National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Evaluation of the Sensitivity of Inventory and Monitoring National Parks to Acidification Effects from Atmospheric Sulfur and Nitrogen Deposition

National Capital Region Network (NCRN)

Natural Resource Report NPS/NRPC/ARD/NRR—2011/367

ON THE COVER

Some ecosystems and vegetation types, such as remote high-elevation lakes, sugar maple trees, headwater streams, and red spruce trees, are sensitive to the effects of acidification from atmospheric nitrogen and sulfur deposition.
Photograph by: National Park Service

Evaluation of the Sensitivity of Inventory and Monitoring National Parks to Acidification Effects from Atmospheric Sulfur and Nitrogen Deposition

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Natural Resource Report NPS/NRPC/ARD/NRR—2011/367

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This report received peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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NPS 962/107403, April 2011

National Capital Region Network (NCRN)

National maps of atmospheric S and N emissions and deposition are provided in Maps A through D as context for subsequent network data presentations. Maps A and B show county level emissions of total S and total N for the year 2002. Maps C and D show total S and total N deposition, again for the year 2002.

There are 11 parks in the National Capital Region Network; none are larger than 100 square miles. Some parks are in and around the Washington, DC urban area; others are located to the south and west.

Total annual S and N emissions, by county, are shown on Maps E and F, respectively for lands in and surrounding the National Capital Region Network. County-level S emissions within the network were variable, ranging from less than 1 ton per square mile per year, mostly in the northwestern portion of the network, to more than 100 tons per square mile per year in one county near Washington, DC (Map E). Annual county-level N emissions within the network ranged from 1 to 5 tons per square mile in the west to more than 20 (and as high as more than 100) tons per square mile in the area surrounding Washington, DC (Map F). In general, annual county N emissions were between 1 and 20 tons per square mile throughout most of the network, with higher emissions in the eastern portion. Individual point source emissions of S are shown on Map G. There were no S point sources of great magnitude within the network, but there were several large point sources outside the network to the west. In general, S point sources were less than 5,000 tons per year throughout the network, with only two sources in the range of 5,000 to 20,000 tons per year (Map G). Point source emissions of oxidized (nitrogen oxides, NO_x) and reduced (ammonia, NH_3) N are shown on Map F. There are no large (larger than 2,000 tons per square mile) point sources of N within the network, but several outside the network, especially to the west. Most point sources in and around the network are sources of oxidized N.

Urban centers within the network and within a 300-mile buffer around the network are shown in Map I. The eastern third of the network is densely populated; the western two-thirds is not.

Total S and N deposition in and around the network are shown in Maps J and K, respectively. Included in this analysis are both wet and dry forms of acidic deposition and both the oxidized and reduced N species. Total S deposition within the network generally ranged from 10 to 20 kg/ha/yr, with several smaller areas in the range of 20 to 30 kg/ha/yr. Total N deposition within the network generally ranged from 10 to 15 kg N/ha/yr to as high as 15 to 20 kg N/ha/yr, with the higher values mainly in and around Washington, DC.

Land cover in and around the network is shown in Map L. The predominant cover types within this network are generally forest in the west, pasture/hay and row crops in the central portion, and developed land in the east.

Land slope within the network is shown in Map M. Terrain within the park lands in the network tends to have fairly low relief, with most parks averaging less than 10^o slope. One park has average slope between 10^o and 20^o and the slope in two of the parks is between 20^o and 30^o.

Map N, showing park lands requiring special protection against potential adverse impacts associated with acidic deposition is shown for this network, but there are no Class I or designated wilderness areas in the network. The closest park receiving special protection is Shenandoah to the south.

Network rankings are given in Figures A through C as the average ranking of the Pollutant Exposure, Ecosystem Sensitivity, and Park Protection metrics, respectively. Figure D shows the overall network Summary Risk ranking. In each figure, the rank for this particular network is highlighted to show its relative position compared with the ranks of the other 31 networks.

The National Capital Region Network ranked in the highest quintile, second to the highest among networks, in Pollutant Exposure (Figure A). Emissions and deposition within the network are both very high. However, the network Ecosystem Sensitivity ranking was Low, within the second lowest quintile among networks (Figure B). This network ranked at the bottom of the lowest quintile in Park Protection, having no protected Class I or wilderness lands (Figure C).

In combination, the network rankings for Pollutant Exposure, Ecosystem Sensitivity, and Park Protection yielded an overall Network Risk ranking that was near the middle of the distribution among networks (Figure D). This is despite having one of the highest pollutant exposure rankings of all 32 I&M networks.

Because there are no parks in this network that are larger than 100 square miles, Figures E through H, that compare rankings among individual parks, are not presented for parks in this network. Relative ranks for all parks, including the smaller parks, are given in Table A and Appendix A.

All parks in this network were ranked in the top quintile for Pollutant Exposure. The parks were ranked either in the highest quintile (four parks), second highest quintile (one park) or middle quintile (six parks) for Ecosystem Sensitivity. All parks in the network were ranked in the middle quintile for Park Protection. The Summary Risk for individual parks in this network was High in seven parks and Very High in four parks.

Table A. Relative rankings of individual I&M parks within the network for Pollutant Exposure, Ecosystem Sensitivity, Park Protection, and overall Summary Risk from acidic deposition.

I&M Parks[2] in Network	Relative Ranking of Individual Parks[1]			
	Pollutant Exposure	Ecosystem Sensitivity	Park Protection	Summary Risk
Antietam	Very High	Very High	Moderate	Very High
Catoctin Mountain	Very High	Very High	Moderate	Very High
Chesapeake and Ohio Canal	Very High	Very High	Moderate	Very High
George Washington	Very High	Moderate	Moderate	High
Harpers Ferry	Very High	Very High	Moderate	Very High
Manassas	Very High	Moderate	Moderate	High
Monocacy	Very High	Moderate	Moderate	High
National Capital Parks - East	Very High	High	Moderate	High
Prince William Forest	Very High	Moderate	Moderate	High
Rock Creek Park	Very High	Moderate	Moderate	High
Wolf Trap National Park for the Performing Arts	Very High	Moderate	Moderate	High

[1] Relative park rankings are designated according to quintile ranking, among all I&M Parks, from the lowest quintile (very low risk) to the highest quintile (very high risk).

[2] Park name is printed in bold italic for parks larger than 100 square miles.

Map A. National map of total S emissions by county for the year 2002, in units of tons of S per square mile per year. (Source of data: EPA National Emissions Inventory, http://www.epa.gov/ttn/chief/net/2002inventory.html)

Map B. National map of total N emissions by county for the year 2002. Both oxidized (nitrogen oxides, NO_x) and reduced (ammonia, NH_3) forms of N are included. The total is expressed in tons per square mile per year. (Source of data: EPA National Emissions Inventory, http://www.epa.gov/ttn/chief/net/2002inventory.html)

Map C. Total S deposition for the conterminous United States for the year 2002, expressed in units of kilograms of S deposited from the atmosphere to the Earth surface per hectare per year. For the eastern half of the country, wet deposition values were derived from interpolated measured values from NADP (three-year average centered on 2002) and dry deposition values were derived from 12-km CMAQ model projections for 2002. For the western half of the country, both wet and dry deposition values were derived from 36-km CMAQ model projections for 2002. NADP interpolations were performed using the approach of Grimm and Lynch (1997). CMAQ model projections were provided by Robin Dennis, U.S. EPA.

Map D. Total N deposition for the conterminous United States for the year 2002, expressed in units of kilograms of N deposited from the atmosphere to the Earth surface per hectare per year. Wet and dry forms of both oxidized (nitrogen oxides, NO_x) and reduced (ammonia, NH_3) N are included. For the eastern half of the country, wet deposition values were derived from interpolated measured values from NADP

(three-year average centered on 2002) and dry deposition values were derived from 12-km CMAQ model projections for 2002. For the western half of the country, both wet and dry deposition values were derived from 36-km CMAQ model projections for 2002. NADP interpolations were performed using the approach of Grimm and Lynch (1997). CMAQ model projections were provided by Robin Dennis, U.S. EPA.

Map E. Total S emissions by county for lands surrounding the network, expressed as tons of S emitted into the atmosphere per square mile per year. (Source of data: EPA National Emissions Inventory, http://www.epa.gov/ttn/chief/net/2002inventory.html)

Map F. Total N emissions by county for lands surrounding the network, expressed as tons of N emitted into the atmosphere per square mile per year. The total includes both oxidized (nitrogen oxides, NO_x) and reduced (ammonia, NH_3) N. (Source of data: EPA National Emissions Inventory, http://www.epa.gov/ttn/chief/net/2002inventory.html)

Map G. Major point source emissions of SO_2 for lands surrounding the network. (Source of data: EPA National Emissions Inventory, http://www.epa.gov/ttn/chief/net/2002inventory.html)

Map H. Major point source emissions of oxidized (nitrogen oxides, NO_x) and reduced (ammonia, NH_3) N in and around the network. The base of each vertical bar is positioned in the map at the approximate location of the source. The height of the bar is proportional to the magnitude of the source. (Source of data: EPA National Emissions Inventory, http://www.epa.gov/ttn/chief/net/2002inventory.html)

Map I. Urban centers having more than 10,000 people within the network and within a 300-mile buffer around the perimeter of the network. (Source of data: U.S. Census 2000)

Map J. Total S deposition in and around the network. Values are expressed as kilograms of S deposited per hectare per year. (Source of data: Interpolated NADP wet and CMAQ Model dry deposition data for 2002; see information for Map C above for details)

Map K. Total N deposition in and around the network. Included in the total are wet plus dry forms of both oxidized (nitrogen oxides, NO_x) and reduced (ammonia, NH_3) N. Values are expressed as kilograms of N deposited per hectare per year. (Source of data: Interpolated NADP wet and CMAQ Model dry deposition data for 2002; see information for Map D above for details)

Map L. Land cover types in and around the network, based on the National Land Cover dataset. (Source of data: National Land Cover Dataset, http://www.mrlc.gov/nlcd_multizone_map.php)

Map M. Average land slope within park units that occur within the network, by 10-digit HUC. (Source of data: U.S. EPA National Elevation Dataset [http://ned.usgs.gov/])

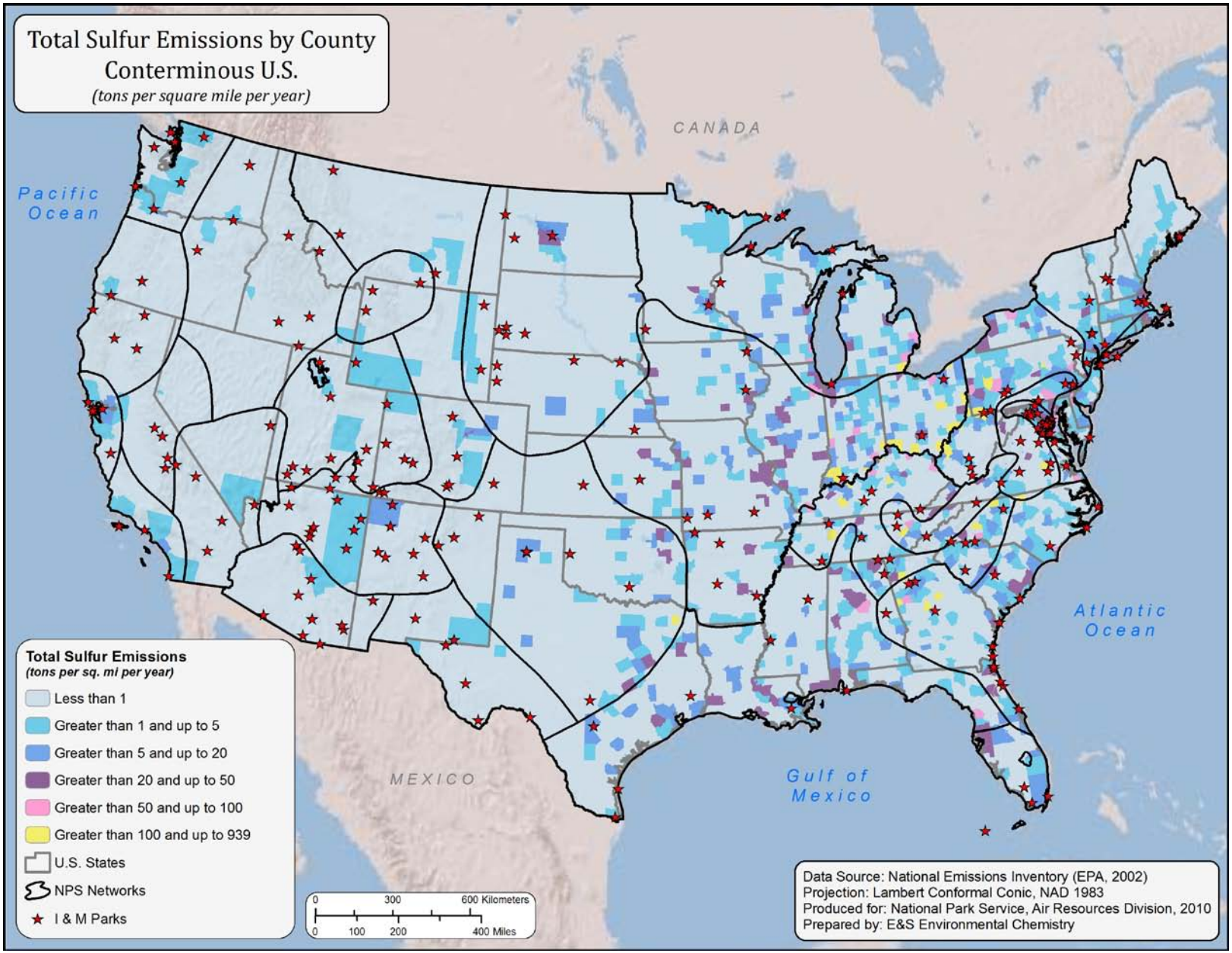
Map N. Lands within the network that are classified as Class I or wilderness area. (Source of data: USGS 2005 [National Atlas; http://nationalatlas.gov] and NPS)

Figure A. Network rankings for Pollutant Exposure, calculated as the average of scores for all Pollutant Exposure variables.

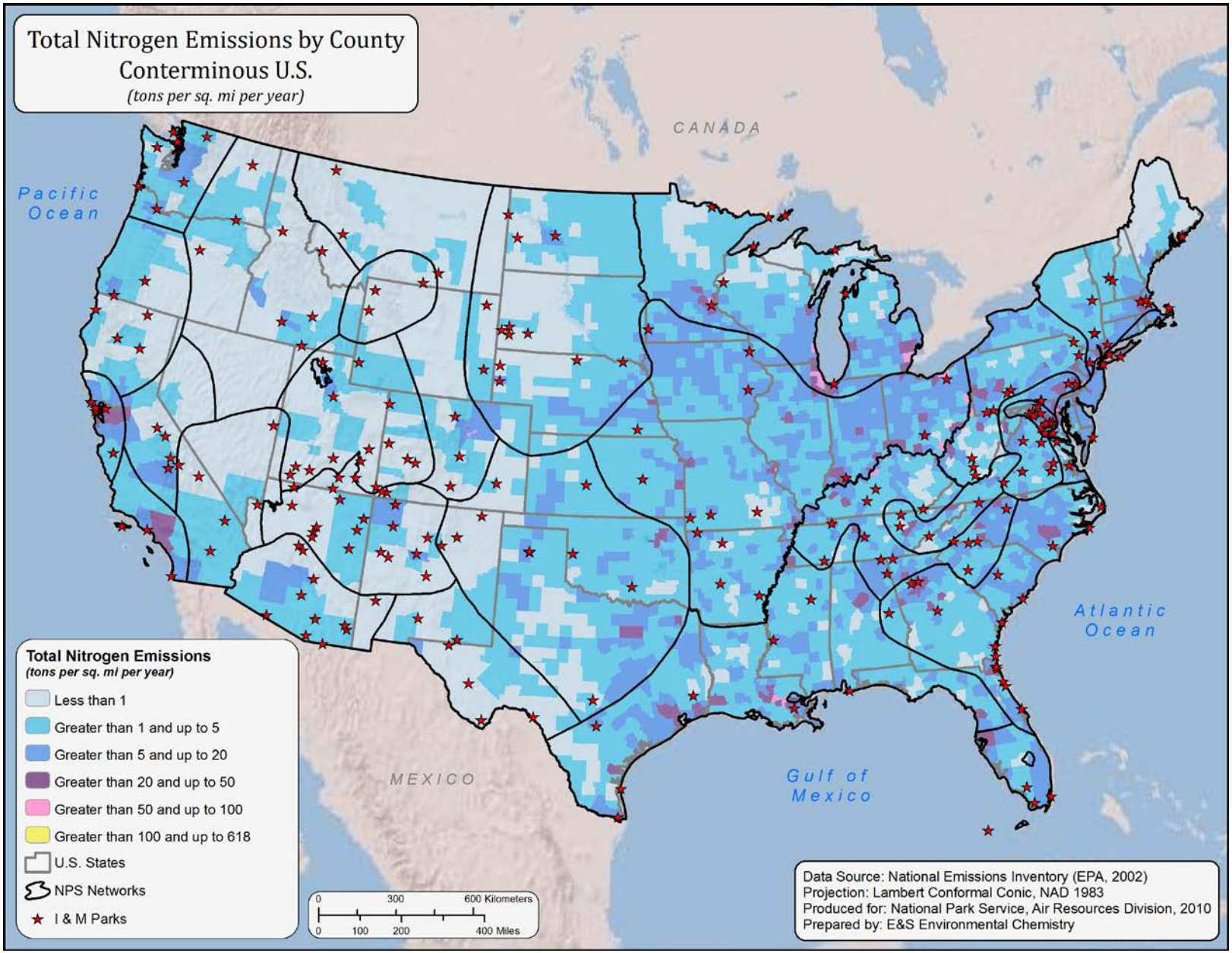
Figure B. Network rankings for Ecosystem Sensitivity, calculated as the average of scores for all Ecosystem Sensitivity variables.

Figure C. Network rankings for Park Protection, calculated as the average of scores for all Park Protection variables.

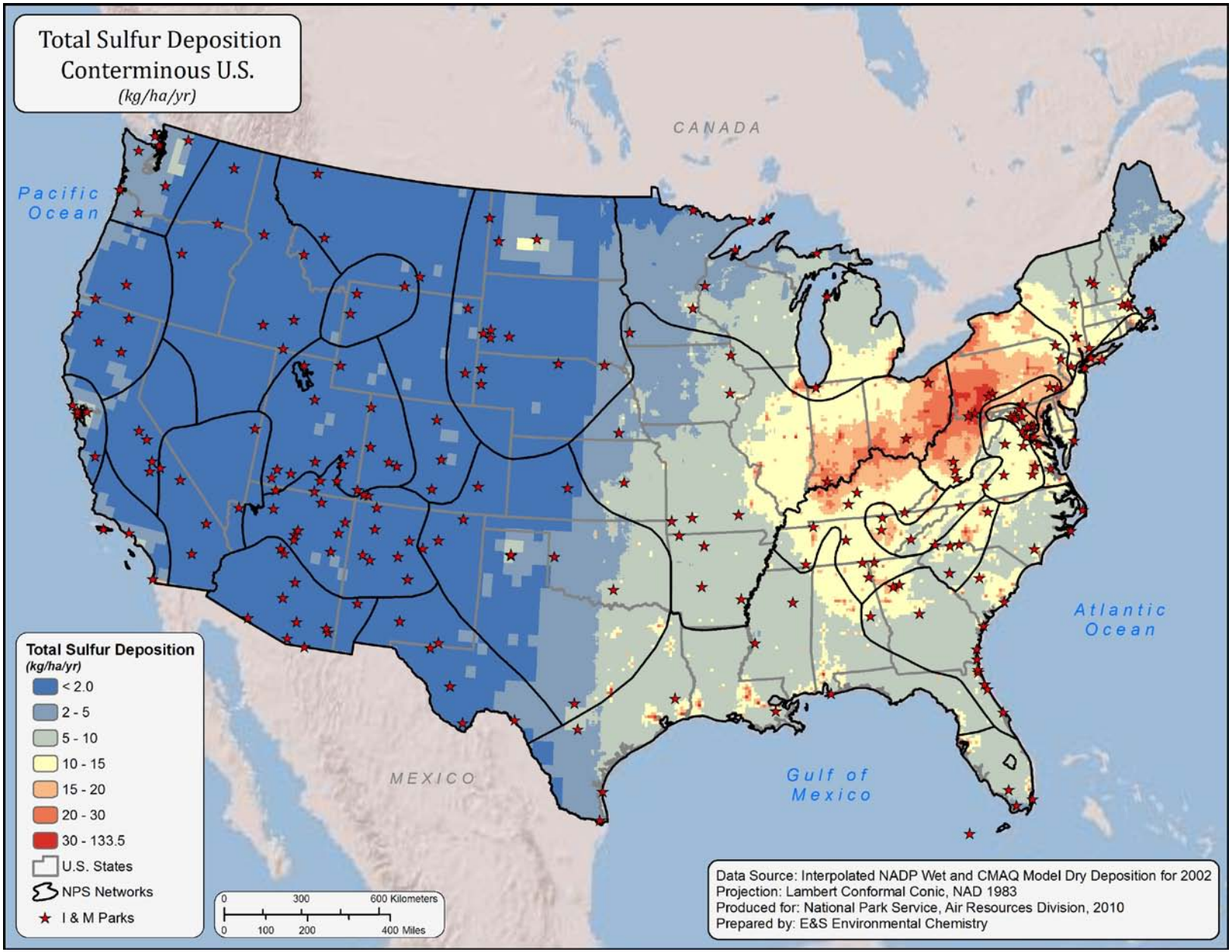
Figure D. Network Summary Risk rankings, calculated as the average of the quintile ranks for the Pollutant Exposure, Ecosystem Sensitivity, and Park Protection themes.


Total Sulfur Emissions by County
Conterminous U.S.
(tons per square mile per year)
CANADA
Pacific Ocean
Atlantic Ocean
MEXICO
Gulf of Mexico
Total Sulfur Emissions
(tons per sq. mi per year)
Less than 1
Greater than 1 and up to 5
Greater than 5 and up to 20
Greater than 20 and up to 50
Greater than 50 and up to 100
Greater than 100 and up to 939
U.S. States
NPS Networks
I & M Parks
0 300 600 Kilometers
0 100 200 400 Miles
Data Source: National Emissions Inventory (EPA, 2002)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

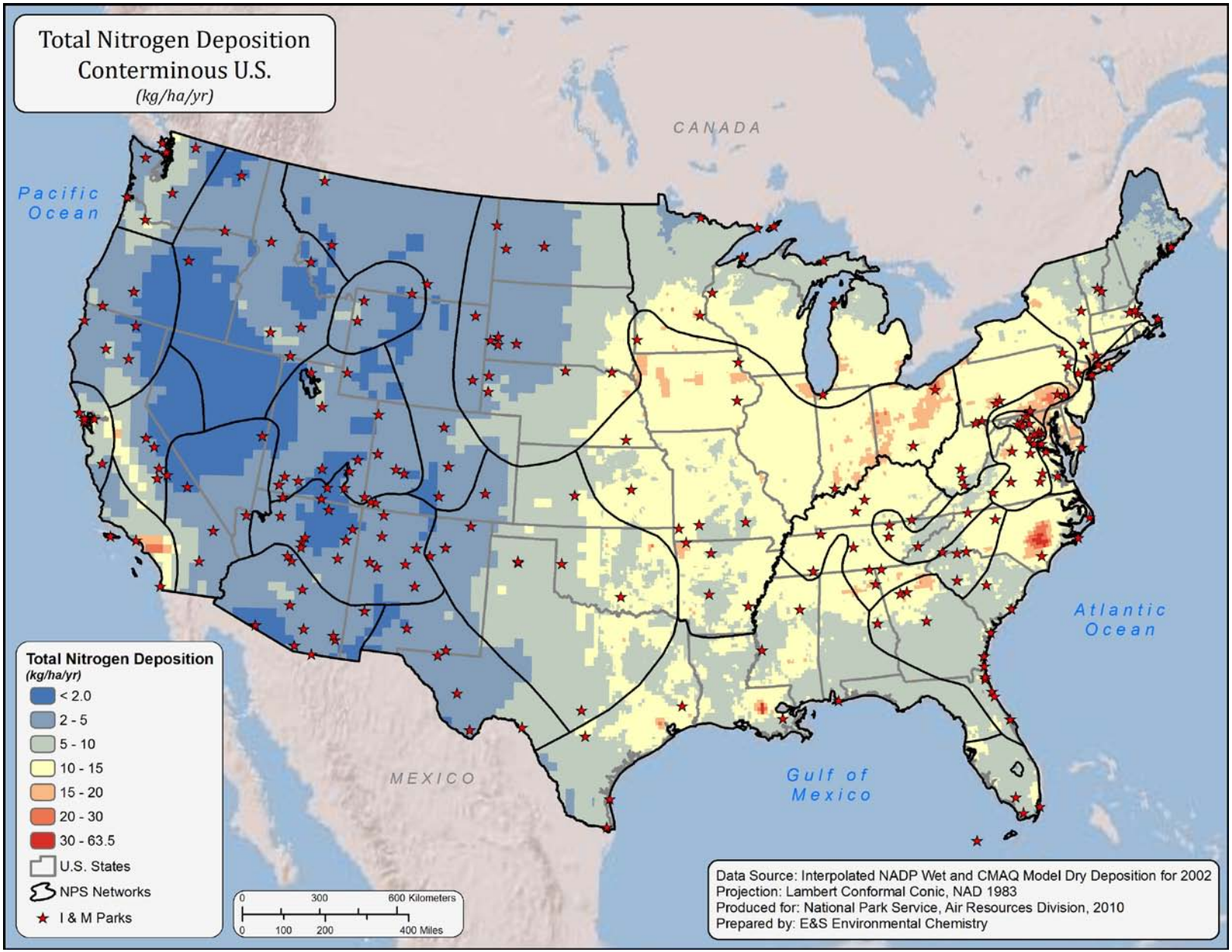
Map A


Total Nitrogen Emissions by County
Conterminous U.S.
(tons per sq. mi per year)
CANADA
Pacific Ocean
Atlantic Ocean
MEXICO
Gulf of Mexico
Total Nitrogen Emissions
(tons per sq. mi per year)
Less than 1
Greater than 1 and up to 5
Greater than 5 and up to 20
Greater than 20 and up to 50
Greater than 50 and up to 100
Greater than 100 and up to 618
U.S. States
NPS Networks
I & M Parks
0 300 600 Kilometers
0 100 200 400 Miles
Data Source: National Emissions Inventory (EPA, 2002)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

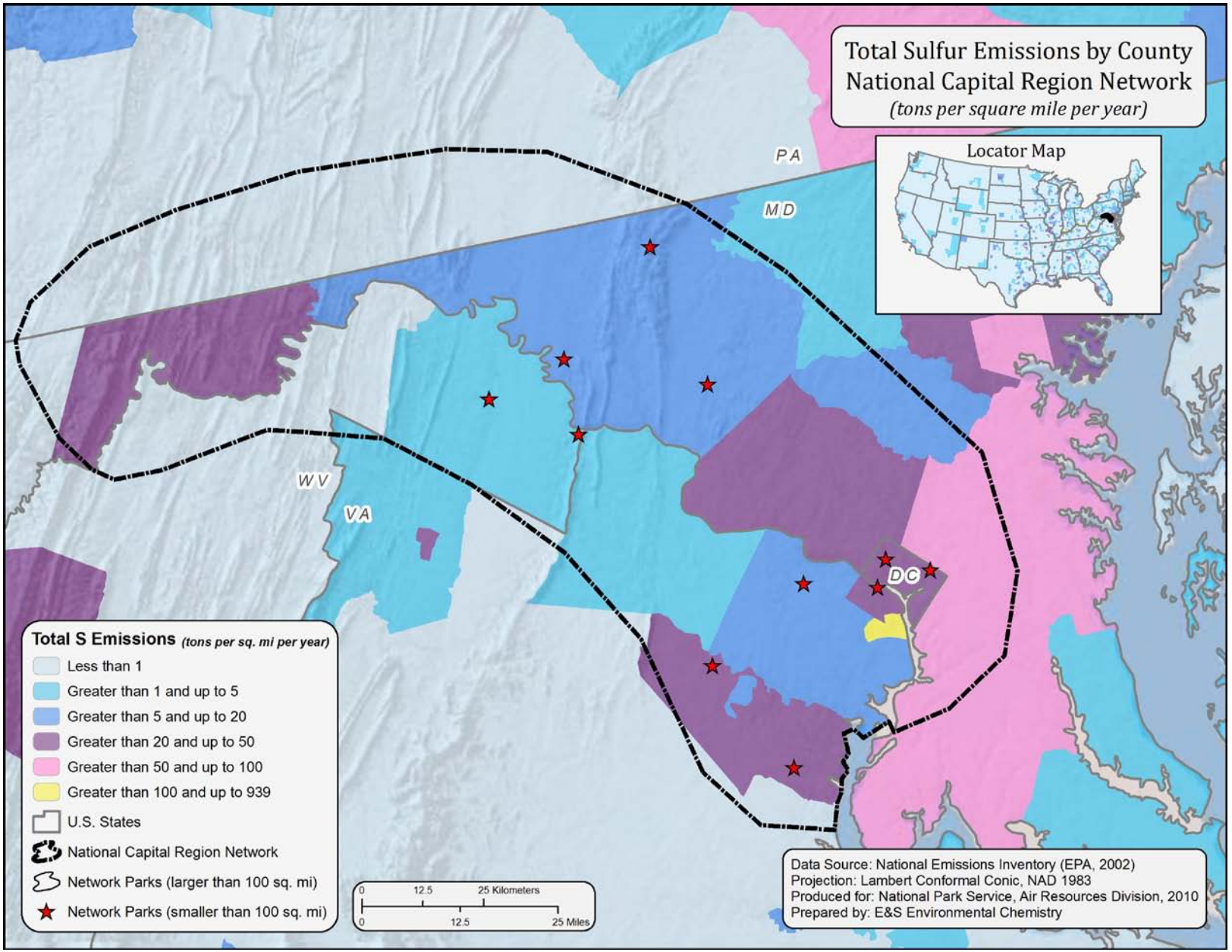
Map B


Total Sulfur Deposition
Conterminous U.S.
(kg/ha/yr)
CANADA
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
MEXICO
Total Sulfur Deposition
(kg/ha/yr)
< 2.0
2 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 133.5
U.S. States
NPS Networks
I & M Parks
0 300 600 Kilometers
0 100 200 400 Miles
Data Source: Interpolated NADP Wet and CMAQ Model Dry Deposition for 2002
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

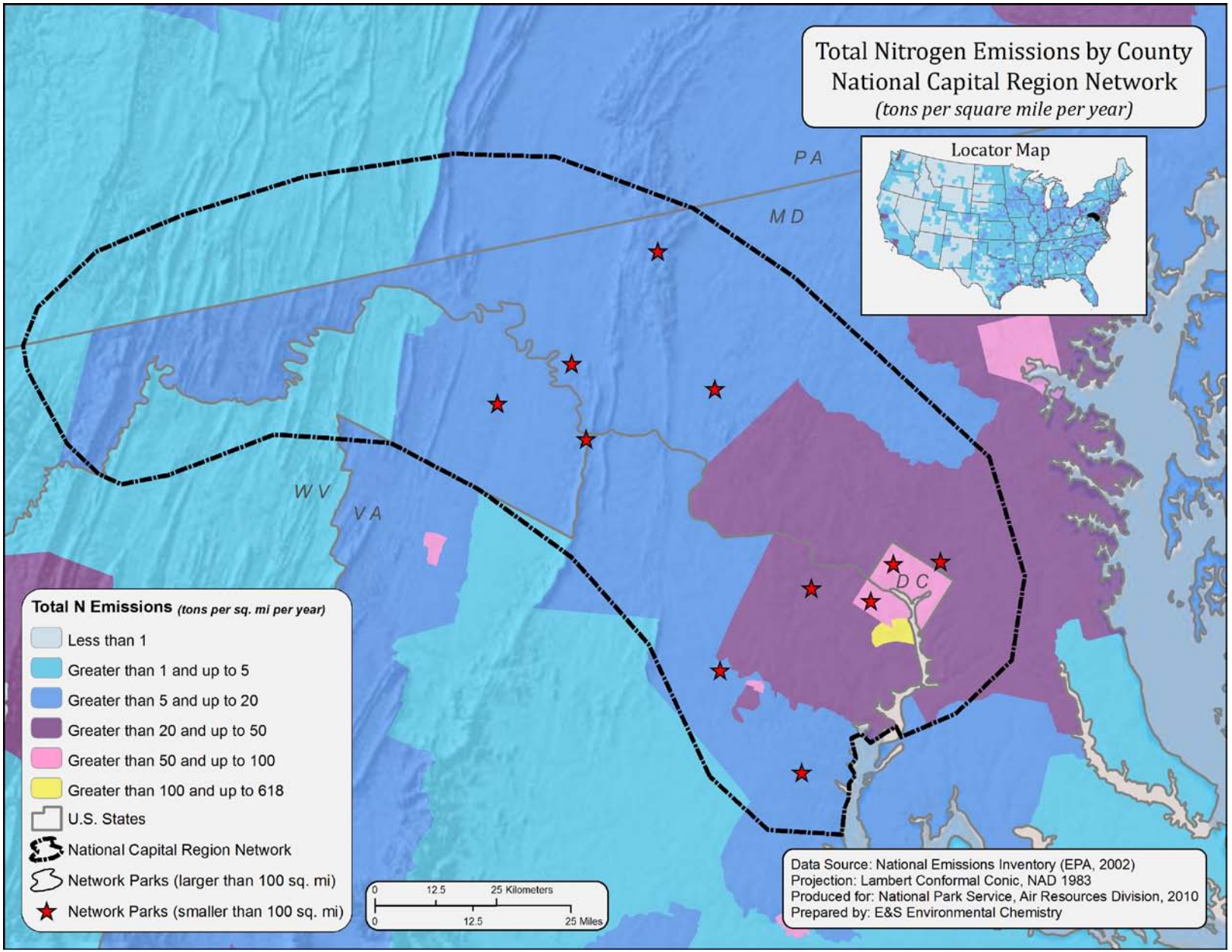
Map C


Total Nitrogen Deposition
Conterminous U.S.
(kg/ha/yr)
CANADA
Pacific Ocean
Atlantic Ocean
MEXICO
Gulf of Mexico
Total Nitrogen Deposition
(kg/ha/yr)
< 2.0
2 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 63.5
U.S. States
NPS Networks
I & M Parks
0 300 600 Kilometers
0 100 200 400 Miles
Data Source: Interpolated NADP Wet and CMAQ Model Dry Deposition for 2002
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

Map D

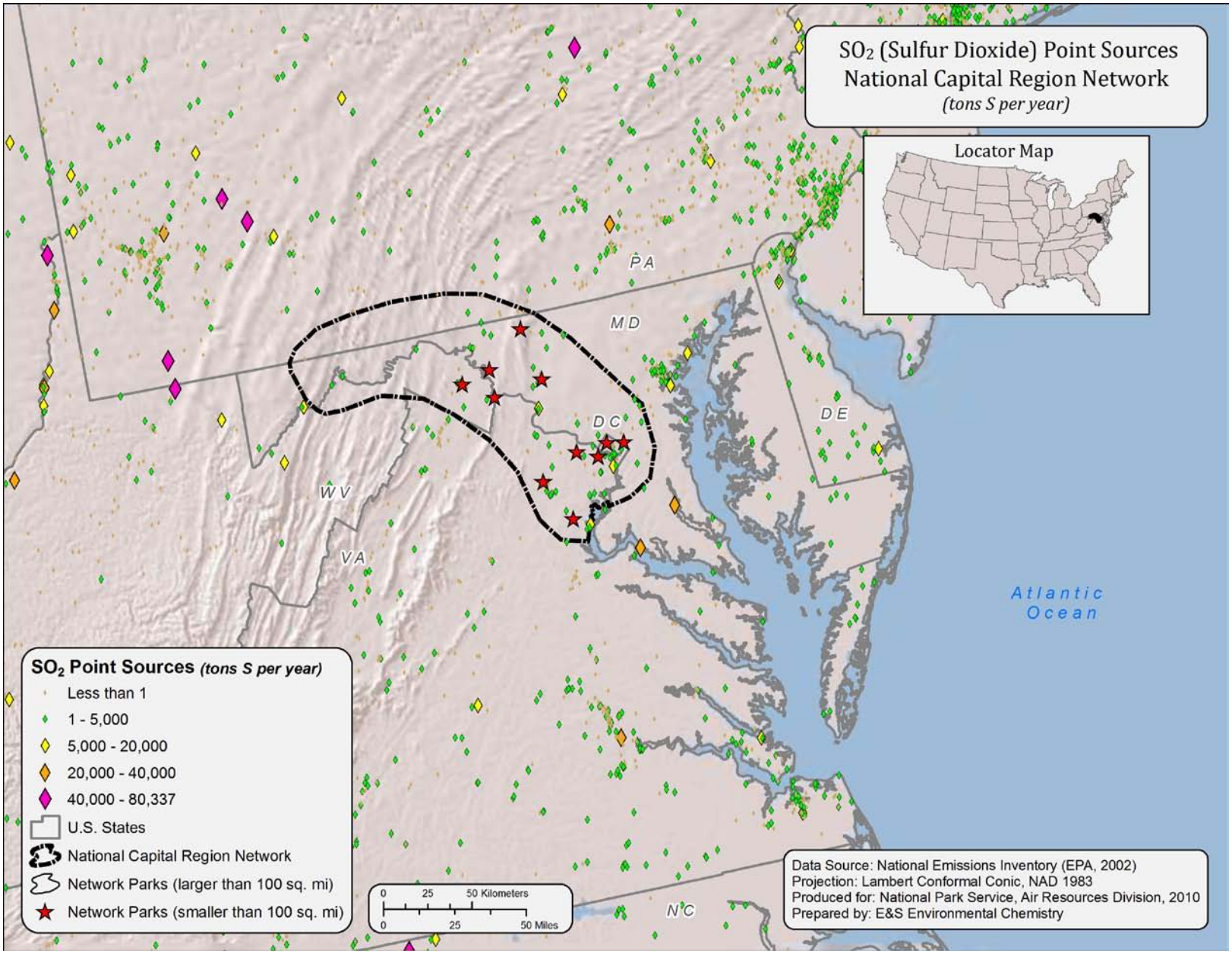

Total Sulfur Emissions by County
National Capital Region Network
(tons per square mile per year)
Locator Map
PA
MD
WV
VA
DC
Total S Emissions (tons per sq. mi per year)
Less than 1
Greater than 1 and up to 5
Greater than 5 and up to 20
Greater than 20 and up to 50
Greater than 50 and up to 100
Greater than 100 and up to 939
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 12.5 25 Kilometers
0 12.5 25 Miles
Data Source: National Emissions Inventory (EPA, 2002)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

Map E

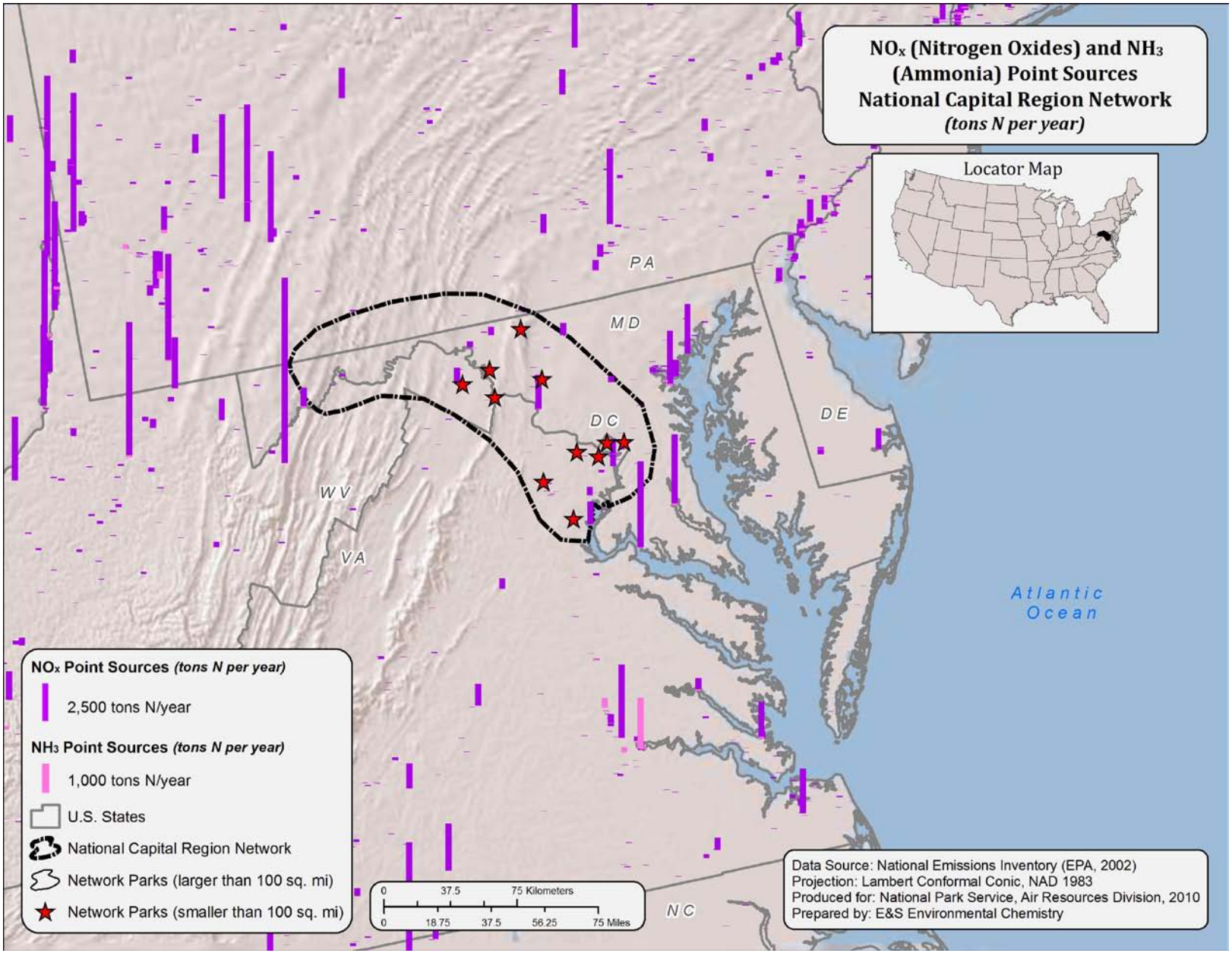

Total Nitrogen Emissions by County
National Capital Region Network
(tons per square mile per year)
Locator Map
PA
MD
WV
VA
DC
Total N Emissions (tons per sq. mi per year)
Less than 1
Greater than 1 and up to 5
Greater than 5 and up to 20
Greater than 20 and up to 50
Greater than 50 and up to 100
Greater than 100 and up to 618
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 12.5 25 Kilometers
0 12.5 25 Miles
Data Source: National Emissions Inventory (EPA, 2002)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

Map F

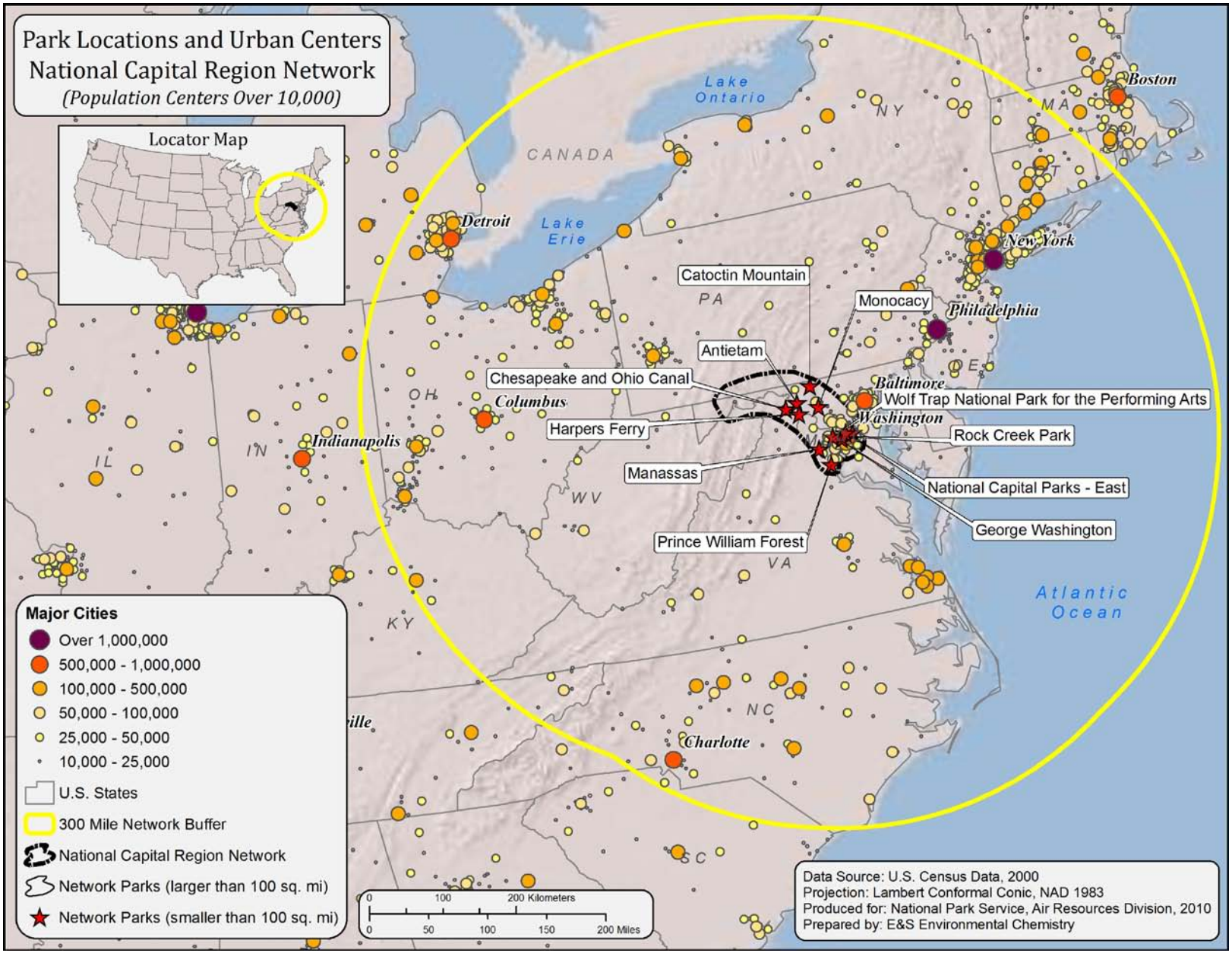
NCRN-12


SO2 (Sulfur Dioxide) Point Sources
National Capital Region Network
(tons S per year)
Locator Map
PA
MD
DC
DE
WV
VA
NC
Atlantic Ocean
SO2 Point Sources (tons S per year)
Less than 1
1 - 5,000
5,000 - 20,000
20,000 - 40,000
40,000 - 80,337
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 25 50 Kilometers
0 25 50 Miles
Data Source: National Emissions Inventory (EPA, 2002)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

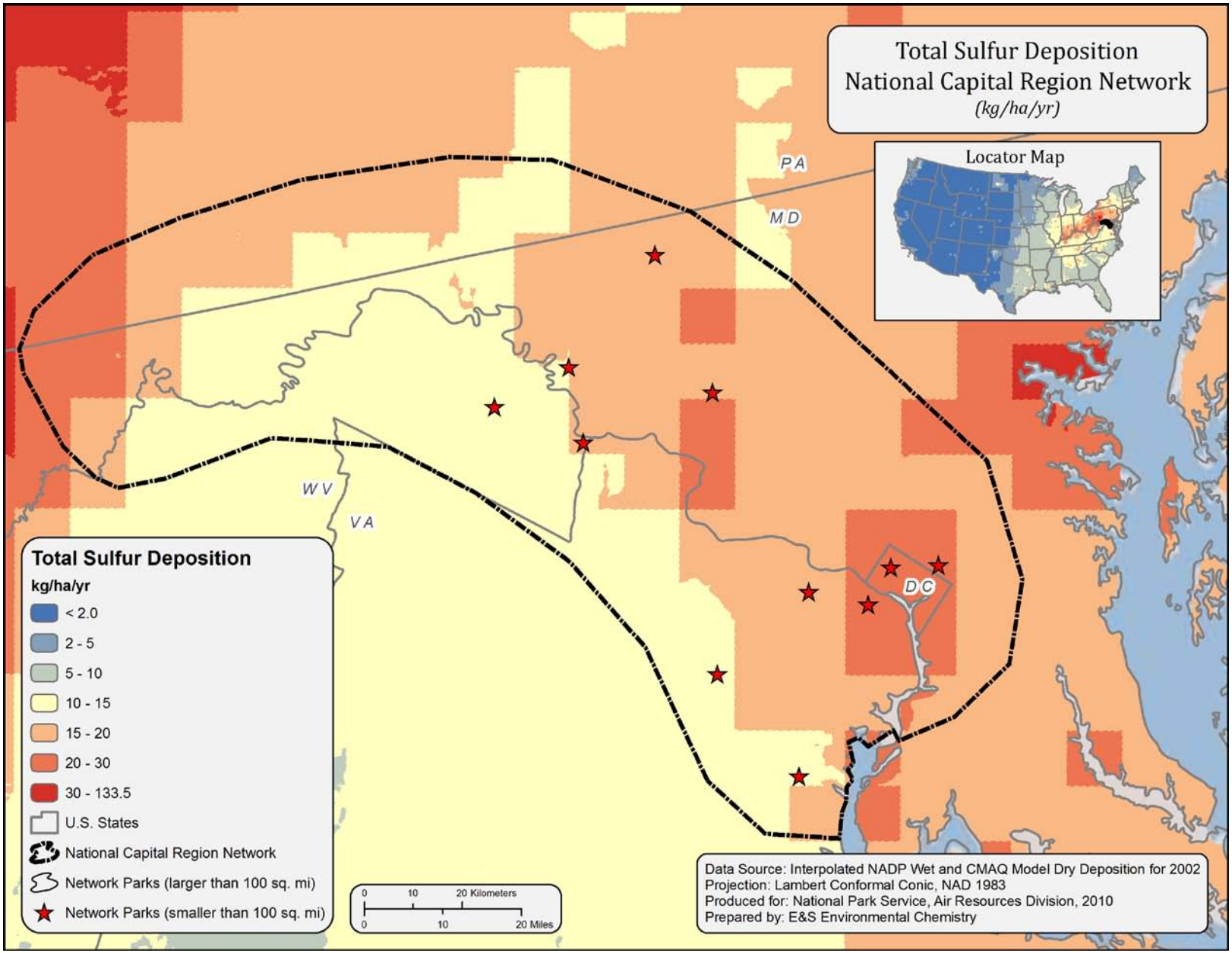
Map G


NOx (Nitrogen Oxides) and NH3 (Ammonia) Point Sources
National Capital Region Network
(tons N per year)
Locator Map
PA
MD
DC
DE
WV
VA
NC
Atlantic Ocean
NOx Point Sources (tons N per year)
2,500 tons N/year
NH3 Point Sources (tons N per year)
1,000 tons N/year
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 37.5 75 Kilometers
0 18.75 37.5 56.25 75 Miles
Data Source: National Emissions Inventory (EPA, 2002)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

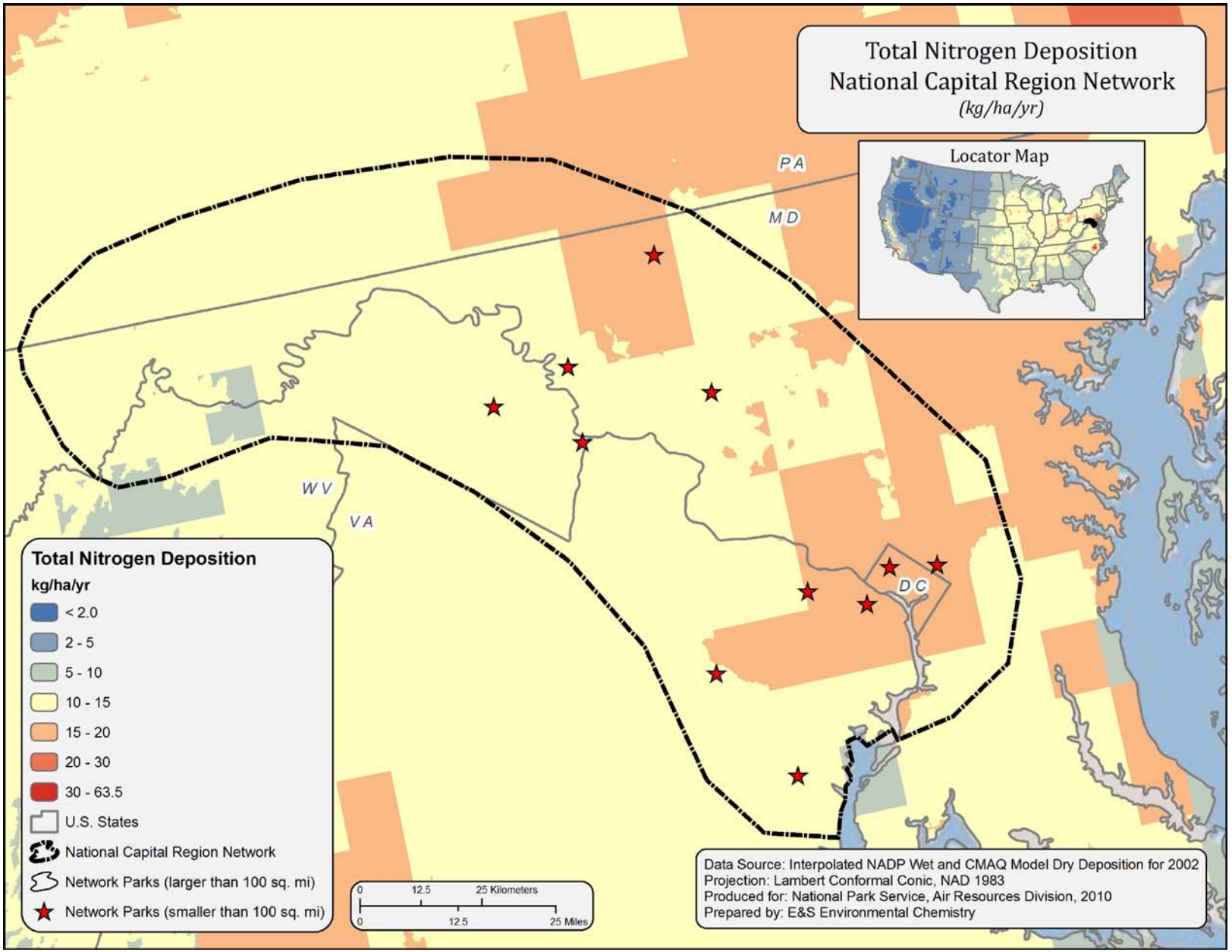
Map H


Park Locations and Urban Centers
National Capital Region Network
(Population Centers Over 10,000)
Locator Map
Lake Ontario
CANADA
Lake Erie
Detroit
Boston
New York
Philadelphia
Baltimore
Washington
Columbus
Indianapolis
Catoctin Mountain
Monocacy
Antietam
Chesapeake and Ohio Canal
Harpers Ferry
Wolf Trap National Park for the Performing Arts
Rock Creek Park
Manassas
National Capital Parks - East
George Washington
Prince William Forest
Charlotte
Atlantic Ocean
NY
MA
PA
OH
IN
IL
WV
VA
KY
NC
SC
DE
Major Cities
Over 1,000,000
500,000 - 1,000,000
100,000 - 500,000
50,000 - 100,000
25,000 - 50,000
10,000 - 25,000
U.S. States
300 Mile Network Buffer
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 100 200 Kilometers
0 50 100 150 200 Miles
Data Source: U.S. Census Data, 2000
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

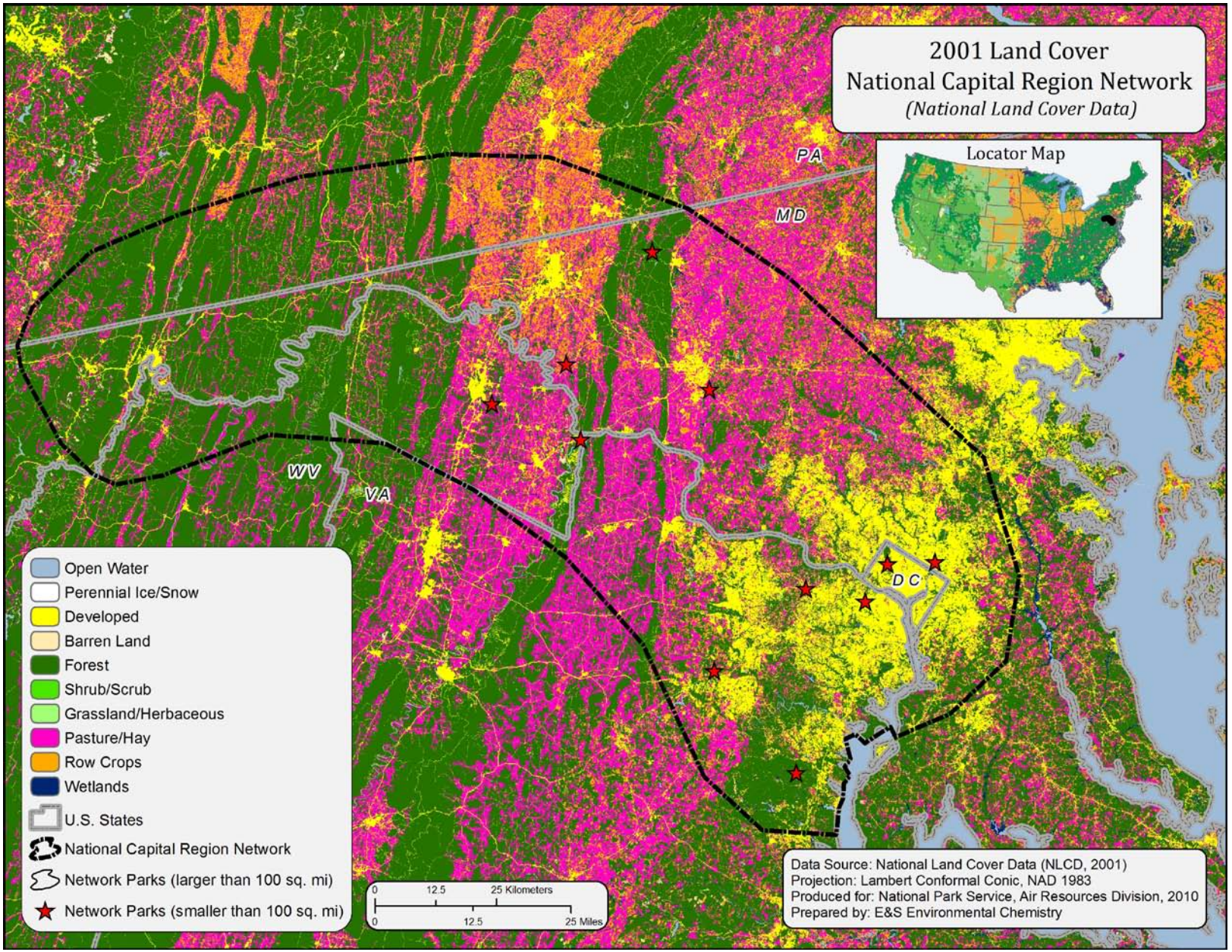
Map I


Total Sulfur Deposition
National Capital Region Network
(kg/ha/yr)
Locator Map
PA
MD
WV
VA
DC
Total Sulfur Deposition
kg/ha/yr
< 2.0
2 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 133.5
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 10 20 Kilometers
0 10 20 Miles
Data Source: Interpolated NADP Wet and CMAQ Model Dry Deposition for 2002
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

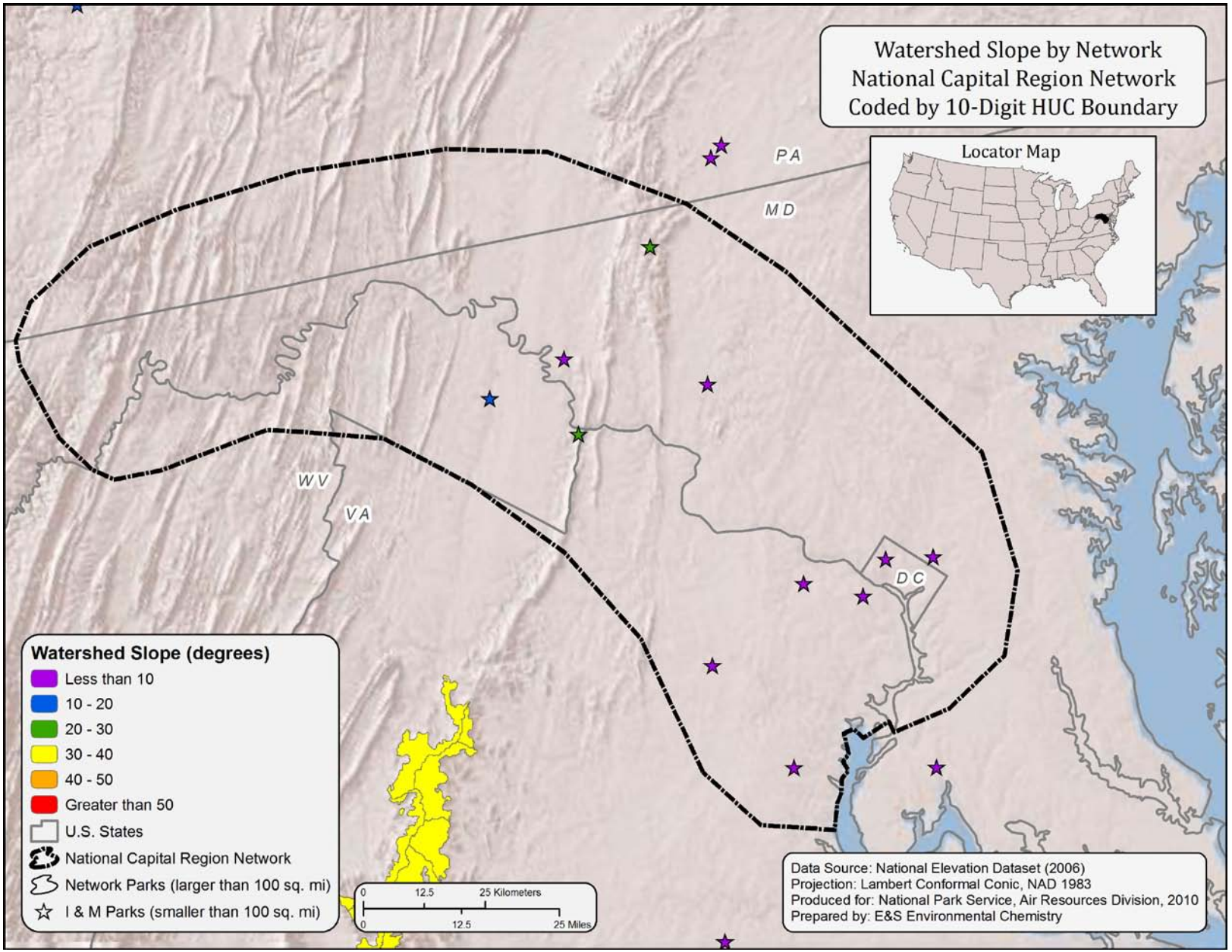
Map J


Total Nitrogen Deposition
National Capital Region Network
(kg/ha/yr)
Locator Map
PA
MD
WV
VA
DC
Total Nitrogen Deposition
kg/ha/yr
< 2.0
2 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 63.5
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 12.5 25 Kilometers
0 12.5 25 Miles
Data Source: Interpolated NADP Wet and CMAQ Model Dry Deposition for 2002
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

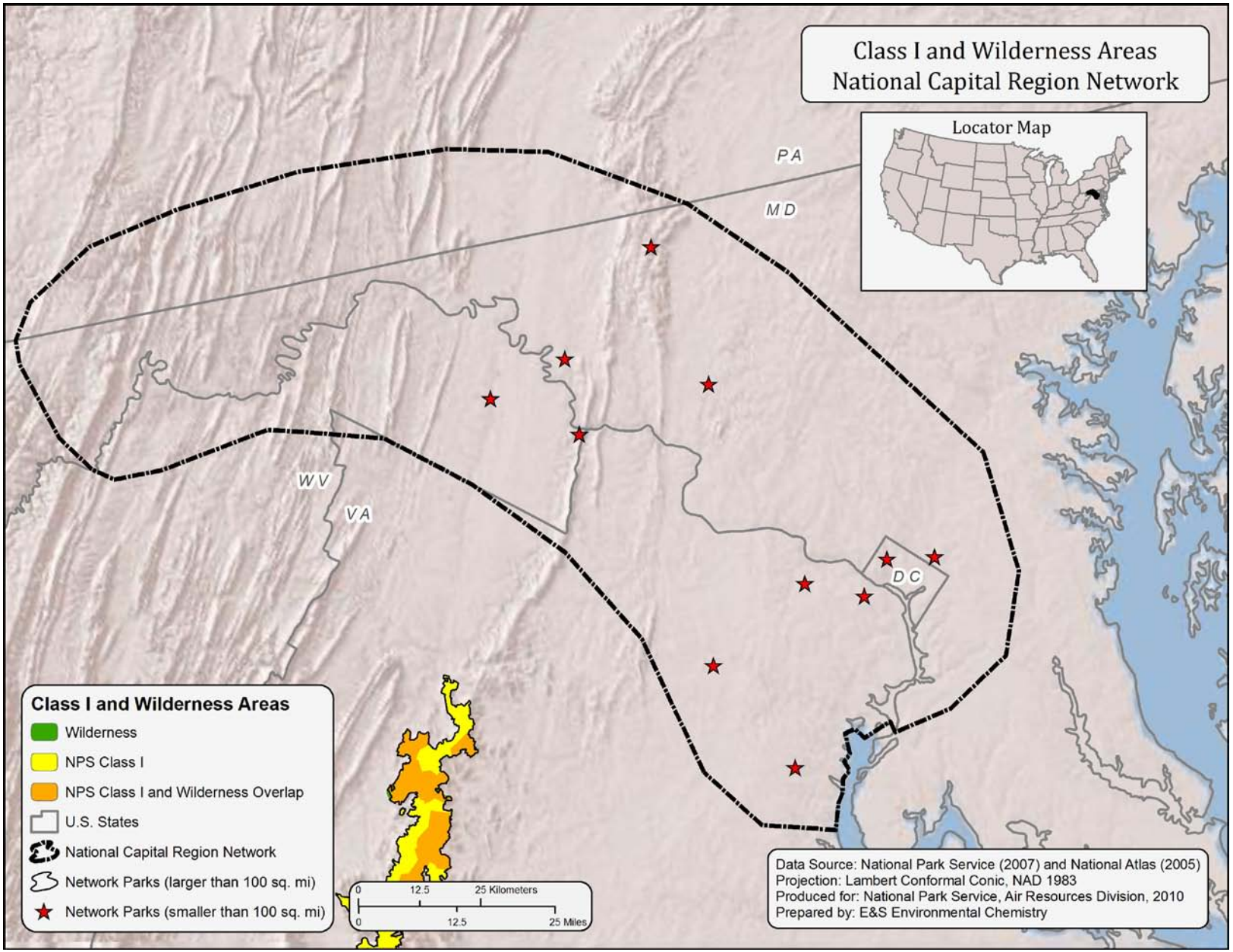
Map K


2001 Land Cover
National Capital Region Network
(National Land Cover Data)
Locator Map
PA
MD
WV
VA
DC
Open Water
Perennial Ice/Snow
Developed
Barren Land
Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Row Crops
Wetlands
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 12.5 25 Kilometers
0 12.5 25 Miles
Data Source: National Land Cover Data (NLCD, 2001)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

Map L


Watershed Slope by Network
National Capital Region Network
Coded by 10-Digit HUC Boundary
Locator Map
PA
MD
WV
VA
DC
Watershed Slope (degrees)
Less than 10
10 - 20
20 - 30
30 - 40
40 - 50
Greater than 50
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
I & M Parks (smaller than 100 sq. mi)
0 12.5 25 Kilometers
0 12.5 25 Miles
Data Source: National Elevation Dataset (2006)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

Map M


Class I and Wilderness Areas
National Capital Region Network
Locator Map
PA
MD
WV
VA
DC
Class I and Wilderness Areas
Wilderness
NPS Class I
NPS Class I and Wilderness Overlap
U.S. States
National Capital Region Network
Network Parks (larger than 100 sq. mi)
Network Parks (smaller than 100 sq. mi)
0 12.5 25 Kilometers
0 12.5 25 Miles
Data Source: National Park Service (2007) and National Atlas (2005)
Projection: Lambert Conformal Conic, NAD 1983
Produced for: National Park Service, Air Resources Division, 2010
Prepared by: E&S Environmental Chemistry

Map N

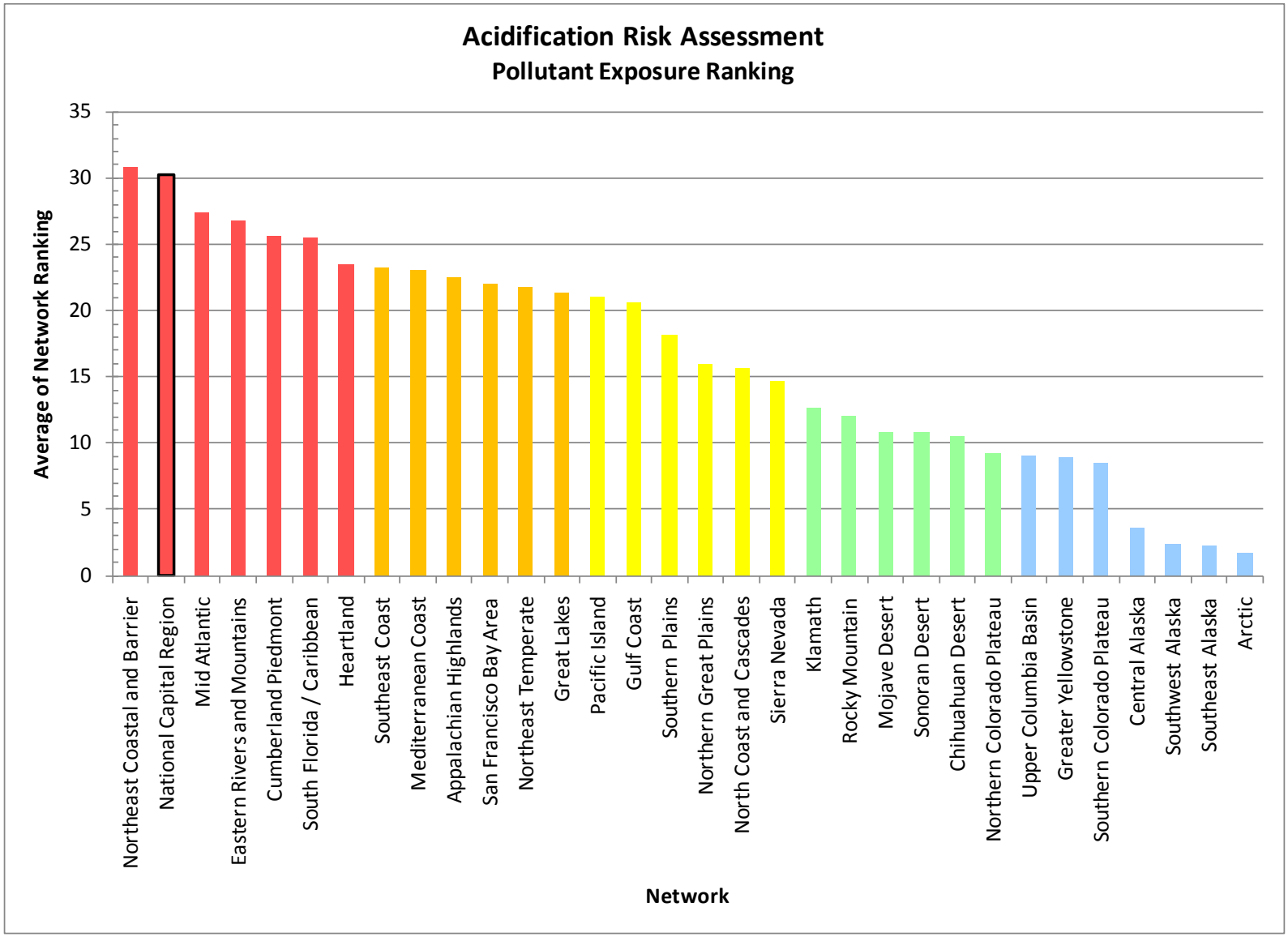

Acidification Risk Assessment
Pollutant Exposure Ranking
Average of Network Ranking
35
30
25
20
15
10
5
0
Northeast Coastal and Barrier
National Capital Region
Mid Atlantic
Eastern Rivers and Mountains
Cumberland Piedmont
South Florida / Caribbean
Heartland
Southeast Coast
Mediterranean Coast
Appalachian Highlands
San Francisco Bay Area
Northeast Temperate
Great Lakes
Pacific Island
Gulf Coast
Southern Plains
Northern Great Plains
North Coast and Cascades
Sierra Nevada
Klamath
Rocky Mountain
Mojave Desert
Sonoran Desert
Chihuahuan Desert
Northern Colorado Plateau
Upper Columbia Basin
Greater Yellowstone
Southern Colorado Plateau
Central Alaska
Southwest Alaska
Southeast Alaska
Arctic
Network

Figure A

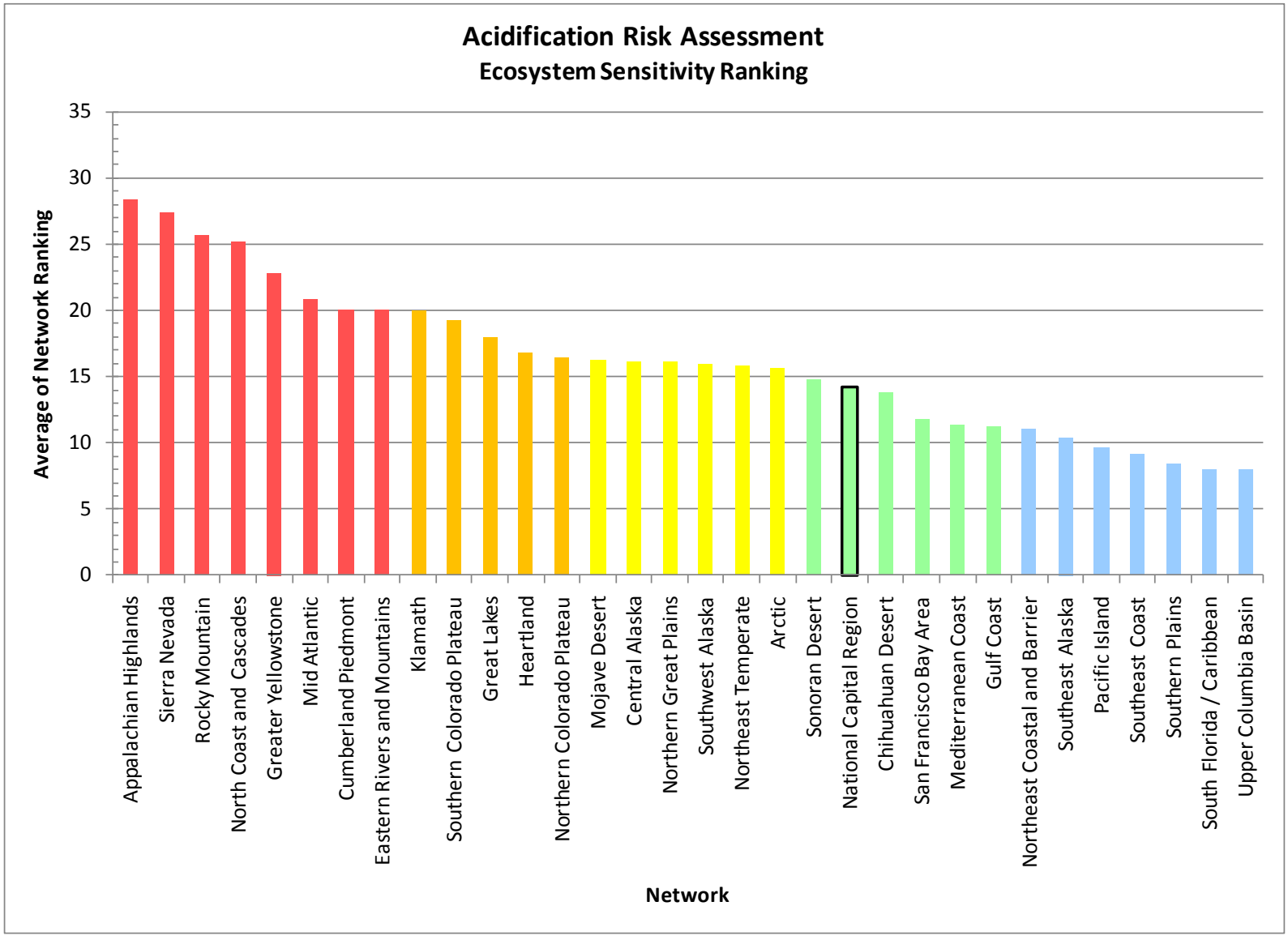

Acidification Risk Assessment
Ecosystem Sensitivity Ranking
Average of Network Ranking
35
30
25
20
15
10
5
0
Appalachian Highlands
Sierra Nevada
Rocky Mountain
North Coast and Cascades
Greater Yellowstone
Mid Atlantic
Cumberland Piedmont
Eastern Rivers and Mountains
Klamath
Southern Colorado Plateau
Great Lakes
Heartland
Northern Colorado Plateau
Mojave Desert
Central Alaska
Northern Great Plains
Southwest Alaska
Northeast Temperate
Arctic
Sonoran Desert
National Capital Region
Chihuahuan Desert
San Francisco Bay Area
Mediterranean Coast
Gulf Coast
Northeast Coastal and Barrier
Southeast Alaska
Pacific Island
Southeast Coast
Southern Plains
South Florida / Caribbean
Upper Columbia Basin
Network

Figure B

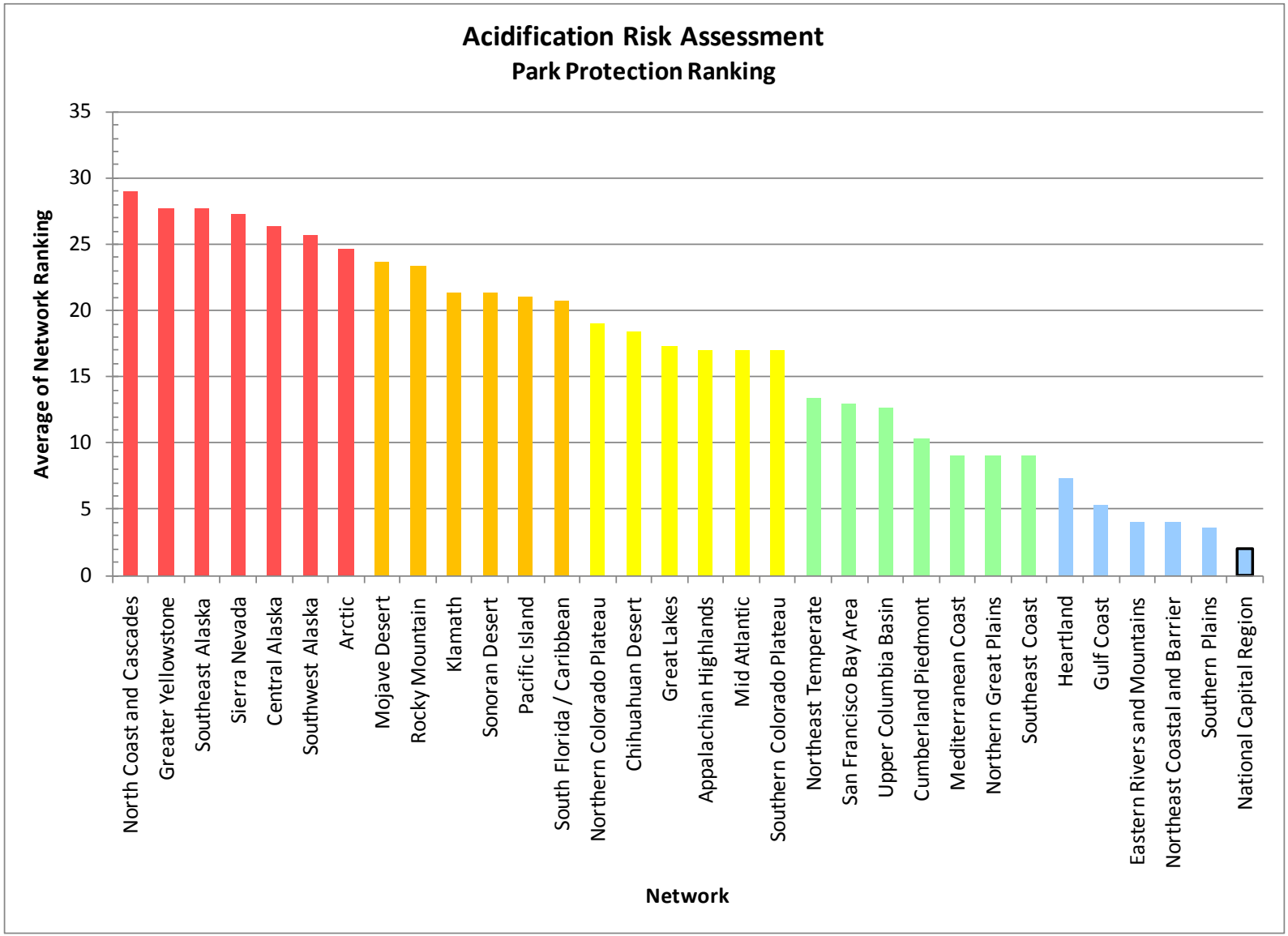

Acidification Risk Assessment
Park Protection Ranking
Average of Network Ranking
35
30
25
20
15
10
5
0
North Coast and Cascades
Greater Yellowstone
Southeast Alaska
Sierra Nevada
Central Alaska
Southwest Alaska
Arctic
Mojave Desert
Rocky Mountain
Klamath
Sonoran Desert
Pacific Island
South Florida / Caribbean
Northern Colorado Plateau
Chihuahuan Desert
Great Lakes
Appalachian Highlands
Mid Atlantic
Southern Colorado Plateau
Northeast Temperate
San Francisco Bay Area
Upper Columbia Basin
Cumberland Piedmont
Mediterranean Coast
Northern Great Plains
Southeast Coast
Heartland
Gulf Coast
Eastern Rivers and Mountains
Northeast Coastal and Barrier
Southern Plains
National Capital Region
Network

Figure C

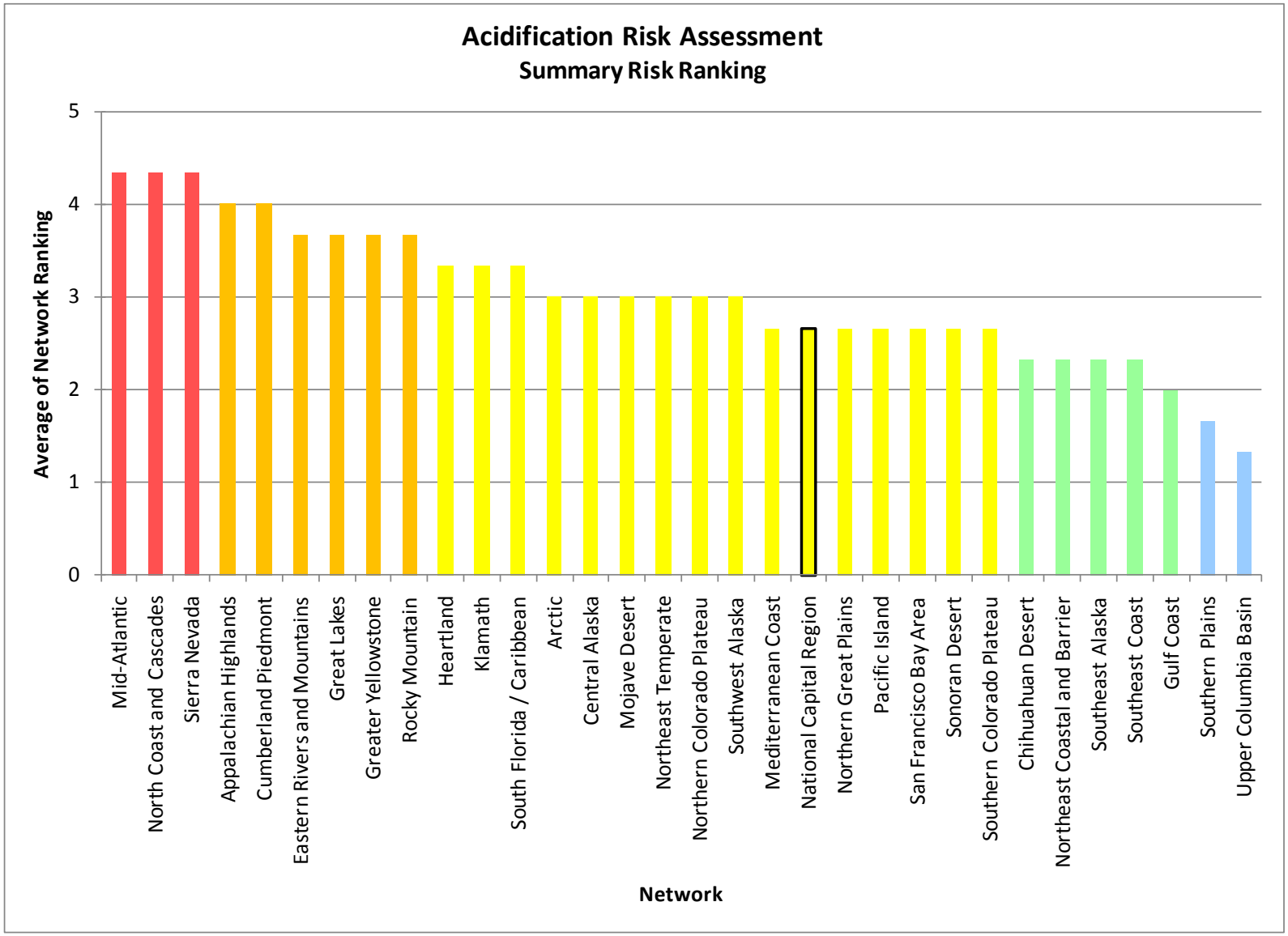

Acidification Risk Assessment
Summary Risk Ranking
Average of Network Ranking
0
1
2
3
4
5
Mid-Atlantic
North Coast and Cascades
Sierra Nevada
Appalachian Highlands
Cumberland Piedmont
Eastern Rivers and Mountains
Great Lakes
Greater Yellowstone
Rocky Mountain
Heartland
Klamath
South Florida / Caribbean
Arctic
Central Alaska
Mojave Desert
Northeast Temperate
Northern Colorado Plateau
Southwest Alaska
Mediterranean Coast
National Capital Region
Northern Great Plains
Pacific Island
San Francisco Bay Area
Sonoran Desert
Southern Colorado Plateau
Chihuahuan Desert
Northeast Coastal and Barrier
Southeast Alaska
Southeast Coast
Gulf Coast
Southern Plains
Upper Columbia Basin
Network

Figure D

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 962/107403, April 2011

National Park Service
U.S. Department of the Interior

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