Regional Open Space Priorities Report



Produced by the

GreenSpace Alliance of Southeastern Pennsylvania

GreenSpace Alliance
of Southeastern Pennsylvania

A Project of the Pennsylvania Environmental Council

Contents

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Executive Summary

Purpose

The Regional Open Space Priorities Report project identifies, prioritizes, and recommends protection strategies for natural resources, agricultural, and recreational lands in the five-county southeastern Pennsylvania area. It encourages partnerships between state, federal, local, and private conservation groups and others to protect critical open spaces in the region while sustaining economic growth.

Need

The Report notes the need for and benefits from protecting open space and setting regional priorities, including the supply and quality of water; flood control; natural diversity; farm products; quality economic development; preservation of scenic, historic, and rural characteristics; recreational amenities; and use of financial resources.

Process

A GIS-based analysis was used, applying 31 data sources to a 30-meter-square grid network comprising more than six million cells. After developing separate analyses and maps for agriculture, natural resources, and recreation, these three components were combined and overlaid to create a final composite regional database and map. The data were then aggregated to identify high-priority open space and urban/suburban areas in the region. The process was guided by expert advisors and overseen by the GreenSpace Alliance Executive Committee.

Findings

The region has tremendous assets in its open space lands and stream/river corridors. However, open space is disappearing quickly. Further, it is not simply the rate of loss that threatens our region; the problem is the fragmented way in which we have chosen to consume those valuable assets.

Priorities can be set for protection based on two kinds of lands: "Open Space Priority Lands," where regional protection should be focused, and "Suburban/Urban Priority Lands," where local community needs should predominate. A balance should be maintained between protection of critical open space, managed growth in undeveloped areas, and community revitalization.

Recommendations

1. Adopt a two-pronged approach to open space conservation in the region: Open Space Priority Lands and Suburban/Urban Priority Lands.

2. As a guideline, see that at least one acre of undeveloped land is protected for every acre that is developed.
3. Set a goal to permanently protect no less than 50% of remaining undeveloped Open Space Priority Lands. Dedicate an extraordinary allocation of resources to this purpose.
4. Recognize that the stream and river corridors that are part of the Open Space Priority Lands are a critical integrating resource for the region. Dedicate planning and funding resources to the permanent protection of these corridors.
5. In the Suburban/Urban Priority Lands, concentrate on protecting high-resource-value lands for recreational purposes and for limited natural resource and specialty agricultural uses.
6. Enact comprehensive plans and land use ordinances and promote multi-municipal cooperation to protect open space.
7. Commit to "Regional Statesmanship": In local communities across the region, support protection of the Open Space Priority Lands, even if those lands are not located in the immediate vicinity.
8. Use the Report as a strategic guide in open space protection decisions.
9. Continue to develop the database underlying the Report as an analytical tool for planners, funders, elected and appointed officials, corporations, organizations, and individuals.
10. Encourage widespread circulation, review, and endorsement of the Report.

Background

The GreenSpace Alliance

The GreenSpace Alliance (the Alliance) was founded in 1992 as a project of the Pennsylvania Environmental Council (PEC). It is a coalition of organizations and concerned individuals, joined in their interests in conservation of open space and encouragement of residential and economic development, as well as recreation consistent with conservation.

The Alliance is guided by an Executive Committee of leading land conservation, smart growth, and environmental organizations, including PEC, four major regional land trusts, Chester County 2020, 10,000 Friends of Pennsylvania, and the Pennsylvania Horticultural Society. The Delaware Valley Regional Planning Commission (DVRPC) participates in an advisory capacity.

The Alliance seeks to promote a regional vision and practical mechanisms for creating an integrated system of open spaces in southeastern Pennsylvania; to help define physical design for livable communities in the region and promote its implementation; and to show the linkage between revitalizing urban communities and preserving open space in suburban and rural areas.

The Region

For the purposes of this Report (and the Alliance's work in general), the southeastern Pennsylvania region is defined as Bucks, Chester, Delaware, Montgomery, and Philadelphia Counties. Some facts follow:

- The population as of 2001 was 3,851,648, growing at about 3% per decade but, more significantly, redistributing itself from Philadelphia and the inner suburbs to the middle and more rural parts of the four suburban counties.
- The region contains 238 local municipalities.
- The total area is 1,405,000 acres.[1]
- Developed land as of 1995 totaled 591,000 acres.[2]
- Protected lands as of 2002 totaled 161,000 acres.
- Undeveloped land as of 2002 totaled 653,000 acres.

Challenges in the region include the following:

- Land is being consumed by development at a rate that exceeds population growth by a factor of 10 or more.
- Viability of agriculture is threatened: Acreage in agriculture has declined by 34% since 1969.
- Sprawl contributes to 40% of stream pollution due to erosion, increased impervious surface areas, and contaminants in runoff.
- Development is impinging on scenic and historic landscapes.

Why Set Regional Open Space Priorities?

Sprawl development in southeastern Pennsylvania is severely impacting the region's natural resources and green spaces. A recent report by the Brookings Institution[3] noted that in the region over the 15 years from 1982 to1997:

- 131,000 acres of land were converted to urban uses.
- Nearly 55,000 acres of prime farmland were lost.
- 122,300 new households were accommodated.

Recent years have also seen the following:

- Migration of employment opportunities to suburban locations
- Extensive highway construction to accommodate increased traffic loads, which in itself consumes open space and facilitates highway-dependent commercial development
- Fragmentation of large areas of undeveloped land into smaller, less ecologically valuable parcels due to scattered development

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[1] Acreage figures are rounded to the nearest 1,000 acres throughout the Report.
[2] 1995 was the last year for which these data were available.
[3] *Back to Prosperity: A Competitive Agenda for Renewing Pennsylvania*, Philadelphia Area Profile, Brookings Institution, Washington, DC, 2003.

- Threats to water supply, both qualitative and quantitative
- A growing demand for outdoor recreational opportunities such as biking, hiking, fishing, and boating
- The decline of older communities, many of which were built in an era when green space was given little thought and therefore today lack the open spaces and trails that are basic infrastructure for attracting residents and jobs in an information-based economy
- Rapidly escalating costs of acquiring or otherwise protecting open lands and of converting vacant land to new green space in urban communities

Complicating factors in addressing this situation include:

- Division of the southeastern Pennsylvania suburbs into 238 local municipalities, most of which are not participating in multi-municipal planning or engaging in open space funding initiatives within their boundaries.
- The lack of a regional perspective based either on natural resources (watersheds) or economics (metropolitan region).
- Limited availability of funds for open space protection and compatible recreational development.
- Lack of comprehensive agreed-upon regional open space priorities to guide funding and related decisions. These need to be presented, discussed, and supported before priceless landscapes, historical sites, contiguous ecological areas, and recreational opportunities are lost.

County, multi-county and multi-municipal comprehensive plans are addressing the impact of growing sprawl and diminishing open space, and their acquisitions are responsive to plans and priorities. Still, in local entities where effective comprehensive planning is lacking, the historic tendency to respond to development pressures in a piecemeal, reactive way remains.

In the face of these pressures, funders, both governmental and private, have difficulty in choosing among projects and question whether their resources are being expended as effectively as they might be.

This Report puts a particular focus on the importance of thinking *regionally*; i.e., on a multi-county basis, taking into account the interests of the metro area's population and economy. The Report also urges development of a consensus on the balance between protection and development.

While the situation is serious, there are opportunities to slow the tide of sprawl in the years just ahead—if the necessary commitments can be obtained.

The Report

This Report was developed by the Alliance, with funding from the Pennsylvania Department of Conservation and Natural Resources (DCNR) and the William Penn Foundation. It is a study of the five-county southeastern Pennsylvania region, using Geographic Information System (GIS) technology and expert advisory input to determine and display the value of the lands for agricultural,

natural resources, and recreational purposes and to recommend priority areas for protection.

Purpose

Establishing regional priorities has become important, as levels of investment necessary to acquire or otherwise protect land have increased dramatically. Setting priorities is intended to:

- Promote a well-reasoned approach to protection of land
- Leverage resources and funding among state and local government, private conservation groups, and others
- Help the region protect open space before the pressures of urbanization and sprawl become overwhelming
- Identify the most critical resources before the pressure of urbanization and sprawl destroys them

Protecting open space on a multi-county regional basis has significant benefits that extend beyond the boundaries of the place protected, impacting the entire region. These include:

- Protection of the water supply
- Provision of flood control
- Enhancement of the quality of life and provision of recreational opportunities
- Maintenance of wildlife and natural diversity
- Preservation of scenic, historic, and rural character of the region's landscape
- Encouragement of high-quality economic development through attraction of businesses and employees that look for nearby open space amenities in making location decisions

The purposes of the Report project are to:

- Foster partnerships and dialogue among state, federal, local, private conservation groups, and other parties to balance economic growth and protection of open space in the region.
- Identify, prioritize, and develop strategies through a GIS-based analysis to protect valued natural resources, farming, and recreational opportunities.
- Establish linked regional priorities that will improve health and quality of life by:
    - Conserving large, unfragmented tracts of open land that protect natural resources and agricultural areas
    - Revitalizing previously developed land
    - Encouraging compatible recreational use
- Obtain commitment to the Report and its recommendations in the form of organizational endorsements.

Methodology

With the aid of advisory groups, the Alliance identified three open space uses—agriculture, natural resources, and recreation—and developed data layers to determine how valuable land across the region is for each use. Each data layer contains a measurable criterion, such as soil quality (for agriculture), riparian buffers (for natural resources), or population (for recreation).

The layers were weighted by the advisory groups as a means of determining the relative value of the different criteria to each other. Then, three major subsections were created by merging the agricultural layers into one composite map, the natural resources layers into a second, and the recreation layers into a third. From this, it was possible to identify areas within the region that were of particular value for agriculture, natural resources, or recreation.

Finally, the three components were overlaid onto each other to produce a composite map showing the overall values for all layers throughout the region. In these combined displays, the three sections were weighted equally against each other.

Analysis

Analyses were performed using GIS technology to highlight large, contiguous, and connected areas where open space conservation would be valued highest ("Open Space Priority Lands") and those where neighborhood uses would predominate ("Suburban/Urban Priority Lands").

By overlaying development data on Open Space Priority Lands, it was apparent that they are already experiencing the pressures of development. As of 1995, 171,000 acres were identified as developed—some 22% of the total area of 745,000 acres. Another 130,000 acres were protected, leaving 444,000 undeveloped and unprotected. Development in these sub-regions is occurring in a fragmented way, with developed sites scattered throughout these lands, threatening their contiguity and connectedness.

The balance of the five-county region contains most of its residential, commercial, and industrial uses. Within this 660,000-acre area, 423,000 acres are developed and 32,000 protected, leaving 205,000 acres undeveloped and unprotected. Of these 205,000 acres, 91,000 are high-resource-value lands.

Advisory Process

Expert advice was utilized throughout the development of the Report and database. Some 135 persons gave input in the course of the Report's development, and an estimated 330 persons saw and commented on it during 21 presentations in PowerPoint format between June and December of 2003.

In addition, the Alliance's Executive Committee received briefings and provided guidance on a monthly basis throughout the development process.

Agriculture

Important agricultural lands of the four suburban counties (Bucks, Chester, Delaware, and Montgomery) were evaluated. Philadelphia was not evaluated for agricultural purposes, owing to the absence of large-scale agriculture within the City limits.

Agricultural lands were defined using the 1995 DVRPC definition as "land devoted to crops, pastures, orchards, tree farms, or other agricultural uses. The farmstead and associated buildings are also considered agricultural. Single- or double-lot splitoffs with houses are included in the agricultural classification."

Using the available agricultural data universal to all four counties, GIS maps defining the most important agricultural areas were created. Development of the maps and weighting of the data were done with the assistance of an advisory group, with representation from agriculture, land conservation, GIS, and land use professionals.

Consensus was developed in numerous areas, ranging from the definition of important agricultural lands in this region to the determination of specific agricultural prioritization weights.

Layers

To prioritize land in the region for its agricultural value, a cell-based (raster) modeling technique was used, in which an invisible mesh of cells overlaid each GIS data layer. Thus, each map contained a grid. Each individual grid cell represented a 30-square-meter area and received an overall value and score, determined by the scores of all of the data layers for that area.

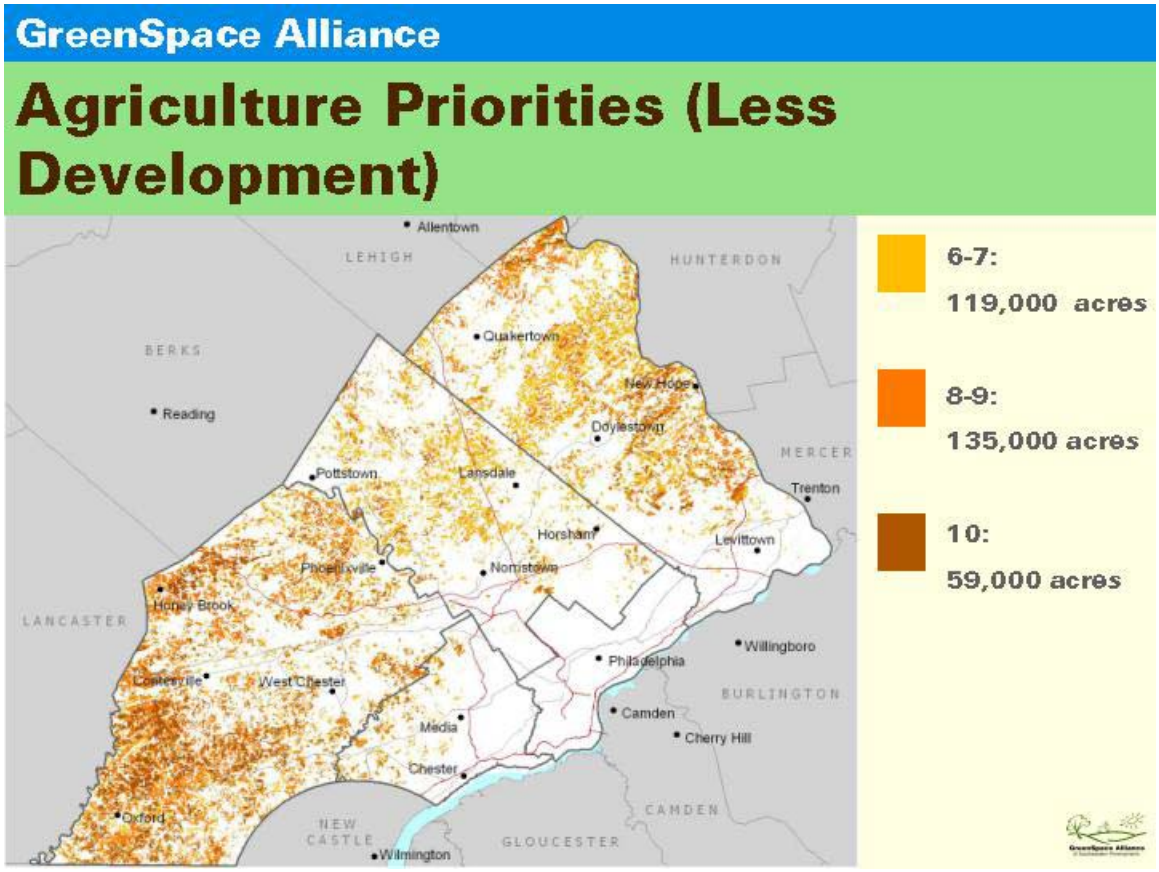
The data layers that make up the agricultural component of the Report include the following. (Weighting was determined through consensus of the advisory group.)

- The presence of prime farmland and soils of statewide importance, as defined by the Natural Resources Conservation Service (NRCS) and the State. This layer determined 35% of each cell's total value.
- Land in agricultural use, as defined by DVRPC's *1995 Land Use Data*. This layer determined 24% of each cell's total value.
- The size of contiguous agricultural soils. This layer determined 18% of each cell's total value.
- The proximity to existing protected lands (conservation easements, agricultural easements, parklands, and fee-owned protected lands). This layer determined 15% of each cell's total value.
- The percent area of each township within Agricultural Security Areas (ASAs). This layer determined 8% of each cell's total value.

Each cell's value was based on the combination of these five layers, with a perfect cell score totaling 100. For example, a cell might receive 35 points because it had federally designated prime soils, an additional 24 points because it was in use as farmland, 9 points because it was near other areas of prime soils, 5 points for being near protected lands, and 4 points because a portion of the township was located in is an ASA, for a total of 77 points.

Putting It All Together

All five base layers were added together, weighted, and classed into ten-percent quantiles to create a composite map that shows the region's top agricultural priorities. Developed land was removed. The resulting map shows areas that scored higher than the median (5 points). The higher the score, the deeper the shade.



A sizable amount of land is in agricultural use in the region, and much of that land is considered valuable agriculturally. Specifically:

- Of the total five-county acreage (1,405,000), 403,000 acres are in agricultural use.
- Of the lands in agricultural use, 196,000 acres are high value (8, 9, or 10 in the ranking process).

High-value agricultural lands are found across the region, from Bucks County in the northeast through Montgomery County and extending to the southwestern corner of Chester County. Delaware County, in its western portion, has soils of high importance, but development has greatly reduced the amount of land in active farming.

While all this is good news, much valuable farmland is in the path of development, and accordingly, its survival as farmland is threatened. Because contiguity to other high-resource-value agricultural lands is important, this should be a priority in protection efforts.

Natural Resources

The data used in the natural resources component of the Report were derived from the Natural Lands Trust (NLT) "Smart Conservation" model. This model was developed using a process that involved a broad range of scientists and practicing conservationists organized into workgroups, guiding criteria development according to taxonomic groups: 1) plants, 2) mammals, 3) birds, 4) herps (reptiles and amphibians), 5) aquatics (water quality and aquatic organisms), and 6) terrestrial invertebrates.

The technical staff of NLT, which initially developed the data for an 11-county area of southeastern Pennsylvania, adapted it for the current project to the five counties examined in this Report.

Layers

To prioritize land in the region for its natural resources value, a modeling technique similar to that for agriculture was used. The 15 data layers that make up the natural resources component of the Report include the following:

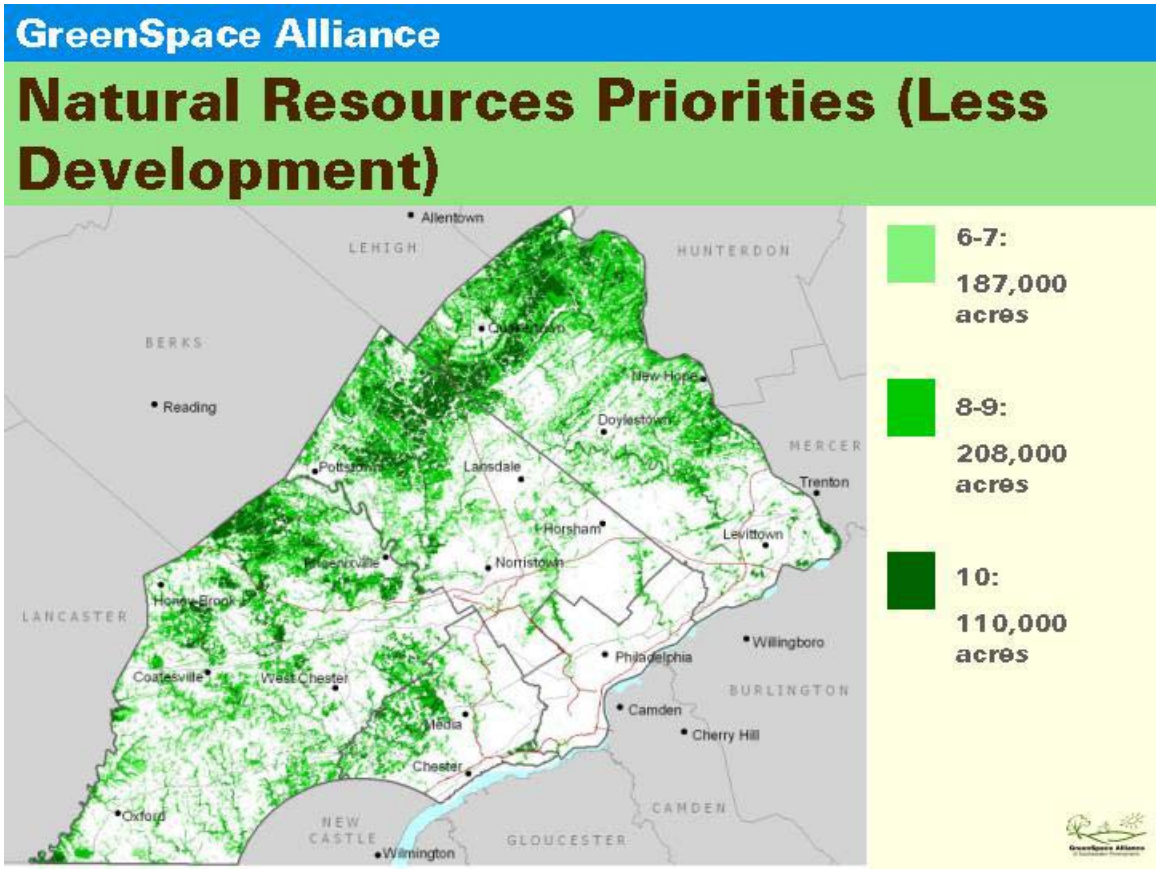
- Wildlife/fish habitat subcomponent
    - Mammals
    - Fish
    - Herps
    - Birds
    - Important bird areas (IBAs)
- Stream/wetlands subcomponent
    - National Wetlands Inventory (NWI)
    - Hydric soils
    - Floodplains
    - Forested water quality
    - Riparian buffer quality
    - Headwaters protection

- Woodlands/meadowlands subcomponent
    - Interior forest habitat
    - Natural vegetation habitat blocks
    - Orphan agricultural soils
    - Steep slopes

Putting It All Together

Each layer was added with the others in its subcomponent. The final scores were then normalized back to a 0-to-10 (10%) quantile classification system. Whereas this had the benefit of allowing easy data compilation and comparison as part of a relative ranking system, it also had the disadvantage of changing the proportional weight of each subcomponent from its original value to a uniform 33.33% for each subcomponent. In order to recalibrate the scoring to achieve the original subcomponent values, an adjustment factor was required.

Once compiled, the three subcomponents were added together and multiplied by the adjustment factors, producing a composite Natural Resources Priorities map. This map was recalibrated again to show results as 10% quantiles. Developed areas were then removed. The resulting map shows natural resources priorities 6 through 10 in progressively deeper shades.



The results indicate that high-resource-value lands (levels 8, 9, and 10) in the region total 318,000 acres. Natural resource values are not evenly distributed: Concentrations of high-resource-value land are found in central and northern Bucks County, the northwestern third of Montgomery County, northern Chester County, and the western and northern portions of Delaware County, extending into southeastern Chester County. River and stream corridors have high values; wetlands, highlands, steep slopes, and forested areas tend to have the highest values.

As with agricultural lands, much of the high-resource-value land for natural resources is contiguous to other high-value land and derives part of its value from this connectedness. Agriculturally valuable lands are generally not highly valuable as natural resource lands, most likely because factors important for natural resources purposes are not present in land that is being farmed.

Note that most of the natural resource value of lands within Philadelphia is low, due to development. Several stream corridors have high values where they enter Philadelphia, but develop lower values as they pass further into the city.

Recreation

Creation of the recreation component followed three "tracks": 1) mapping *existing* recreational facilities; 2) mapping *proposed* recreational priorities; and 3) *ranking* proposed recreational priorities.

Advice was sought throughout the development process from county open space planners; Bucks, Chester, Delaware, Montgomery, and Philadelphia Counties; NLT; Brandywine Conservancy; Heritage Conservancy; and two private consultants active in greenway, park, and trail planning.

Base Mapping and Inventory of Existing Resources

Defining Recreational Open Space

For this project, the act of enjoying the outdoors was considered the most essential form of recreation that open space provides. (Driving or biking down a road and enjoying the scenery is a form of recreation, and the open space that creates that scene is "recreational open space.") DVRPC chose to highlight those open spaces that permit and facilitate *passive recreation* (activities that utilize natural, largely undeveloped landscapes and facilities that don't require a large change to the natural environment).

Additionally, the recreational resources considered in this project are primarily publicly owned and/or freely available to the public—privately owned resources were not inventoried. Privately owned lands that are protected from development, however, were included, because the views they provide to the public are integral components of outdoor recreational experiences.

Protected Lands Inventory

DVRPC compiled an inventory of existing recreational open space resources and created base maps for the purpose of developing recreational open space priorities in the region. Included were:

- Federal, state, county, and municipal lands. Many of these lands are classified specifically as "parks," but they also include game lands, state forests, historical sites, lands held for watershed protection, wildlife refuges, nature preserves, and other types of public lands.
- Privately owned lands permanently protected from development. This "protected private open space" consists of land trust–owned and –eased lands and farmland eased through public and private funding.
- Trails and greenways.
- Public facilities and places where passive recreational activities occur.
- Regionally significant historical sites and landmarks, natural features, arboretums, nature preserves, and wildlife refuges.

Based on comments from the advisory group and County outreach meetings, recreational priority areas were distilled into three categories: nodes, connectors, and focal areas.

"Nodes" were defined as existing parks (federal, state, county, and municipal), including linear parks, state game lands, and preserves of regional importance. In developing maps, buffer areas were placed around all county, state, and federal open space lands, based on the notion that parks should be expanded, where possible, or enhanced. Existing linear parks were also buffered to maintain scenic views and the integrity of the landscapes. Municipal parks were not buffered, as they generally serve local populations only.

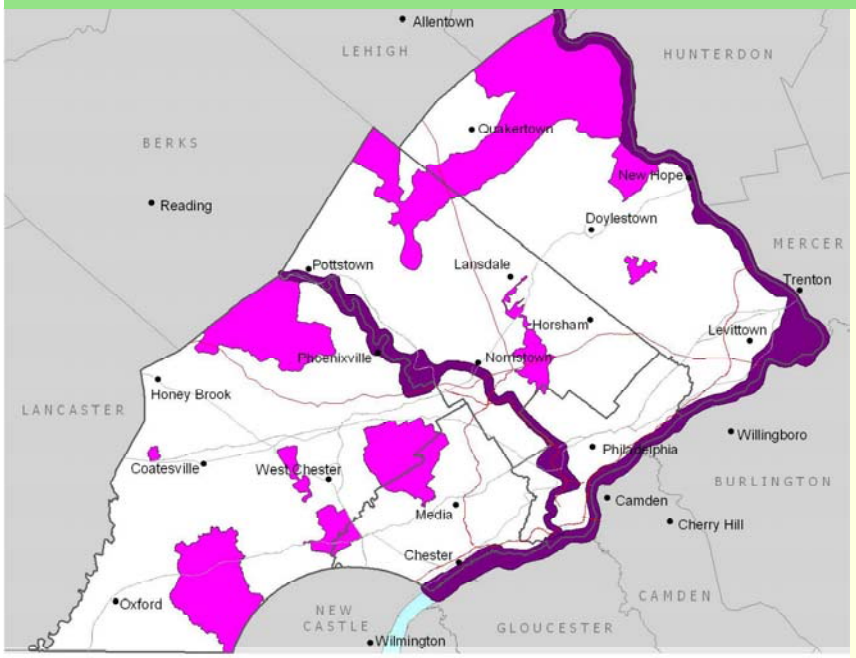
This study does not research the particular needs of any node but, rather, ranks the relative need for investment in the node compared with other nodes.

"Connectors" are linear corridors that provide links between nodes or between population centers and nodes. Most connectors shown on the map are planned trails that Counties have prioritized. In addition, stream corridors are shown as connectors because the Counties plan to protect them and add trail systems along them. Other connectors are existing roads to which recreational components such as bike lanes, streetscape improvements, and even parallel multi-use trails could be added.

"Focal areas" are large landscapes with a specific unifying resource that have a recreational component. Among the 12 focal areas identified across the region are major rivers, areas with unique geology and beauty, and landscapes identified as National Historic Landmarks. A map of the focal areas follows:

GreenSpace Alliance

Focal Areas—Recreation



Focal areas:

- **Delaware River**
- **Schuylkill River**
- **Highlands**
- **Brandywine Battlefield**
- **White Clay Watershed**
- **Big Woods**
- **Forks of the Neshaminy**
- **Paunacussing**
- **Wissahickon Green Ribbon**
- **Willistown Conservation Area**
- **Stroud Area**
- **Sadsbury**

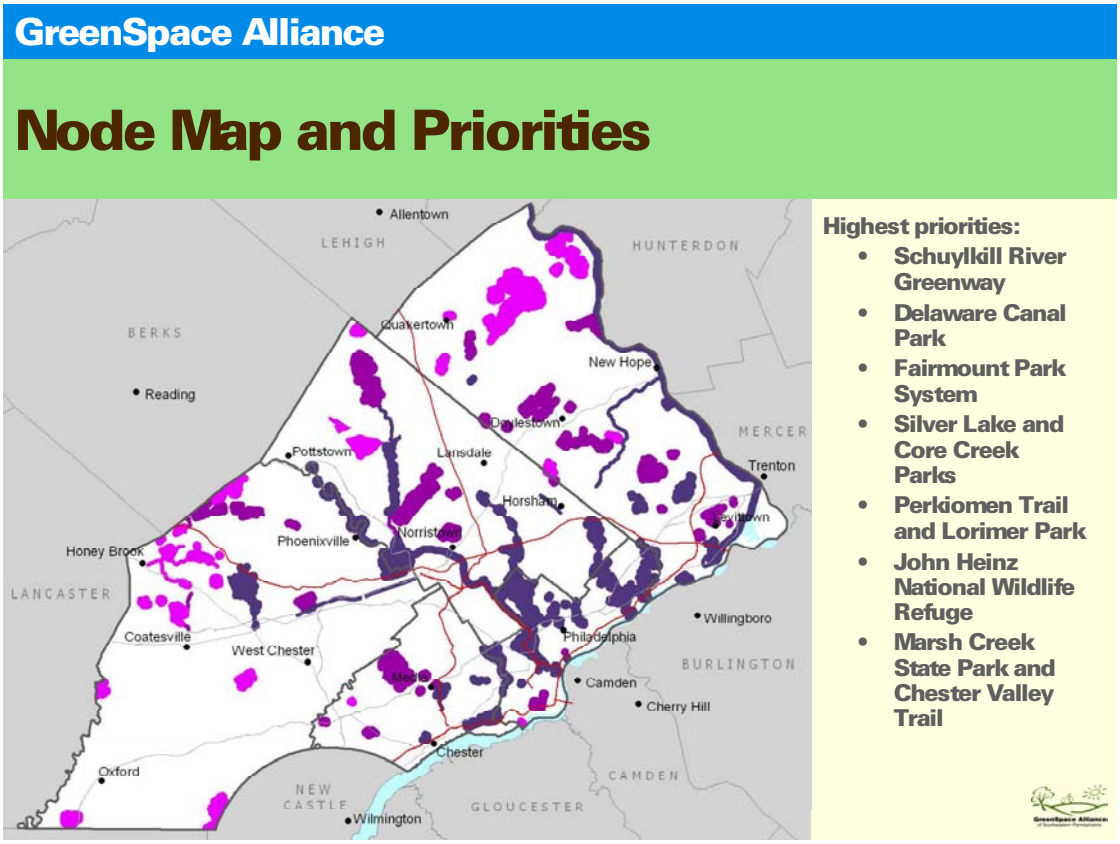
Ranking the Recreational Priorities

Because nodes and connectors represent different types of regional recreation, they were not ranked against each other. Instead, nodes were ranked against other nodes, and connectors were ranked against other connectors. Focal areas were not ranked, as they are large, diverse areas that encompass too many variables to adequately compare. Instead, nodes and connectors located within a focal area received a percent boost in points.

Nodes and buffers around them have a single value, based on the addition of criteria 1 through 4 below, multiplied by criteria 5.

1. **Population served:** Population density of the census blocks closest to that node. Because access to recreation is considered extremely important, these values were then weighted 50% of the whole.
2. **Intersections with connectors:** Nodes' intersections with connectors received points based on the relative value of the connector.
3. **Proximity to other nodes:** Nodes received points based on how close they were to other nodes.
4. **Proximity to private open space:** Nodes were ranked based on how close they were to private open space.
5. **Inside focal area:** A 50% boost was given to total node score for nodes within the Delaware or Schuylkill River focal areas; a 20% boost was given to total node score for nodes located within any of the other 10 focal areas.

Finally, nodes' scores were classified into quantiles of high, medium, and low priority. The ranking process resulted in at least three high-priority nodes within each county. However, with the heavy emphasis on proximity to population density, most of the region's high-priority nodes are in Philadelphia and first-generation suburb areas. Parks on the fringe of the region are generally ranked lowest. A map of the nodes follows:

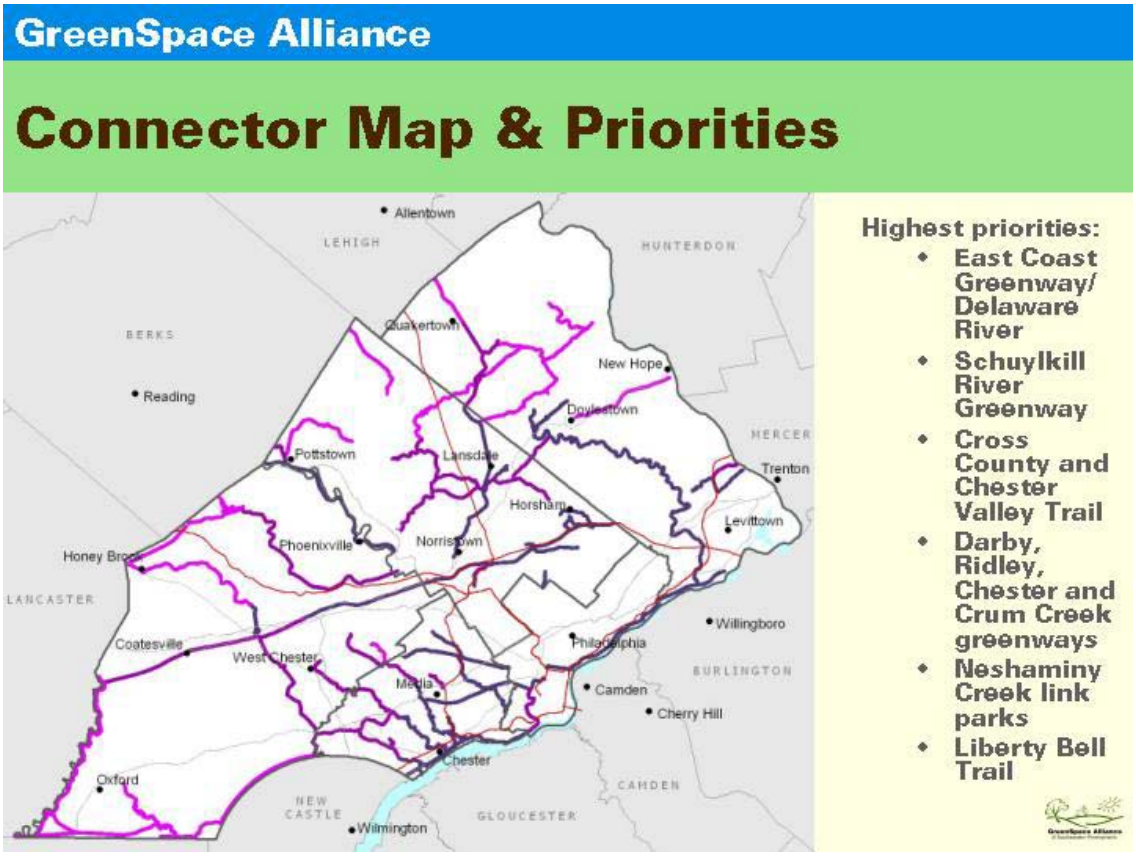


Connectors have various scores assigned to individual 30-by-30-meter grid cells based on these inputs:

1. **Proximity to parks by size:** Points are gained for each park within ½ mile of each grid cell. The amount of points varies depending on the size of the park.
2. **Proximity to private open space:** Points are gained for each private open space within a mile of each grid cell. The amount of points varies depending on the size of the open space.
3. **Population served.**
4. **Proximity to colleges and universities.**
5. **Proximity to gateway communities:** Gateway communities are areas of population and/or employment concentration as defined by the DVRPC *2025 Plan*, as well as by their proximity to the rail stations in the region.
6. **Inside focal area:** A 50% boost was given to the total grid's score for connectors within the Delaware or Schuylkill River focal areas, and a 20% boost was given to the grid's score for connectors located within other focal areas.

Final connector scores were classified into quantiles that were manually adjusted and shown as high, medium, and low priority on the GIS map showing recreational priorities and the composite regional priorities map.

Again, with the heavy emphasis on population served, the connectors in the urbanized areas come out as the highest priorities. Low rankings generally go to connectors on the fringe of the region or that otherwise travel through low-density rural areas. A map of connectors follows:



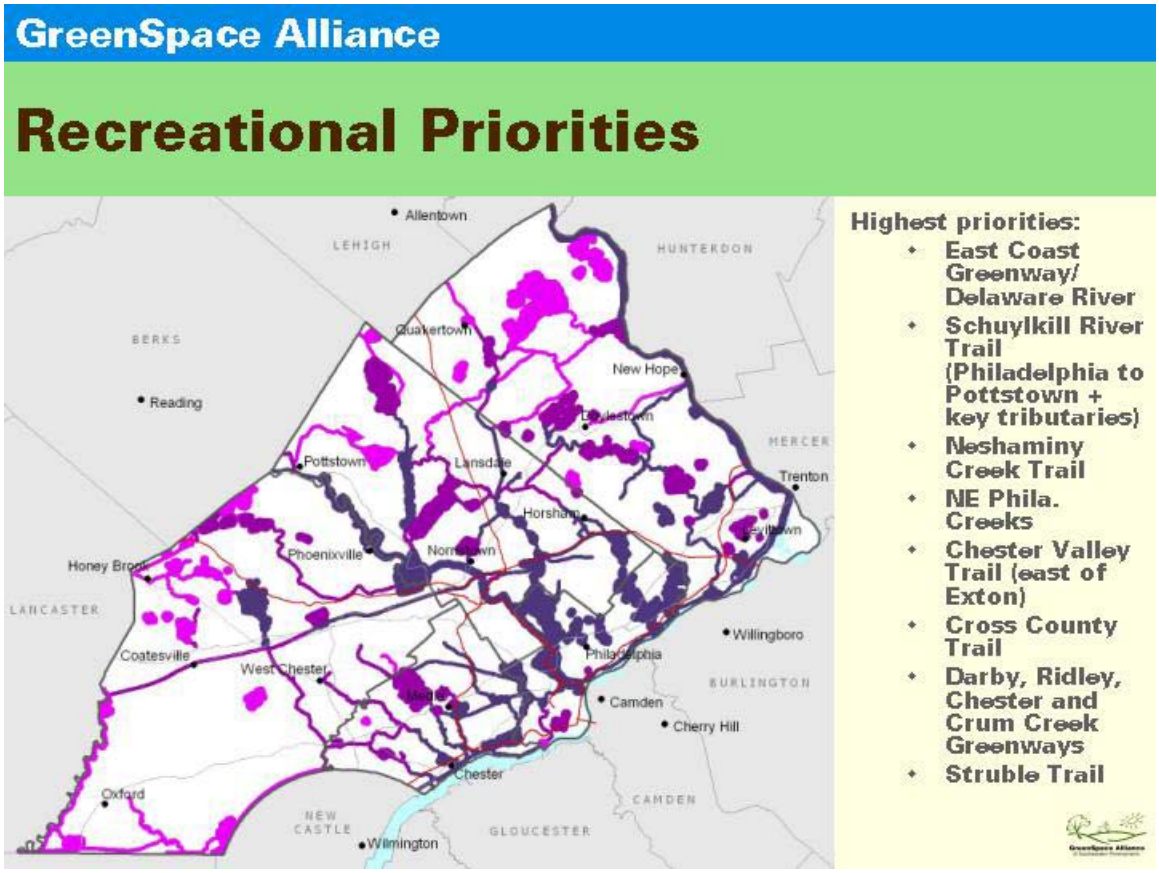
Buffers around nodes and all connectors are delineated by a 2,000-foot-wide line. Because of historic development patterns, much of these buffer areas has been developed. Accordingly, the width of the lines is not intended to represent an actual area of adjoining lands to be acquired or the actual width of a greenway or trail, but instead to denote the notion of adjoining acquisitions, park enhancements, interface with host community, and scenic views from greenways and trails.

Putting It All Together

The nodes and connectors maps were overlaid to form the recreation map for the region and the recreation component of the composite map.

Based on the scores obtained, the recreationally significant cells were sorted into three equal-size categories, low, medium, and high. Because nodes

(predominantly parks and major stream corridors) represent different types of regional recreation from connectors, they were ranked separately—nodes against nodes and connectors against connectors. The combined nodes and connectors constitute the recreational priorities.



Stream and river corridors and water-connected parks emerge as the highest priorities for recreation. In particular, the Schuylkill River and Delaware River corridors are of prime significance. Most of the other high-value recreation land is in the form of trails that follow streams.

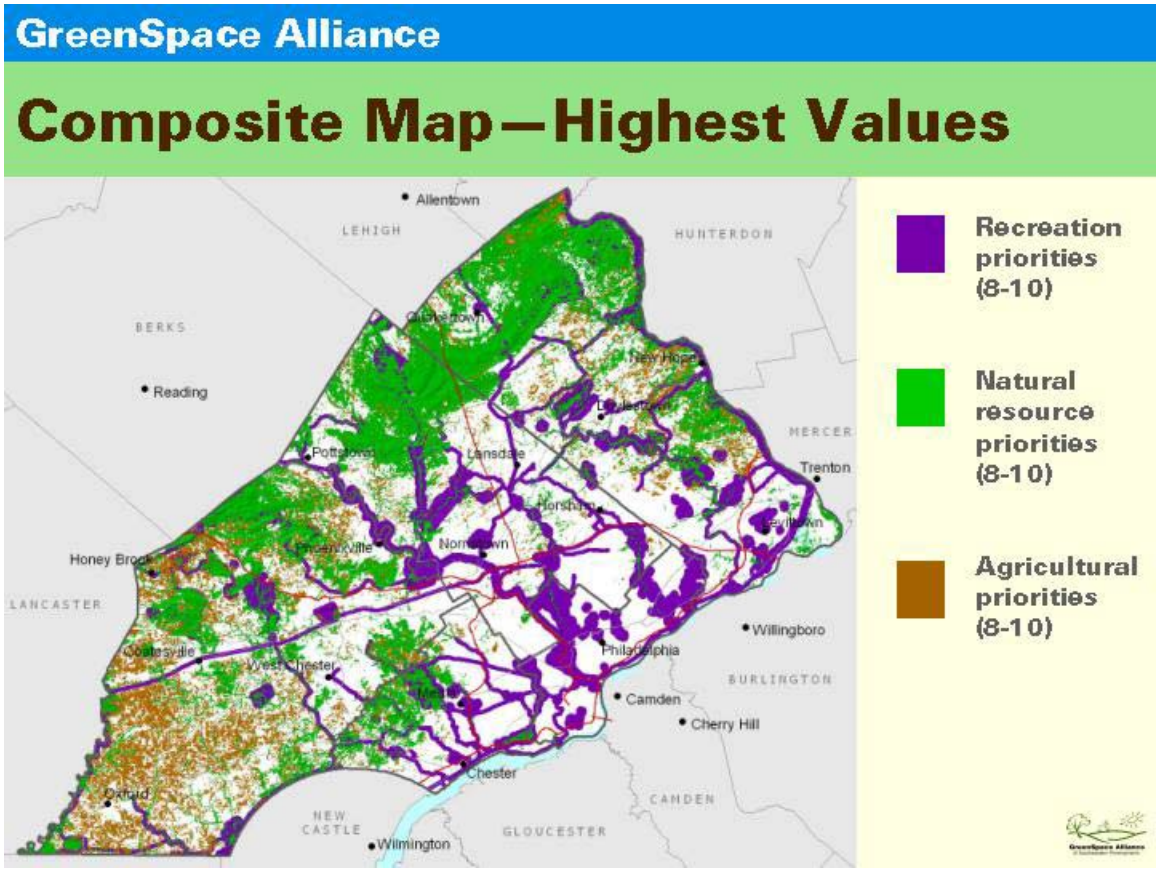
There are numerous places where trails might be extended to connect with other trails and with nodes. We note for the purposes of this study, to keep the project to manageable levels, that only facilities that were either in existence or on County plans were evaluated. A valuable, but also sizeable, continuation project could be developed to fill in the gaps in the five-county trail and greenway network.

In general, the rankings of recreational values reflect the concentrations of nearby population, which was assigned 40% to 50% of the weight.

Combined Data

The agricultural, natural resources, and recreation data layers were received from the subcontractors who developed them and combined by Alliance staff into a single display. For this combined analysis, each layer was weighted equally against the others; i.e., agriculture, natural resources, and recreation each counted for one third of the total value in each cell. In the case of Philadelphia County, because agriculture was not evaluated at all, natural resources and recreation each accounted for one half of the score.

A composite display was developed. This is a "highest-value" display (see figure, below), in which each cell was given the value of the highest of the three components and in the graphic was shown with the color that matched that component. For example, if a cell received a score of 10 for agriculture, 9 for natural resources, and 8 for recreation, it was given a value of 10 and displayed in brown, for agriculture.



For display purposes, the recreational layer is shown in its entirety on the composite map, so that if a given cell had a 10 for natural resources and an 8 for recreation, it would show as a recreation priority. Without this feature, the

connectors tended to appear fragmented and at times to disappear. However, the database can be displayed without this feature to show where high-value agricultural and natural resources values appear in recreational areas.

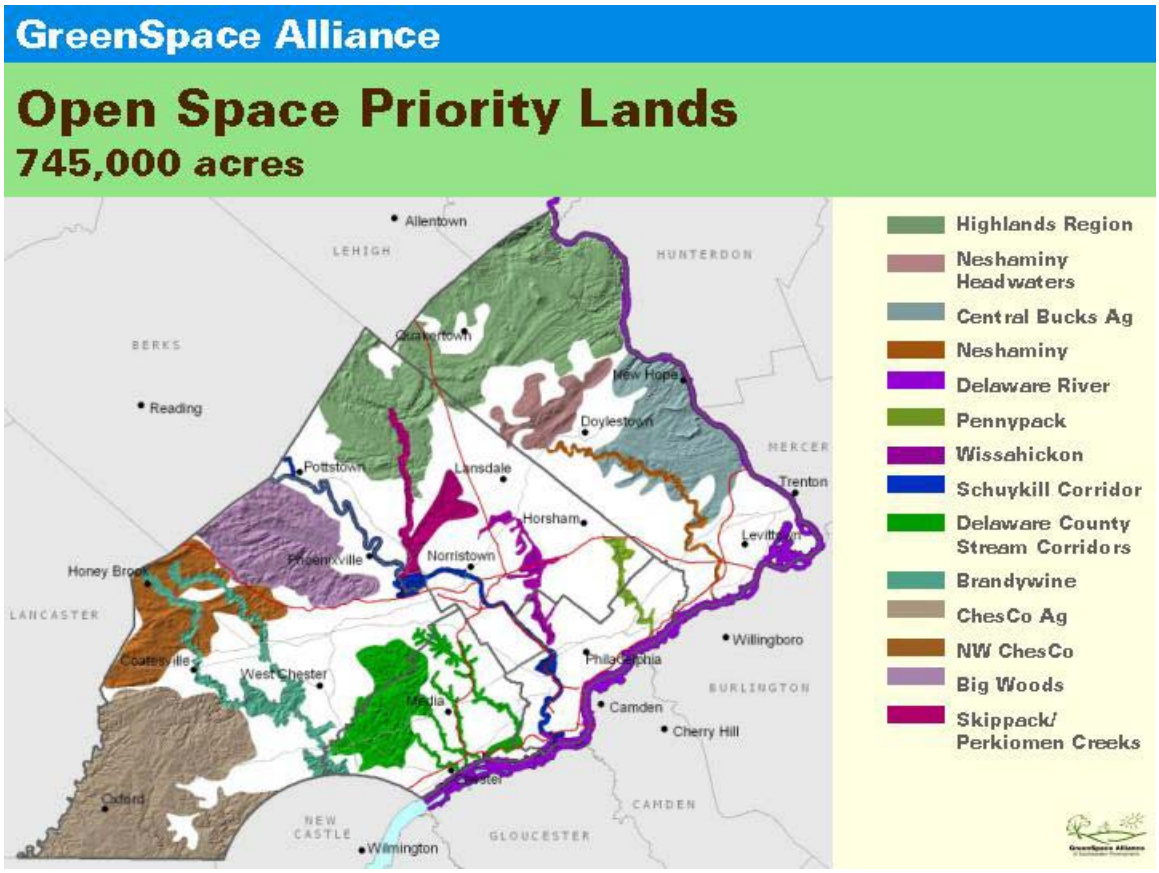
The combined area of high-resource-value (8, 9, 10) cells located in undeveloped and unprotected lands is 459,000 acres. A breakdown follows:

- Agriculture highest value: 156,000 acres
- Natural resource highest value: 222,000 acres
- Recreation highest value: 93,000 acres

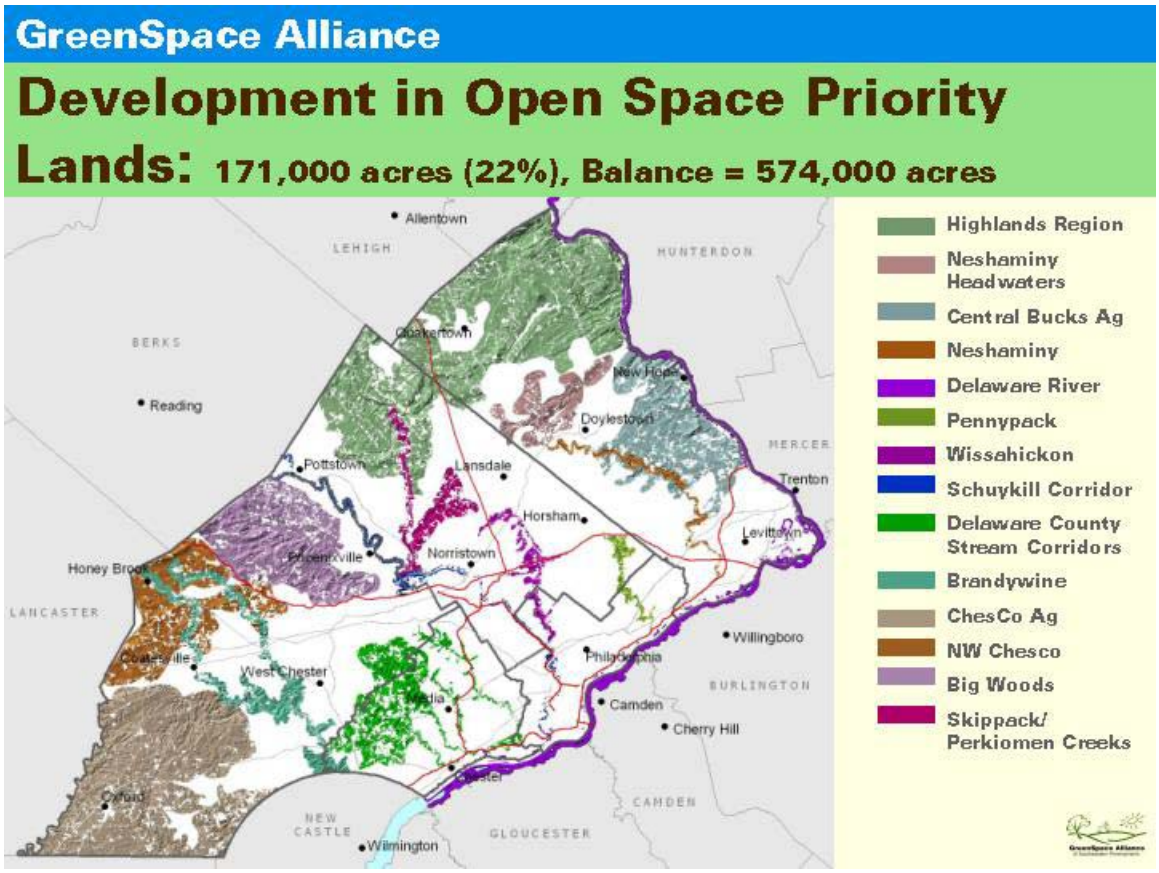
(Because ties are counted two, and sometimes three times, the total component acreage is higher than actual acreage by 12,000 acres.)

Identification of Open Space Priority Lands

Working from these data, the project engaged in a "clustering" and "smoothing" process to define large contiguous layers, or clusters, of high-priority lands. Using the composite data, programs were run that caused each cell to, in effect, look at the values in the cells surrounding it and increase or decrease its score depending upon whether these neighboring values were high or low. These recalculations resulted in the creation of clusters of high- and low-value cells, making it possible to identify high-priority open space areas within the region. The criteria adopted to distinguish significant clusters from smaller fragments were that 1) a cluster must have an area of at least 10 square miles, and 2) within the cluster, at least 60% of the lands must have resource values of 8, 9, or 10. Fourteen clusters were identified as "Open Space Priority Lands" and are pictured in the following figure.



Open Space Priority Lands are of two kinds: large land masses and river/stream corridors. In some cases, headwaters and stream corridors represent both kinds in one area. In size, the combined total of all 14 Open Space Priority Land areas is 745,000 acres, just over half the total acreage of the region. As of 1995, 171,000 acres (22% of total acreage of these lands) had been developed, leaving 574,000 undeveloped. The impact of development is displayed in the following figure.

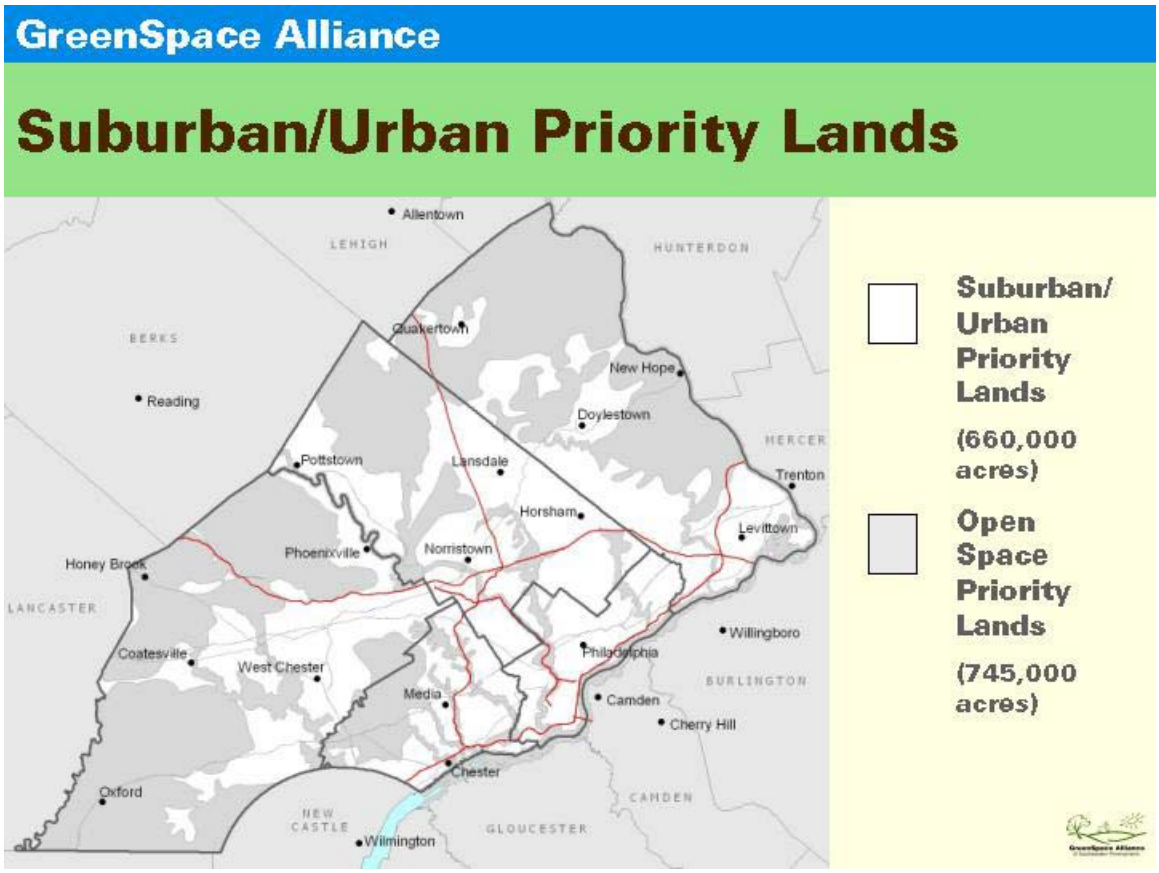


A total of 456,000 acres have high resource value (8, 9, or 10). Of these, 129,000 acres are protected, leaving 327,000 high-resource-value acres in Open Space Priority Lands unprotected.

Given the importance of contiguity and continuity reflected in all three of the components of this study, these data point to an urgent need to protect open space in these areas from further fragmentation.

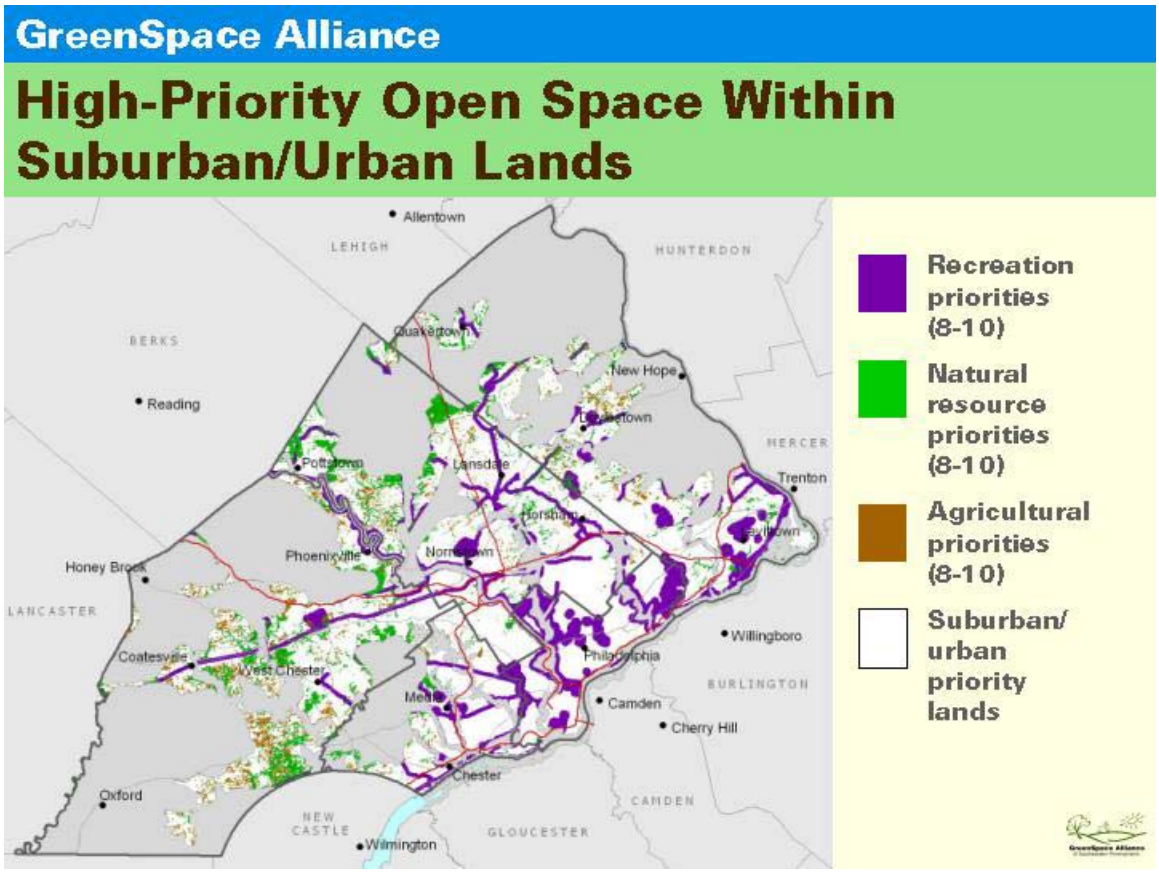
Identification of Suburban/Urban Priority Lands

The remainder of the five-county region rated low in the clustering process, mainly because there were large clusters of developed land with corresponding low resource value for agriculture or natural resources and little or no regional recreation value, as defined in this study (recreation corridors having already been classified as Open Space Priority Lands). These lands are mostly suburban or urban in nature and are therefore named Suburban/Urban Priority Lands. Total Suburban/Urban Priority Land area is 660,000 acres.



High-Value Areas Within Suburban/Urban Priority Lands

Adding priorities 8, 9, and 10 to the figure above and subtracting those high-priority lands that are already developed, the following figure is obtained.



The presence of many recreational nodes and connectors, combined with those agricultural and natural resources priorities that also exist, indicate that there are significant open space values to be protected within suburban and urban areas.

Of the 660,000-acre total of Suburban/Urban Priority Lands, 423,000 acres are developed, leaving 237,000 acres undeveloped. This high percentage of developed land is what makes these areas suburban or urban in nature—they are where most residents of the region have chosen to live and work. This leaves 102,000 acres undeveloped, of which 91,000 are also unprotected. These parcels are generally small and in populated areas, suggesting that community open space uses would be appropriate.

Findings, Conclusions, and Recommendations

Findings

Overall

As of 1995 (the latest year for which figures were available):

- Of the region's 1,405,000 acres, 591,000 were developed.
- 161,000 acres were protected.
- 653,000 acres were undeveloped and unprotected.

Of the undeveloped and unprotected land, 459,000 acres are rated as being of high priority for one or a combination of purposes (agriculture, natural resources, or recreation).

Agriculture

- The top 50% of agricultural lands, in terms of resource value as defined in this Report, total 348,000 acres. However, development on these lands has reduced this to 313,000 acres.
- The top 30% of agricultural lands totals 196,000 acres. Development has reduced this to 194,000 acres.
- There is high-resource-value agricultural land in most rural parts of the region, particularly in southern and western Chester County, central Montgomery County, central and northern Bucks County, and along the Chester-Delaware County border.
- Much remaining high-resource-value farmland is in the path of development.

Natural Resources

- The top 50% of natural resource lands totals 680,000 acres. Development on these lands has reduced this to 505,000 acres.
- The top 30% of natural resource lands totals 404,000 acres. Development has reduced this to 318,000 acres.
- The greatest concentrations of high-resource-value lands are in northern Bucks, northern Montgomery, and northern Chester Counties. These are on the southern fringes of the Highlands Region, also known as the Diabase Ridge. In addition, there are concentrations in northwestern Delaware County and central Bucks.
- High-resource-value lands also are found along rivers and streams.
- Within Philadelphia and nearby inner suburbs, much of the natural resource value has been lost.
- Development is fragmenting the large landscapes in the high-value areas. While not taking large acreages, development nevertheless impinges upon contiguity and connectedness.
- There is limited overlap between agricultural and natural resources areas in northern Chester, northern Montgomery, and northern and central Bucks Counties. The largest concentration of *agricultural* lands, in western Chester County, does not contain high-rated *natural resource* lands.

Recreation

- Nodes, including buffers, and connectors total 361,000 acres. Of this, 155,000 acres are already developed, leaving a net of 206,000 acres.

- The Schuylkill River Corridor, running from northwest to southeast through the middle of the region, is a key recreational and natural resource asset.
- Likewise, the Delaware River Corridor, which frames the region to the south and east, is of key importance.
- Most of the regionally important recreation lands are water-based, either surrounding bodies of water or following rivers and streams.
- There are numerous places where trails and greenways might interconnect but are not currently planned to do so.

Composite High-Value Map

- The total area of agricultural, natural resources, and recreational lands with values of 8, 9, or 10 is 767,000 acres.
- Of this area, the total undeveloped acreage is 558,000.
- The principal high-value lands for agriculture and natural resources are in an arc starting in southwestern Chester County and running through central and western Montgomery County and into northern and central Bucks County.
- Also significant is the stream headwaters area of northwestern Delaware County and eastern Chester County.
- Few agricultural and natural resources priorities are found in areas of population concentration, such as the City of Philadelphia and inner suburbs.
- Significant recreation priorities exist in the southeastern section of the region; i.e., the City of Philadelphia and immediate suburbs.
- Recreational values are highest along the river and stream corridors.
- The Schuylkill and Delaware Rivers have high value as recreational spines, tying together the region for recreational purposes.

Open Space and Suburban/Urban Priority Lands

- Using GIS technology, it is possible to analyze the data in the composite maps and draw boundaries around high-resource-value areas.
- The areas with the boundaries are defined as Open Space Priority Lands, and the remaining areas, as Suburban/Urban Priority Lands.
- Open Space Priority Lands constitute 745,000 acres, some of which are developed. The undeveloped lands totaled 574,000 acres in 1995.
- Open Space Priority Lands provide the Region with:
    - Water supply and flood control
    - Wildlife protection and diversity
    - Agricultural products
    - Recreation
    - Landscapes: scenic, historic, rural
    - A sense of living in a green metro area
- Suburban/Urban Priority Lands constitute 660,000 acres, most of which are developed. The undeveloped lands totaled 237,000 acres in 1995.
- Suburban/Urban Priority Lands are where most of the region's residents:
    - Live
    - Work
    - Shop

- Attend school or college

Fragmentation of Open Space With High Resource Values

High-value open space is being fragmented significantly by roads, residences, and commercial and industrial uses. This makes it more difficult to maintain contiguity and continuity for agriculture, natural resource protection, and recreation.

Conclusions

- The fabric of the region, in terms of land and its use, is interwoven and interconnected. Water supply, wildlife diversity, recreation, food production, and economic growth all demand a regional perspective.
- Choices must be made for open space protection because resources are limited. Protection decisions need to take into account the resource values at the collective, regional level, as well as the local, community level.
- Development—residential, industrial, and commercial—is compatible with open space protection. There is ample land available in the region for development consistent with protection.
- Land use patterns are inconsistent across the region with respect to the three resource values (agriculture, natural resources, recreation) as a result of inconsistent land use ordinances.
- Wherever possible, development should be done using Smart Growth principles to conserve land.
- Within the region, people and communities are investing in land protection at unprecedented levels; for example, by approving open space bond referenda. The region must now ensure that these resources are being used and leveraged to preserve the right places in the most efficient and effective way possible.
- There are clusters of high-resource-value lands in the region, identified by the Report as Open Space Priority Lands, which are relatively rural in character. The balance of the region is identified as Suburban/Urban Lands, where most of the region's population lives and works.
- The resource values obtained from the GIS-based analysis demand "regional statesmanship"—support by local communities for protection of Open Space Priority Lands, regardless of their proximity to immediate neighborhoods.
- In the Open Space Priority Lands, preservation of large, contiguous areas and river and stream corridors should be the principal goal. The following strategies need to be pursued in these large areas and key corridors:
    - Recognizing the land and water interconnection
        - Land and water quality are closely interconnected and must be addressed together to ensure effective quality and quantity of water supply.
        - Pristine headwaters areas and first-order streams are needed to sustain the quality and supply of water and also to provide critical wildlife corridors.

    - Emphasizing contiguity and connectedness
        - Contiguity and connectedness of open space are crucial.
        - Fragmentation should be avoided.
        - Stream and river corridors are vital for ecology, water supply, stormwater controls, and recreation.
        - Large, undisturbed woodland and other vegetation areas are vital for wildlife diversity.
        - Greenways (including trails and linked conservation corridors) provide vital interconnections with other large parcels, serving as wildlife corridors, promoting biodiversity, and, where appropriate, providing recreational linkages.
        - Large areas of contiguous farms are needed for a productive agricultural economy.
    - Preserving extensive floodplains for stormwater control
    - Protecting scenic landscapes and rural areas, which are part of our heritage and enhance the quality of life, and are also economically valuable for tourism
    - Following Smart Growth and Smart Conservation principles where large parcels cannot be protected to minimize residential and commercial intrusion on the natural landscape; typically these would include:
        - Conservation subdivision
        - Village extension instead of greenfields development
        - Transfer of development rights (TDR)
        - Transit-oriented development
        - Comprehensive plans and land use ordinances supportive of these measures
- Protecting open space in the Suburban/Urban Lands, with a different focus, recognizing that large, contiguous tracts are rare:
    - Wherever possible, natural resources and agricultural sites with high resource values should be protected.
    - Recreation uses in Suburban/Urban Lands should be promoted:
        - Smaller green areas—neighborhood and municipal parks—are priorities.
        - Greenways and trails should connect with the regional open space system.
    - Development should follow Smart Growth and Smart Conservation principles.
    - Infill and redevelopment should be used for growth wherever possible.
- Recognizing that Open Space Priority and Suburban/Urban Priority Lands are interconnected and interdependent:
    - Growth is necessary and needs to be channeled, not prevented.
    - Yet high-quality natural settings are needed in close proximity to population centers for:
        - Water supply
        - Stormwater control
        - Farming
        - Fish and wildlife

        - Recreation and scenic enjoyment
    - Farming and biodiversity needs cannot be met in fragments, but only in large, contiguous areas.
    - People may not value large open spaces that aren't in their immediate area if they do not have daily contact with green and open spaces.
    - Without popular support, neither the Open Space Priority Lands nor the Suburban/Urban Priority Lands will succeed.
    - Both enlightened self-interest and "regional statesmanship" require that the Open Space Priority Lands receive increased attention and funding.

Recommendations

1. Adopt a two-pronged approach for open space prioritization, recognizing the importance of both Open Space Priority Lands and Suburban/Urban Priority Lands.
2. As a guideline, see that at least one acre of undeveloped land is protected for every acre of unprotected land that is developed.
3. In the Open Space Priority Lands, permanently protect no less than 50% of remaining undeveloped lands, thereby achieving protection for at least 288,000 acres, of which 130,000 are currently protected, leaving a minimum of 158,000 to be protected.
4. Protect the continuity and natural amenities of the stream and river corridors that are part of the Open Space Priority Lands.
5. Focus on attracting new revenue sources to accomplish #2 and #3.
6. In the Suburban/Urban Priority Lands, concentrate on protecting high-resource-value lands for recreational purposes and for limited natural resource and specialty agricultural uses.
7. Develop the database of GIS layers and composite maps further as an analytical tool for planners, funders, legislators, commissioners, supervisors, and individuals to use to protect open space.
8. Update the database periodically as new information becomes available, especially as regards land use and open space protection.
9. Make the database readily available on line.
10. Discuss and obtain endorsement for this Report by as wide and diverse a collection of groups as possible, including municipal, county, and state officials; public and private funding sources; business and economic development organizations; watershed groups; land conservancies; civic organizations; and concerned individuals.
11. Work to achieve consensus on open space goals and strategies on region-wide, county-by-county, and municipality-by-municipality bases, using this Report for the multi-county regional level and developing the accompanying database for county, municipal, and parcel levels.
12. Dedicate planning and funding activities to concentrate on accomplishing the recommended results in the priority areas, both Open Space Priority Lands and Suburban/Urban Priority Lands.

13. Enact comprehensive plans and land use ordinances and promote multi-municipal cooperation to protect open space.
14. Develop funding strategies combining federal, state, county, municipal, and private sources for financing and expanding extraordinary protection efforts in the Open Space Priority Lands.
15. Develop an education strategy to reach citizens, municipalities, foundations, business and economic development organizations, and civic leaders with the information contained in the Report.