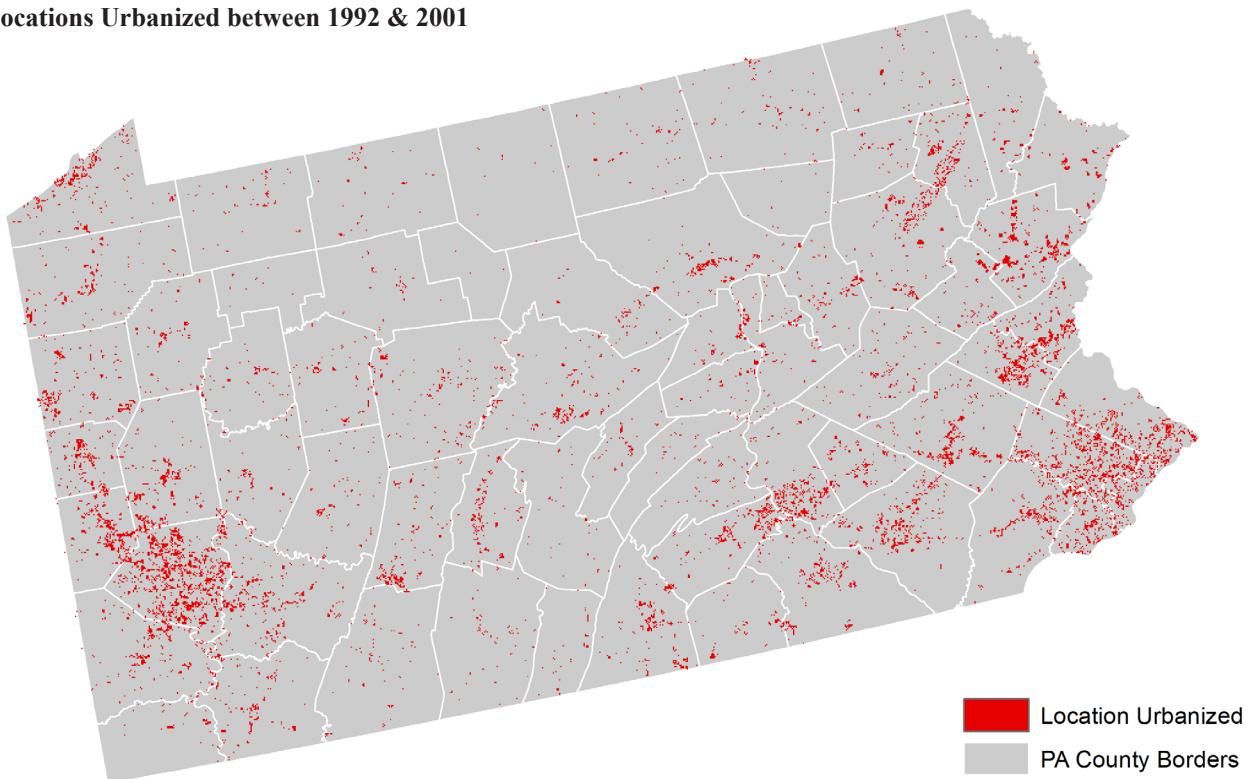


2001 Urban Locations



0 10 20 40 60 80 Miles

Locations Urbanized between 1992 & 2001



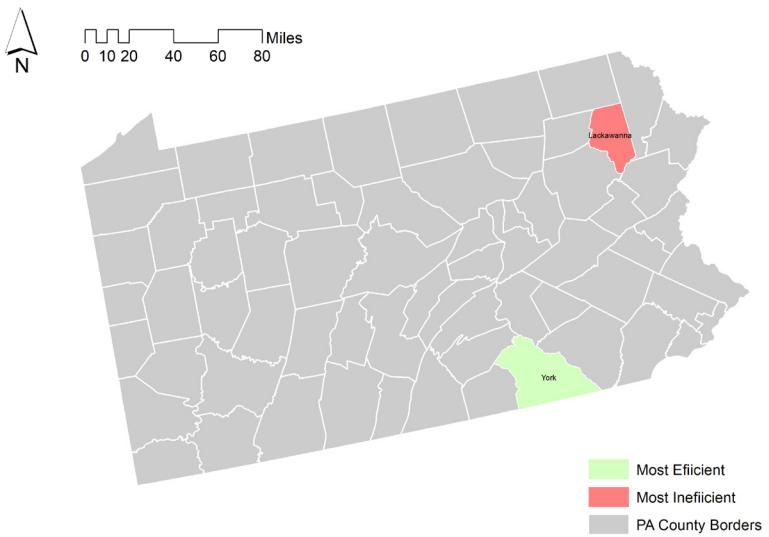
The number of grid cells newly converted to urban in 2001 is **12418**.

# Land Conversion, Population Growth & Their Ratio

The most efficient county is York County, whose population increased 58042 with 132 grid cells of land conversion. The urbanization process brought about large number of population increase efficiently.

By contrast, the most inefficient county is Lackawanna County, whose population increase remained almost still, while urban locations expanded 116 grid cells. It means it has notable urban sprawl with low density yet.

## Locations of Most Efficient & Inefficient Counties

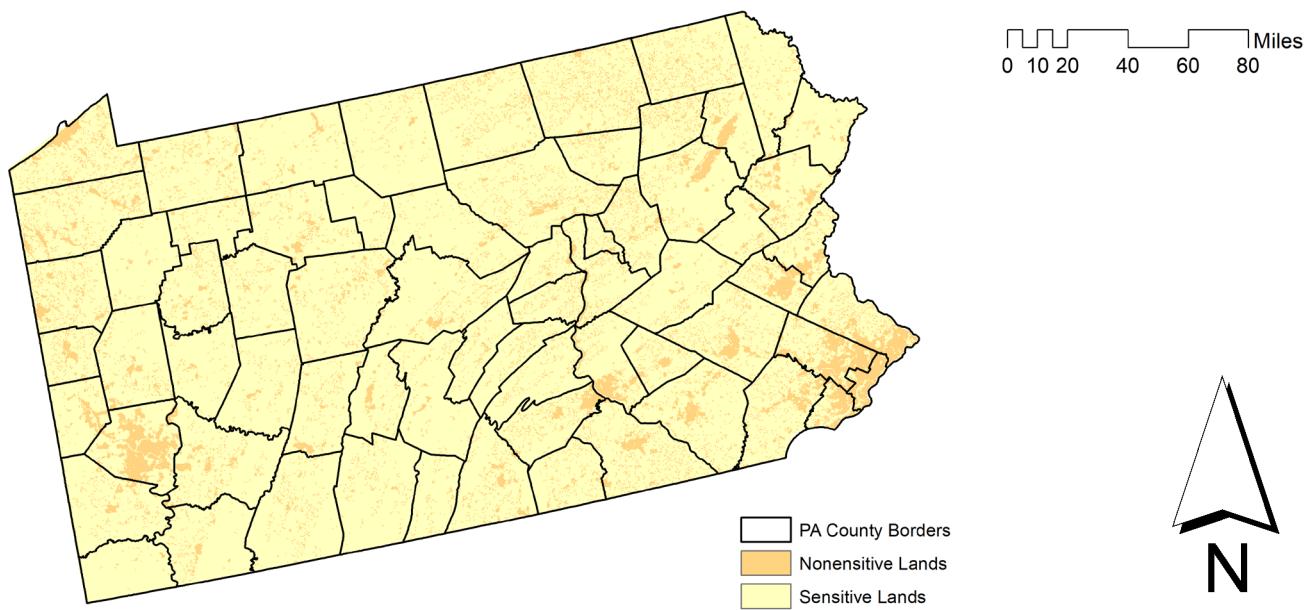


County Name	Land Conv	Pop Growth	Ratio (L to P)
Philadelphia	-46	-68940	0.1%
Delaware	-12	697	-1.7%
Cameron	0	7270	0.0%
Sullivan	11	4180	0.3%
Potter	12	1698	0.7%
Forest	13	5016	0.3%
Juniata	21	4797	0.4%
Montour	24	4257	0.6%
Elk	26	2086	1.2%
Huntingdon	31	9090	0.3%
Fulton	34	933	3.6%
Greene	39	1902	2.1%
McKean	39	353	11.0%
Wyoming	44	5434	0.8%
Mifflin	44	2307	1.9%
Perry	46	1743	2.6%
Bedford	47	2264	2.1%
Warren	49	5256	0.9%
Clinton	52	3883	1.3%
Somerset	58	7903	0.7%
Indiana	59	-111	-53.2%
Tioga	59	1661	3.6%
Snyder	61	4215	1.4%
Union	63	8583	0.7%
Susquehanna	64	7002	0.9%
Adams	68	23189	0.3%
Clarion	71	-390	-18.2%
Bradford	74	6691	1.1%
Armstrong	74	4132	1.8%
Northumberland	74	299	24.7%
Wayne	75	20068	0.4%
Schuylkill	78	3280	2.4%
Jefferson	80	918	8.7%
Columbia	83	6574	1.3%

County Name	Land Conv	Pop Growth	Ratio (L to P)
Carbon	84	10812	0.8%
Venango	84	1855	4.5%
Fayette	97	4490	2.2%
Blair	105	2357	4.5%
Lebanon	116	2708	4.3%
Lackawanna	116	59	196.6%
Pike	120	30740	0.4%
York	132	58042	0.2%
Luzerne	135	-9359	-1.4%
Chester	135	53626	0.3%
Washington	138	-10436	-1.3%
Cambria	139	-12183	-1.1%
Lycoming	148	11148	1.3%
Clearfield	151	11549	1.3%
Bucks	162	38793	0.4%
Crawford	166	4786	3.5%
Lawrence	167	3585	4.7%
Franklin	169	10485	1.6%
Centre	174	19168	0.9%
Northampton	183	26018	0.7%
Cumberland	186	26529	0.7%
Beaver	191	-5504	-3.5%
Erie	199	5964	3.3%
Mercer	205	4134	5.0%
Dauphin	219	8754	2.5%
Westmoreland	233	-4974	-4.7%
Lehigh	250	27850	0.9%
Berks	252	36913	0.7%
Butler	267	26479	1.0%
Lancaster	269	52055	0.5%
Montgomery	324	24762	1.3%
Monroe	385	50065	0.8%
Allegheny	652	-55123	-1.2%

The less land conversion and the larger population growth, the higher conversion efficiency. This sort of ratio can reflects the relationship between land growth and population growth. Also, it comprehensively reflects the tendency of urban sprawl.

# Sensitive & Nonsensitive Lands



By adding up (Union) all four kinds of raster files, water, farm, pasture and forest, we can get the environmentally sensitive lands, which covers almost the whole territory of Pennsylvania.

County Name	Grid Cells	Area (km <sup>2</sup> )
Philadelphia	286	71.5
Delaware	870	217.5
Montour	1067	266.7
Lehigh	2256	564.0
Montgomery	2393	598.2
Union	2668	667.0
Snyder	2698	674.5
Northampton	2709	677.2
Lawrence	2816	704.0
Lebanon	2901	725.2
Wyoming	3215	803.7
Carbon	3315	828.7
Juniata	3391	847.7
Beaver	3532	883.0
Cameron	3538	884.5
Lackawanna	3566	891.5
Mifflin	3577	894.2
Forest	3742	935.5
Bucks	3788	947.0
Sullivan	3795	948.7
Fulton	3818	954.5
Northumberland	3862	965.5
Columbia	3887	971.7

County Name	Grid Cells	Area (km <sup>2</sup> )
Allegheny	4104	1026.0
Cumberland	4139	1034.7
Dauphin	4146	1036.5
Adams	4333	1083.2
Blair	4464	1116.0
Perry	4831	1207.7
Monroe	4872	1218.0
Pike	4889	1222.2
Clarion	5055	1263.7
Greene	5200	1300.0
Mercer	5301	1325.2
Jefferson	5655	1413.7
Chester	5659	1414.7
Cambria	5814	1453.5
Armstrong	5864	1466.0
Erie	5949	1487.2
Venango	6085	1521.2
Franklin	6259	1564.7
Wayne	6412	1603.0
Butler	6636	1659.0
Susquehanna	6726	1681.5
Berks	6760	1690.0

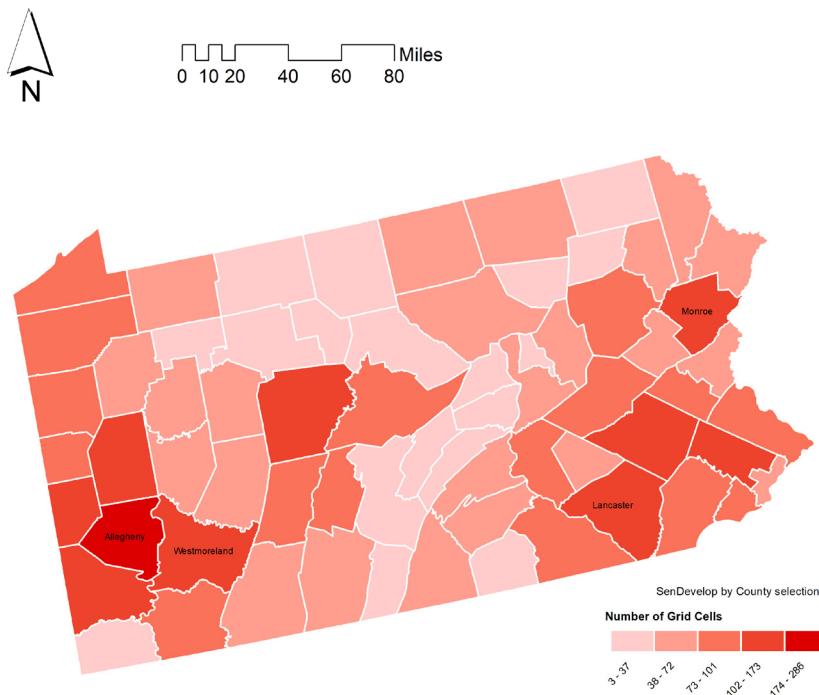
County Name	Grid Cells	Area (km <sup>2</sup> )
Schuylkill	6798	1699.5
Fayette	6877	1719.2
Elk	6931	1732.7
York	7020	1755.0
Washington	7210	1802.5
Luzerne	7266	1816.5
Indiana	7303	1825.7
Warren	7443	1860.7
Huntingdon	7828	1957.0
Clinton	7863	1965.7
Lancaster	7905	1976.2
Crawford	8124	2031.0
Westmoreland	8523	2130.7
McKean	8560	2140.0
Bedford	8926	2231.5
Bradford	9263	2315.7
Somerset	9405	2351.2
Centre	9525	2381.2
Potter	9533	2383.2
Tioga	9535	2383.7
Clearfield	9720	2430.0
Lycoming	10261	2565.2

# Sensitive Lands Already Developed by County

County Name	Number	Area (km <sup>2</sup> )
Allegheny	286	71.5
Westmoreland	173	43.2
Lancaster	149	37.2
Monroe	142	35.5
Washington	134	33.5
Montgomery	131	32.7
Butler	125	31.2
Clearfield	123	30.7
Beaver	118	29.5
Berks	113	28.2
Lawrence	101	25.2
Centre	99	24.7
Luzerne	97	24.2
Dauphin	95	23.7
Mercer	94	23.5
Bucks	93	23.2
Chester	93	23.2
Erie	92	23.0
York	91	22.7
Crawford	90	22.5
Schuylkill	90	22.5
Fayette	88	22.0
Cambria	87	21.7

County Name	Number	Area (km <sup>2</sup> )
Blair	81	20.2
Delaware	81	20.2
Lehigh	75	18.7
Cumberland	72	18.0
Franklin	71	17.7
Somerset	67	16.7
Northampton	65	16.2
Lackawanna	63	15.7
Venango	62	15.5
Pike	62	15.5
Jefferson	62	15.5
Carbon	61	15.2
Lebanon	59	14.7
Lycoming	58	14.5
Bradford	57	14.2
Armstrong	56	14.0
Bedford	52	13.0
Wayne	51	12.7
Indiana	51	12.7
Perry	50	12.5
Tioga	46	11.5
Clarion	46	11.5

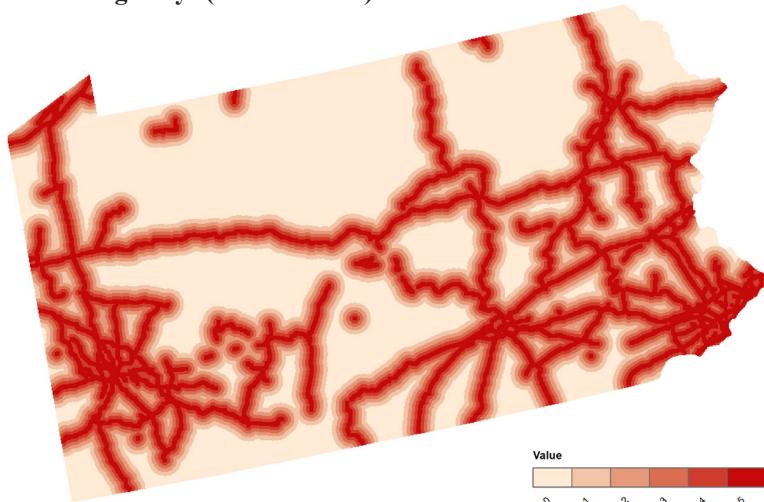
County Name	Number	Area (km <sup>2</sup> )
Columbia	46	11.5
Warren	44	11.0
Northumberland	41	10.2
Philadelphia	41	10.2
Susquehanna	37	9.2
Huntingdon	37	9.2
Clinton	36	9.0
Snyder	35	8.7
Greene	35	8.7
McKean	34	8.5
Mifflin	33	8.2
Adams	32	8.0
Fulton	28	7.0
Union	27	6.7
Wyoming	23	5.7
Elk	23	5.7
Montour	18	4.5
Juniata	15	3.7
Potter	12	3.0
Sullivan	9	2.2
Forest	8	2.0
Cameron	3	0.7



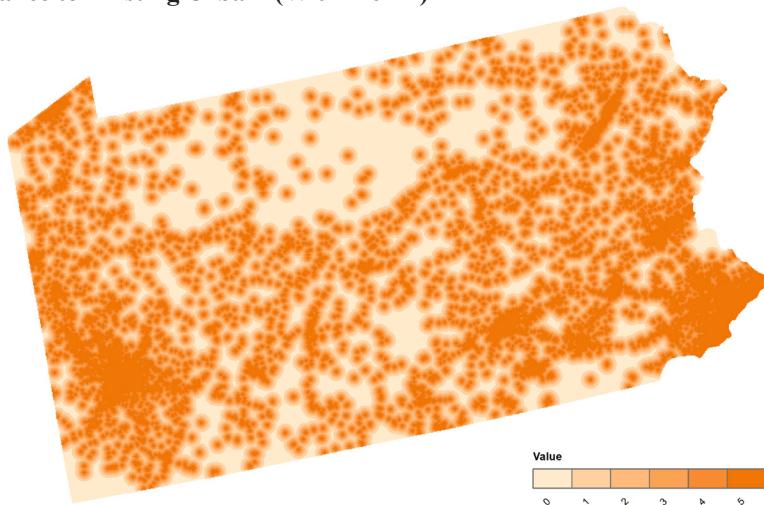
Recent urban growth most threatened places including Allegheny, Westmoreland, Lancaster and Monroe County, where sensitive lands threatened by urbanization are more than 33.5 km<sup>2</sup>.

# Decision Factors of Future Urbanization

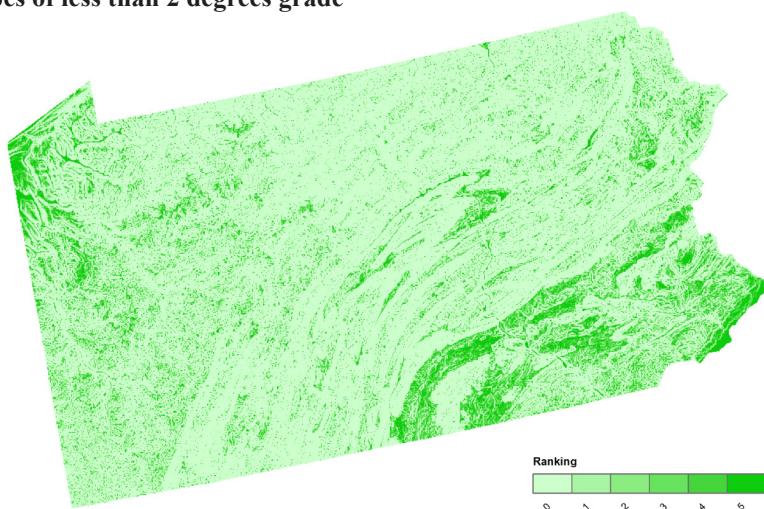
Distance to Highways (Within 10km)



Distance to Existing Urbani (Within 6km)



Slopes of less than 2 degrees grade

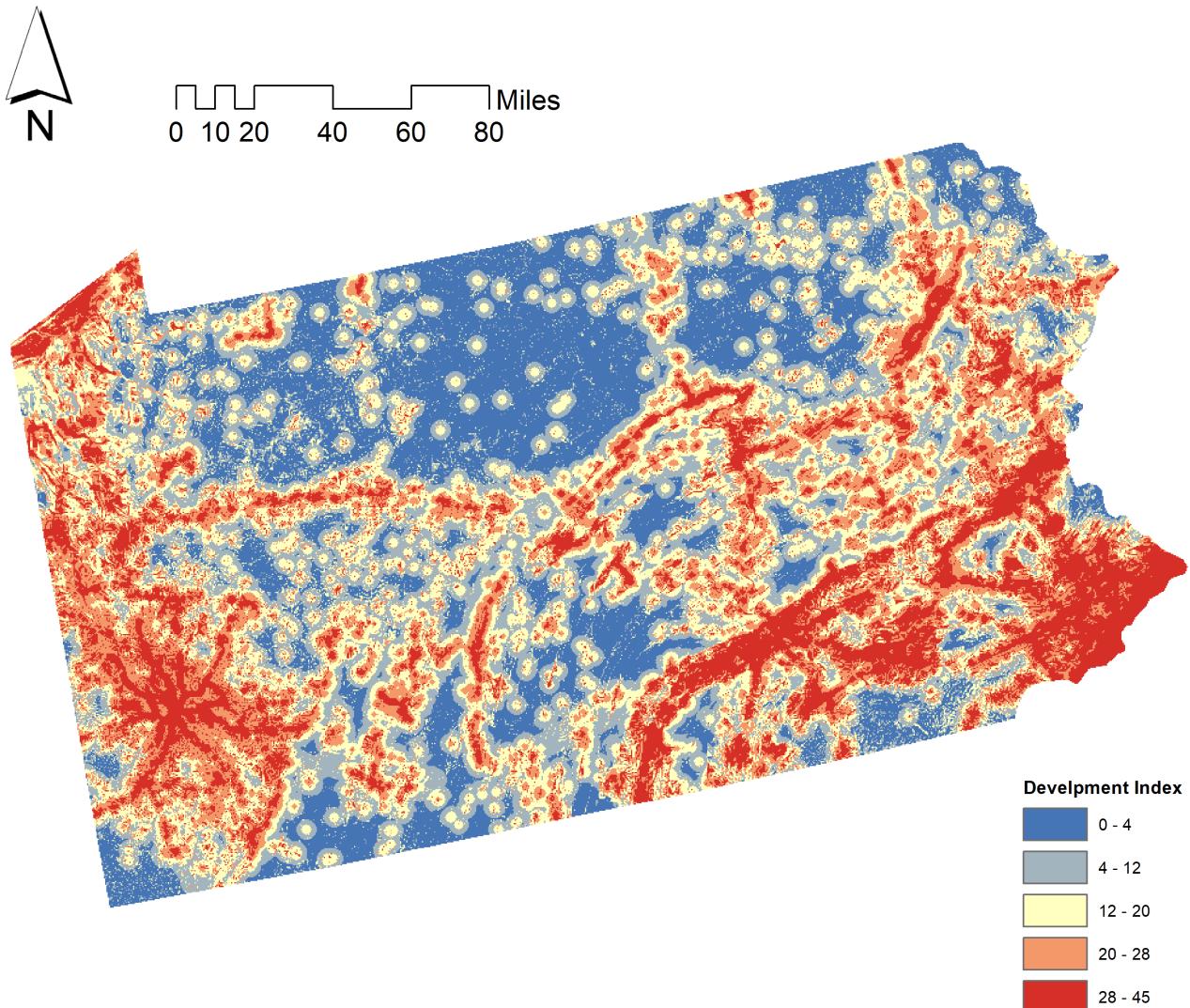


In this map, higher ranking numbers and darker colors mean closer distance to highways. Areas covered by the 2nd lightest red whose ranking number is 1 are closest to maximum distance 10km.

In this map, higher ranking numbers and darker colors mean closer distance to existing urban development in 2001. Areas covered by the 2nd lightest orange whose ranking number is 1 are closest to maximum distance 6km.

In this map, higher ranking numbers and darker colors mean lower degrees of slopes. Areas covered by the 2nd lightest green whose ranking number is 1 are closest to Zero degree.

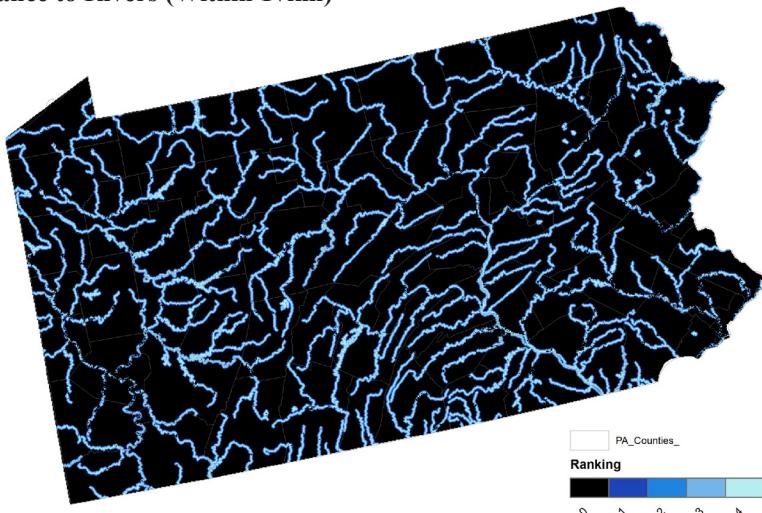
# Future Urbanization Index Map



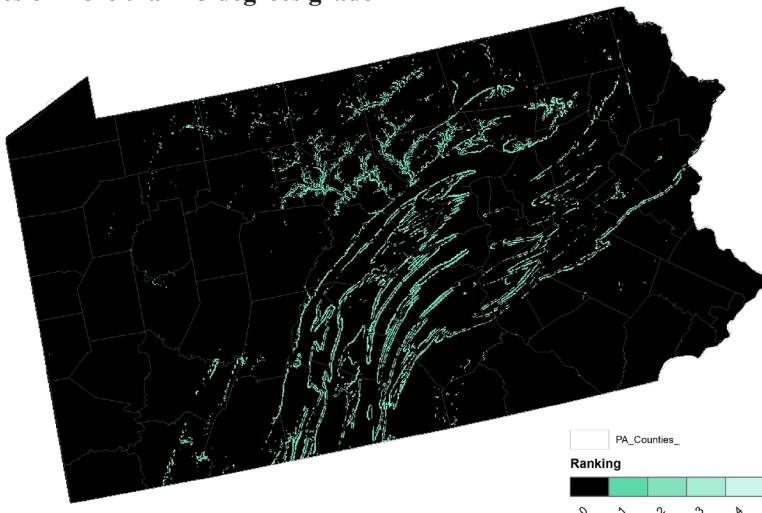
By combining three decision factors with respective weights, we can draw this Future Urbanization Index Map. The darkest red with largest numbers stand for areas, where development are most likely to be carried out in the future. These areas have highest index scores, measured by the three factors urbanization tends favor. Likewise, the darkest blue with smallest number cover lands with lowest possibility to be urbanized, whose construction conditions are worse correspondingly.

# Decisiton Factors of Environmental Sensitivity

Distance to Rivers (Within 1vkm)



Slopes of more than 15 degrees grade



Active Farm & Forest

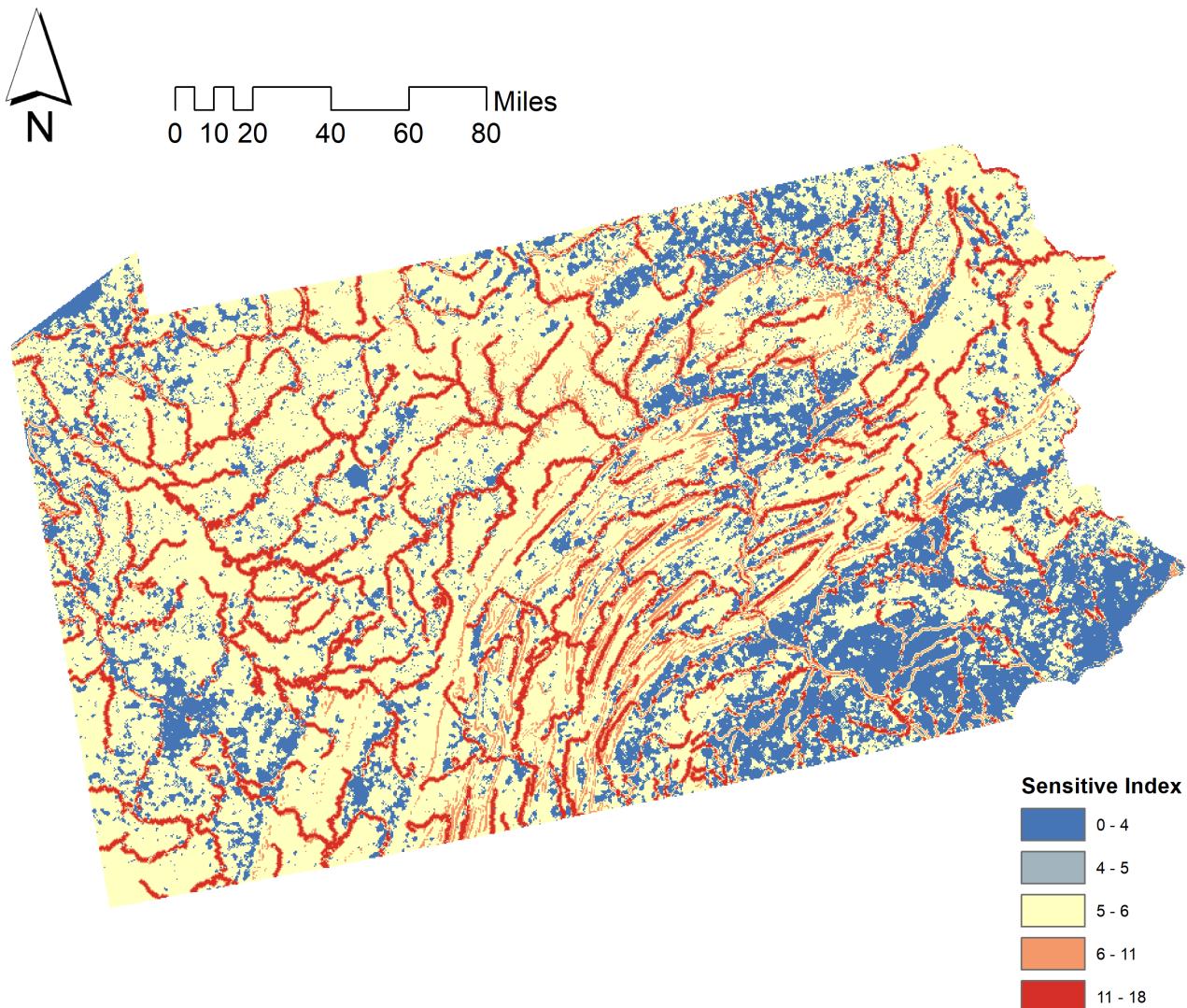


In this map, higher ranking numbers and lighter colors mean closer distance to rivers. Areas covered by the 2nd darkest blue whose ranking number is 1 are closest to maximum distance 1km.

In this map, higher ranking numbers and lighter colors mean higher degrees of slopes. Areas covered by the 2nd darkest mint whose ranking number is 1 are closest to 15 degree grades.

In this map, green means active farms and forests.

# Environmental Sensitivity Index Map



By combining three decision factors with respective weights: Give farm & forest a weight of 6, distance to rivers a weight of 2 and slope a weight of 1, we can draw this Environmental Sensitivity Index Map.

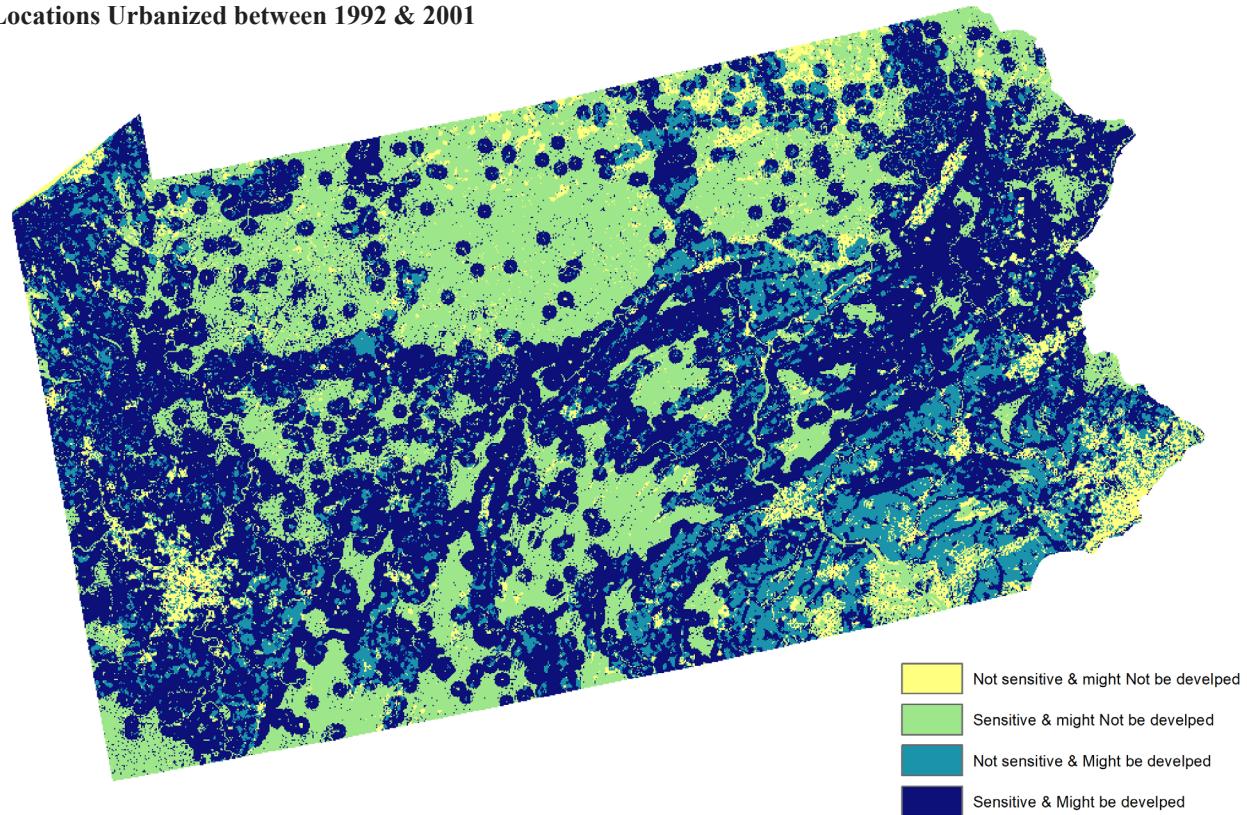
The reason why I give the three factors such weights are: Firstly, based on information I searched for, the prime environmental problem in Pennsylvania is loss of farmland and forest land due to inefficient urbanization and urban sprawl, with one of the highest rates of land development but much lower population increase. So I give farm & forest the priority to be protected, with a weight of 6. Next, water quality and supply is another serious natural challenge facing Pennsylvania, with a weight of 2. Lastly, hillsides with slopes of more than 15 degree grads are generally difficult to be exploited. In other words, its attraction to human disturbance and exposure to damages are both less. Thus, I think a weight of 1 is enough.

# Sensitivity & Possibility to be Developed



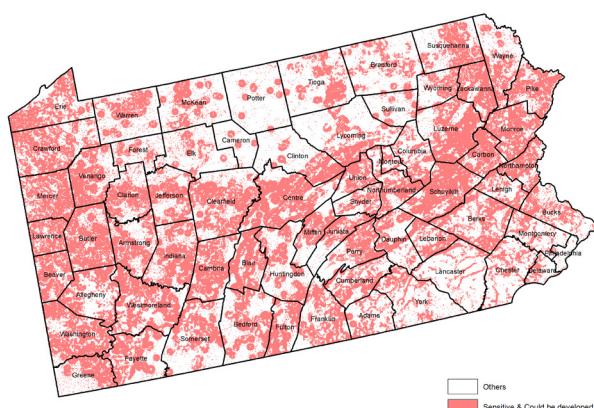
0 10 20 40 60 80 Miles

Locations Urbanized between 1992 & 2001



0 10 20 40 60 80 Miles

Sensitive & Could be developed



Not sensitive & Could be developed

