



Intermodel Comparison of Atmospheric Nitrogen Deposition Estimates for the Conterminous United States and Critical Load Exceedance for Selected National Parks

Natural Resource Report NPS/NRSS/ARD/NRR—2020/2125



ON THE COVER

Ecosystems of North Cascades National Park evaluated in this study.

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Intermodel Comparison of Atmospheric Nitrogen Deposition Estimates for the Conterminous United States and Critical Load Exceedance for Selected National Parks

Natural Resource Report NPS/NRSS/ARD/NRR—2020/2125

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Abstract

Atmospheric deposition of reactive nitrogen (N_r), including both reduced and oxidized forms, can have adverse impacts on aquatic and terrestrial ecosystem elements of National Parks, including eutrophication and acidification processes. Critical loads (CLs) of atmospheric N_r deposition are used to quantify ecosystem impacts associated with a given, tipping point, level of deposition. Critical load exceedance is determined as the difference between ambient deposition and the CL. Exceedances can be calculated using a variety of methods for estimating deposition. This report quantifies differences in atmospheric deposition estimates generated by two modeling approaches (Total Deposition [TDep] and Community Multiscale Air Quality [CMAQ]) at two points in time (2003 and 2011) throughout the conterminous US. The extent to which calculations of CL exceedance varied based on these two approaches for modeling deposition and the timeframes of exceedance were evaluated throughout 10 National Parks. At the national scale, estimates of total N deposition from TDep were generally higher than those from CMAQ, and agreement between TDep and CMAQ was better in 2011 than 2003. TDep estimates of deposition tended to be higher in mountainous areas near the west coast, whereas eastern mountain regions generally showed higher values from CMAQ. Locations where total N deposition estimated by CMAQ was higher than TDep by the largest magnitudes were mostly near densely populated urban areas. Exceedance of CLs protective of lichen species richness, herbaceous species richness, tree growth, and/or probability of tree survival occurred within all of the National Park lands included in this study. The magnitude and spatial extent of exceedance was dependent at many locations on the source of deposition data. Grand Teton and Yosemite National Parks showed substantially more areas in exceedance of lichen CLs based on TDep as compared with CMAQ. Relatively minor differences in the spatial patterns of exceedance of CLs protective of herbaceous species richness were observed between the two deposition models. Few substantial differences in the magnitude or extent of exceedance between TDep and CMAQ occurred for the CLs protective of tree growth. TDep indicated greater effects on probability of tree survival for Grand Teton, Great Smoky Mountains, North Cascades, and Yosemite National Parks and CMAQ indicated greater effects on probability of tree survival for Acadia, Glacier, and Rocky Mountain National Parks and Sleeping Bear Dunes National Lakeshore. These differences highlight the importance of accurately modeling deposition to provide the foundation for informed management decisions.

Acknowledgments

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Introduction

Atmospheric nitrogen (N) deposition can cause some plant and animal species to experience increased growth and abundance, whereas other species can be out-competed and eventually eliminated from the biological community. Deposition of reactive N (N_r) can have adverse impacts on both aquatic and terrestrial ecosystem elements, including eutrophication and acidification processes. Wet deposition is routinely measured and dry deposition is modeled based on measurements at specific sites across the United States. In order to determine the deposition in the spaces between measurement sites, chemical transport models (CTM) are used. These models evaluate emissions together with atmospheric and environmental processes to predict deposition. These deposition estimates can then be used to evaluate changes to ecosystem processes and determine critical loads (CLs) and their exceedances. The CL is an estimate of the level of pollutant exposure below which harm does not occur according to current knowledge (Nilsson and Grennfelt 1988). The CLs for a number of ecosystem elements have been developed in the US, including forest-tree health, plant community composition, and change in lichen biodiversity (Clark et al. 2018, Geiser et al. 2019). Exceedance of the CL occurs when N_r deposition is higher than the N_r CL tipping point. Deposition is estimated for determining CL exceedance using CTMs (Simkin et al. 2016, Clark et al. 2018, Makar et al. 2018) or through the use of measurement-model fusion (MMF) approaches (Schwede and Lear 2014, Nanus et al. 2017, McDonnell et al. 2018, U.S. Environmental Protection Agency 2019). MMF techniques are generally considered to be more accurate than CTM techniques because the former incorporate measurement data (Walker et al. 2019).

Regional modeling of atmospheric N deposition to National Park Service (NPS) lands has been an active area of research for several decades. Atmospheric deposition effects studies in national parks have commonly relied on a combination of spatial interpolation of wet deposition and process modeled dry deposition output from the Community Multiscale Air Quality (CMAQ) model to derive estimates of total N deposition. Many other approaches for estimating total deposition, including estimates based on throughfall chemistry (cf., Weathers et al. 2006) have also been applied to better understand effects of air pollution. A hybrid approach was developed by the National Atmospheric Deposition Program (NADP) Total Deposition (TDep) Science Committee to leverage the strengths of the monitoring and modeling approaches (Schwede and Lear 2014). The TDep Science Committee is a multi-organizational group that includes the USEPA, USGS, NPS, USFS, NOAA, USFWS, EPRI, university researchers and other industries.

There are various CTMs that are used by federal agencies to determine the total N loads to an ecosystem. Each model uses a unique set of inputs and equations to determine how emissions move from their sources to ecosystem sinks. Variability among CTM estimates of deposition can reflect the complexity and uncertainty of canopy-atmosphere exchange processes (Walker et al. 2020). While similar in function, model choices vary by agency and project. Therefore, to compare across agencies and boundaries, we need a better sense of where the similarities and differences exist between the models. For NPS interests specifically, it is important to understand if the inconsistencies among the models change the exceedance of known CLs in NPS management units. Nationally consistent

deposition model output is needed to make comparisons between parks at a broad scale (e.g., the conterminous United States [CONUS]).

The objectives of the research reported herein were to:

1. Conduct model comparisons to quantify differences in deposition estimates generated by the TDep and CMAQ models at two points in time (2003 and 2011) throughout the CONUS.
2. Evaluate differences in deposition estimates based on ecosystem type and other landscape features.
3. Compare model outputs of deposition with known CLs within case study areas, including 10 national park sites across the CONUS.

Atmospheric deposition of N in excess of the CL can have negative impacts on ecosystem services, including biodiversity, tree growth, recreation, and cultural and aesthetic values (Compton et al. 2011, Munns et al. 2016). The estimated CL is used to inform public policy decision-making. There is concern among researchers and land managers that differences among modeling methods may influence whether the interpretation of CL exceedances reflect the estimated likelihood of ecological effects caused by the pollution deposition. Therefore, differences and uncertainties in exceedance must be understood. Walker et al. (2019) reviewed the state of science regarding sources of uncertainty in total reactive N deposition budgets. Estimates were found to be most uncertain in portions of the US where dry deposition makes a larger contribution to the total N amount, especially ammonia (NH_3) in and near agricultural areas and oxidized N in and near urban areas. The potential to misunderstand exceedance has both policy and management implications associated with risk perception from current and future pollution levels; this is because land managers use exceedance to develop resource management strategies and inform emissions policy.

Methods

Nitrogen Deposition Comparison

Spatial datasets describing annual total (wet + dry), wet only, and dry only N deposition previously developed using the TDep (Schwede and Lear 2014) and CMAQ (Byun and Schere 2006) methods were obtained for the CONUS from NADP (<http://nadp.slh.wisc.edu/committees/tdep/tdepmaps/>) and USEPA (Donna Schwede, personal communication May 4, 2017¹). The TDep model uses measurements of HNO₃ (dry), NO₃ (wet/dry), and NH₄ (wet) to modify the CMAQ model, and then incorporates modeled dry deposition of gaseous NH₃, PAN, N₂O₅, NO, NO₂, HONO and organic nitrates. TDep version 2018.02 and CMAQ model (v5.0.2) results were used. Annual deposition representative of years 2003 and 2011 were expressed as three-year averages centered on 2003 and 2011 for both methodologies. These dates were chosen as the earliest and latest time periods for which both TDep and CMAQ data were available at time of publication. Deposition units were reported as kg N/ha/yr. Analyses were conducted to compare TDep and CMAQ model estimates based on both absolute and percent differences, as described below:

Absolute difference was calculated as TDep - CMAQ

Percent difference was calculated as ((TDep - CMAQ) / TDEP) * 100

Maps and summary statistics were generated for both difference metrics.

Analyses were conducted to explain differences in deposition that might be attributable to landscape features characteristic of level 1 and level 3 ecoregions (<https://www.epa.gov/eo-research/ecoregions>). These landscape features included aspects of precipitation, terrain roughness, and land cover (Table 1). Absolute differences in total, wet, and dry N deposition representative of year 2011 were regressed against spatial gradients in these landscape characteristics. Summary statistics (minimum, mean, maximum) of the absolute difference in total, wet, and dry N deposition (year 2011) between TDep and CMAQ among all deposition grid cells that occurred within a given Inventory and Monitoring (I&M) Park with available deposition data (n = 256) were also generated for evaluating differences between the TDep and CMAQ model output.

¹ CMAQ output was generated by Robin L. Dennis and Kristen Foley; USEPA

Table 1. Landscape characteristics used to evaluate absolute differences in total, wet, and dry N deposition among level 1 and level 3 ecoregions.

Variable Type	Description	Source
Precipitation	Ecoregion average PRISM 30-year normal (1981 - 2010) annual precipitation total	http://www.prism.oregonstate.edu
Terrain Roughness	Ecoregion average terrain roughness of all local (3x3 cell) neighborhoods	Riley et al. (1999)
Agricultural land cover	Percent of ecoregion as agricultural land cover	https://www.mrlc.gov/data/nlcd-2011-land-cover-conus-0
Urban land cover	Percent of ecoregion as urban land cover	https://www.mrlc.gov/data/nlcd-2011-land-cover-conus-0
Forest land cover	Percent of ecoregion as forest land cover	https://www.mrlc.gov/data/nlcd-2011-land-cover-conus-0
Coniferous land cover	Percent of ecoregion as coniferous land cover	https://www.mrlc.gov/data/nlcd-2011-land-cover-conus-0

Evaluation of Critical Load Exceedance

Exceedance of critical loads for lichen species richness, herbaceous species richness, and tree growth and survival was determined within 10 National Parks (Acadia National Park, Glacier National Park, Grand Teton National Park, Great Smoky Mountains National Park, Joshua Tree National Park, North Cascades National Park, Rocky Mountain National Park, Sleeping Bear Dunes National Lakeshore, Theodore Roosevelt National Park, Yosemite National Park), distributed throughout the CONUS (Figure 1). Parks were selected for inclusion based on data availability and potential sensitivity to adverse impacts attributable to N_r deposition.

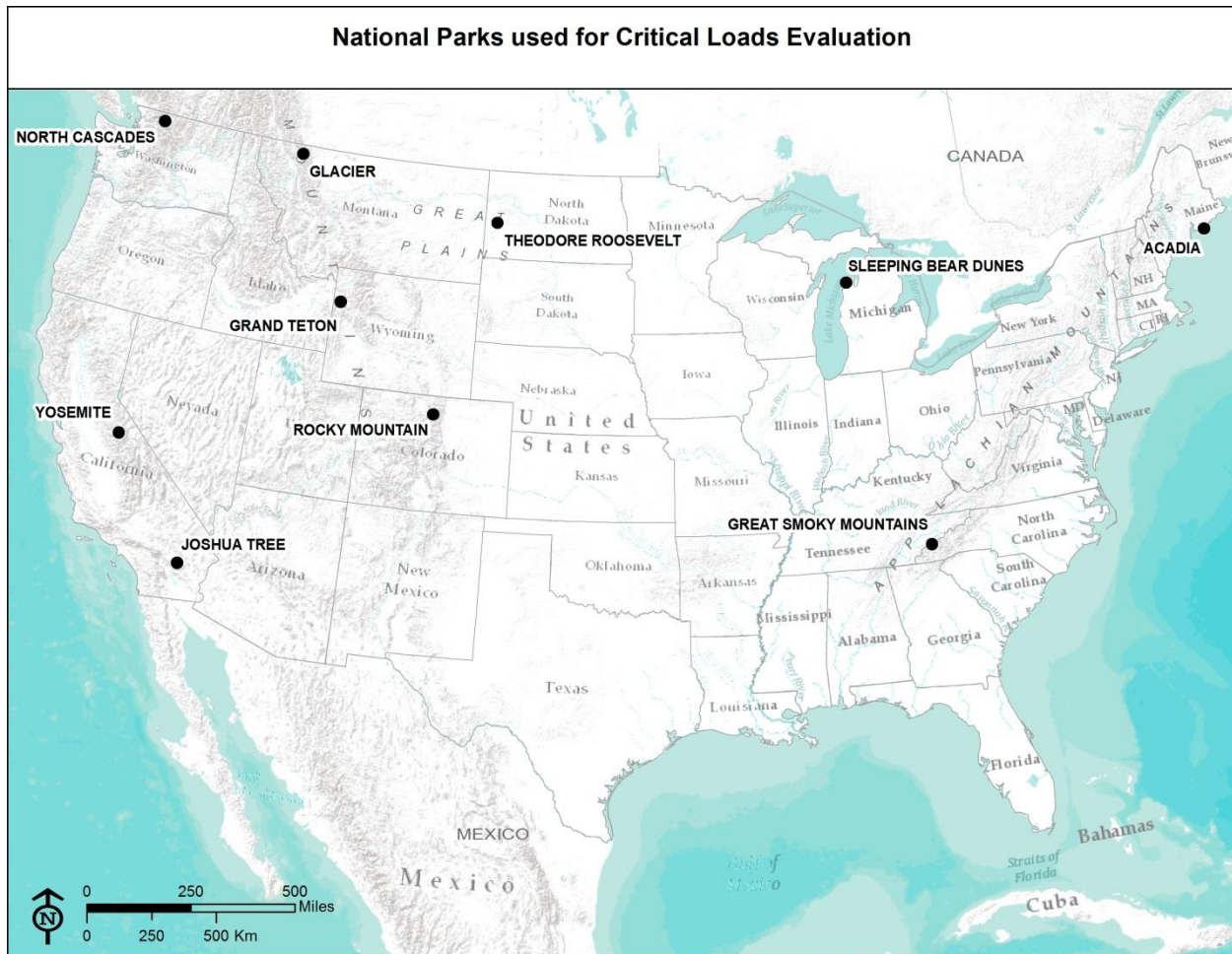


Figure 1. Ten National Parks included in this study.

The critical load of 3.5 kg N/ha/yr associated with a decrease in 20% of epiphytic macrolichen species richness reported by Geiser et al. (2019) was used as the basis for evaluating critical load exceedance for lichens. This critical load was applied only to forested areas of each park, as defined by the 2011 National Land Cover Database (<https://www.mrlc.gov/data/nlcd-2011-land-cover-conus-0>).

Critical loads for a decrease in herbaceous species richness were adapted from Simkin et al. (2016) by summarizing point critical loads by EPA Ecoregions III and IV (NCLD 3.1, 2018). These values are spatially variable and range from 7.3 to 8.9 kg N/ha/yr for closed canopy conditions (forests) and 8.7 to 15.9 kg N/ha/yr for open canopy conditions (grasslands, shrub lands, and woodlands; Simkin et al. (2016)). Herbaceous CLs were not available for four parks: Glacier, Joshua Tree, Rocky Mountain, and Yosemite NPs.

Response values of 0%, 1%, 2%, 5% and 10% declines in tree species growth and probability of survival over a 10-year period were evaluated after exceedance of critical loads developed by Horn et al. (2018). The areas of response were allocated within each park according to locations of expected tree species occurrence of at least 1 sq. ft/acre basal area based on Wilson et al. (2012). Selected tree

CLs varied by species, response metric, and magnitude of response (Tables 2 and 3); and ranged from 2.0 to 29.3 kg N/ha/yr. These tree growth and survival CLs were allocated to parks based on 1) known species prevalence within the park and 2) having threshold values that were within the general range of park deposition. A maximum of two species was used to evaluate tree CLs for each park, with those with the largest distribution within the park boundary taking priority. Joshua Tree NP was not evaluated for tree CLs because no suitable models existed for tree species contained within this park.

Table 2. Levels of total N deposition (kg N/ha/yr) protective of various percent declines in growth for tree species considered in this study.

Common Name	Scientific Name	Percent Decline in Growth				
		0%	1%	2%	5%	10%
Balsam poplar	<i>Populus balsamifera</i>	3.3	3.4	3.6	4.2	5.4
Eastern hemlock	<i>Tsuga canadensis</i>	3.1	3.3	3.5	4.1	5.4
Quaking aspen	<i>Populus tremuloides</i>	11.1	13.6	14.8	17.5	21.3
Western hemlock	<i>Tsuga heterophylla</i>	6.0	7.4	8.1	9.7	12.0
Yellow birch	<i>Betula alleghaniensis</i>	3.3	3.8	4.3	6.2	11.2

Table 3. Levels of total N deposition (kg N/ha/yr) protective of various percent declines in probability of survival for tree species considered in this study.

Common Name	Scientific Name	Percent Decline in Probability of Survival				
		0%	1%	2%	5%	10%
American elm	<i>Ulmus americana</i>	3.6	4.2	4.9	7.6	16.1
Douglas-fir	<i>Pseudotsuga menziesii</i>	2.0	3.5	4.5	7.4	13.2
eastern hemlock	<i>Tsuga canadensis</i>	5.5	8.1	9.5	13.1	19.2
green ash	<i>Fraxinus pennsylvanica</i>	6.1	9.8	12.1	18.1	29.1
mountain hemlock	<i>Tsuga mertensiana</i>	6.8	10.7	12.9	18.9	29.3
quaking aspen	<i>Populus tremuloides</i>	4.2	6.6	8.0	11.8	18.4

Estimates of total N deposition based on both methodologies (TDep and CMAQ) and representative years (2003 and 2011) were used to calculate the spatial extent of CL exceedance for each biological receptor and threshold for a given park. Critical load exceedance was determined as total N deposition minus the CL, with exceedance values more than +0.5 kg N/ha/yr considered to be “above the CL” and exceedance values less than -0.5 kg N/ha/yr were considered to be “below the CL”. Values of exceedance between -0.5 and +0.5 kg N/ha/yr were considered to be “at the CL”.

Results

National Scale Deposition Comparison

Differences in total N deposition indicated higher values generated by TDep (positive values) more often than for CMAQ (negative values; Figure 2 and Table 4). Absolute differences in total N deposition showed that TDep and CMAQ were within 1 kg N/ha/yr throughout the majority (78% for 2003; 83% for 2011) of the CONUS. Although absolute differences in the range of +/- 1 to 4 kg N/ha/yr were less common, these magnitudes were somewhat prevalent at 22% and 17% of the study region for 2003 and 2011, respectively. Few areas (< 0.5% of the CONUS) showed absolute differences greater than +4 kg N/ha/yr or less than -4 kg N/ha/yr. Percent differences were typically in the range of +/- 15% and showed similar patterns as the absolute difference overall for both years. Nearly all of the study region (98%) showed absolute difference in total N deposition between approximately -2.2 and 2.5 kg N/ha/yr and percent difference between approximately -33% and 45% (Table 4). Of note, absolute differences were +/- 0.5 kg N/ha/yr for at least half of the CONUS (50% for 2003; 56% for 2011).

TDep showed more areas with higher values of wet deposition, with median wet deposition differences of 0.2 and 0.1 kg N/ha/yr for years 2003 and 2011, respectively (Table 5). An approximately equal amount of study area showed higher values of dry deposition based on TDep versus CMAQ (median dry deposition differences = 0.0 kg N/ha/yr for both years; Figure 3).

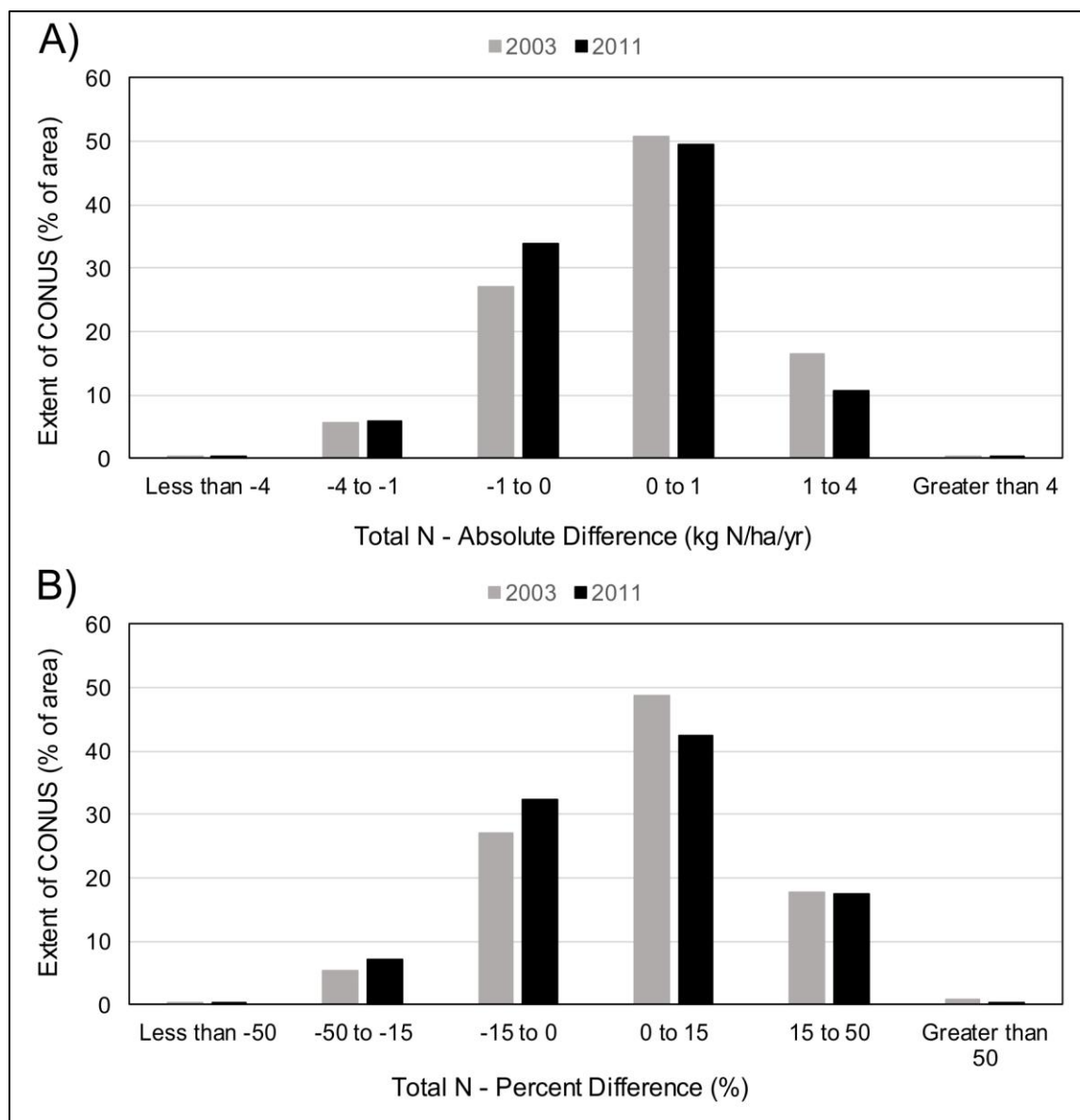


Figure 2. Percent area of the conterminous United States (CONUS) in various categories of A) absolute and B) percent difference between TDep and CMAQ estimates of total N deposition representative of 2003 and 2011.

Table 4. Distribution of the absolute and percent difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 throughout the conterminous United States.

Difference Metric (units)	Year	Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
Absolute (kg N/ha/yr)	2003	-30.3	-2.3	-1.1	-0.2	0.3	0.3	0.7	1.7	2.7	14.3
	2011	-29.1	-2.1	-1.1	-0.3	0.2	0.2	0.6	1.4	2.3	11.0
Percent (%)	2003	-294.4	-32.2	-16.1	-2.1	4.2	5.3	11.6	31.8	47.8	80.3
	2011	-191.5	-34.3	-18.7	-4.1	2.6	3.6	11.1	28.5	43.3	76.5

Table 5. Distribution of the absolute difference between TDep and CMAQ estimates of wet and dry N deposition representative of years 2003 and 2011 throughout the conterminous United States.

Type of Deposition	Year	Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
Wet N	2003	-6.0	-1.2	-0.6	-0.1	0.2	0.2	0.5	1.3	1.9	6.9
	2011	-5.0	-1.3	-0.8	-0.2	0.1	0.1	0.4	1.1	1.9	6.4
Dry N	2003	-25.2	-1.7	-0.8	-0.2	0.0	0.1	0.3	1.2	2.2	14.5
	2011	-25.5	-1.3	-0.6	-0.2	0.0	0.1	0.2	0.9	1.6	11.2

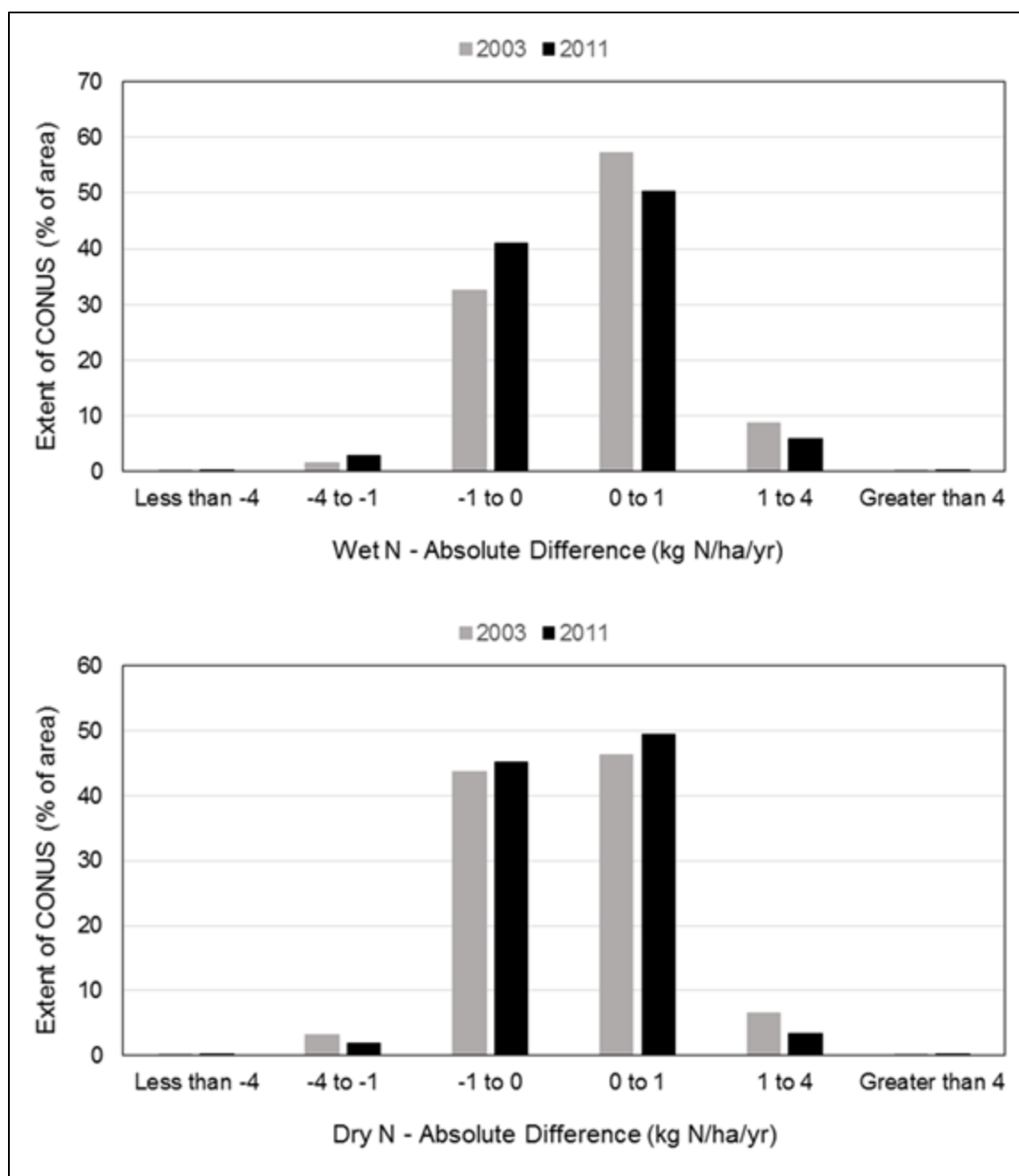


Figure 3. Percent area of the conterminous United States (CONUS) in various categories of absolute difference between TDep and CMAQ estimates of A) wet and B) dry N deposition representative of 2003 and 2011.

Differences between the two approaches for estimating total N deposition were spatially heterogeneous (Figures 4 through 7). Spatial patterns in absolute and percent difference were generally similar between 2003 and 2011, with the exception of portions of the Northeast that changed from having higher values of total N deposition from TDep in 2003 to having higher values from CMAQ in 2011. Locations where total N deposition estimated by CMAQ was more than 4 kg N/ha/yr greater than TDep were mostly located in close proximity to densely populated urban areas.

Areas where TDep was more than 4 kg N/ha/yr greater than CMAQ were mostly located in the Sierra Nevada. Many of the mountainous areas of the western US showed higher wet N deposition from TDep, whereas CMAQ typically showed higher values in mountains of the eastern US (Figures 8 and 9). An inverse of this spatial pattern of differences in wet N deposition between the two coasts was evident in lowland areas. Absolute differences in dry N deposition were generally highest in the western, southern, and eastern portions of the US (Figures 10 and 11). In 2011, relatively large portions of the southwestern US showed 1 to 4 kg N/ha/yr greater dry N deposition from TDep.

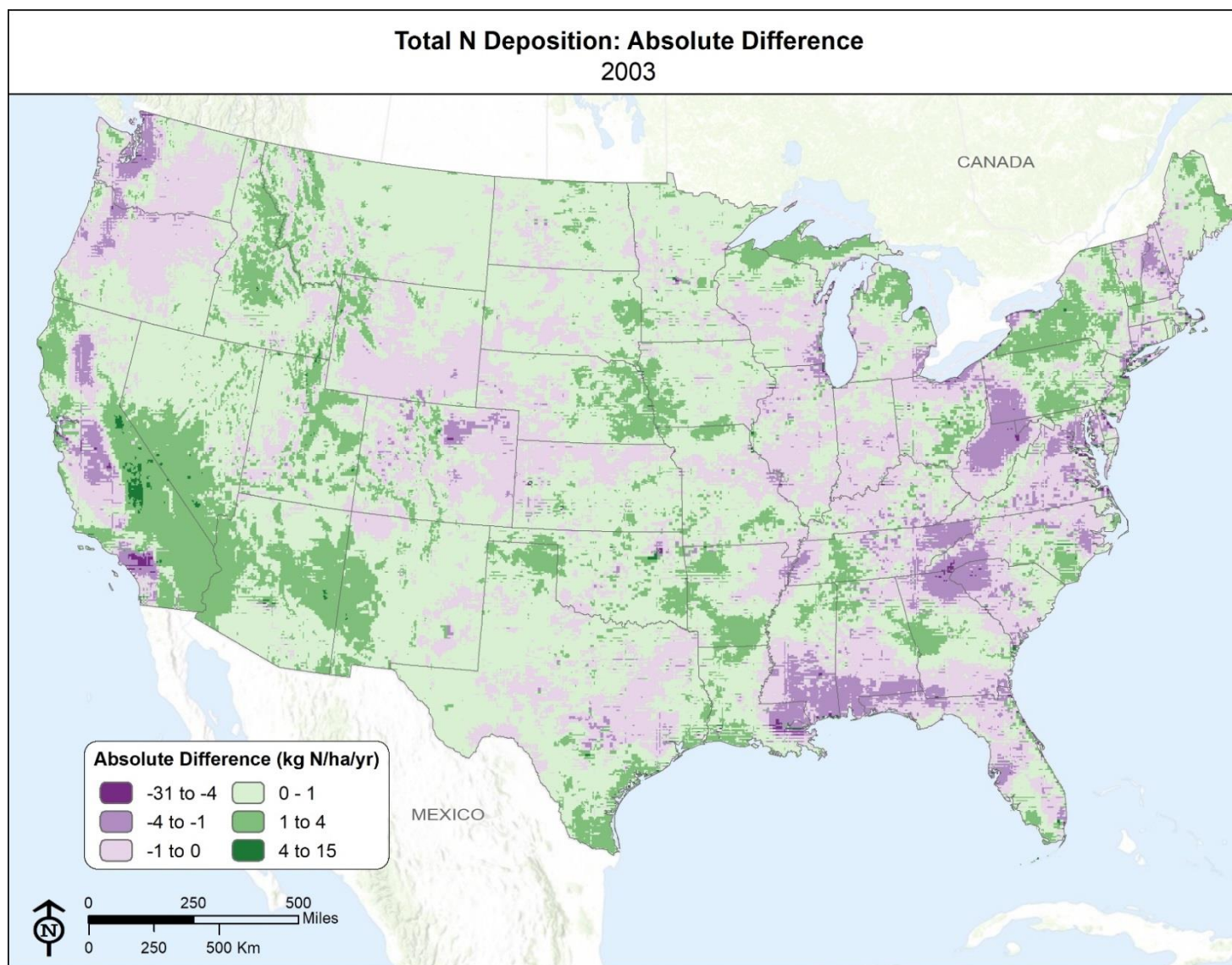


Figure 4. Absolute difference between TDep and CMAQ total N deposition representative of year 2003 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

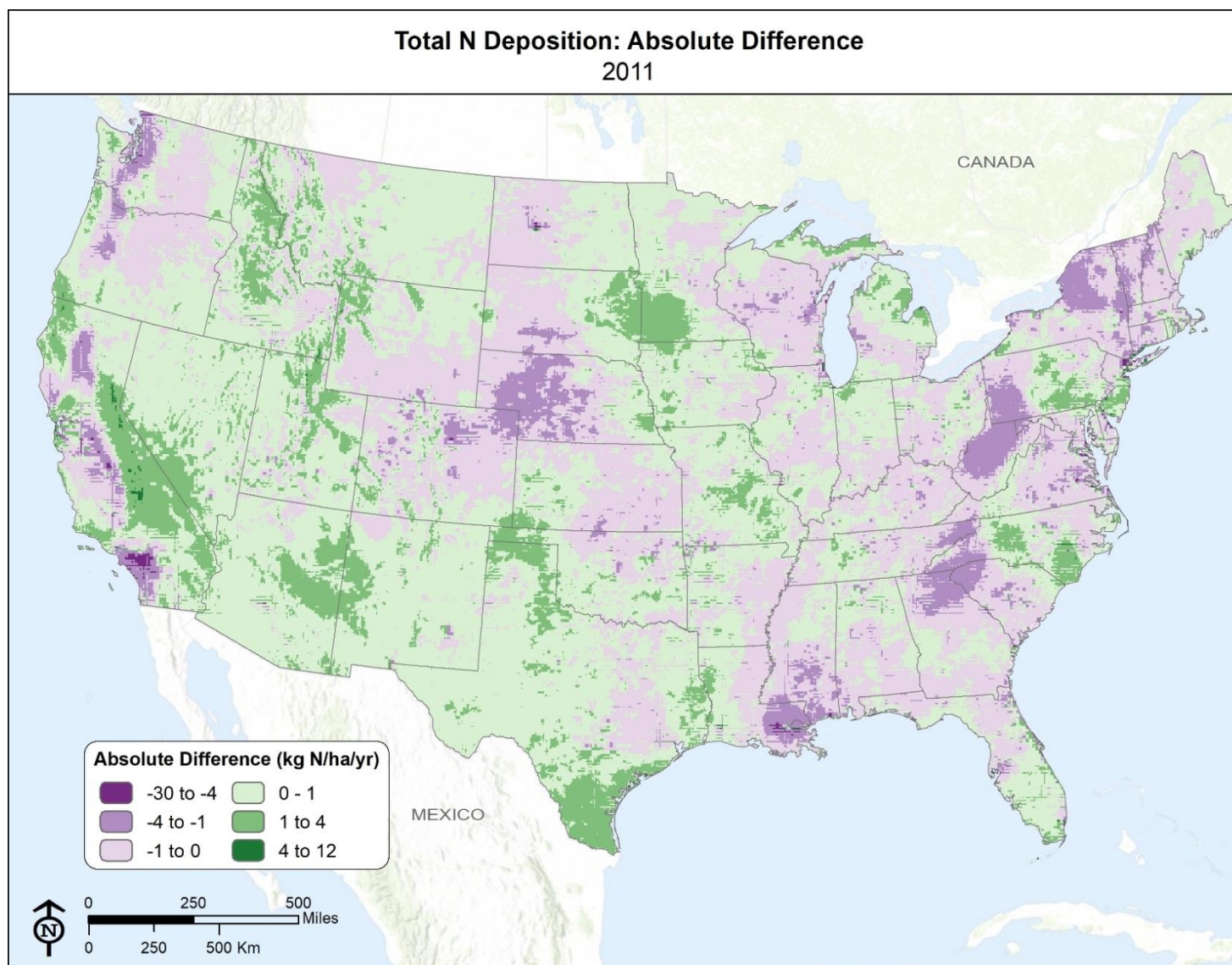


Figure 5. Absolute difference between TDep and CMAQ total N deposition representative of year 2011 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

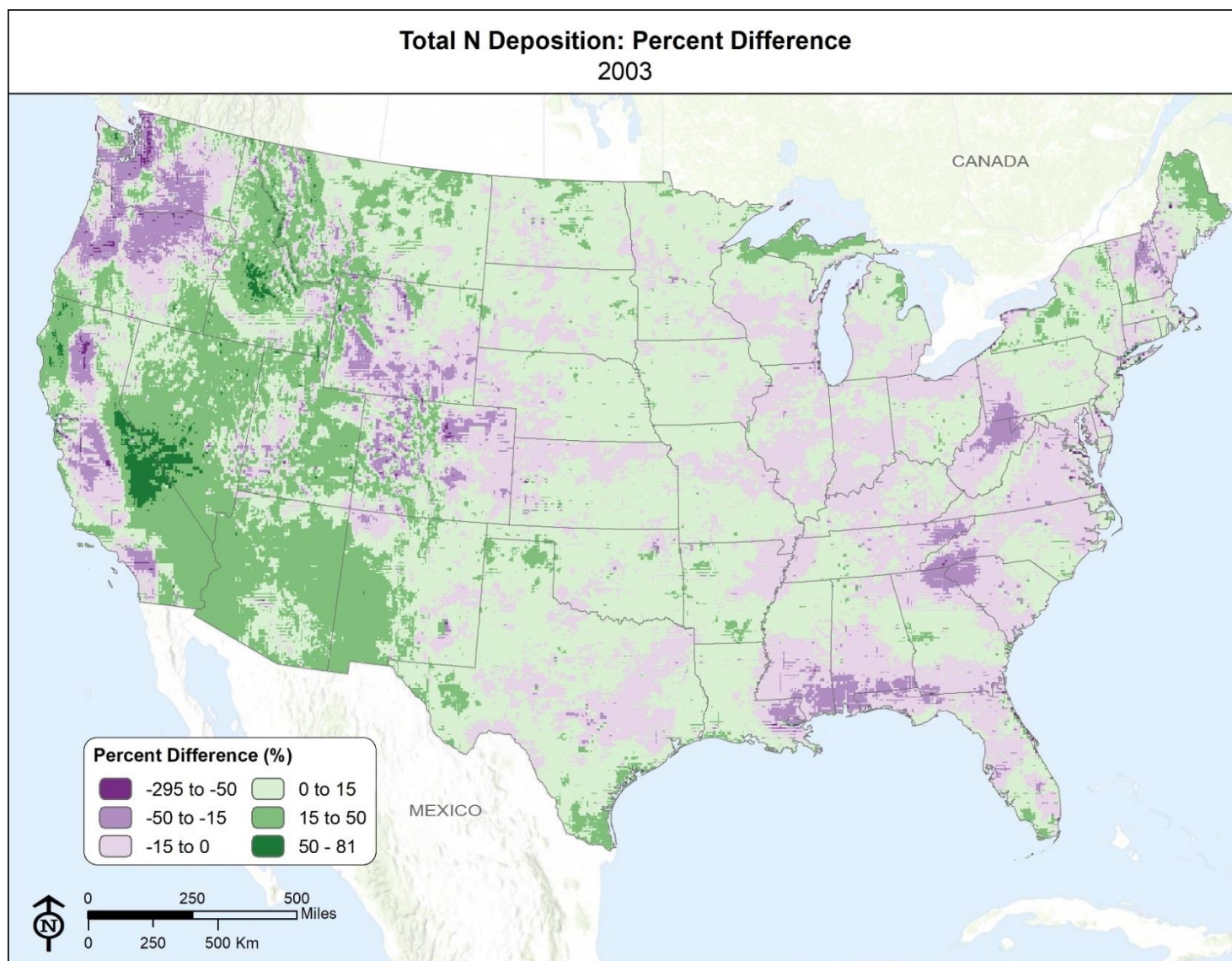


Figure 6. Percent difference between TDep and CMAQ total N deposition representative of year 2003 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

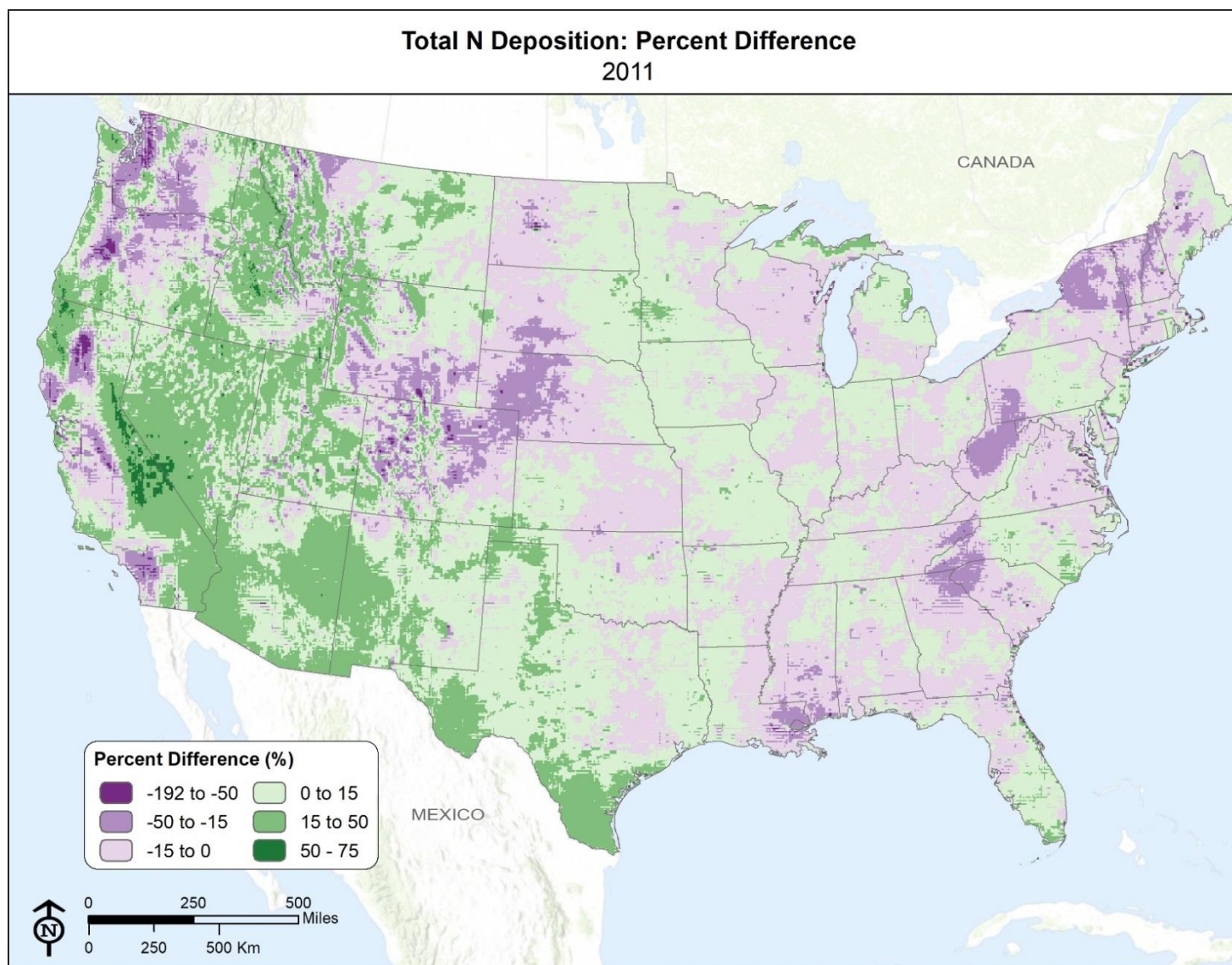


Figure 7. Percent difference between TDep and CMAQ total N deposition representative of year 2011 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

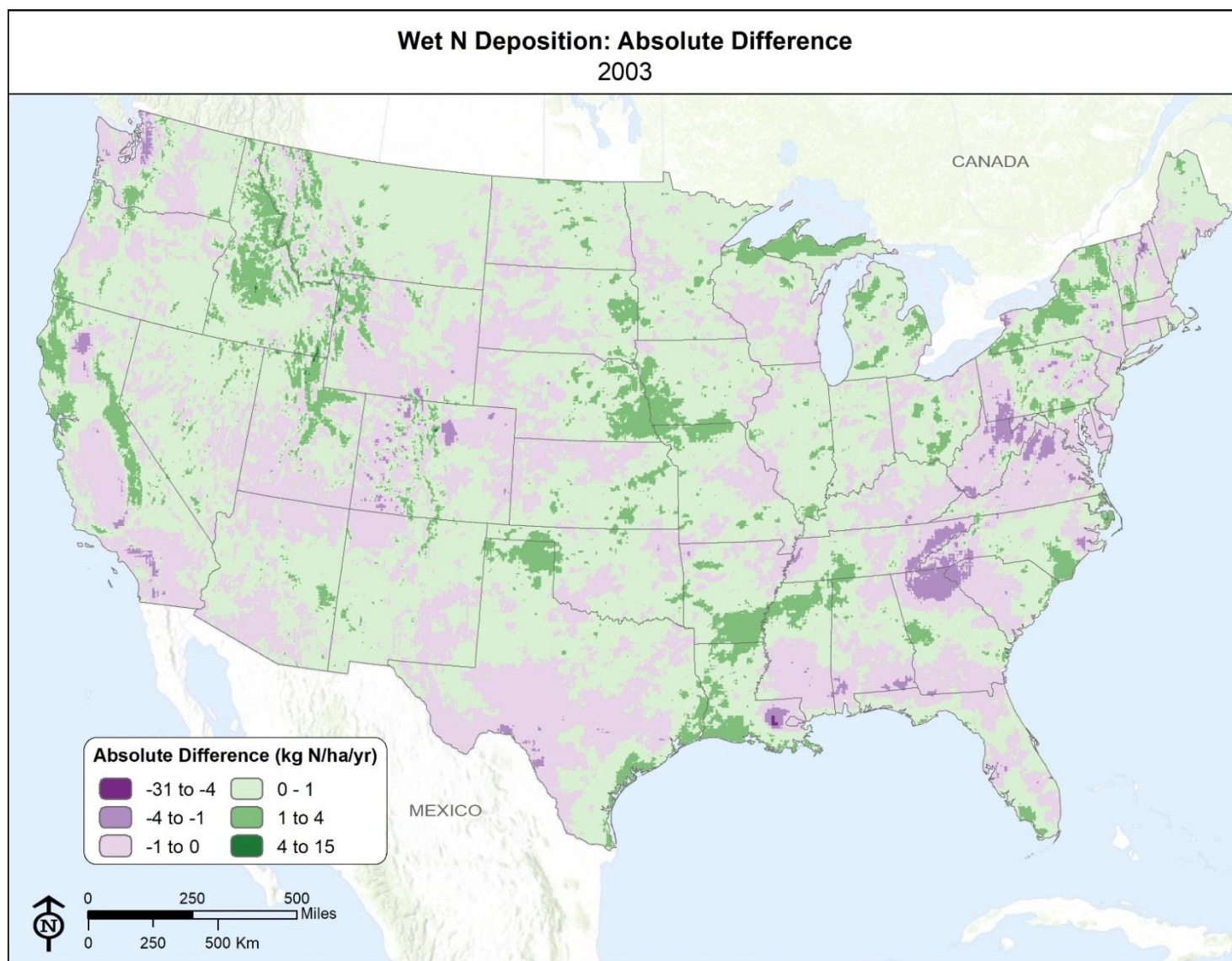


Figure 8. Absolute difference between TDep and CMAQ wet N deposition representative of year 2003 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

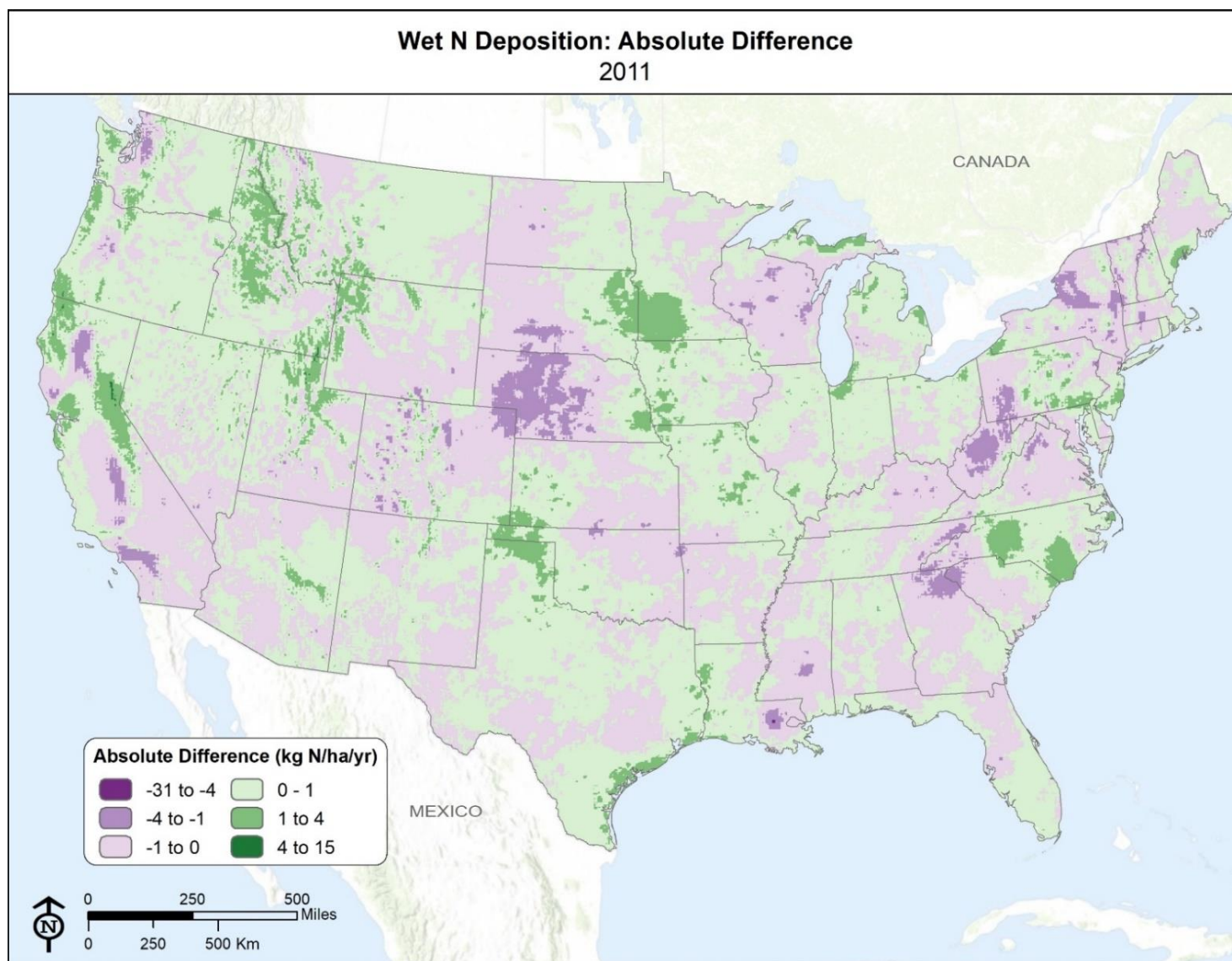


Figure 9. Absolute difference between TDep and CMAQ wet N deposition representative of year 2011 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

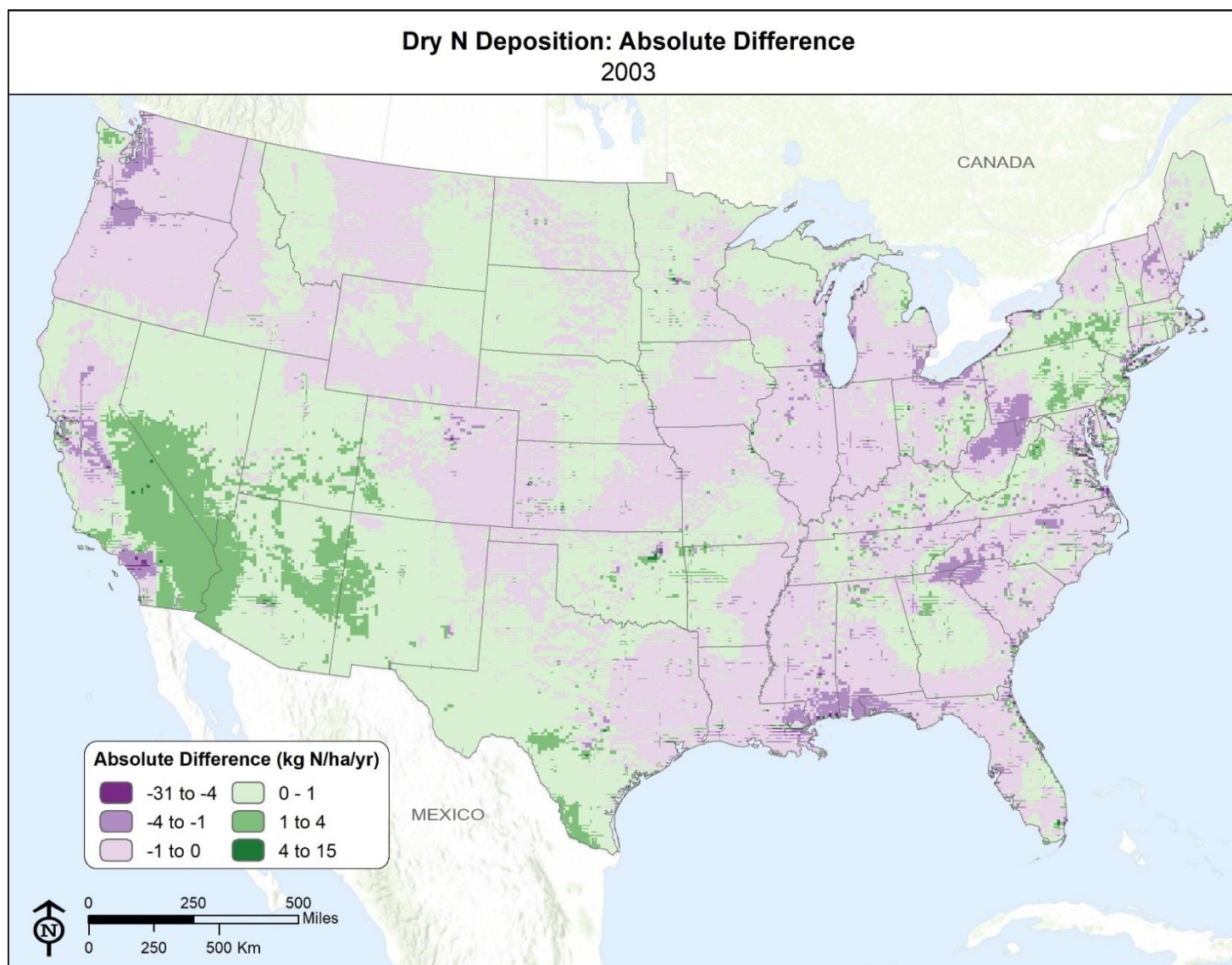


Figure 10. Absolute difference between TDep and CMAQ dry N deposition representative of year 2003 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher.

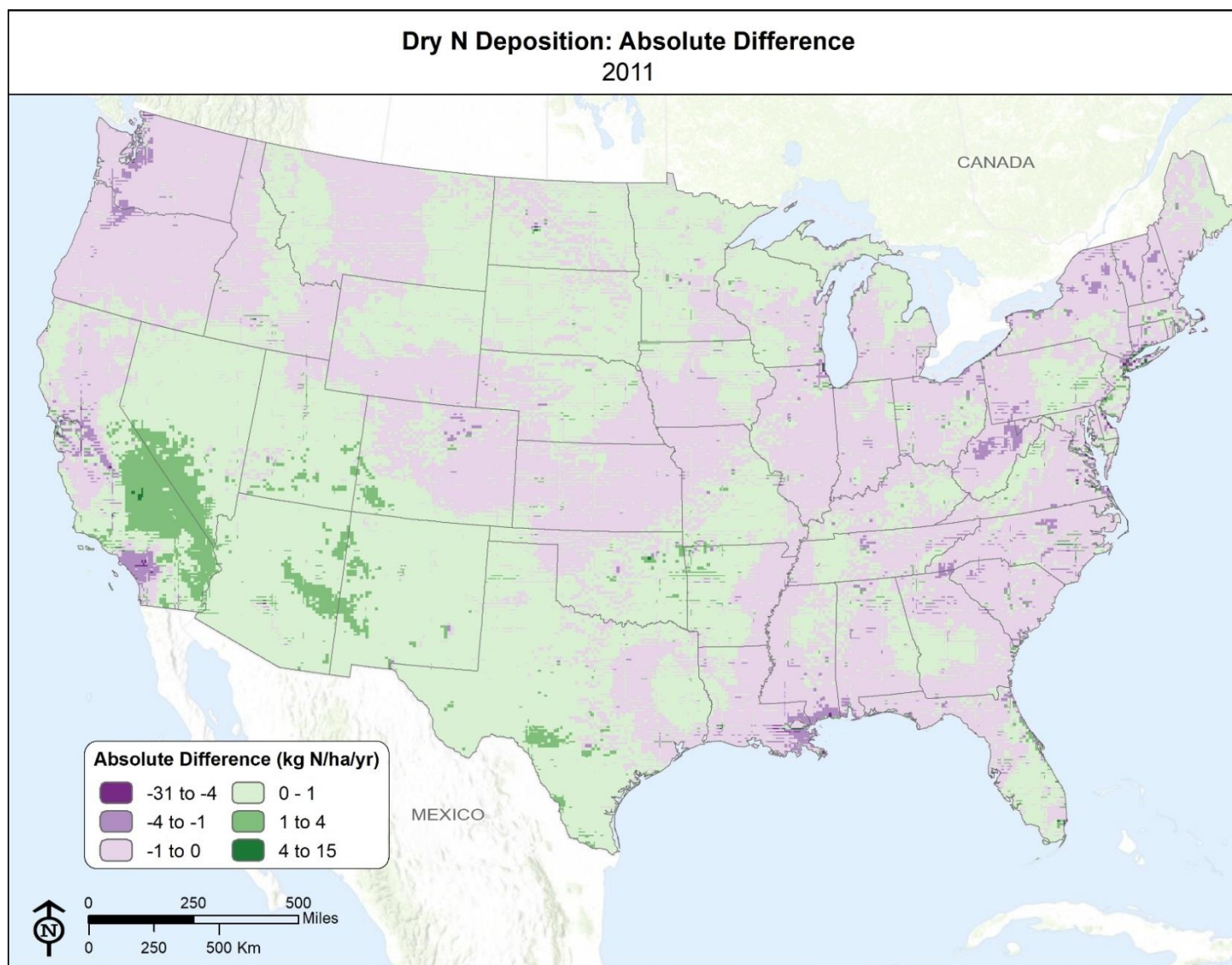


Figure 11. Absolute difference between TDep and CMAQ dry N deposition representative of year 2011 throughout the conterminous US. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher

Median absolute differences in total N deposition aggregated by level 1 ecoregion ranged between -0.31 and 0.95 kg N/ha/yr (Table 6) with eastern ecoregions generally showing either negative values (i.e., higher CMAQ) or values close to zero. Western ecoregions mostly showed either positive values (i.e., higher TDep) or values close to zero (Figure 12). None of the landscape characteristics (precipitation, terrain roughness, land cover; Table 7) were able to explain more than approximately one-third of the variation in absolute difference in total N deposition (Figure 13). The only significant landscape relationship showed that TDep was generally higher in level 1 ecoregions with lower agricultural land cover ($p=0.09$). Absolute differences in wet and dry N deposition are shown in Figures 14 and 15. Wet N deposition from TDep was generally higher in areas of high precipitation ($p=0.07$) and more extensive coniferous land cover ($p=0.05$; Figure 16). Higher values of dry N deposition from TDep, relative to CMAQ, were somewhat associated with drier ecoregions ($p=0.02$) with less urban land cover ($p=0.05$; Figure 17).

Table 6. Level 1 ecoregion median absolute difference between TDep and CMAQ estimates of total, wet, and dry N deposition, representative of year 2011.

Level 1 Ecoregion Code	Level 1 Ecoregion Name	Median Absolute Difference (kg N/ha/yr)		
		Total N Deposition	Wet N Deposition	Dry N Deposition
5	Northern Forests	-0.11	0.00	0.02
6	Northwestern Forested Mountains	0.34	0.35	-0.02
7	Marine West Coast Forest	0.08	0.40	-0.40
8	Eastern Temperate Forests	-0.08	0.01	-0.11
9	Great Plains	0.19	0.10	0.04
10	North American Deserts	0.37	0.00	0.31
11	Mediterranean California	-0.31	-0.20	-0.16
12	Southern Semiarid Highlands	0.62	0.05	0.56
13	Temperate Sierras	0.95	0.21	0.72
15	Tropical Wet Forests	0.42	0.32	0.11

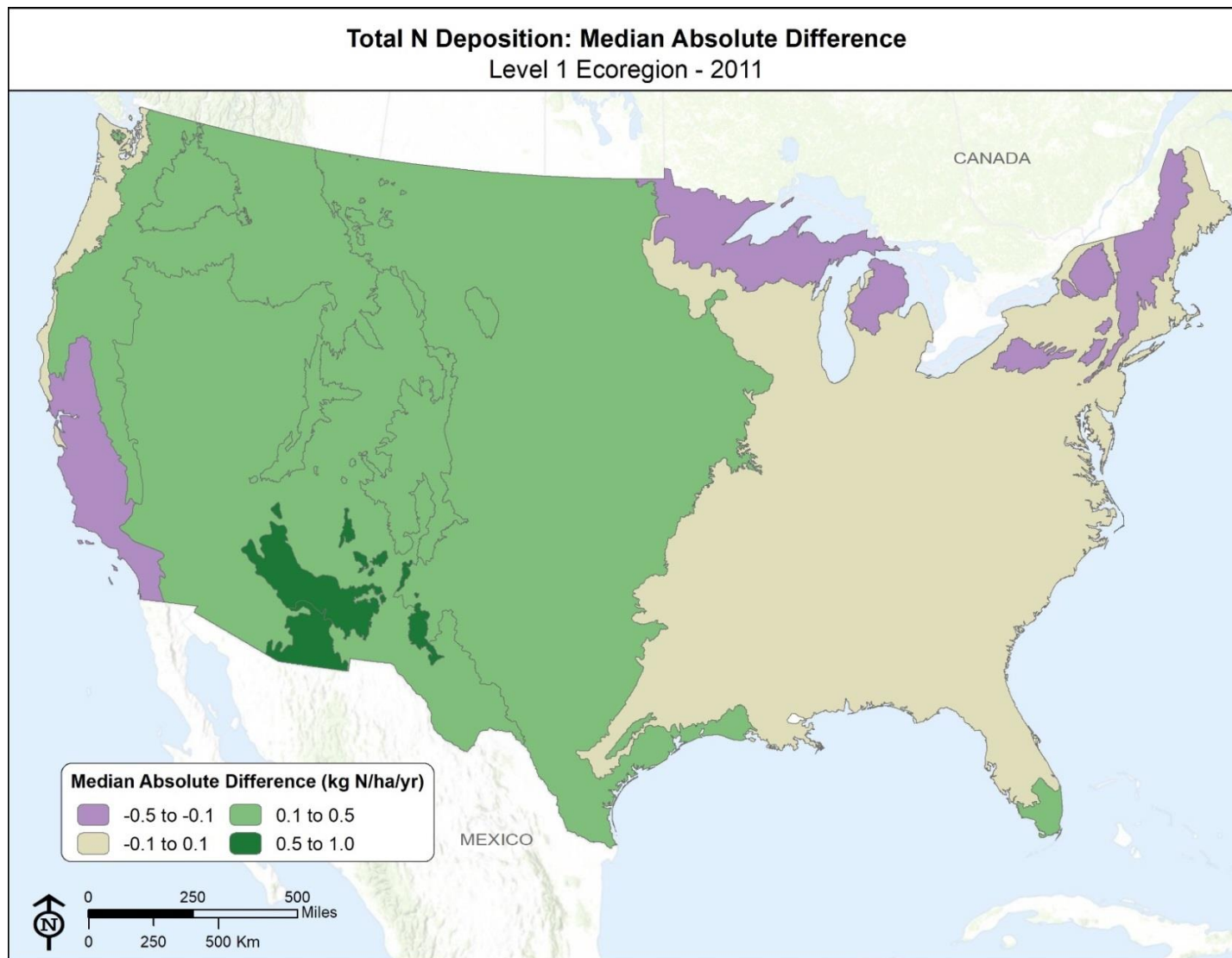


Figure 12. Level 1 ecoregion median absolute difference between TDep and CMAQ total N deposition representative of year 2011. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher. Tan color indicates that the two models are similar (i.e., within 0.1 kg N/ha/yr).

Table 7. Landscape characteristics for Level 1 ecoregions.

Level 1 Ecoregion Code	Level 1 Ecoregion Name	Mean Precip (mm)	Mean Terrain Roughness Index	Agricultural (%)	Urban (%)	Forest (%)	Coniferous (%)
5	Northern Forests	992	22195	5.7	4.0	57.7	10.0
6	Northwestern Forested Mountains	917	196519	2.1	1.4	54.4	49.8
7	Marine West Coast Forest	2037	114717	11.6	11.9	55.9	42.9
8	Eastern Temperate Forests	1154	12491	31.8	9.8	39.9	10.3
9	Great Plains	570	3418	37.7	4.0	4.8	1.5
10	North American Deserts	269	45808	5.7	1.8	6.6	6.2
11	Mediterranean California	546	74258	21.9	12.5	11.3	7.2
12	Southern Semiarid Highlands	335	58831	1.8	1.2	6.6	6.4
13	Temperate Sierras	415	73036	0.0	1.1	47.0	46.8
15	Tropical Wet Forests	1360	3	13.9	15.2	1.5	1.2

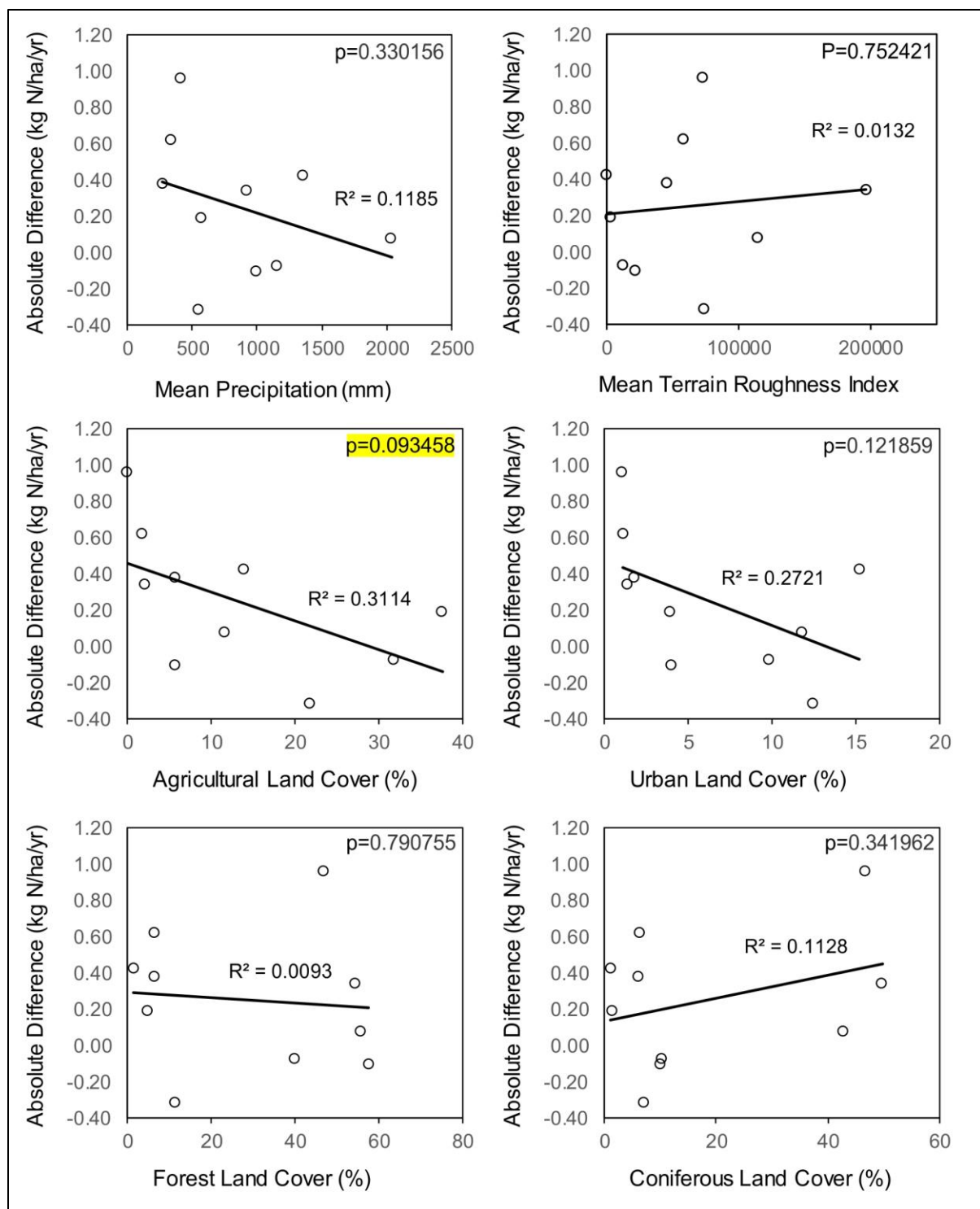


Figure 13. Relationships between the median absolute difference between TDep and CMAQ estimates of total N deposition representative of year 2011 and landscape characteristics for North American level 1 ecoregions. P-values less than 0.1 are highlighted yellow.

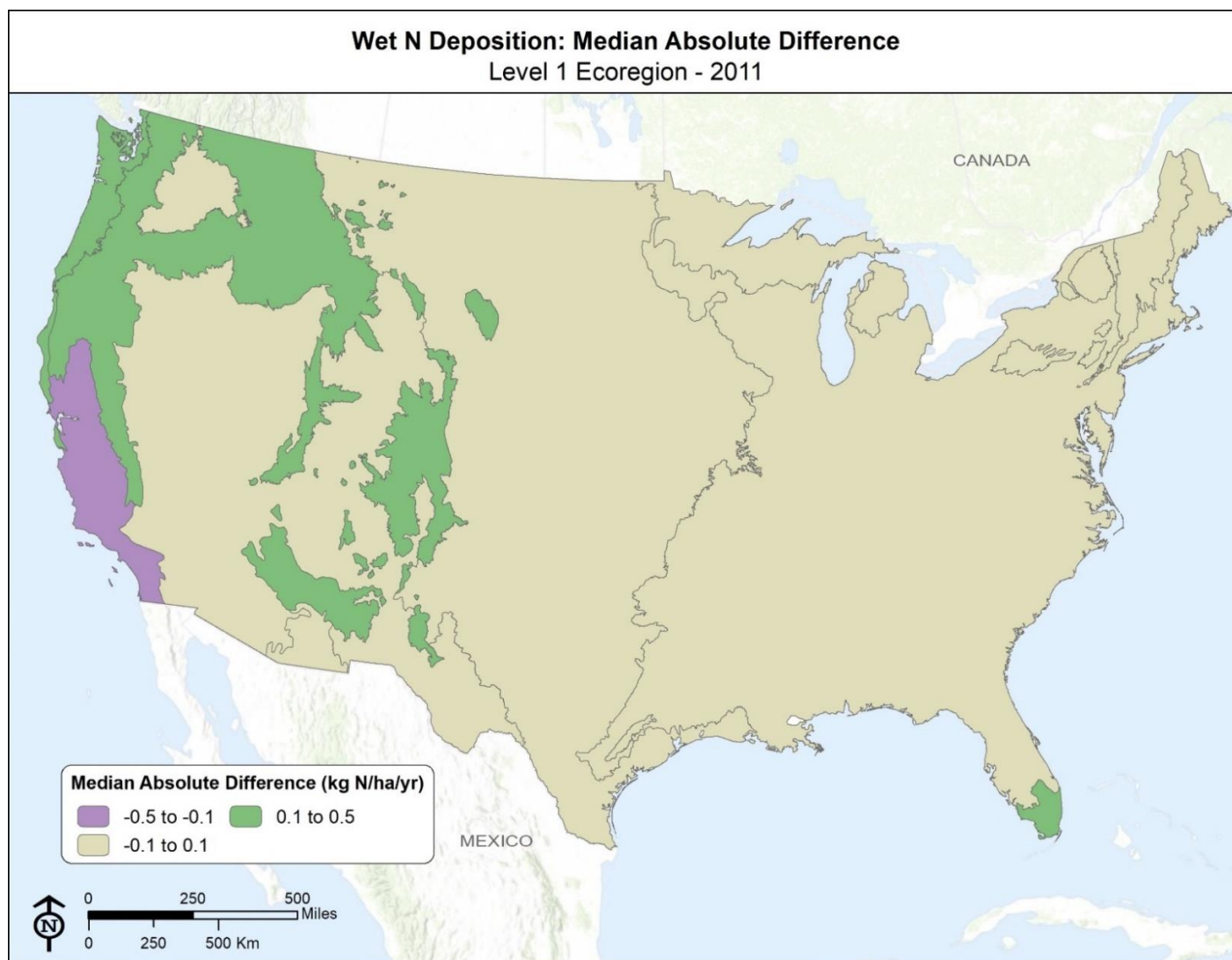


Figure 14. Level 1 ecoregion median absolute difference between TDep and CMAQ wet N deposition representative of year 2011. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher. Tan color indicates that the two models are similar (i.e., within 0.1 kg N/ha/yr).

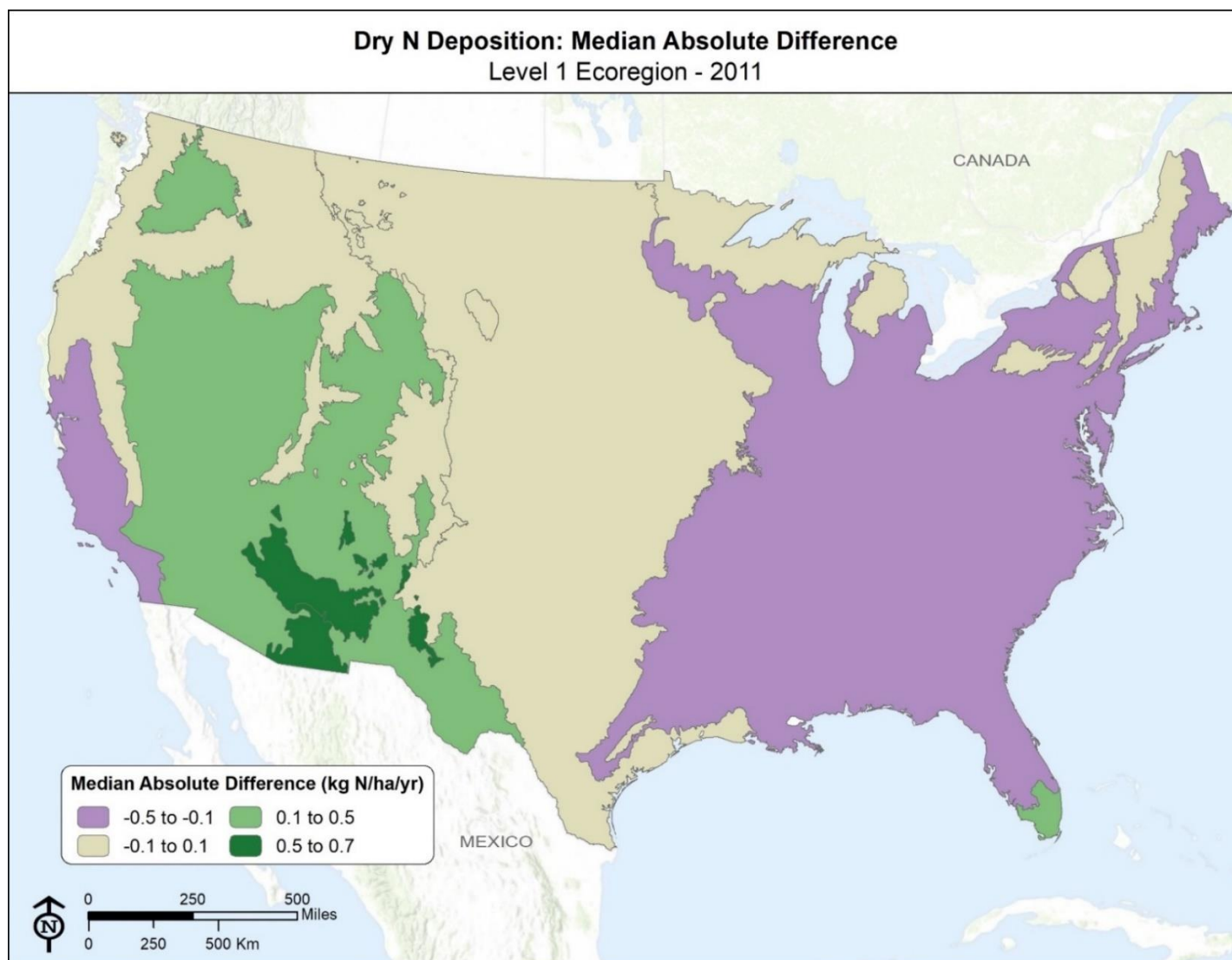


Figure 15. Level 1 ecoregion median absolute difference between TDep and CMAQ dry N deposition representative of year 2011. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher. Tan color indicates that the two models are similar (i.e., within 0.1 kg N/ha/yr).

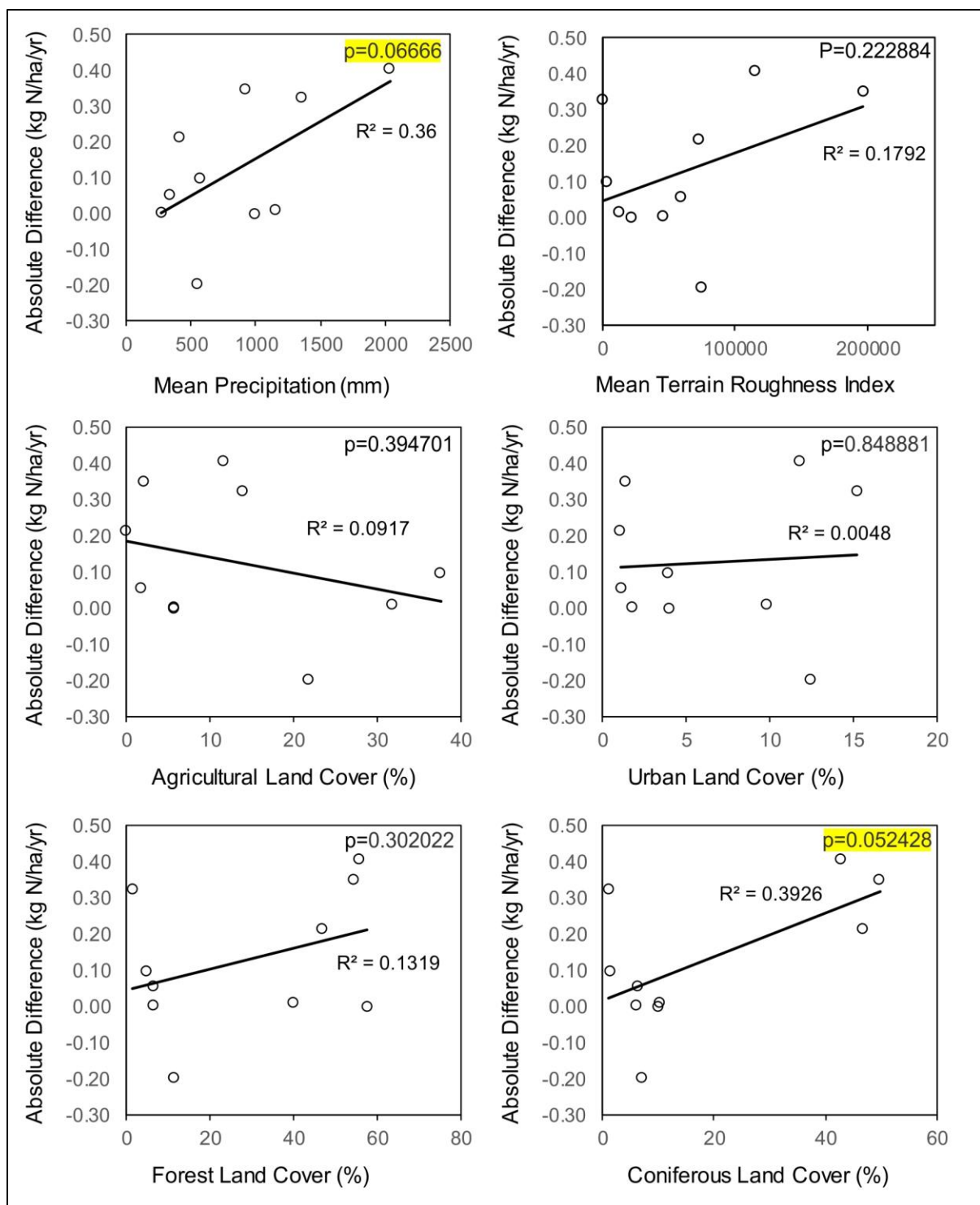


Figure 16. Relationships between the median absolute difference between TDep and CMAQ estimates of wet N deposition representative of year 2011 and landscape characteristics for North American level 1 ecoregions. P-values less than 0.1 are highlighted yellow.

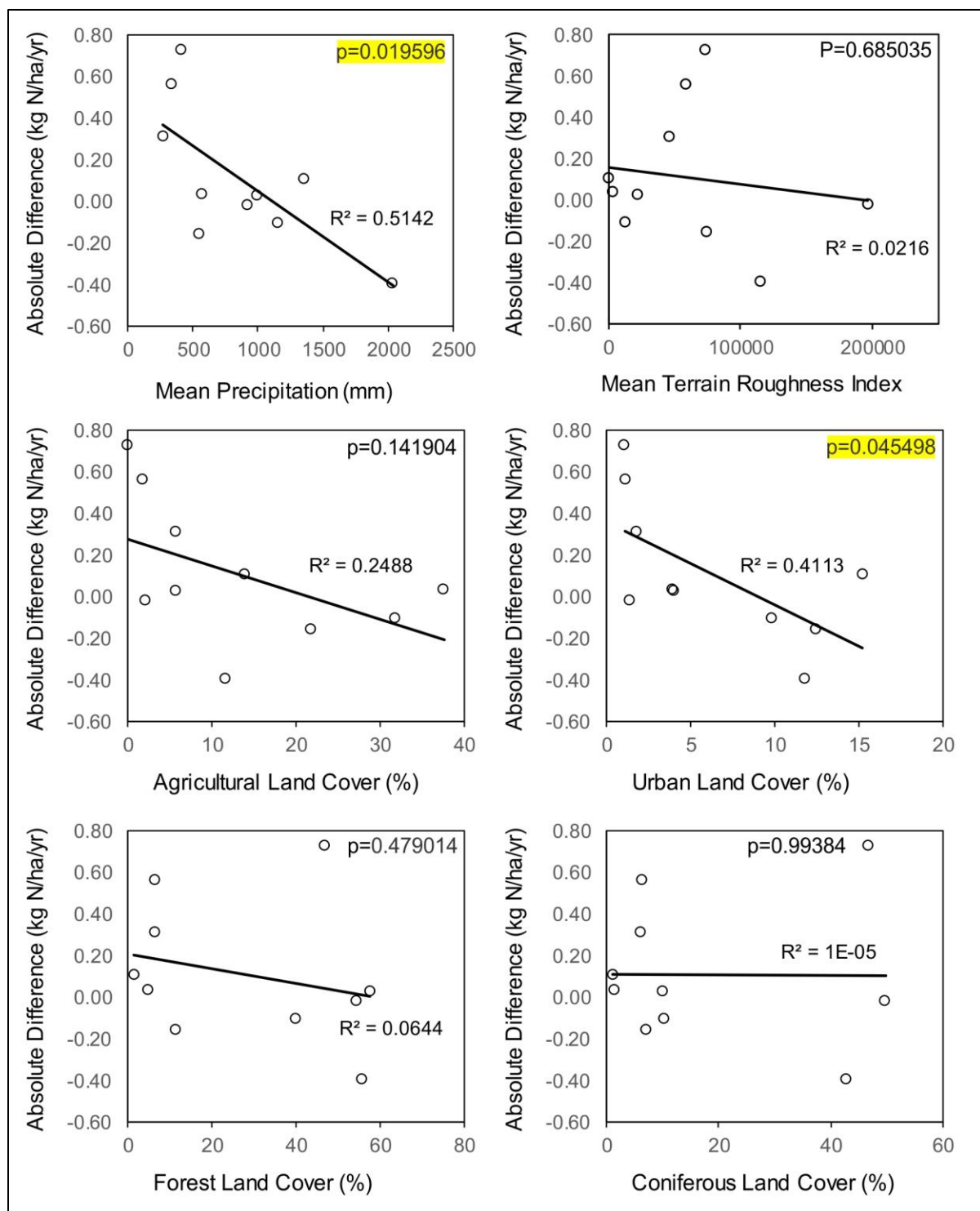


Figure 17. Relationships between the median absolute difference between TDep and CMAQ estimates of dry N deposition representative of year 2011 and landscape characteristics for North American level 1 ecoregions. P-values less than 0.1 are highlighted yellow.

Spatial patterns in median absolute difference in total, wet, and dry N deposition for level 3 ecoregions were more heterogeneous than those for level 1 ecoregions (Figures 18 through 20). Although more of the relationships between median absolute difference in total, wet, and dry N deposition and landscape characteristics were significant for level 3 ecoregions, none of these variables were able to explain more than about 25% of the variation in any of the difference metrics (Figures 21 through 23). TDep showed higher values of total N deposition in rougher terrain with lower agricultural and urban land cover and higher coniferous cover. These same relationships generally held for differences in wet N deposition. Higher values of dry N deposition from TDep were mostly associated with ecoregions characterized by lower precipitation and less agricultural and urban land cover. Although the significance levels and amount of variance explained differed between the level 1 and level 3 comparisons of absolute differences with landscape characteristics, the same general relationships were found regardless of the ecoregion resolution used as the basis for evaluation. Descriptive statistics for all level 3 ecoregions are included in Appendix A.

Although a nearly identical proportion of parks showed higher wet and dry N deposition from TDep as for CMAQ, total N deposition from TDep was higher than CMAQ for the majority (62%) of the I&M parks included in this study (Figure 24). Appendix B includes park-level summary statistics (minimum, mean, maximum) of the absolute difference in total, wet, and dry N deposition.

Park-Scale Critical Loads Exceedance

Lichen Species Richness

Portions of all National Park lands included in this study ($n = 10$) and the full extent of forest areas within six National Parks/Lakeshores (ACAD, GRSM, JOTR, ROMO, SBLE, and THRO) were either at or above the CL protective of lichen species richness regardless of which year or deposition model was used to calculate exceedance (Table 8). Based on total N deposition representative of 2011, Grand Teton and Yosemite National Parks showed nearly 25% and 75% more area above the CL, respectively, based on TDep as compared with CMAQ. Acadia NP showed almost 40% more area in exceedance based on CMAQ relative to TDep. Deposition levels above the CL are associated with increased deterioration of the lichen community, which increases the magnitude of impact to lichens and expands the area in decline.

If changes in the extent of area above the CL were observed between 2003 and 2011 for a given park, this extent almost always decreased between 2003 and 2011 regardless of which deposition model was used. However, there were a few instances of small ($< 4\%$) increases in area above the CL between 2003 and 2011. Spatial patterns in the extent of the CL exceedance protective of lichen species richness based on TDep and CMAQ total N deposition representative of 2003 and 2011 can be found for each park in Appendix C.

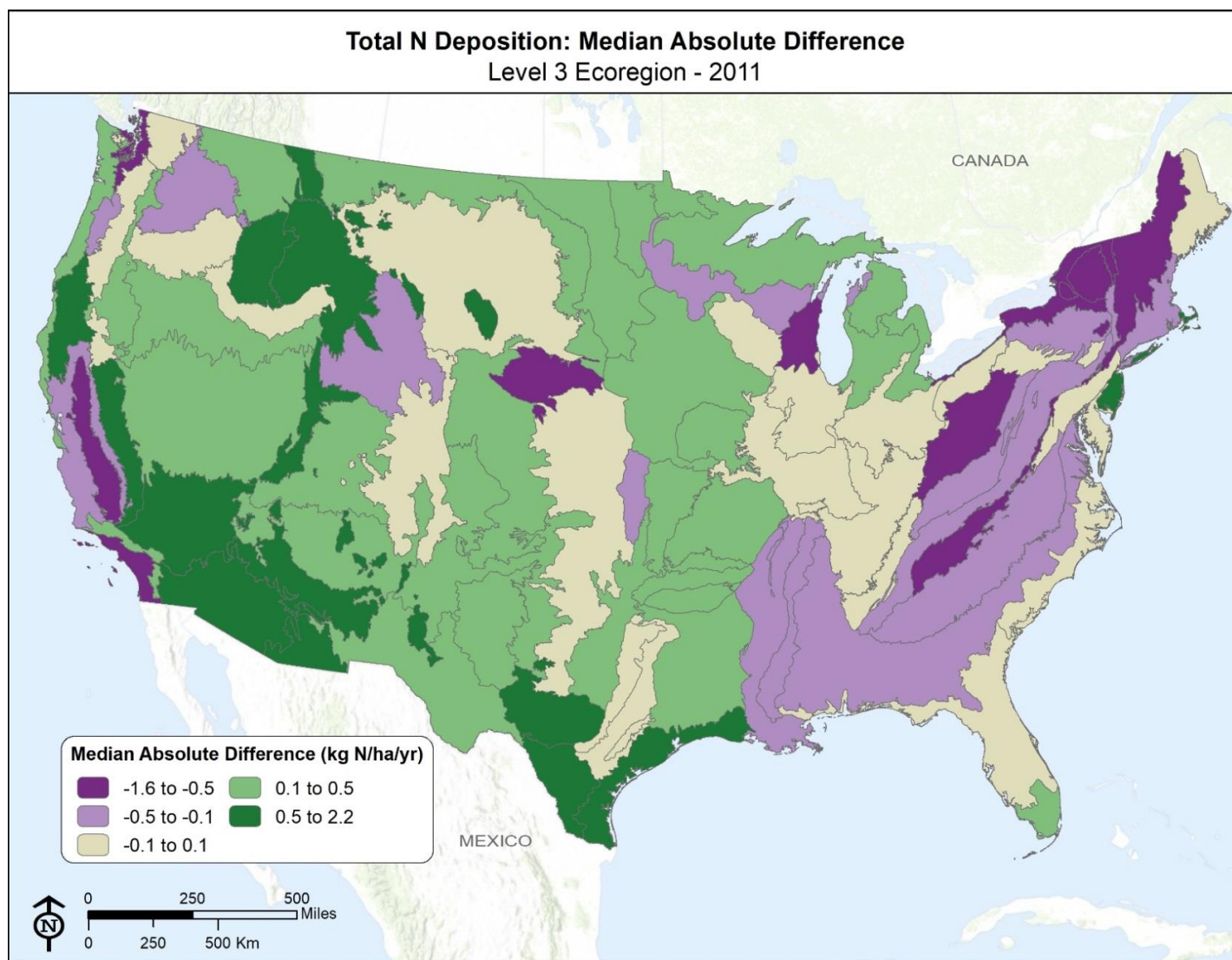


Figure 18. Level 3 ecoregion median absolute difference between TDep and CMAQ total N deposition representative of year 2011. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher. Tan color indicates that the two models are similar (i.e., within 0.1 kg N/ha/yr).

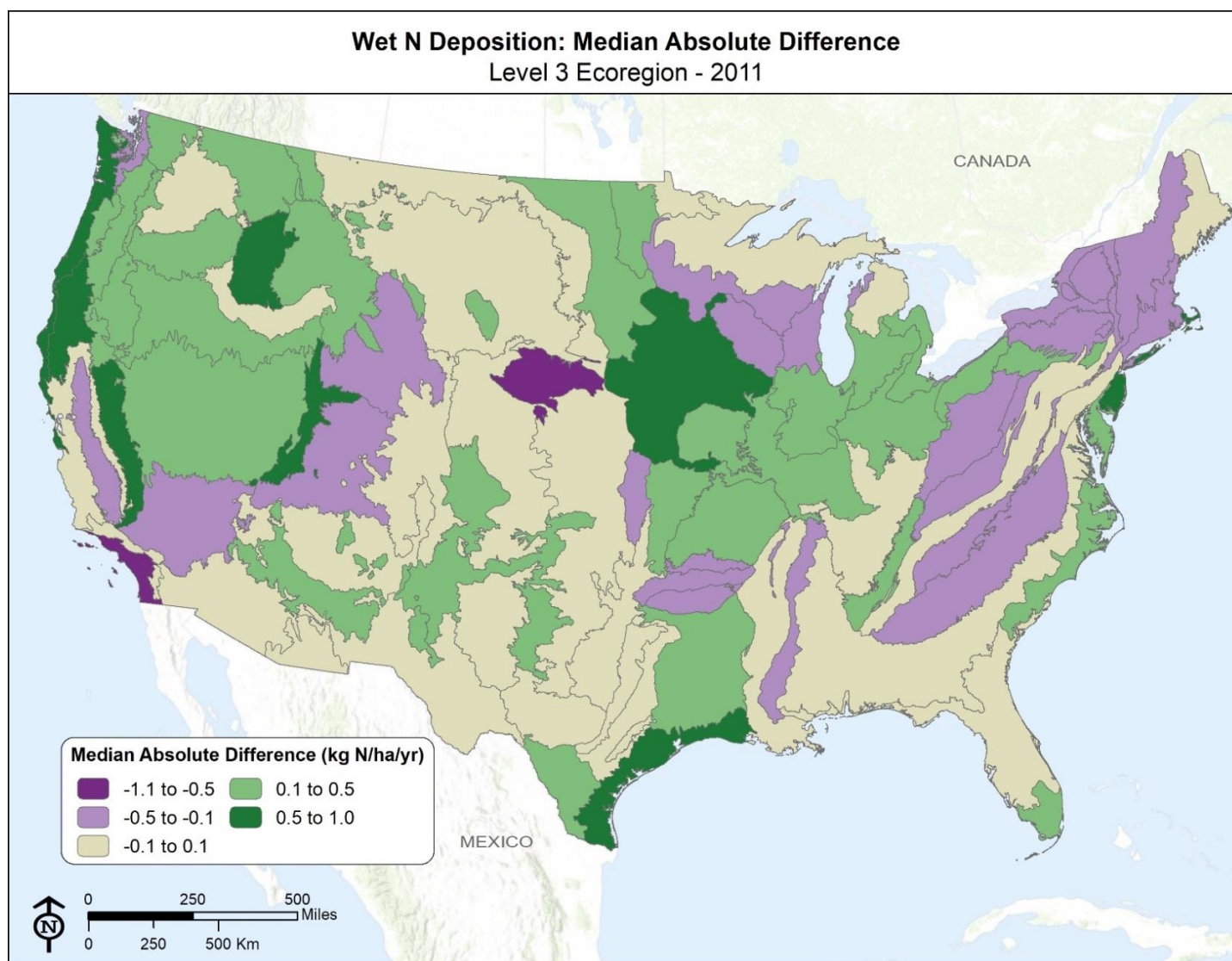


Figure 19. Level 3 ecoregion median absolute difference between TDep and CMAQ wet N deposition representative of year 2011. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher. Tan color indicates that the two models are similar (i.e., within 0.1 kg N/ha/yr).

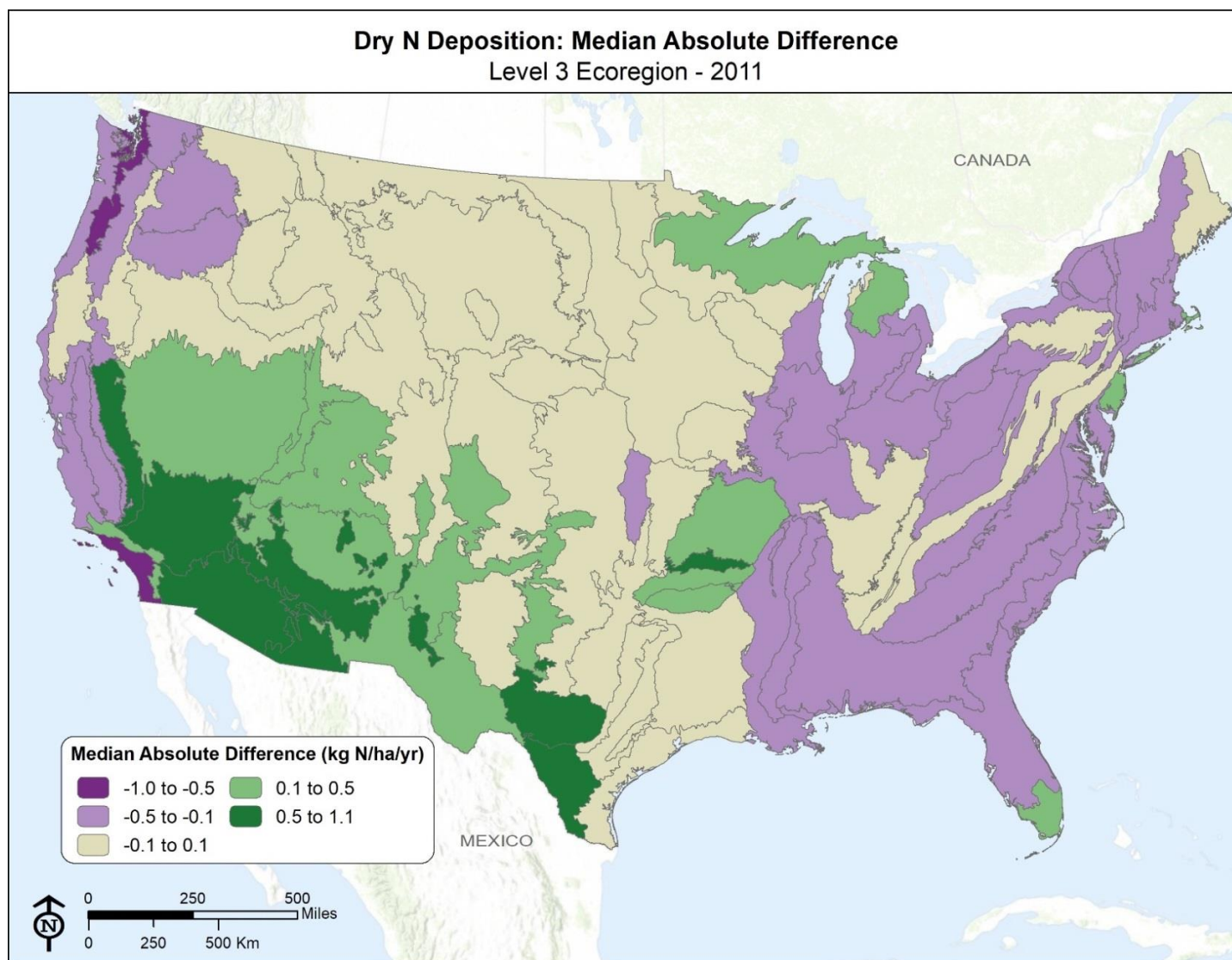


Figure 20. Level 3 ecoregion median absolute difference between TDep and CMAQ dry N deposition representative of year 2011. Green colors indicate that deposition estimates from TDep are higher and purple colors indicate that CMAQ estimates are higher. Tan color indicates that the two models are similar (i.e., within 0.1 kg N/ha/yr).

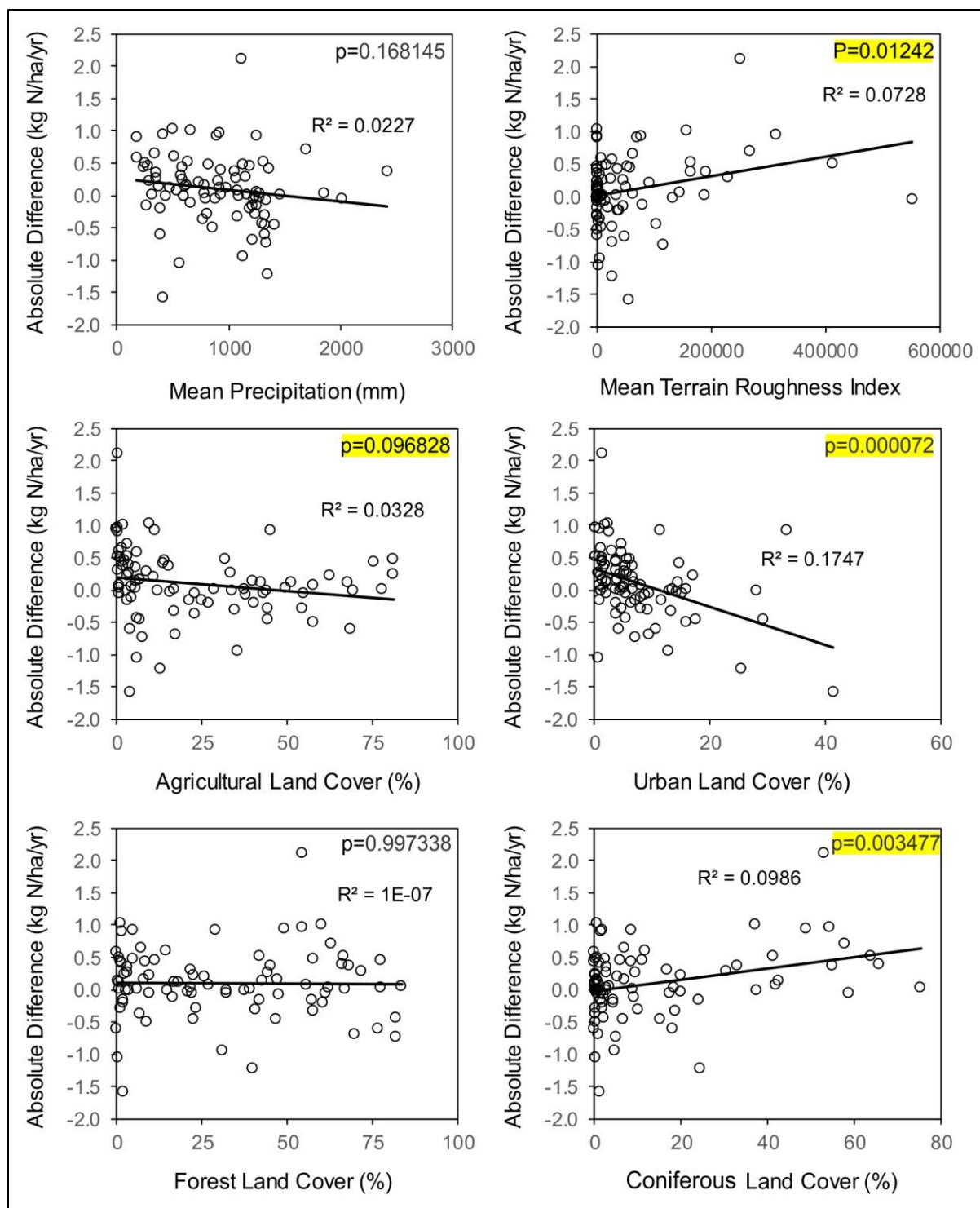


Figure 21. Relationships between the median absolute difference between TDep and CMAQ estimates of total N deposition representative of year 2011 and landscape characteristics for United States level 3 ecoregions. P-values less than 0.1 are highlighted yellow.

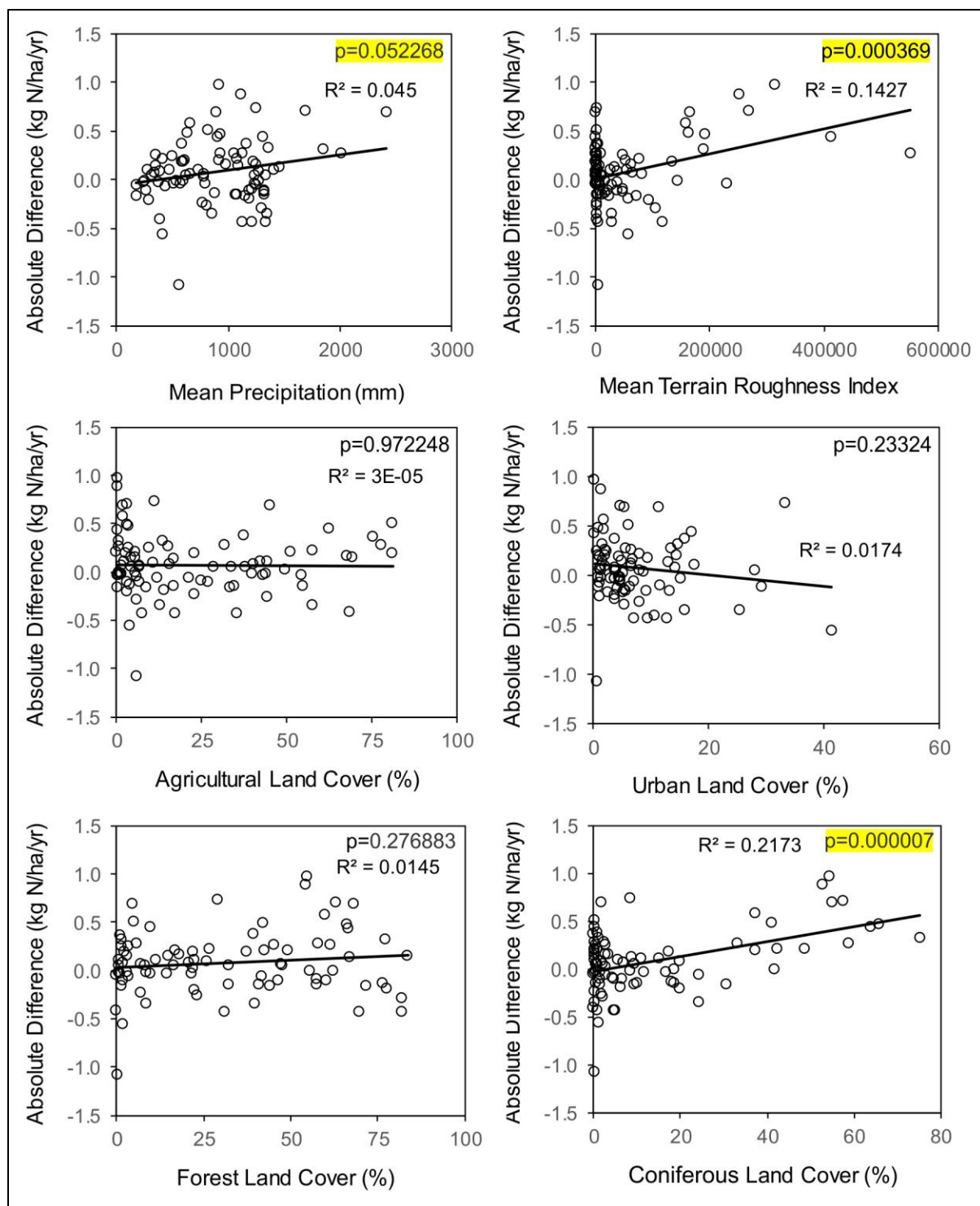


Figure 22. Relationships between the median absolute difference between TDep and CMAQ estimates of wet N deposition representative of year 2011 and landscape characteristics for United States level 3 ecoregions. P-values less than 0.1 are highlighted yellow.

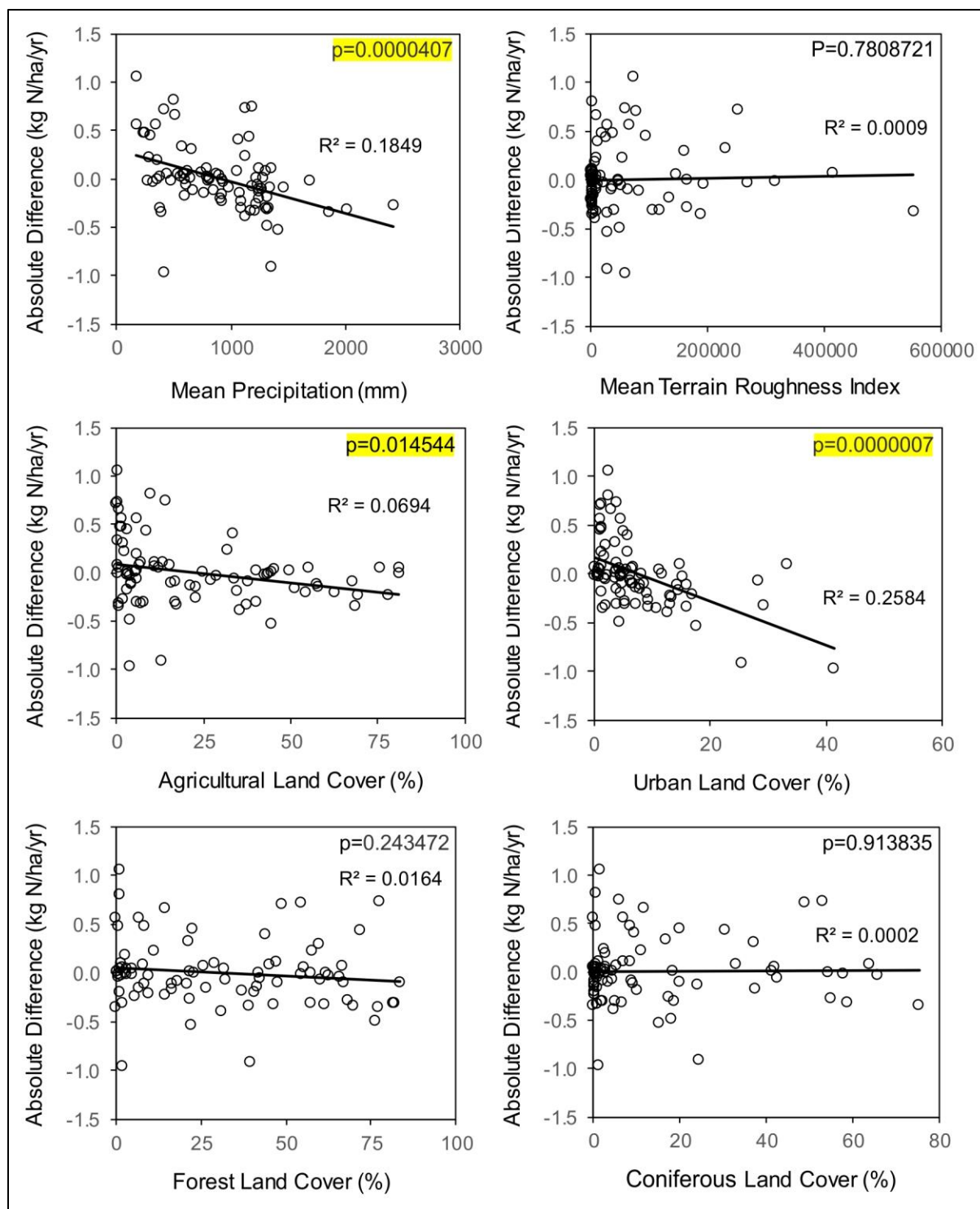


Figure 23. Relationships between the median absolute difference between TDep and CMAQ estimates of dry N deposition representative of year 2011 and landscape characteristics for United States level 3 ecoregions. P-values less than 0.1 are highlighted yellow.

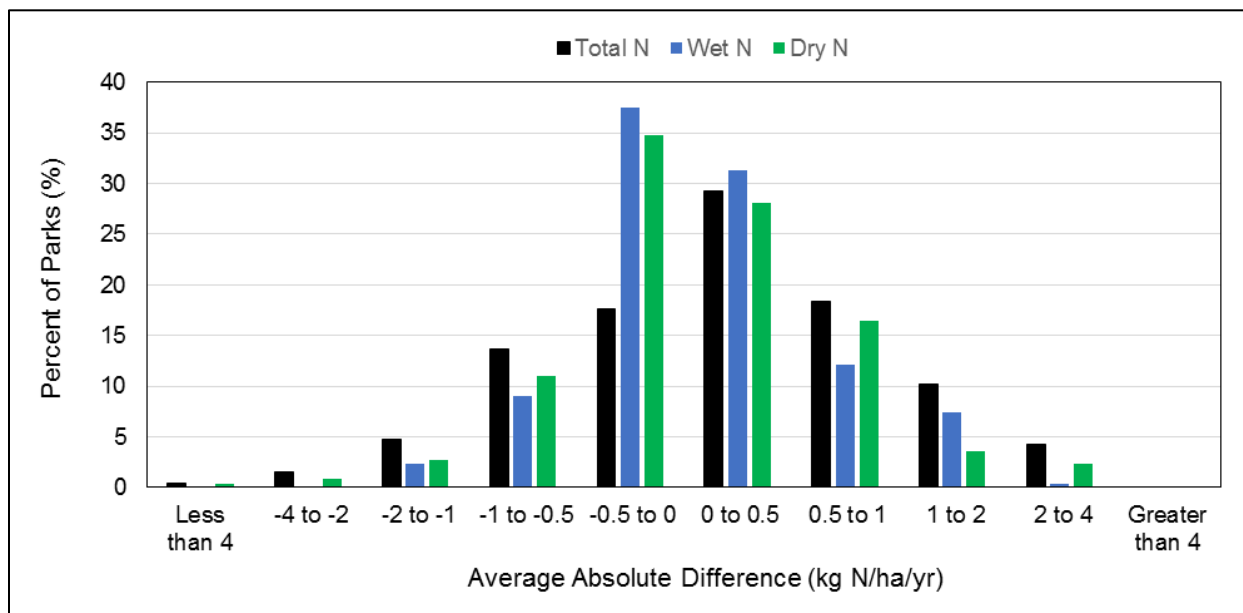


Figure 24. Percent of Inventory and Monitoring Parks included in this study (n = 256) within various categories of absolute difference between TDep and CMAQ estimates of total, wet, and dry N deposition representative of 2011.

Table 8. Percentage of forested park area below, at, or above (i.e., exceedance) the critical load (CL) protective of lichen species richness based on estimates of total N deposition from TDep and CMAQ representative of years 2003 and 2011. Values are based on the portion of the park for which deposition data were available. The difference in percent area above the CL based on the two deposition models (TDep – CMAQ) is included in the grey shaded column.

Year	Park	CMAQ			TDep			TDep - CMAQ
		Below CL	At CL	Above CL	Below CL	At CL	Above CL	Above CL
2003	ACAD	0.0	0.0	100.0	0.0	7.3	92.7	-7.3
	GLAC	2.7	55.7	41.7	6.2	25.7	68.0	26.4
	GRSM	0.0	0.0	100.0	0.0	0.0	100.0	0.0
	GRTE	8.4	54.0	37.6	0.2	35.5	64.3	26.7
	JOTR	0.0	0.0	100.0	0.0	0.0	100.0	0.0
	NOCA	88.6	11.4	0.0	29.0	68.4	2.5	2.5
	ROMO	0.0	0.4	99.6	0.0	0.0	100.0	0.4
	SLBE	0.0	0.0	100.0	0.0	0.0	100.0	0.0
	THRO	0.0	1.4	98.6	0.0	0.6	99.4	0.9
	YOSE	24.4	37.4	38.2	0.0	0.0	100.0	61.8
2011	ACAD	0.0	61.4	38.6	0.0	99.6	0.4	-38.3
	GLAC	14.5	55.0	30.6	30.2	40.4	29.4	-1.2
	GRSM	0.0	0.0	100.0	0.0	0.0	100.0	0.0
	GRTE	8.4	55.7	35.9	1.0	39.0	60.1	24.2
	JOTR	0.0	4.9	95.1	0.0	0.0	100.0	4.9
	NOCA	79.8	17.0	3.3	60.3	38.8	0.9	-2.4
	ROMO	0.0	16.7	83.3	0.0	12.0	88.0	4.7
	SLBE	0.0	0.0	100.0	0.0	0.0	100.0	0.0
	THRO	0.0	0.0	100.0	0.0	0.0	100.0	0.0
	YOSE	19.9	54.8	25.3	0.0	0.0	100.0	74.7

Herbaceous Species Richness

Three of the parks (Acadia, North Cascades, and Theodore Roosevelt) showed all areas below the CL for herbaceous species richness based on 2011 deposition data from both models (Table 9). Critical load exceedance based on CMAQ data representative of 2003 within Sleeping Bears Dunes NL showed 9% more area either at or above the CL relative to using TDep. Although Grand Teton NP showed all areas below the herbaceous CL based on CMAQ in 2011, the TDep model showed small

portions to be either at the CL (1.8%) or above the CL (1.1%). Higher values of total N deposition representative of 2003, relative to 2011, led to greater extents of area in exceedance, particularly for Great Smoky Mountains NP. Spatial patterns in the extent of the CL protective of herbaceous species richness based on TDep and CMAQ total N deposition representative of 2003 and 2011 can be found for each park in Appendix D.

Table 9. Percentage of park area below, at, or above (i.e., exceedance) the critical load (CL) protective of herbaceous species richness based on estimates of total N deposition from TDep and CMAQ representative of years 2003 and 2011. Values are based on the portion of the park for which CL and deposition data were available.

Year	Park	CMAQ			TDep		
		Below CL	At CL	Above CL	Below CL	At CL	Above CL
2003	ACAD	100.0	0.0	0.0	100.0	0.0	0.0
	GRSM	17.2	27.9	54.8	24.9	22.5	52.6
	GRTE	100.0	0.0	0.0	97.9	1.0	1.1
	NOCA	100.0	0.0	0.0	100.0	0.0	0.0
	SLBE	87.8	6.9	5.3	96.6	0.2	3.1
	THRO	100.0	0.0	0.0	100.0	0.0	0.0
2011	ACAD	100.0	0.0	0.0	100.0	0.0	0.0
	GRSM	99.2	0.5	0.3	99.4	0.4	0.3
	GRTE	100.0	0.0	0.0	97.1	1.8	1.1
	NOCA	100.0	0.0	0.0	100.0	0.0	0.0
	SLBE	95.4	2.7	1.9	96.9	3.0	0.1
	THRO	100.0	0.0	0.0	100.0	0.0	0.0

Tree Growth and Survival

Exceedance of CLs protective against reductions in tree growth associated with total N deposition generally showed the same patterns based on deposition data between 2003 and 2011 (Tables 10 and 11). An exception to this was for Eastern hemlock in Acadia NP which showed reductions in growth of 2 – 10% for Eastern hemlock based TDep data from 2003 compared to <1% growth reductions in 2011. Also, exceedance of the CL to protect against any reduction in growth (i.e., more than 0% growth reduction) of quaking aspen in Sleeping Bear Dunes NL occurred in 2003, but not in 2011. Although this pattern was observed for both deposition models, CMAQ showed a greater extent of exceedance in 2003 (36%) relative to TDep (3%). The only meaningful difference between the expression of tree growth CL exceedance based on TDep relative to CMAQ in 2011 was for Eastern hemlock in Acadia NP, with TDep showing total N deposition reflective of <1% reductions in growth and CMAQ indicative of 2 to >10% growth reductions.

Table 10. Percent of park area in which a given tree species is expected to occur within various classes of growth reductions. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2003.

Park Name	Tree Species	Model	Growth Reduction Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
Acadia	Eastern Hemlock	CMAQ	0.0	0.0	0.0	0.0	72.1	27.9
	Eastern Hemlock	TDep	0.0	0.0	0.0	76.5	23.5	0.0
	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Glacier	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
	Western Hemlock	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Western Hemlock	TDep	96.7	2.7	0.6	0.0	0.0	0.0
Grand Teton	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Great Smoky Mountains	Eastern Hemlock	CMAQ	0.0	0.0	0.0	0.0	0.0	100.0
	Eastern Hemlock	TDep	0.0	0.0	0.0	0.0	0.0	100.0
	Yellow Birch	CMAQ	0.0	0.0	0.0	0.0	20.3	79.7
	Yellow Birch	TDep	0.0	0.0	0.0	0.0	15.1	84.9
North Cascades	Western Hemlock	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Western Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Rocky Mountain	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0

Table 10 (continued). Percent of park area in which a given tree species is expected to occur within various classes of growth reductions. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2003.

Park Name	Tree Species	Model	Growth Reduction Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
Sleeping Bear Dunes	Eastern Hemlock	CMAQ	0.0	0.0	0.0	0.0	0.0	100.0
	Eastern Hemlock	TDep	0.0	0.0	0.0	0.0	0.0	100.0
	Quaking Aspen	CMAQ	64.4	35.6	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	96.6	3.4	0.0	0.0	0.0	0.0
Yosemite	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0

Table 11. Percent of park area in which a given tree species is expected to occur within various classes of growth reductions. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2011.

Park Name	Tree Species	Model	Growth Reduction Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
Acadia	Eastern Hemlock	CMAQ	0.0	0.0	0.0	72.1	12.4	15.5
	Eastern Hemlock	TDep	0.0	100.0	0.0	0.0	0.0	0.0
	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Glacier	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
	Western Hemlock	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Western Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0

Table 11 (continued). Percent of park area in which a given tree species is expected to occur within various classes of growth reductions. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2011.

Park Name	Tree Species	Model	Growth Reduction Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
Grand Teton	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Great Smoky Mountains	Eastern Hemlock	CMAQ	0.0	0.0	0.0	0.0	0.0	100.0
	Eastern Hemlock	TDep	0.0	0.0	0.0	0.0	0.0	100.0
	Yellow Birch	CMAQ	0.0	0.0	0.0	0.0	100.0	0.0
	Yellow Birch	TDep	0.0	0.0	0.0	0.0	100.0	0.0
North Cascades	Western Hemlock	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Western Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Rocky Mountain	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Sleeping Bear Dunes	Eastern Hemlock	CMAQ	0.0	0.0	0.0	0.0	0.0	100.0
	Eastern Hemlock	TDep	0.0	0.0	0.0	0.0	1.0	99.0
	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Yosemite	Quaking Aspen	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0

Exceedance of CLs protective of reductions in probability of tree survival occurred more often than for reductions in growth based on 2003 and 2011 total N deposition from both models (Tables 12 and 13). Expected effects on probability of survival almost always decreased between 2003 and 2011 according to total N deposition estimates from both models. One exception to this was for quaking aspen in Grand Teton NP. Here, TDep showed nearly a 5% increase in CL exceedance beyond the 0% reduction in probability threshold, whereas CMAQ showed almost a 7% decrease in exceedance of the same threshold. In 2011, for species in parks where CL exceedance was observed (n = 8; all except Theodore Roosevelt NP), TDep indicated greater effects on probability of survival for four parks (Grand Teton, Great Smoky Mountains, North Cascades, and Yosemite NPs) and CMAQ indicated greater effects for the other four (Acadia, Glacier, and Rocky Mountain NPs; and Sleeping Bear Dunes NL).

Table 12. Percent of park area in which a given tree species is expected to occur within various classes of reductions in probability of survival. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2003.

Park Name	Tree Species	Model	Reduction in Probability of Survival Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
Acadia	Eastern Hemlock	CMAQ	0.0	84.5	15.5	0.0	0.0	0.0
	Eastern Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	CMAQ	0.0	70.6	16.4	13.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Glacier	Douglas-Fir	CMAQ	0.0	29.8	60.6	9.6	0.0	0.0
	Douglas-Fir	TDep	0.0	29.1	28.9	41.3	0.7	0.0
	Quaking Aspen	CMAQ	68.7	31.3	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	34.4	60.7	4.6	0.3	0.0	0.0
Grand Teton	Douglas-Fir	CMAQ	0.0	38.7	61.0	0.3	0.0	0.0
	Douglas-Fir	TDep	0.0	32.9	33.7	32.2	1.2	0.0
	Quaking Aspen	CMAQ	92.1	7.9	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	67.2	29.0	3.2	0.6	0.0	0.0
Great Smoky Mountains	American Elm	CMAQ	0.0	0.0	0.0	0.0	100.0	0.0
	American Elm	TDep	0.0	0.0	0.0	0.0	100.0	0.0
	Eastern Hemlock	CMAQ	0.0	0.0	7.1	64.0	29.0	0.0
	Eastern Hemlock	TDep	0.0	0.3	3.5	72.8	23.4	0.0

Table 12 (continued). Percent of park area in which a given tree species is expected to occur within various classes of reductions in probability of survival. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2003.

Park Name	Tree Species	Model	Reduction in Probability of Survival Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
North Cascades	Douglas-Fir	CMAQ	14.1	83.0	2.9	0.0	0.0	0.0
	Douglas-Fir	TDep	0.0	75.8	24.2	0.0	0.0	0.0
	Mountain Hemlock	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Mountain Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Rocky Mountain	Douglas-Fir	CMAQ	0.0	0.0	29.9	70.1	0.0	0.0
	Douglas-Fir	TDep	0.0	0.0	7.9	90.1	2.0	0.0
	Quaking Aspen	CMAQ	0.6	99.4	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	1.1	76.1	21.0	1.8	0.0	0.0
Sleeping Bear Dunes	Eastern Hemlock	CMAQ	0.0	25.4	35.5	39.1	0.0	0.0
	Eastern Hemlock	TDep	0.0	75.0	0.8	24.2	0.0	0.0
	Quaking Aspen	CMAQ	0.0	0.0	15.6	49.3	35.1	0.0
	Quaking Aspen	TDep	0.0	0.0	74.9	22.9	2.2	0.0
Theodore Roosevelt	Green Ash	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Green Ash	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Yosemite	Douglas-Fir	CMAQ	0.0	23.2	55.6	21.3	0.0	0.0
	Douglas-Fir	TDep	0.0	0.0	0.0	100.0	0.0	0.0
	Quaking Aspen	CMAQ	88.7	11.3	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	0.0	99.9	0.1	0.0	0.0	0.0

Table 13. Percent of park area in which a given tree species is expected to occur within various classes of reductions in probability of survival. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2011.

Park Name	Tree Species	Model	Reduction in Probability of Survival Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
Acadia	Eastern Hemlock	CMAQ	72.1	27.9	0.0	0.0	0.0	0.0
	Eastern Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0
	Quaking Aspen	CMAQ	70.6	29.4	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Glacier	Douglas-Fir	CMAQ	0.0	41.5	53.1	5.5	0.0	0.0
	Douglas-Fir	TDep	0.9	57.9	35.3	6.0	0.0	0.0
	Quaking Aspen	CMAQ	82.1	17.9	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	85.2	14.8	0.0	0.0	0.0	0.0
Grand Teton	Douglas-Fir	CMAQ	0.0	26.2	71.7	2.2	0.0	0.0
	Douglas-Fir	TDep	0.0	40.5	26.1	31.5	1.9	0.0
	Quaking Aspen	CMAQ	85.3	14.7	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	71.9	24.7	2.9	0.6	0.0	0.0
Great Smoky Mountains	American Elm	CMAQ	0.0	0.0	0.0	3.5	96.5	0.0
	American Elm	TDep	0.0	0.0	0.0	1.0	99.0	0.0
	Eastern Hemlock	CMAQ	0.0	13.4	31.0	55.6	0.0	0.0
	Eastern Hemlock	TDep	0.0	9.7	31.2	59.1	0.0	0.0

Table 13 (continued). Percent of park area in which a given tree species is expected to occur within various classes of reductions in probability of survival. Results are shown based on TDep and CMAQ estimates of total N deposition representative of 2011.

Park Name	Tree Species	Model	Reduction in Probability of Survival Category (%)					
			0	< 1	1 - 2	2 - 5	5 - 10	> 10
North Cascades	Douglas-Fir	CMAQ	15.6	81.4	2.9	0.0	0.0	0.0
	Douglas-Fir	TDep	0.0	83.2	16.8	0.0	0.0	0.0
	Mountain Hemlock	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Mountain Hemlock	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Rocky Mountain	Douglas-Fir	CMAQ	0.0	1.2	33.6	65.2	0.0	0.0
	Douglas-Fir	TDep	0.0	6.3	47.2	46.5	0.0	0.0
	Quaking Aspen	CMAQ	20.0	80.0	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	21.7	78.3	0.0	0.0	0.0	0.0
Sleeping Bear Dunes	Eastern Hemlock	CMAQ	0.0	63.0	21.0	16.0	0.0	0.0
	Eastern Hemlock	TDep	0.0	75.8	24.2	0.0	0.0	0.0
	Quaking Aspen	CMAQ	0.0	63.2	1.3	35.6	0.0	0.0
	Quaking Aspen	TDep	0.0	74.9	0.4	24.7	0.0	0.0
Theodore Roosevelt	Green Ash	CMAQ	100.0	0.0	0.0	0.0	0.0	0.0
	Green Ash	TDep	100.0	0.0	0.0	0.0	0.0	0.0
Yosemite	Douglas-Fir	CMAQ	0.0	25.0	72.8	2.2	0.0	0.0
	Douglas-Fir	TDep	0.0	0.0	0.0	100.0	0.0	0.0
	Quaking Aspen	CMAQ	98.9	1.1	0.0	0.0	0.0	0.0
	Quaking Aspen	TDep	0.0	99.7	0.3	0.0	0.0	0.0

Conclusions

At the national scale, the estimates of total N deposition from TDep were generally higher than those from CMAQ, and agreement between TDep and CMAQ was better in 2011 than 2003. TDep estimates tended to be higher in mountainous areas near the west coast, whereas eastern mountain regions generally showed higher values from CMAQ. Locations where total N deposition estimated by CMAQ was higher than TDep by the largest magnitudes were mostly located near densely populated urban areas. Ecoregion-scale differences in total N deposition were mostly explained by variations in urban land cover, providing further evidence of the association between higher values of CMAQ and proximity to urban areas. Higher values of wet N deposition from TDep, relative to CMAQ, were generally associated with areas of greater precipitation, terrain roughness, and coniferous land cover across ecoregions. Higher values of dry N deposition from TDep were related to ecoregions with lower precipitation and less agricultural and urban land cover.

Exceedance of CLs protective of lichen species richness, herbaceous species richness, tree growth, and/or probability of tree survival occurred within all of the National Park lands included in this study, regardless of the model (TDep, CMAQ) or year (2003, 2011) of deposition used to determine exceedance. However, the magnitude and spatial extent of exceedance were dependent at many locations on the source of deposition data. This highlights the importance of accurately modeling deposition to make informed management decisions. When local data are not available for comparison, the areas in exceedance based on both models may be prioritized for active management.

For the year 2011, Grand Teton and Yosemite National Parks showed substantially more areas in exceedance of lichen CLs based on TDep as compared with CMAQ. Acadia NP showed greater area in exceedance based on CMAQ relative to TDep. Relatively minor differences in the spatial patterns of exceedance of CLs protective of herbaceous species richness were observed between the two deposition models. Few substantial differences in the magnitude or extent of exceedance between TDep and CMAQ occurred for the CLs protective of tree growth. TDep indicated greater effects on probability of tree survival for Grand Teton, Great Smoky Mountains, North Cascades, and Yosemite NPs and CMAQ indicated greater effects on probability of tree survival for Acadia, Glacier, and Rocky Mountain NPs and Sleeping Bear Dunes NL.

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Appendix A - Level 3 Ecoregion Deposition Difference Summaries

Table A-1. Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of total N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Total N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
1	Coast Range	0.0	1.7	19.7	60.0	18.3	0.3
2	Puget Lowland	2.4	63.2	29.6	4.1	0.3	0.3
3	Willamette Valley	0.0	23.9	57.7	17.8	0.6	0.0
4	Cascades	0.0	13.4	34.9	47.5	4.2	0.0
5	Sierra Nevada	0.0	0.5	3.8	17.2	73.3	5.3
6	Central California Foothills and Coastal Mountains	0.5	15.9	39.3	31.8	12.3	0.2
7	Central California Valley	1.4	31.6	44.5	18.0	4.5	0.1
8	Southern California Mountains	4.4	18.4	19.6	30.2	27.3	0.1
9	Eastern Cascades Slopes and Foothills	0.0	0.2	29.1	70.3	0.4	0.0
10	Columbia Plateau	0.0	0.4	72.5	27.1	0.1	0.0
11	Blue Mountains	0.0	0.0	52.4	45.7	1.9	0.0
12	Snake River Plain	0.0	0.9	45.4	50.8	2.8	0.1
13	Central Basin and Range	0.0	0.3	6.5	76.8	16.3	0.0
14	Mojave Basin and Range	0.0	0.7	5.6	49.9	43.9	0.0
15	Northern Rockies	0.0	0.5	18.9	56.7	23.9	0.0
16	Idaho Batholith	0.0	0.2	7.3	44.6	48.0	0.0

Table A-1 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of total N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Total N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
17	Middle Rockies	0.0	0.2	21.9	51.9	25.9	0.1
18	Wyoming Basin	0.0	1.0	68.2	30.3	0.6	0.0
19	Wasatch and Uinta Mountains	0.0	0.3	10.9	37.9	49.7	1.1
20	Colorado Plateaus	0.0	1.5	28.0	62.9	7.6	0.0
21	Southern Rockies	0.0	4.1	41.2	44.9	9.8	0.0
22	Arizona/New Mexico Plateau	0.0	0.0	12.7	69.6	17.6	0.0
23	Arizona/New Mexico Mountains	0.0	0.0	1.5	51.7	46.8	0.0
24	Chihuahuan Deserts	0.0	0.5	3.0	93.8	2.7	0.0
25	High Plains	0.0	10.8	31.3	47.7	10.2	0.0
26	Southwestern Tablelands	0.0	0.7	21.6	67.3	10.4	0.0
27	Central Great Plains	0.0	6.4	43.7	45.9	3.9	0.0
28	Flint Hills	0.0	1.2	84.3	14.6	0.0	0.0
29	Cross Timbers	0.0	1.2	28.0	68.6	2.2	0.0
30	Edwards Plateau	0.0	0.3	6.9	85.3	7.4	0.0
31	Southern Texas Plains	0.0	0.0	0.1	44.6	55.4	0.0
32	Texas Blackland Prairies	0.0	0.8	55.1	38.6	5.5	0.0
33	East Central Texas Plains	0.0	0.7	46.3	45.3	7.7	0.0
34	Western Gulf Coastal Plain	0.0	1.1	18.9	32.6	47.0	0.3

Table A-1 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of total N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Total N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
35	South Central Plains	0.0	0.5	23.1	66.1	10.2	0.1
36	Ouachita Mountains	0.0	0.5	25.4	68.1	6.0	0.0
37	Arkansas Valley	0.0	1.8	26.0	63.4	8.9	0.0
38	Boston Mountains	0.0	0.7	16.4	74.6	8.2	0.0
39	Ozark Highlands	0.0	1.9	15.9	65.2	17.0	0.0
40	Central Irregular Plains	0.0	1.7	40.4	55.1	2.8	0.0
41	Canadian Rockies	0.0	3.4	19.1	51.4	26.0	0.0
42	Northwestern Glaciated Plains	0.0	0.5	36.1	62.5	0.9	0.0
43	Northwestern Great Plains	0.1	2.7	47.3	49.9	0.1	0.0
44	Nebraska Sand Hills	0.0	55.4	37.4	7.1	0.1	0.0
45	Piedmont	0.0	19.4	47.7	25.7	7.2	0.0
46	Northern Glaciated Plains	0.0	0.0	16.3	61.9	21.8	0.0
47	Western Corn Belt Plains	0.0	0.3	17.9	60.9	20.9	0.0
48	Lake Agassiz Plain	0.0	0.1	9.6	89.0	1.2	0.0
49	Northern Minnesota Wetlands	0.0	0.0	25.6	74.2	0.2	0.0
50	Northern Lakes and Forests	0.0	1.2	39.8	49.2	9.8	0.0
51	North Central Hardwood Forests	0.1	6.0	56.9	33.7	3.2	0.0
52	Driftless Area	0.0	4.3	49.5	40.4	5.8	0.0

Table A-1 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of total N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Total N: Absolute Difference Category					
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	Greater than 4 kg N/ha/y
53	Southeastern Wisconsin Till Plains	0.4	12.3	75.5	9.0	2.5	0.2
54	Central Corn Belt Plains	0.2	1.5	47.6	46.0	4.5	0.2
55	Eastern Corn Belt Plains	0.1	1.6	49.6	46.8	1.8	0.1
56	Southern Michigan/Northern Indiana Drift Plains	0.0	5.3	37.5	53.0	4.2	0.1
57	Huron/Erie Lake Plains	0.0	3.2	31.8	53.6	10.8	0.6
58	Northeastern Highlands	0.0	25.4	63.0	11.2	0.4	0.0
59	Northeastern Coastal Zone	0.7	22.4	52.4	19.5	3.7	1.4
60	Northern Allegheny Plateau	0.0	3.5	61.3	34.9	0.4	0.0
61	Erie Drift Plain	0.0	5.9	43.0	42.6	8.5	0.0
62	North Central Appalachians	0.0	0.8	46.0	41.2	12.0	0.0
63	Middle Atlantic Coastal Plain	0.7	4.3	49.1	30.7	14.6	0.6
64	Northern Piedmont	1.1	7.8	41.1	31.0	18.9	0.2
65	Southeastern Plains	0.2	8.0	56.0	32.9	2.8	0.1
66	Blue Ridge	0.0	37.4	35.8	22.2	4.6	0.0
67	Ridge and Valley	0.0	11.1	45.8	35.4	7.7	0.0
68	Southwestern Appalachians	0.0	1.4	47.3	48.4	3.0	0.0
69	Central Appalachians	0.0	28.5	49.2	21.0	1.3	0.0
70	Western Allegheny Plateau	0.0	39.1	37.1	22.9	0.9	0.0

Table A-1 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of total N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Total N: Absolute Difference Category					
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	Greater than 4 kg N/ha/y
71	Interior Plateau	0.0	3.6	52.2	41.3	2.9	0.0
72	Interior River Valleys and Hills	0.0	0.4	42.5	51.8	5.3	0.0
73	Mississippi Alluvial Plain	0.7	10.8	68.8	19.0	0.5	0.2
74	Mississippi Valley Loess Plains	0.5	11.8	67.9	19.4	0.4	0.0
75	Southern Coastal Plain	0.3	7.6	43.2	43.9	4.8	0.1
76	Southern Florida Coastal Plain	0.5	1.2	12.2	68.5	16.8	0.9
77	North Cascades	0.2	12.9	40.9	42.4	3.7	0.0
78	Klamath Mountains/California High North Coast Range	0.1	5.7	13.8	41.8	38.2	0.5
79	Madrean Archipelago	0.0	0.0	1.0	85.3	13.7	0.0
80	Northern Basin and Range	0.0	0.1	13.0	81.1	5.8	0.0
81	Sonoran Basin and Range	0.0	0.8	2.7	87.8	8.6	0.0
82	Acadian Plains and Hills	0.0	1.0	44.1	52.8	2.1	0.0
83	Eastern Great Lakes Lowlands	0.7	46.7	39.0	11.2	2.4	0.0
84	Atlantic Coastal Pine Barrens	0.9	5.9	11.7	35.5	43.5	2.5
85	Southern California/Northern Baja Coast	15.8	47.9	13.9	12.9	9.3	0.3

Table A-2. Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of wet N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Wet N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
1	Coast Range	0.0	0.1	9.1	64.0	26.8	0.0
2	Puget Lowland	0.0	16.8	71.3	11.9	0.0	0.0
3	Willamette Valley	0.0	0.3	36.2	62.9	0.6	0.0
4	Cascades	0.0	2.3	26.1	56.9	14.7	0.0
5	Sierra Nevada	0.0	0.6	13.9	39.5	44.8	1.1
6	Central California Foothills and Coastal Mountains	0.0	10.3	33.1	47.6	9.0	0.0
7	Central California Valley	0.0	12.0	59.9	24.7	3.4	0.0
8	Southern California Mountains	0.0	17.2	33.8	47.5	1.4	0.0
9	Eastern Cascades Slopes and Foothills	0.0	0.0	10.3	88.2	1.5	0.0
10	Columbia Plateau	0.0	0.0	20.9	78.4	0.7	0.0
11	Blue Mountains	0.0	0.0	19.5	76.4	4.1	0.0
12	Snake River Plain	0.0	0.1	40.2	59.2	0.5	0.0
13	Central Basin and Range	0.0	0.0	31.5	65.2	3.3	0.0
14	Mojave Basin and Range	0.0	0.4	85.5	14.2	0.0	0.0
15	Northern Rockies	0.0	0.3	13.4	61.0	25.3	0.0
16	Idaho Batholith	0.0	0.1	7.9	43.7	48.4	0.0
17	Middle Rockies	0.0	0.2	23.1	52.1	24.6	0.1
18	Wyoming Basin	0.0	0.7	69.6	29.0	0.6	0.0

Table A-2 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of wet N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Wet N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
19	Wasatch and Uinta Mountains	0.0	1.0	25.5	38.1	34.5	1.0
20	Colorado Plateaus	0.0	1.8	75.0	22.3	0.9	0.0
21	Southern Rockies	0.0	3.8	47.0	44.6	4.6	0.0
22	Arizona/New Mexico Plateau	0.0	0.0	52.7	47.3	0.0	0.0
23	Arizona/New Mexico Mountains	0.0	0.0	24.2	69.7	6.1	0.0
24	Chihuahuan Deserts	0.0	0.0	53.4	46.6	0.0	0.0
25	High Plains	0.0	7.7	44.5	39.3	8.4	0.0
26	Southwestern Tablelands	0.0	0.2	32.8	62.2	4.8	0.0
27	Central Great Plains	0.0	6.4	44.4	47.7	1.5	0.0
28	Flint Hills	0.0	0.1	74.4	25.4	0.0	0.0
29	Cross Timbers	0.0	0.4	35.3	64.2	0.1	0.0
30	Edwards Plateau	0.0	0.0	55.2	44.8	0.0	0.0
31	Southern Texas Plains	0.0	0.0	18.2	81.3	0.5	0.0
32	Texas Blackland Prairies	0.0	0.0	54.0	46.0	0.0	0.0
33	East Central Texas Plains	0.0	0.0	47.2	52.4	0.4	0.0
34	Western Gulf Coastal Plain	0.0	0.0	9.7	68.2	22.1	0.0
35	South Central Plains	0.0	0.0	25.3	70.7	4.0	0.0
36	Ouachita Mountains	0.0	0.1	68.2	31.7	0.0	0.0

Table A-2 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of wet N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Wet N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
37	Arkansas Valley	0.0	0.2	68.7	30.9	0.2	0.0
38	Boston Mountains	0.0	0.4	85.4	14.3	0.0	0.0
39	Ozark Highlands	0.0	1.5	31.2	62.7	4.6	0.0
40	Central Irregular Plains	0.0	0.0	37.8	59.8	2.4	0.0
41	Canadian Rockies	0.0	3.9	22.3	52.6	21.2	0.0
42	Northwestern Glaciated Plains	0.0	0.3	37.8	61.4	0.5	0.0
43	Northwestern Great Plains	0.0	3.1	53.1	43.8	0.0	0.0
44	Nebraska Sand Hills	0.0	58.5	38.1	3.4	0.0	0.0
45	Piedmont	0.0	6.8	52.6	30.4	10.2	0.0
46	Northern Glaciated Plains	0.0	0.0	17.2	64.8	18.0	0.0
47	Western Corn Belt Plains	0.0	0.0	15.6	62.9	21.4	0.0
48	Lake Agassiz Plain	0.0	0.0	14.4	85.2	0.4	0.0
49	Northern Minnesota Wetlands	0.0	0.0	38.5	61.5	0.0	0.0
50	Northern Lakes and Forests	0.0	1.0	44.6	48.8	5.6	0.0
51	North Central Hardwood Forests	0.0	2.5	63.2	33.6	0.7	0.0
52	Driftless Area	0.0	3.8	54.6	40.7	0.9	0.0
53	Southeastern Wisconsin Till Plains	0.0	5.6	76.1	18.3	0.0	0.0
54	Central Corn Belt Plains	0.0	0.1	25.8	70.6	3.4	0.0

Table A-2 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of wet N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Wet N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
55	Eastern Corn Belt Plains	0.0	0.0	36.0	63.9	0.2	0.0
56	Southern Michigan/Northern Indiana Drift Plains	0.0	0.5	30.9	62.9	5.7	0.0
57	Huron/Erie Lake Plains	0.0	0.0	11.9	80.3	7.9	0.0
58	Northeastern Highlands	0.0	8.0	53.7	37.6	0.7	0.0
59	Northeastern Coastal Zone	0.0	7.8	52.8	36.7	2.7	0.0
60	Northern Allegheny Plateau	0.0	3.0	53.8	42.3	0.9	0.0
61	Erie Drift Plain	0.0	0.0	22.2	66.4	11.5	0.0
62	North Central Appalachians	0.0	0.3	39.1	53.2	7.4	0.0
63	Middle Atlantic Coastal Plain	0.0	0.1	27.5	57.7	14.7	0.0
64	Northern Piedmont	0.0	2.5	44.9	37.0	15.6	0.0
65	Southeastern Plains	0.0	0.8	55.5	41.3	2.4	0.0
66	Blue Ridge	0.0	14.5	56.5	24.2	4.8	0.0
67	Ridge and Valley	0.0	6.6	51.0	39.9	2.6	0.0
68	Southwestern Appalachians	0.0	0.0	36.7	63.3	0.0	0.0
69	Central Appalachians	0.0	13.6	59.2	25.3	1.9	0.0
70	Western Allegheny Plateau	0.0	18.9	56.0	25.1	0.0	0.0
71	Interior Plateau	0.0	0.5	43.9	55.5	0.1	0.0
72	Interior River Valleys and Hills	0.0	0.0	25.9	71.1	3.0	0.0

Table A-2 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of wet N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Wet N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
73	Mississippi Alluvial Plain	0.0	1.7	53.5	44.7	0.1	0.0
74	Mississippi Valley Loess Plains	0.3	3.8	68.3	27.6	0.1	0.0
75	Southern Coastal Plain	0.0	0.2	43.1	56.4	0.3	0.0
76	Southern Florida Coastal Plain	0.0	0.0	11.7	88.0	0.2	0.0
77	North Cascades	0.0	4.4	22.3	63.9	9.4	0.0
78	Klamath Mountains/California High North Coast Range	0.0	5.1	11.9	45.6	36.9	0.5
79	Madrean Archipelago	0.0	0.2	34.6	64.5	0.7	0.0
80	Northern Basin and Range	0.0	0.0	7.9	86.2	6.0	0.0
81	Sonoran Basin and Range	0.0	0.0	71.6	28.4	0.0	0.0
82	Acadian Plains and Hills	0.0	0.0	51.5	43.7	4.8	0.0
83	Eastern Great Lakes Lowlands	0.0	20.7	54.9	24.2	0.1	0.0
84	Atlantic Coastal Pine Barrens	0.0	0.0	3.5	72.5	23.9	0.0
85	Southern California/Northern Baja Coast	0.0	26.4	59.8	13.8	0.0	0.0

Table A-3. Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of dry N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Dry N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
1	Coast Range	0.0	1.9	81.5	15.6	0.9	0.1
2	Puget Lowland	1.0	37.6	54.3	5.0	1.8	0.4
3	Willamette Valley	0.0	14.0	81.2	4.8	0.0	0.0
4	Cascades	0.0	9.2	85.5	5.4	0.0	0.0
5	Sierra Nevada	0.0	0.0	22.5	41.0	35.0	1.4
6	Central California Foothills and Coastal Mountains	0.6	6.0	57.2	31.2	4.9	0.1
7	Central California Valley	0.6	17.9	46.9	32.1	2.5	0.1
8	Southern California Mountains	0.0	14.4	24.2	46.4	14.9	0.0
9	Eastern Cascades Slopes and Foothills	0.0	0.4	71.5	28.2	0.0	0.0
10	Columbia Plateau	0.0	0.4	97.6	2.0	0.1	0.0
11	Blue Mountains	0.0	0.0	98.9	1.1	0.0	0.0
12	Snake River Plain	0.0	0.5	71.5	26.1	1.9	0.1
13	Central Basin and Range	0.0	0.2	7.9	81.1	10.8	0.0
14	Mojave Basin and Range	0.0	0.1	2.5	42.3	55.1	0.0
15	Northern Rockies	0.0	0.1	61.8	38.1	0.0	0.0
16	Idaho Batholith	0.0	0.0	56.9	43.1	0.0	0.0
17	Middle Rockies	0.0	0.0	43.6	56.4	0.0	0.0
18	Wyoming Basin	0.0	0.0	58.0	41.9	0.0	0.0

Table A-3 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of dry N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Dry N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
19	Wasatch and Uinta Mountains	0.0	0.1	13.9	81.0	4.9	0.0
20	Colorado Plateaus	0.0	0.0	10.6	83.4	5.9	0.0
21	Southern Rockies	0.0	0.2	42.8	53.6	3.5	0.0
22	Arizona/New Mexico Plateau	0.0	0.0	1.8	94.0	4.2	0.0
23	Arizona/New Mexico Mountains	0.0	0.0	0.4	70.0	29.6	0.0
24	Chihuahuan Deserts	0.0	0.2	1.0	97.5	1.3	0.0
25	High Plains	0.0	0.9	46.0	52.5	0.5	0.0
26	Southwestern Tablelands	0.0	0.0	33.0	66.7	0.2	0.0
27	Central Great Plains	0.0	0.2	50.2	49.1	0.5	0.0
28	Flint Hills	0.0	0.0	94.2	5.8	0.0	0.0
29	Cross Timbers	0.0	0.4	29.1	69.4	1.0	0.1
30	Edwards Plateau	0.0	0.3	9.1	78.6	12.0	0.0
31	Southern Texas Plains	0.0	0.0	0.2	93.8	6.0	0.0
32	Texas Blackland Prairies	0.0	0.4	58.0	37.9	3.7	0.0
33	East Central Texas Plains	0.0	0.0	44.4	54.3	1.2	0.0
34	Western Gulf Coastal Plain	0.0	1.8	45.0	50.7	2.4	0.0
35	South Central Plains	0.0	0.4	32.0	67.2	0.3	0.1
36	Ouachita Mountains	0.0	0.1	7.9	87.5	4.5	0.0

Table A-3 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of dry N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Dry N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
37	Arkansas Valley	0.0	1.1	11.9	82.4	4.6	0.0
38	Boston Mountains	0.0	0.0	2.3	85.8	11.9	0.0
39	Ozark Highlands	0.0	0.8	16.4	79.5	3.3	0.0
40	Central Irregular Plains	0.0	0.6	70.6	27.8	0.9	0.0
41	Canadian Rockies	0.0	0.0	19.7	80.3	0.0	0.0
42	Northwestern Glaciated Plains	0.0	0.1	55.8	44.0	0.2	0.0
43	Northwestern Great Plains	0.0	0.1	28.2	71.5	0.1	0.0
44	Nebraska Sand Hills	0.0	0.5	40.8	58.5	0.2	0.0
45	Piedmont	0.0	4.0	76.8	18.7	0.6	0.0
46	Northern Glaciated Plains	0.0	0.0	21.9	78.0	0.1	0.0
47	Western Corn Belt Plains	0.0	0.4	52.5	46.5	0.6	0.0
48	Lake Agassiz Plain	0.0	0.1	9.1	90.6	0.2	0.0
49	Northern Minnesota Wetlands	0.0	0.0	12.8	87.0	0.2	0.0
50	Northern Lakes and Forests	0.0	1.1	17.2	81.0	0.8	0.0
51	North Central Hardwood Forests	0.0	1.7	46.5	50.1	1.7	0.0
52	Driftless Area	0.0	0.0	39.1	60.3	0.6	0.0
53	Southeastern Wisconsin Till Plains	0.2	3.2	77.2	16.5	2.6	0.3
54	Central Corn Belt Plains	0.3	1.8	88.3	8.5	0.8	0.2

Table A-3 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of dry N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Dry N: Absolute Difference Category					Greater than 4 kg N/ha/y
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	
55	Eastern Corn Belt Plains	0.1	0.7	82.8	15.0	1.3	0.1
56	Southern Michigan/Northern Indiana Drift Plains	0.0	2.1	75.7	21.2	0.9	0.1
57	Huron/Erie Lake Plains	0.0	3.4	68.0	26.3	2.4	0.0
58	Northeastern Highlands	0.0	7.2	83.7	9.0	0.2	0.0
59	Northeastern Coastal Zone	0.9	11.2	65.0	17.6	3.9	1.4
60	Northern Allegheny Plateau	0.0	0.6	63.3	36.0	0.0	0.0
61	Erie Drift Plain	0.2	6.9	78.4	13.6	1.0	0.0
62	North Central Appalachians	0.0	0.0	63.2	36.7	0.1	0.0
63	Middle Atlantic Coastal Plain	0.9	5.1	78.7	11.8	3.1	0.4
64	Northern Piedmont	0.7	5.5	52.5	39.0	2.1	0.2
65	Southeastern Plains	0.1	3.0	66.6	29.4	0.7	0.1
66	Blue Ridge	0.0	6.3	70.2	22.2	1.3	0.0
67	Ridge and Valley	0.0	3.1	45.8	48.7	2.4	0.0
68	Southwestern Appalachians	0.0	1.1	66.6	31.1	1.1	0.0
69	Central Appalachians	0.0	7.9	61.6	30.4	0.1	0.0
70	Western Allegheny Plateau	0.0	7.4	65.6	26.5	0.5	0.0
71	Interior Plateau	0.0	2.2	58.7	38.3	0.7	0.0
72	Interior River Valleys and Hills	0.0	0.6	74.8	23.9	0.7	0.0

Table A-3 (continued). Percent of ecoregion within various categories of absolute difference between TDep and CMAQ estimates of dry N deposition representative of 2011.

US Level 3 Ecoregion Code	US Level 3 Ecoregion Name	Dry N: Absolute Difference Category					
		Less than - 4 kg N/ha/y	-4 to -1	-1 to 0	0 to 1	1 to 4	Greater than 4 kg N/ha/y
73	Mississippi Alluvial Plain	0.5	6.8	86.7	5.3	0.4	0.3
74	Mississippi Valley Loess Plains	0.2	1.2	78.6	19.7	0.3	0.0
75	Southern Coastal Plain	0.2	6.3	56.5	33.6	3.3	0.1
76	Southern Florida Coastal Plain	0.6	0.4	31.9	61.9	4.5	0.8
77	North Cascades	0.2	4.8	94.7	0.3	0.0	0.0
78	Klamath Mountains/California High North Coast Range	0.0	0.2	55.9	43.9	0.0	0.0
79	Madrean Archipelago	0.0	0.0	0.1	97.2	2.7	0.0
80	Northern Basin and Range	0.0	0.2	52.8	47.0	0.0	0.0
81	Sonoran Basin and Range	0.0	0.7	1.7	85.6	12.0	0.0
82	Acadian Plains and Hills	0.0	0.8	47.3	51.9	0.0	0.0
83	Eastern Great Lakes Lowlands	1.0	8.4	80.1	7.3	3.1	0.0
84	Atlantic Coastal Pine Barrens	1.5	7.8	35.0	42.5	10.9	2.3
85	Southern California/Northern Baja Coast	2.9	45.1	24.4	17.9	8.8	0.7

Table A-4. Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
1: Coast Range	2003	-5.0	-1.3	-1.0	-0.4	0.1	0.2	0.8	1.9	3.3	5.9
	2011	-3.6	-1.2	-0.6	0.1	0.4	0.5	0.8	1.7	2.5	4.8
2: Puget Lowland	2003	-10.2	-4.7	-3.3	-2.0	-1.4	-1.6	-0.9	-0.2	0.8	7.6
	2011	-12.3	-4.5	-2.9	-1.9	-1.2	-1.4	-0.8	0.0	0.7	6.2
3: Willamette Valley	2003	-4.8	-2.7	-2.2	-1.1	-0.8	-0.9	-0.5	0.0	0.4	0.9
	2011	-3.4	-2.5	-1.8	-1.0	-0.5	-0.6	-0.1	0.4	0.8	1.3
4: Cascades	2003	-4.2	-2.4	-1.5	-0.7	0.0	-0.2	0.4	0.9	1.4	2.4
	2011	-3.9	-1.9	-1.3	-0.6	0.0	-0.1	0.4	0.9	1.4	2.5
5: Sierra Nevada	2003	-1.4	-0.8	-0.2	0.7	1.9	2.1	3.4	4.9	5.7	6.8
	2011	-1.5	-0.7	0.1	1.2	2.1	2.1	3.0	4.0	4.6	5.3
6: Central California Foothills and Coastal Mountains	2003	-8.3	-3.3	-1.7	-0.7	-0.1	0.0	0.5	2.0	3.1	12.4
	2011	-6.9	-3.1	-1.9	-0.7	-0.1	-0.1	0.5	1.6	2.8	11.0
7: Central California Valley	2003	-5.7	-3.9	-2.7	-1.4	-0.7	-0.8	-0.2	0.6	1.6	3.5
	2011	-6.3	-4.4	-3.0	-1.2	-0.6	-0.7	-0.1	0.9	1.5	4.4
8: Southern California Mountains	2003	-5.3	-4.6	-3.5	-0.9	0.6	0.4	1.8	2.9	4.5	9.6
	2011	-6.3	-4.7	-3.8	-0.9	0.3	-0.1	1.1	1.8	2.3	4.2
9: Eastern Cascades Slopes and Foothills	2003	-1.5	-0.9	-0.4	0.0	0.2	0.1	0.3	0.5	0.9	1.6
	2011	-1.2	-0.6	-0.3	0.0	0.1	0.1	0.3	0.5	0.9	1.4

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
10: Columbia Plateau	2003	-1.9	-1.1	-0.8	-0.6	-0.4	-0.3	-0.1	0.2	0.5	1.4
	2011	-2.0	-0.8	-0.6	-0.4	-0.2	-0.1	0.0	0.5	0.8	1.7
11: Blue Mountains	2003	-1.2	-0.7	-0.5	-0.3	-0.1	-0.1	0.1	0.6	1.0	1.7
	2011	-0.8	-0.5	-0.3	-0.1	0.0	0.1	0.2	0.7	1.2	2.2
12: Snake River Plain	2003	-1.9	-0.7	-0.4	0.0	0.2	0.2	0.3	0.9	1.8	3.3
	2011	-2.1	-1.0	-0.5	-0.2	0.0	0.1	0.2	0.8	2.0	4.3
13: Central Basin and Range	2003	-2.4	-0.6	-0.2	0.2	0.5	0.7	1.1	2.3	3.2	5.6
	2011	-2.7	-0.4	0.0	0.2	0.5	0.6	0.8	1.6	2.3	4.4
14: Mojave Basin and Range	2003	-2.7	-0.3	0.4	1.2	1.6	1.6	2.1	2.8	3.6	5.7
	2011	-3.9	-0.9	-0.1	0.5	0.9	0.9	1.3	1.9	2.4	3.7
15: Northern Rockies	2003	-2.1	-0.7	-0.4	0.0	0.4	0.5	0.9	2.0	2.9	4.9
	2011	-1.5	-0.8	-0.4	0.1	0.4	0.6	1.0	2.0	2.8	4.5
16: Idaho Batholith	2003	-0.6	-0.1	0.2	0.8	1.3	1.4	1.9	2.8	3.6	4.6
	2011	-1.1	-0.6	-0.2	0.5	1.0	1.0	1.5	2.3	3.0	4.0
17: Middle Rockies	2003	-1.4	-0.8	-0.4	0.1	0.6	0.6	1.1	2.0	2.6	6.8
	2011	-1.7	-0.7	-0.5	0.1	0.5	0.6	1.0	1.9	2.6	6.2
18: Wyoming Basin	2003	-1.4	-1.0	-0.7	-0.4	-0.2	-0.2	0.0	0.4	0.8	1.7
	2011	-2.1	-1.0	-0.6	-0.3	-0.2	-0.1	0.0	0.4	0.9	1.9

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
19: Wasatch and Uinta Mountains	2003	-1.6	-0.8	-0.2	0.5	1.3	1.4	2.1	3.2	4.1	8.3
	2011	-1.5	-0.7	-0.3	0.4	1.0	1.1	1.7	2.9	4.1	8.2
20: Colorado Plateaus	2003	-1.7	-1.0	-0.6	0.1	0.4	0.5	0.8	1.7	2.6	4.4
	2011	-2.0	-1.1	-0.6	-0.1	0.2	0.2	0.5	1.2	1.8	3.2
21: Southern Rockies	2003	-2.6	-1.4	-0.8	-0.2	0.3	0.3	0.8	1.7	2.6	6.0
	2011	-2.4	-1.4	-0.9	-0.3	0.1	0.1	0.5	1.3	1.9	4.4
22: Arizona/New Mexico Plateau	2003	-2.6	-0.6	-0.1	0.3	0.7	0.7	1.1	1.5	1.9	3.5
	2011	-2.0	-0.5	-0.2	0.2	0.4	0.5	0.9	1.3	1.6	2.4
23: Arizona/New Mexico Mountains	2003	-0.8	-0.1	0.3	0.9	1.4	1.4	1.9	2.6	3.5	4.7
	2011	-0.6	-0.1	0.2	0.6	0.9	1.1	1.5	2.3	2.9	3.9
24: Chihuahuan Deserts	2003	-2.4	-0.6	-0.2	0.2	0.4	0.4	0.6	1.0	1.3	2.7
	2011	-1.9	-0.3	0.1	0.4	0.5	0.5	0.7	0.9	1.2	2.3
25: High Plains	2003	-6.3	-1.9	-0.9	-0.3	0.0	0.0	0.4	1.0	1.6	6.1
	2011	-4.5	-2.0	-1.4	-0.5	0.1	0.0	0.5	1.3	1.8	2.6
26: Southwestern Tablelands	2003	-2.0	-0.8	-0.4	0.0	0.3	0.3	0.5	1.2	1.7	2.7
	2011	-2.7	-0.9	-0.7	0.1	0.4	0.3	0.7	1.2	1.5	2.4
27: Central Great Plains	2003	-6.7	-0.7	-0.4	0.0	0.4	0.4	0.7	1.2	1.5	9.2
	2011	-4.4	-1.4	-1.1	-0.4	0.0	0.0	0.5	0.9	1.3	4.3

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
28: Flint Hills	2003	-0.9	-0.5	-0.3	0.2	0.5	0.5	0.8	1.2	1.5	1.8
	2011	-1.3	-1.0	-0.9	-0.6	-0.4	-0.3	-0.1	0.2	0.4	0.7
29: Cross Timbers	2003	-2.8	-0.9	-0.4	0.1	0.4	0.4	0.6	1.1	1.7	4.8
	2011	-2.8	-1.0	-0.6	0.0	0.2	0.2	0.4	0.8	1.1	3.9
30: Edwards Plateau	2003	-3.0	-1.8	-0.9	-0.2	0.1	0.0	0.3	0.9	1.3	3.2
	2011	-1.6	-0.7	-0.1	0.4	0.6	0.6	0.8	1.1	1.3	2.3
31: Southern Texas Plains	2003	-2.2	-0.3	-0.1	0.3	0.6	0.6	0.9	1.3	1.6	3.7
	2011	-0.4	0.4	0.6	0.9	1.0	1.1	1.3	1.5	1.7	2.6
32: Texas Blackland Prairies	2003	-3.2	-1.5	-0.8	-0.4	0.0	0.0	0.3	1.0	3.1	4.6
	2011	-2.1	-0.9	-0.6	-0.3	-0.1	0.0	0.2	1.1	2.6	3.3
33: East Central Texas Plains	2003	-1.4	-1.1	-0.7	-0.3	-0.1	0.0	0.3	0.9	1.4	2.4
	2011	-1.4	-0.9	-0.5	-0.2	0.0	0.1	0.4	1.1	1.5	2.3
34: Western Gulf Coastal Plain	2003	-8.1	-1.5	-0.6	0.5	1.0	0.9	1.4	2.0	3.9	7.7
	2011	-4.3	-1.1	-0.5	0.1	0.9	0.8	1.4	1.8	2.4	5.9
35: South Central Plains	2003	-2.9	-1.0	-0.4	0.1	0.6	0.6	0.9	1.6	2.0	9.8
	2011	-2.3	-0.7	-0.4	0.0	0.4	0.4	0.7	1.2	1.4	7.5
36: Ouachita Mountains	2003	-2.8	-0.4	0.0	0.5	0.9	0.9	1.3	1.8	2.1	3.0
	2011	-2.3	-0.7	-0.4	0.0	0.3	0.3	0.6	1.1	1.4	1.8

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
37: Arkansas Valley	2003	-4.4	-1.2	-0.1	0.3	0.6	0.6	0.9	1.6	2.4	4.2
	2011	-2.2	-1.3	-0.5	0.0	0.3	0.3	0.6	1.1	1.8	2.3
38: Boston Mountains	2003	-1.4	-0.6	0.1	0.7	1.1	1.1	1.6	2.3	2.7	3.4
	2011	-1.4	-0.7	-0.2	0.1	0.5	0.4	0.7	1.1	1.9	2.5
39: Ozark Highlands	2003	-3.6	-0.9	-0.4	0.1	0.4	0.4	0.8	1.3	2.1	4.8
	2011	-3.3	-1.3	-0.5	0.1	0.5	0.5	0.9	1.3	1.8	3.5
40: Central Irregular Plains	2003	-9.2	-1.5	-0.4	0.1	0.4	0.4	0.8	1.4	2.0	8.4
	2011	-3.9	-1.1	-0.7	-0.3	0.1	0.1	0.4	0.9	1.2	3.8
41: Canadian Rockies	2003	-1.2	-1.0	-0.5	0.6	1.2	1.2	1.8	2.6	3.4	5.2
	2011	-2.2	-1.4	-0.9	0.0	0.5	0.5	1.0	1.8	2.4	3.3
42: Northwestern Glaciated Plains	2003	-1.7	-0.3	-0.1	0.2	0.4	0.4	0.5	0.9	1.2	1.8
	2011	-2.2	-0.9	-0.5	-0.1	0.1	0.1	0.4	0.7	1.0	2.3
43: Northwestern Great Plains	2003	-1.4	-0.5	-0.3	0.0	0.2	0.2	0.4	0.6	0.7	1.5
	2011	-12.2	-1.3	-0.8	-0.3	0.0	-0.1	0.2	0.5	0.7	10.0
44: Nebraska Sand Hills	2003	-1.3	-0.9	-0.4	0.0	0.3	0.3	0.6	1.1	1.4	2.0
	2011	-2.9	-2.3	-1.7	-1.3	-1.0	-1.0	-0.7	0.1	0.4	1.5
45: Piedmont	2003	-4.9	-3.3	-2.4	-0.9	-0.4	-0.4	0.3	1.4	1.9	4.4
	2011	-3.6	-2.3	-1.8	-0.9	-0.3	-0.3	0.2	1.2	1.7	3.5

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
46: Northern Glaciated Plains	2003	-1.1	-0.2	0.0	0.4	0.6	0.6	0.9	1.3	1.6	2.0
	2011	-1.0	-0.6	-0.3	0.2	0.4	0.5	0.9	1.6	2.2	3.0
47: Western Corn Belt Plains	2003	-12.0	-0.7	-0.3	0.2	0.5	0.5	0.9	1.5	2.0	8.3
	2011	-2.9	-0.7	-0.3	0.1	0.5	0.6	0.9	1.9	2.4	3.2
48: Lake Agassiz Plain	2003	-1.4	-0.5	-0.3	0.0	0.2	0.2	0.4	0.7	0.9	1.3
	2011	-1.2	-0.2	-0.1	0.1	0.2	0.3	0.4	0.7	1.0	1.9
49: Northern Minnesota Wetlands	2003	-0.5	-0.5	0.0	0.3	0.5	0.5	0.8	1.1	1.3	1.7
	2011	-0.7	-0.6	-0.4	0.0	0.2	0.1	0.3	0.5	0.8	1.2
50: Northern Lakes and Forests	2003	-4.4	-1.0	-0.3	0.3	0.6	0.7	1.1	2.0	2.8	4.3
	2011	-4.1	-1.1	-0.7	-0.2	0.2	0.2	0.5	1.3	1.8	3.2
51: North Central Hardwood Forests	2003	-6.0	-2.7	-0.7	-0.2	0.1	0.1	0.4	1.2	1.9	5.8
	2011	-4.6	-1.7	-1.0	-0.6	-0.3	-0.2	0.2	0.9	1.5	2.9
52: Driftless Area	2003	-1.5	-1.0	-0.7	-0.2	0.1	0.1	0.4	0.8	1.1	1.4
	2011	-1.4	-1.2	-1.0	-0.5	-0.1	0.0	0.5	1.0	1.4	2.2
53: Southeastern Wisconsin Till Plains	2003	-11.5	-3.5	-1.8	-0.8	-0.4	-0.5	-0.1	0.5	3.6	8.1
	2011	-7.8	-2.5	-1.3	-0.8	-0.5	-0.5	-0.2	0.4	2.8	6.9
54: Central Corn Belt Plains	2003	-11.8	-2.0	-0.9	-0.4	-0.1	-0.2	0.1	0.6	1.3	9.2
	2011	-8.9	-1.3	-0.7	-0.3	0.0	0.0	0.3	1.0	1.6	7.0

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
55: Eastern Corn Belt Plains	2003	-6.3	-1.2	-0.8	-0.4	-0.1	0.0	0.3	0.9	1.9	5.9
	2011	-5.2	-1.1	-0.8	-0.4	0.0	0.0	0.3	0.6	1.4	4.6
56: Southern Michigan/Northern Indiana Drift Plains	2003	-4.6	-1.6	-0.8	-0.2	0.1	0.1	0.3	0.9	1.3	8.0
	2011	-3.7	-1.6	-1.0	-0.3	0.1	0.1	0.4	0.9	1.6	6.7
57: Huron/Erie Lake Plains	2003	-4.9	-2.4	-1.3	-0.7	-0.2	-0.1	0.5	1.3	2.2	5.1
	2011	-3.7	-1.7	-0.8	-0.2	0.2	0.2	0.7	1.4	2.0	4.4
58: Northeastern Highlands	2003	-4.5	-2.1	-1.2	-0.4	0.2	0.2	0.8	1.6	2.3	3.6
	2011	-4.2	-2.3	-1.8	-1.0	-0.6	-0.7	-0.2	0.2	0.6	2.1
59: Northeastern Coastal Zone	2003	-12.7	-4.0	-1.7	-0.6	0.0	0.0	0.5	1.3	9.0	13.5
	2011	-10.2	-3.6	-2.1	-0.9	-0.4	-0.5	0.0	1.0	5.1	10.9
60: Northern Allegheny Plateau	2003	-1.1	-0.2	0.3	1.0	1.4	1.3	1.7	2.3	2.6	3.6
	2011	-2.0	-1.3	-0.9	-0.5	-0.2	-0.2	0.2	0.6	0.9	1.3
61: Erie Drift Plain	2003	-7.3	-2.8	-1.8	-0.8	-0.3	-0.1	0.5	2.0	2.7	4.2
	2011	-3.6	-1.7	-1.0	-0.4	0.0	0.0	0.4	1.4	1.9	3.3
62: North Central Appalachians	2003	-0.7	-0.3	0.0	0.7	1.0	1.0	1.4	2.0	2.2	2.6
	2011	-1.2	-1.0	-0.9	-0.4	0.1	0.1	0.6	1.3	1.4	1.6
63: Middle Atlantic Coastal Plain	2003	-10.4	-5.2	-1.8	-0.7	-0.1	-0.1	0.6	1.7	4.7	11.5
	2011	-6.8	-3.5	-1.0	-0.3	-0.1	0.1	0.5	1.8	3.5	6.9

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
64: Northern Piedmont	2003	-4.4	-3.1	-1.6	-0.9	0.2	0.1	0.9	1.8	2.4	14.3
	2011	-5.7	-4.5	-1.3	-0.5	0.0	0.1	0.8	1.4	1.8	10.0
65: Southeastern Plains	2003	-11.3	-2.5	-1.8	-1.0	-0.3	-0.3	0.5	1.2	1.7	9.7
	2011	-6.1	-1.9	-1.2	-0.5	-0.2	-0.2	0.1	0.7	1.7	7.7
66: Blue Ridge	2003	-5.0	-4.3	-3.5	-1.6	-0.8	-0.9	0.0	1.0	2.1	3.1
	2011	-3.7	-2.4	-2.1	-1.3	-0.7	-0.6	0.1	1.0	1.9	2.4
67: Ridge and Valley	2003	-4.3	-3.1	-1.9	-0.7	0.0	-0.1	0.7	1.4	2.1	3.9
	2011	-3.8	-2.2	-1.4	-0.6	-0.1	-0.1	0.4	1.2	1.8	3.4
68: Southwestern Appalachians	2003	-2.2	-1.7	-1.1	-0.5	-0.1	0.0	0.3	1.2	1.9	3.2
	2011	-1.3	-1.0	-0.7	-0.3	0.0	0.0	0.3	0.8	1.4	3.3
69: Central Appalachians	2003	-5.4	-3.8	-2.9	-1.1	-0.4	-0.6	0.2	0.9	1.4	2.2
	2011	-3.6	-2.5	-2.2	-1.2	-0.4	-0.6	0.0	0.5	1.1	1.7
70: Western Allegheny Plateau	2003	-3.8	-3.0	-2.3	-1.4	-0.2	-0.3	0.7	1.6	2.3	4.2
	2011	-3.5	-2.7	-2.4	-1.5	-0.7	-0.8	0.0	0.7	1.0	3.3
71: Interior Plateau	2003	-5.1	-1.8	-1.0	-0.4	0.0	0.1	0.6	1.4	2.1	4.0
	2011	-3.8	-1.4	-0.9	-0.4	-0.1	-0.1	0.3	0.8	1.3	3.0
72: Interior River Valleys and Hills	2003	-5.6	-1.3	-0.9	-0.5	-0.2	-0.2	0.1	0.7	1.3	7.8
	2011	-4.9	-0.9	-0.5	-0.2	0.1	0.1	0.4	1.0	1.5	3.3

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
73: Mississippi Alluvial Plain	2003	-30.3	-4.3	-1.4	-0.4	-0.1	-0.1	0.4	1.0	1.6	14.1
	2011	-29.1	-3.4	-1.6	-0.5	-0.3	-0.4	-0.1	0.4	0.9	5.4
74: Mississippi Valley Loess Plains	2003	-5.7	-3.5	-2.1	-0.9	-0.5	-0.5	0.0	0.7	1.2	3.9
	2011	-23.6	-3.0	-1.7	-0.6	-0.3	-0.4	-0.1	0.4	0.7	2.6
75: Southern Coastal Plain	2003	-8.9	-3.9	-2.0	-0.8	-0.2	-0.3	0.3	1.1	2.8	6.1
	2011	-6.1	-3.2	-1.4	-0.4	0.0	0.0	0.5	1.0	2.1	5.1
76: Southern Florida Coastal Plain	2003	-12.6	-2.3	-1.2	-0.5	0.2	0.2	1.0	1.7	3.8	5.2
	2011	-7.5	-1.4	-0.6	0.2	0.4	0.5	0.8	1.5	3.3	4.8
77: North Cascades	2003	-7.2	-2.9	-2.2	-0.5	0.1	-0.1	0.5	1.0	1.4	2.4
	2011	-7.4	-2.6	-1.8	-0.4	0.0	-0.2	0.3	0.9	1.5	2.5
78: Klamath Mountains/California High North Coast Range	2003	-3.1	-1.8	-0.8	0.2	0.9	0.8	1.4	2.4	3.0	3.7
	2011	-4.2	-2.7	-1.2	0.2	0.7	0.7	1.4	2.4	3.6	5.0
79: Madrean Archipelago	2003	-1.8	-0.2	0.2	0.5	0.7	0.7	0.9	1.4	1.9	3.0
	2011	-0.6	0.0	0.2	0.5	0.7	0.7	0.9	1.2	1.8	3.1
80: Northern Basin and Range	2003	-1.4	-0.2	-0.1	0.1	0.3	0.4	0.5	1.2	1.9	4.7
	2011	-1.9	-0.2	-0.1	0.1	0.3	0.3	0.5	1.0	1.7	3.3
81: Sonoran Basin and Range	2003	-5.9	-0.6	0.2	0.6	1.0	1.1	1.6	2.5	2.8	5.4
	2011	-4.5	-0.8	0.1	0.4	0.6	0.6	0.8	1.1	1.4	3.9

Table A-4 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of total N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Total N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
82: Acadian Plains and Hills	2003	-2.2	-1.0	-0.4	0.4	0.8	0.7	1.0	1.2	1.4	2.5
	2011	-1.4	-1.0	-0.7	-0.2	0.0	0.0	0.2	0.7	1.1	1.7
83: Eastern Great Lakes Lowlands	2003	-8.1	-5.0	-2.0	-0.3	0.5	0.4	1.3	2.6	3.7	6.4
	2011	-5.2	-3.7	-2.4	-1.5	-1.0	-0.9	-0.4	0.5	1.7	5.5
84: Atlantic Coastal Pine Barrens	2003	-9.9	-5.3	-2.7	-0.1	0.7	0.7	1.5	3.0	9.5	13.4
	2011	-6.5	-3.9	-1.6	0.2	0.9	0.8	1.4	2.3	6.0	10.7
85: Southern California/Northern Baja Coast	2003	-8.8	-6.5	-4.7	-2.8	-0.9	-1.2	0.1	1.9	3.5	9.0
	2011	-8.5	-6.5	-5.3	-3.2	-1.6	-1.7	-0.2	1.4	3.0	4.4

Table A-5. Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
1: Coast Range	2003	-1.2	-0.9	-0.7	-0.2	0.3	0.4	0.8	1.8	2.8	5.9
	2011	-1.0	-0.7	-0.4	0.4	0.7	0.7	1.0	1.8	2.5	3.8
2: Puget Lowland	2003	-2.5	-2.0	-1.6	-0.9	-0.6	-0.6	-0.3	-0.1	0.1	0.6
	2011	-2.5	-1.8	-1.5	-0.8	-0.3	-0.5	-0.1	0.2	0.4	0.8
3: Willamette Valley	2003	-1.1	-0.8	-0.5	-0.2	0.0	0.0	0.1	0.3	0.5	1.0
	2011	-1.1	-0.9	-0.6	-0.1	0.1	0.1	0.3	0.7	0.9	1.5
4: Cascades	2003	-1.5	-0.9	-0.6	-0.1	0.3	0.4	0.8	1.4	2.1	3.7
	2011	-1.5	-1.1	-0.8	-0.1	0.3	0.3	0.8	1.3	2.1	3.5
5: Sierra Nevada	2003	-1.5	-1.1	-0.3	0.4	0.9	1.0	1.5	2.5	3.3	3.9
	2011	-1.5	-0.9	-0.4	0.3	0.9	1.1	1.8	3.1	4.0	5.0
6: Central California Foothills and Coastal Mountains	2003	-2.0	-1.3	-0.9	-0.3	0.0	0.1	0.5	1.6	2.4	3.3
	2011	-3.4	-1.9	-1.3	-0.5	0.1	0.0	0.4	1.3	2.2	3.0
7: Central California Valley	2003	-1.6	-0.9	-0.7	-0.6	-0.4	-0.2	0.1	0.8	1.0	1.5
	2011	-1.8	-1.4	-1.2	-0.7	-0.4	-0.3	0.2	0.9	1.4	1.6
8: Southern California Mountains	2003	-2.5	-1.8	-1.4	-0.7	-0.1	-0.1	0.4	1.0	1.6	2.1
	2011	-3.6	-2.8	-1.8	-0.7	0.0	-0.2	0.4	0.8	1.1	1.4
9: Eastern Cascades Slopes and Foothills	2003	-0.5	-0.2	-0.1	0.1	0.2	0.2	0.3	0.7	1.1	2.4
	2011	-0.5	-0.1	-0.1	0.1	0.2	0.2	0.3	0.7	1.1	2.1

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
10: Columbia Plateau	2003	-0.4	-0.2	-0.2	-0.1	0.0	0.1	0.1	0.5	0.8	1.9
	2011	-0.5	-0.2	-0.1	0.0	0.1	0.2	0.3	0.7	1.0	2.0
11: Blue Mountains	2003	-0.8	-0.3	-0.2	0.0	0.1	0.2	0.3	0.9	1.4	2.3
	2011	-0.8	-0.3	-0.2	0.0	0.2	0.3	0.4	0.9	1.6	2.6
12: Snake River Plain	2003	-0.8	-0.5	-0.2	0.0	0.2	0.2	0.3	0.7	1.1	1.8
	2011	-1.3	-0.5	-0.3	-0.1	0.1	0.1	0.2	0.5	0.9	1.6
13: Central Basin and Range	2003	-1.7	-0.7	-0.4	0.0	0.1	0.2	0.3	0.9	1.6	3.4
	2011	-1.9	-0.5	-0.3	0.0	0.1	0.2	0.3	0.8	1.4	3.5
14: Mojave Basin and Range	2003	-1.2	-0.5	-0.4	-0.1	0.1	0.1	0.3	0.6	1.2	2.7
	2011	-1.5	-0.7	-0.5	-0.3	-0.2	-0.2	-0.1	0.1	0.2	0.7
15: Northern Rockies	2003	-1.9	-0.6	-0.4	0.1	0.4	0.6	0.9	1.9	2.8	4.7
	2011	-1.5	-0.8	-0.4	0.2	0.5	0.6	1.0	2.0	2.8	4.4
16: Idaho Batholith	2003	-0.6	-0.1	0.2	0.8	1.3	1.4	1.9	2.8	3.6	4.6
	2011	-1.1	-0.6	-0.2	0.5	1.0	1.0	1.5	2.3	3.0	4.0
17: Middle Rockies	2003	-1.4	-0.8	-0.4	0.1	0.5	0.6	1.1	2.0	2.7	6.9
	2011	-1.3	-0.7	-0.5	0.0	0.5	0.6	1.0	1.9	2.6	6.3
18: Wyoming Basin	2003	-1.5	-1.0	-0.6	-0.2	-0.1	-0.1	0.1	0.4	0.8	1.9
	2011	-1.6	-0.9	-0.6	-0.3	-0.1	-0.1	0.0	0.4	0.9	2.0

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
19: Wasatch and Uinta Mountains	2003	-1.6	-0.9	-0.5	0.0	0.8	1.0	1.7	3.0	4.2	6.5
	2011	-1.7	-1.0	-0.7	0.0	0.6	0.8	1.3	2.8	3.9	6.4
20: Colorado Plateaus	2003	-1.6	-1.1	-0.8	-0.4	-0.1	-0.1	0.1	0.7	1.4	3.3
	2011	-1.8	-1.1	-0.8	-0.4	-0.2	-0.2	0.0	0.4	1.0	2.3
21: Southern Rockies	2003	-2.2	-1.3	-0.8	-0.2	0.2	0.2	0.6	1.4	2.2	6.4
	2011	-2.0	-1.3	-0.9	-0.4	0.0	0.0	0.3	1.0	1.5	3.5
22: Arizona/New Mexico Plateau	2003	-0.8	-0.6	-0.4	-0.2	0.0	0.0	0.2	0.4	0.5	1.3
	2011	-1.2	-0.6	-0.4	-0.2	0.0	0.0	0.2	0.3	0.5	0.9
23: Arizona/New Mexico Mountains	2003	-1.0	-0.4	-0.2	0.1	0.4	0.4	0.6	1.1	1.7	3.0
	2011	-1.3	-0.5	-0.3	0.0	0.2	0.3	0.5	1.1	1.5	2.3
24: Chihuahuan Deserts	2003	-1.2	-1.0	-0.6	-0.2	0.0	0.0	0.2	0.4	0.5	1.1
	2011	-1.2	-0.4	-0.3	-0.1	0.0	0.0	0.1	0.3	0.4	0.6
25: High Plains	2003	-2.1	-1.2	-0.6	-0.2	0.1	0.1	0.4	0.9	1.5	2.1
	2011	-2.2	-1.6	-1.2	-0.4	0.0	0.0	0.3	1.2	1.6	2.6
26: Southwestern Tablelands	2003	-1.3	-0.6	-0.3	0.0	0.3	0.3	0.5	1.2	1.7	2.6
	2011	-1.2	-0.8	-0.5	-0.1	0.2	0.2	0.5	1.0	1.4	2.5
27: Central Great Plains	2003	-1.0	-0.6	-0.4	-0.1	0.3	0.3	0.6	1.1	1.4	1.9
	2011	-2.2	-1.4	-1.1	-0.4	0.0	-0.1	0.3	0.8	1.1	1.5

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
28: Flint Hills	2003	-0.5	-0.3	-0.1	0.3	0.6	0.6	0.9	1.3	1.5	1.9
	2011	-1.1	-0.8	-0.7	-0.5	-0.2	-0.2	0.0	0.4	0.6	0.8
29: Cross Timbers	2003	-0.6	-0.5	-0.3	0.0	0.2	0.2	0.4	0.7	0.9	1.2
	2011	-1.2	-0.8	-0.5	-0.1	0.1	0.1	0.3	0.5	0.7	1.1
30: Edwards Plateau	2003	-1.1	-0.9	-0.8	-0.6	-0.5	-0.4	-0.3	0.2	0.5	0.7
	2011	-0.8	-0.6	-0.4	-0.2	0.0	0.0	0.1	0.4	0.6	0.8
31: Southern Texas Plains	2003	-1.3	-1.1	-1.0	-0.5	-0.2	-0.2	0.1	0.4	0.5	0.7
	2011	-0.6	-0.4	-0.2	0.1	0.3	0.3	0.5	0.8	0.9	1.2
32: Texas Blackland Prairies	2003	-1.1	-0.9	-0.7	-0.3	0.0	0.0	0.2	0.6	0.8	1.0
	2011	-0.7	-0.5	-0.5	-0.2	0.0	0.0	0.2	0.4	0.6	0.7
33: East Central Texas Plains	2003	-1.1	-0.8	-0.6	-0.3	0.0	0.0	0.2	0.5	0.8	1.2
	2011	-0.8	-0.6	-0.4	-0.2	0.0	0.0	0.3	0.6	0.8	1.2
34: Western Gulf Coastal Plain	2003	-1.4	-0.7	-0.3	0.4	0.8	0.8	1.2	1.8	2.1	2.4
	2011	-0.8	-0.5	-0.2	0.4	0.7	0.7	1.0	1.4	1.6	1.9
35: South Central Plains	2003	-0.9	-0.5	-0.2	0.2	0.7	0.6	1.0	1.6	1.9	2.2
	2011	-1.0	-0.6	-0.4	0.0	0.3	0.3	0.6	1.0	1.2	1.4
36: Ouachita Mountains	2003	-0.4	-0.1	0.1	0.3	0.6	0.6	0.8	1.2	1.5	1.9
	2011	-1.0	-0.9	-0.7	-0.4	-0.2	-0.1	0.1	0.5	0.7	0.9

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
37: Arkansas Valley	2003	-0.6	-0.4	-0.2	0.0	0.2	0.3	0.5	0.8	1.2	1.6
	2011	-1.4	-0.8	-0.6	-0.3	-0.2	-0.1	0.1	0.7	0.9	1.1
38: Boston Mountains	2003	-1.1	-0.6	-0.3	0.2	0.6	0.5	0.9	1.3	1.7	1.9
	2011	-1.4	-0.9	-0.8	-0.3	-0.2	-0.2	-0.1	0.1	0.3	0.4
39: Ozark Highlands	2003	-1.2	-0.7	-0.4	-0.1	0.2	0.2	0.5	0.9	1.1	1.5
	2011	-1.7	-1.1	-0.8	-0.2	0.3	0.2	0.6	1.0	1.2	1.5
40: Central Irregular Plains	2003	-1.0	-0.5	-0.3	0.2	0.5	0.5	0.9	1.4	1.8	2.2
	2011	-1.2	-0.8	-0.6	-0.2	0.2	0.1	0.5	0.9	1.1	1.4
41: Canadian Rockies	2003	-1.2	-1.0	-0.6	0.4	0.9	0.9	1.5	2.3	3.2	4.9
	2011	-2.1	-1.4	-0.9	0.0	0.4	0.5	0.9	1.8	2.3	3.2
42: Northwestern Glaciated Plains	2003	-0.7	-0.2	-0.1	0.2	0.4	0.4	0.5	0.8	1.1	2.0
	2011	-1.4	-0.8	-0.5	-0.1	0.1	0.1	0.3	0.6	0.8	2.3
43: Northwestern Great Plains	2003	-1.0	-0.5	-0.3	0.0	0.1	0.1	0.3	0.5	0.7	1.5
	2011	-2.5	-1.3	-0.9	-0.4	-0.1	-0.1	0.2	0.5	0.7	1.2
44: Nebraska Sand Hills	2003	-1.2	-0.5	-0.2	0.0	0.2	0.3	0.6	0.9	1.3	1.7
	2011	-2.1	-1.8	-1.6	-1.3	-1.1	-1.0	-0.8	-0.1	0.2	0.3
45: Piedmont	2003	-3.2	-2.5	-1.7	-0.6	-0.1	-0.2	0.4	0.9	1.3	1.5
	2011	-2.1	-1.6	-1.1	-0.5	-0.1	0.0	0.4	1.6	2.0	2.8

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
46: Northern Glaciated Plains	2003	-0.6	-0.2	0.0	0.3	0.6	0.6	0.8	1.2	1.5	1.9
	2011	-0.8	-0.5	-0.3	0.1	0.4	0.5	0.8	1.5	2.0	2.6
47: Western Corn Belt Plains	2003	-1.0	-0.4	-0.1	0.2	0.5	0.6	0.9	1.5	1.9	2.2
	2011	-0.7	-0.5	-0.3	0.2	0.5	0.6	0.9	1.7	2.1	2.8
48: Lake Agassiz Plain	2003	-0.7	-0.4	-0.3	0.0	0.2	0.2	0.3	0.6	0.7	1.0
	2011	-0.4	-0.3	-0.1	0.1	0.2	0.2	0.3	0.5	0.8	1.3
49: Northern Minnesota Wetlands	2003	-0.4	-0.3	-0.1	0.2	0.4	0.4	0.6	0.9	1.0	1.2
	2011	-0.7	-0.6	-0.4	-0.1	0.1	0.0	0.2	0.3	0.4	0.5
50: Northern Lakes and Forests	2003	-1.3	-0.5	-0.1	0.3	0.5	0.6	0.9	1.7	2.3	3.5
	2011	-1.4	-1.0	-0.7	-0.3	0.1	0.1	0.4	1.0	1.5	2.3
51: North Central Hardwood Forests	2003	-1.6	-0.6	-0.4	-0.1	0.1	0.2	0.4	0.9	1.4	2.3
	2011	-1.4	-1.1	-0.9	-0.6	-0.3	-0.2	0.2	0.6	0.9	1.3
52: Driftless Area	2003	-1.0	-0.8	-0.6	-0.2	0.1	0.0	0.3	0.5	0.8	1.2
	2011	-1.3	-1.1	-1.0	-0.5	-0.1	-0.1	0.4	0.8	1.0	1.2
53: Southeastern Wisconsin Till Plains	2003	-1.6	-1.2	-0.7	-0.4	-0.1	-0.1	0.1	0.5	0.8	1.0
	2011	-1.6	-1.4	-1.0	-0.6	-0.3	-0.3	-0.1	0.2	0.4	0.7
54: Central Corn Belt Plains	2003	-1.4	-0.5	-0.2	0.1	0.4	0.4	0.6	0.9	1.2	1.8
	2011	-1.1	-0.6	-0.4	0.0	0.3	0.3	0.5	0.9	1.4	1.9

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
55: Eastern Corn Belt Plains	2003	-1.0	-0.6	-0.4	0.0	0.3	0.3	0.5	0.9	1.3	1.6
	2011	-1.2	-0.6	-0.4	-0.1	0.1	0.1	0.4	0.7	0.9	1.2
56: Southern Michigan/Northern Indiana Drift Plains	2003	-1.4	-0.4	-0.2	0.1	0.4	0.5	0.8	1.2	1.5	1.8
	2011	-1.4	-0.9	-0.5	-0.1	0.2	0.2	0.5	1.0	1.5	1.9
57: Huron/Erie Lake Plains	2003	-0.7	-0.5	-0.3	0.0	0.2	0.3	0.6	1.2	1.4	1.6
	2011	-0.6	-0.4	-0.2	0.2	0.4	0.4	0.7	1.1	1.3	1.5
58: Northeastern Highlands	2003	-2.2	-1.1	-0.7	-0.2	0.2	0.3	0.7	1.5	2.2	4.5
	2011	-2.2	-1.7	-1.2	-0.4	-0.1	-0.2	0.2	0.6	0.9	2.5
59: Northeastern Coastal Zone	2003	-1.1	-0.9	-0.7	-0.4	-0.1	-0.1	0.1	0.4	0.6	0.8
	2011	-1.7	-1.4	-1.1	-0.5	-0.1	-0.1	0.2	0.7	1.4	1.7
60: Northern Allegheny Plateau	2003	-1.3	-1.0	-0.5	0.2	0.6	0.6	1.0	1.6	2.0	2.4
	2011	-1.5	-1.2	-0.9	-0.5	-0.1	-0.1	0.3	0.7	1.0	1.3
61: Erie Drift Plain	2003	-1.1	-0.9	-0.6	-0.3	0.0	0.2	0.6	1.4	1.9	2.5
	2011	-0.7	-0.5	-0.3	0.1	0.4	0.4	0.7	1.4	1.8	2.3
62: North Central Appalachians	2003	-1.5	-1.0	-0.6	0.1	0.5	0.5	0.9	1.5	1.7	1.9
	2011	-1.3	-0.8	-0.6	-0.3	0.2	0.2	0.6	1.0	1.3	1.8
63: Middle Atlantic Coastal Plain	2003	-1.6	-1.2	-0.8	-0.3	0.2	0.2	0.7	1.6	1.9	2.5
	2011	-1.3	-0.6	-0.4	0.0	0.2	0.4	0.6	1.8	2.4	3.0

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
64: Northern Piedmont	2003	-2.2	-2.0	-1.5	-0.5	-0.1	-0.1	0.5	1.3	1.7	2.1
	2011	-1.3	-1.2	-0.8	-0.3	0.1	0.2	0.7	1.3	1.4	1.8
65: Southeastern Plains	2003	-2.8	-1.1	-0.8	-0.4	0.0	0.0	0.4	1.1	1.4	2.0
	2011	-1.4	-1.0	-0.6	-0.3	-0.1	0.0	0.2	0.7	1.6	3.6
66: Blue Ridge	2003	-2.8	-2.3	-1.8	-1.1	-0.6	-0.6	0.0	0.9	1.4	2.4
	2011	-1.9	-1.5	-1.3	-0.8	-0.4	-0.3	0.2	1.0	1.4	1.8
67: Ridge and Valley	2003	-2.6	-1.9	-1.4	-0.7	-0.3	-0.3	0.2	0.8	1.2	2.2
	2011	-1.8	-1.5	-1.1	-0.5	-0.1	-0.1	0.2	0.8	1.2	1.7
68: Southwestern Appalachians	2003	-1.4	-1.0	-0.7	-0.3	0.0	0.0	0.4	0.9	1.1	1.3
	2011	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.3	0.6	0.9	1.2
69: Central Appalachians	2003	-3.2	-1.9	-1.4	-0.7	-0.4	-0.3	0.0	0.9	1.3	1.8
	2011	-1.8	-1.5	-1.2	-0.7	-0.3	-0.3	0.0	0.7	1.2	1.9
70: Western Allegheny Plateau	2003	-2.3	-1.7	-1.1	-0.5	0.0	0.0	0.5	1.1	1.4	1.6
	2011	-2.1	-1.7	-1.4	-0.9	-0.4	-0.5	0.0	0.4	0.7	1.1
71: Interior Plateau	2003	-1.0	-0.7	-0.5	-0.1	0.2	0.2	0.5	1.1	1.4	1.7
	2011	-1.1	-0.9	-0.7	-0.2	0.0	0.0	0.2	0.6	0.8	1.1
72: Interior River Valleys and Hills	2003	-0.9	-0.7	-0.5	-0.1	0.2	0.2	0.5	0.9	1.2	5.4
	2011	-1.0	-0.6	-0.3	0.0	0.2	0.2	0.5	0.9	1.2	1.7

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
73: Mississippi Alluvial Plain	2003	-5.1	-1.5	-0.7	-0.1	0.3	0.3	0.8	1.4	1.7	2.3
	2011	-3.7	-1.7	-0.7	-0.2	0.0	-0.1	0.1	0.6	0.8	1.5
74: Mississippi Valley Loess Plains	2003	-6.0	-2.7	-1.2	-0.4	-0.1	-0.1	0.3	1.0	1.3	1.5
	2011	-5.0	-2.1	-0.9	-0.3	-0.1	-0.2	0.0	0.4	0.6	1.1
75: Southern Coastal Plain	2003	-1.6	-1.0	-0.7	-0.3	0.1	0.1	0.4	0.8	1.1	1.8
	2011	-1.3	-0.8	-0.5	-0.2	0.1	0.1	0.4	0.7	0.9	1.3
76: Southern Florida Coastal Plain	2003	-1.1	-0.9	-0.6	-0.2	0.2	0.3	0.8	1.3	1.4	1.5
	2011	-0.7	-0.5	-0.2	0.1	0.3	0.3	0.6	0.8	0.9	1.4
77: North Cascades	2003	-2.3	-1.7	-1.1	-0.1	0.2	0.2	0.5	1.0	1.4	2.6
	2011	-2.0	-1.4	-0.9	0.0	0.3	0.3	0.7	1.2	1.7	2.6
78: Klamath Mountains/California High North Coast Range	2003	-2.2	-1.6	-0.6	0.3	0.8	0.8	1.3	2.3	2.8	3.5
	2011	-3.6	-2.6	-1.0	0.2	0.7	0.8	1.3	2.4	3.6	5.0
79: Madrean Archipelago	2003	-1.0	-0.6	-0.3	0.0	0.1	0.1	0.3	0.6	1.0	2.1
	2011	-1.4	-0.6	-0.3	-0.1	0.1	0.1	0.2	0.5	0.9	2.1
80: Northern Basin and Range	2003	-0.9	-0.2	0.0	0.1	0.3	0.4	0.5	1.2	1.9	5.0
	2011	-0.9	-0.1	0.0	0.1	0.3	0.3	0.5	1.1	1.7	3.4
81: Sonoran Basin and Range	2003	-1.7	-0.7	-0.3	-0.1	0.0	0.0	0.1	0.2	0.4	0.8
	2011	-1.1	-0.4	-0.2	-0.1	-0.1	-0.1	0.0	0.1	0.3	0.8

Table A-5 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of wet N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Wet N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
82: Acadian Plains and Hills	2003	-0.8	-0.5	-0.3	0.0	0.3	0.3	0.6	0.9	1.0	1.1
	2011	-0.8	-0.8	-0.6	-0.2	0.0	0.0	0.2	1.0	1.4	1.5
83: Eastern Great Lakes Lowlands	2003	-1.7	-1.4	-0.9	-0.2	0.4	0.5	1.1	1.9	2.3	3.2
	2011	-2.6	-2.1	-1.7	-0.9	-0.4	-0.5	0.0	0.4	0.7	1.1
84: Atlantic Coastal Pine Barrens	2003	-0.6	-0.4	-0.3	0.0	0.2	0.2	0.4	0.7	0.8	0.9
	2011	-0.4	-0.2	0.1	0.4	0.7	0.7	1.0	1.3	1.5	1.7
85: Southern California/Northern Baja Coast	2003	-2.2	-1.7	-1.1	-0.6	-0.2	-0.3	0.0	0.3	0.6	1.0
	2011	-3.5	-2.7	-1.8	-1.1	-0.6	-0.7	-0.2	0.2	0.4	0.8

Table A-6. Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
1: Coast Range	2003	-6.7	-1.4	-0.8	-0.5	-0.3	-0.1	0.2	1.0	1.6	5.3
	2011	-4.0	-1.4	-0.8	-0.5	-0.3	-0.3	-0.1	0.1	0.7	4.5
2: Puget Lowland	2003	-8.2	-4.1	-2.1	-1.3	-0.9	-0.9	-0.4	0.5	1.7	8.2
	2011	-10.6	-3.9	-1.9	-1.2	-0.9	-0.9	-0.5	0.5	1.6	6.5
3: Willamette Valley	2003	-4.8	-2.6	-1.7	-0.9	-0.7	-0.8	-0.6	-0.1	0.3	0.6
	2011	-3.2	-2.5	-1.5	-0.7	-0.5	-0.6	-0.4	0.0	0.4	0.5
4: Cascades	2003	-3.3	-2.0	-1.5	-0.8	-0.4	-0.5	-0.1	0.1	0.3	0.7
	2011	-3.3	-1.4	-1.1	-0.6	-0.3	-0.4	-0.1	0.0	0.1	0.2
5: Sierra Nevada	2003	-1.2	-0.9	-0.6	0.1	1.0	1.1	1.8	3.4	4.0	4.7
	2011	-0.9	-0.6	-0.5	0.1	0.7	1.0	1.7	3.4	4.1	4.5
6: Central California Foothills and Coastal Mountains	2003	-9.2	-3.8	-1.3	-0.6	-0.1	-0.2	0.2	1.2	2.3	11.4
	2011	-7.6	-3.4	-1.3	-0.4	-0.1	-0.1	0.1	1.0	2.3	10.0
7: Central California Valley	2003	-5.4	-3.4	-2.4	-1.0	-0.5	-0.6	0.0	0.5	1.2	3.7
	2011	-6.0	-3.8	-2.3	-0.7	-0.3	-0.4	0.2	0.6	1.9	4.9
8: Southern California Mountains	2003	-3.9	-3.6	-2.5	-0.2	0.6	0.5	1.2	3.1	4.9	8.6
	2011	-4.0	-2.9	-2.1	-0.5	0.3	0.1	0.8	1.4	2.0	3.5
9: Eastern Cascades Slopes and Foothills	2003	-1.6	-1.2	-0.7	-0.2	0.0	-0.1	0.1	0.1	0.3	0.7
	2011	-1.3	-0.9	-0.5	-0.2	-0.1	-0.1	0.0	0.0	0.2	0.8

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
10: Columbia Plateau	2003	-1.9	-1.1	-0.8	-0.5	-0.4	-0.4	-0.3	0.0	0.2	1.0
	2011	-2.0	-0.8	-0.6	-0.4	-0.3	-0.3	-0.2	-0.1	0.1	1.2
11: Blue Mountains	2003	-1.2	-0.8	-0.6	-0.3	-0.2	-0.3	-0.2	-0.1	0.0	0.2
	2011	-0.7	-0.5	-0.4	-0.3	-0.2	-0.2	-0.1	-0.1	0.0	0.2
12: Snake River Plain	2003	-1.9	-0.7	-0.2	-0.1	0.0	0.0	0.0	0.4	1.5	3.1
	2011	-2.0	-0.9	-0.2	-0.1	0.0	0.0	0.0	0.5	1.9	4.2
13: Central Basin and Range	2003	-1.6	-0.3	-0.1	0.2	0.4	0.6	0.8	1.8	2.6	4.6
	2011	-2.3	-0.3	0.0	0.1	0.2	0.4	0.5	1.4	2.2	4.5
14: Mojave Basin and Range	2003	-2.8	0.0	0.6	1.2	1.5	1.5	1.9	2.6	2.9	4.6
	2011	-3.5	-0.4	0.3	0.7	1.1	1.1	1.4	2.1	2.7	3.9
15: Northern Rockies	2003	-1.4	-0.4	-0.3	-0.1	0.0	0.0	0.1	0.2	0.2	0.8
	2011	-1.2	-0.4	-0.3	-0.2	0.0	-0.1	0.0	0.1	0.2	0.6
16: Idaho Batholith	2003	-0.5	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.1	0.2	1.5
	2011	-0.4	-0.2	-0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.6
17: Middle Rockies	2003	-1.1	-0.3	-0.2	0.0	0.0	0.0	0.1	0.3	0.6	1.3
	2011	-1.0	-0.3	-0.1	0.0	0.0	0.0	0.1	0.2	0.6	0.9
18: Wyoming Basin	2003	-1.1	-0.5	-0.3	-0.2	0.0	-0.1	0.0	0.1	0.2	0.9
	2011	-2.0	-0.4	-0.2	-0.1	0.0	0.0	0.0	0.1	0.2	1.7

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
19: Wasatch and Uinta Mountains	2003	-1.4	-0.6	-0.2	0.1	0.3	0.4	0.6	1.2	2.1	4.6
	2011	-1.2	-0.4	-0.1	0.1	0.3	0.4	0.6	1.0	1.5	3.8
20: Colorado Plateaus	2003	-1.0	-0.3	-0.1	0.3	0.6	0.6	0.8	1.4	2.0	3.1
	2011	-0.9	-0.3	-0.1	0.2	0.5	0.4	0.6	1.1	1.4	2.0
21: Southern Rockies	2003	-1.6	-0.7	-0.4	-0.1	0.1	0.1	0.3	0.9	1.3	3.0
	2011	-1.4	-0.6	-0.4	-0.1	0.1	0.1	0.3	0.9	1.3	1.9
22: Arizona/New Mexico Plateau	2003	-2.5	-0.2	0.0	0.4	0.7	0.7	1.0	1.2	1.6	3.8
	2011	-1.8	0.0	0.1	0.3	0.5	0.5	0.7	1.0	1.3	2.7
23: Arizona/New Mexico Mountains	2003	-1.3	0.0	0.3	0.7	1.0	1.0	1.4	1.7	2.0	2.4
	2011	-0.3	0.2	0.3	0.5	0.7	0.8	1.1	1.4	1.6	1.8
24: Chihuahuan Deserts	2003	-2.2	-0.2	0.2	0.3	0.4	0.5	0.6	0.8	1.1	2.6
	2011	-1.8	-0.1	0.3	0.4	0.5	0.5	0.6	0.8	1.2	2.5
25: High Plains	2003	-6.2	-1.2	-0.5	-0.2	0.0	-0.1	0.1	0.3	0.7	6.2
	2011	-3.2	-1.0	-0.5	-0.1	0.0	0.0	0.2	0.4	0.8	1.8
26: Southwestern Tablelands	2003	-1.6	-0.5	-0.3	-0.1	0.0	0.0	0.1	0.3	0.5	1.7
	2011	-1.5	-0.3	-0.2	0.0	0.2	0.1	0.3	0.4	0.7	1.8
27: Central Great Plains	2003	-7.1	-0.6	-0.2	0.0	0.1	0.1	0.1	0.5	0.9	8.3
	2011	-4.0	-0.5	-0.2	-0.1	0.0	0.0	0.1	0.5	0.9	3.4

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
28: Flint Hills	2003	-1.5	-0.5	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.4	0.7
	2011	-0.7	-0.5	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.2	0.4
29: Cross Timbers	2003	-2.9	-0.9	-0.4	0.0	0.1	0.1	0.3	0.7	1.3	4.1
	2011	-2.1	-0.7	-0.3	0.0	0.1	0.1	0.2	0.6	1.1	4.3
30: Edwards Plateau	2003	-2.7	-1.4	-0.5	0.3	0.6	0.5	0.7	1.1	1.3	4.1
	2011	-1.5	-0.8	-0.2	0.4	0.7	0.6	0.9	1.1	1.3	2.2
31: Southern Texas Plains	2003	-1.6	0.2	0.5	0.6	0.8	0.8	1.0	1.2	1.4	4.0
	2011	-0.5	0.2	0.4	0.6	0.8	0.8	0.9	1.0	1.3	2.3
32: Texas Blackland Prairies	2003	-2.9	-1.3	-0.5	-0.1	-0.1	0.1	0.1	0.9	3.3	4.3
	2011	-2.0	-0.8	-0.3	-0.1	0.0	0.1	0.0	0.8	2.2	2.6
33: East Central Texas Plains	2003	-0.9	-0.6	-0.3	-0.2	-0.1	0.0	0.1	0.6	1.3	2.0
	2011	-0.9	-0.6	-0.2	-0.1	0.0	0.1	0.2	0.5	1.0	2.0
34: Western Gulf Coastal Plain	2003	-8.9	-2.3	-0.9	-0.2	0.0	0.1	0.6	1.1	2.8	6.9
	2011	-4.0	-1.4	-0.6	-0.3	0.0	0.1	0.5	0.8	1.7	5.2
35: South Central Plains	2003	-3.2	-1.0	-0.4	-0.2	-0.1	-0.1	0.0	0.3	0.8	8.7
	2011	-2.2	-0.7	-0.3	0.0	0.1	0.1	0.2	0.4	0.7	6.5
36: Ouachita Mountains	2003	-3.2	-0.7	-0.3	0.1	0.4	0.3	0.5	0.9	1.2	1.7
	2011	-2.2	-0.4	-0.1	0.3	0.4	0.4	0.6	1.0	1.3	2.0

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
37: Arkansas Valley	2003	-4.5	-1.2	-0.3	0.2	0.4	0.4	0.6	1.1	2.3	3.9
	2011	-1.4	-1.0	-0.1	0.2	0.4	0.4	0.6	0.9	2.0	2.7
38: Boston Mountains	2003	-0.9	-0.4	0.0	0.2	0.7	0.6	0.8	1.1	2.3	2.9
	2011	-0.9	-0.2	0.1	0.3	0.7	0.7	0.9	1.3	2.1	2.7
39: Ozark Highlands	2003	-3.2	-0.8	-0.4	0.0	0.2	0.2	0.4	0.9	2.2	4.9
	2011	-2.5	-1.0	-0.3	0.1	0.2	0.3	0.4	0.9	2.0	4.4
40: Central Irregular Plains	2003	-8.2	-1.3	-0.5	-0.3	-0.2	-0.1	0.0	0.4	1.6	8.1
	2011	-3.3	-0.8	-0.4	-0.2	-0.1	0.0	0.0	0.4	0.9	4.3
41: Canadian Rockies	2003	-0.2	0.0	0.0	0.1	0.2	0.2	0.3	0.5	0.6	0.7
	2011	-0.2	-0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3
42: Northwestern Glaciated Plains	2003	-1.5	-0.4	-0.2	-0.1	0.0	0.0	0.1	0.2	0.4	1.3
	2011	-1.4	-0.3	-0.2	-0.1	0.0	0.0	0.1	0.3	0.6	1.4
43: Northwestern Great Plains	2003	-1.4	-0.3	-0.1	0.0	0.1	0.1	0.1	0.2	0.3	1.3
	2011	-9.8	-0.3	-0.1	0.0	0.1	0.0	0.1	0.2	0.4	11.2
44: Nebraska Sand Hills	2003	-1.0	-0.6	-0.3	0.0	0.0	0.0	0.1	0.3	0.5	0.8
	2011	-1.6	-0.7	-0.3	0.0	0.0	0.0	0.1	0.3	0.7	1.3
45: Piedmont	2003	-4.2	-2.1	-1.3	-0.7	-0.2	-0.2	0.3	0.8	1.5	5.0
	2011	-3.2	-1.7	-0.9	-0.5	-0.3	-0.3	-0.1	0.3	0.7	3.9

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
46: Northern Glaciated Plains	2003	-1.1	-0.4	-0.2	0.0	0.0	0.0	0.1	0.2	0.4	1.2
	2011	-1.0	-0.4	-0.2	0.0	0.1	0.1	0.1	0.3	0.5	1.8
47: Western Corn Belt Plains	2003	-11.7	-0.7	-0.4	-0.2	0.0	-0.1	0.0	0.2	0.9	8.6
	2011	-2.8	-0.8	-0.3	-0.1	0.0	0.0	0.1	0.2	0.8	2.4
48: Lake Agassiz Plain	2003	-1.1	-0.3	0.0	0.0	0.1	0.1	0.1	0.2	0.4	1.3
	2011	-1.0	-0.3	-0.1	0.1	0.1	0.1	0.1	0.2	0.4	1.3
49: Northern Minnesota Wetlands	2003	-0.8	-0.2	-0.1	0.1	0.1	0.1	0.2	0.3	0.5	0.9
	2011	-0.8	-0.2	0.0	0.1	0.1	0.1	0.1	0.3	0.8	1.1
50: Northern Lakes and Forests	2003	-4.8	-1.8	-0.5	0.0	0.1	0.1	0.3	0.6	1.2	3.6
	2011	-3.5	-1.0	-0.3	0.0	0.1	0.1	0.2	0.5	0.9	2.4
51: North Central Hardwood Forests	2003	-5.4	-3.2	-0.6	-0.2	0.0	-0.1	0.1	0.6	1.3	6.1
	2011	-3.9	-1.6	-0.5	-0.1	0.0	0.0	0.1	0.5	1.2	2.8
52: Driftless Area	2003	-1.2	-0.5	-0.2	-0.1	0.0	0.0	0.1	0.4	0.8	1.2
	2011	-0.9	-0.5	-0.1	0.0	0.0	0.1	0.2	0.5	0.9	1.3
53: Southeastern Wisconsin Till Plains	2003	-11.3	-3.0	-1.5	-0.5	-0.3	-0.3	-0.1	0.2	4.2	8.4
	2011	-7.9	-2.2	-0.8	-0.2	-0.1	-0.1	0.0	0.4	3.0	6.4
54: Central Corn Belt Plains	2003	-11.9	-2.3	-1.0	-0.6	-0.5	-0.5	-0.4	0.0	0.7	9.1
	2011	-9.3	-1.6	-0.6	-0.3	-0.2	-0.2	-0.2	0.2	1.0	6.4

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
55: Eastern Corn Belt Plains	2003	-5.5	-1.3	-0.9	-0.6	-0.4	-0.3	-0.1	0.5	1.8	6.5
	2011	-4.8	-0.9	-0.5	-0.3	-0.2	-0.2	-0.1	0.3	1.2	4.8
56: Southern Michigan/Northern Indiana Drift Plains	2003	-5.0	-1.9	-1.1	-0.6	-0.4	-0.4	-0.2	0.1	0.9	8.0
	2011	-3.1	-1.4	-0.7	-0.3	-0.2	-0.2	0.0	0.2	0.9	5.9
57: Huron/Erie Lake Plains	2003	-4.7	-2.7	-1.3	-0.7	-0.3	-0.4	-0.1	0.5	1.6	4.6
	2011	-3.9	-2.0	-0.9	-0.5	-0.2	-0.2	0.0	0.4	1.7	3.5
58: Northeastern Highlands	2003	-3.9	-1.6	-1.0	-0.5	-0.1	-0.1	0.2	0.7	1.1	2.5
	2011	-2.5	-1.3	-1.1	-0.8	-0.5	-0.5	-0.2	0.1	0.3	2.2
59: Northeastern Coastal Zone	2003	-12.7	-4.0	-1.5	-0.4	0.2	0.1	0.6	1.4	8.8	13.3
	2011	-10.0	-3.7	-1.7	-0.6	-0.3	-0.3	0.0	1.0	5.3	10.4
60: Northern Allegheny Plateau	2003	-1.1	-0.5	0.1	0.5	0.8	0.8	1.0	1.2	1.5	2.3
	2011	-1.4	-0.9	-0.5	-0.2	-0.1	-0.1	0.1	0.2	0.5	1.0
61: Erie Drift Plain	2003	-6.5	-2.4	-1.6	-0.8	-0.3	-0.3	0.2	0.8	1.5	3.2
	2011	-4.3	-1.8	-1.2	-0.6	-0.3	-0.4	-0.1	0.3	0.9	2.9
62: North Central Appalachians	2003	-0.7	-0.3	0.0	0.3	0.5	0.5	0.8	1.0	1.2	1.9
	2011	-0.8	-0.5	-0.4	-0.2	-0.1	-0.1	0.1	0.3	0.4	1.2
63: Middle Atlantic Coastal Plain	2003	-12.5	-6.1	-1.5	-0.6	-0.3	-0.3	0.0	1.0	5.1	11.2
	2011	-8.0	-3.9	-1.1	-0.4	-0.3	-0.3	-0.1	0.6	3.3	7.0

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
64: Northern Piedmont	2003	-4.1	-2.7	-1.1	-0.3	0.2	0.2	0.5	1.2	2.1	14.1
	2011	-4.7	-3.9	-1.2	-0.2	-0.1	-0.1	0.2	0.6	1.3	9.8
65: Southeastern Plains	2003	-9.7	-2.0	-1.3	-0.6	-0.3	-0.3	0.0	0.5	1.1	10.7
	2011	-5.9	-1.6	-0.9	-0.3	-0.1	-0.2	0.0	0.3	0.9	5.9
66: Blue Ridge	2003	-3.0	-2.4	-1.8	-0.8	-0.3	-0.3	0.2	0.9	1.7	3.8
	2011	-2.1	-1.3	-1.1	-0.7	-0.3	-0.3	0.0	0.5	1.1	3.5
67: Ridge and Valley	2003	-3.2	-1.8	-1.0	-0.3	0.2	0.2	0.7	1.2	2.1	5.7
	2011	-2.4	-1.2	-0.8	-0.3	0.0	0.0	0.3	0.7	1.4	3.8
68: Southwestern Appalachians	2003	-2.2	-1.5	-0.8	-0.4	-0.1	-0.1	0.2	0.7	1.5	3.3
	2011	-1.3	-1.1	-0.6	-0.3	-0.1	-0.1	0.1	0.4	1.0	2.9
69: Central Appalachians	2003	-3.3	-2.2	-1.8	-0.9	-0.1	-0.3	0.5	0.8	1.1	1.7
	2011	-2.6	-1.4	-1.1	-0.7	-0.3	-0.3	0.1	0.4	0.5	1.2
70: Western Allegheny Plateau	2003	-3.2	-1.9	-1.3	-0.9	-0.3	-0.3	0.3	0.9	1.4	3.2
	2011	-2.4	-1.4	-1.0	-0.7	-0.3	-0.3	0.0	0.4	0.8	2.9
71: Interior Plateau	2003	-4.7	-1.8	-1.0	-0.5	-0.2	-0.1	0.2	0.9	1.5	4.1
	2011	-3.8	-1.4	-0.7	-0.2	-0.1	-0.1	0.1	0.5	1.0	2.1
72: Interior River Valleys and Hills	2003	-5.0	-1.4	-0.8	-0.6	-0.4	-0.4	-0.2	0.3	1.0	7.8
	2011	-4.4	-0.8	-0.4	-0.2	-0.1	-0.1	0.0	0.3	0.8	3.4

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
73: Mississippi Alluvial Plain	2003	-25.2	-3.8	-1.1	-0.5	-0.4	-0.5	-0.3	0.0	0.7	14.5
	2011	-25.5	-3.1	-1.3	-0.4	-0.2	-0.4	-0.1	0.1	0.5	5.9
74: Mississippi Valley Loess Plains	2003	-3.2	-1.5	-0.9	-0.6	-0.4	-0.4	-0.2	0.1	0.8	6.1
	2011	-18.6	-1.2	-0.7	-0.3	-0.2	-0.2	0.0	0.2	0.6	2.9
75: Southern Coastal Plain	2003	-8.9	-4.3	-1.7	-0.6	-0.3	-0.4	0.0	0.7	2.7	5.8
	2011	-5.7	-3.4	-1.2	-0.3	-0.1	-0.1	0.2	0.7	2.2	5.3
76: Southern Florida Coastal Plain	2003	-12.6	-2.5	-0.8	-0.4	-0.1	-0.1	0.1	1.2	4.0	5.1
	2011	-13.5	-1.0	-0.5	-0.1	0.1	0.1	0.3	1.1	3.2	4.5
77: North Cascades	2003	-6.8	-1.6	-1.2	-0.5	-0.2	-0.3	0.0	0.4	1.2	1.5
	2011	-6.7	-1.2	-1.0	-0.5	-0.3	-0.4	-0.2	-0.1	-0.1	0.2
78: Klamath Mountains/California High North Coast Range	2003	-1.6	-0.6	-0.3	-0.1	0.0	0.0	0.2	0.3	0.4	1.2
	2011	-1.3	-0.5	-0.2	-0.1	0.0	0.0	0.1	0.2	0.3	1.5
79: Madrean Archipelago	2003	-1.7	0.3	0.4	0.5	0.6	0.6	0.7	0.9	1.5	2.2
	2011	-0.6	0.3	0.4	0.5	0.6	0.6	0.7	0.9	1.4	1.7
80: Northern Basin and Range	2003	-1.5	-0.3	-0.2	-0.1	0.0	0.0	0.1	0.1	0.2	0.7
	2011	-2.0	-0.4	-0.1	-0.1	0.0	0.0	0.0	0.1	0.1	0.9
81: Sonoran Basin and Range	2003	-5.6	-0.4	0.4	0.7	0.9	1.2	1.7	2.5	2.7	5.5
	2011	-4.3	-0.6	0.3	0.5	0.6	0.6	0.8	1.1	1.5	4.0

Table A-6 (continued). Distribution of the absolute difference between TDep and CMAQ estimates of dry N deposition representative of years 2003 and 2011 for each level 3 ecoregion of the United States.

US_L3 CODE: Ecoregion Name	Year	Dry N: absolute difference									
		Minimum	1st Percentile	5th Percentile	First Quartile	Median	Average	Third Quartile	95th Percentile	99th Percentile	Maximum
82: Acadian Plains and Hills	2003	-3.0	-0.8	-0.2	0.2	0.3	0.4	0.6	1.0	1.2	2.5
	2011	-2.1	-0.9	-0.4	-0.1	0.0	0.0	0.1	0.3	0.4	0.9
83: Eastern Great Lakes Lowlands	2003	-10.1	-5.3	-1.8	-0.2	0.1	0.0	0.4	1.1	2.9	6.8
	2011	-6.9	-3.5	-1.7	-0.6	-0.4	-0.5	-0.2	0.3	2.1	4.6
84: Atlantic Coastal Pine Barrens	2003	-10.2	-5.7	-3.1	-0.2	0.5	0.5	1.1	2.7	9.1	13.3
	2011	-7.0	-4.1	-2.1	-0.4	0.1	0.1	0.5	1.5	5.8	10.4
85: Southern California/Northern Baja Coast	2003	-8.8	-6.5	-4.0	-2.3	-0.6	-0.9	0.3	1.8	3.7	8.6
	2011	-7.8	-5.5	-3.6	-2.1	-1.0	-1.1	0.1	1.3	3.2	5.3

Appendix B – Deposition Difference Summary for Inventory and Monitoring Parks

Table B-1. Summary statistics (minimum, mean, maximum) of the absolute difference between TDep and CMAQ total, wet, and dry N deposition (year 2011) for each Inventory and Monitoring Park with available deposition data.

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
ABLI	Abraham Lincoln Birthplace National Historical Park	-0.21	0.02	0.14	0.17	0.19	0.25	-0.46	-0.17	-0.03
ACAD	Acadia National Park	-2.96	-0.43	-0.07	-0.40	-0.27	-0.10	-2.65	-0.10	0.32
AGFO	Agate Fossil Beds National Monument	-0.56	-0.50	-0.46	-0.46	-0.44	-0.38	-0.12	-0.06	-0.05
ALFL	Alibates Flint Quarries National Monument	0.02	0.02	0.02	-0.18	-0.17	-0.03	0.05	0.19	0.20
ALPO	Allegheny Portage Railroad National Historic Site	-0.99	0.68	1.52	-0.17	1.24	1.58	-0.82	-0.55	0.12
AMIS	Amistad National Recreation Area	0.11	0.66	1.36	-0.54	-0.19	0.10	0.49	0.81	1.54
ANTI	Antietam National Battlefield	-0.33	-0.21	0.16	-0.45	-0.41	-0.26	0.09	0.20	0.56
APCO	Appomattox Court House National Historical Park	-0.62	-0.52	-0.05	-0.60	-0.52	-0.36	-0.13	0.00	0.41
APIS	Apostle Islands National Lakeshore	-2.30	-0.40	2.28	-0.54	-0.38	0.19	-2.35	-0.03	2.22
APPA	Appalachian National Scenic Trail	-2.68	-0.33	3.24	-1.60	-0.10	2.49	-2.13	-0.23	3.49
ARCH	Arches National Park	-0.03	0.38	0.70	-0.66	-0.17	0.08	0.51	0.55	0.78
ARPO	Arkansas Post National Memorial	-0.52	-0.36	-0.26	-0.35	-0.22	-0.10	-0.17	-0.14	-0.06
ASIS	Assateague Island National Seashore	-0.35	0.17	0.50	0.29	0.52	0.70	-5.91	-0.56	-0.20
AZRU	Aztec Ruins National Monument	0.10	0.10	0.14	-0.43	-0.43	-0.39	0.53	0.53	0.53
BADL	Badlands National Park	-1.26	-0.62	0.02	-1.32	-0.66	-0.06	-0.13	0.04	0.30

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BAND	Bandelier National Monument	-1.56	-0.19	0.15	-1.34	-0.56	-0.23	-0.28	0.37	0.60
BEOL	Bent's Old Fort National Historic Site	-0.14	-0.14	-0.14	-0.07	-0.07	-0.07	-0.08	-0.08	-0.08
BIBE	Big Bend National Park	0.00	0.76	1.59	-0.42	0.00	0.52	0.15	0.75	1.56
BICA	Bighorn Canyon National Recreation Area	-0.41	0.04	0.62	-0.37	0.05	0.66	-0.27	-0.01	0.22
BICY	Big Cypress National Preserve	-0.09	0.52	1.22	-0.09	0.41	0.79	-0.73	0.10	0.76
BIHO	Big Hole National Battlefield	0.30	0.52	0.81	0.05	0.43	0.77	0.03	0.08	0.26
BISC	Biscayne National Park	0.44	2.95	5.18	0.69	0.99	1.17	-0.25	0.96	4.01
BISO	Big South Fork National River and Recreation Area	-1.02	-0.37	0.25	-0.66	-0.31	0.03	-0.56	-0.05	0.52
BITH	Big Thicket National Preserve	0.44	0.95	3.08	0.49	0.77	1.07	-0.37	0.18	2.12
BLCA	Black Canyon of the Gunnison National Park	-0.71	-0.05	0.46	-0.66	0.06	0.41	-0.34	-0.12	0.05
BLRI	Blue Ridge Parkway	-2.60	-0.07	1.47	-1.04	0.31	1.45	-2.14	-0.38	1.90
BLUE	Bluestone National Scenic River	-0.48	0.38	0.60	-0.38	0.17	0.25	-0.48	0.21	0.52
BOHA	Boston Harbor Islands National Recreation Area	-0.21	0.18	1.94	-0.20	-0.06	0.18	-0.21	0.24	2.03
BOWA	Booker T. Washington National Monument	-0.14	-0.14	-0.14	-0.35	-0.35	-0.35	0.22	0.22	0.22
BRCA	Bryce Canyon National Park	-0.55	0.29	0.81	-0.65	-0.08	0.38	-0.06	0.37	0.65
BUFF	Buffalo National River	-0.61	0.47	1.16	-0.81	-0.17	0.34	-0.18	0.64	1.27
CACH	Canyon de Chelly National Monument	0.67	1.11	1.83	-0.05	0.10	0.42	0.67	1.01	1.73
CACO	Cape Cod National Seashore	-3.73	-0.03	0.26	0.24	0.32	0.43	-4.05	-0.33	-0.14
CAGR	Casa Grande Ruins National Monument	0.40	0.40	0.40	-0.13	-0.13	-0.13	0.52	0.52	0.52

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
CAHA	Cape Hatteras National Seashore	0.47	0.97	1.34	0.90	1.42	1.80	-0.54	-0.43	-0.15
CALO	Cape Lookout National Seashore	-2.09	0.31	0.81	0.98	1.14	1.25	-3.27	-0.64	-0.41
CAMO	Castle Mountains National Monument	0.94	1.12	1.60	-0.15	-0.09	0.03	1.01	1.21	1.64
CANA	Canaveral National Seashore	-2.32	-0.13	1.63	0.12	0.25	0.39	-2.58	-0.38	1.40
CANY	Canyonlands National Park	-0.55	0.32	0.93	-0.54	-0.23	0.20	-0.22	0.54	0.83
CARE	Capitol Reef National Park	-0.89	0.33	1.36	-0.74	-0.26	0.26	-0.15	0.60	1.11
CARL	Carl Sandburg Home National Historic Site	-1.37	-1.37	-1.37	-0.61	-0.61	-0.61	-0.76	-0.76	-0.76
CATO	Catoctin Mountain Park	-0.19	0.06	0.09	-0.31	-0.18	-0.15	0.10	0.24	0.24
CAVE	Carlsbad Caverns National Park	-0.13	0.21	0.65	-0.31	-0.18	0.03	0.12	0.39	0.62
CAVO	Capulin Volcano National Monument	0.04	0.04	0.04	-0.09	-0.09	-0.09	0.13	0.13	0.13
CEBR	Cedar Breaks National Monument	0.43	0.88	1.34	-0.35	0.12	0.53	0.44	0.77	1.12
CHAT	Chattahoochee River National Recreation Area	-2.22	-0.99	0.82	-1.32	-0.81	-0.41	-1.13	-0.18	1.43
CHCH	Chickamauga and Chattanooga National Military Park	-3.26	-0.57	2.14	-0.27	-0.03	0.13	-2.99	-0.53	2.08
CHCU	Chaco Culture National Historical Park	0.01	0.16	0.45	-0.35	-0.27	-0.10	0.34	0.43	0.58
CHIC	Chickasaw National Recreation Area	0.18	0.61	0.72	0.10	0.23	0.33	0.08	0.39	0.48
CHIR	Chiricahua National Monument	-0.22	0.82	2.33	-0.16	0.12	0.44	-0.06	0.69	2.00
CHIS	Channel Islands National Park	-2.72	0.82	4.79	0.17	0.29	0.45	-2.90	0.51	4.39
CHOH	Chesapeake and Ohio Canal	-2.28	-0.42	1.52	-1.16	-0.36	0.28	-2.18	-0.06	1.78
CHPI	Charles Pinckney National Historic Site	-0.81	-0.81	-0.81	-0.27	-0.27	-0.27	-0.54	-0.54	-0.54

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
CIRO	City of Rocks National Reserve	-0.47	0.76	1.87	-0.61	0.72	1.57	-0.45	0.03	0.29
COLM	Colorado National Monument	-1.64	0.08	0.53	-0.70	-0.20	-0.06	-0.94	0.28	0.61
COLO	Colonial National Historical Park	-1.10	-0.80	0.22	-0.51	-0.22	0.01	-0.70	-0.51	0.48
CONG	Congaree National Park	-1.53	-0.80	-0.03	-0.73	-0.52	-0.19	-0.90	-0.28	0.17
CORO	Coronado National Memorial	0.92	1.73	3.23	0.39	0.68	1.33	0.53	1.06	1.90
COWP	Cowpens National Battlefield	-1.45	-1.45	-1.45	-0.81	-0.81	-0.81	-0.64	-0.64	-0.64
CRLA	Crater Lake National Park	0.55	0.90	1.50	0.44	1.01	1.53	-0.24	-0.11	0.22
CRMO	Craters of the Moon National Monument and Preserve	-0.64	0.14	0.56	-0.27	0.11	0.35	-0.69	0.03	0.46
CUGA	Cumberland Gap National Historical Park	-0.81	0.06	0.97	-0.01	0.61	1.06	-1.15	-0.55	-0.02
CUIS	Cumberland Island National Seashore	-3.25	-2.81	-0.90	-0.86	-0.43	-0.29	-3.50	-2.81	-0.04
CURE	Curecanti National Recreation Area	-0.55	-0.18	0.63	-0.63	-0.29	0.53	-0.19	0.11	0.41
CUVA	Cuyahoga Valley National Park	-0.88	0.11	1.12	0.18	0.50	1.12	-1.39	-0.39	0.58
DEPO	Devils Postpile National Monument	1.61	2.21	3.02	0.03	1.05	1.82	1.00	1.16	1.58
DETO	Devils Tower National Monument	0.70	0.72	0.73	0.55	0.57	0.58	0.15	0.15	0.15
DEVA	Death Valley National Park	-0.47	1.60	4.01	-1.39	-0.21	0.66	0.07	1.81	3.94
DEWA	Delaware Water Gap National Recreation Area	-1.42	-0.32	0.12	-1.35	-0.42	0.24	-0.45	0.10	0.96
DINO	Dinosaur National Monument	-0.55	0.00	0.46	-0.66	0.01	0.39	-0.33	-0.01	0.30
EBLA	Ebey's Landing National Historical Reserve	-1.34	-1.32	-0.85	-0.12	-0.10	-0.08	-3.85	-1.56	-0.31
EFMO	Effigy Mounds National Monument	-0.02	0.43	0.75	-0.20	0.24	0.41	0.18	0.19	0.34

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
EISE	Eisenhower National Historic Site	0.74	0.78	1.53	0.76	0.77	1.07	-0.02	0.01	0.46
ELMA	El Malpais National Monument	0.34	1.16	2.06	0.00	0.19	0.39	0.30	0.96	1.81
ELMO	El Morro National Monument	1.07	1.09	1.10	0.30	0.33	0.34	0.76	0.76	0.77
ELRO	Eleanor Roosevelt National Historic Site	-0.99	-0.91	-0.88	-0.70	-0.61	-0.59	-0.29	-0.29	-0.29
EUON	Eugene O'Neill National Historic Site	2.13	2.13	2.13	1.55	1.55	1.55	0.58	0.58	0.58
EVER	Everglades National Park	-0.77	1.00	3.60	-0.10	0.64	1.09	-1.71	0.35	3.16
FIIS	Fire Island National Seashore	-4.49	0.30	5.90	0.60	0.73	0.76	-5.12	-0.57	5.30
FLFO	Florissant Fossil Beds National Monument	-0.13	0.06	0.17	-0.05	0.07	0.21	-0.15	-0.01	0.01
FOBO	Fort Bowie National Historic Site	0.46	0.81	0.88	-0.15	0.15	0.20	0.61	0.66	0.67
FOBU	Fossil Butte National Monument	0.19	0.50	0.61	0.32	0.59	0.76	-0.21	-0.09	0.15
FOCA	Fort Caroline National Memorial	-5.84	-5.49	-3.21	-0.23	-0.21	-0.06	-5.61	-5.28	-3.15
FODA	Fort Davis National Historic Site	0.82	0.87	0.91	-0.03	0.02	0.05	0.84	0.85	0.87
FODO	Fort Donelson National Battlefield	0.38	0.61	1.03	-0.05	0.09	0.36	0.43	0.51	0.67
FOFR	Fort Frederica National Monument	-0.25	-0.16	2.05	-0.14	0.06	0.07	-0.32	-0.22	2.19
FOLA	Fort Laramie National Historic Site	-0.69	-0.68	-0.68	-0.67	-0.66	-0.66	-0.02	-0.02	-0.02
FOLS	Fort Larned National Historic Site	0.34	0.36	0.40	0.38	0.39	0.43	-0.04	-0.03	-0.03
FOMA	Fort Matanzas National Monument	-0.09	-0.09	-0.09	-0.06	-0.06	-0.06	-0.04	-0.04	-0.04
FONE	Fort Necessity National Battlefield	-2.40	-2.10	-0.82	-1.30	-1.03	-0.62	-1.10	-1.07	-0.19
FOPU	Fort Pulaski National Monument	-5.65	-0.87	0.30	-0.82	-0.23	-0.07	-4.83	-0.70	0.37

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
FORA	Fort Raleigh National Historic Site	0.56	0.75	0.81	0.98	1.08	1.11	-0.42	-0.33	-0.31
FOSU	Fort Sumter National Monument	-1.32	-0.65	0.03	-0.61	-0.43	-0.25	-0.71	-0.21	0.28
FOUN	Fort Union National Monument	0.05	0.10	0.25	-0.11	-0.10	-0.09	0.16	0.20	0.34
FOUS	Fort Union Trading Post National Historic Site	0.15	0.15	0.15	0.10	0.10	0.11	0.04	0.04	0.04
FOVA	Fort Vancouver National Historic Site	-1.45	-1.41	-1.12	-0.14	-0.08	-0.07	-1.38	-1.33	-0.98
FOWA	Fort Washington Park	-0.67	-0.67	-0.56	-0.49	-0.49	-0.38	-0.18	-0.18	-0.18
FRDO	Frederick Douglass National Historic Site	-0.80	-0.80	-0.80	-0.63	-0.63	-0.63	-0.17	-0.17	-0.17
FRHI	Friendship Hill National Historic Site	-3.17	-2.78	-2.63	-1.85	-1.83	-1.75	-1.32	-0.95	-0.88
FRSP	Fredericksburg and Spotsylvania County Battlefields Memorial National Military Park	-1.14	-0.65	0.02	-0.62	-0.40	0.06	-1.03	-0.25	-0.03
GARI	Gauley River National Recreation Area	-1.78	-1.60	-1.39	-1.41	-1.14	-0.96	-0.74	-0.46	-0.20
GATE	Gateway National Recreation Area	0.40	3.69	11.86	0.08	0.42	0.69	-0.22	3.26	11.50
GETT	Gettysburg National Military Park	0.74	1.28	1.73	0.68	0.95	1.27	-0.02	0.33	0.54
GICL	Gila Cliff Dwellings National Monument	1.06	1.22	1.36	-0.14	0.00	0.13	1.21	1.22	1.23
GLAC	Glacier National Park	-2.22	0.07	3.26	-2.08	0.07	3.23	-0.50	0.00	0.43
GLCA	Glen Canyon National Recreation Area	-0.94	0.16	1.21	-0.81	-0.33	0.71	-0.22	0.49	1.06
GOGA	Golden Gate National Recreation Area	-5.55	1.71	5.75	0.33	1.58	3.25	-6.46	0.19	3.65
GOSP	Golden Spike National Historic Site	0.49	0.75	0.98	0.57	0.82	1.22	-0.24	-0.07	-0.03
GRBA	Great Basin National Park	-0.89	0.93	1.91	0.03	0.71	1.60	-0.93	0.21	0.66

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
GRCA	Grand Canyon National Park	-1.84	0.06	1.84	-1.24	-0.27	1.14	-0.85	0.33	1.60
GREE	Greenbelt Park	-0.73	-0.73	-0.73	-0.55	-0.55	-0.55	-0.19	-0.19	-0.19
GRKO	Grant-Kohrs Ranch National Historic Site	-0.53	-0.37	-0.24	-0.47	-0.39	-0.26	-0.10	0.02	0.07
GRPO	Grand Portage National Monument	0.58	0.77	0.91	0.47	0.65	0.78	0.11	0.12	0.16
GRSA	Great Sand Dunes National Park and Preserve	-2.50	0.11	2.09	-2.18	0.10	1.88	-0.38	0.01	0.55
GRSM	Great Smoky Mountains National Park	-2.38	0.02	2.06	-1.40	-0.11	1.42	-1.65	0.13	1.62
GRTE	Grand Teton National Park	-1.19	0.85	6.23	-1.12	0.91	6.32	-0.42	-0.06	0.31
GUCO	Guilford Courthouse National Military Park	0.27	0.56	3.13	0.89	0.90	0.94	-0.62	-0.34	2.18
GUIS	Gulf Islands National Seashore	0.68	2.42	5.02	0.40	0.93	1.26	-4.43	-0.74	4.57
GUMO	Guadalupe Mountains National Park	-0.29	0.65	1.89	-0.47	0.05	0.52	-0.21	0.60	1.68
GWCA	George Washington Carver National Monument	-0.18	-0.12	-0.10	0.02	0.03	0.04	-0.22	-0.14	-0.12
GWMP	George Washington Memorial Parkway	-2.56	-0.94	0.48	-1.26	-0.52	-0.24	-2.17	-0.43	0.80
HAFE	Harpers Ferry National Historical Park	-0.43	-0.17	0.17	-0.32	-0.15	0.03	-0.17	-0.02	0.36
HAFO	Hagerman Fossil Beds National Monument	-0.04	0.11	0.28	0.04	0.11	0.15	-0.11	0.00	0.20
HEHO	Herbert Hoover National Historic Site	0.25	0.37	0.69	0.25	0.25	0.26	0.00	0.12	0.43
HOBE	Horseshoe Bend National Military Park	0.08	0.16	0.37	-0.17	-0.09	-0.07	0.23	0.25	0.47
HOCU	Hopewell Culture National Historical Park	-1.28	-0.80	-0.23	-0.50	-0.20	0.01	-0.83	-0.60	-0.19
HOFR	Home of Franklin D. Roosevelt National Historic Site	-0.99	-0.87	-0.63	-0.70	-0.60	-0.53	-0.29	-0.28	0.03
HOFU	Hopewell Furnace National Historic Site	0.53	1.40	1.70	0.45	0.56	0.68	0.01	0.84	1.13

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
HOME	Homestead National Monument	0.38	0.38	0.38	0.43	0.43	0.43	-0.05	-0.05	-0.05
HOSP	Hot Springs National Park	-0.05	0.77	1.57	-0.05	0.00	0.07	0.00	0.76	1.53
HOVE	Hovenweep National Monument	0.17	0.29	0.53	-0.35	-0.27	-0.09	0.47	0.56	0.64
HUTR	Hubbell Trading Post National Historic Site	0.93	1.04	1.11	0.14	0.19	0.22	0.80	0.84	0.88
INDU	Indiana Dunes National Lakeshore	-5.37	0.62	5.20	0.50	0.99	1.74	-6.89	-0.88	4.47
ISRO	Isle Royale National Park	-1.85	-0.05	2.49	-0.31	0.33	0.79	-2.05	-0.23	2.09
JECA	Jewel Cave National Monument	0.57	0.65	0.83	0.33	0.40	0.60	0.15	0.25	0.32
JELA	Jean Lafitte National Historical Park and Preserve	-3.41	-1.82	-0.71	-0.31	-0.13	0.05	-3.31	-1.70	-0.64
JODA	John Day Fossil Beds National Monument	-0.30	-0.18	-0.06	-0.19	-0.05	0.15	-0.20	-0.13	-0.08
JODR	John D. Rockefeller, Jr., Memorial Parkway	0.71	1.32	2.62	0.74	1.38	2.78	-0.40	-0.06	-0.03
JOFL	Johnstown Flood National Memorial	-0.23	-0.23	-0.23	0.64	0.64	0.64	-0.87	-0.87	-0.87
JOMU	John Muir National Historic Site	0.73	0.98	1.85	0.86	1.02	1.07	-0.34	-0.05	0.99
JOTR	Joshua Tree National Park	-0.83	0.65	1.56	-0.32	-0.04	0.24	-0.60	0.68	1.47
KAWW	Katahdin Woods And Waters National Monument	-0.19	0.23	0.83	-0.25	0.22	0.88	-0.20	0.01	0.36
KEMO	Kennesaw Mountain National Battlefield Park	-2.06	0.05	1.88	-0.76	-0.59	-0.47	-1.39	0.64	2.39
KICA	Kings Canyon National Park	1.52	3.30	5.14	-0.74	0.73	1.97	1.32	2.56	4.17
KIMO	Kings Mountain National Military Park	-0.79	-0.31	-0.10	0.43	0.47	0.53	-1.24	-0.78	-0.64
KNRI	Knife River Indian Villages National Historic Site	-1.84	-1.64	-0.84	-0.97	-0.92	-0.91	-0.87	-0.71	0.07
LABE	Lava Beds National Monument	-0.50	0.10	1.03	0.03	0.19	0.79	-0.58	-0.09	0.24

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
LAKE	Lake Mead National Recreation Area	-0.67	0.55	1.41	-0.42	-0.11	0.21	-0.67	0.66	1.49
LAMR	Lake Meredith National Recreation Area	-0.52	0.02	0.71	-0.59	-0.14	0.48	-0.13	0.16	0.40
LARO	Lake Roosevelt National Recreation Area	-0.27	0.01	0.47	0.00	0.17	0.58	-0.46	-0.16	0.17
LAVO	Lassen Volcanic National Park	-0.49	0.45	1.42	-0.19	0.78	1.64	-0.55	-0.33	-0.08
LEWI	Lewis and Clark National Historical Park	-0.36	0.06	1.26	0.42	0.57	0.83	-0.86	-0.50	0.70
LIBI	Little Bighorn Battlefield National Monument	-0.04	-0.01	0.11	-0.01	0.02	0.12	-0.03	-0.03	-0.01
LIBO	Lincoln Boyhood National Memorial	0.06	0.06	0.06	0.25	0.25	0.25	-0.20	-0.20	-0.20
LIRI	Little River Canyon National Preserve	-0.29	0.37	0.64	0.08	0.34	0.65	-0.41	0.04	0.20
LYJO	Lyndon B. Johnson National Historical Park	0.08	0.16	0.31	-0.18	-0.11	0.15	0.09	0.27	0.32
MABI	Marsh-Billings-Rockefeller National Historical Park	-0.48	-0.40	-0.36	0.21	0.29	0.32	-0.69	-0.69	-0.69
MACA	Mammoth Cave National Park	-0.20	0.37	0.95	-0.11	0.08	0.27	-0.16	0.29	0.83
MANA	Manassas National Battlefield Park	-0.55	-0.30	0.01	-0.43	-0.22	-0.17	-0.12	-0.08	0.35
MANZ	Manzanar National Historic Site	1.57	1.57	1.57	-0.44	-0.44	-0.44	2.01	2.01	2.01
MEVE	Mesa Verde National Park	0.14	0.56	0.78	-0.79	-0.09	0.09	0.34	0.65	0.98
MIMA	Minute Man National Historical Park	-0.22	0.01	0.14	-0.19	0.04	0.09	-0.29	-0.03	0.23
MISS	Mississippi National River and Recreation Area	-2.36	-0.49	2.74	-0.78	-0.42	0.02	-1.89	-0.07	3.16
MNRR	Missouri National Recreation River	-0.02	0.54	1.35	-0.61	0.28	0.90	-0.12	0.27	1.25
MOCA	Montezuma Castle National Monument	0.22	0.31	0.64	-0.19	-0.17	-0.10	0.41	0.49	0.83
MOCR	Moore's Creek National Battlefield	1.06	1.06	1.06	1.69	1.69	1.69	-0.64	-0.64	-0.64

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
MOJA	Mojave National Preserve	-0.05	0.96	2.16	-0.57	-0.10	0.21	-0.03	1.06	2.35
MONO	Monocacy National Battlefield	-1.56	-1.05	-0.28	-0.49	-0.42	-0.33	-1.08	-0.62	0.19
MORA	Mount Rainier National Park	-1.02	0.50	2.08	-0.36	0.90	2.46	-1.10	-0.40	0.25
MORR	Morristown National Historical Park	-0.27	-0.04	0.01	-0.32	-0.08	-0.03	0.01	0.04	0.05
MORU	Mount Rushmore National Memorial	0.29	0.38	0.53	-0.19	-0.14	-0.05	0.48	0.52	0.58
MUWO	Muir Woods National Monument	0.41	1.51	1.83	1.46	2.86	3.25	-1.45	-1.35	0.37
NABR	Natural Bridges National Monument	0.61	1.08	1.92	-0.12	0.07	0.72	0.57	1.01	1.21
NACE	National Capital Parks-East	-0.59	-0.33	-0.30	-0.94	-0.20	-0.12	-0.18	-0.13	0.36
NATR	Natchez Trace Parkway	-2.52	0.03	1.98	-0.74	0.12	0.84	-1.97	-0.09	1.44
NAVA	Navajo National Monument	0.18	0.42	0.53	-0.31	-0.26	-0.15	0.44	0.67	0.81
NEPE	Nez Perce National Historical Park	-0.27	0.12	0.60	-0.22	0.20	0.68	-0.48	-0.08	0.12
NERI	New River Gorge National River	-1.56	-0.63	0.40	-1.26	-0.56	0.22	-0.40	-0.07	0.33
NIOB	Niobrara National Scenic River	-1.54	-1.05	-0.12	-1.81	-1.20	-0.08	-0.20	0.15	0.41
NISI	Ninety Six National Historic Site	-1.01	-0.98	-0.96	-0.57	-0.55	-0.53	-0.44	-0.44	-0.44
NOCA	North Cascades National Park	-0.96	0.49	1.91	-0.74	0.79	2.11	-0.67	-0.30	0.05
OBRI	Obed Wild and Scenic River	-0.46	-0.33	0.25	-0.39	-0.27	0.08	-0.27	-0.06	0.30
OCMU	Ocmulgee National Monument	-2.45	-0.84	-0.32	-0.27	-0.17	-0.15	-2.18	-0.67	-0.17
OLYM	Olympic National Park	-0.69	0.94	2.53	-0.03	1.10	2.60	-1.12	-0.17	0.79
ORCA	Oregon Caves National Monument	1.39	1.51	1.75	1.46	1.56	1.83	-0.08	-0.05	-0.01

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
ORPI	Organ Pipe Cactus National Monument	0.35	0.65	0.91	-0.10	0.08	0.33	0.44	0.57	0.72
OZAR	Ozark National Scenic Riverway	0.18	0.84	1.39	-0.13	0.47	0.77	-0.04	0.37	0.94
PAAL	Palo Alto Battlefield National Historical Park	1.65	1.66	1.70	0.91	0.92	0.95	0.74	0.74	0.74
PAIS	Padre Island National Seashore	1.12	1.53	3.33	0.72	0.85	0.95	-1.13	0.59	2.48
PARA	Grand Canyon-Parashant National Monument	-1.21	0.42	1.83	-0.54	0.01	0.68	-0.77	0.41	1.48
PECO	Pecos National Historical Park	0.02	0.57	0.69	0.11	0.16	0.22	-0.09	0.42	0.48
PEFO	Petrified Forest National Park	0.74	1.03	1.50	0.20	0.28	0.38	0.47	0.76	1.19
PERI	Pea Ridge National Military Park	-2.04	-0.69	-0.04	-0.46	-0.34	-0.30	-1.67	-0.35	0.32
PETE	Petersburg National Battlefield	-4.58	-0.57	0.93	-0.80	-0.28	0.04	-3.79	-0.29	0.89
PETR	Petroglyph National Monument	-1.74	0.35	1.52	-0.22	-0.16	-0.05	-1.62	0.51	1.71
PINN	Pinnacles National Park	-0.59	-0.36	-0.15	0.03	0.10	0.13	-0.62	-0.47	-0.26
PIPE	Pipestone National Monument	2.05	2.13	2.28	1.89	1.98	2.13	0.15	0.15	0.15
PIRO	Pictured Rocks National Lakeshore	-2.09	0.20	3.05	0.47	1.30	1.78	-3.03	-1.13	1.92
PISP	Pipe Spring National Monument	-0.05	-0.05	-0.05	-0.45	-0.45	-0.45	0.41	0.41	0.41
PORE	Point Reyes National Seashore	-0.51	1.12	4.10	0.61	1.18	2.13	-1.45	-0.11	2.95
PRWI	Prince William Forest Park	-2.11	-0.34	0.08	0.01	0.12	0.27	-2.21	-0.47	-0.01
RABR	Rainbow Bridge National Monument	0.11	0.11	0.11	-0.29	-0.29	-0.29	0.40	0.40	0.40
REDW	Redwood National and State Parks	-0.01	1.19	2.86	0.16	1.13	2.74	-0.48	0.06	0.80
RICH	Richmond National Battlefield Park	-2.46	-0.91	0.10	-0.86	-0.54	-0.11	-2.10	-0.36	0.25

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
RIGR	Rio Grande Wild and Scenic River	0.36	0.59	1.02	-0.11	0.03	0.29	0.25	0.56	0.89
ROCR	Rock Creek Park	-0.97	-0.64	-0.40	-0.81	-0.52	-0.41	-0.16	-0.13	0.06
ROMO	Rocky Mountain National Park	-1.22	0.27	1.85	-1.26	0.05	1.18	-0.66	0.22	1.18
ROVA	Roosevelt-Vanderbilt National Historic Sites	-0.83	-0.83	-0.83	-0.53	-0.53	-0.53	-0.29	-0.29	-0.29
RUCA	Russell Cave National Monument	0.37	0.37	0.37	0.34	0.34	0.34	0.03	0.03	0.03
SAAN	San Antonio Missions National Historical Park	0.67	2.37	3.21	0.20	0.28	0.59	0.40	2.09	3.01
SACN	Saint Croix National Scenic Riverway	-0.59	0.05	0.73	-0.59	-0.09	0.48	-0.41	0.14	0.77
SAGA	Saint-Gaudens National Historic Site	-0.83	-0.78	-0.63	-0.30	-0.24	-0.18	-0.65	-0.54	-0.43
SAGU	Saguaro National Park	-0.10	0.58	1.43	-0.15	0.26	0.98	-0.21	0.32	0.99
SAHI	Sagamore Hill National Historic Site	-0.57	-0.57	-0.57	0.01	0.01	0.01	-0.58	-0.58	-0.58
SAIR	Saugus Iron Works National Historic Site	-0.20	-0.20	-0.20	0.05	0.05	0.05	-0.25	-0.25	-0.25
SAJH	San Juan Island National Historical Park	-3.20	-1.53	-0.29	-0.06	-0.04	-0.01	-3.15	-1.49	-0.28
SAMO	Santa Monica Mountains National Recreation Area	-3.30	0.15	13.00	-1.27	-0.22	0.40	-6.36	0.20	13.11
SAND	Sand Creek Massacre National Historic Site	-0.32	-0.21	0.09	-0.23	-0.13	0.04	-0.17	-0.07	0.25
SAPU	Salinas Pueblo Missions National Monument	0.47	0.48	0.50	0.14	0.15	0.17	0.33	0.33	0.33
SARA	Saratoga National Historical Park	-1.70	-1.69	-1.56	-1.36	-1.35	-1.23	-0.36	-0.34	-0.34
SCBL	Scotts Bluff National Monument	-2.51	-0.95	-0.28	-0.65	-0.51	-0.21	-1.86	-0.45	-0.06
SEKI	Sequoia and Kings Canyon National Parks	1.02	3.10	5.42	-0.55	0.34	1.83	1.42	2.76	4.82
SEQU	Sequoia National Park	1.24	2.53	3.82	-0.40	0.02	0.44	1.64	2.51	3.39

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
SHEN	Shenandoah National Park	-2.47	-0.24	2.54	-1.52	-0.53	0.73	-2.13	0.29	3.49
SHIL	Shiloh National Battlefield	0.04	0.11	0.31	0.02	0.10	0.26	0.00	0.01	0.07
SLBE	Sleeping Bear Dunes National Lakeshore	-2.92	-0.60	2.82	-0.68	0.11	1.10	-3.41	-0.67	2.75
STRI	Stones River National Battlefield	-1.31	-1.00	0.11	-0.11	-0.10	0.13	-1.21	-0.90	-0.02
SUCR	Sunset Crater Volcano National Monument	0.40	0.71	0.83	-0.20	0.14	0.28	0.55	0.56	0.60
TAPR	Tallgrass Prairie National Preserve	-0.82	-0.67	-0.45	-0.65	-0.52	-0.39	-0.17	-0.15	-0.02
THRO	Theodore Roosevelt National Park	-0.42	-0.11	0.45	-0.51	-0.29	-0.03	0.06	0.18	0.51
THST	Thomas Stone National Historic Site	-0.45	-0.20	0.19	-0.21	-0.19	-0.18	-0.23	-0.02	0.37
TICA	Timpanogos Cave National Monument	1.55	1.55	1.55	0.67	0.67	0.67	0.88	0.88	0.88
TIMU	Timucuan Ecological and Historic Preserve	-6.06	-2.55	1.85	-0.68	-0.35	-0.06	-5.61	-2.21	2.01
TONT	Tonto National Monument	-0.14	0.04	0.23	-0.36	-0.30	-0.18	0.11	0.34	0.41
TUMA	Tumacacori National Historical Park	0.65	0.75	0.76	-0.01	0.11	0.16	0.57	0.64	0.75
TUSK	Tule Springs Fossil Beds National Monument	0.09	0.85	1.70	-0.38	-0.31	-0.14	0.44	1.16	2.01
TUZI	Tuzigoot National Monument	0.01	0.01	0.01	-0.37	-0.37	-0.37	0.38	0.38	0.38
UPDE	Upper Delaware Scenic and Recreational River	-0.99	-0.38	0.39	-0.93	-0.45	0.33	-0.46	0.06	0.29
VAFO	Valley Forge National Historical Park	0.26	0.28	0.44	0.36	0.38	0.54	-0.10	-0.10	-0.10
VICK	Vicksburg National Military Park	-1.71	-0.15	0.93	-0.29	0.01	0.06	-1.42	-0.17	0.89
VOYA	Voyageurs National Park	-0.64	0.46	0.87	0.01	0.29	0.49	-0.83	0.16	0.72
WABA	Washita Battlefield National Historic Site	0.04	0.04	0.04	0.06	0.06	0.06	-0.02	-0.02	-0.02

Park Code	Park Name	Absolute Difference Between TDep and CMAQ Total N Deposition			Absolute Difference Between TDep and CMAQ Wet N Deposition			Absolute Difference Between TDep and CMAQ Dry N Deposition		
		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
WACA	Walnut Canyon National Monument	1.08	1.30	1.57	0.52	0.62	0.86	0.57	0.69	0.71
WEFA	Weir Farm National Historic Site	-0.79	-0.73	-0.71	-0.18	-0.10	-0.08	-0.64	-0.63	-0.61
WHIS	Whiskeytown-Shasta-Trinity National Recreation Area	-4.87	-1.81	-0.10	-2.43	-1.64	0.05	-2.43	-0.18	0.07
WHMI	Whitman Mission National Historic Site	-0.62	-0.62	-0.62	-0.23	-0.23	-0.23	-0.39	-0.39	-0.39
WHS	White Sands National Monument	0.08	0.46	0.76	-0.40	0.07	0.28	0.11	0.39	0.85
WICA	Wind Cave National Park	-0.53	-0.14	0.12	-0.36	-0.14	0.03	-0.37	0.00	0.16
WICR	Wilson's Creek National Battlefield	-1.03	-0.48	-0.13	-0.43	-0.41	-0.39	-0.61	-0.06	0.26
WOTR	Wolf Trap National Park for the Performing Arts	-0.47	-0.47	-0.47	-0.28	-0.28	-0.28	-0.19	-0.19	-0.19
WRBR	Wright Brothers National Memorial	0.32	0.35	0.37	0.65	0.73	0.82	-0.50	-0.38	-0.28
WUPA	Wupatki National Monument	-0.15	0.10	0.42	-0.42	-0.27	-0.05	0.27	0.37	0.53
YELL	Yellowstone National Park	-0.92	1.03	3.89	-0.69	1.09	4.09	-0.79	-0.06	0.73
YOSE	Yosemite National Park	0.44	2.12	4.19	0.24	1.46	3.54	-0.02	0.66	1.32
YUHO	Yucca House National Monument	0.67	0.67	0.67	-0.02	-0.02	-0.02	0.68	0.68	0.68
ZION	Zion National Park	-0.30	0.50	1.44	-0.77	-0.17	0.90	-0.30	0.68	1.10

Appendix C – Maps of Critical Load Exceedance for Lichen Species Richness for Selected National Parks

Figures C-1 through C-10 show maps of critical load exceedance for lichen species richness.

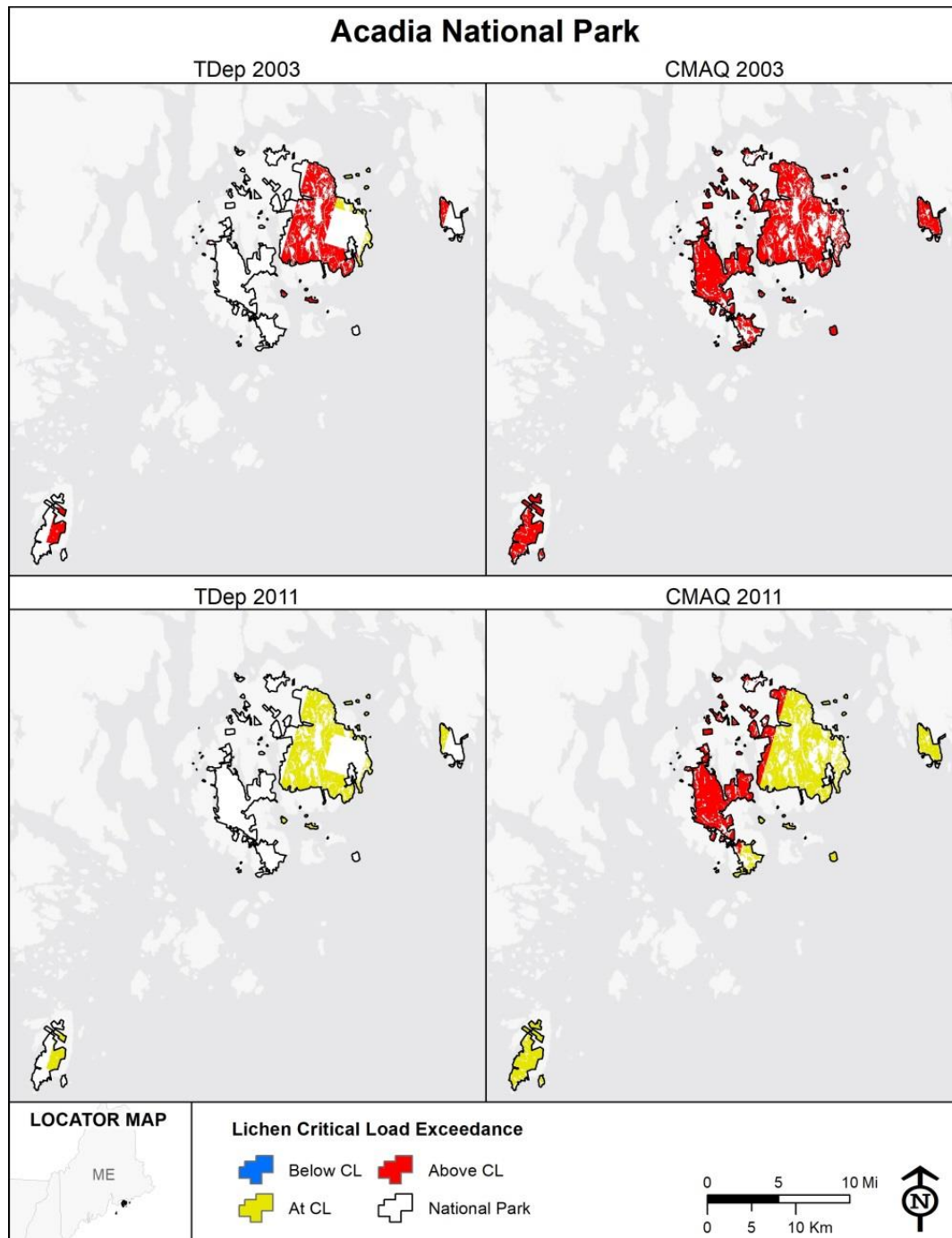


Figure C-1. Locations within Acadia National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

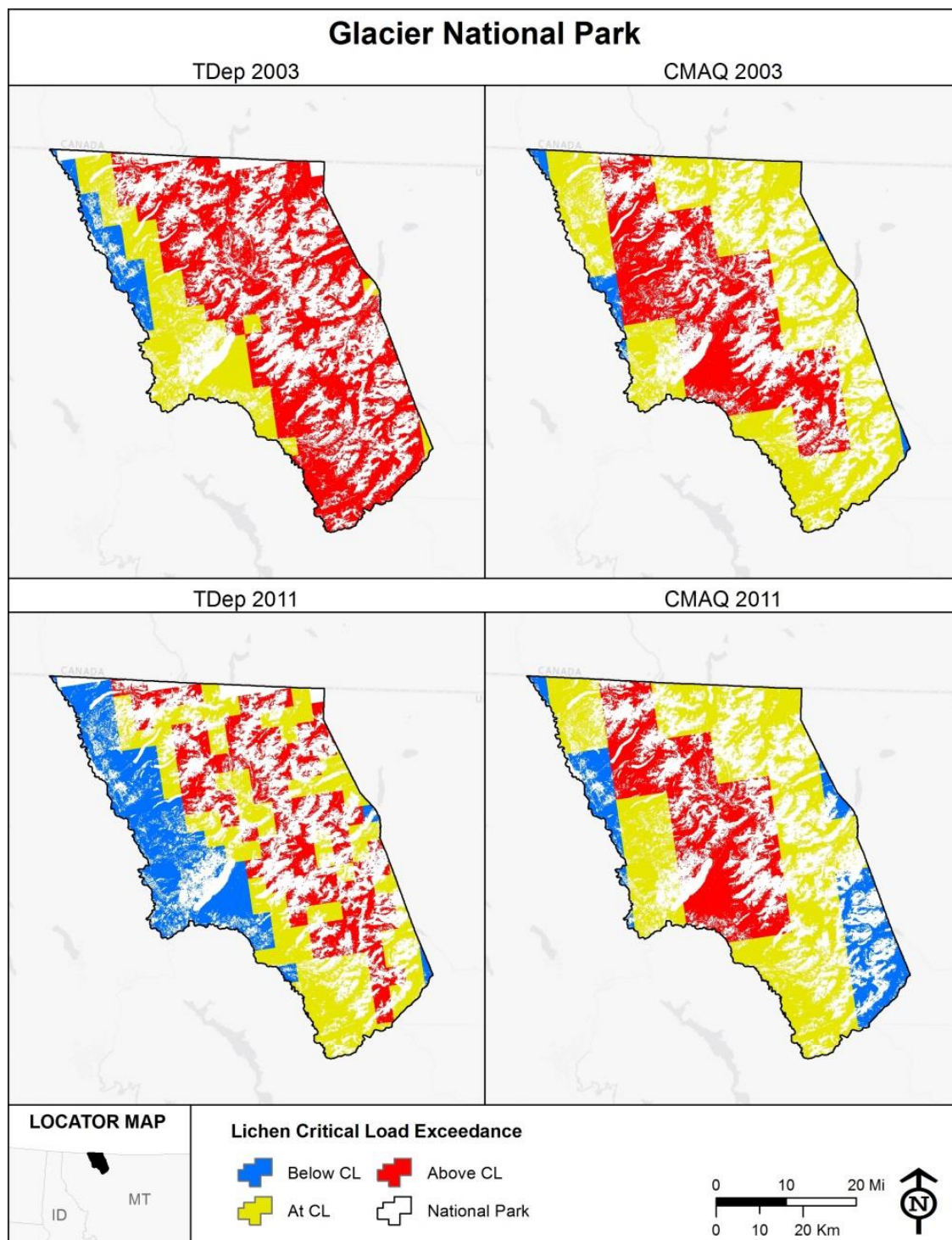


Figure C-2. Locations within Glacier National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

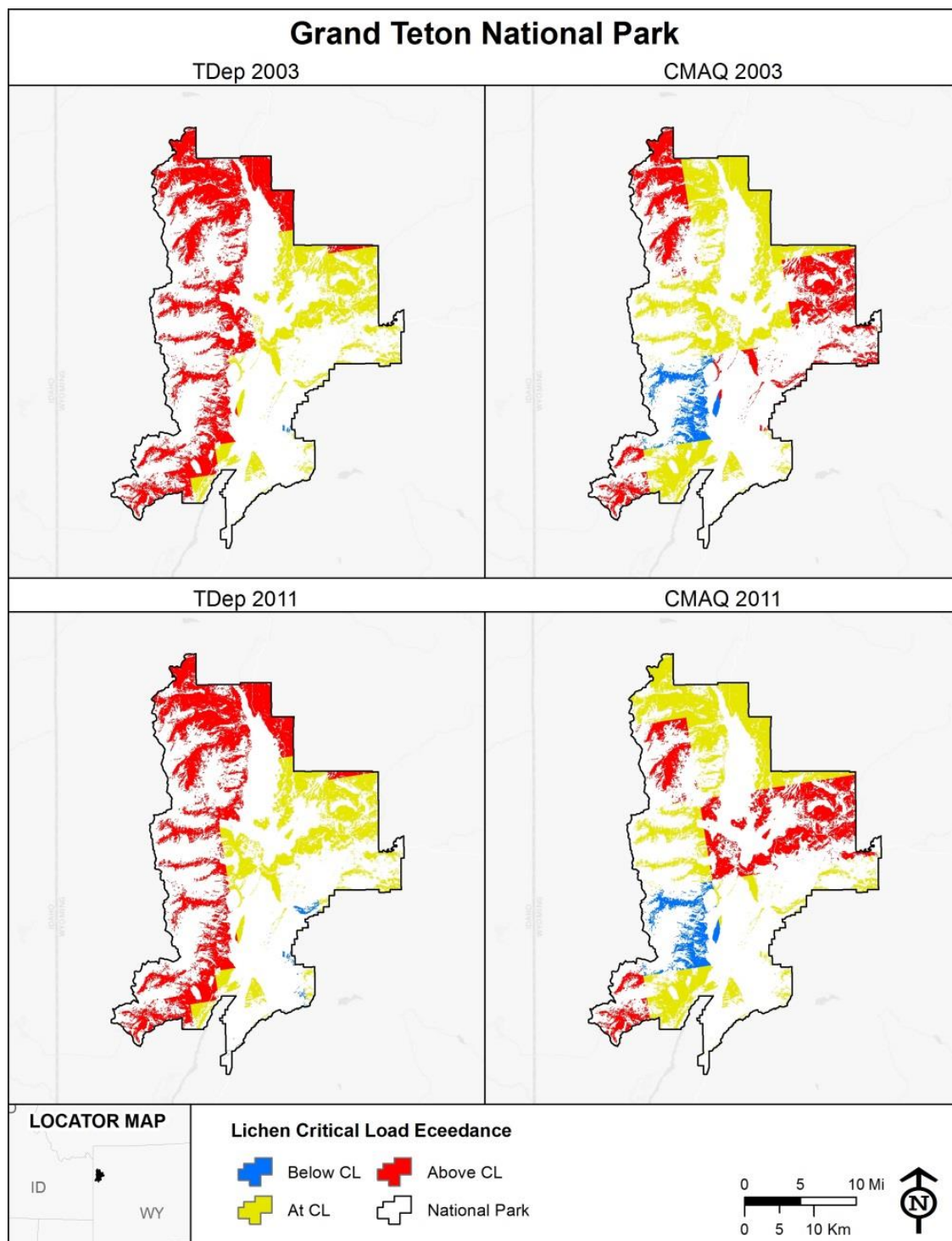


Figure C-3. Locations within Grand Teton National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

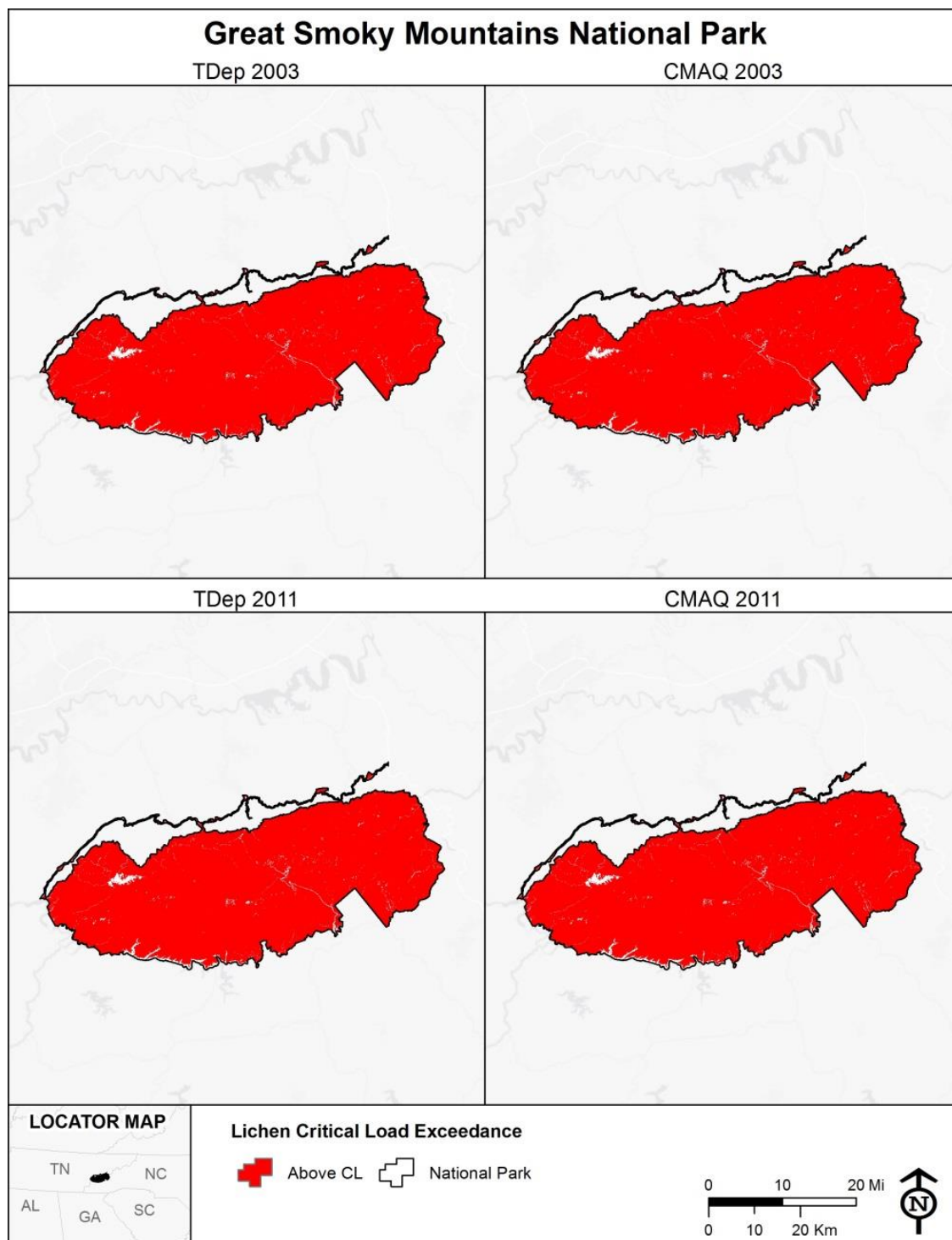


Figure C-4. Locations within Great Smoky Mountains National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

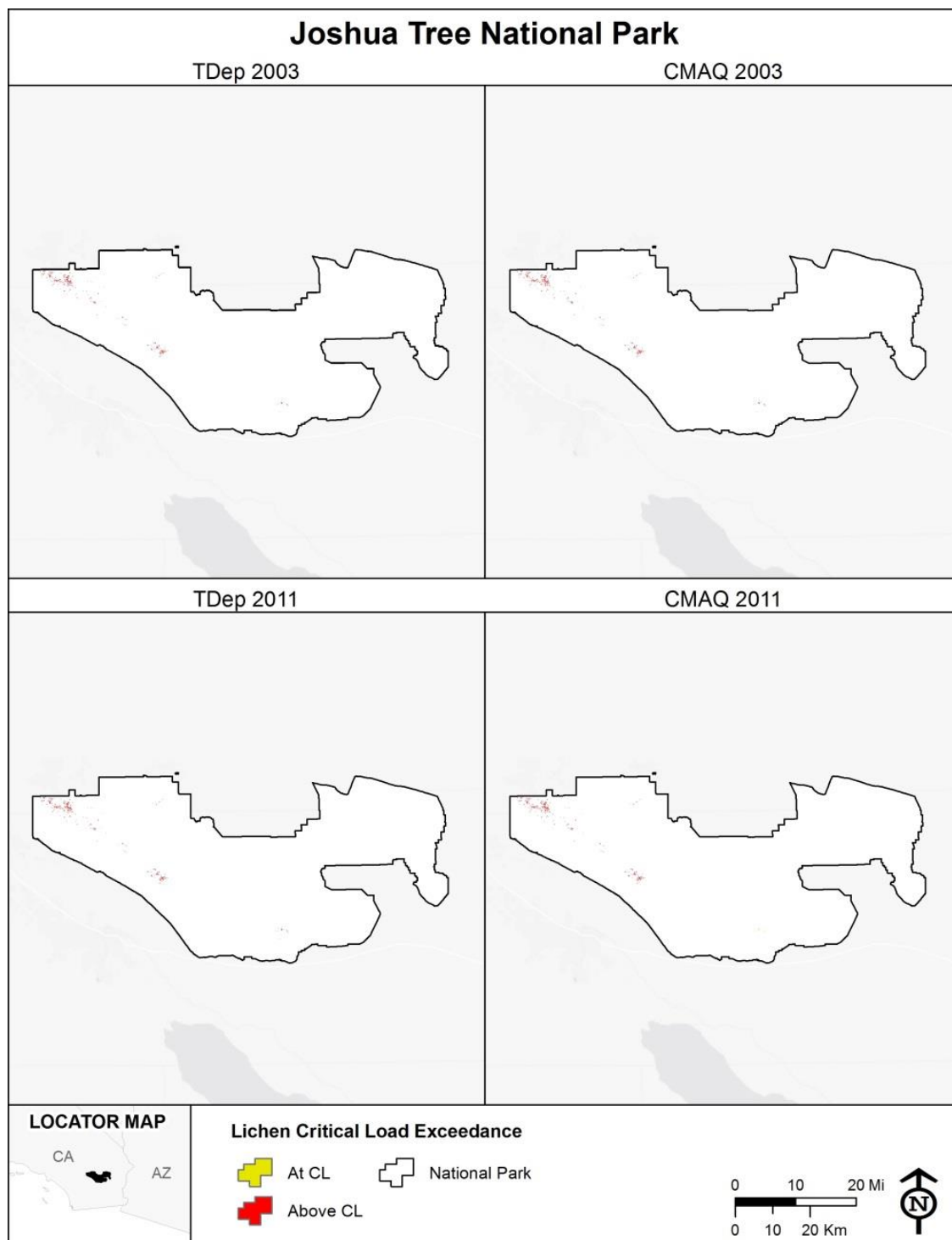


Figure C-5. Locations within Joshua Tree National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

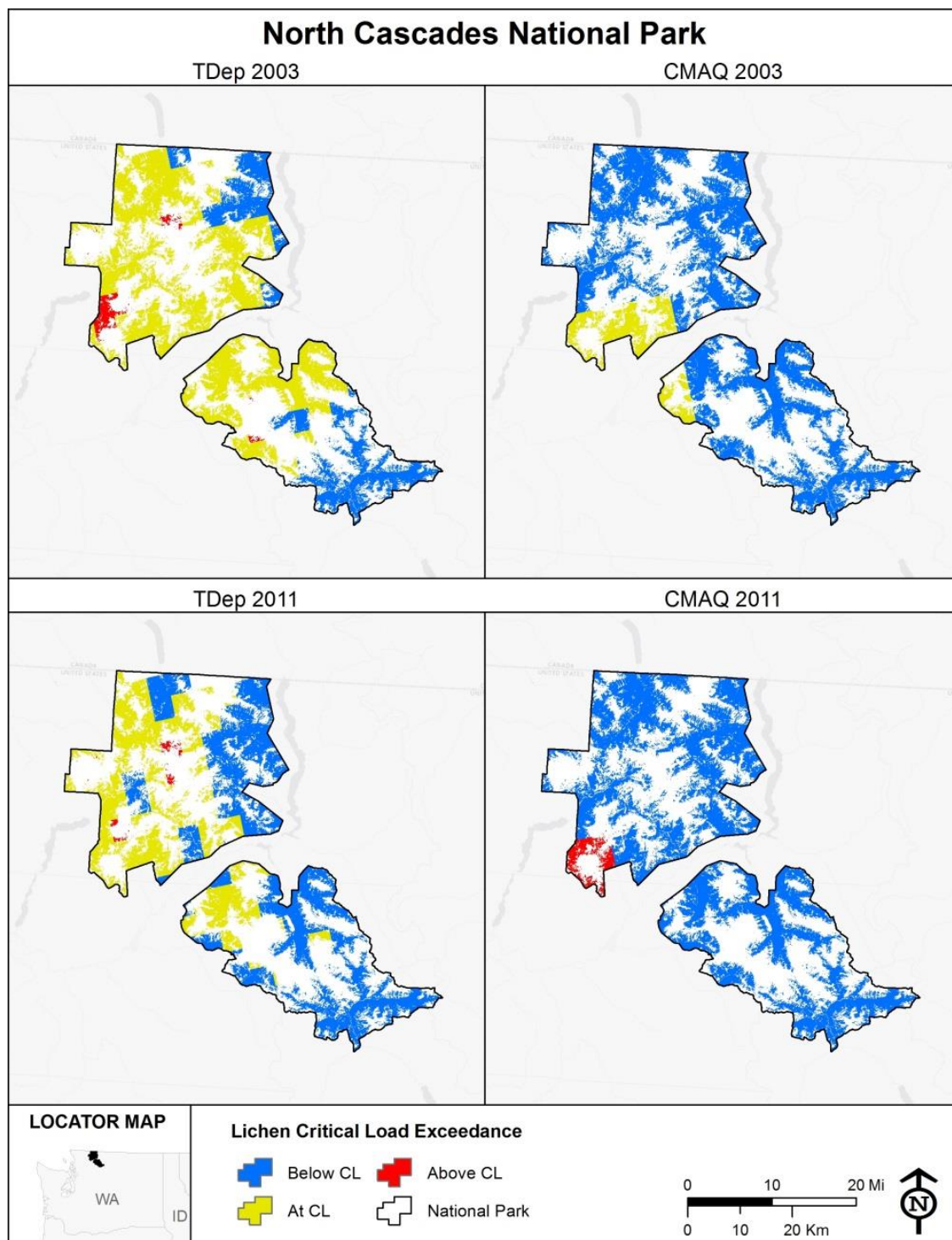


Figure C-6. Locations within North Cascades National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

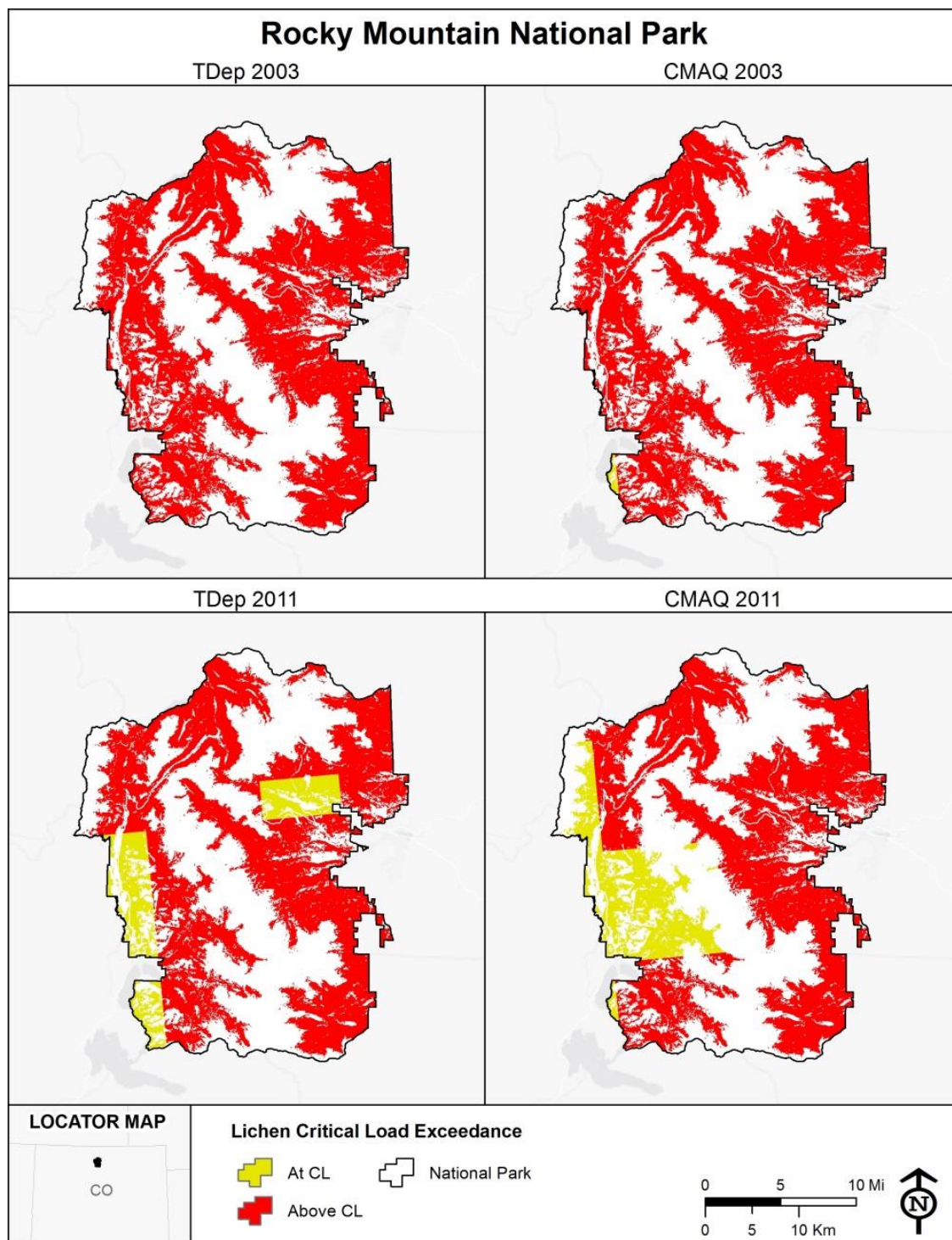


Figure C-7. Locations within Rocky Mountain National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

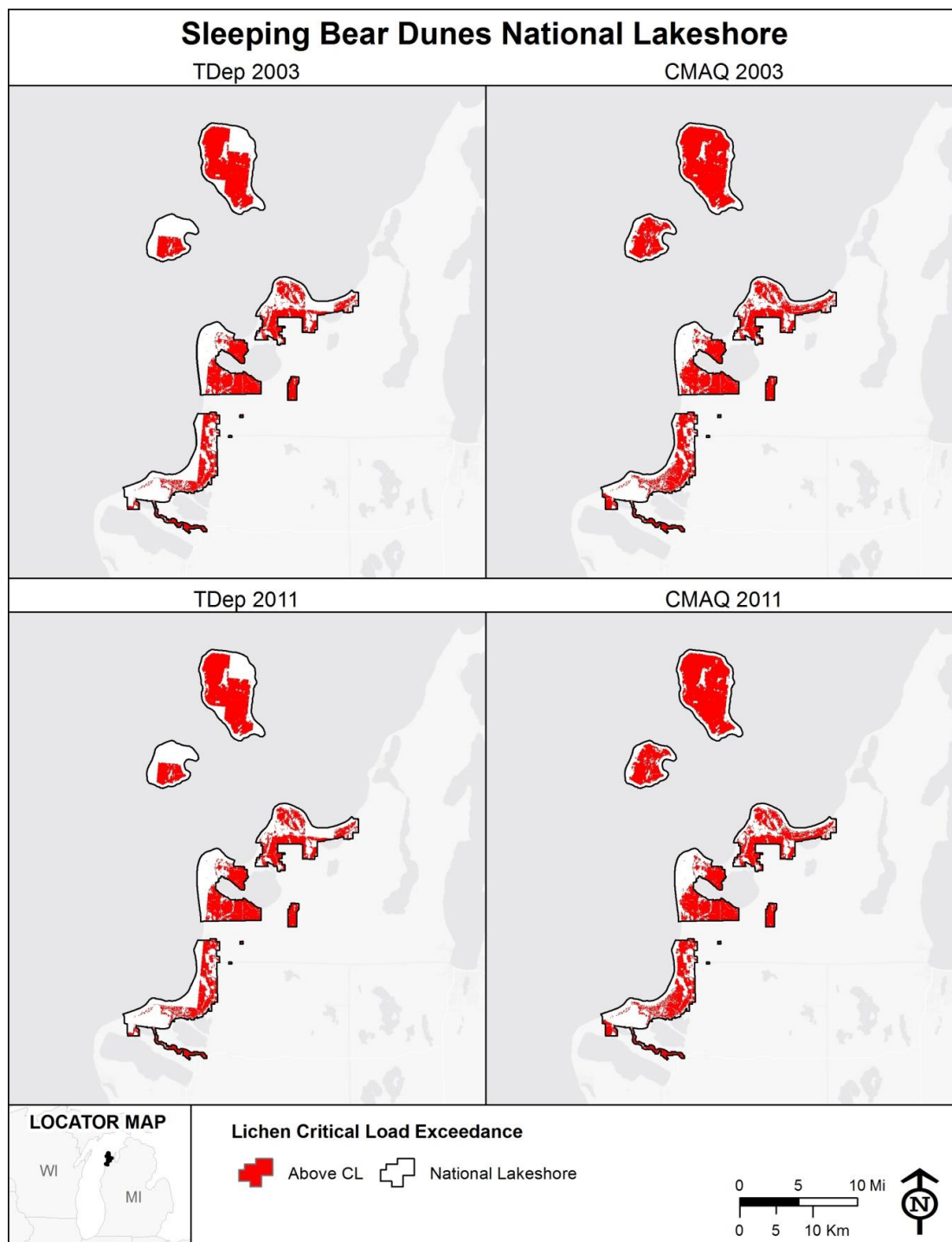


Figure C-8. Locations within Sleeping Bear Dunes National Lakeshore that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

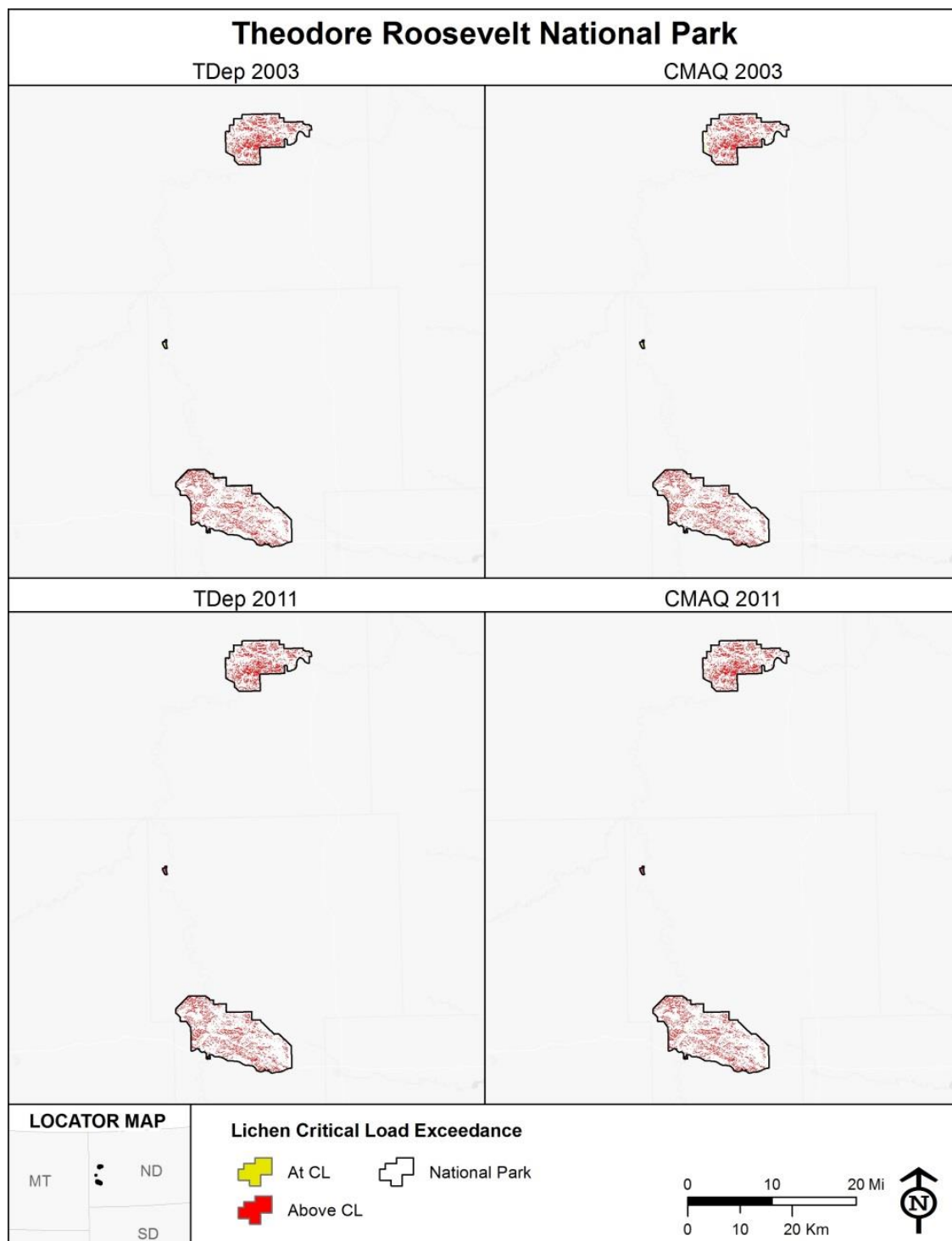


Figure C-9. Locations within Theodore Roosevelt National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

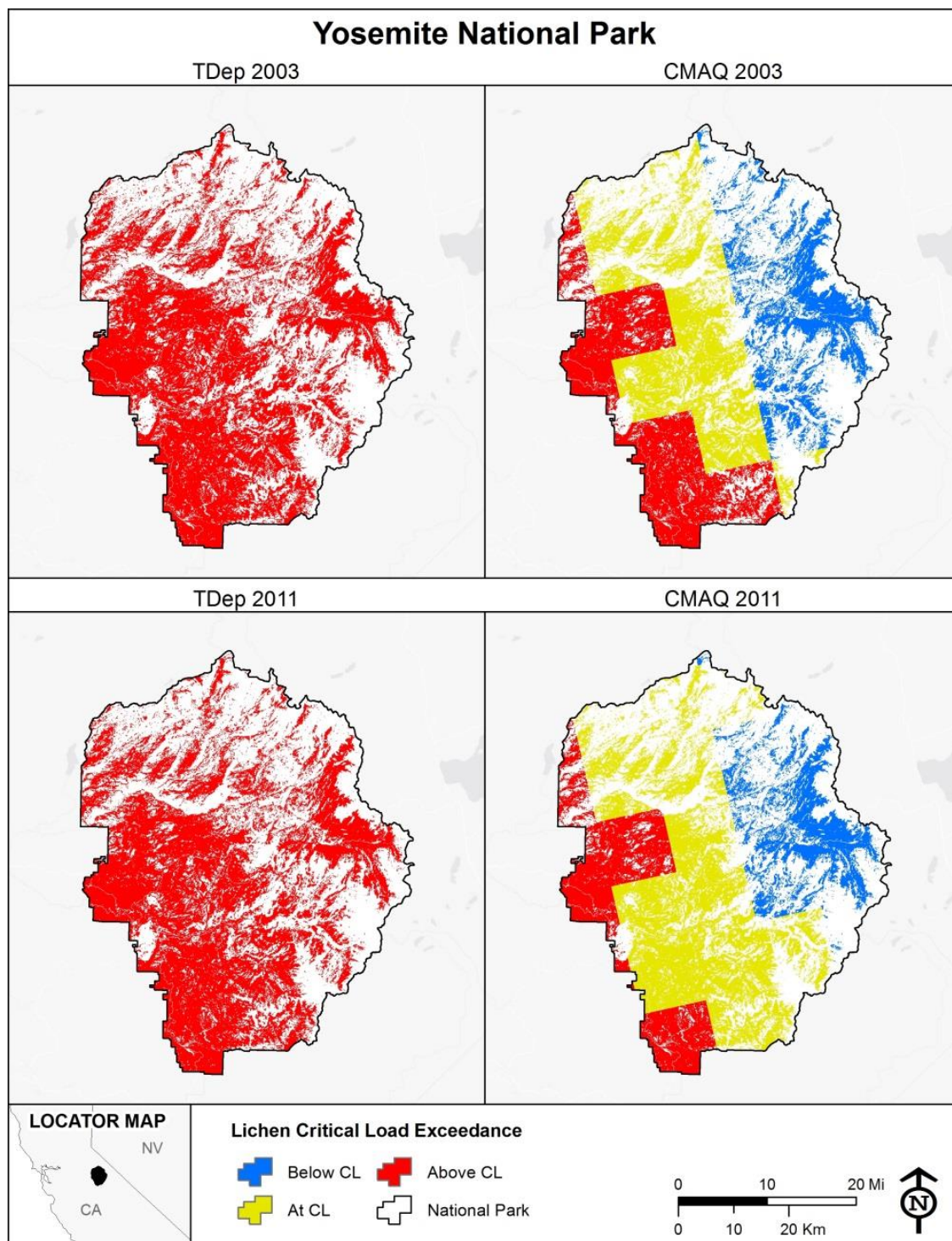


Figure C-10. Locations within Yosemite National Park that are either below, at, or above the critical load (CL) protective of lichen species richness (Geiser et al. 2019) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

Appendix D – Maps of Critical Load Exceedance for Herbaceous Species Richness for Selected National Parks

Figures D-1 through D-6 show maps of critical load exceedance for herbaceous species richness.



Figure D-1. Locations within Acadia National Park that are either below, at, or above the critical load (CL) protective of herbaceous species richness (Simkin et al. 2016) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

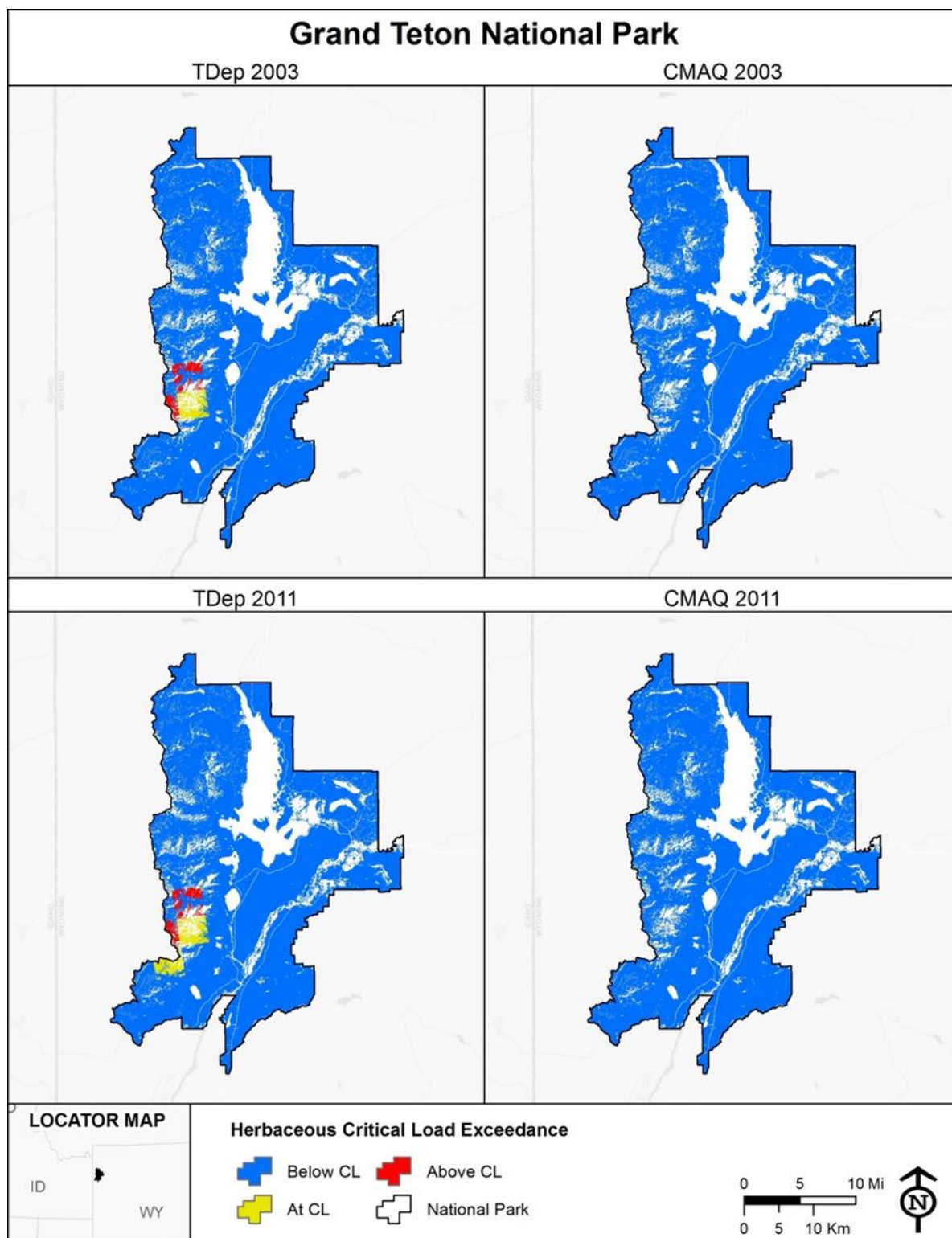


Figure D-2. Locations within Grand Teton National Park that are either below, at, or above the critical load (CL) protective of herbaceous species richness (Simkin et al. 2016) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

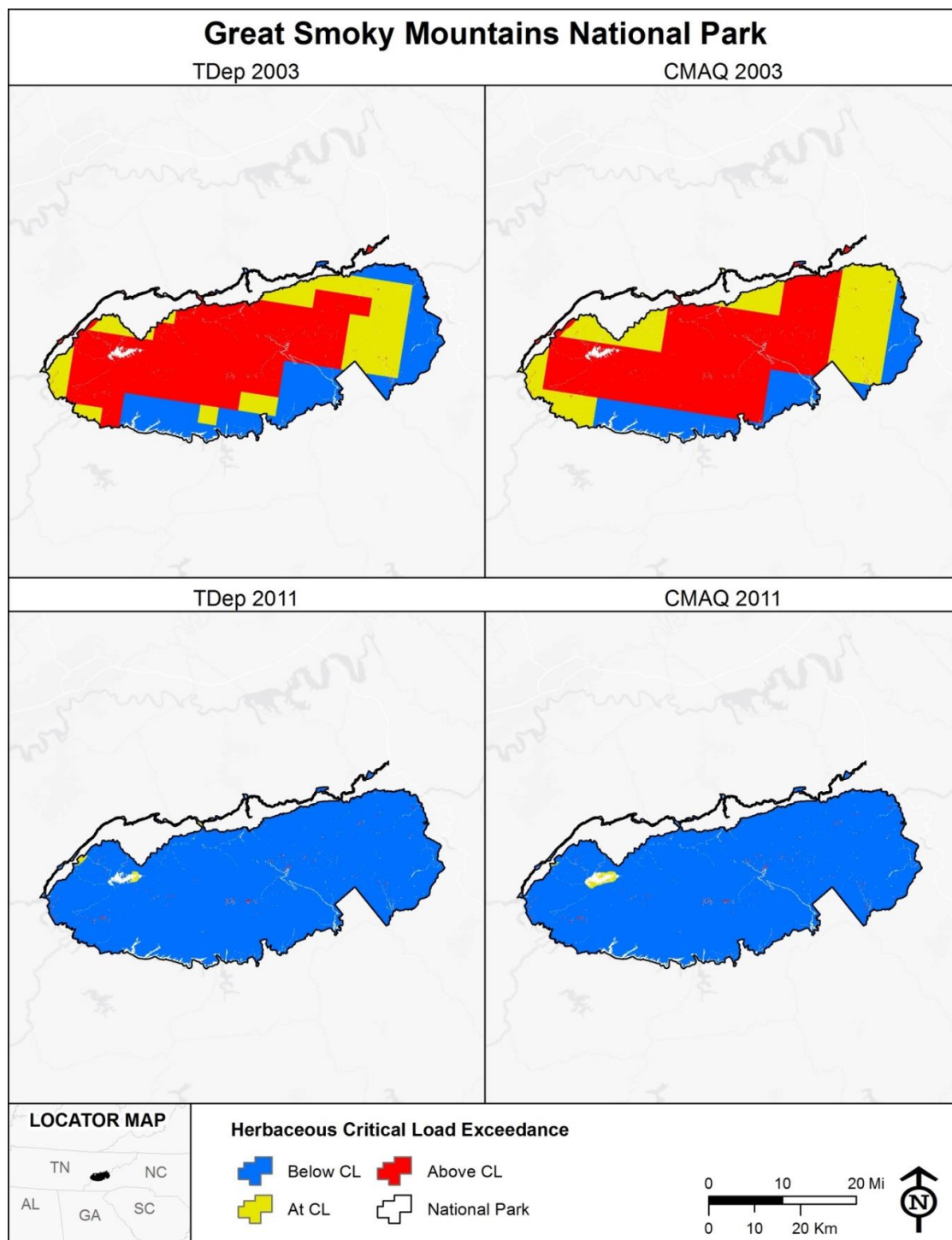
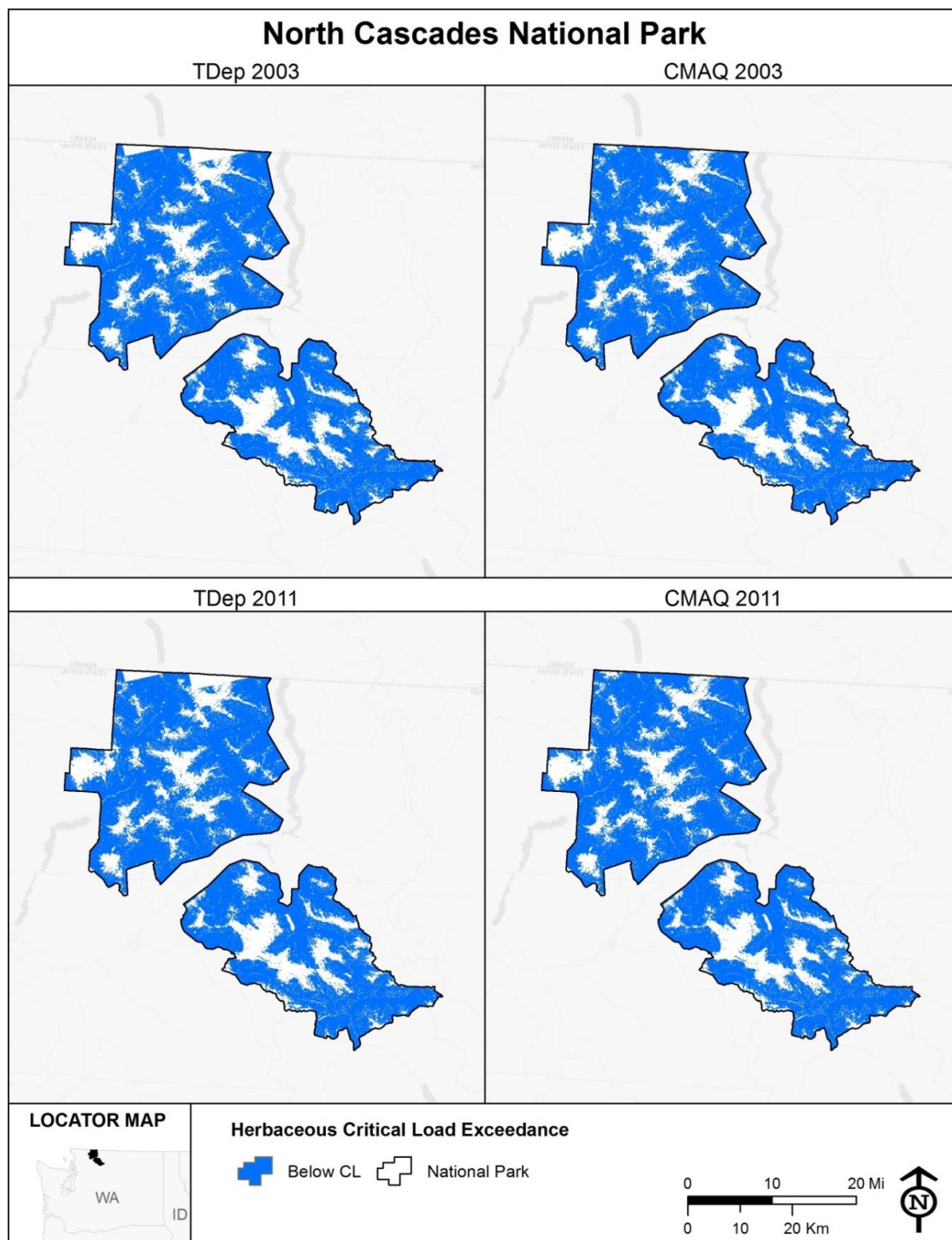


Figure D-3. Locations within Great Smoky Mountains National Park that are either below, at, or above the critical load (CL) protective of herbaceous species richness (Simkin et al. 2016) based on TDep and CMAQ total N deposition representative of 2003 and 2011.



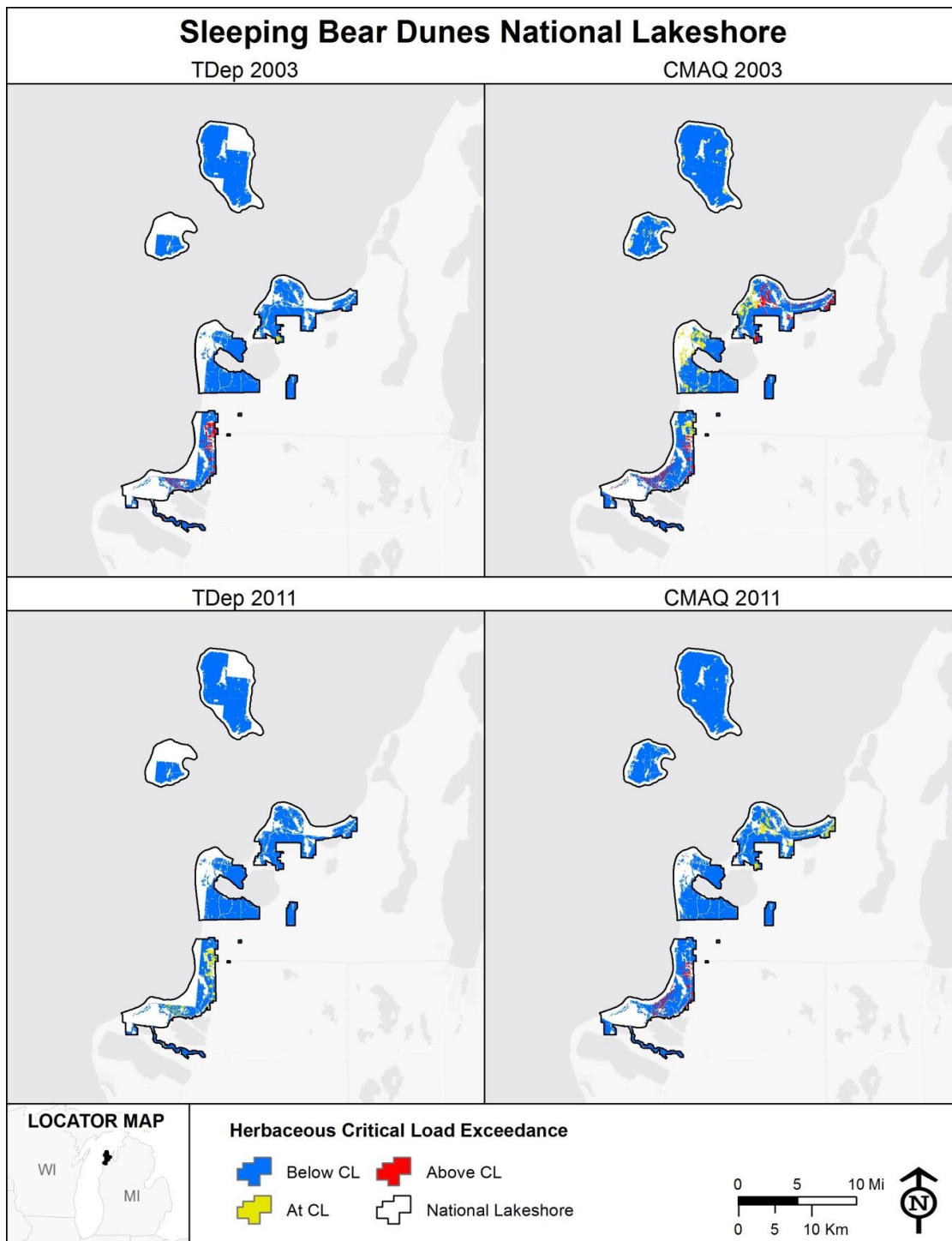


Figure D-5. Locations within Sleeping Bear Dunes National Lakeshore that are either below, at, or above the critical load (CL) protective of herbaceous species richness (Simkin et al. 2016) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

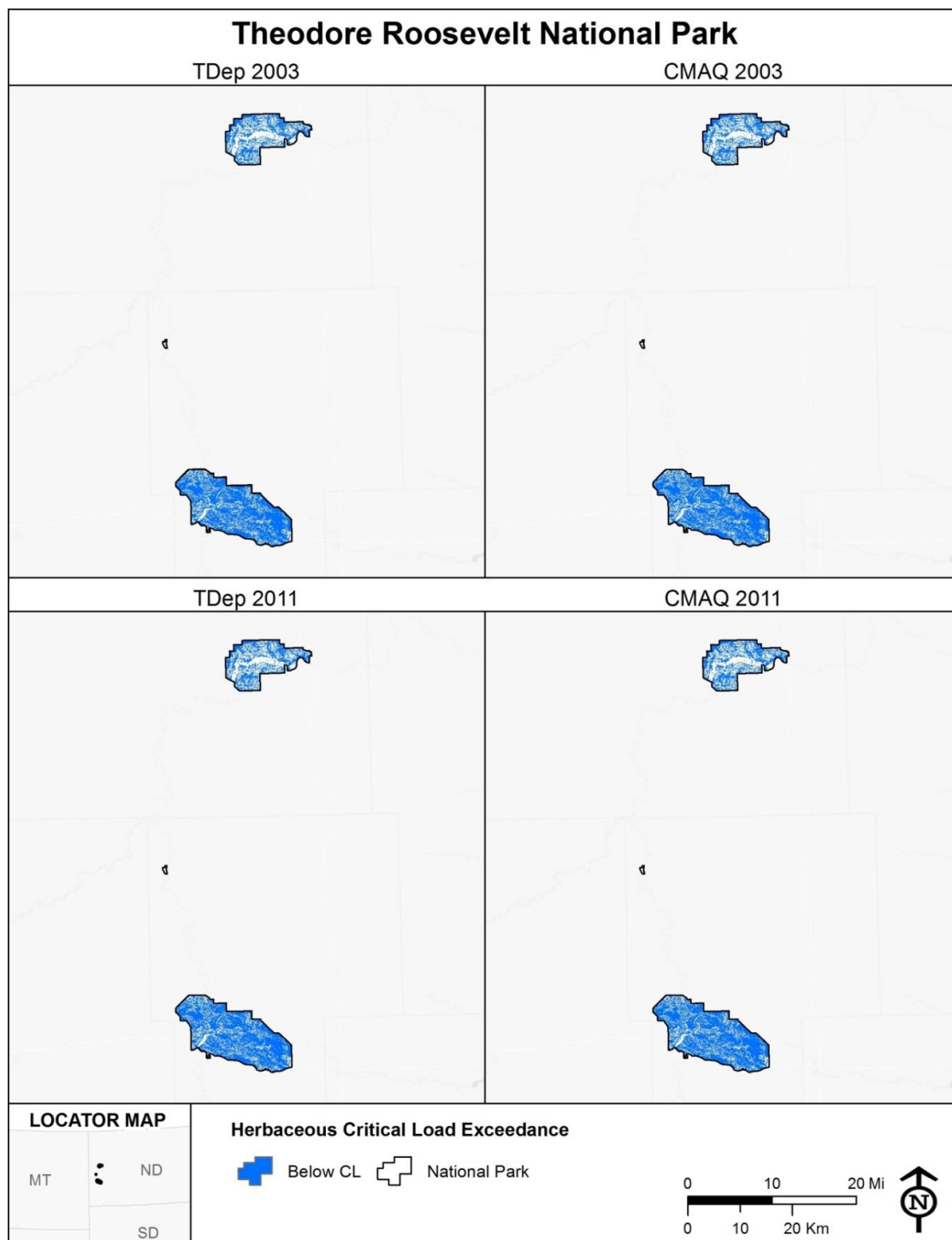


Figure D-6. Locations within Theodore Roosevelt National Park that are either below, at, or above the critical load (CL) protective of herbaceous species richness (Simkin et al. 2016) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

Appendix E – Maps of Critical Load Exceedance for Tree Growth and Survival for Selected National Parks

Figures E-1 through E-29 show maps of critical load exceedance for tree growth and survival.



Figure E-1. Locations within Acadia National Park included within various categories of percent decline in tree growth of Eastern Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

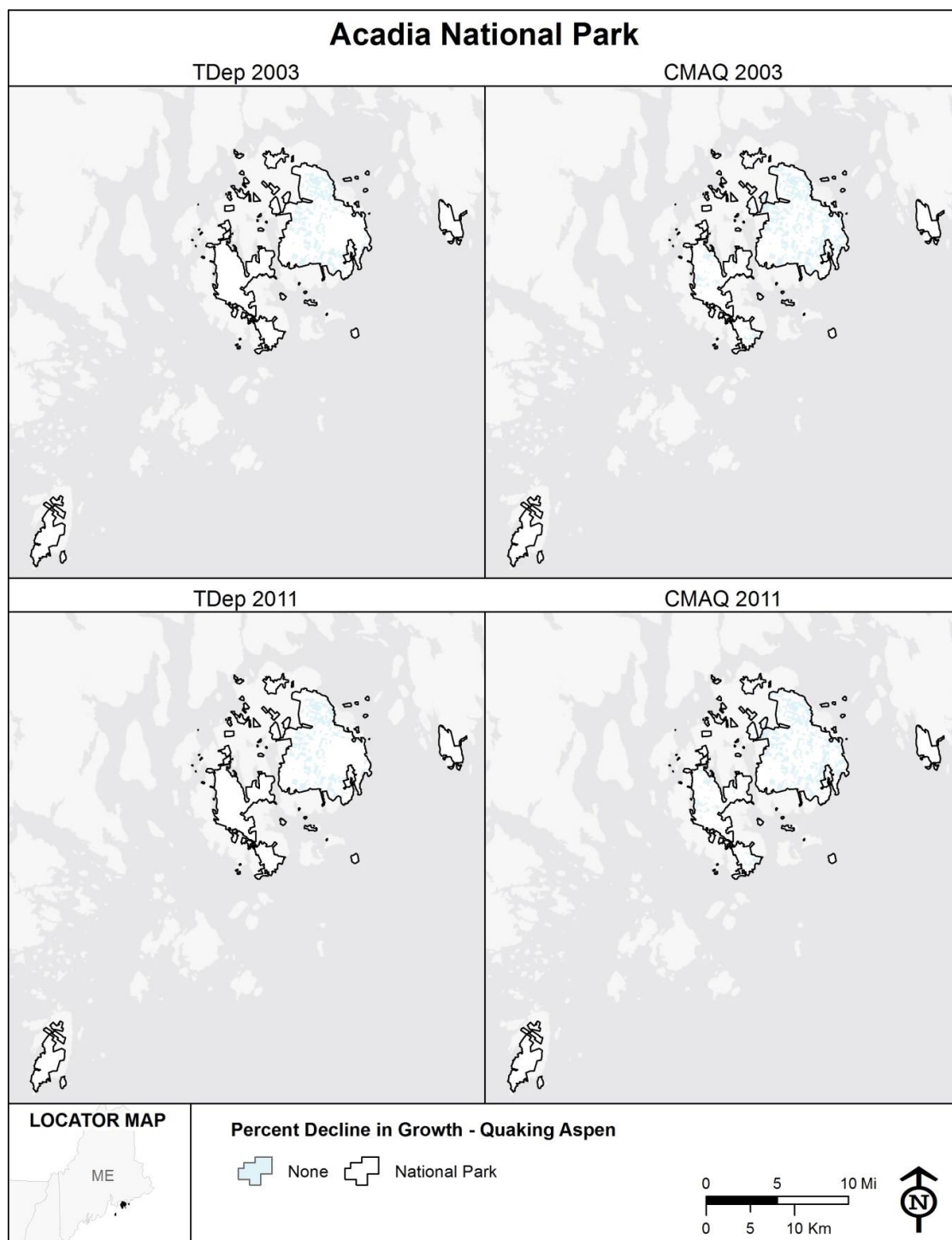


Figure E-2. Locations within Acadia National Park included within various categories of percent decline in tree growth of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

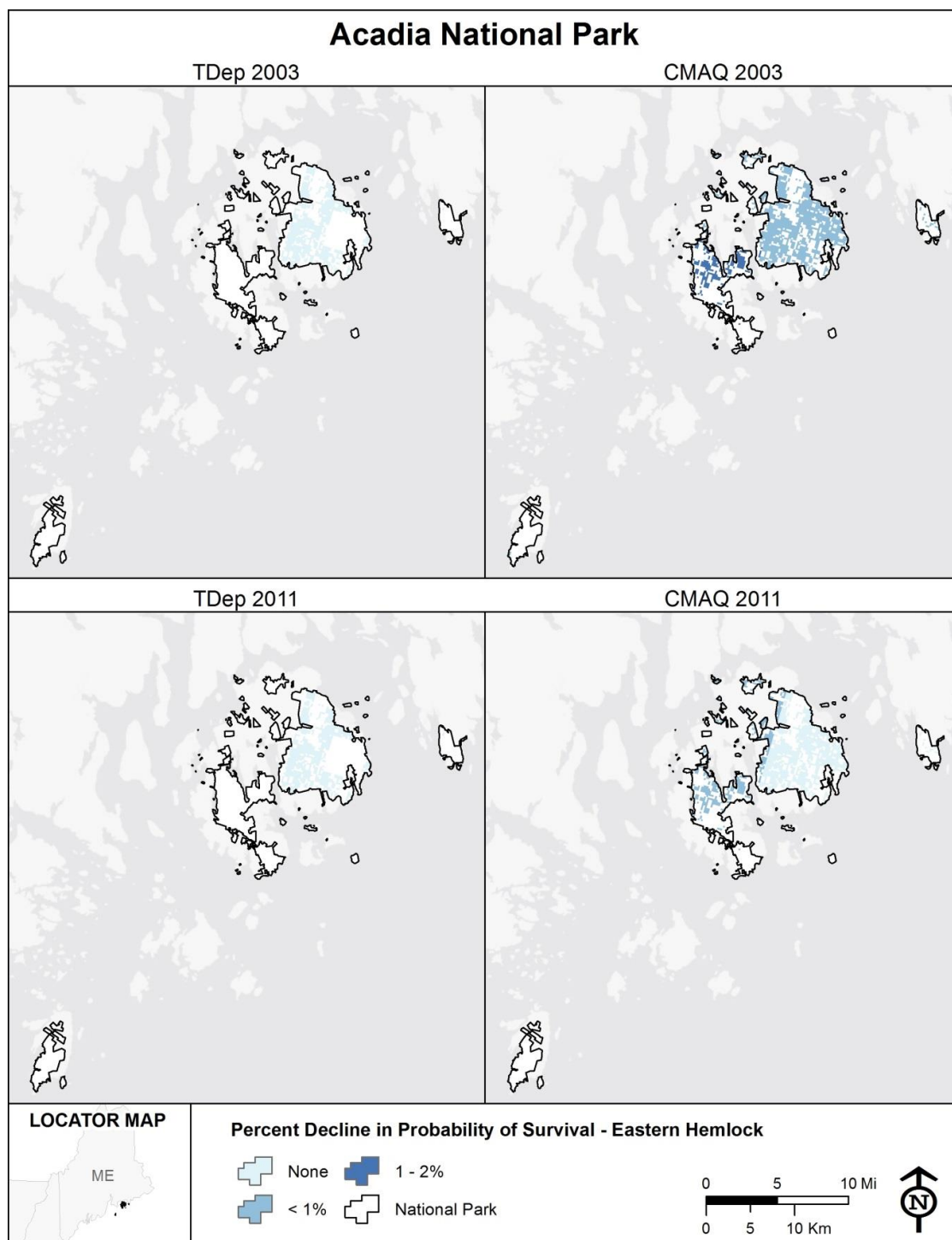


Figure E-3. Locations within Acadia National Park included within various categories of percent decline in probability of survival of Eastern Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

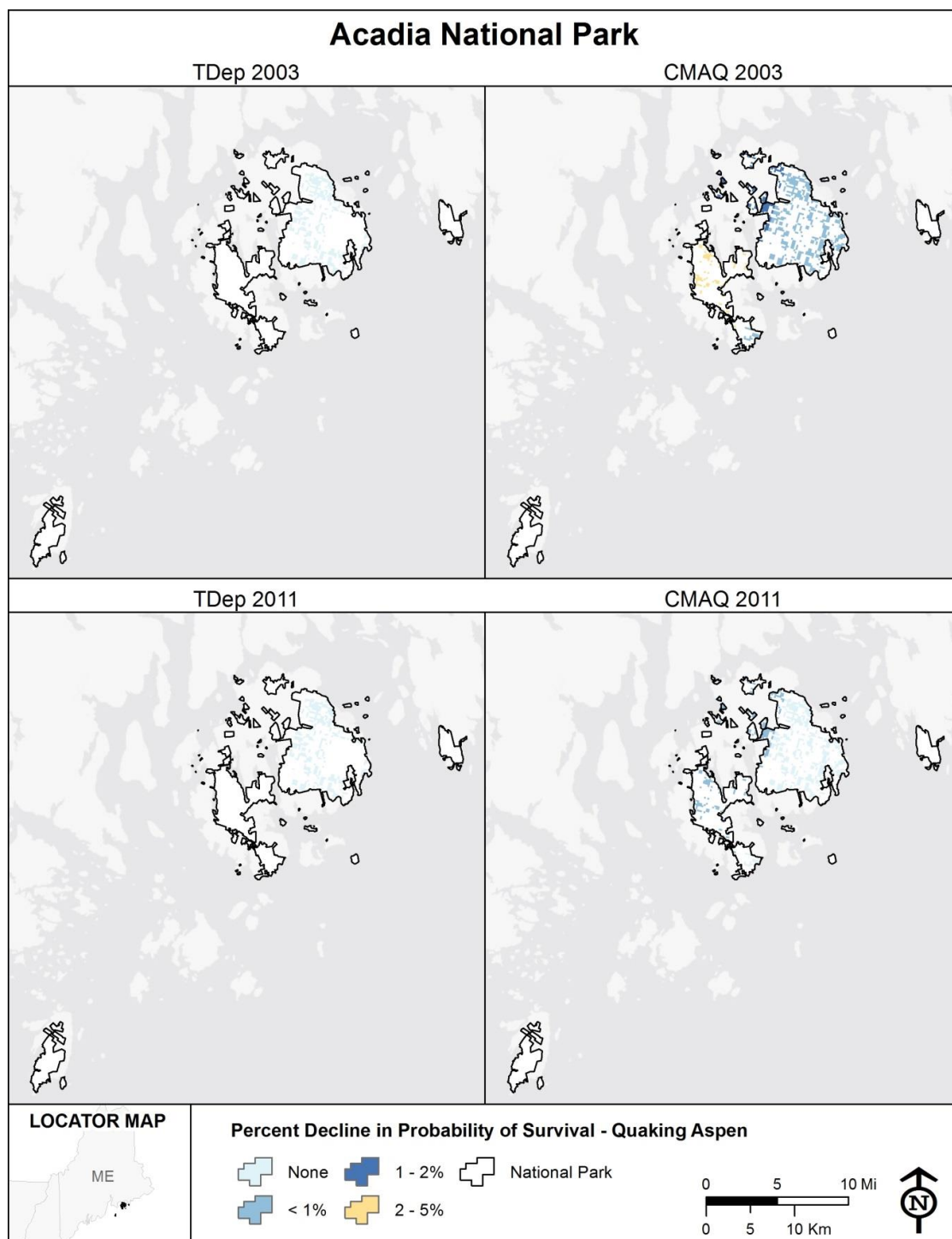


Figure E-4. Locations within Acadia National Park included within various categories of percent decline in probability of survival of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

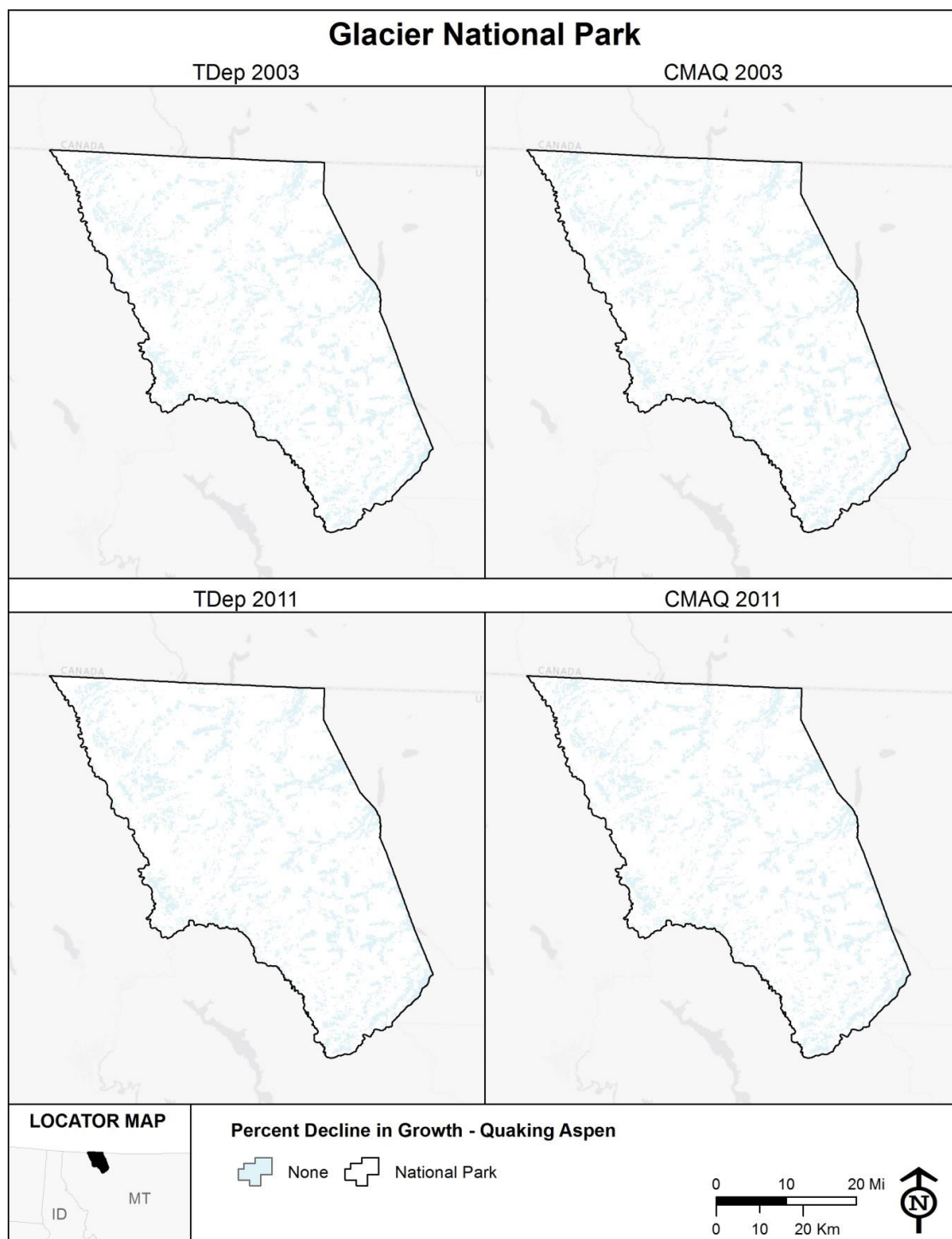


Figure E-5. Locations within Glacier National Park included within various categories of percent decline in tree growth of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

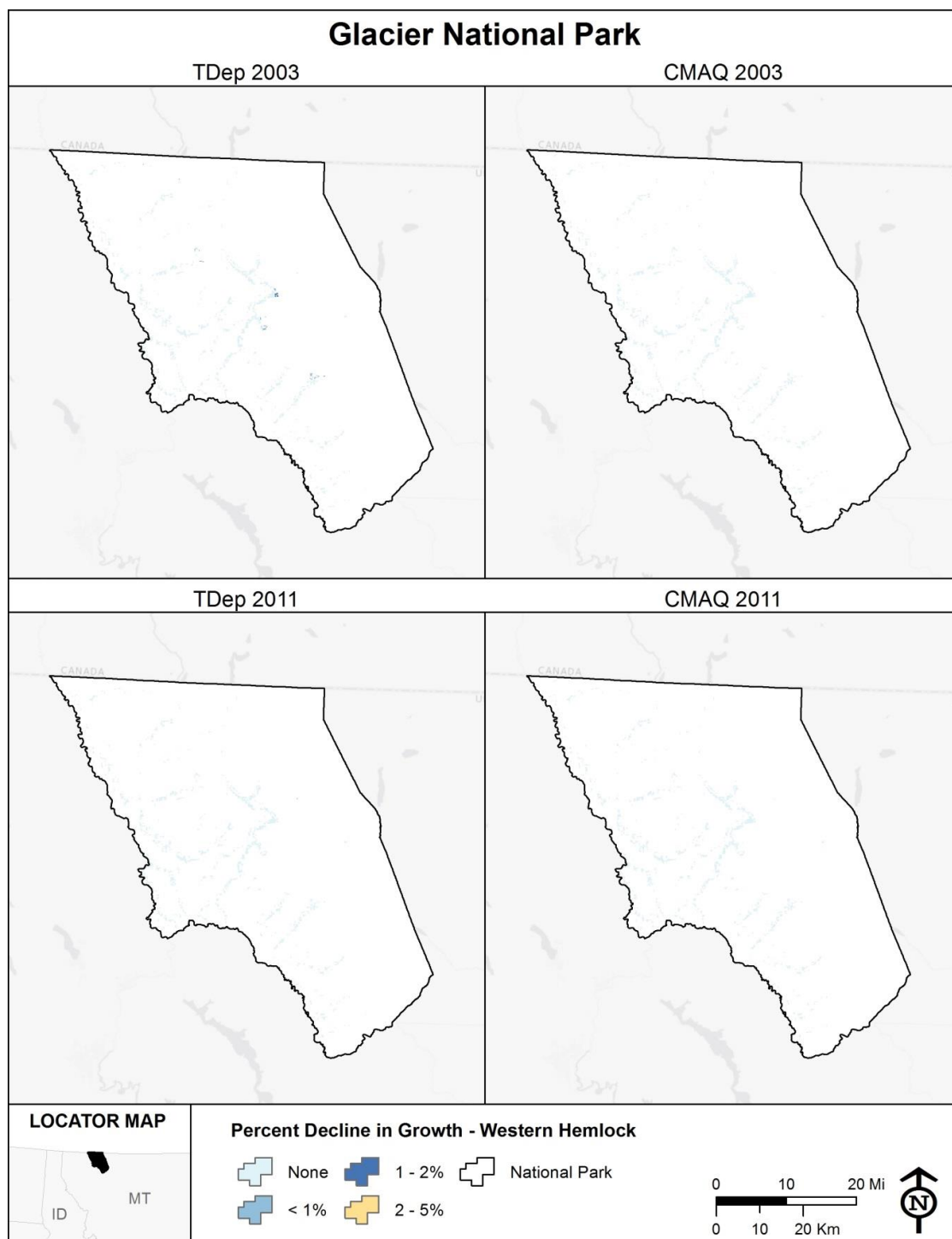


Figure E-6. Locations within Glacier National Park included within various categories of percent decline in tree growth of Western Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

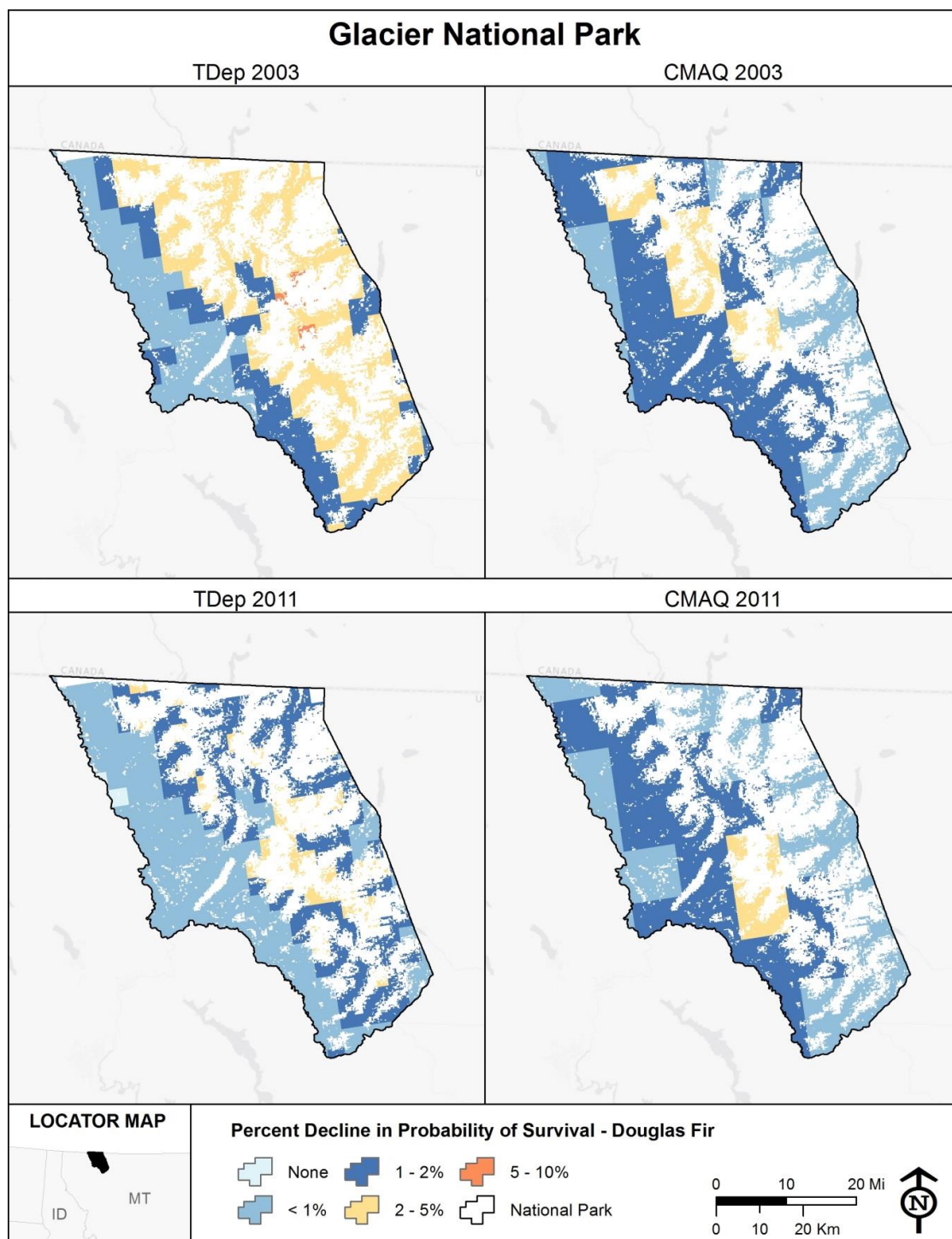


Figure E-7. Locations within Glacier National Park included within various categories of percent decline in probability of survival of Douglas Fir (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

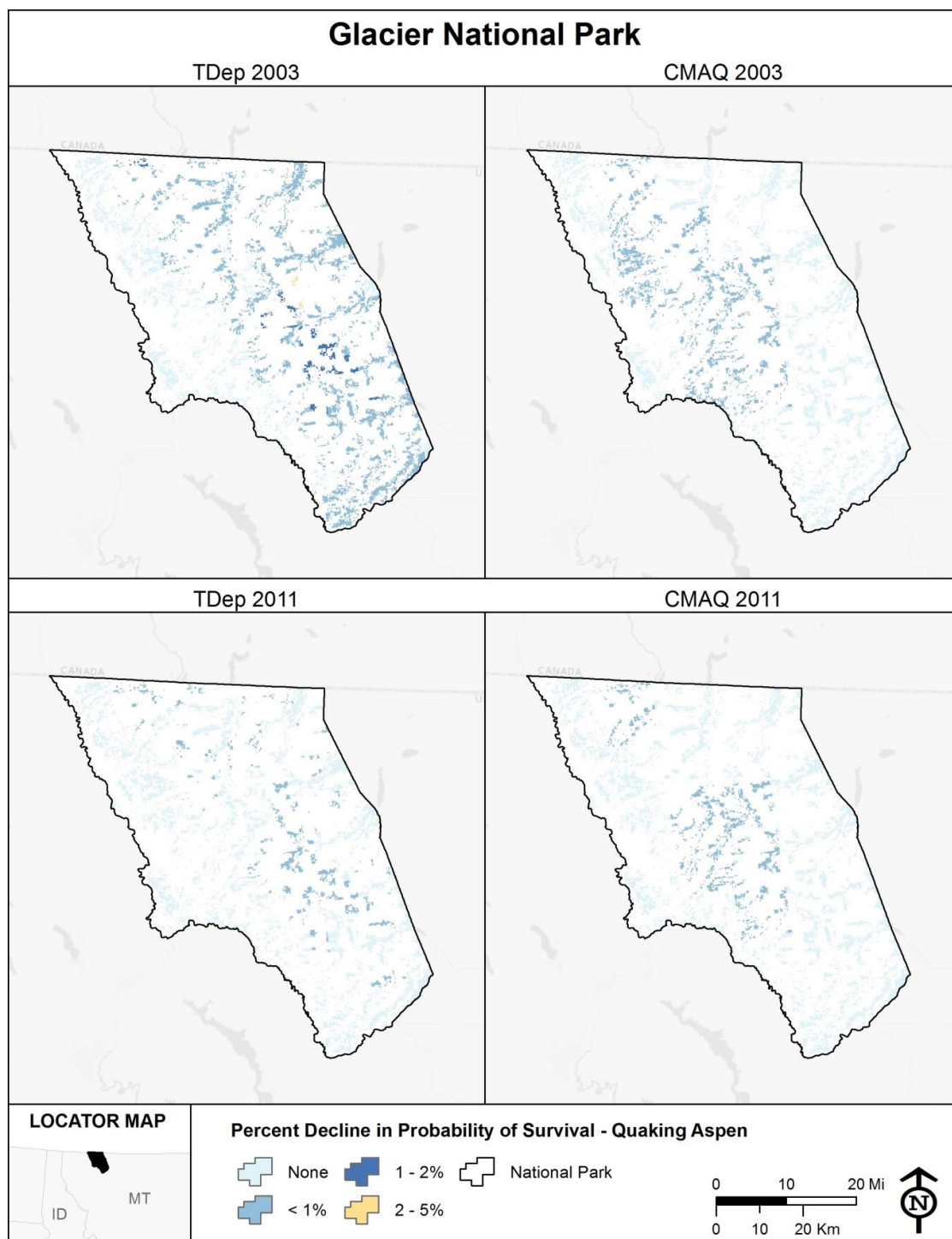


Figure E-8. Locations within Glacier National Park included within various categories of percent decline in probability of survival of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

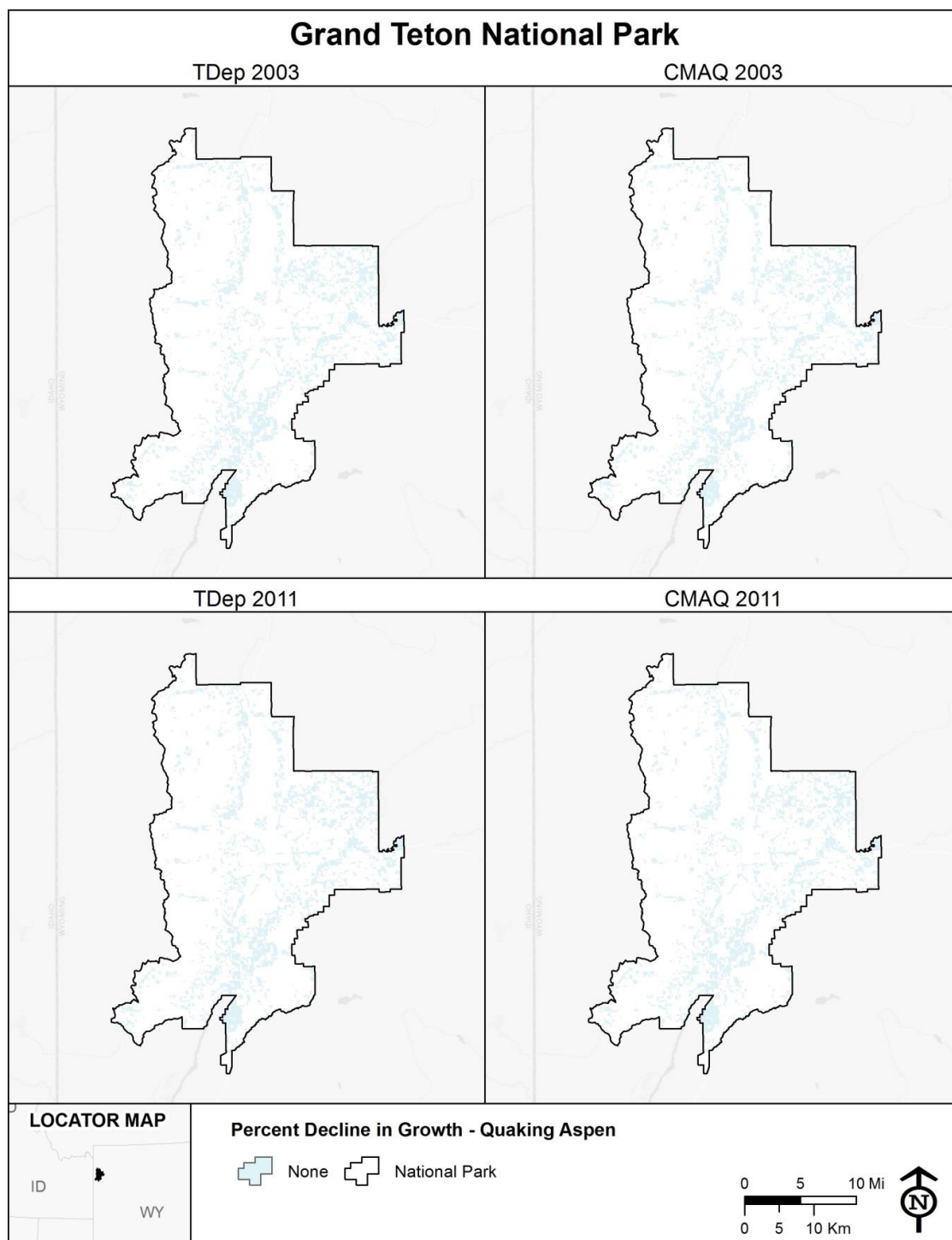


Figure E-9. Locations within Grand Teton National Park included within various categories of percent decline in tree growth of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

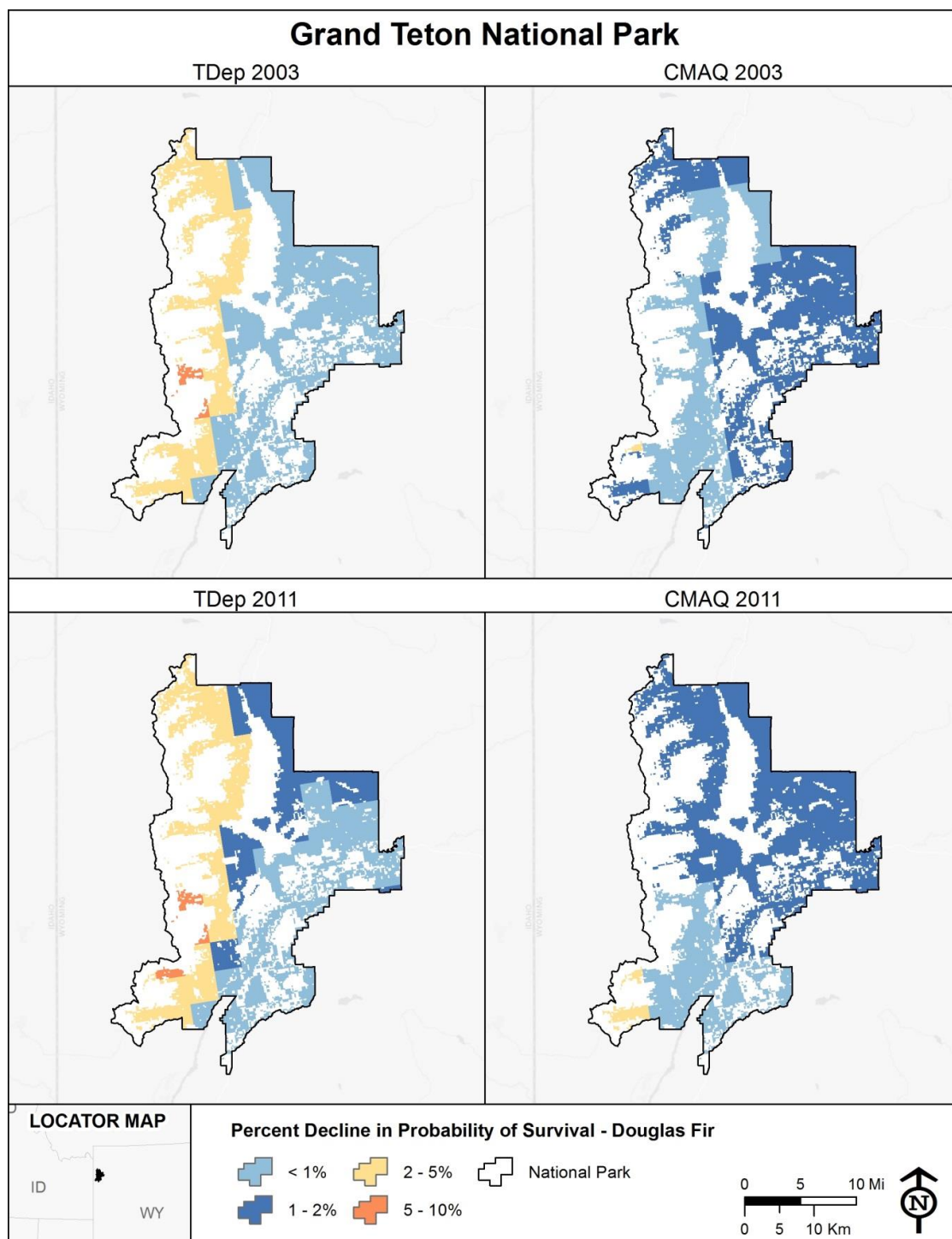


Figure E-10. Locations within Grand Teton National Park included within various categories of percent decline in probability of survival of Douglas Fir (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

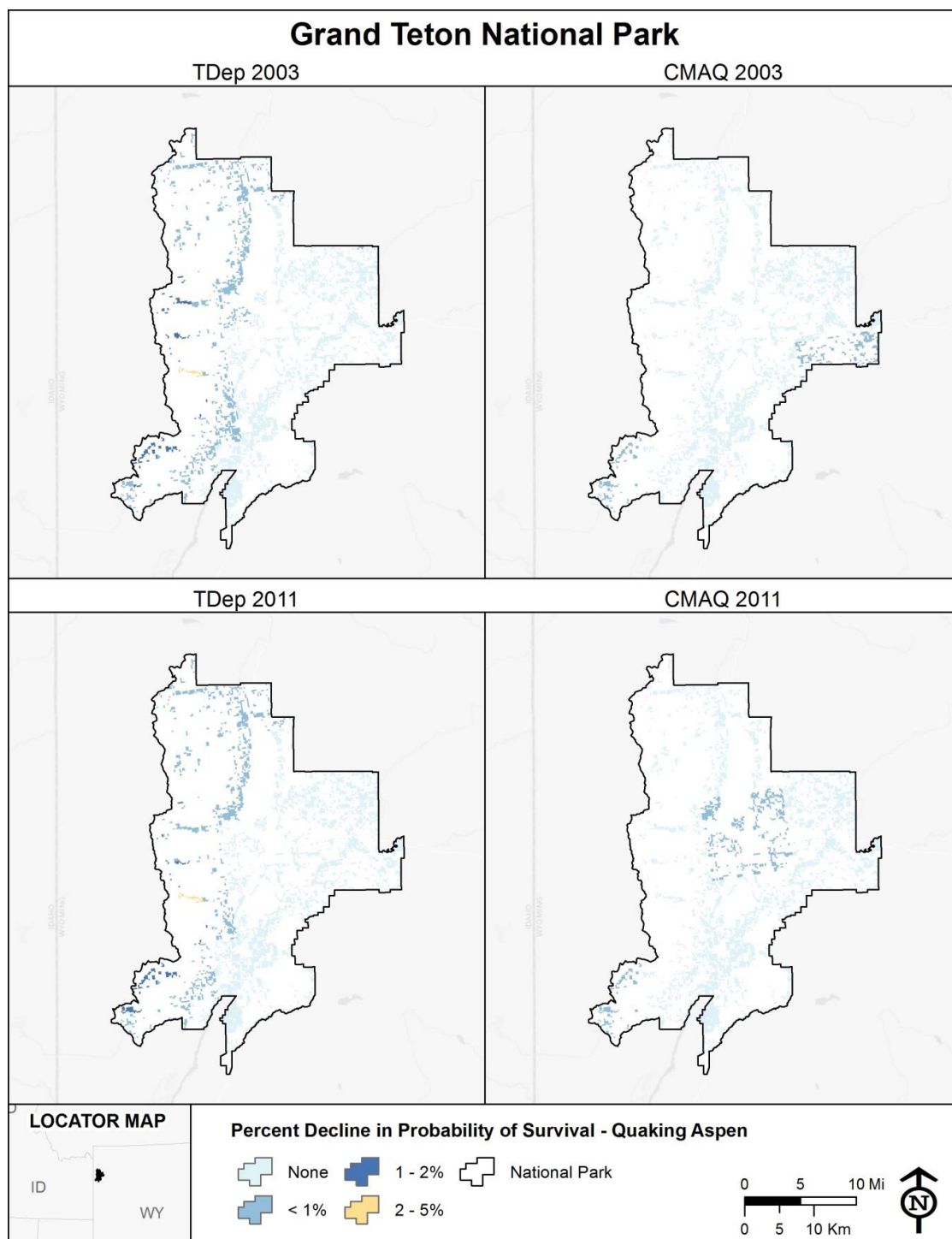


Figure E-11. Locations within Grand Teton National Park included within various categories of percent decline in probability of survival of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

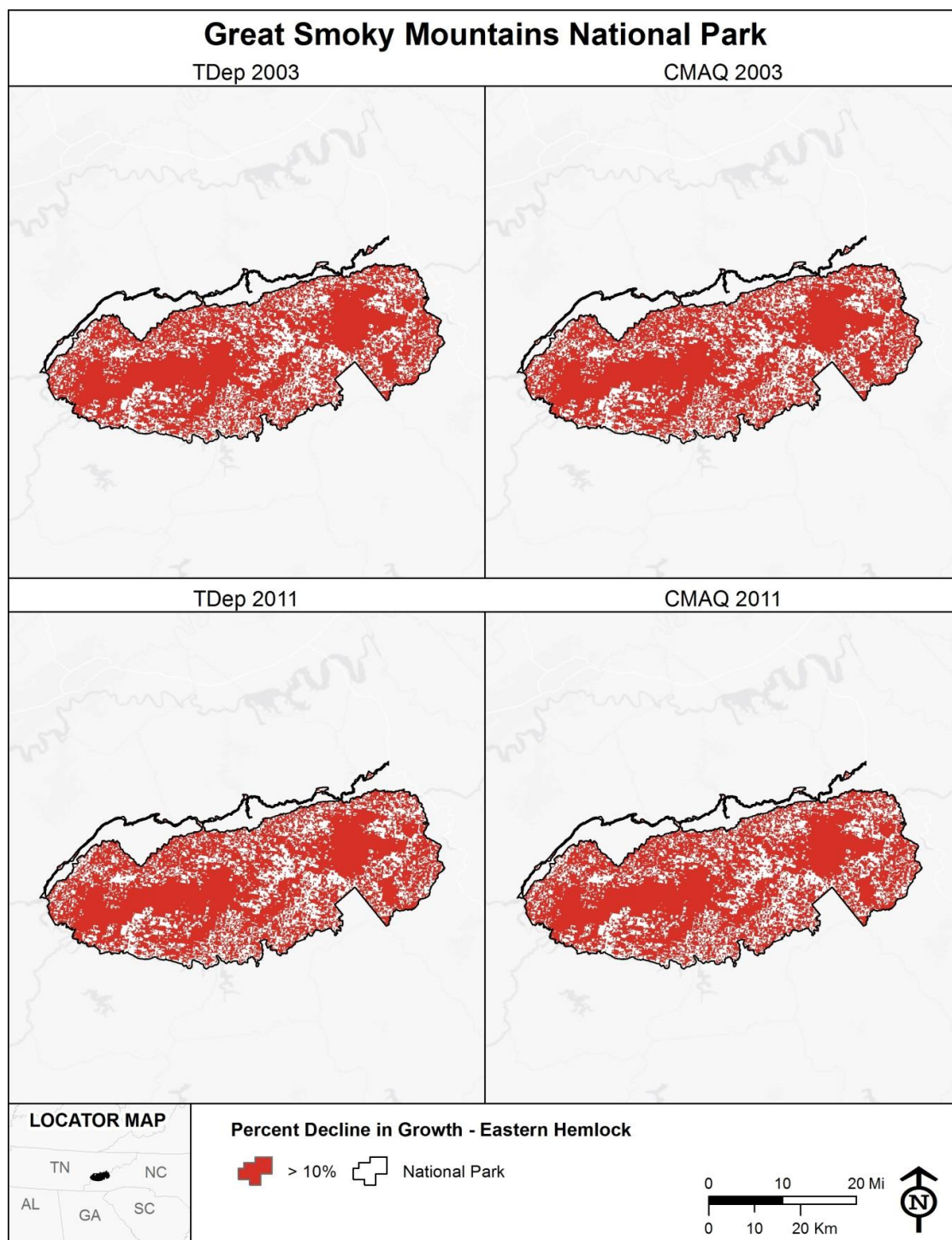


Figure E-12. Locations within Great Smoky Mountains National Park included within various categories of percent decline in tree growth of Eastern Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

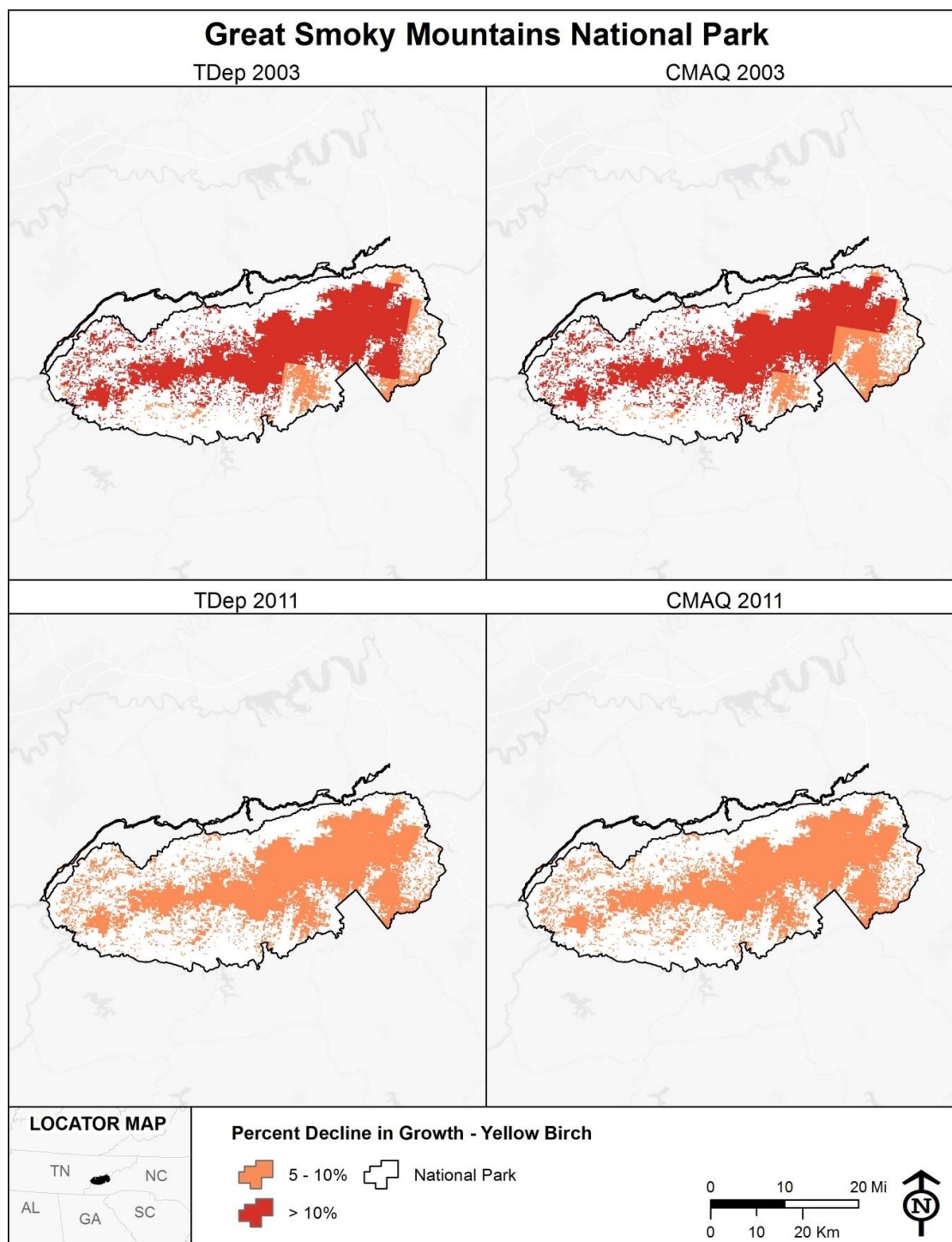


Figure E-13. Locations within Great Smoky Mountains National Park included within various categories of percent decline in tree growth of Yellow Birch (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

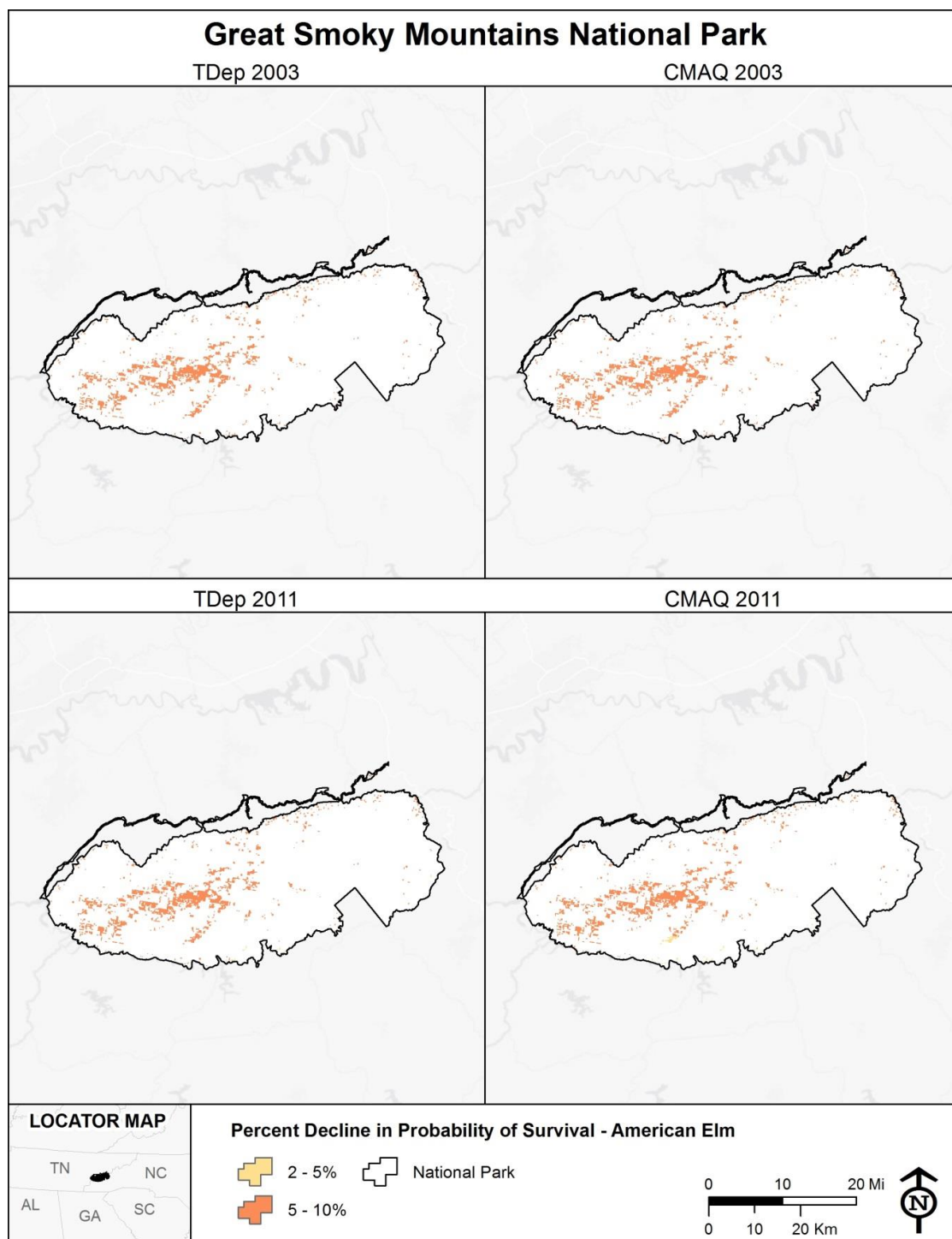


Figure E-14. Locations within Great Smoky Mountains National Park included within various categories of percent decline in probability of survival of American Elm (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

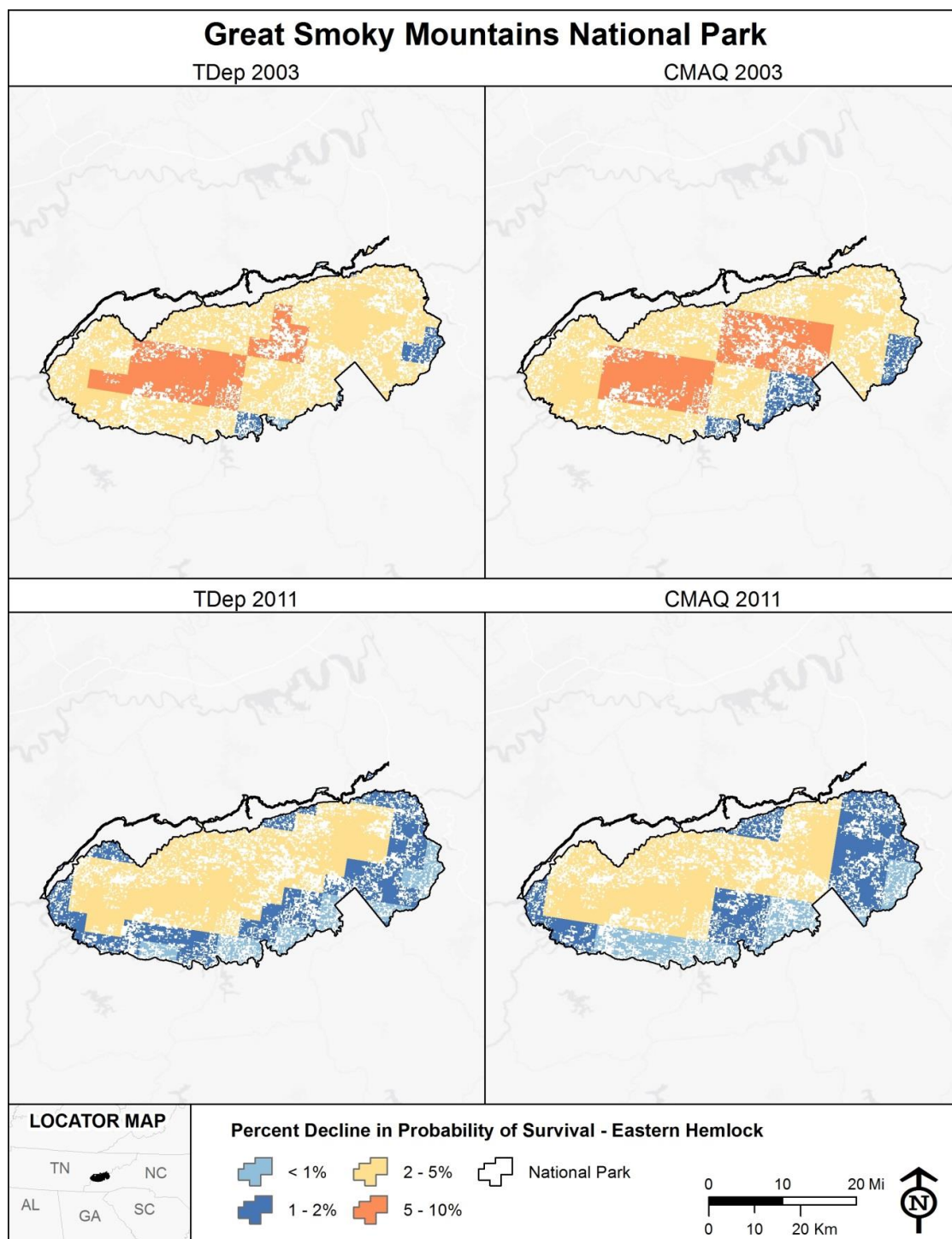


Figure E-15. Locations within Great Smoky Mountains National Park included within various categories of percent decline in probability of survival of Eastern Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

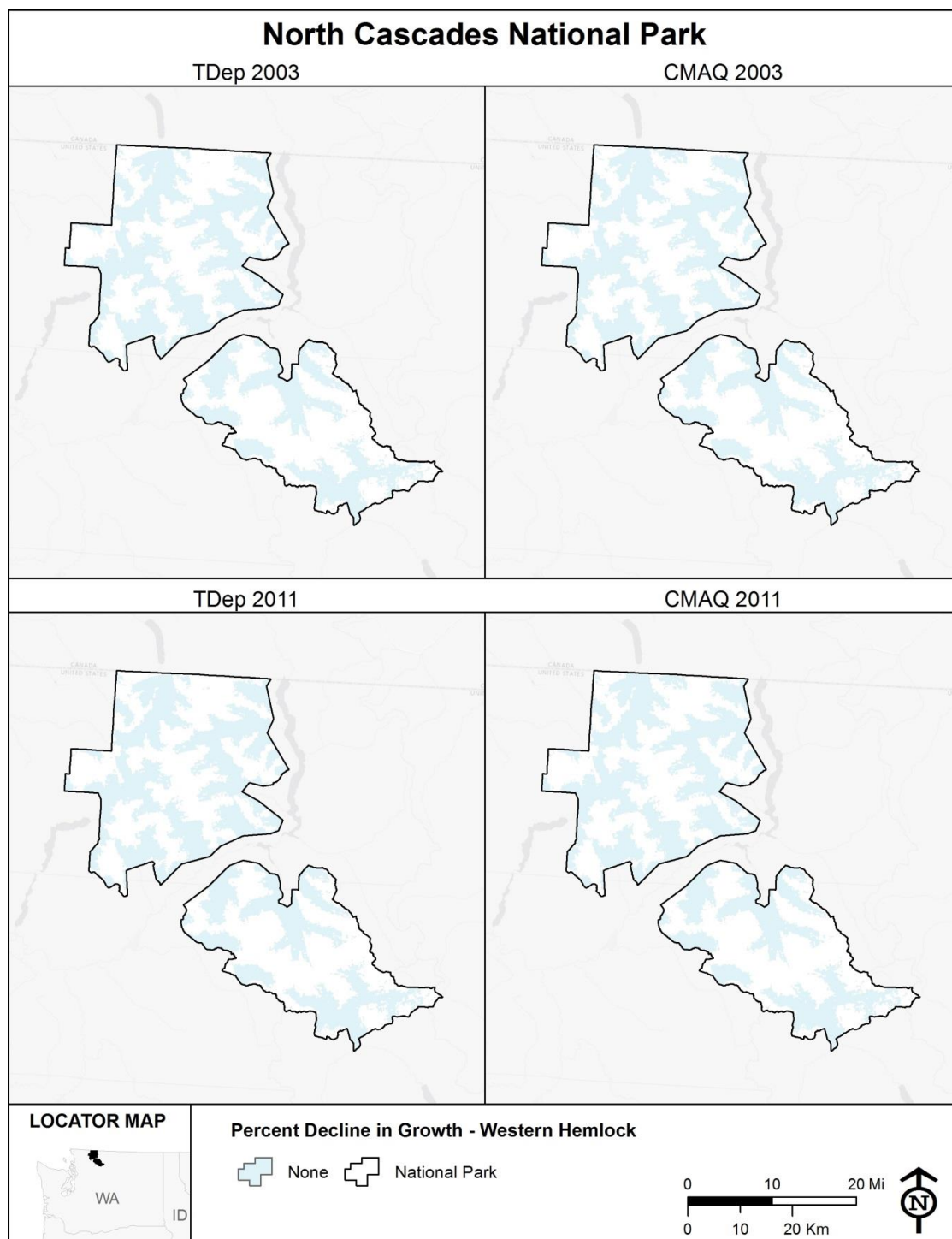


Figure E-16. Locations within North Cascades National Park included within various categories of percent decline in tree growth of Western Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

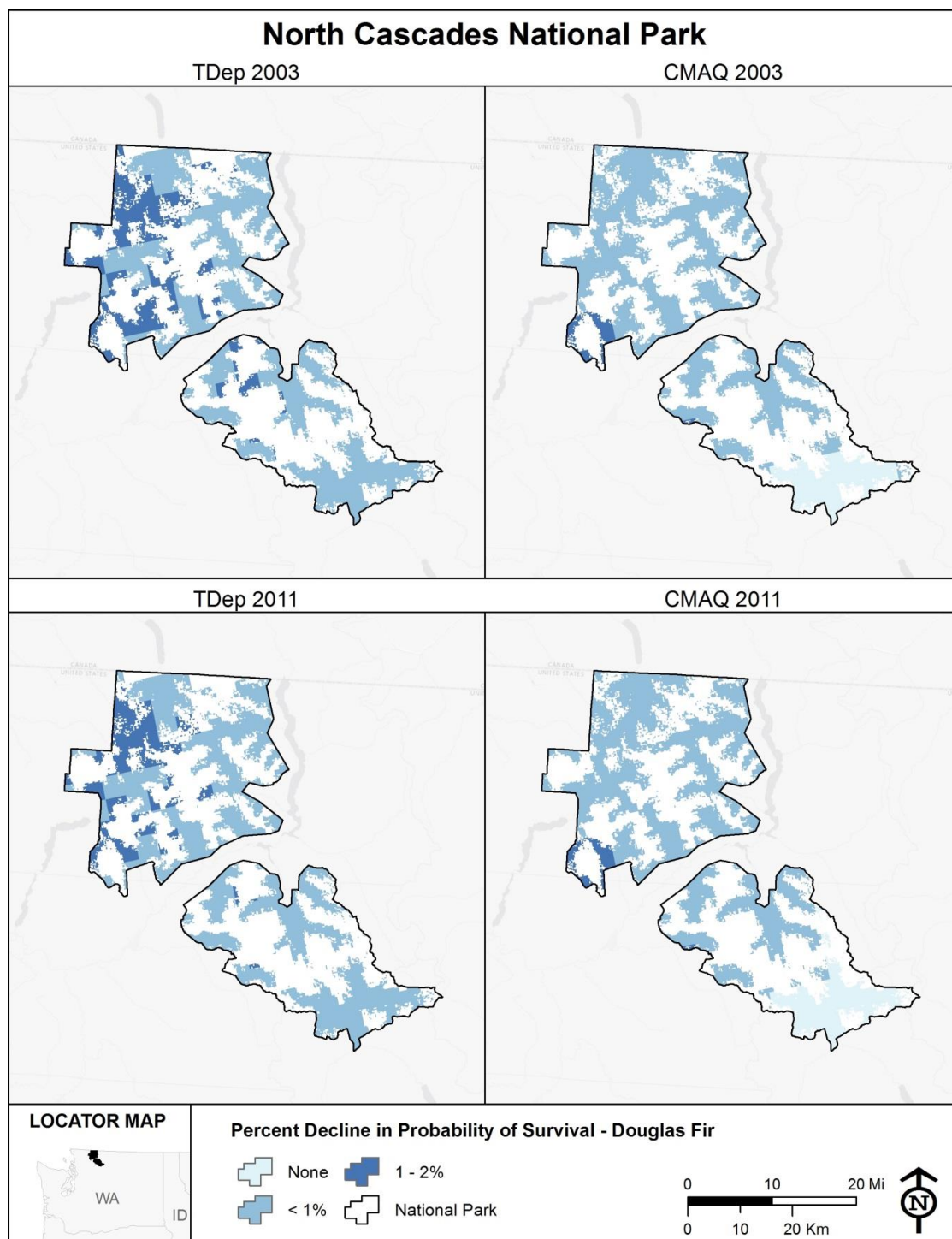


Figure E-17. Locations within North Cascades National Park included within various categories of percent decline in probability of survival of Douglas Fir (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

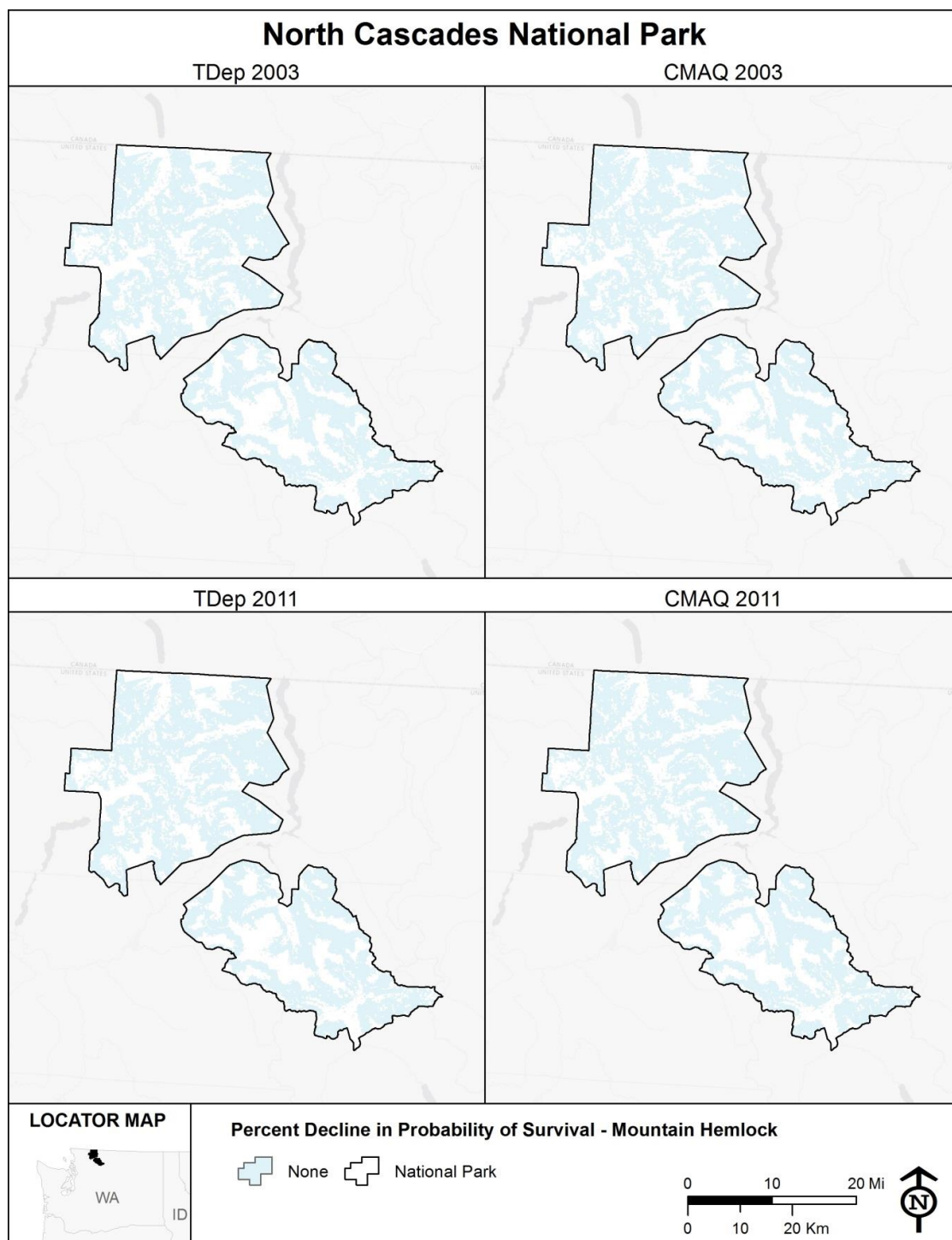


Figure E-18. Locations within North Cascades National Park included within various categories of percent decline in probability of survival of Mountain Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

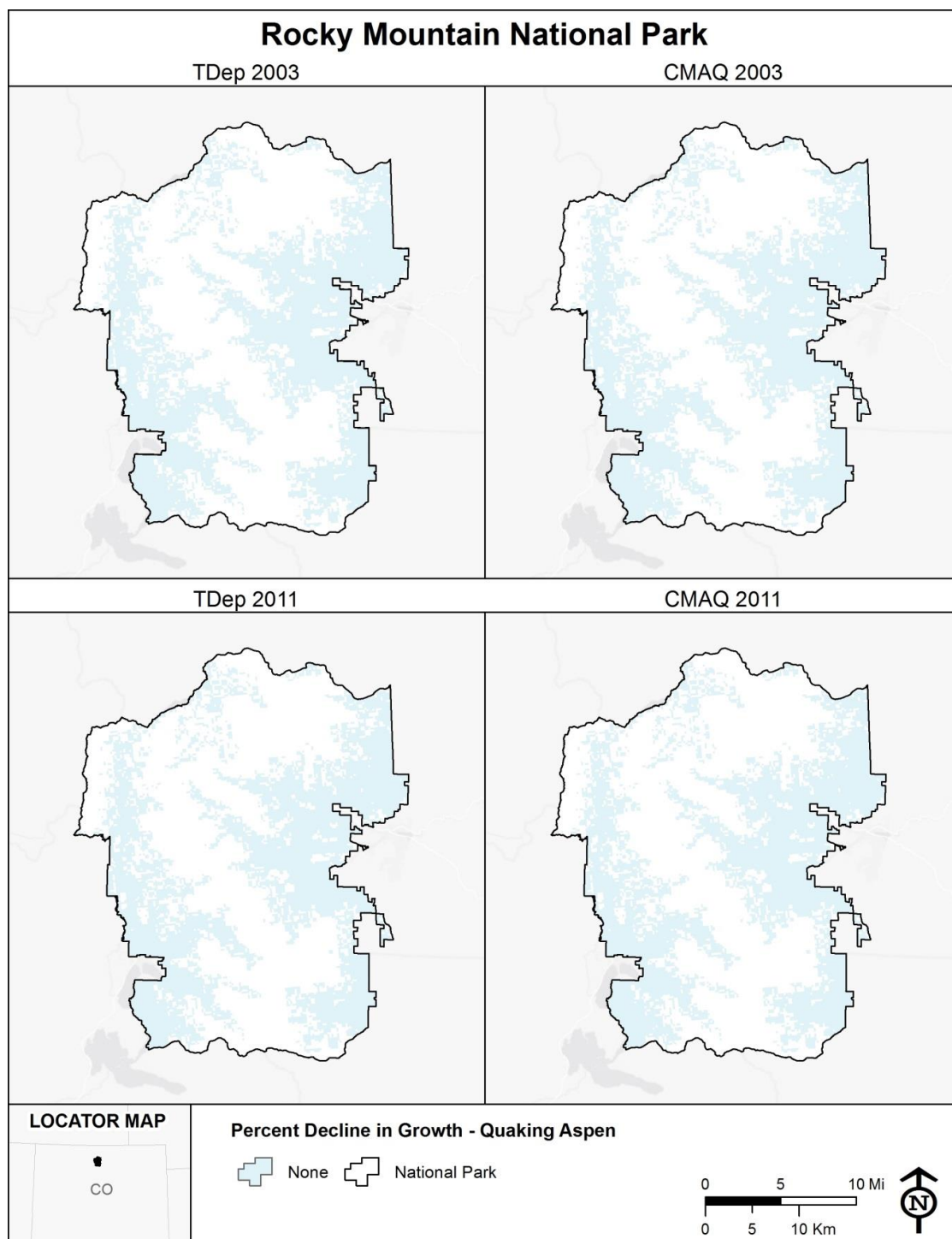


Figure E-19. Locations within Rocky Mountain National Park included within various categories of percent decline in tree growth of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

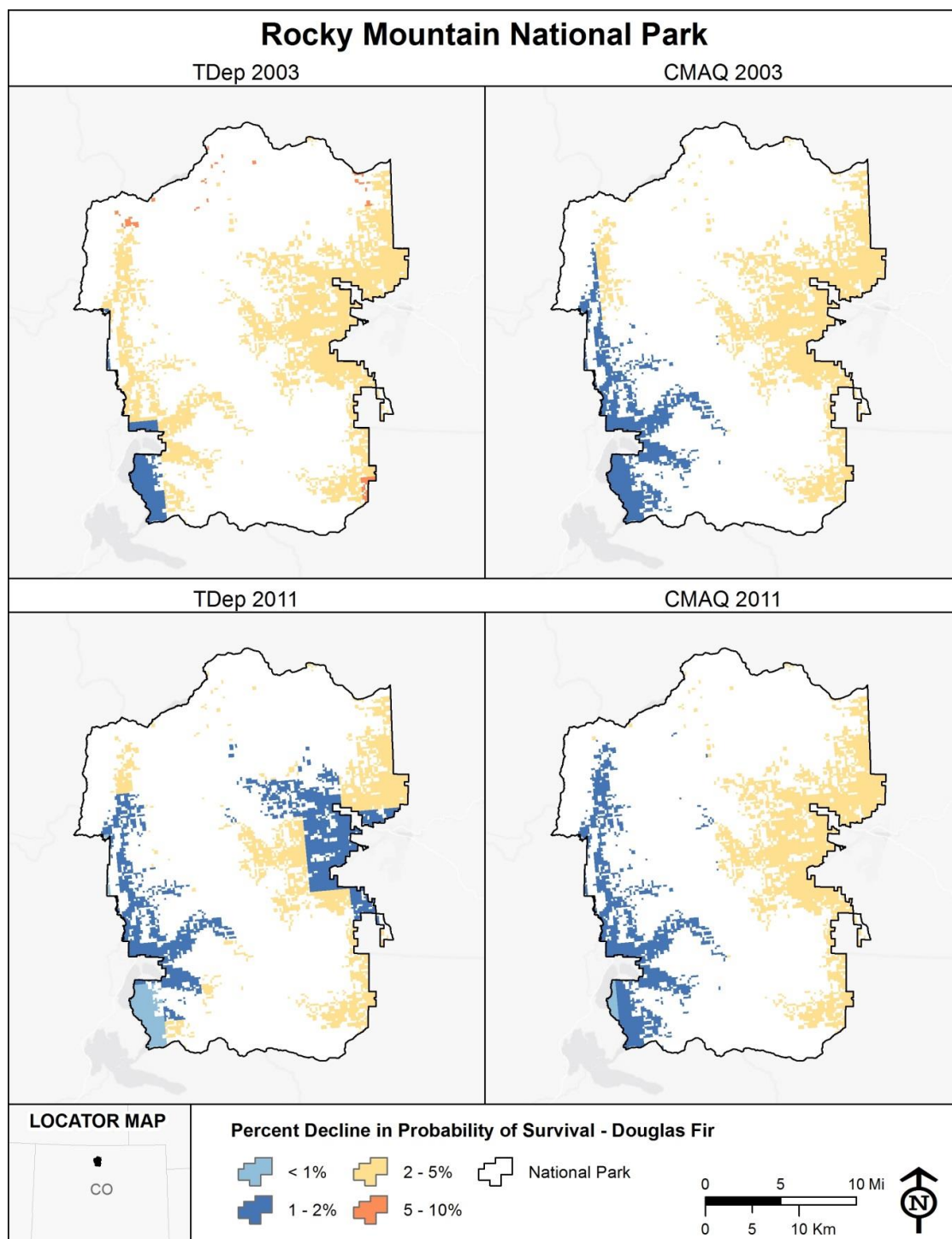


Figure E-20. Locations within Rocky Mountain National Park included within various categories of percent decline in probability of survival of Douglas Fir (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

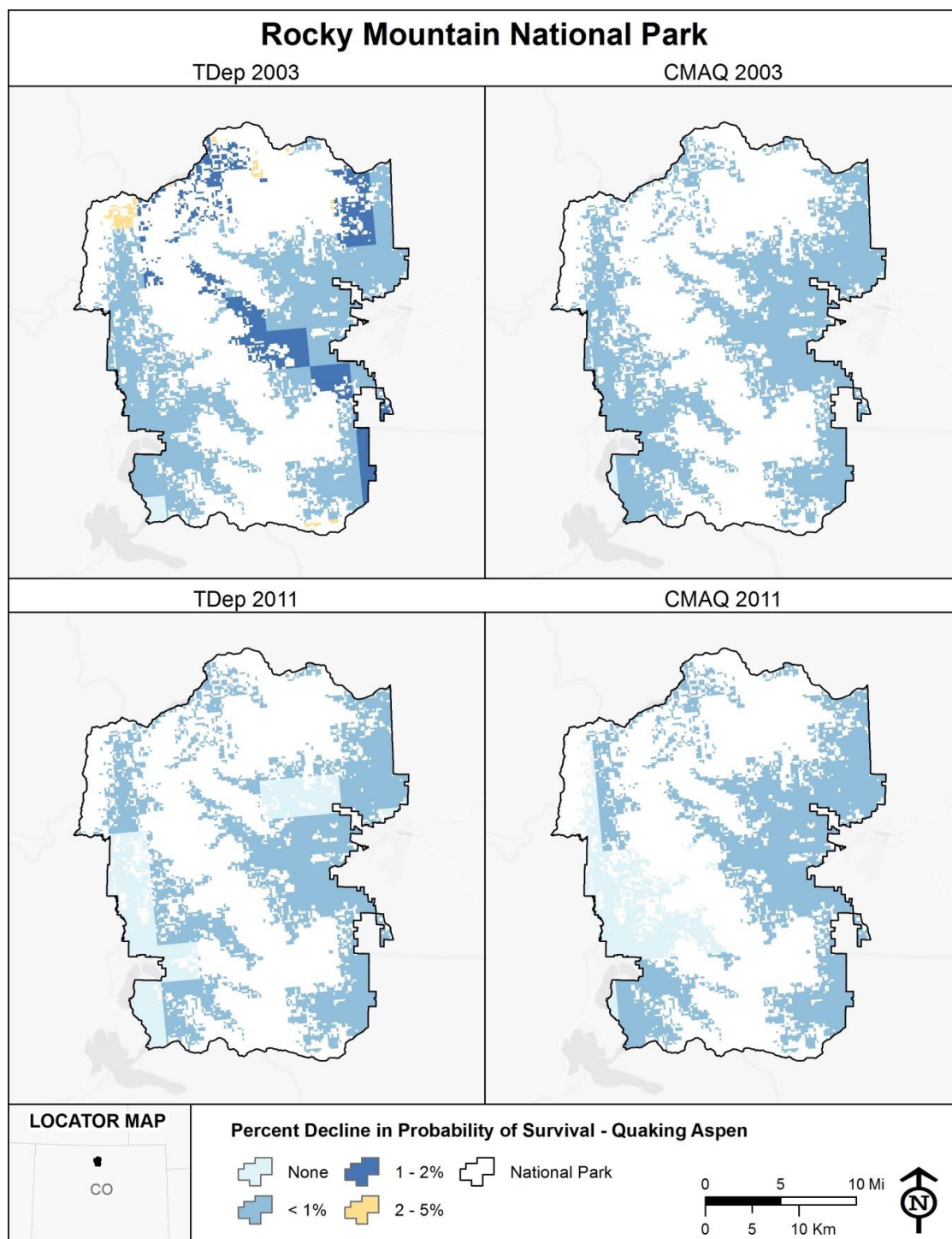


Figure E-21. Locations within Rocky Mountain National Park included within various categories of percent decline in probability of survival of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.



Figure E-22. Locations within Sleeping Bear Dunes National Lakeshore included within various categories of percent decline in tree growth of Eastern Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

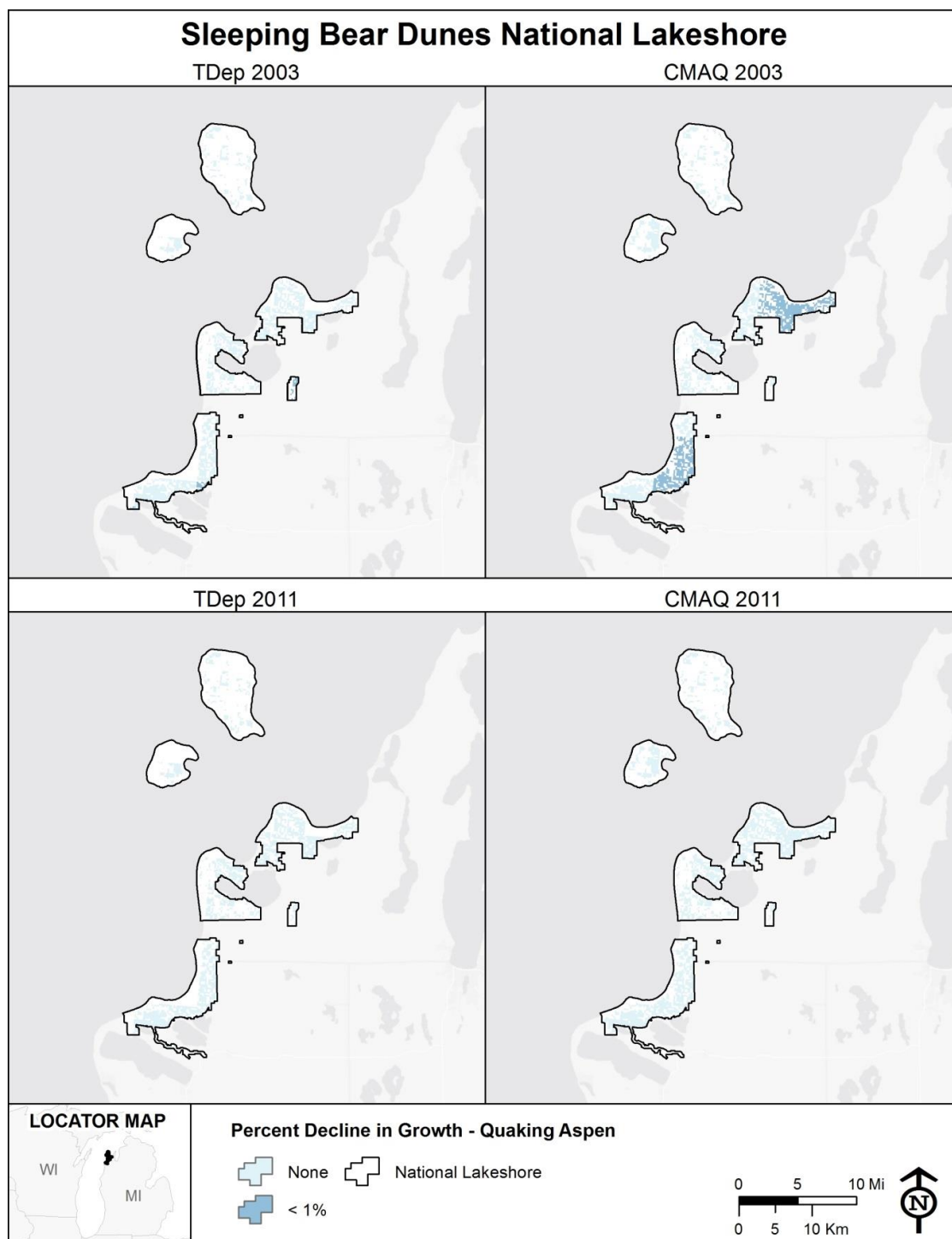


Figure E-23. Locations within Sleeping Bear Dunes National Lakeshore included within various categories of percent decline in tree growth of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

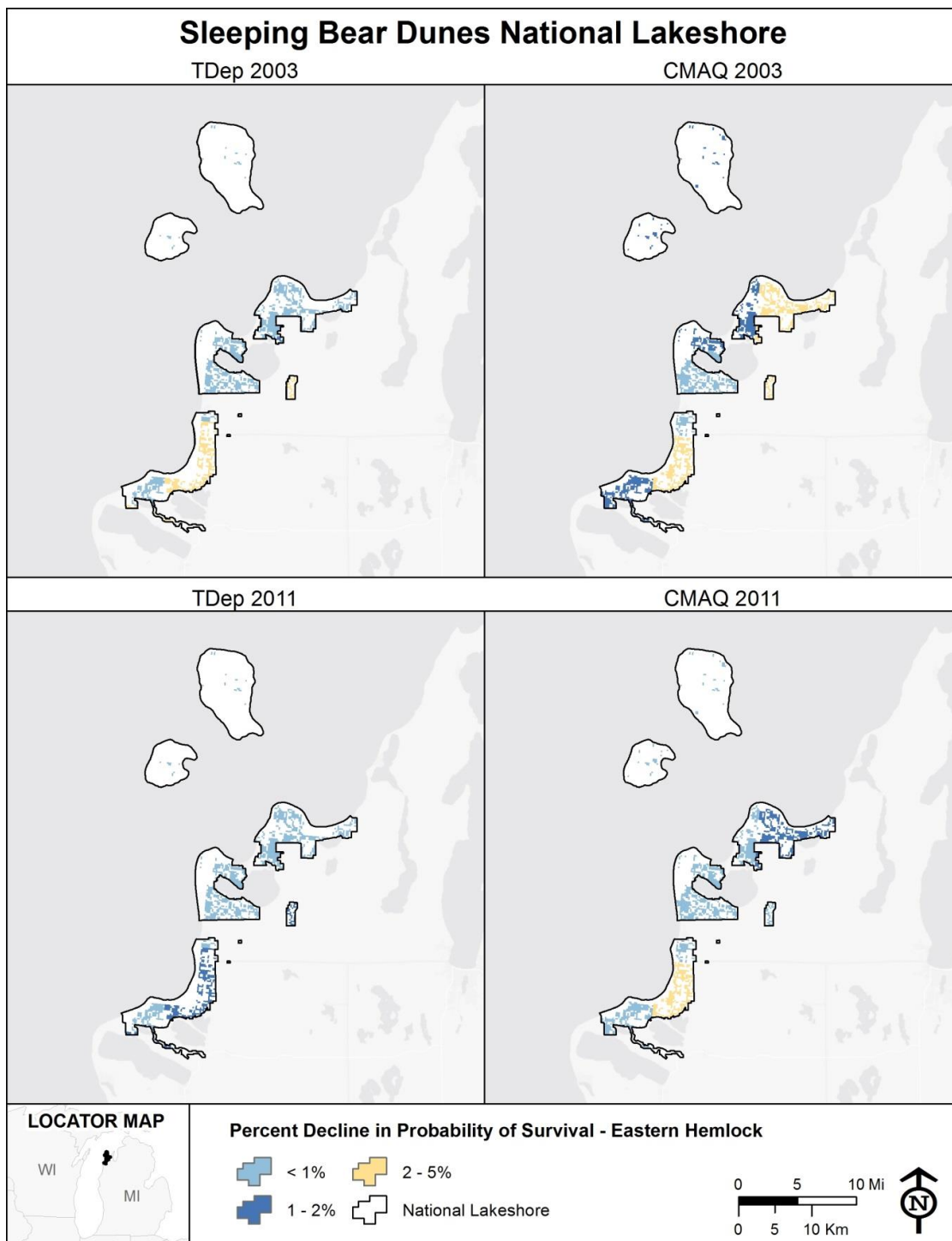


Figure E-24. Locations within Sleeping Bear Dunes National Lakeshore included within various categories of percent decline in probability of survival of Eastern Hemlock (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

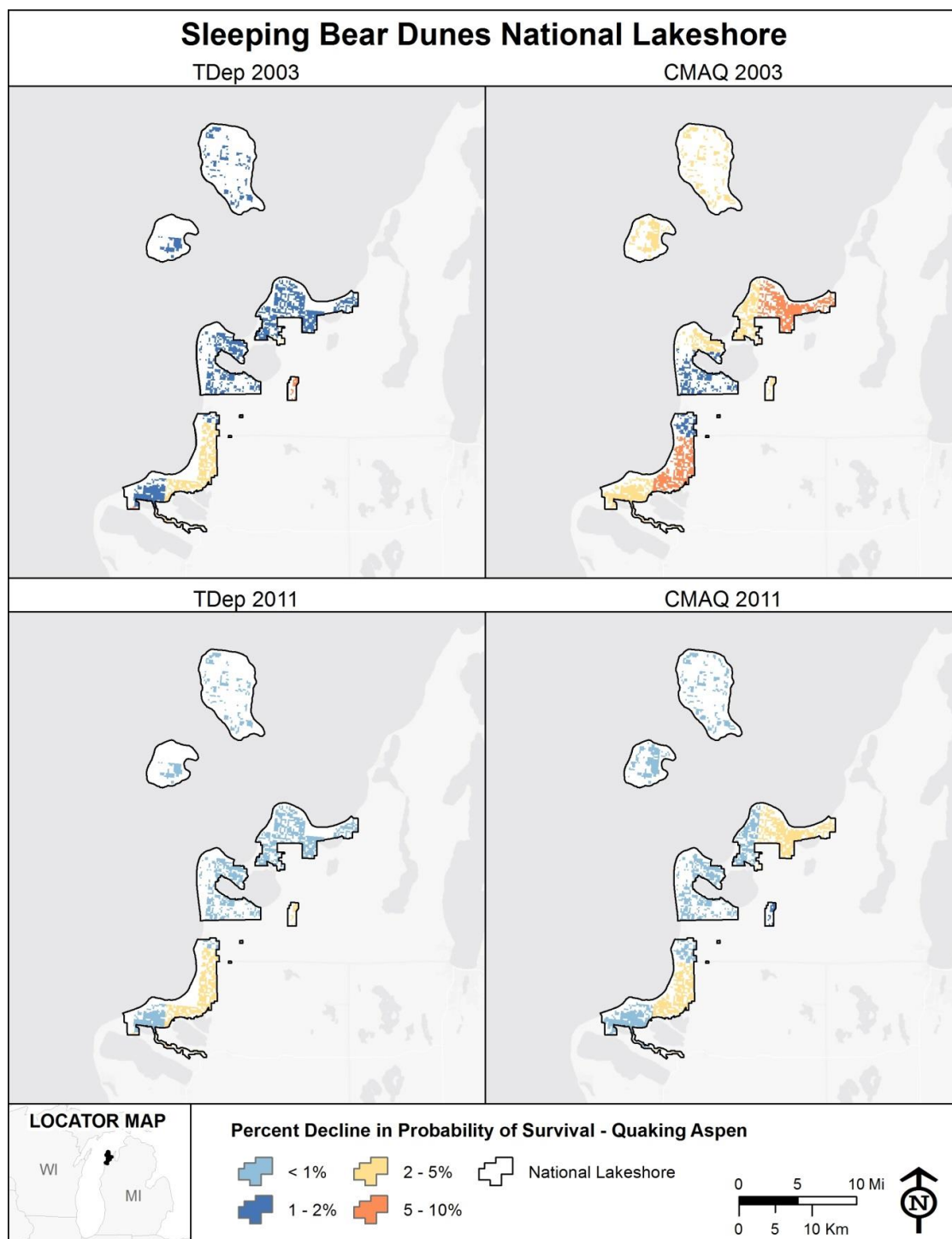


Figure E-25. Locations within Sleeping Bear Dunes National Lakeshore included within various categories of percent decline in probability of survival of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

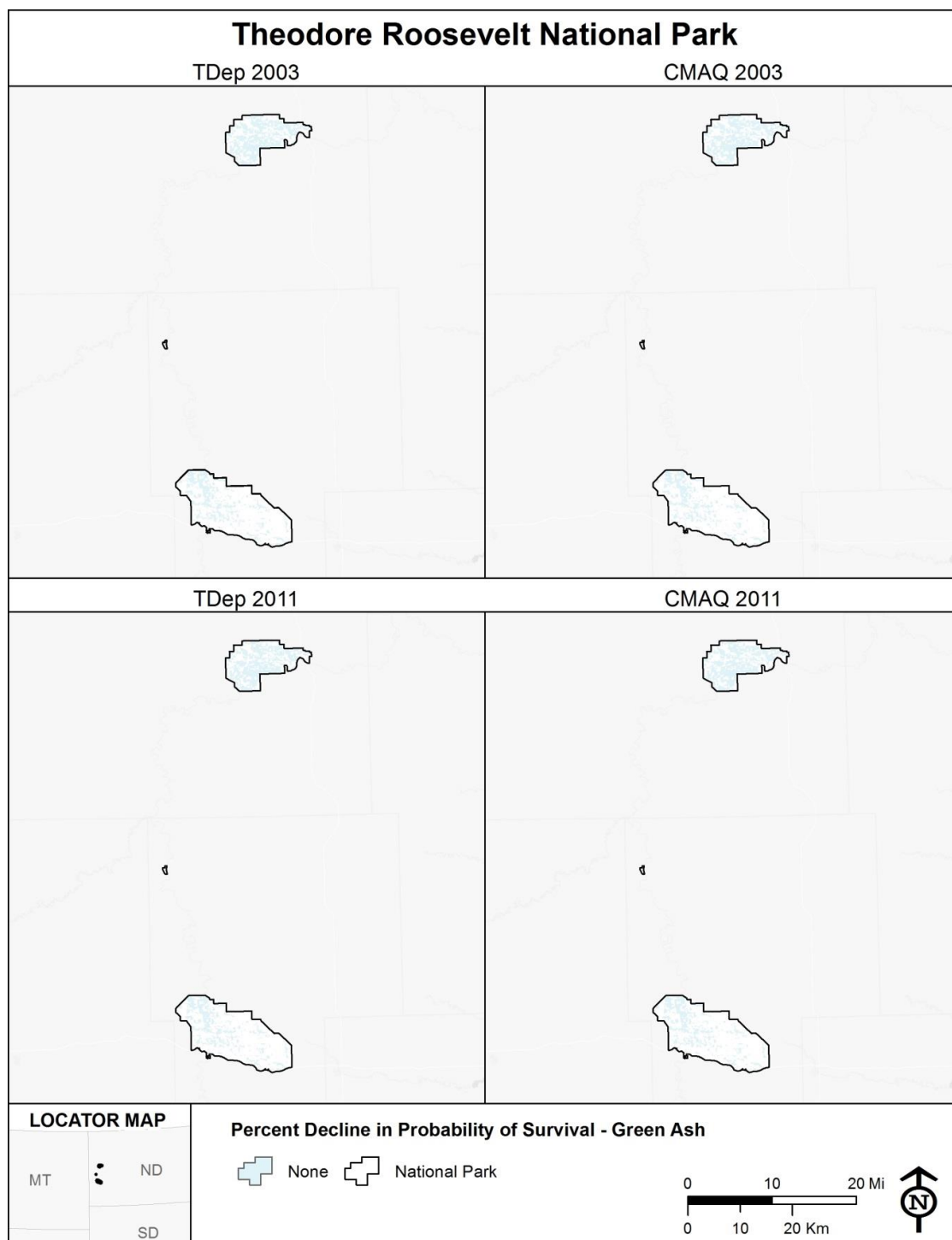


Figure E-26. Locations within Theodore Roosevelt National Park included within various categories of percent decline in probability of survival of Green Ash (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.



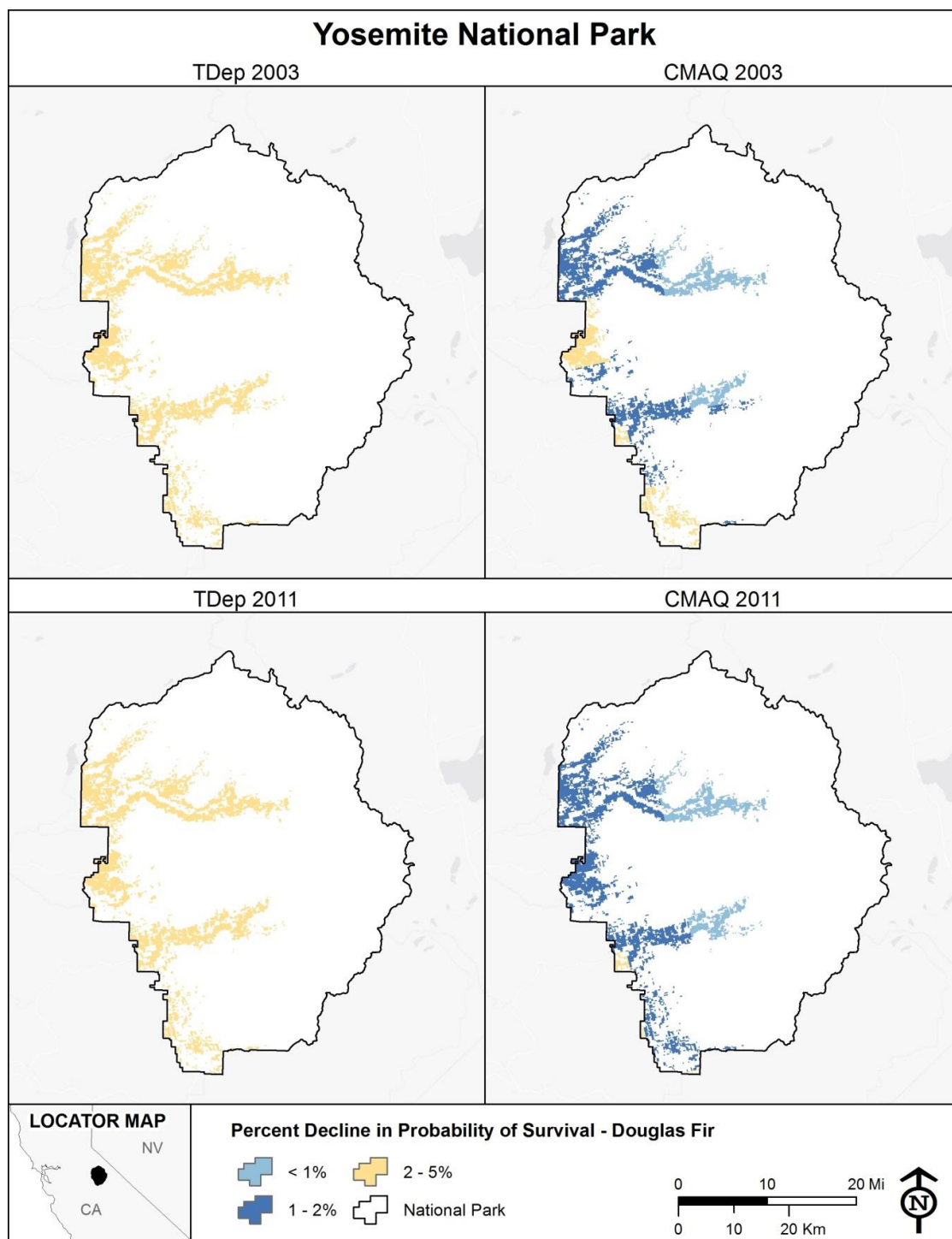


Figure E-28. Locations within Yosemite National Park included within various categories of percent decline in probability of survival of Douglas Fir (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

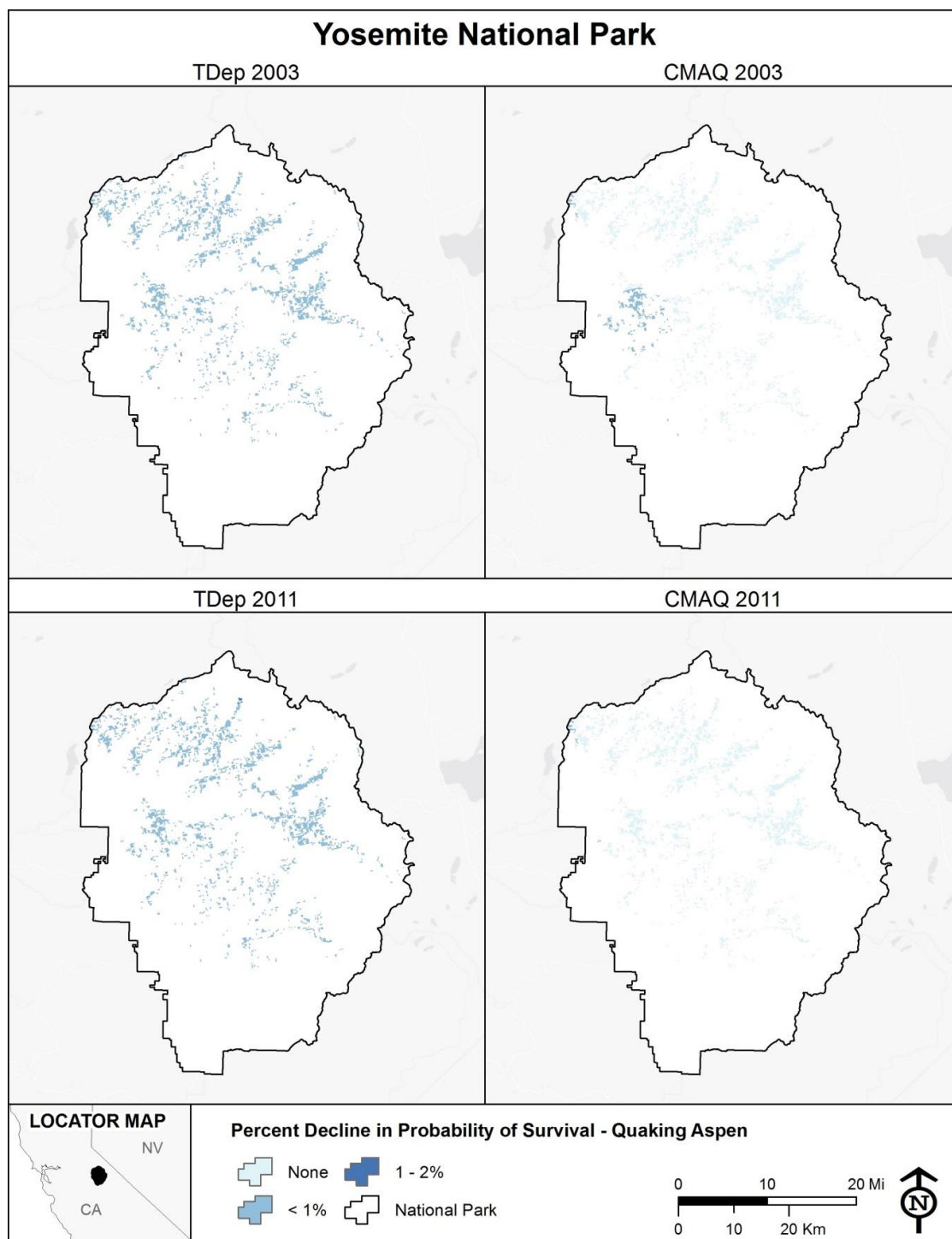


Figure E-29. Locations within Yosemite National Park included within various categories of percent decline in probability of survival of Quaking Aspen (Horn et al. 2018) based on TDep and CMAQ total N deposition representative of 2003 and 2011.

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.

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