Pennsylvania Urban Growth VS. Development Suitability Using Raster Overlay

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Urban Locations in Pennsylvania in 1992

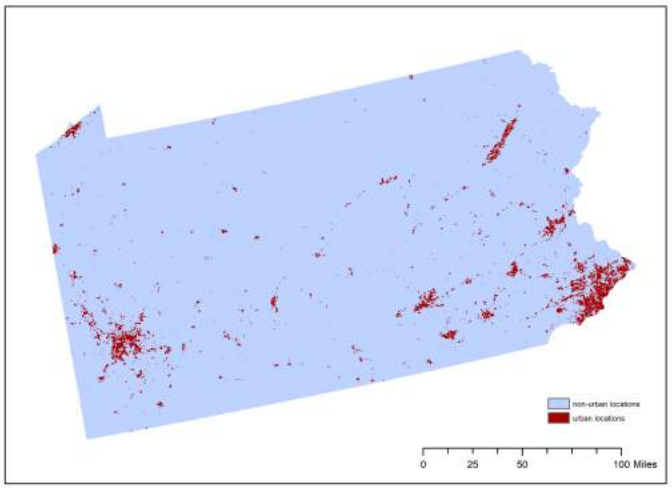

Fig.1.1. Urbanized Locations in Pennsylvania in 1992

Urban Locations in Pennsylvania in 2001

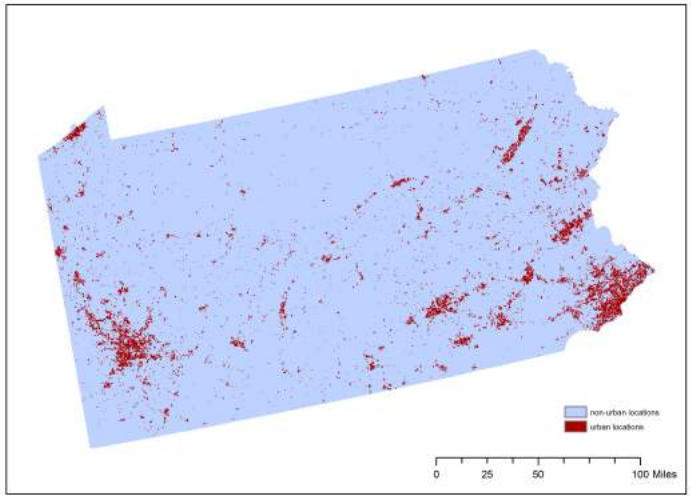

Fig.1.2. Urbanized Locations in Pennsylvania in 2001

Urbanized Locations in Pennsylvania between 1992 and 2001

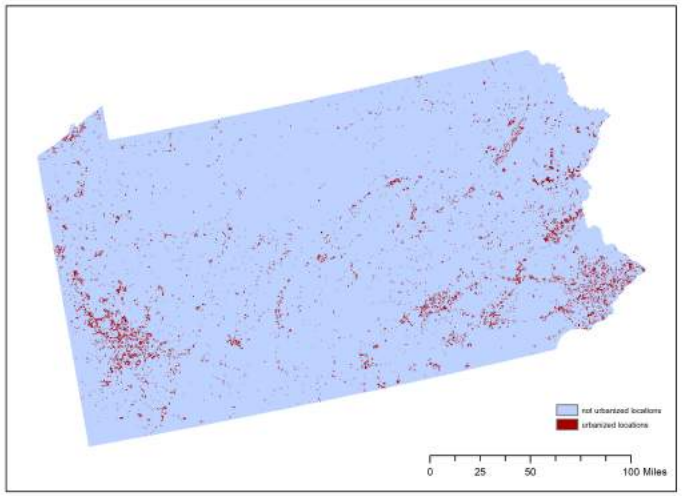

Fig.1.3. Urbanized Locations in Pennsylvania between 1992 and 2001

Here we examined which areas changed from non-urban locations in 1992 to urban in 2001, using the 1992 and 2001 USGS Urban land cover rasters. The number of grid cells that were newly converted to urban between 1992 and 2001 is 12,408.

County Name	Urban Land Growth	Population Growth	Ratio of Land Conversion to Population Growth
Lackawanna	1,062,988,650	59	18,016,756.8
McKean	2,249,475,982	353	6,372,453.2
Northumberland	1,089,738,365	299	3,644,609.9
Jefferson	1,500,733,976	918	1,634,786.5
Tioga	2,599,722,242	1,661	1,565,154.9
Potter	2,472,223,603	1,698	1,455,962.1
Fulton	1,001,989,301	933	1,073,943.5
Bedford	2,325,225,173	2,264	1,027,042.9
Elk	1,901,479,697	2,086	911,543.5
Venango	1,561,733,325	1,855	841,904.8
Perry	1,269,736,443	1,743	728,477.6
Greene	1,320,735,898	1,902	694,393.2
Delaware	437,495,329	697	627,683.4
Schuylkill	1,787,480,914	3,280	544,963.7
Clinton	2,052,478,085	3,883	528,580.5
Blair	1,203,487,150	2,357	510,601.3
Crawford	2,370,974,684	4,786	495,398.0
Mifflin	946,489,894	2,307	410,268.7
Fayette	1,825,480,509	4,490	406,565.8
Bradford	2,653,221,671	6,691	396,535.9
Warren	2,051,478,096	5,256	390,311.7
Mercer	1,559,233,352	4,134	377,173.0
Armstrong	1,516,983,803	4,132	367,130.6
Somerset	2,473,973,585	7,903	313,042.3
Erie	1,850,980,236	5,964	310,358.9
Lebanon	829,491,143	2,708	306,311.4
Susquehanna	1,902,979,681	7,002	271,776.6
Lycoming	2,838,469,693	11,148	254,616.9
Sullivan	1,034,738,952	4,180	247,545.2
Lawrence	829,491,143	3,585	231,378.3
Clearfield	2,638,471,828	11,549	228,458.9
Huntingdon	2,035,228,269	9,090	223,897.5
Forest	985,239,480	5,016	196,419.4
Juniata	900,490,385	4,797	187,719.5

County Name	Urban Land Growth	Population Growth	Ratio of Land Conversion to Population Growth
Snyder	758,241,904	4,215	179,891.3
Columbia	1,118,988,052	6,574	170,214.2
Wyoming	924,490,129	5,434	170,130.7
Franklin	1,765,981,144	10,485	168,429.3
Dauphin	1,272,986,408	8,754	145,417.7
Centre	2,539,722,883	19,168	132,498.1
Cameron	910,490,278	7,270	125,239.4
Wayne	1,713,981,699	20,068	85,408.7
Union	728,492,222	8,583	84,876.2
Carbon	883,990,561	10,812	81,760.1
Montour	301,996,776	4,257	70,941.2
Butler	1,816,480,605	26,479	68,600.8
Berks	1,976,978,891	36,913	53,557.8
Adams	1,191,487,278	23,189	51,381.6
Cumberland	1,260,236,544	26,529	47,504.1
Montgomery	1,113,488,111	24,762	44,967.6
Lancaster	2,249,475,982	52,055	43,213.4
Pike	1,295,486,168	30,740	42,143.3
Bucks	1,421,984,817	38,793	36,655.7
York	2,082,977,759	58,042	35,887.4
Northampton	862,240,794	26,018	33,140.2
Chester	1,735,981,464	53,626	32,372.0
Lehigh	795,991,501	27,850	28,581.4
Monroe	1,409,734,948	50,065	28,158.1
Beaver	1,014,239,171	-5,504	-184,273.1
Luzerne	2,073,727,858	-9,359	-221,575.8
Westmoreland	2,367,724,719	-4,974	-476,020.2
Clarion	1,392,485,132	-390	-3,570,474.7
Indiana	1,905,479,655	-111	-17,166,483.4

Fig 2.1. Summary Table of Urban Land Growth, Population Growth, Ratio of Land Conversion to Population Growth Grouped by County. Counties colored in blue are most efficient; whereas counties colored in gray are most inefficient and have negative population growth.

The statistics work by dividing the amount of urban land conversion between 1992 and 2001 by 1990-2000 population growth to gain the amount of urban land conversion per new resident. This sort of ratio is important because we would like to understand which counties have been the most efficient in accommodating new residents with new urban land.

County Name	Area of Sensitive	County Name	Area of Sensitive
Erie	1,850,980,236	Northampton	862,240,794
Bradford	2,653,221,671	Schuylkill	1,787,480,914
Tioga	2,599,722,242	Indiana	1,905,479,655
Potter	2,472,223,603	Snyder	758,241,904
McKean	2,249,475,982	Beaver	1,014,239,171
Warren	2,051,478,096	Mifflin	946,489,894
Wayne	1,713,981,699	Lehigh	795,991,501
Susquehanna	1,902,979,681	Huntingdon	2,035,228,269
Crawford	2,370,974,684	Blair	1,203,487,150
Wyoming	924,490,129	Cambria	1,584,483,082
Lackawanna	1,062,988,650	Juniata	900,490,385
Elk	1,901,479,697	Westmoreland	2,367,724,719
Forest	985,239,480	Berks	1,976,978,891
Venango	1,561,733,325	Allegheny	1,700,981,838
Cameron	910,490,278	Dauphin	1,272,986,408
Pike	1,295,486,168	Perry	1,269,736,443
Lycoming	2,838,469,693	Bucks	1,421,984,817
Sullivan	1,034,738,952	Lebanon	829,491,143
Mercer	1,559,233,352	Washington	1,967,728,990
Clinton	2,052,478,085	Montgomery	1,113,488,111
Clarion	1,392,485,132	Cumberland	1,260,236,544
Luzerne	2,073,727,858	Bedford	2,325,225,173
Jefferson	1,500,733,976	Lancaster	2,249,475,982
Columbia	1,118,988,052	Franklin	1,765,981,144
Clearfield	2,638,471,828	Somerset	2,473,973,585
Centre	2,539,722,883	Chester	1,735,981,464
Monroe	1,409,734,948	York	2,082,977,759
Northumberland	1,089,738,365	Fulton	1,001,989,301
Butler	1,816,480,605	Fayette	1,825,480,509
Montour	301,996,776	Philadelphia	327,246,506
Armstrong	1,516,983,803	Adams	1,191,487,278
Union	728,492,222	Delaware	437,495,329
Carbon	883,990,561	Greene	1,320,735,898
Lawrence	829,491,143		

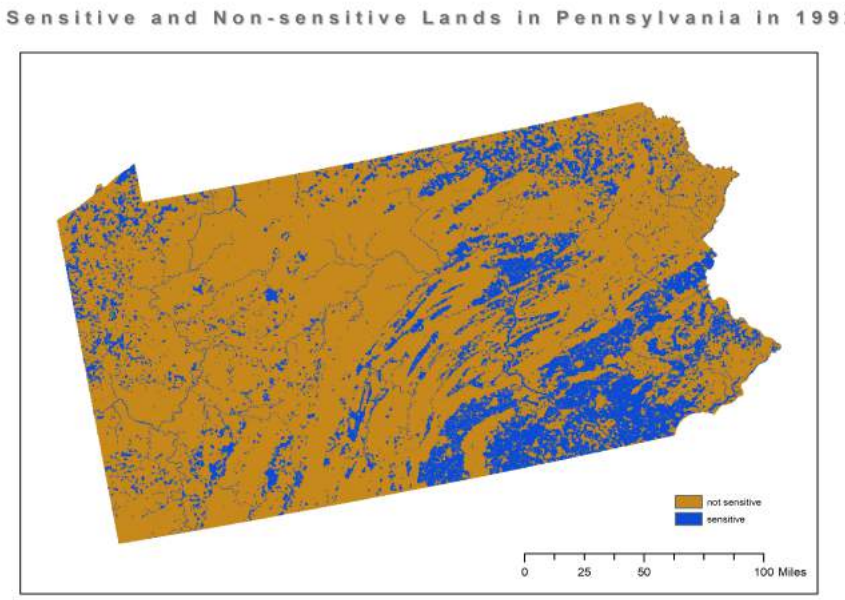

Fig.3.1. Sensitive and not sensitive Lands in Pennsylvania in 1992

Fig.3.2.Summary table of 1992 sensitive land areas by County

County Name	Number of Grid Cells	Area where sensitive land are developed in 2001
Lancaster	142	35,500,000
Montgomery	90	22,500,000
Berks	75	18,750,000
York	70	17,500,000
Allegheny	62	15,500,000
Bucks	62	15,500,000
Cumberland	60	15,000,000
Dauphin	58	14,500,000
Franklin	58	14,500,000
Delaware	52	13,000,000
Northampton	51	12,750,000
Chester	51	12,750,000
Lehigh	50	12,500,000
Lycoming	47	11,750,000
Lebanon	43	10,750,000
Erie	41	10,250,000
Lawrence	36	9,000,000
Bradford	34	8,500,000
Washington	32	8,000,000
Philadelphia	31	7,750,000
Centre	30	7,500,000
Columbia	29	7,250,000
Northumberland	29	7,250,000
Blair	27	6,750,000
Westmoreland	27	6,750,000
Crawford	24	6,000,000
Somerset	24	6,000,000
Tioga	23	5,750,000
Bedford	22	5,500,000
Beaver	21	5,250,000
Adams	21	5,250,000
Wayne	20	5,000,000
Perry	20	5,000,000

County Name	Number of Grid Cells	Area where sensitive land are developed in 2001
Snyder	19	4,750,000
Mercer	18	4,500,000
Luzerne	18	4,500,000
Union	18	4,500,000
Schuylkill	18	4,500,000
Mifflin	18	4,500,000
Butler	17	4,250,000
Clearfield	16	4,000,000
Monroe	16	4,000,000
Montour	16	4,000,000
Fayette	16	4,000,000
Lackawanna	13	3,250,000
Warren	12	3,000,000
Clinton	12	3,000,000
Pike	11	2,750,000
Jefferson	11	2,750,000
Carbon	11	2,750,000
Cambria	11	2,750,000
Venango	10	2,500,000
Fulton	10	2,500,000
Wyoming	9	2,250,000
Armstrong	9	2,250,000
Clarion	7	1,750,000
Indiana	7	1,750,000
Susquehanna	6	1,500,000
Elk	6	1,500,000
Huntingdon	6	1,500,000
Juniata	6	1,500,000
Greene	5	1,250,000
Potter	2	500,000
McKean	2	500,000
Forest	1	250,000

Fig.4.1.Summary Table of sensitive lands that were urbanized by county. Counties colored in blue, Lancaster, Montgomery, and Berks are places where recent urban growth was most threatening to sensitive lands in 1992. The number of grid cells that were sensitive lands developed upon 2001 is 1,819.Here we have summary table of the amount of sensitive lands by county in 1992 and a map with sensitive and non-sensitive lands. The number of grid cells that are sensitive is 86,115.

Three Decision Factors to decide which areas are more likely to be urbanize in future

(i) Proximity to existing urban development with a weight of 4;

(ii) Slope less than 2 degree grade with a weight of 3;

(iii) Proximity to highway with a weight of 2;

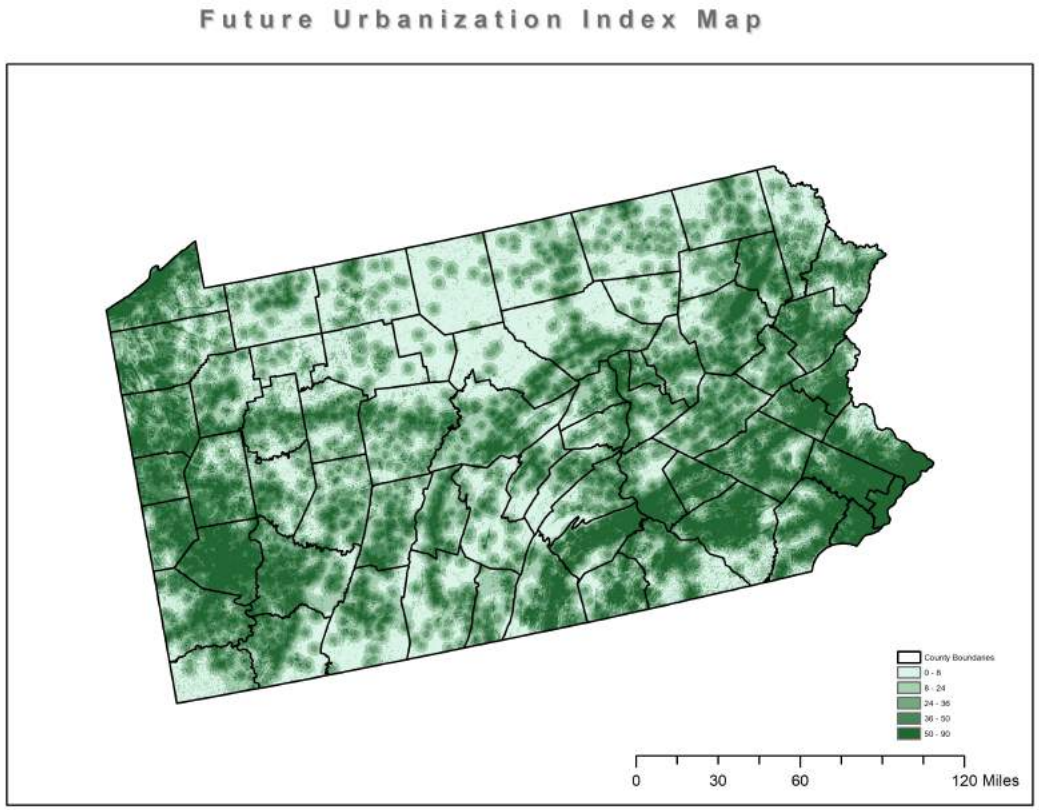

Fig.6.1. Future Urbanization Index Map with 5 Quantile breaks using three decision factors, distance to existing urban development, distance to highways, and slop <=2.

Three decision factors that determine the Environmental Sensitivity Map

(i) In active farm and forest use with a weight of 0.4;
(ii) Undeveloped sites within 1000 meters of rivers with a weight of 0.3;
(iii) Hillsides with slopes of 15 degrees or more with a weight of 0.3;

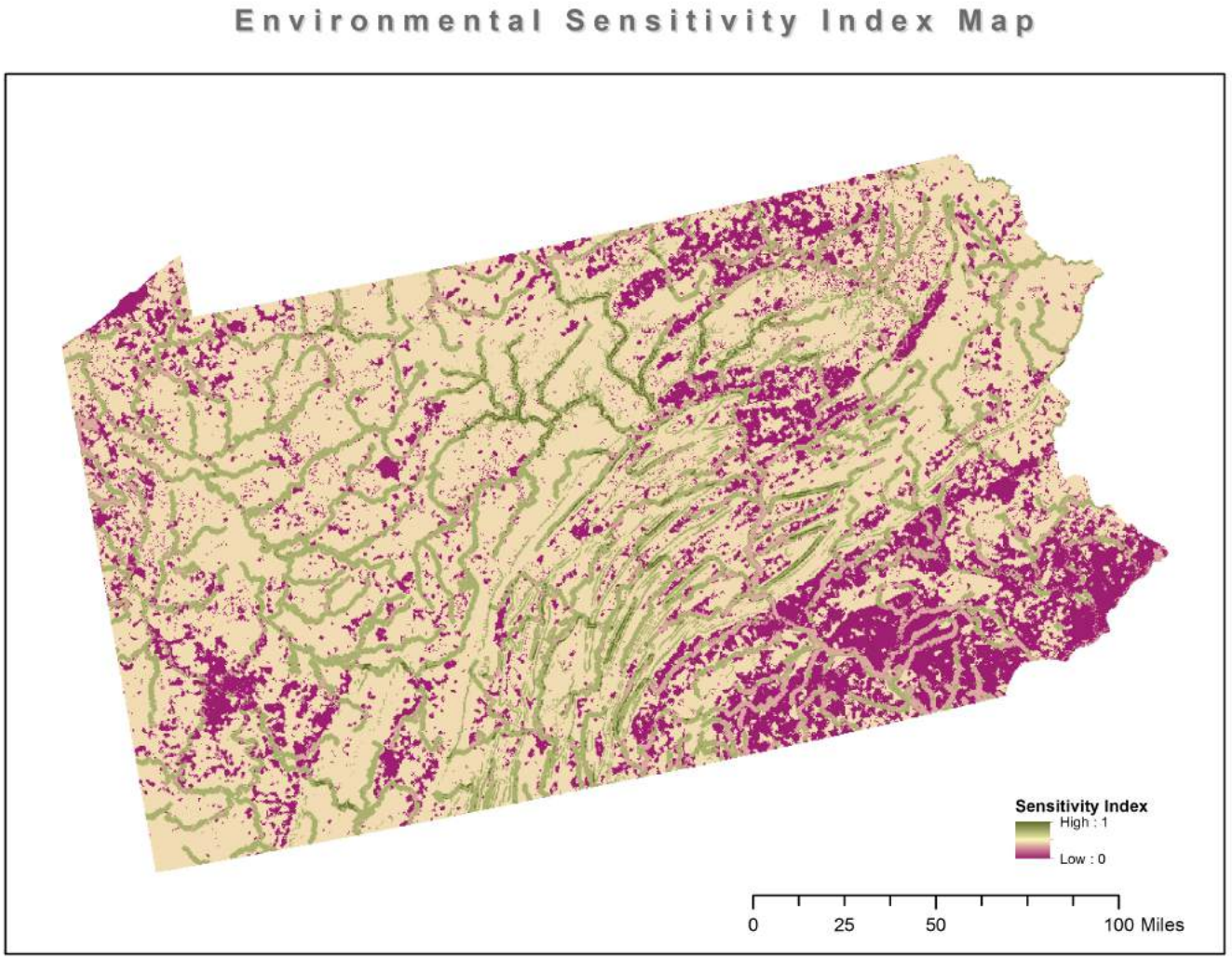

Fig.6.2. Environmental Sensitivity Index Map using three decision factors, (i) in active farm and forest use, (ii) undeveloped sites within 1000 meters of rivers, (iii) hillsides with slopes of 15 degrees or more.

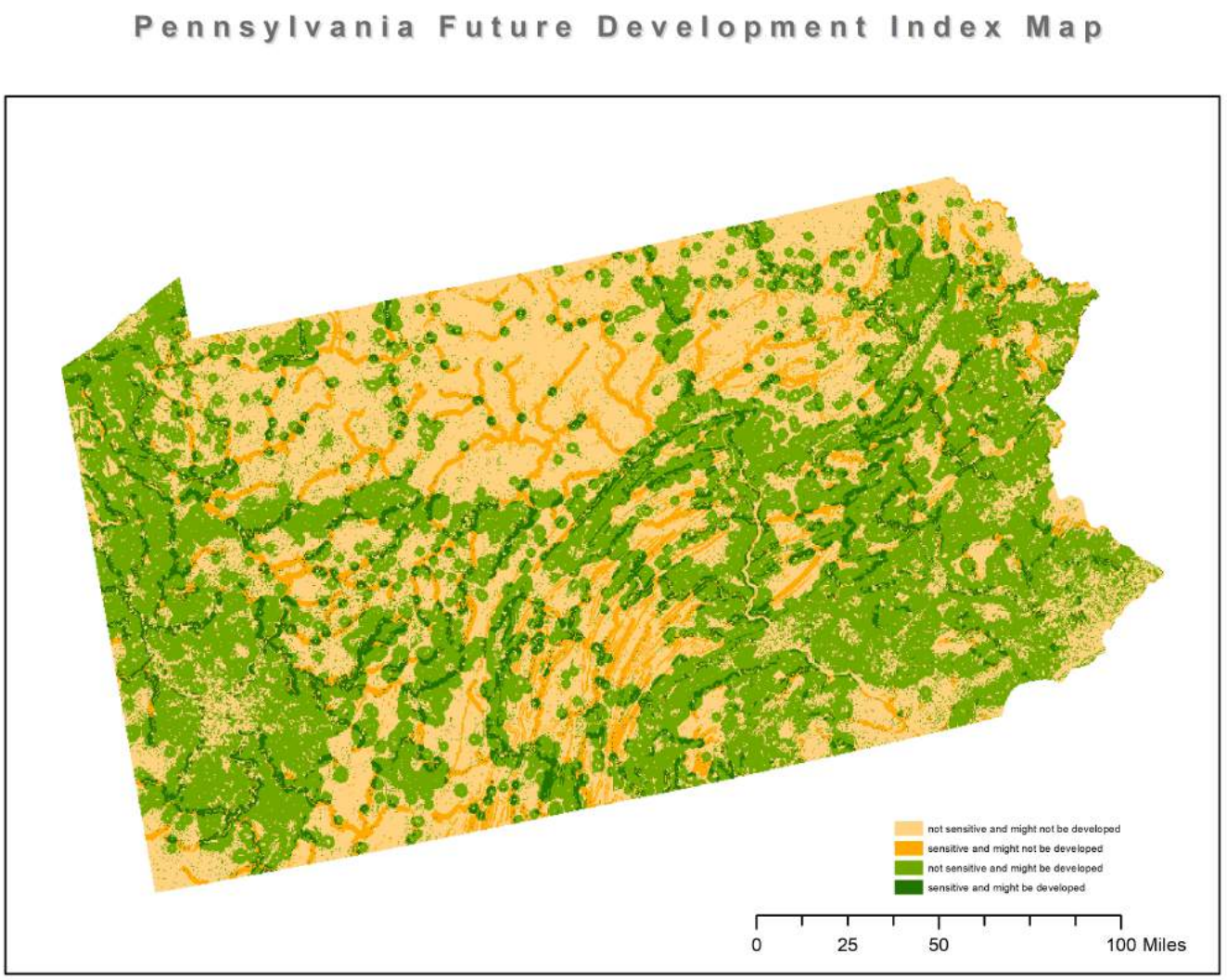

Fig.7.1. The combination of Environmental Sensitivity Index Map and the new Future Urbanization Index Map that contains values 0,1,10,11.

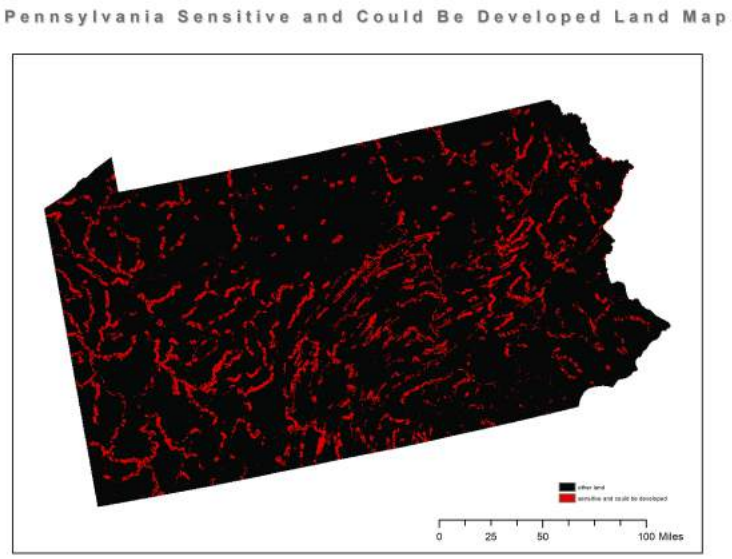

Fig.7.2. The graph colored land that is sensitive and could be developed in red.

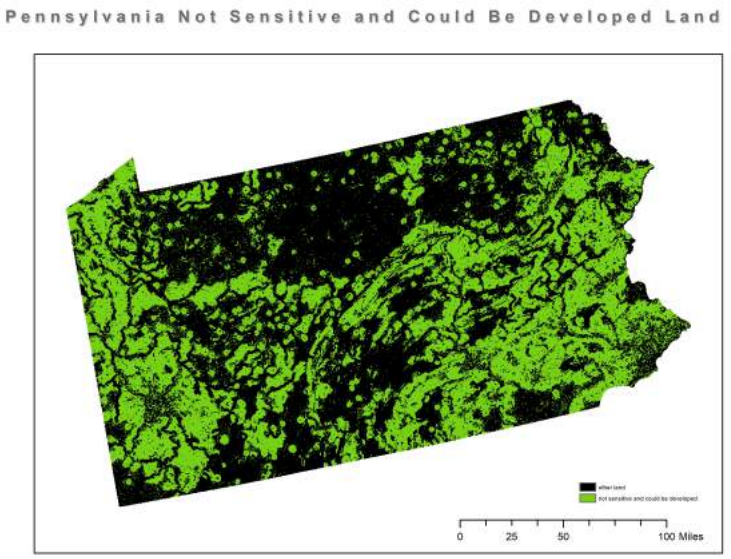

Fig.7.3. The graph colored land that is not sensitive and could be developed in green.

Lots of Potential: Strengthening the Philadelphia by Balancing Preservation and Urban Development

With respect to development opportunities, Philadelphia County has environmentally non-sensitive lands that could be developed in future. We can also see from the table that Philadelphia County has less sensitive land than most counties in Pennsylvania. Prolific non-sensitive lands in Philadelphia's building environment requires planners to balance land preservation and urban development as the city embraces a resurgence in population and urban growth.