Urbanization in Pennsylvania: Threats and Opportunities

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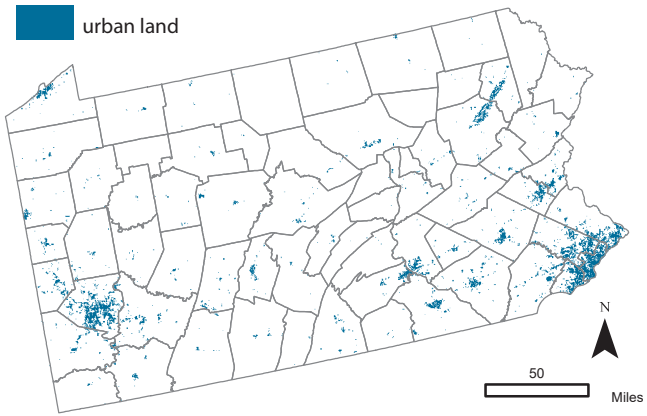
Urban Land in 1992 and 2001

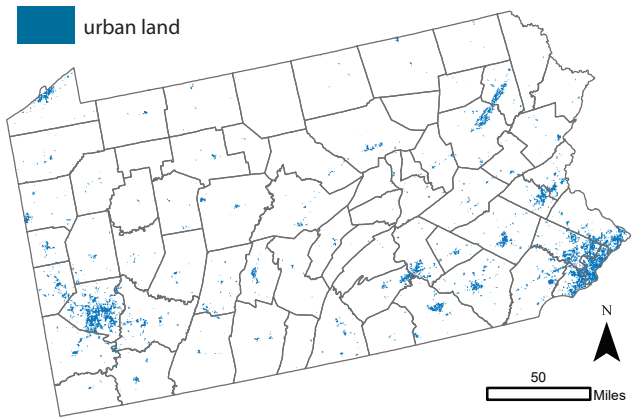
Pennsylvania has a significant amount of land that is undeveloped. When considering opportunities to develop land into urban areas, the threats this development might impose on natural environments should be considered. This report will outline development that has already occured in Pennsylvania and forecast where future develop is most likely, most threatening to the environment, and most beneficial.

Between 1992 and 2001, 2.39 square miles were converted from non-urban land to urban land (6,209,000 meters^2 or 12,418 grid cells).

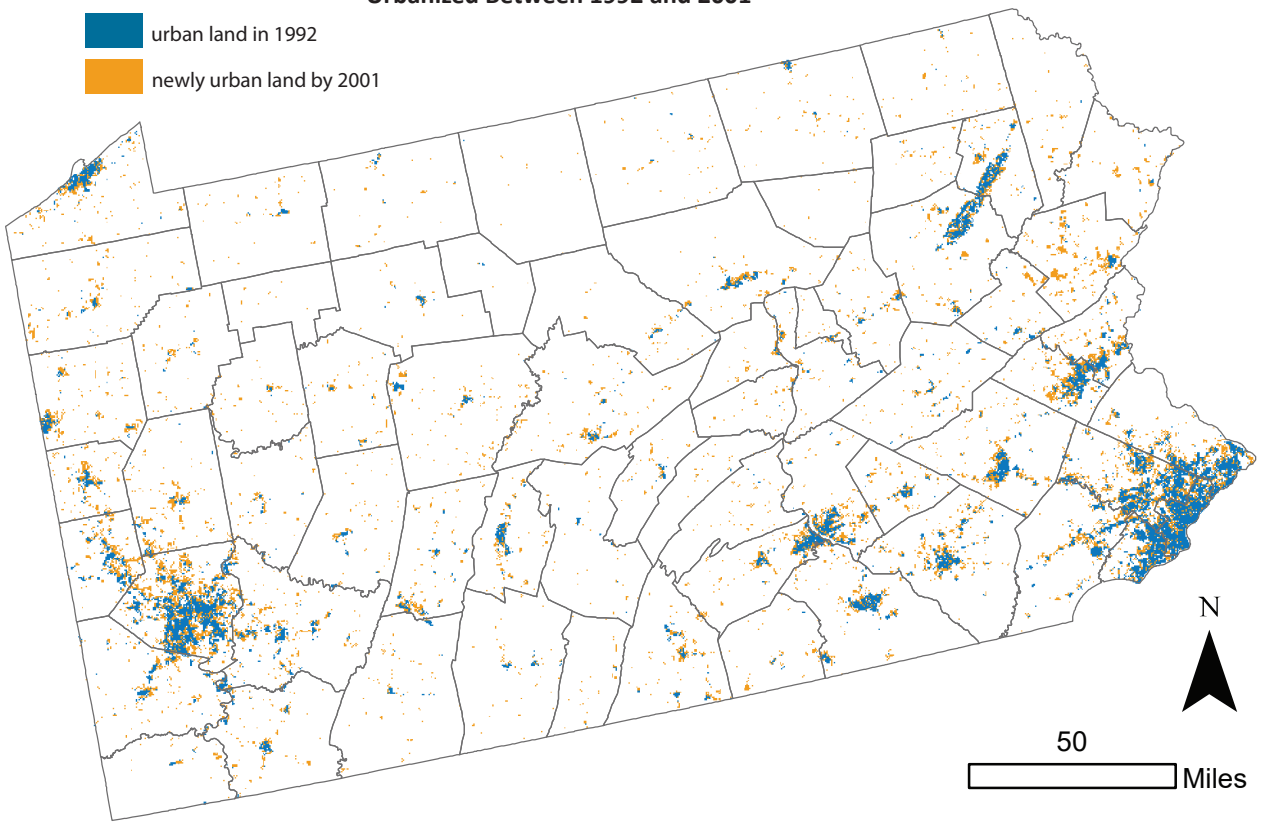
1992 Urban Locations



2001 Urban Locations



Urbanized Between 1992 and 2001



Efficient Urbanization

& Inefficient Urbanization

Between 1992 and 2001, the population across all counties in Pennsylvania increased by 711,407 residents. More than 1 million square meters (3,639 grid cells) of formerly non-urban land was converted to urban land.

Total Population Δ	Total Urbanized Land Δ (grid cells)	Total Urbanized Land Δ (meters squared)	Urbanized Land Δ / Population Δ (Efficiency)
544387	12408	6204000	11.40

In some counties, like Cameron, Adams, York, Forest, and Chester, urbanization was highly efficient. The five most efficient counties urbanized less than one square meter for every new resident. York and Chester are particularly notable because their urbanization included more than 40,000 square meters each.

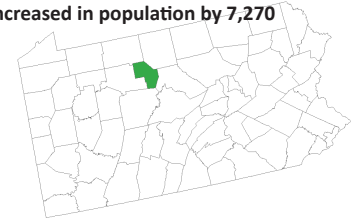
The counties with the least efficient urbanization converted more than 30 square meters of land for every new resident. Lackawanna County, in northeastern PA, urbanized 32,000 square meters of land but saw a population increase of just 64 residents. This resulted in more than 500 square meters of urbanized land per new resident.

Nine counties saw a decrease in population. All of these counties urbanized some land, despite their declining populations, but their efficiency ranged.

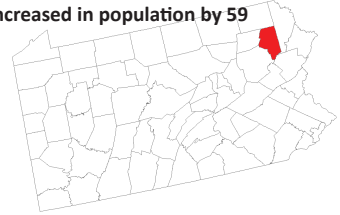
County	Population Δ	Urbanized Land Δ (grid cells)	Urbanized Land Δ (meters squared)	Urbanized Land Δ / Population Δ (Efficiency)
Philadelphia	-68940	215	107500	-1.56
Cambria	-12183	186	93000	-7.63
Allegheny	-55123	1251	625500	-11.35
Washington	-10436	276	138000	-13.22
Luzerne	-9359	294	147000	-15.71
Beaver	-5504	331	165500	-30.07
Westmoreland	-4974	410	205000	-41.21
Clarion	-390	77	38500	-98.72
Indiana	-111	87	43500	-391.89

County	Population Δ	Urbanized Land Δ (grid cells)	Urbanized Land Δ (meters squared)	Urbanized Land Δ / Population Δ (Efficiency)
Cameron	7270	3	1500	0.21
Forest	5016	13	6500	1.30
Sullivan	4180	12	6000	1.44
Adams	23189	78	39000	1.68
Wayne	20068	79	39500	1.97
Pike	30740	132	66000	2.15
York	58042	259	129500	2.23
Huntingdon	9090	44	22000	2.42
Juniata	4797	25	12500	2.61
Chester	53626	329	164500	3.07
Montour	4257	27	13500	3.17
Union	8583	62	31000	3.61
Lancaster	52055	398	199000	3.82
Potter	1698	13	6500	3.83
Monroe	50065	415	207500	4.14
Wyoming	5434	48	24000	4.42
Berks	36913	339	169500	4.59
Susquehanna	7002	66	33000	4.71
Cumberland	26529	267	133500	5.03
Centre	19168	202	101000	5.27
Carbon	10812	117	58500	5.41
Somerset	7903	86	43000	5.44
Northampton	26018	288	144000	5.53
Butler	26479	311	155500	5.87
Bucks	38793	462	231000	5.95
Warren	5256	63	31500	5.99
Lehigh	27850	345	172500	6.19
Bradford	6691	90	45000	6.73
Snyder	4215	61	30500	7.24
Columbia	6574	104	52000	7.91
Clearfield	11549	191	95500	8.27
Clinton	3883	65	32500	8.37
Lycoming	11148	187	93500	8.39
Elk	2086	40	20000	9.59
Franklin	10485	212	106000	10.11
Armstrong	4132	97	48500	11.74
Mifflin	2307	59	29500	12.79
Greene	1902	54	27000	14.20
Montgomery	24762	707	353500	14.28
Bedford	2264	65	32500	14.36
Perry	1743	55	27500	15.78
Dauphin	8754	326	163000	18.62
Schuylkill	3280	124	62000	18.90
Fayette	4490	173	86500	19.27
Tioga	1661	67	33500	20.17
Crawford	4786	196	98000	20.48
Fulton	933	39	19500	20.90
Erie	5964	292	146000	24.48
Venango	1855	99	49500	26.68
Lebanon	2708	145	72500	26.77
Lawrence	3585	215	107500	29.99
Mercer	4134	258	129000	31.20
Blair	2357	171	85500	36.27
Jefferson	918	91	45500	49.56
McKean	353	53	26500	75.07
Northumberland	299	101	50500	168.90
Delaware	697	237	118500	170.01
Lackawanna	59	224	112000	1898.31

Cameron County urbanized 1,500 square meters and increased in population by 7,270



Lackawanna County urbanized 112,000 square meters and increased in population by 59



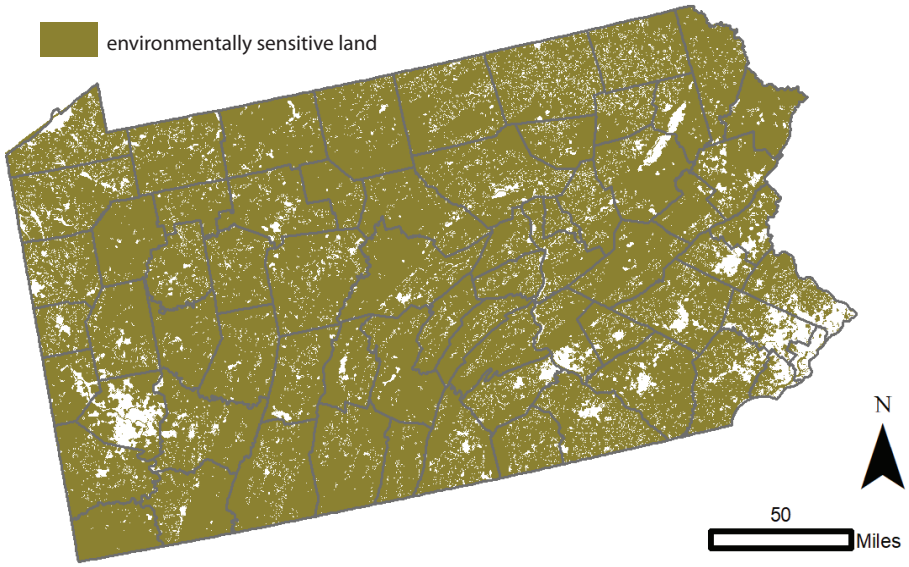
Environmentally Sensitive Land in 1992

Above Average Sensitive Land Area, 1992

County	Sensitive Land (grid cells)	Sensitive Land (square meters)
Lycoming	10256	5128000
Clearfield	9724	4862000
Tioga	9538	4769000
Centre	9527	4763500
Potter	9514	4757000
Somerset	9416	4708000
Bradford	9260	4630000
Bedford	8941	4470500
McKean	8560	4280000
Westmoreland	8522	4261000
Crawford	8120	4060000
Lancaster	7921	3960500
Clinton	7859	3929500
Huntingdon	7846	3923000
Warren	7446	3723000
Indiana	7296	3648000
Luzerne	7264	3632000
Washington	7213	3606500
York	7029	3514500
Elk	6933	3466500
Fayette	6895	3447500
Schuylkill	6777	3388500
Berks	6765	3382500
Susquehanna	6718	3359000
Butler	6637	3318500
Wayne	6432	3216000
Franklin	6292	3146000
Venango	6096	3048000
Erie	5929	2964500
Armstrong	5856	2928000
Cambria	5822	2911000
Chester	5695	2847500
Jefferson	5660	2830000
Average	***5506***	***2753082***

Below Average Sensitive Land Area, 1992

County	Sensitive Land (grid cells)	Sensitive Land (square meters)
Average	***5506***	***2753082***
Mercer	5297	2648500
Greene	5211	2605500
Clarion	5052	2526000
Pike	4905	2452500
Monroe	4861	2430500
Perry	4823	2411500
Blair	4453	2226500
Adams	4355	2177500
Dauphin	4153	2076500
Cumberland	4147	2073500
Allegheny	4096	2048000
Columbia	3890	1945000
Northumberland	3849	1924500
Fulton	3831	1915500
Bucks	3815	1907500
Sullivan	3802	1901000
Forest	3735	1867500
Mifflin	3576	1788000
Lackawanna	3569	1784500
Cameron	3539	1769500
Beaver	3537	1768500
Juniata	3391	1695500
Carbon	3309	1654500
Wyoming	3214	1607000
Lebanon	2898	1449000
Lawrence	2812	1406000
Northampton	2725	1362500
Snyder	2702	1351000
Union	2684	1342000
Montgomery	2406	1203000
Lehigh	2265	1132500
Montour	1066	533000
Delaware	899	449500
Philadelphia	287	143500



In 1992, across all Pennsylvania counties, 184,456,500 square meters of land were considered environmentally sensitive (368,913 grid cells). This sensitive land made up the vast majority of the state, as evidence by the map above.

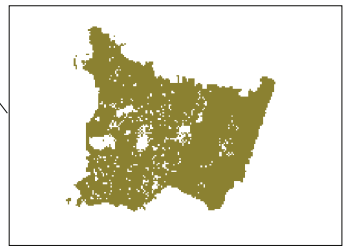
The county with the most environmentally sensitive land was Lycoming, with more than 5 million sqaure meters. The county with the least environmentally sensitive land was Philadelphia, with just 143,500 square meters.

Urbanization of Environmentally Sensitive Land, 1992-2001

County	Sensitive Land in 1992 (meters squared)	Urbanized Sensitive Land (grid cells)	Urbanized Sensitive Land (meters squared)	% of 1992 Sensitive Land Urbanized by 2001
Philadelphia	143500	42	21000	14.63%
Delaware	449500	83	41500	9.23%
Allegheny	2048000	285	142500	6.96%
Montgomery	1203000	132	66000	5.49%
Lawrence	1406000	100	50000	3.56%
Beaver	1768500	118	59000	3.34%
Lehigh	1132500	73	36500	3.22%
Monroe	2430500	141	70500	2.90%
Bucks	1907500	94	47000	2.46%
Northampton	1362500	66	33000	2.42%
Dauphin	2076500	97	48500	2.34%
Westmoreland	4261000	178	! 89000	2.09%
Lebanon	1449000	59	29500	2.04%
Lancaster	3960500	149	! 74500	1.88%
Butler	3318500	124	62000	1.87%
Carbon	1654500	61	30500	1.84%
Blair	2226500	82	41000	1.84%
Washington	3606500	132	! 66000	1.83%
Lackawanna	1784500	64	32000	1.79%
Mercer	2648500	94	47000	1.77%
Cumberland	2073500	72	36000	1.74%
Montour	533000	18	9000	1.69%
Berks	3382500	113	56500	1.67%
Chester	2847500	89	44500	1.56%
Erie	2964500	92	46000	1.55%
Cambria	2911000	88	44000	1.51%
Schuylkill	3388500	92	! 46000	1.36%
Fayette	3447500	91	! 45500	1.32%
Pike	2452500	64	32000	1.30%
York	3514500	91	! 45500	1.29%
Luzerne	3632000	94	! 47000	1.29%
Clearfield	4862000	123	! 61500	1.26%
Snyder	1351000	33	16500	1.22%
Columbia	1945000	46	23000	1.18%
Northumberland	1924500	44	22000	1.14%
Crawford	4060000	92	! 46000	1.13%
Franklin	3146000	71	35500	1.13%
Jefferson	2830000	62	31000	1.10%
Centre	4763500	99	! 49500	1.04%
Venango	3048000	62	31000	1.02%
Perry	2411500	48	24000	1.00%

Counties where recent urban growth was *most threatening*

Allegheny urbanized 142,500 square meters of sensitive land, more than any other county.



Westmoreland had the 10th highest amount of 1992 sensitive land. It urbanized 2% of its sensitive land, a higher portion than any county with more sensitive land.

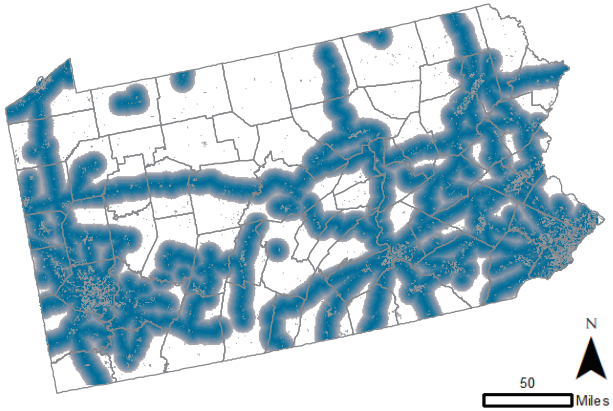
environmentally sensitive land

! **Counties with the highest amount of total sensitive land in 1992 (among the top third of counties)**

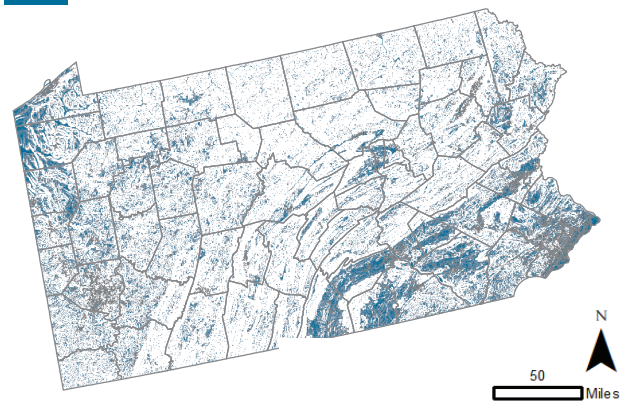
Future Urbanization Factors

& Future Urbanization Index Map

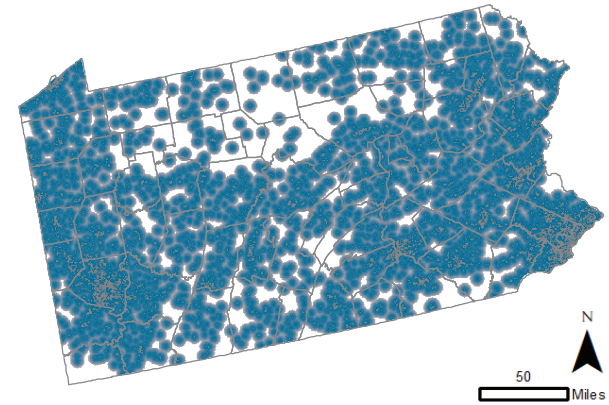
All maps on this page:
Existing urban areas
Land within 10 km of a 4-lane highway



Land with a slope of less than 2 degrees



Land within 6 km of existing urban land

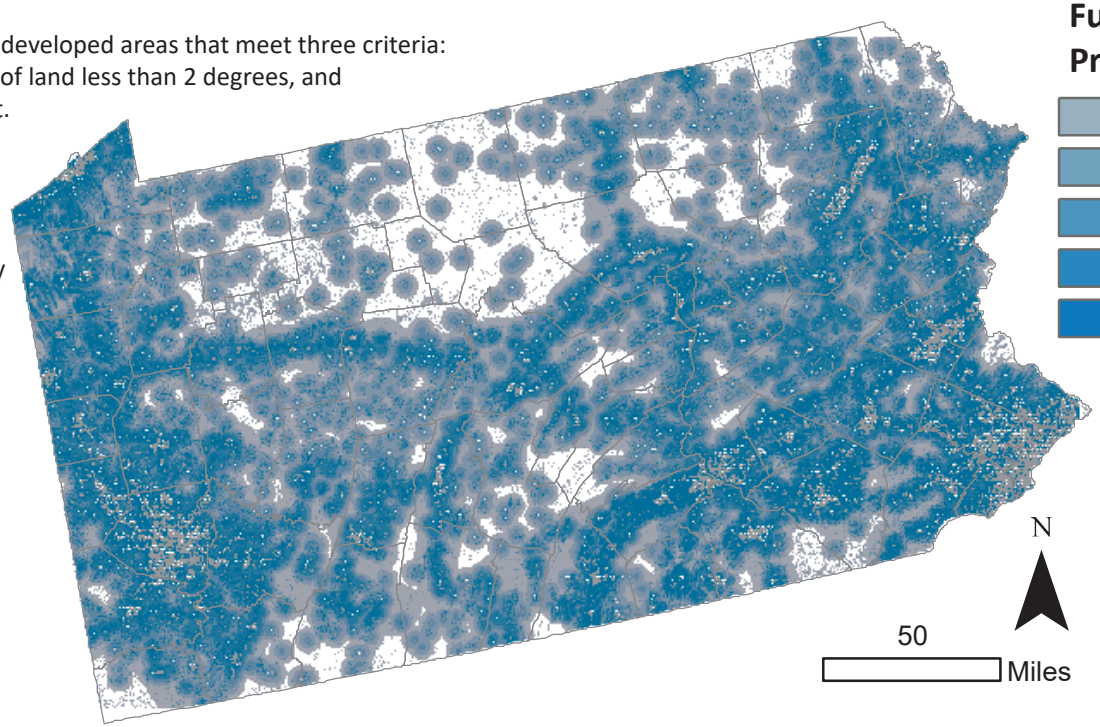


Future Urbanization Index Map

Future urban development is most likely in undeveloped areas that meet three criteria: (i) within 10 km of a 4-lane highway, (ii) slope of land less than 2 degrees, and (iii) within 6km of existing urban development.

We identified areas that met these criteria and then scored every grid cell between 0 (unlikely to be developed) and 90 (most likely to be developed). We weighed proximity to existing development most heavily (weight of 4), then slope (weight of 3), and, finally, proximity to a highway (weight of 2).

Areas in dark blue scored the highest and are most likely to be developed.

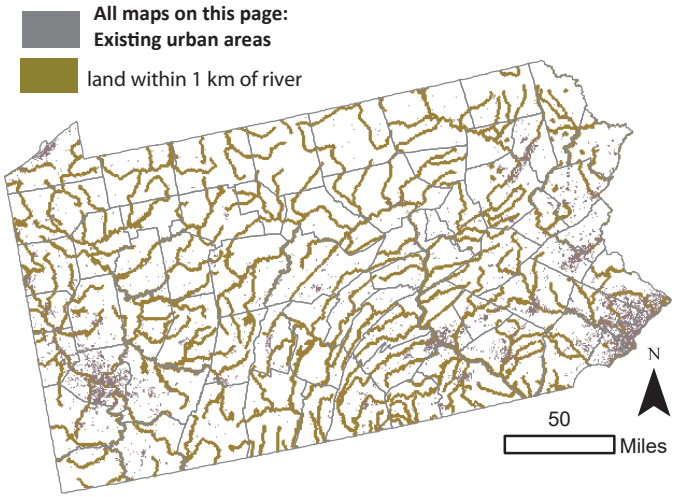


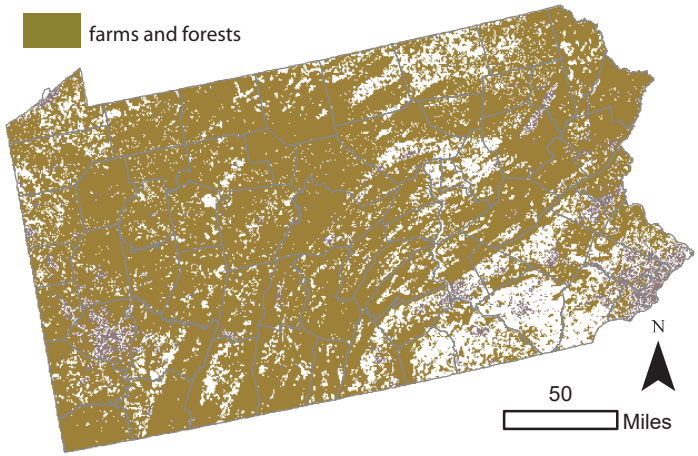
Future Urbanization Prediction Scores (up to 90)

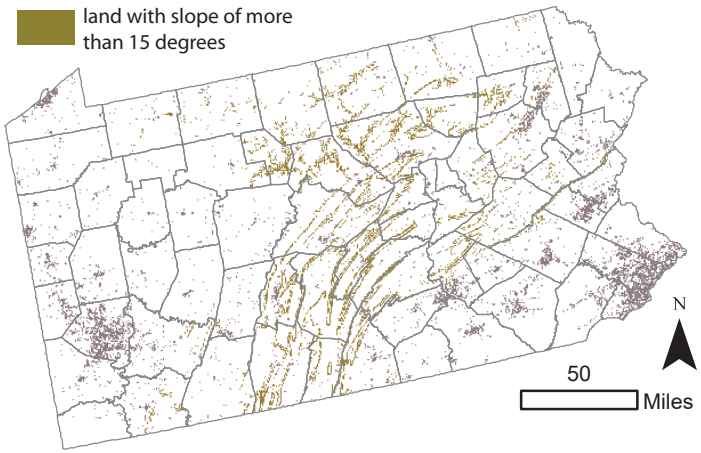
- 1 - 23
- 24 - 34
- 35 - 44
- 45 - 54
- 55 - 90

Environmentally Sensitive Land, 2001

Identification Criteria







Environmental Sensitivity Index

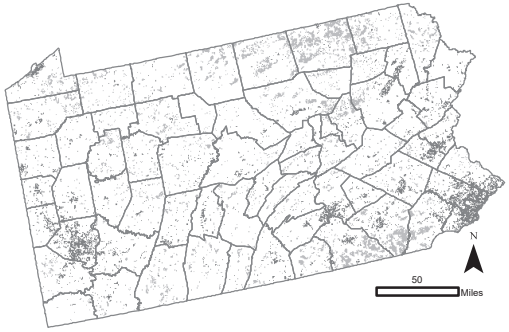
To determine where the most environmentally sensitive land is, we considered the three outlined criteria (proximity to rivers, slope of 15 degrees or more, and use of land for farms or forests). We weighted proximity to rivers most heavily (weight of 4), then slope of 15 degrees or more (weight of 3), and then, lastly, use of land for farms or forests (weight of 2).

We prioritized the criteria this way in the effort to protect water sources (for animal habitats, safe recreational use, and consumption) and account for erosion caused by development in high slope areas. We applied the weakest weight to farms and forests because a large portion of state land is used for these purposes.

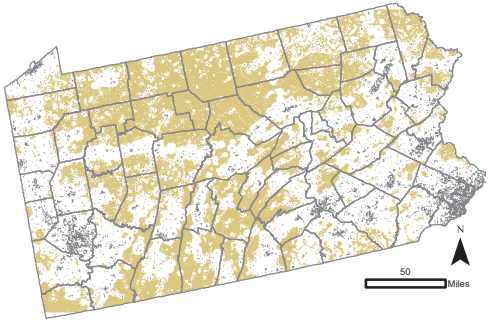
Threats and Opportunities of Urban Development

Combining the Future Urbanization Index and Environmental Sensitivty Index

Land is not sensitive
Land unlikely to be developed



Land is sensitive
Land unlikely to be developed



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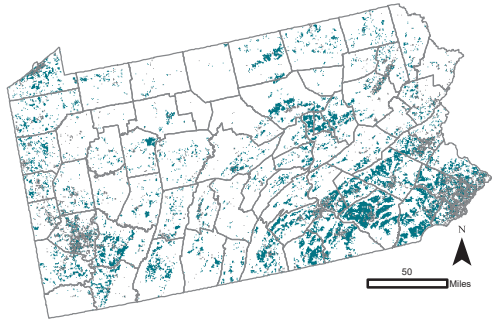
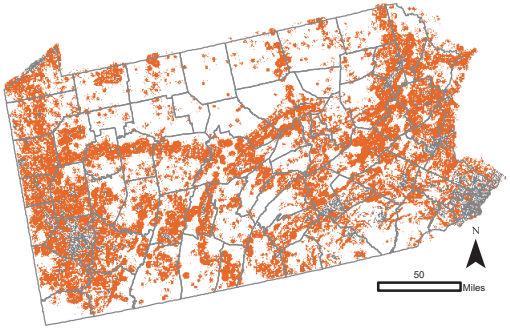
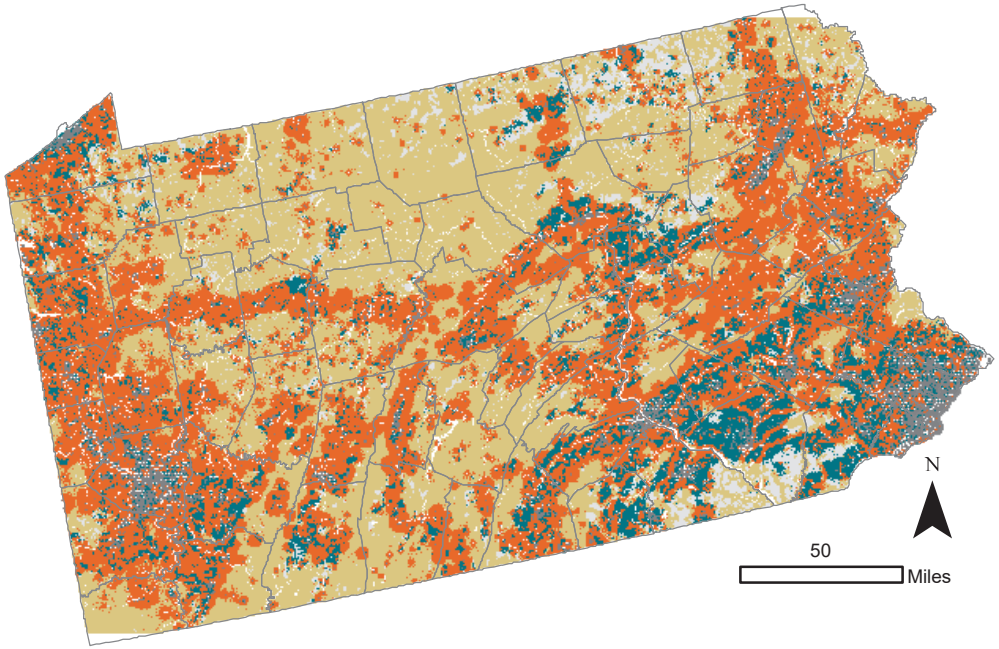
Land ikely to be developed



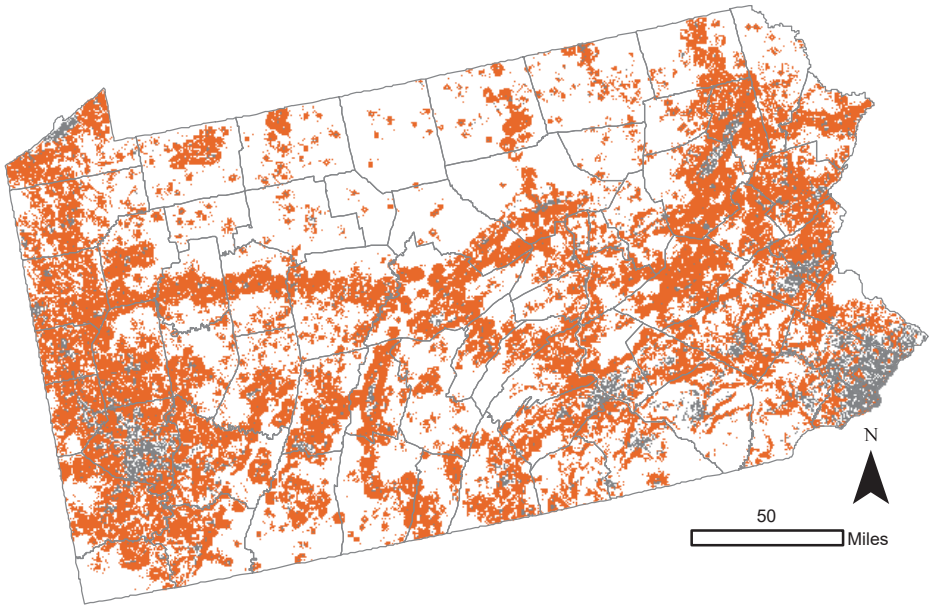
Land is sensitive
Land ikely to be developed



All maps on this page:
Existing urban areas



Conclusion



Existing urban areas

Land that has urban development potential, but is environmentally sensitive

Threats

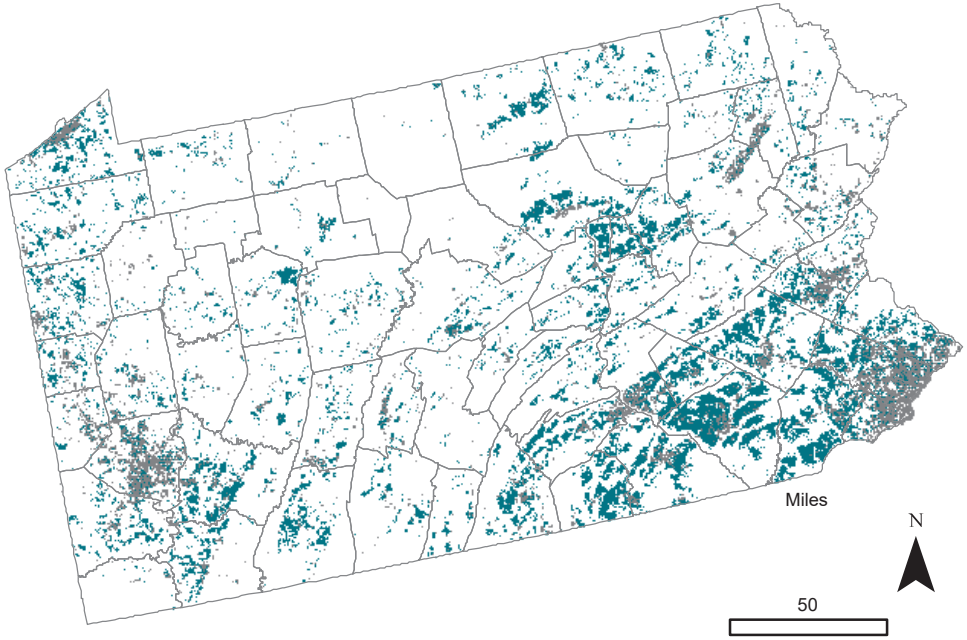
Pennsylvania is full of land that is worth protecting due to nearby water, land slope, and/or use as farm or forest. A significant amount of this environmentally sensitive land is also potentially valuable for urban development.

Land in red should be prioritized for protection.

Opportunities

There are opportunities in Pennsylvania to invest in urban development without risking land that is environmentally sensitive.

Urban development should be encouraged in the land in green.



Existing urban areas

Land that has urban development potential, but is not environmentally sensitive

About Philadelphia County: The vast majority of land in Philadelphia County is urbanized. Some grid cells in Philadelphia are identified as opportunities for urban development. These areas tend to be public parks and cemeteries. The value of these public, grassy areas, in a city with limited open space, is significant. Areas outside Philadelphia should be prioritized for development.