The North Central Region Agricultural Atlas

Introduction to NC-94

Producers often need guidance on the relative benefits and probable impacts of soils and climate resources on crop production. This need for planning and decision aids exists in spite of the increase in data availability on the web and the accumulation of research knowledge --- and may be labeled the information age paradox. The NC-94 project focuses on identifying the resources and performing the research to provide producers, crop consultants, agribusinesses, and policy makers with key information needed to better manage for risk reduction and increased profitability in the face of economic uncertainty and climatic variability.

Who is the NC-94 team?

A multi-state, multidisciplinary research team built on the strengths of the individual State Agricultural Experiment Stations (SAES) and focusing on the following interactions:
•climate
•soils
•managed biological system
•agricultural productivity
•and economic impact.

Objectives of the NC-94 Regional Project

•Update and maintain the NC-94 regional databases on soils, crop production and weather.
•Develop predictive relationships for crop yield in the North Central region as a function of ENSO, SST, and frequencies associated with natural variability.
•Viewing optimum crop(s) selection as a dynamic decision on the basis of variability in natural resource patterns in the region.

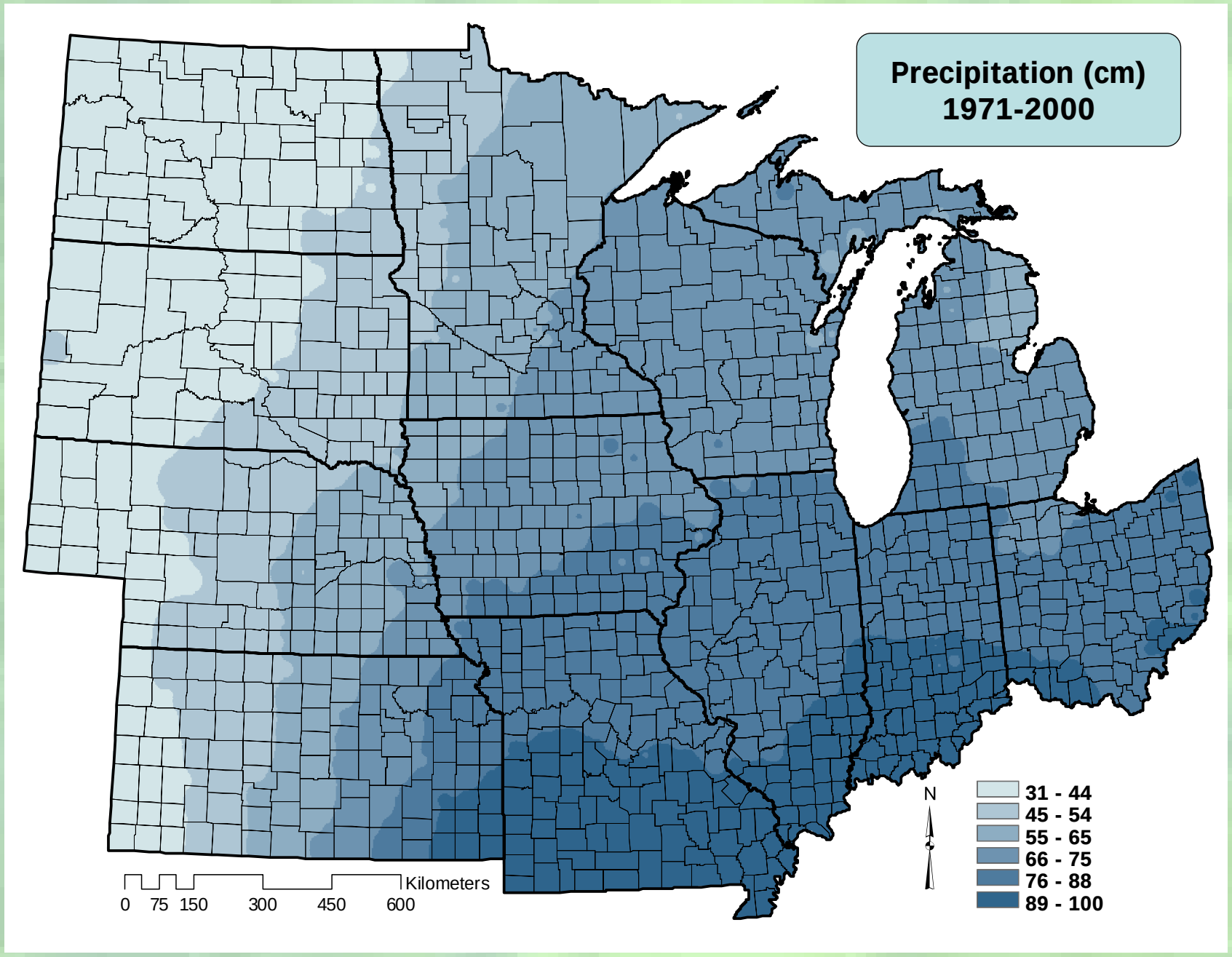
Atlas Introduction

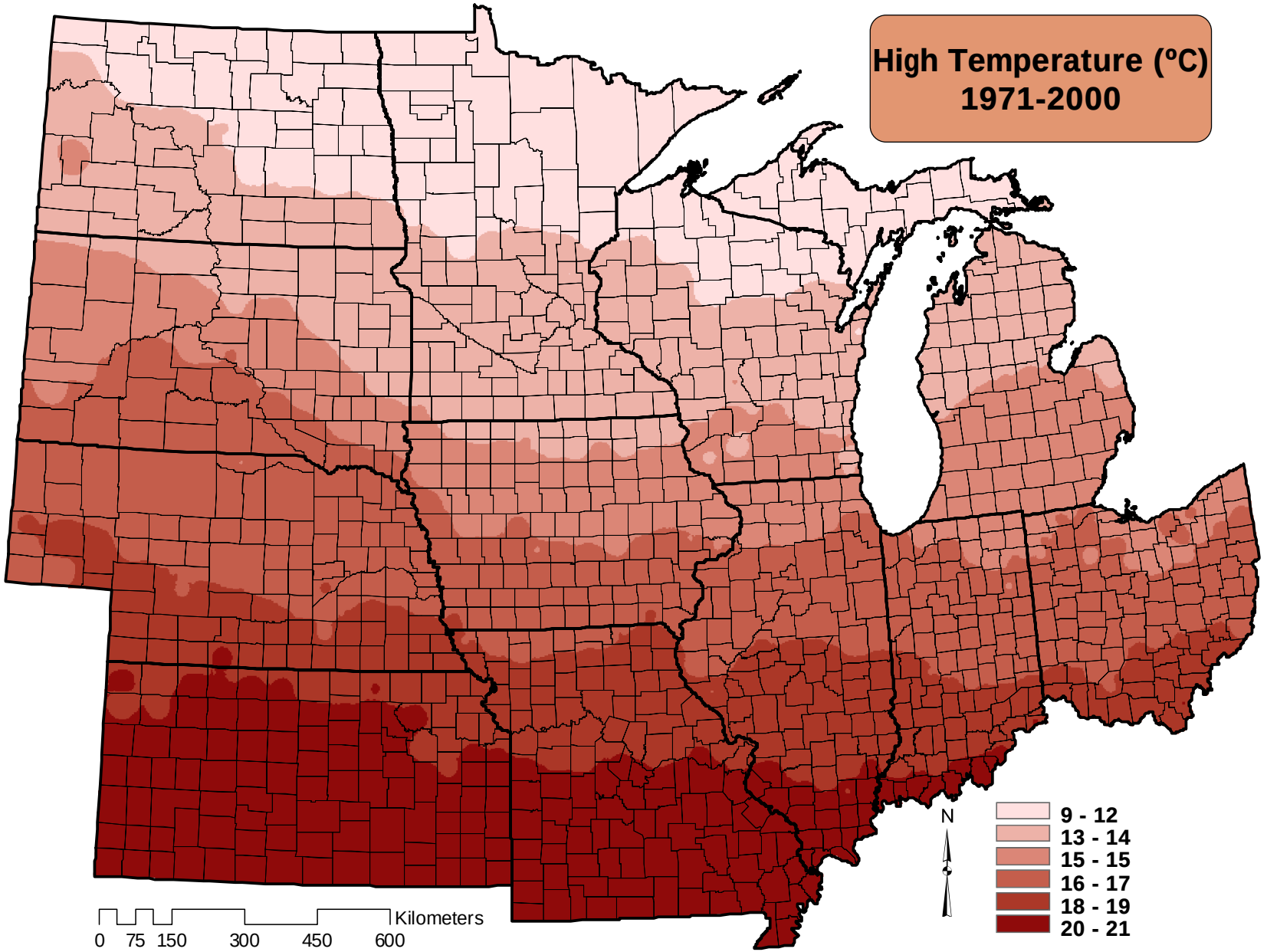
This atlas was created for the NC-94 project by the Computational Ecology and Visualization Laboratory at Michigan State University. It is meant to serve as a visual planning tool for producers, crop consultants, agribusinesses, and policy makers.

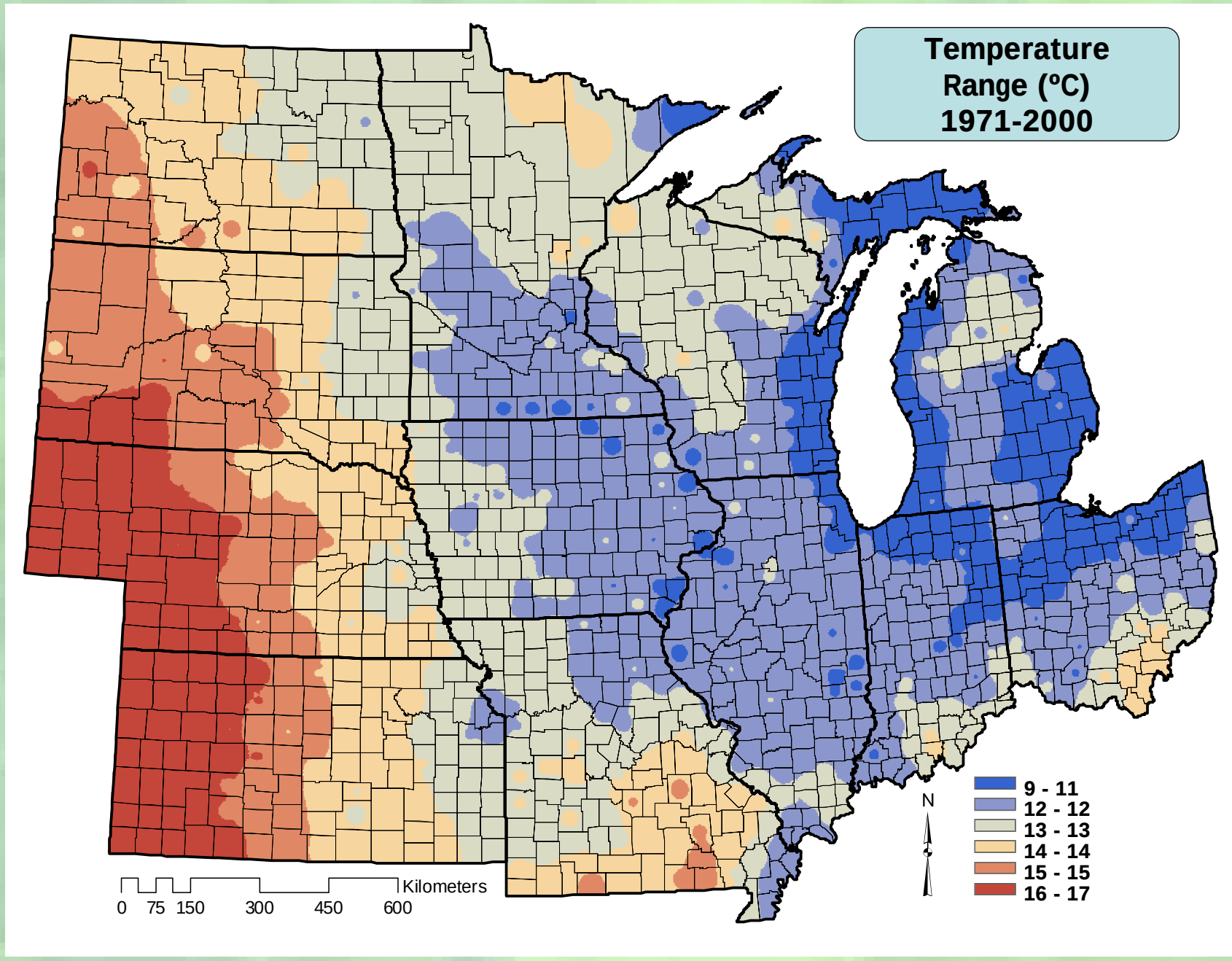
The maps were generated by interpolating the data for all 1052 counties in the region outward from the county centroid to show a contiguous data coverage of the entire region. The resultant maps are 2 kilometer resolution images of the distribution of some of the key agricultural variables.

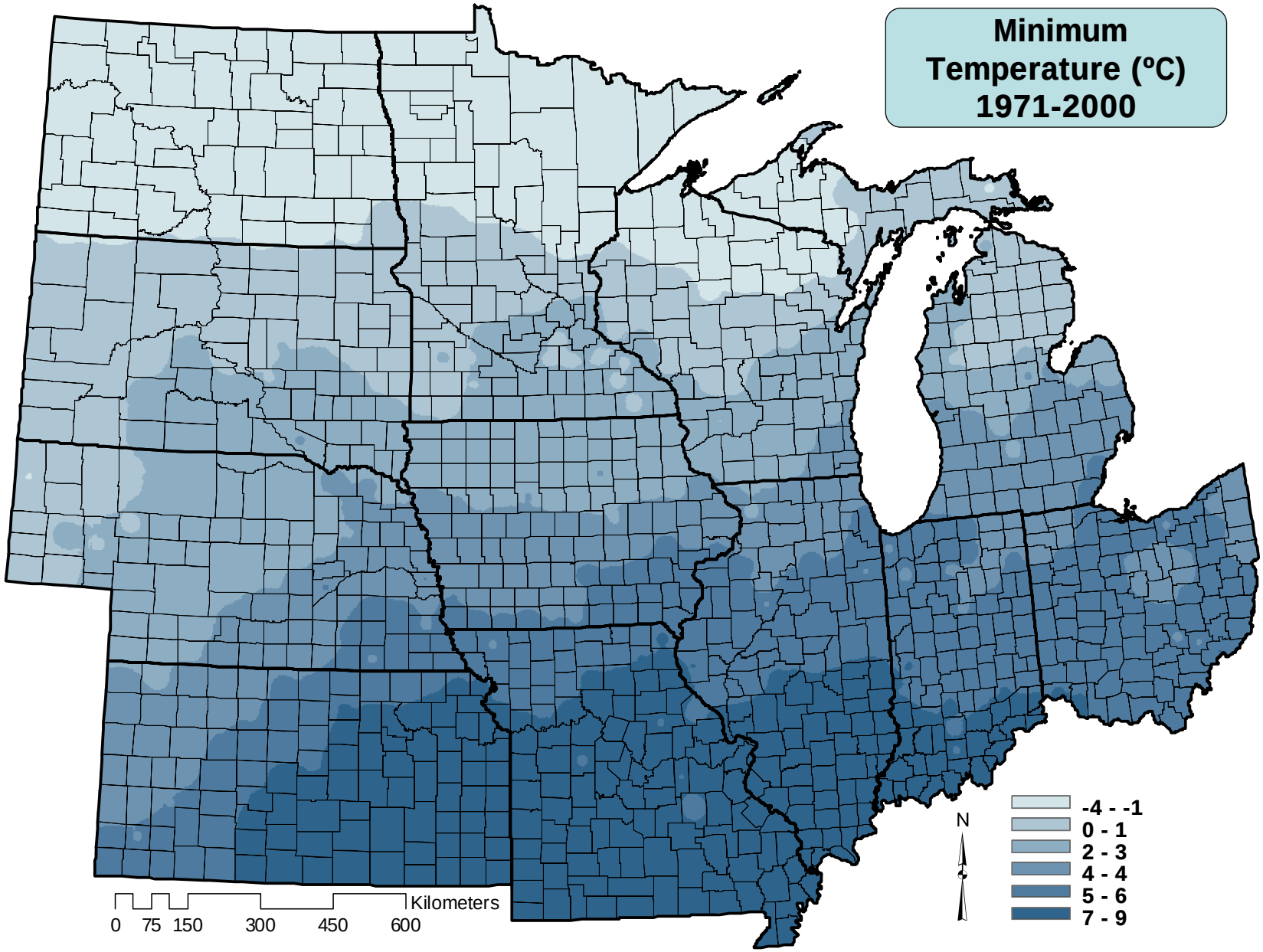
The atlas is divided into these three sections:

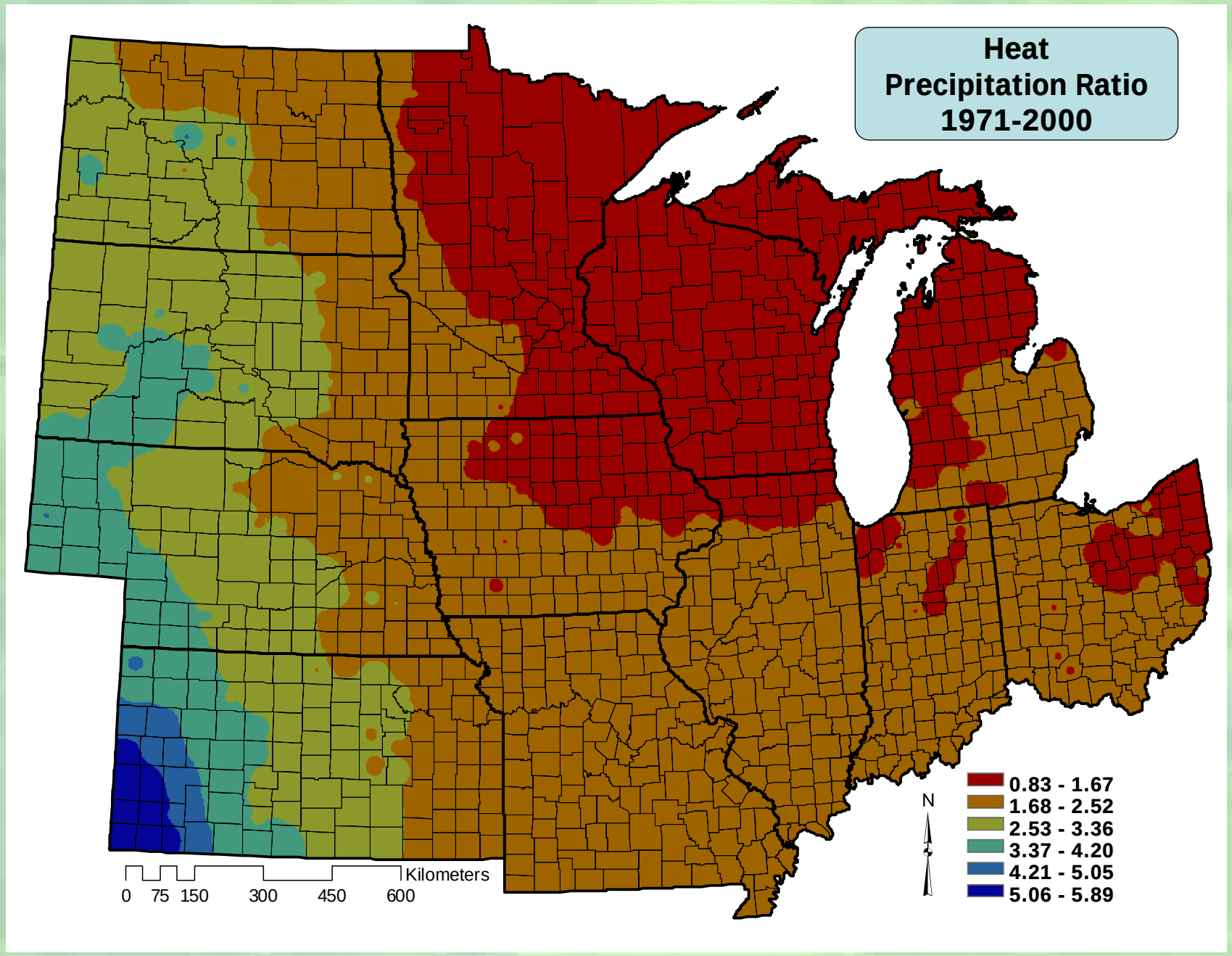
- **Climate-** i.e.. Precipitation, temperature, heat stress. There are two sets of maps, one is a summary of the entire dataset, the other is a series of monthly time steps for the growing season.
- **Soil-** these maps represent county based data such as arable land, and also more continuous variables such as the amount of organic matter in the soil. There are also a series of key soil variables for varying depths.
- **Crops-** These maps are a summary of the average total acres planted, acres harvested, and yield for each county for corn, soybean, and wheat.

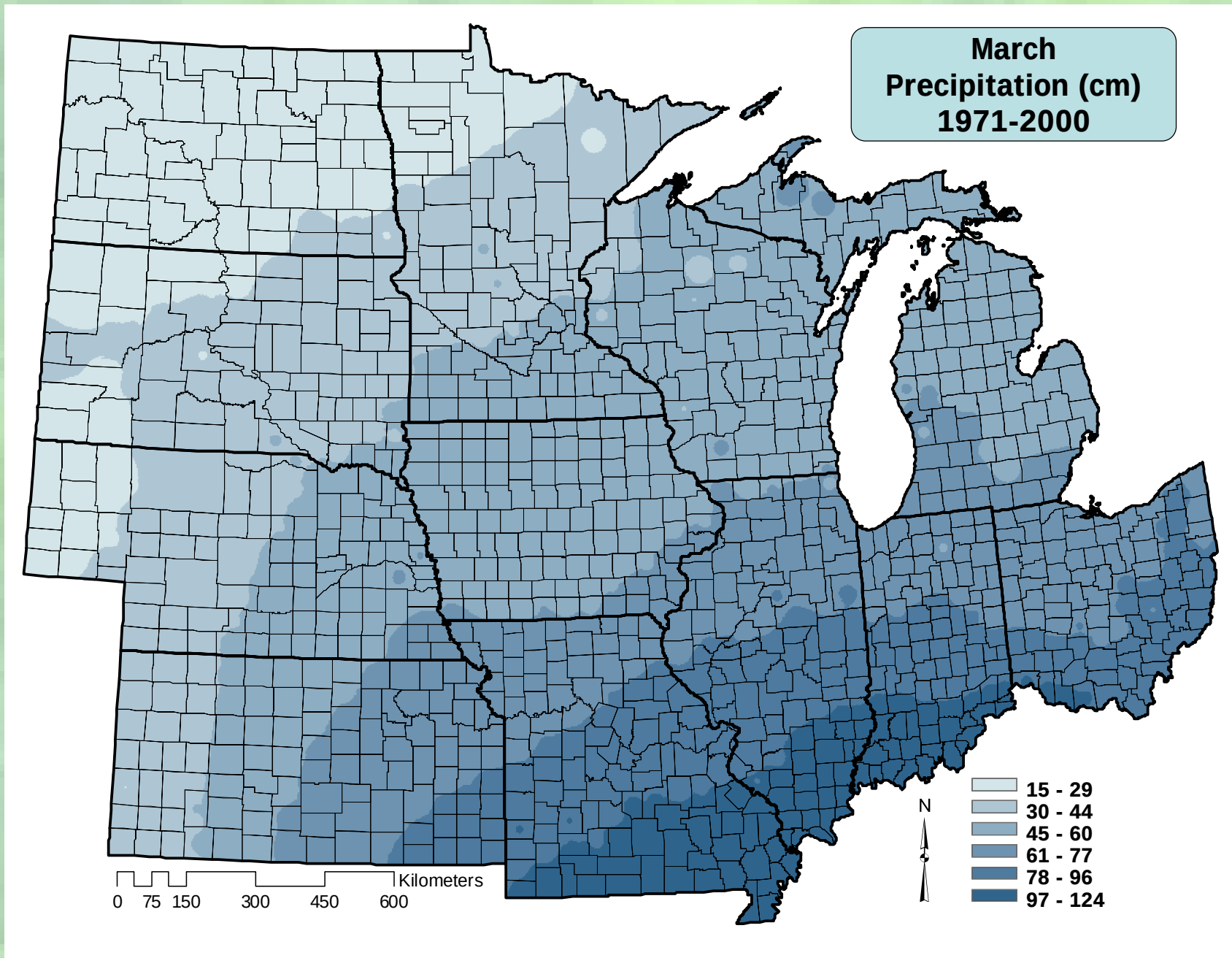

Precipitation (cm)
1971-2000
N
31 - 44
45 - 54
55 - 65
66 - 75
76 - 88
89 - 100
0 75 150 300 450 600
Kilometers

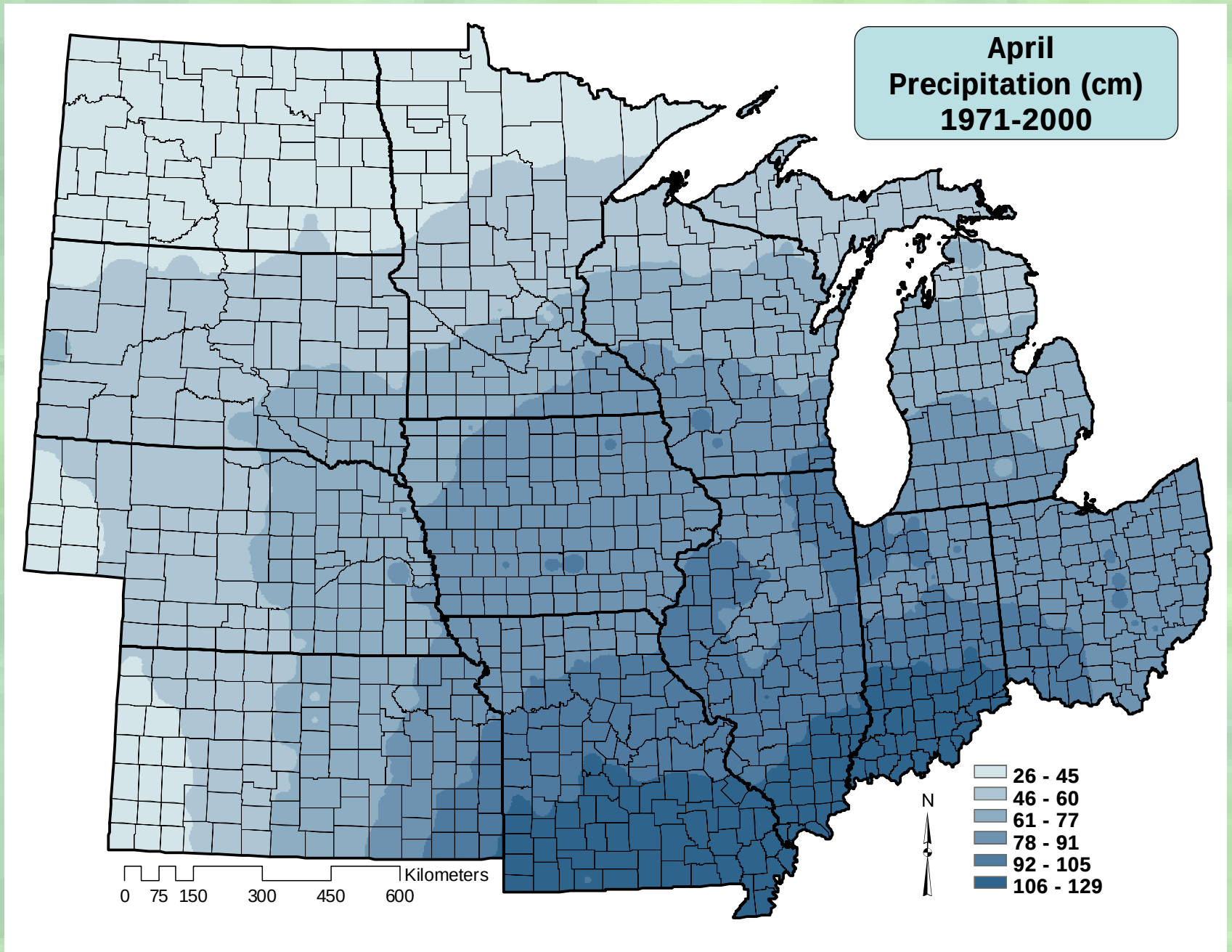

High Temperature (ºC)
1971-2000
9 - 12
13 - 14
15 - 15
16 - 17
18 - 19
20 - 21
N
0 75 150 300 450 600
Kilometers

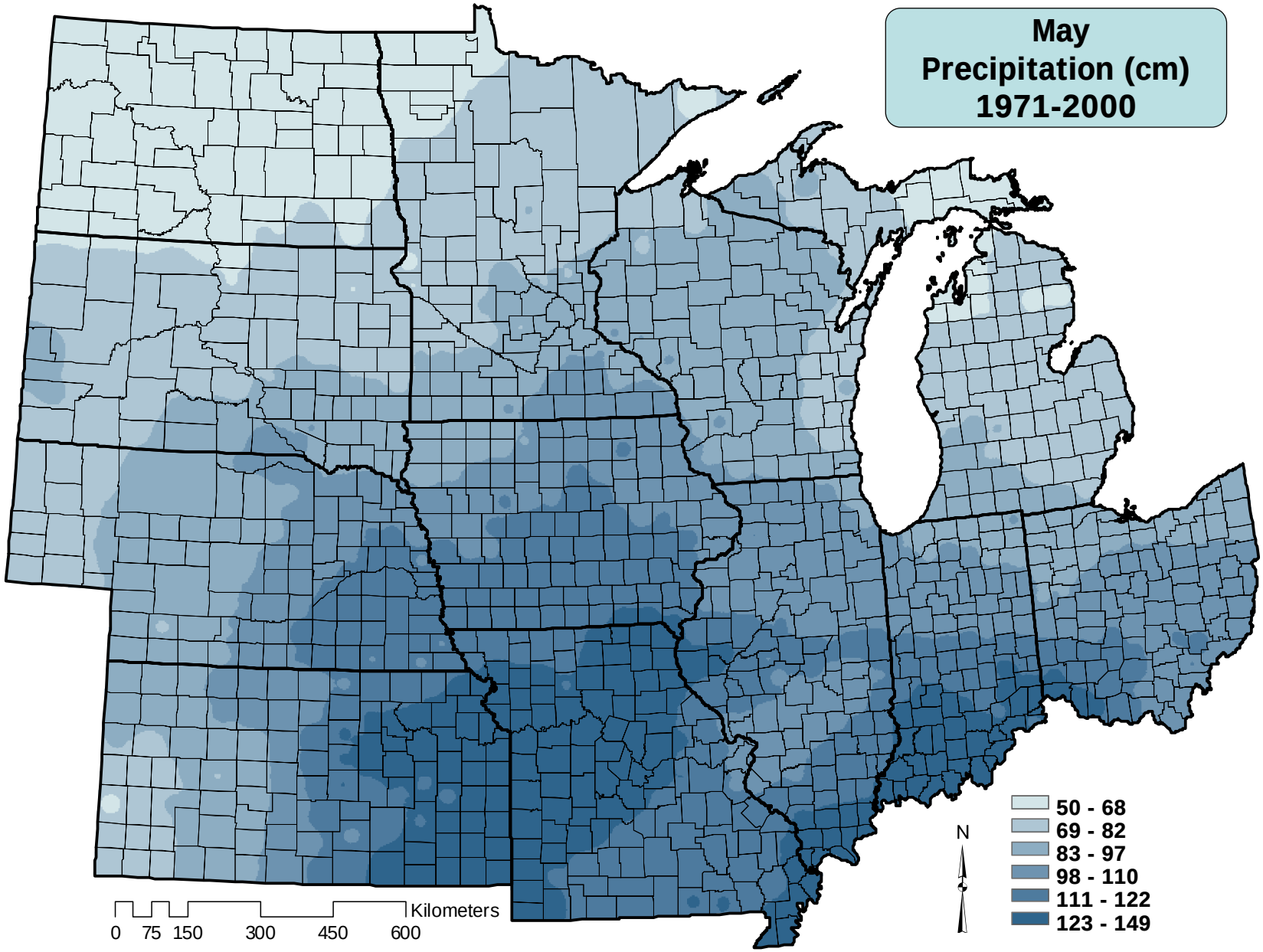

Temperature
Range (°C)
1971-2000
9 - 11
12 - 12
13 - 13
14 - 14
15 - 15
16 - 17
N
0 75 150 300 450 600
Kilometers

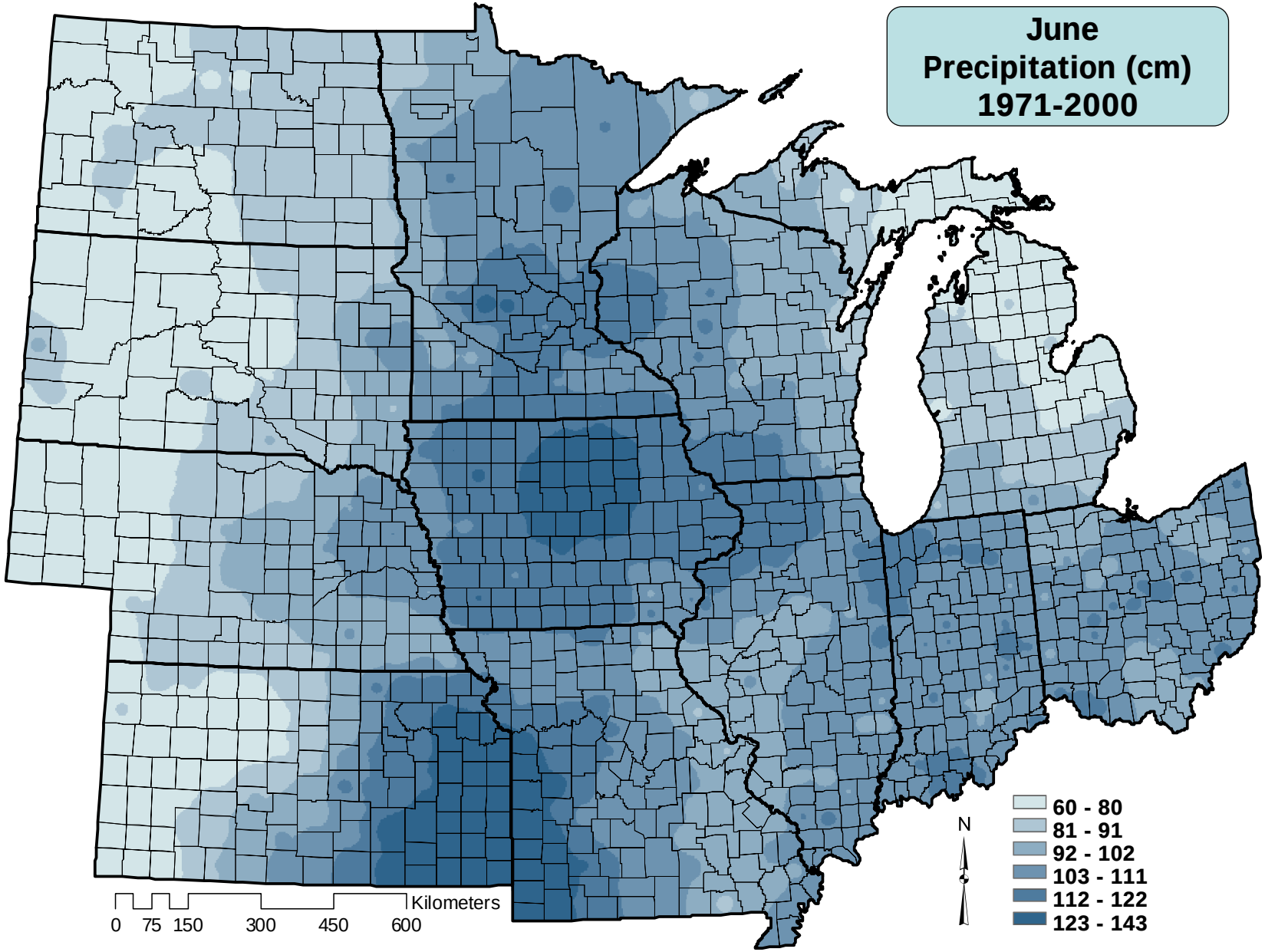

Minimum Temperature (ºC) 1971-2000
-4 - -1
0 - 1
2 - 3
4 - 4
5 - 6
7 - 9
N
0 75 150 300 450 600
Kilometers

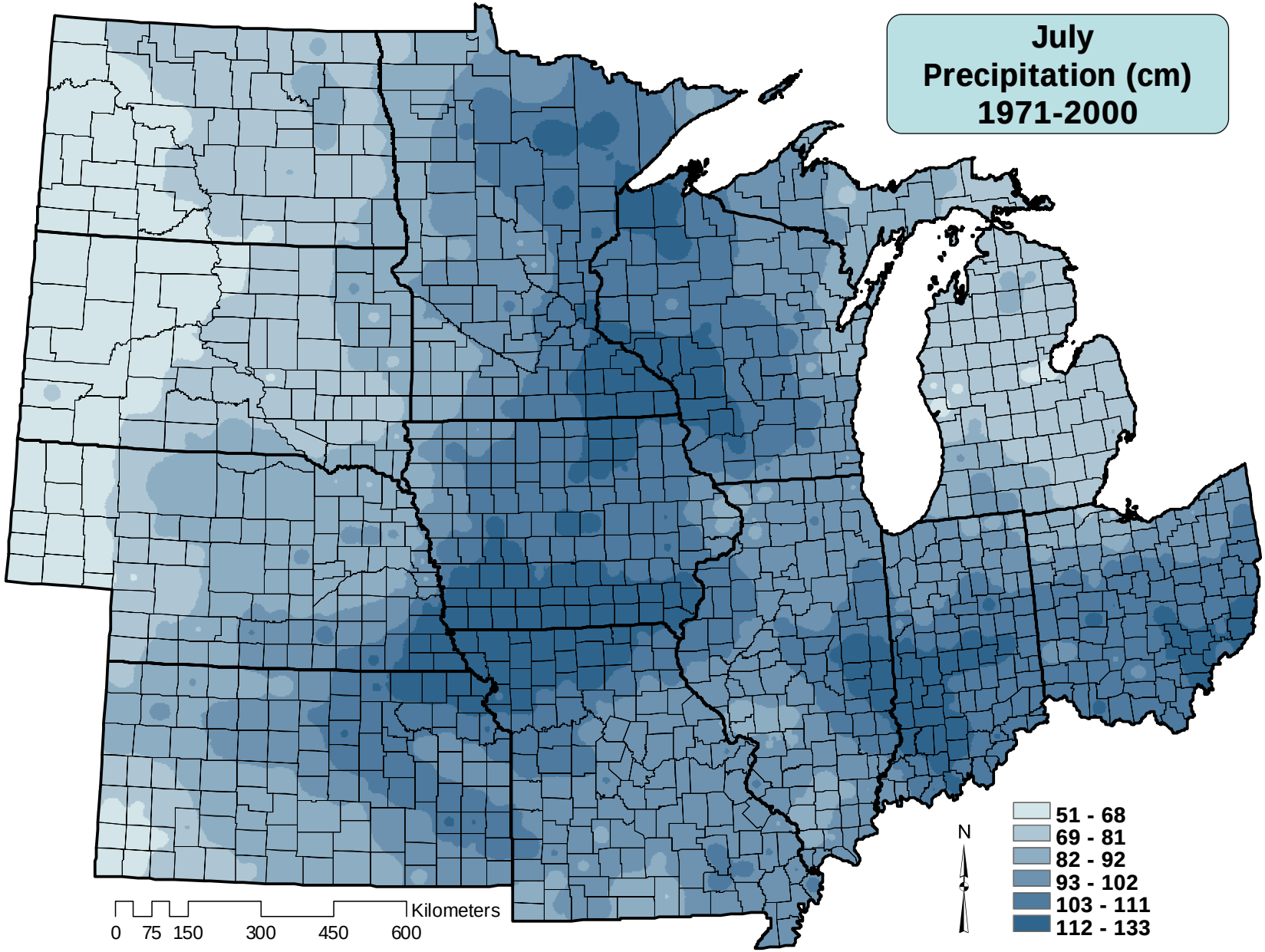

Heat
Precipitation Ratio
1971-2000
0.83 - 1.67
1.68 - 2.52
2.53 - 3.36
3.37 - 4.20
4.21 - 5.05
5.06 - 5.89
N
0 75 150 300 450 600
Kilometers

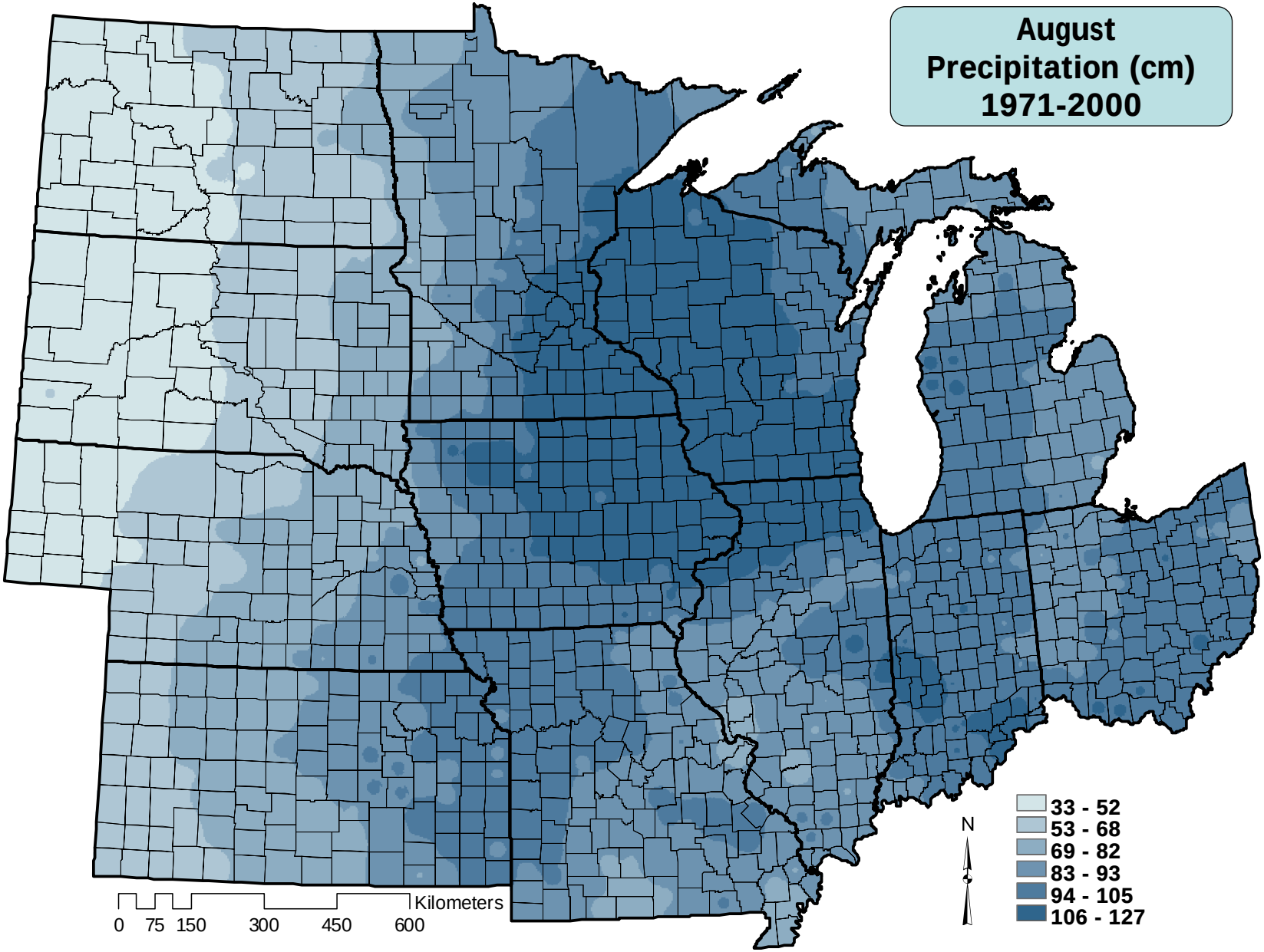

March
Precipitation (cm)
1971-2000
15 - 29
30 - 44
45 - 60
61 - 77
78 - 96
97 - 124
N
0 75 150 300 450 600
Kilometers

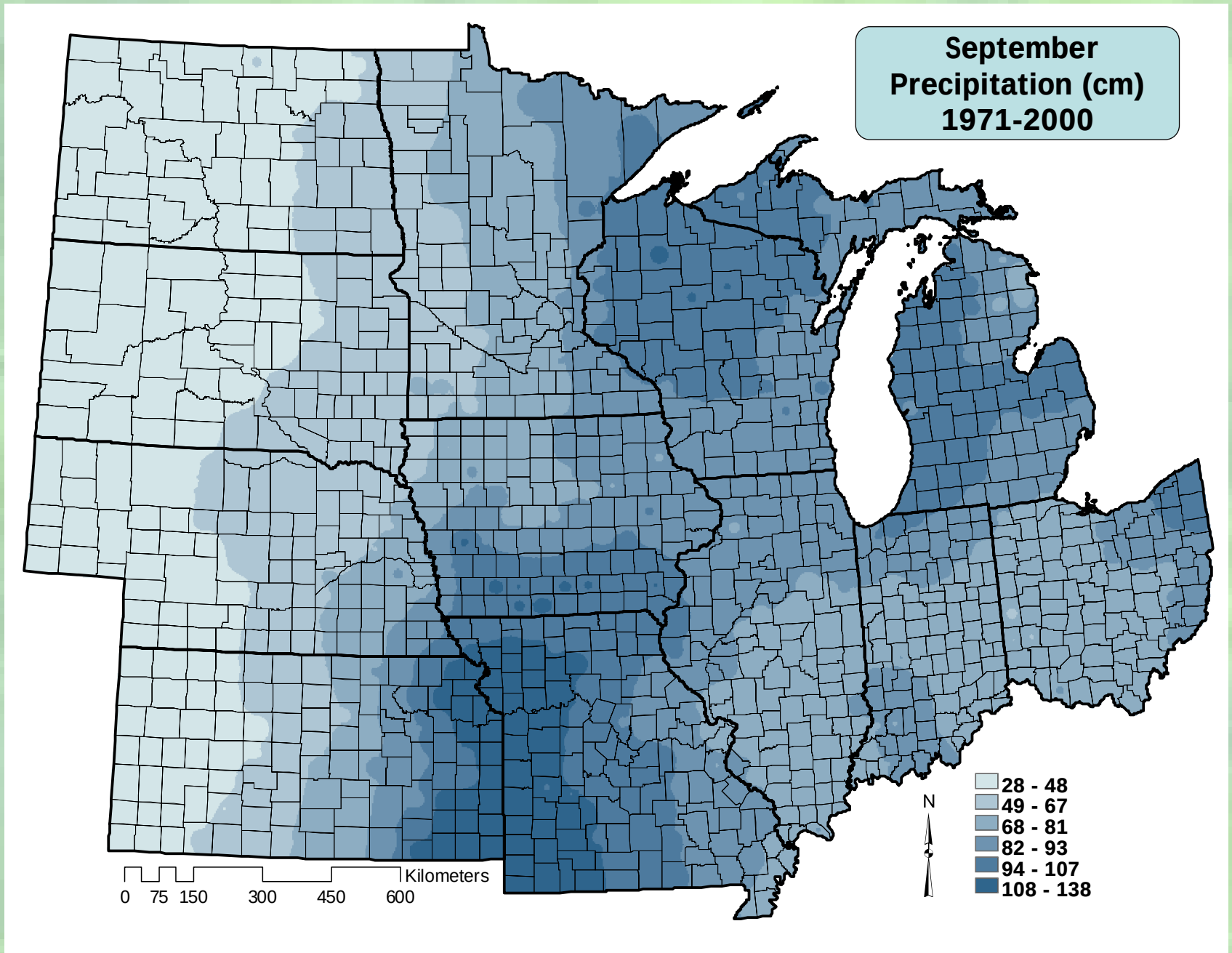

April
Precipitation (cm)
1971-2000
26 - 45
46 - 60
61 - 77
78 - 91
92 - 105
106 - 129
N
0 75 150 300 450 600
Kilometers

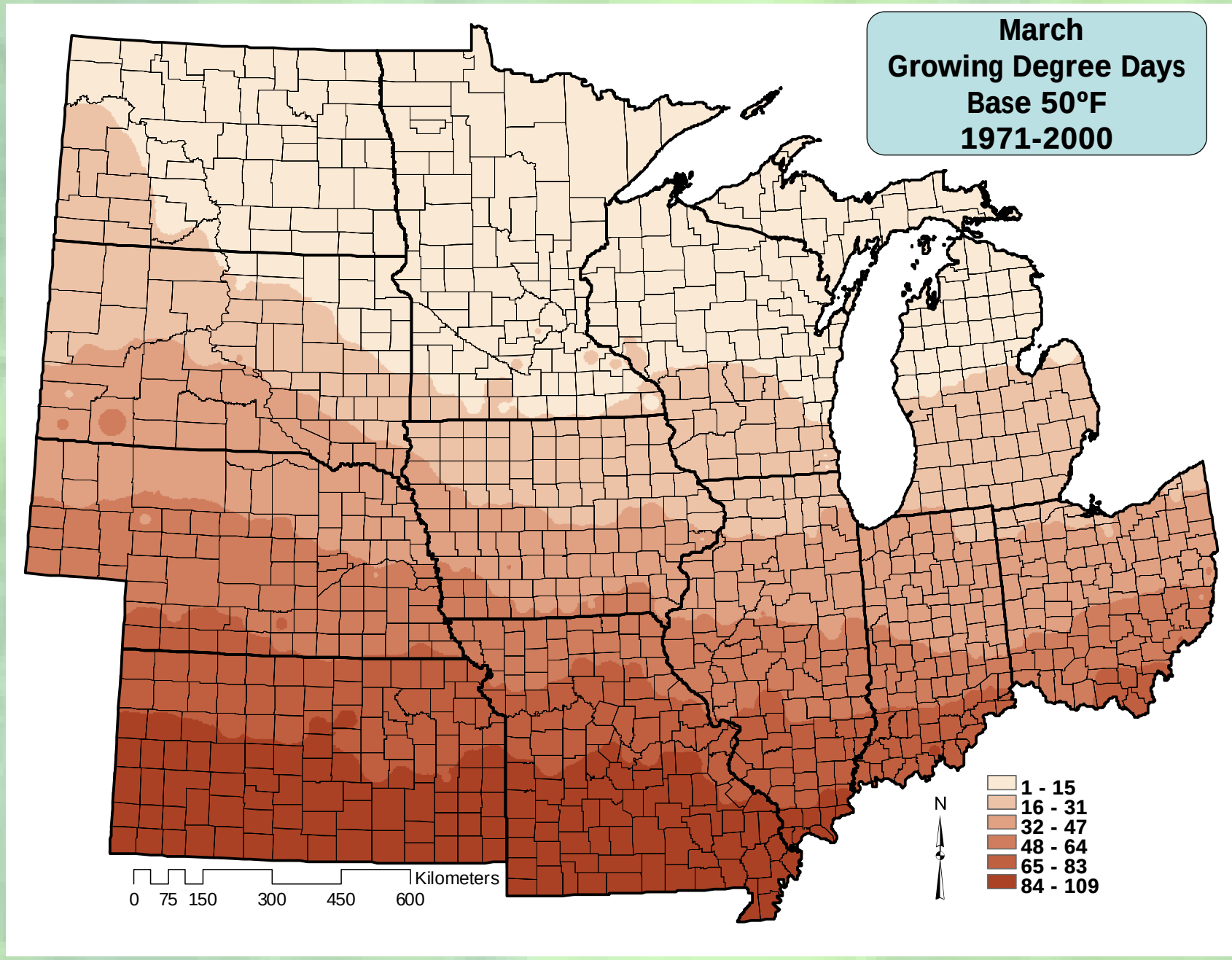

May
Precipitation (cm)
1971-2000
50 - 68
69 - 82
83 - 97
98 - 110
111 - 122
123 - 149
N
0 75 150 300 450 600
Kilometers

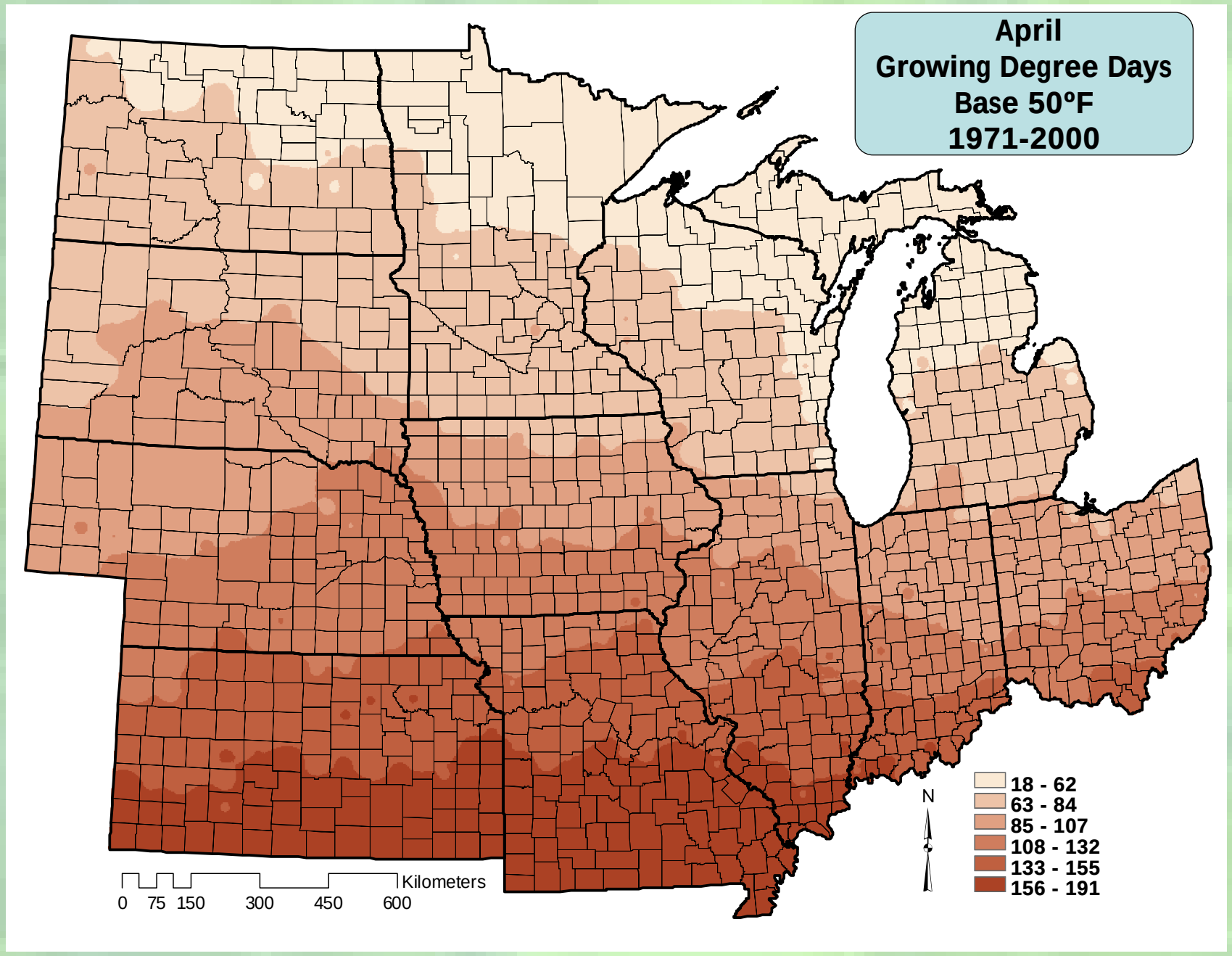

June
Precipitation (cm)
1971-2000
60 - 80
81 - 91
92 - 102
103 - 111
112 - 122
123 - 143
N
0 75 150 300 450 600
Kilometers

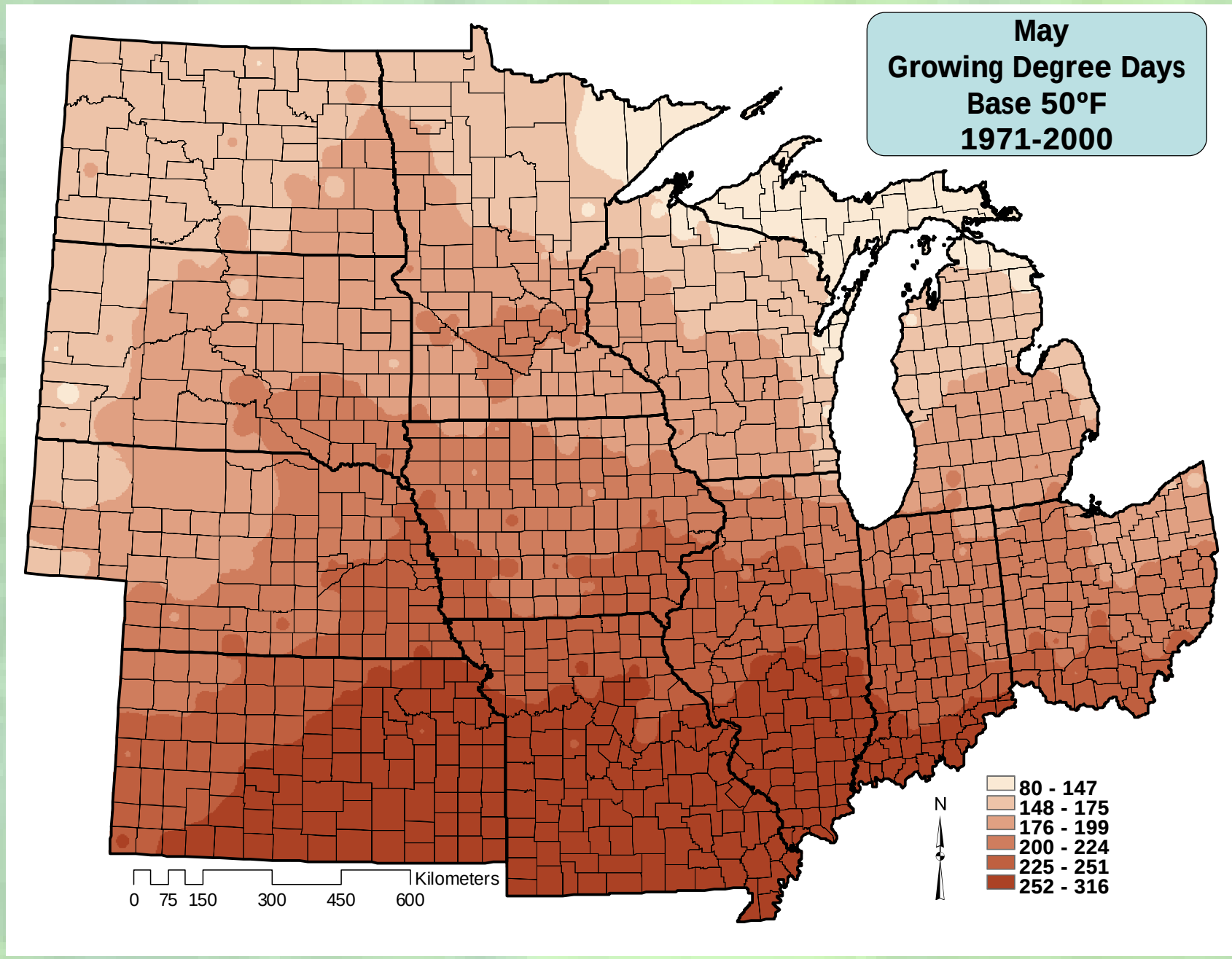

July
Precipitation (cm)
1971-2000
51 - 68
69 - 81
82 - 92
93 - 102
103 - 111
112 - 133
N
0 75 150 300 450 600
Kilometers

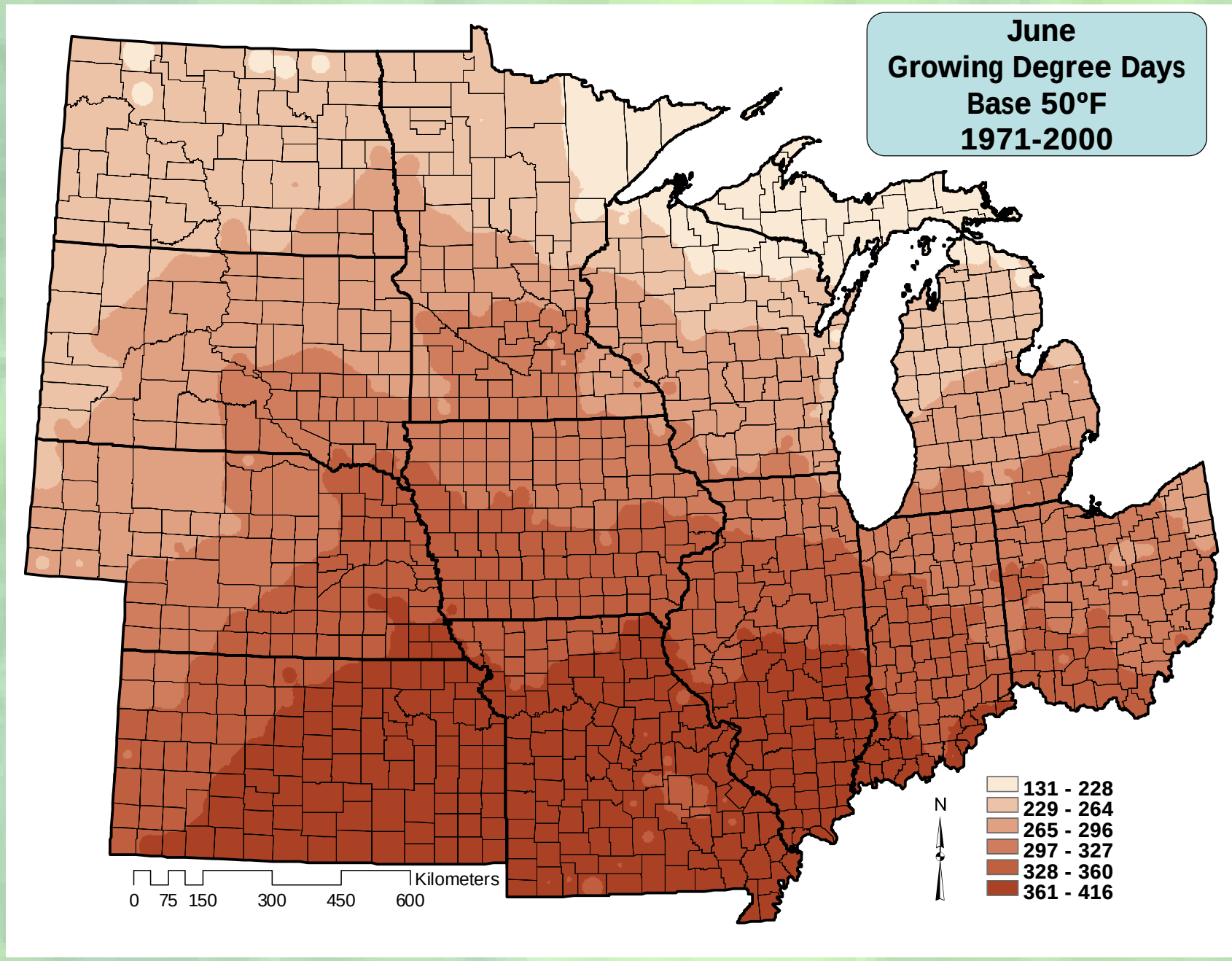

August
Precipitation (cm)
1971-2000
33 - 52
53 - 68
69 - 82
83 - 93
94 - 105
106 - 127
N
Kilometers
0 75 150 300 450 600

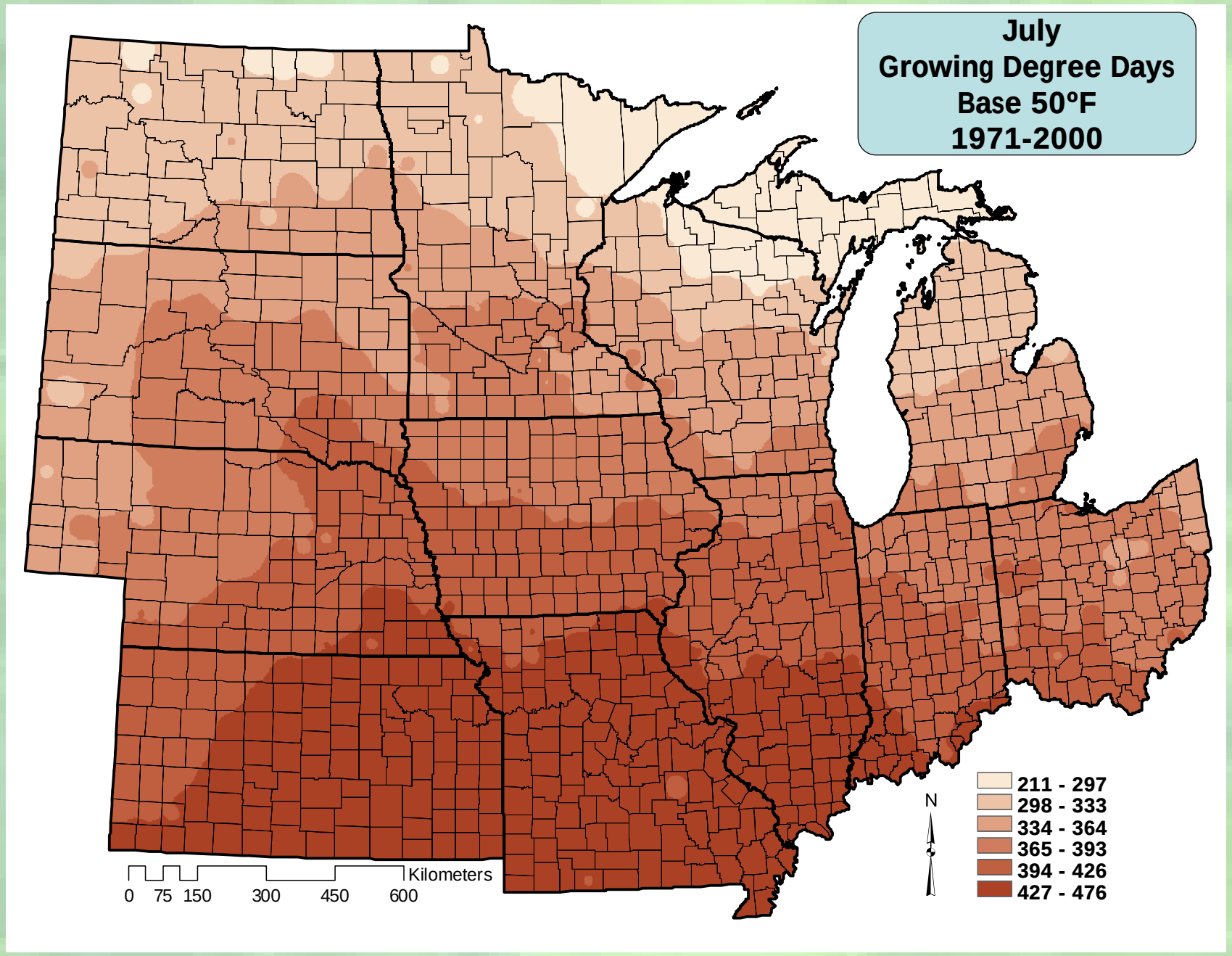

September
Precipitation (cm)
1971-2000
28 - 48
49 - 67
68 - 81
82 - 93
94 - 107
108 - 138
N
0 75 150 300 450 600
Kilometers

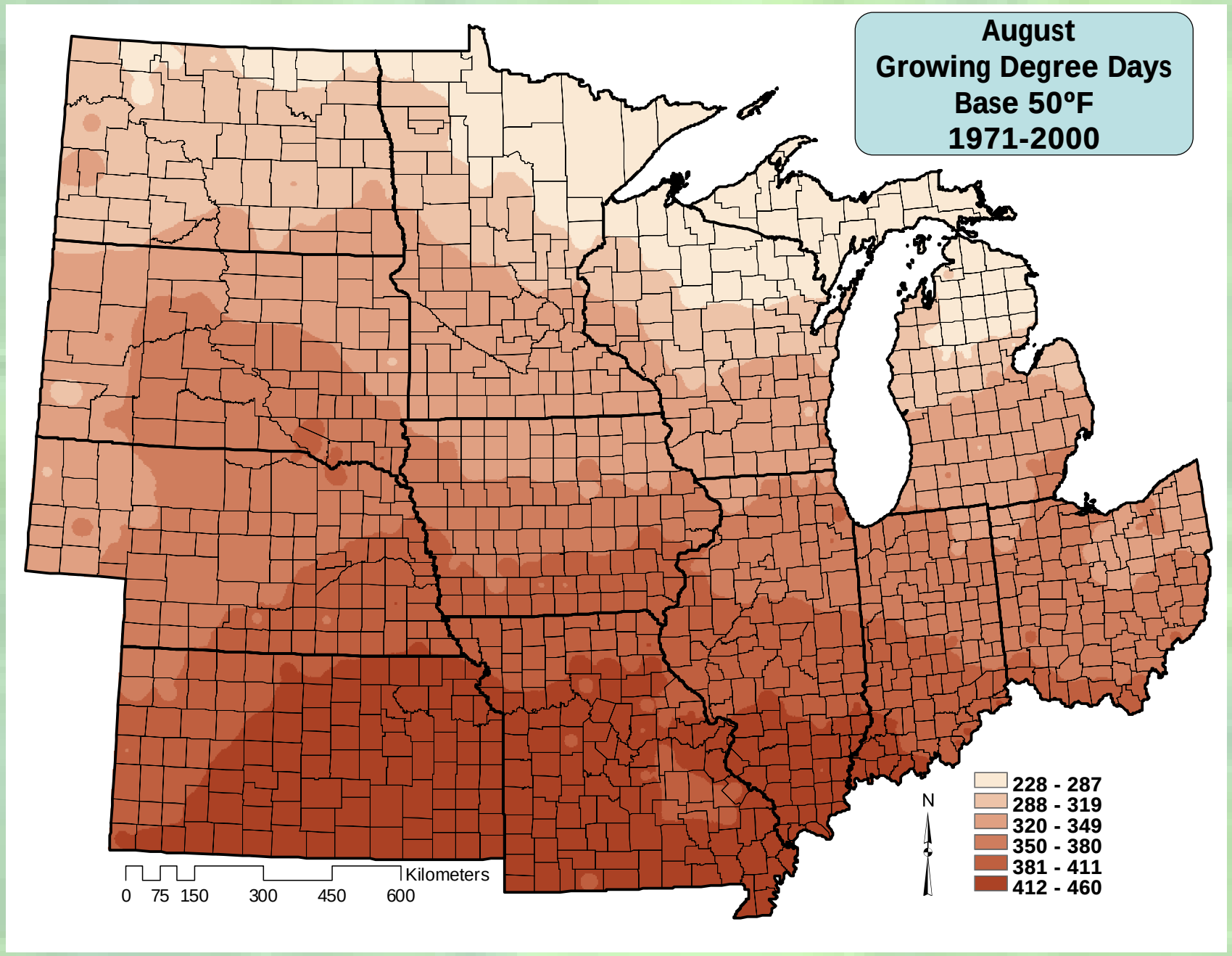

March
Growing Degree Days
Base 50°F
1971-2000
1 - 15
16 - 31
32 - 47
48 - 64
65 - 83
84 - 109
N
0 75 150 300 450 600
Kilometers

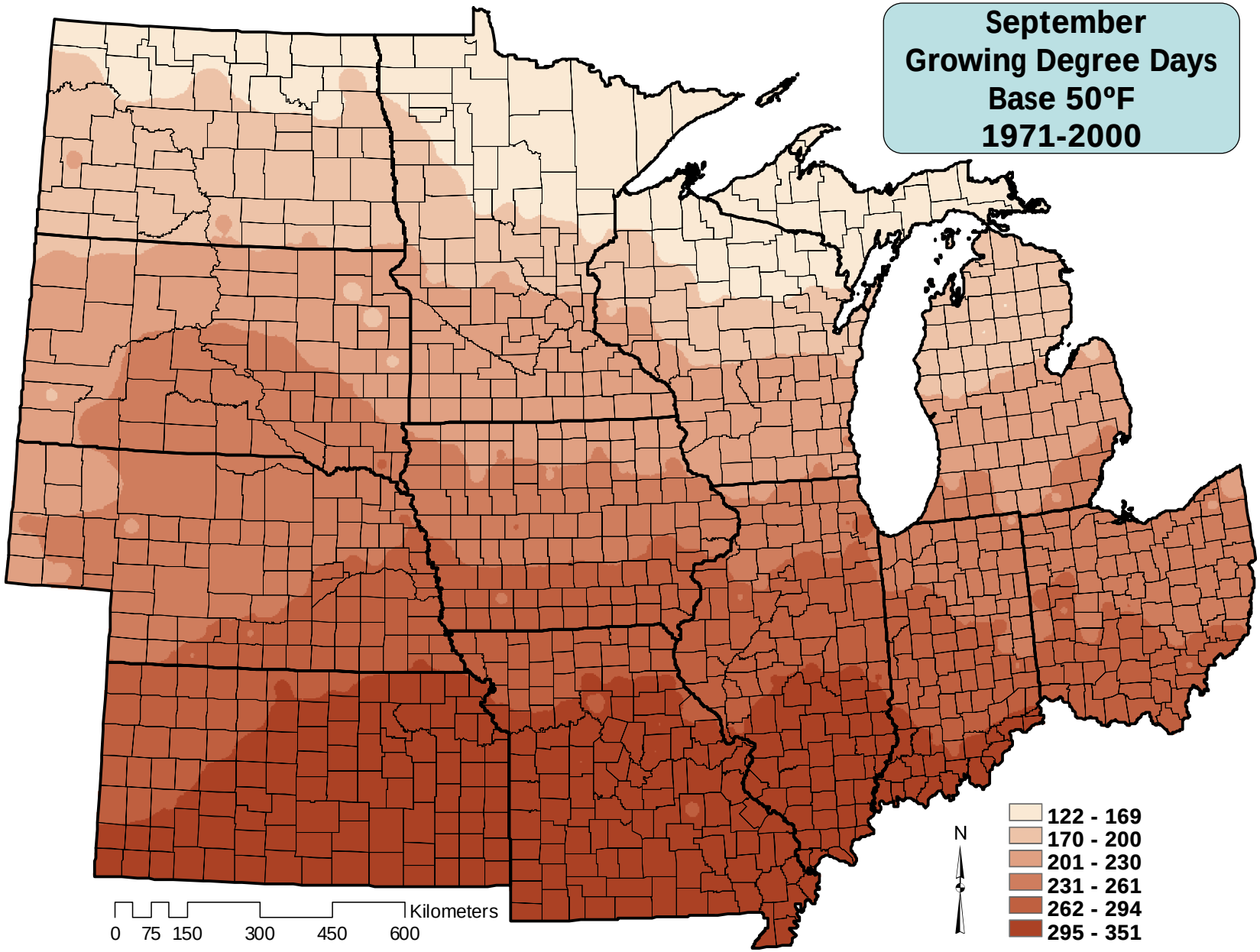

April
Growing Degree Days
Base 50ºF
1971-2000
18 - 62
63 - 84
85 - 107
108 - 132
133 - 155
156 - 191
N
0 75 150 300 450 600
Kilometers

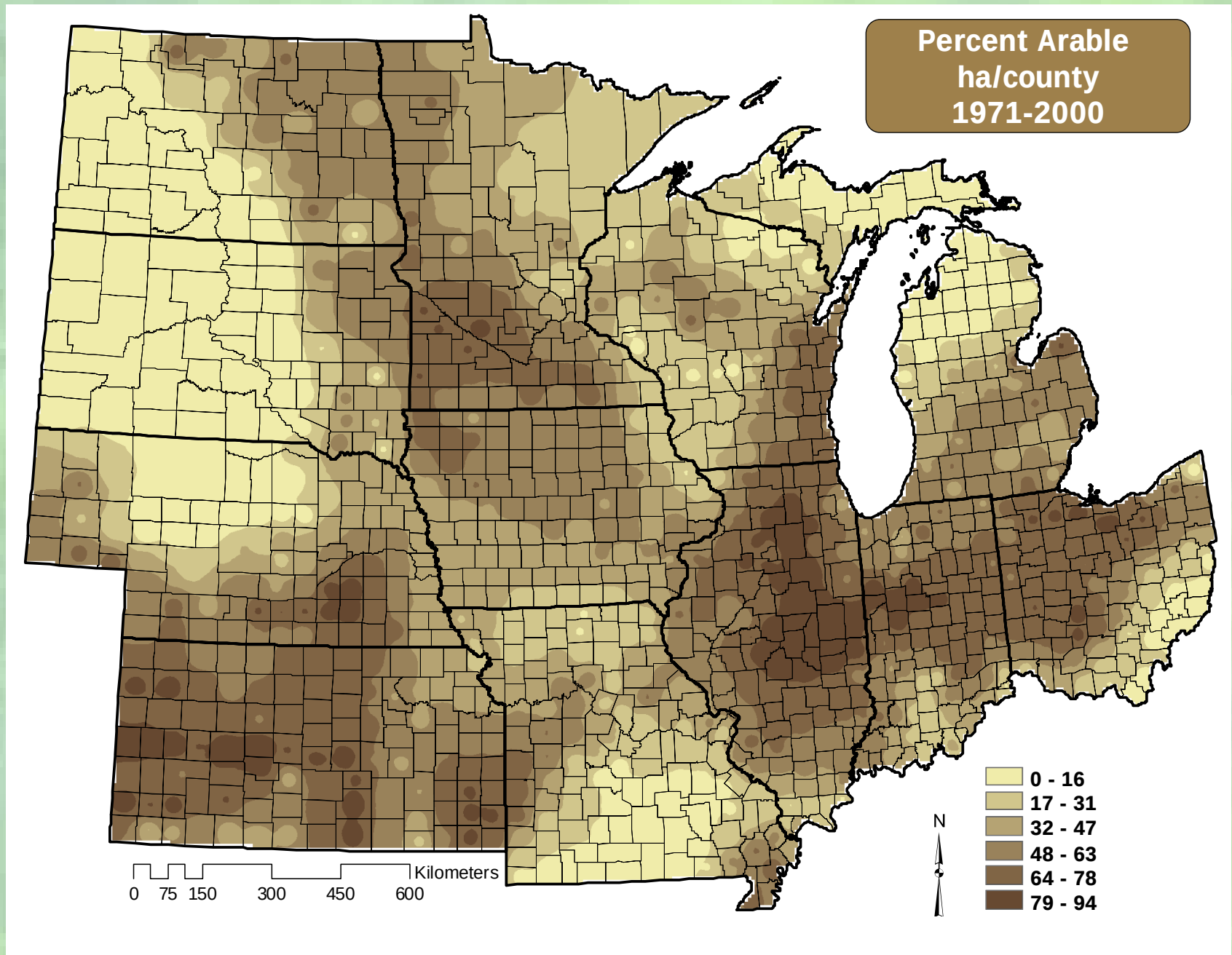

May
Growing Degree Days
Base 50ºF
1971-2000
80 - 147
148 - 175
176 - 199
200 - 224
225 - 251
252 - 316
N
Kilometers
0 75 150 300 450 600

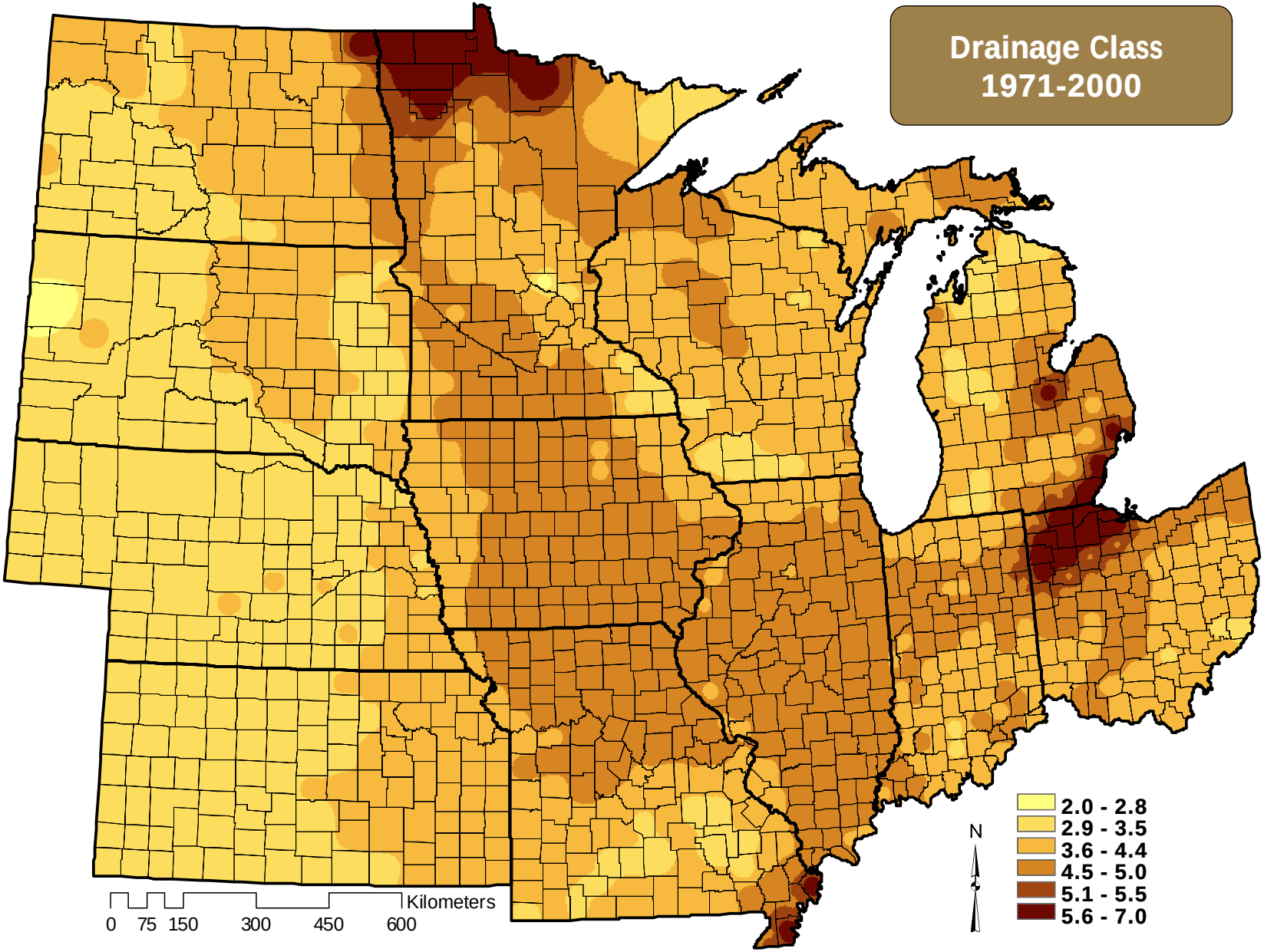

June
Growing Degree Days
Base 50°F
1971-2000
131 - 228
229 - 264
265 - 296
297 - 327
328 - 360
361 - 416
N
0 75 150 300 450 600
Kilometers

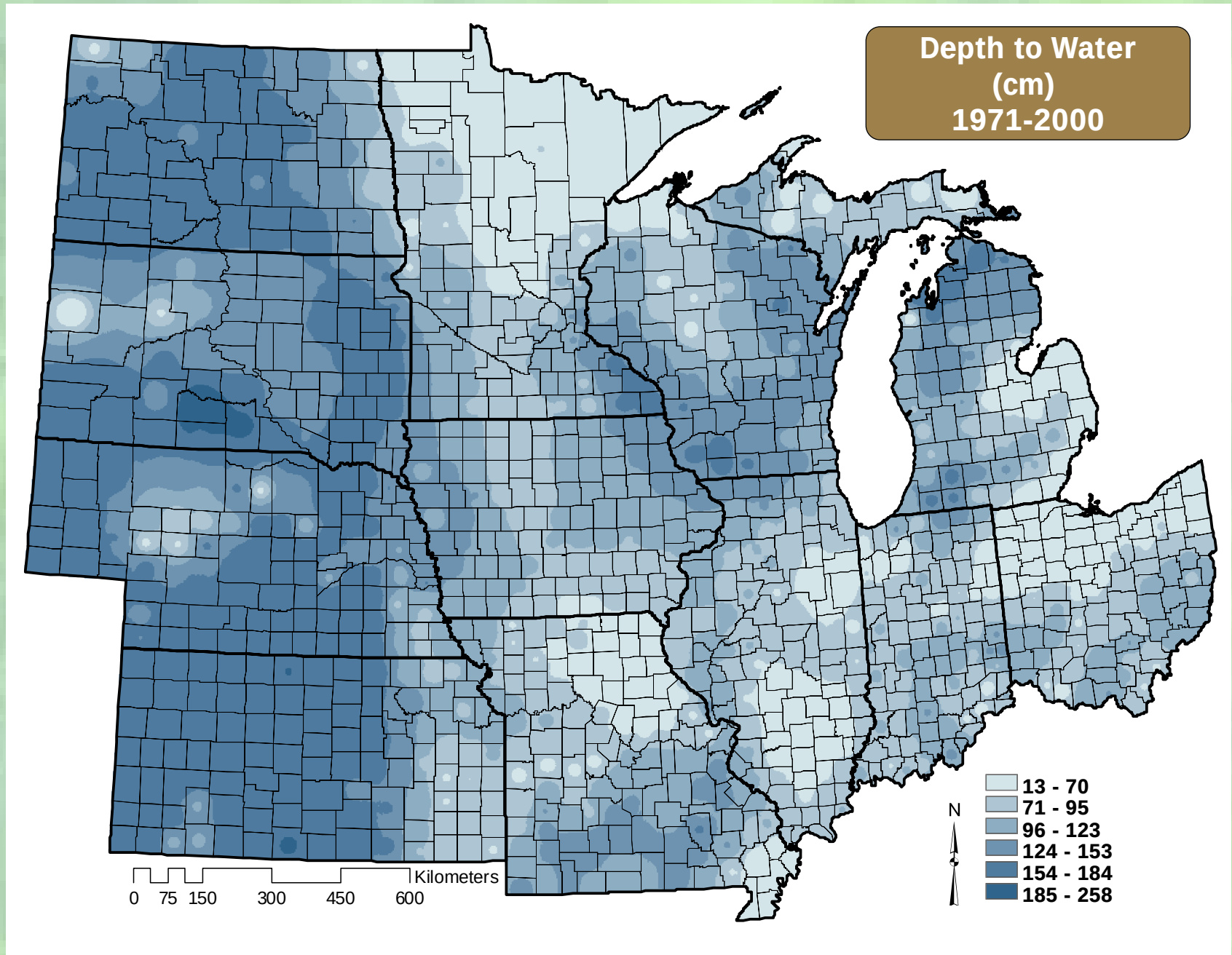

July
Growing Degree Days
Base 50ºF
1971-2000
211 - 297
298 - 333
334 - 364
365 - 393
394 - 426
427 - 476
N
0 75 150 300 450 600
Kilometers

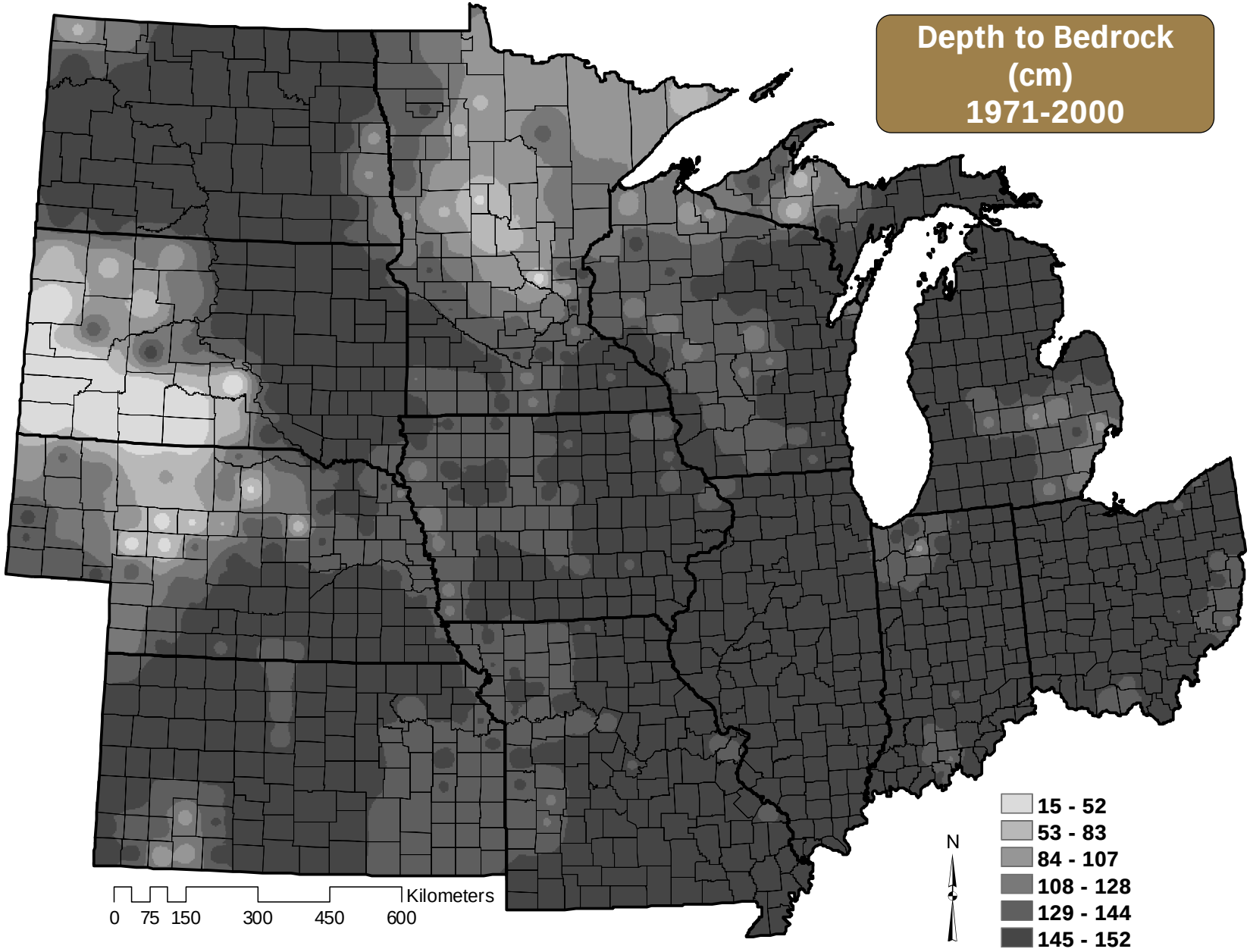

August
Growing Degree Days
Base 50ºF
1971-2000
228 - 287
288 - 319
320 - 349
350 - 380
381 - 411
412 - 460
N
0 75 150 300 450 600
Kilometers

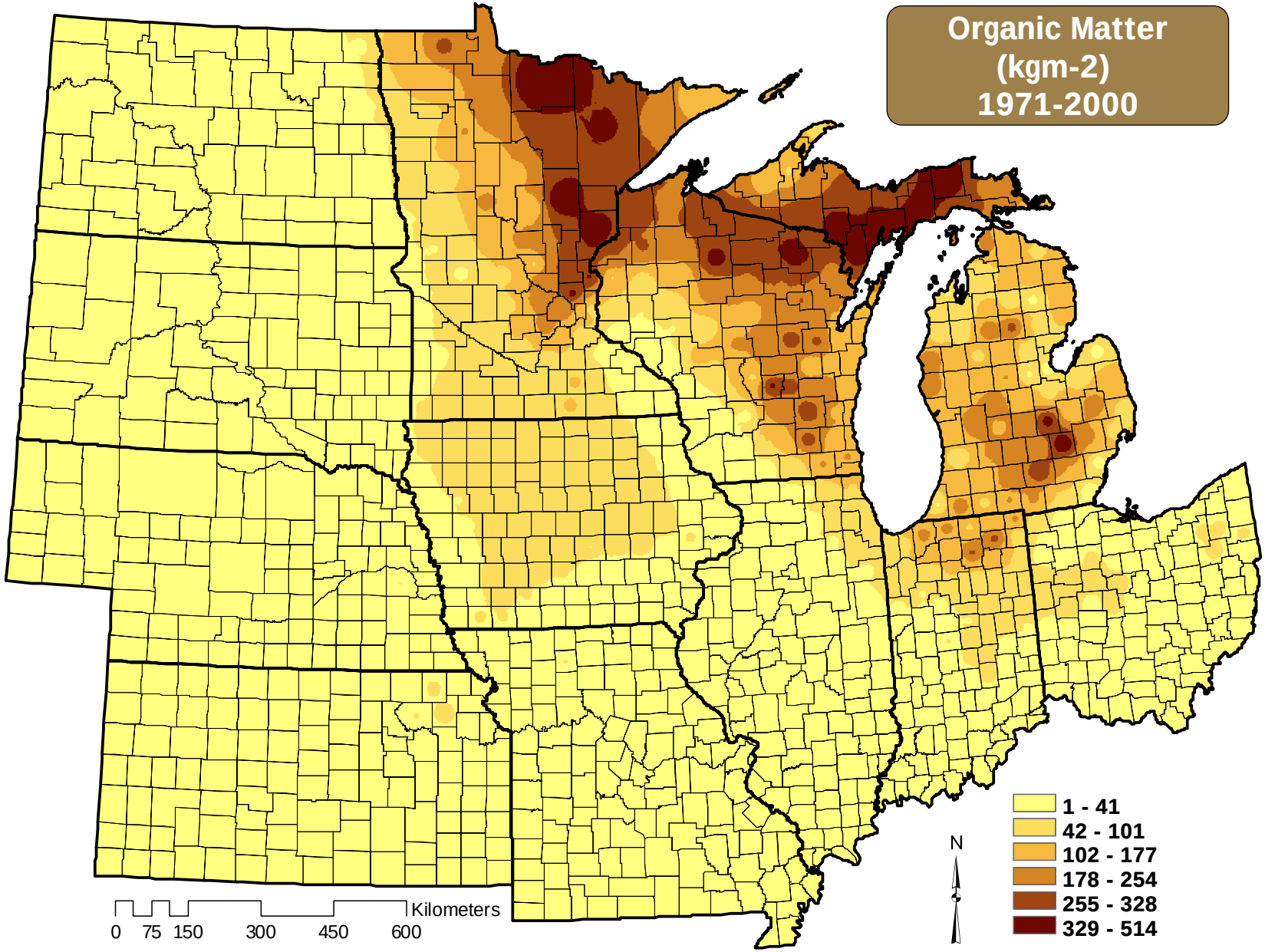

September
Growing Degree Days
Base 50°F
1971-2000
122 - 169
170 - 200
201 - 230
231 - 261
262 - 294
295 - 351
N
0 75 150 300 450 600
Kilometers

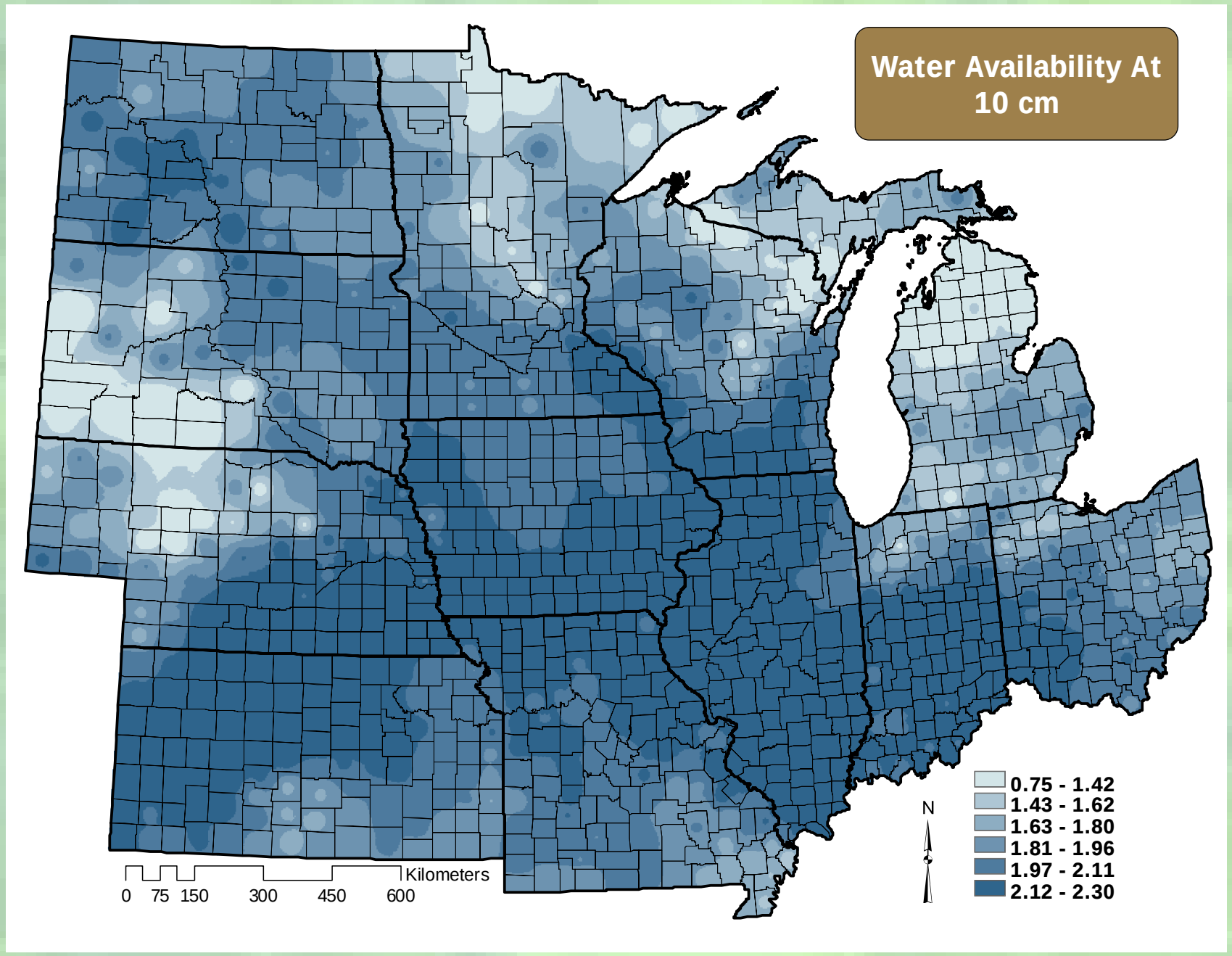

Percent Arable
ha/county
1971-2000
0 - 16
17 - 31
32 - 47
48 - 63
64 - 78
79 - 94
N
0 75 150 300 450 600
Kilometers


Drainage Class
1971-2000
2.0 - 2.8
2.9 - 3.5
3.6 - 4.4
4.5 - 5.0
5.1 - 5.5
5.6 - 7.0
N
0 75 150 300 450 600
Kilometers

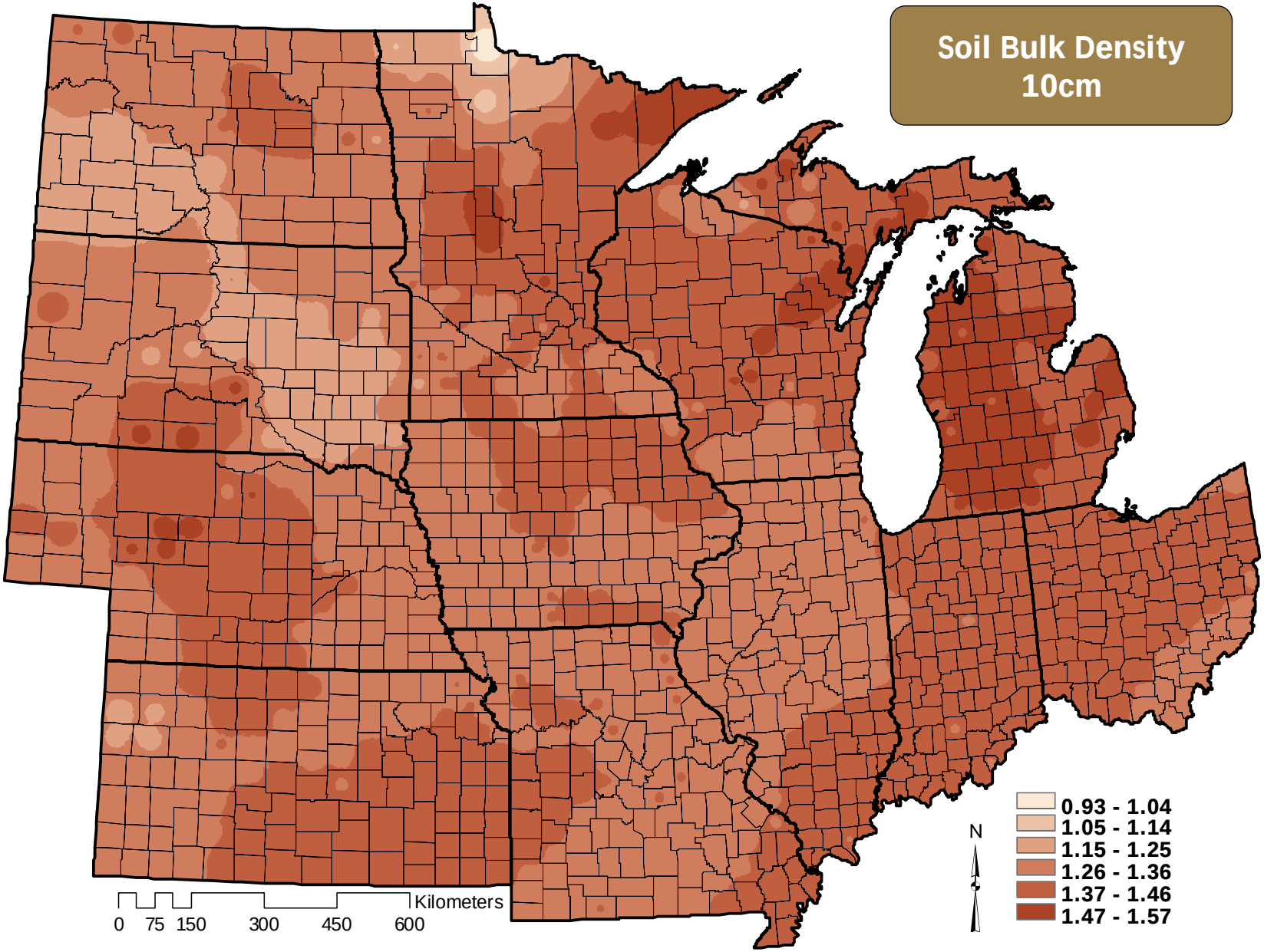

Depth to Water
(cm)
1971-2000
13 - 70
71 - 95
96 - 123
124 - 153
154 - 184
185 - 258
N
0 75 150 300 450 600
Kilometers

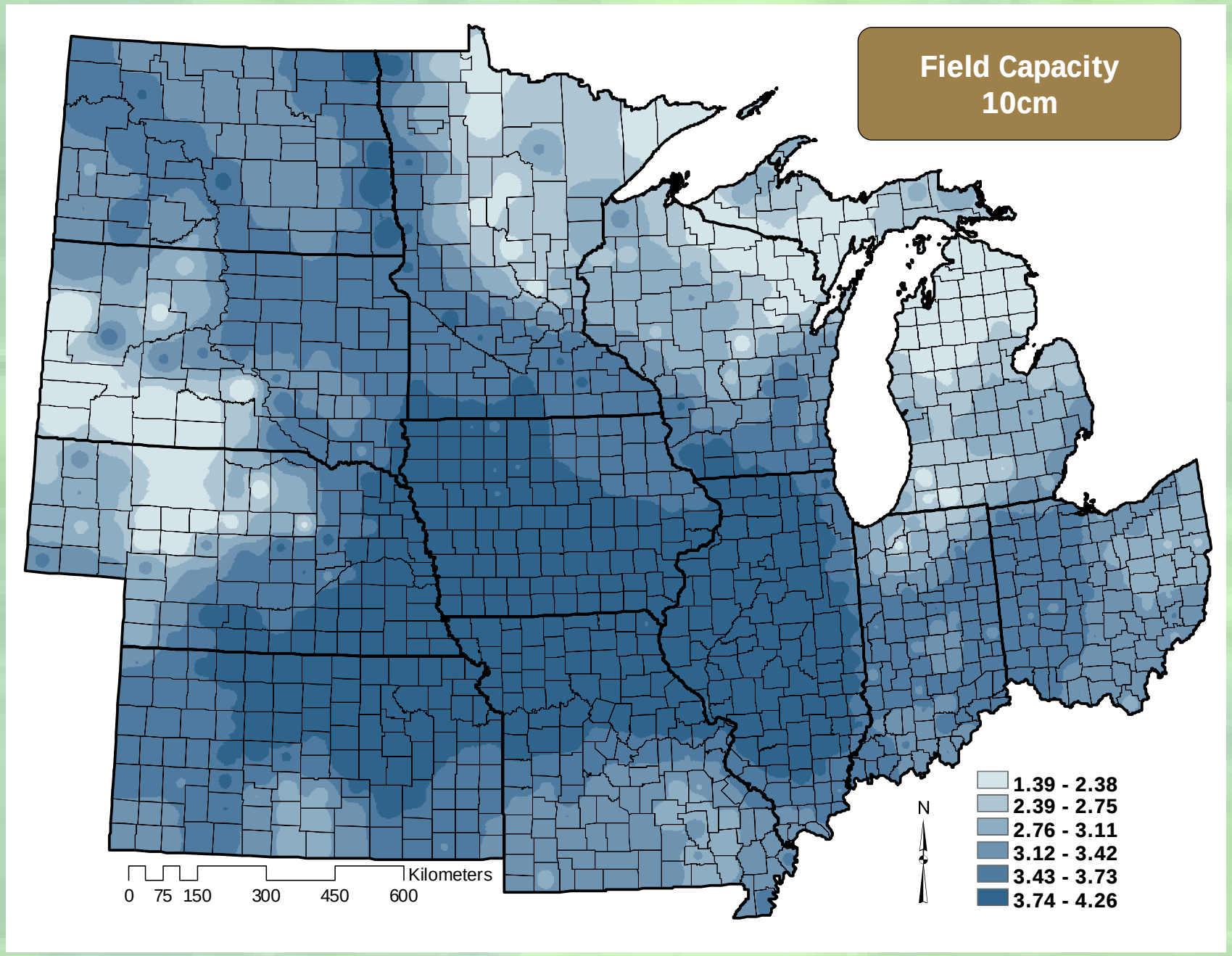

Depth to Bedrock
(cm)
1971-2000
15 - 52
53 - 83
84 - 107
108 - 128
129 - 144
145 - 152
N
0 75 150 300 450 600
Kilometers

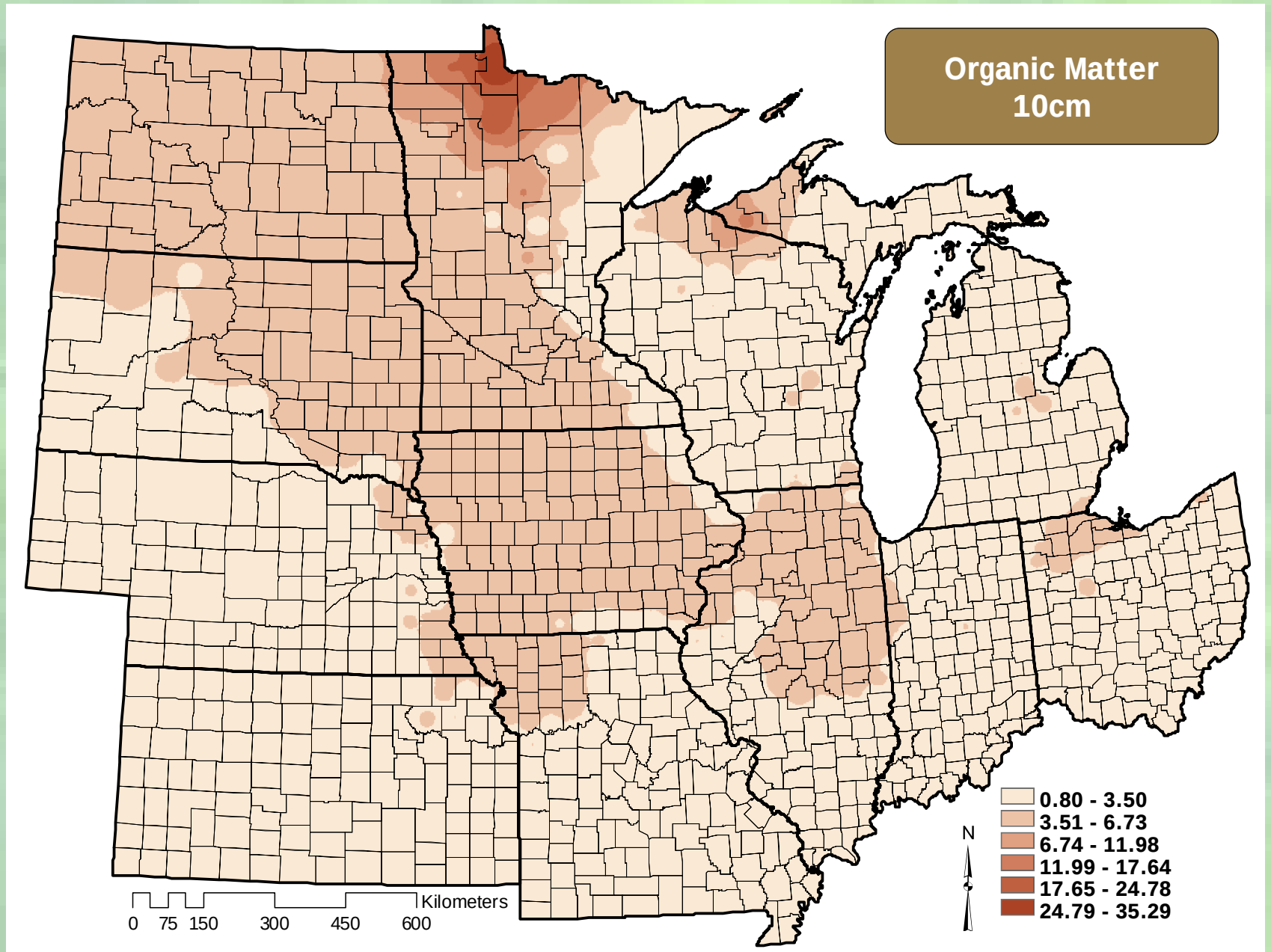

Organic Matter
(kgm-2)
1971-2000
1 - 41
42 - 101
102 - 177
178 - 254
255 - 328
329 - 514
N
0 75 150 300 450 600
Kilometers

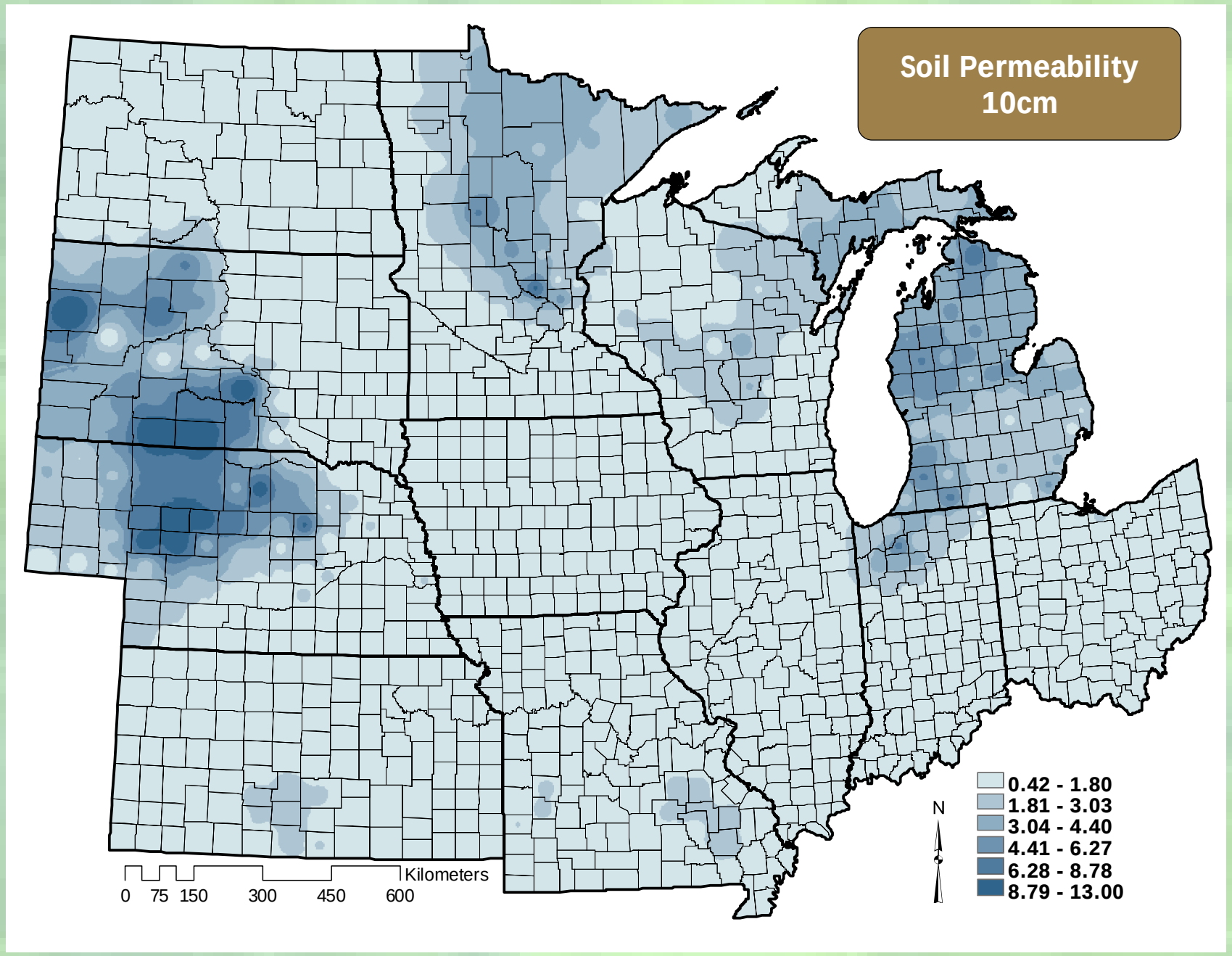

Water Availability At 10 cm
0.75 - 1.42
1.43 - 1.62
1.63 - 1.80
1.81 - 1.96
1.97 - 2.11
2.12 - 2.30
N
0 75 150 300 450 600
Kilometers

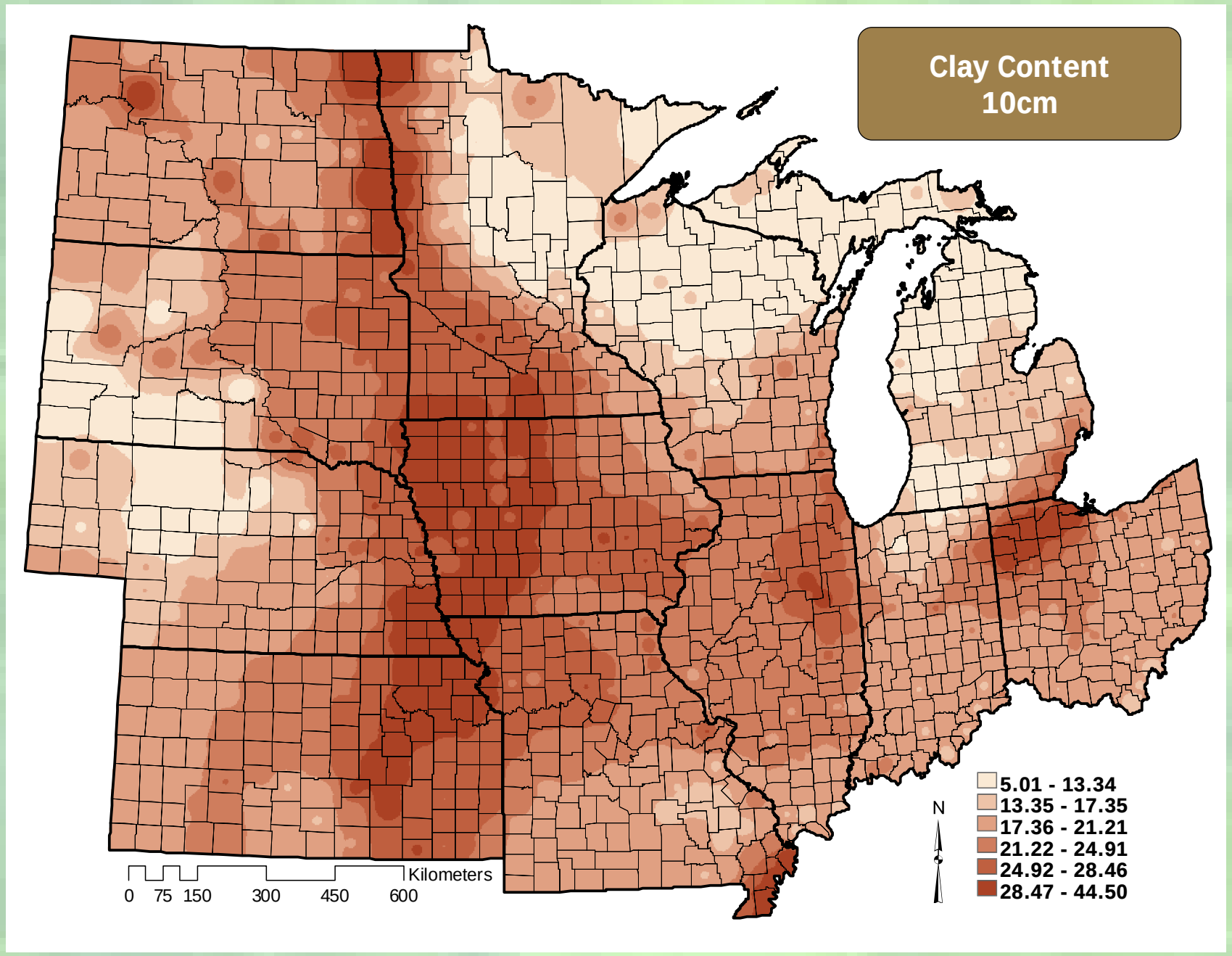
Soil Bulk Density 10cm

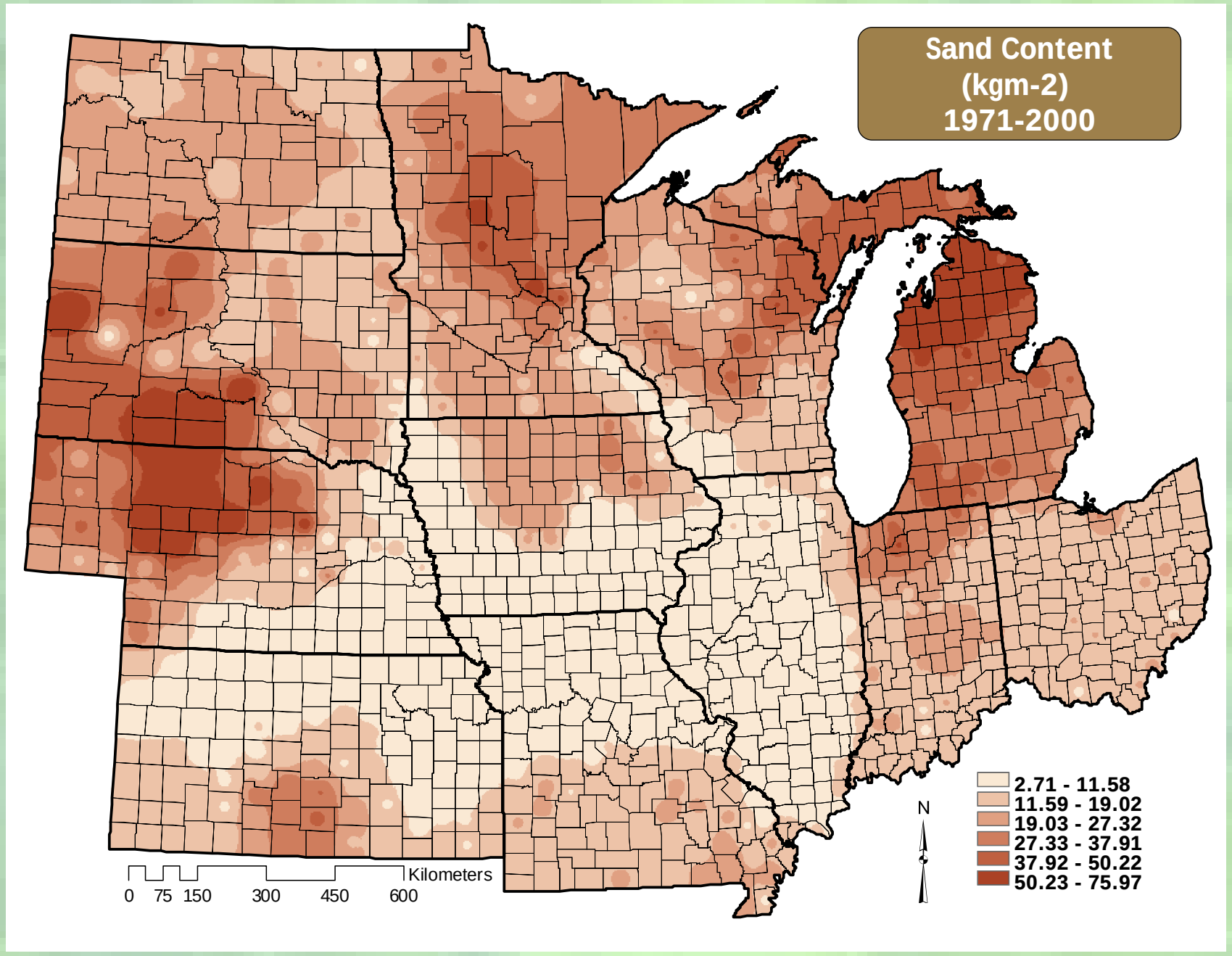


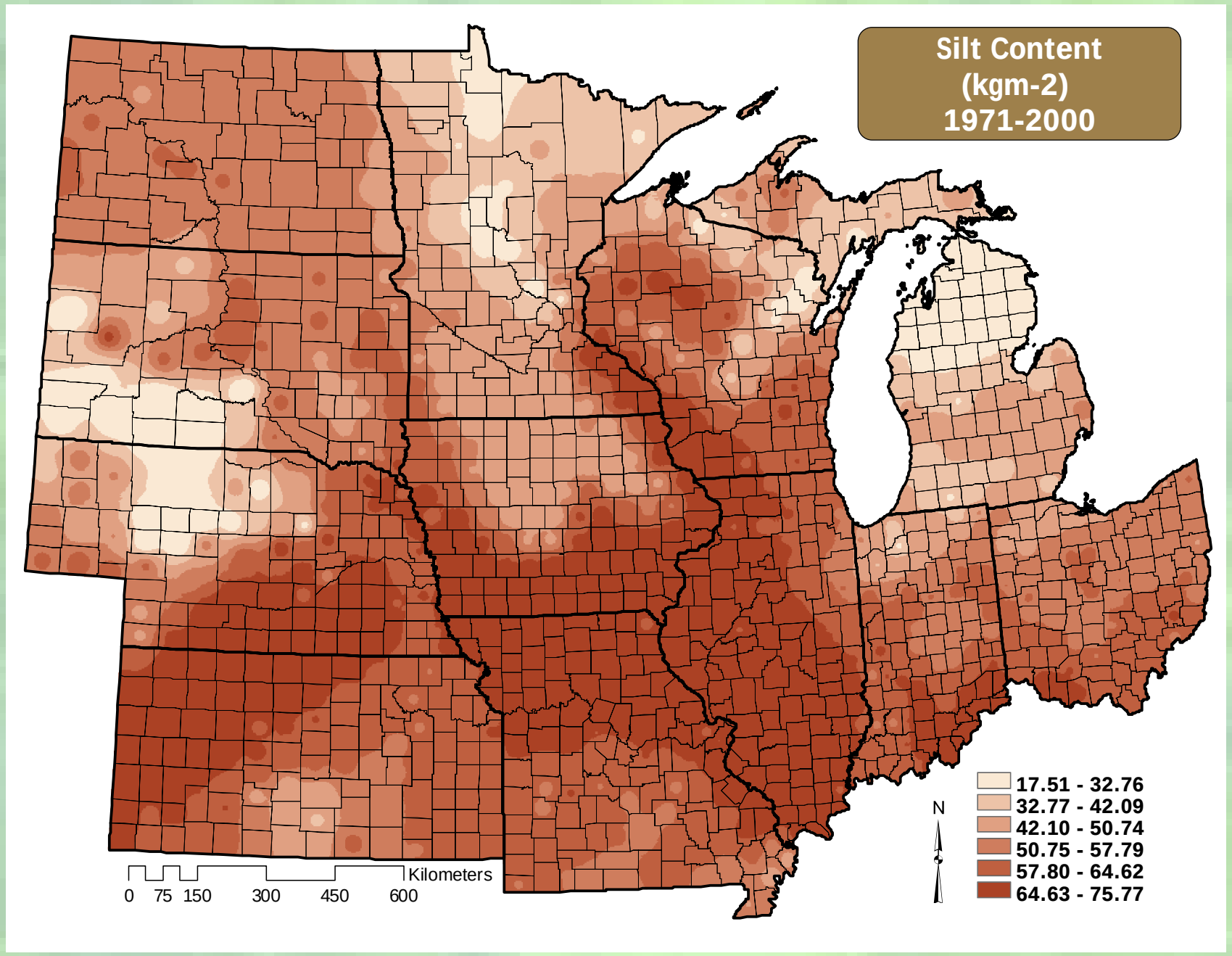

Field Capacity
10cm
1.39 - 2.38
2.39 - 2.75
2.76 - 3.11
3.12 - 3.42
3.43 - 3.73
3.74 - 4.26
N
0 75 150 300 450 600
Kilometers


Organic Matter
10cm
0.80 - 3.50
3.51 - 6.73
6.74 - 11.98
11.99 - 17.64
17.65 - 24.78
24.79 - 35.29
N
0 75 150 300 450 600
Kilometers

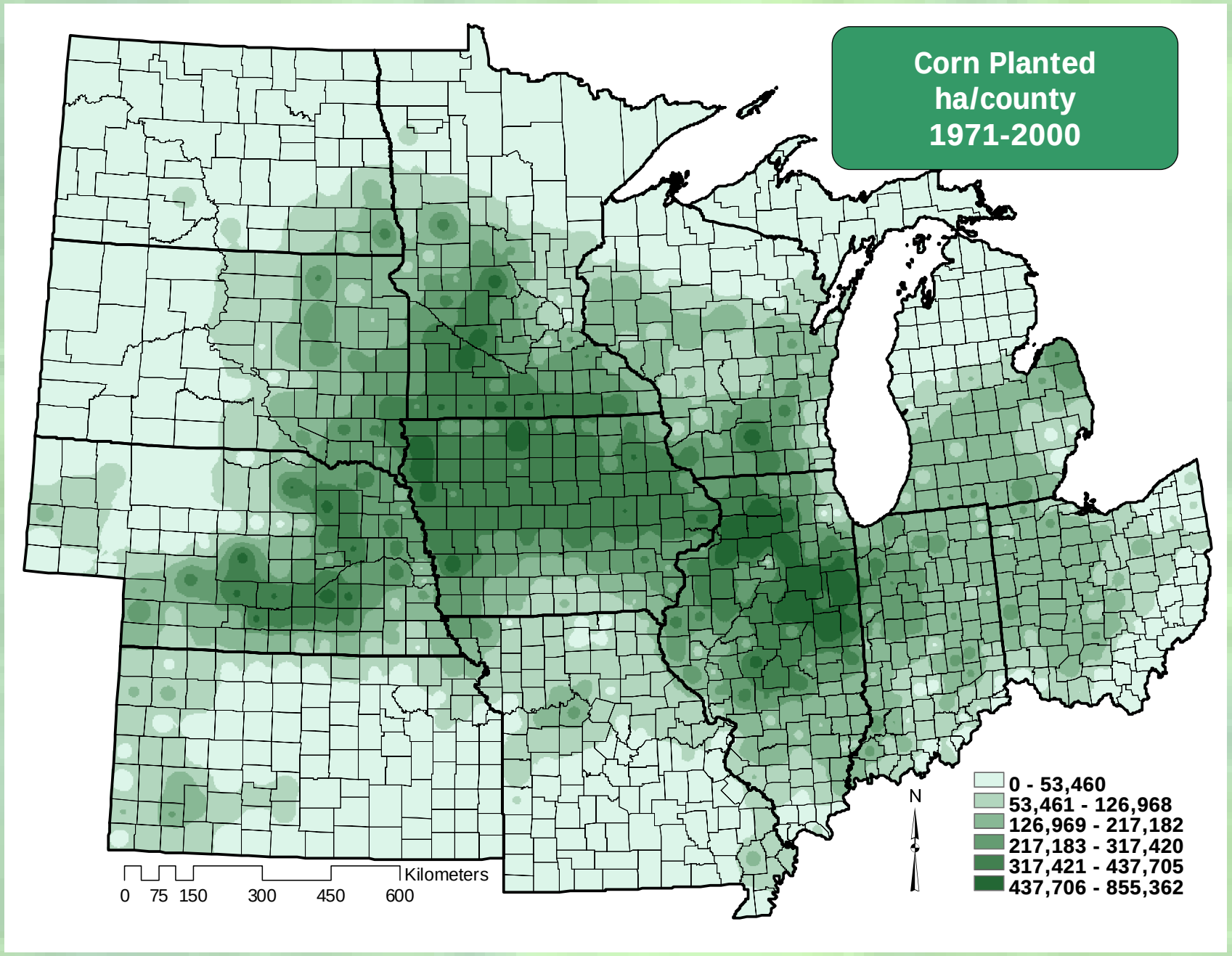

Soil Permeability
10cm
0.42 - 1.80
1.81 - 3.03
3.04 - 4.40
4.41 - 6.27
6.28 - 8.78
8.79 - 13.00
N
0 75 150 300 450 600
Kilometers

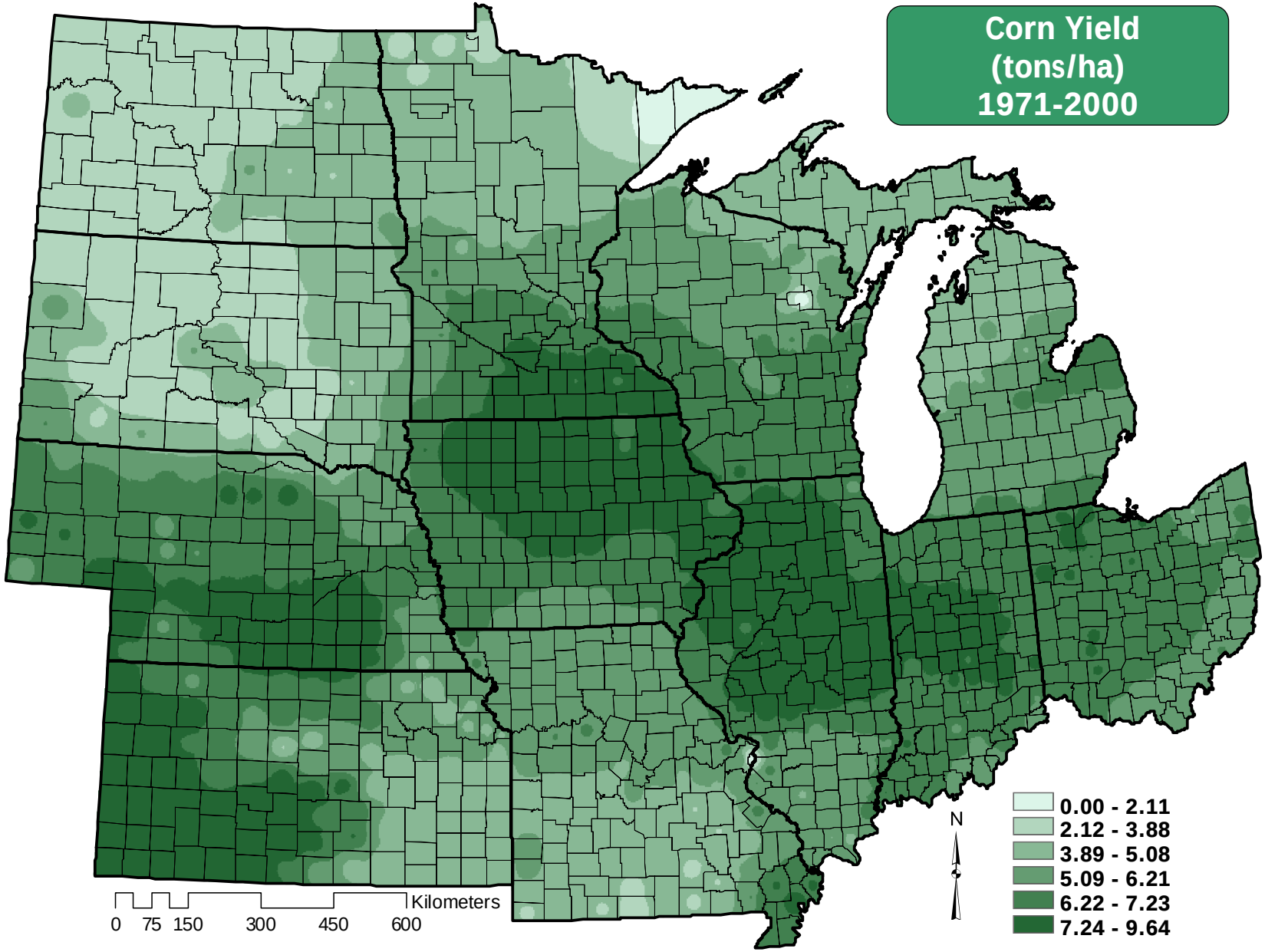

Clay Content
10cm
5.01 - 13.34
13.35 - 17.35
17.36 - 21.21
21.22 - 24.91
24.92 - 28.46
28.47 - 44.50
N
0 75 150 300 450 600
Kilometers

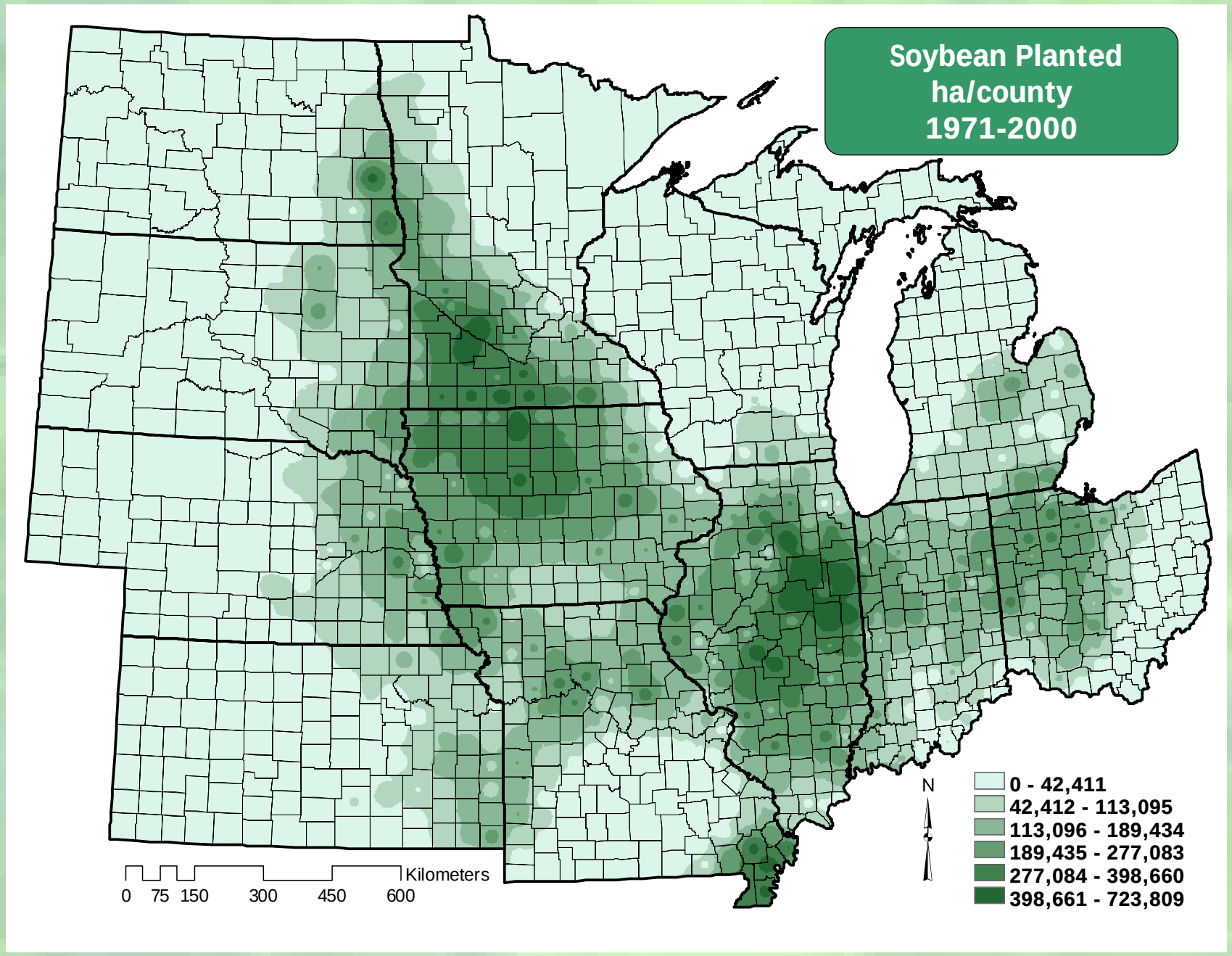

Sand Content
(kgm-2)
1971-2000
2.71 - 11.58
11.59 - 19.02
19.03 - 27.32
27.33 - 37.91
37.92 - 50.22
50.23 - 75.97
N
0 75 150 300 450 600
Kilometers

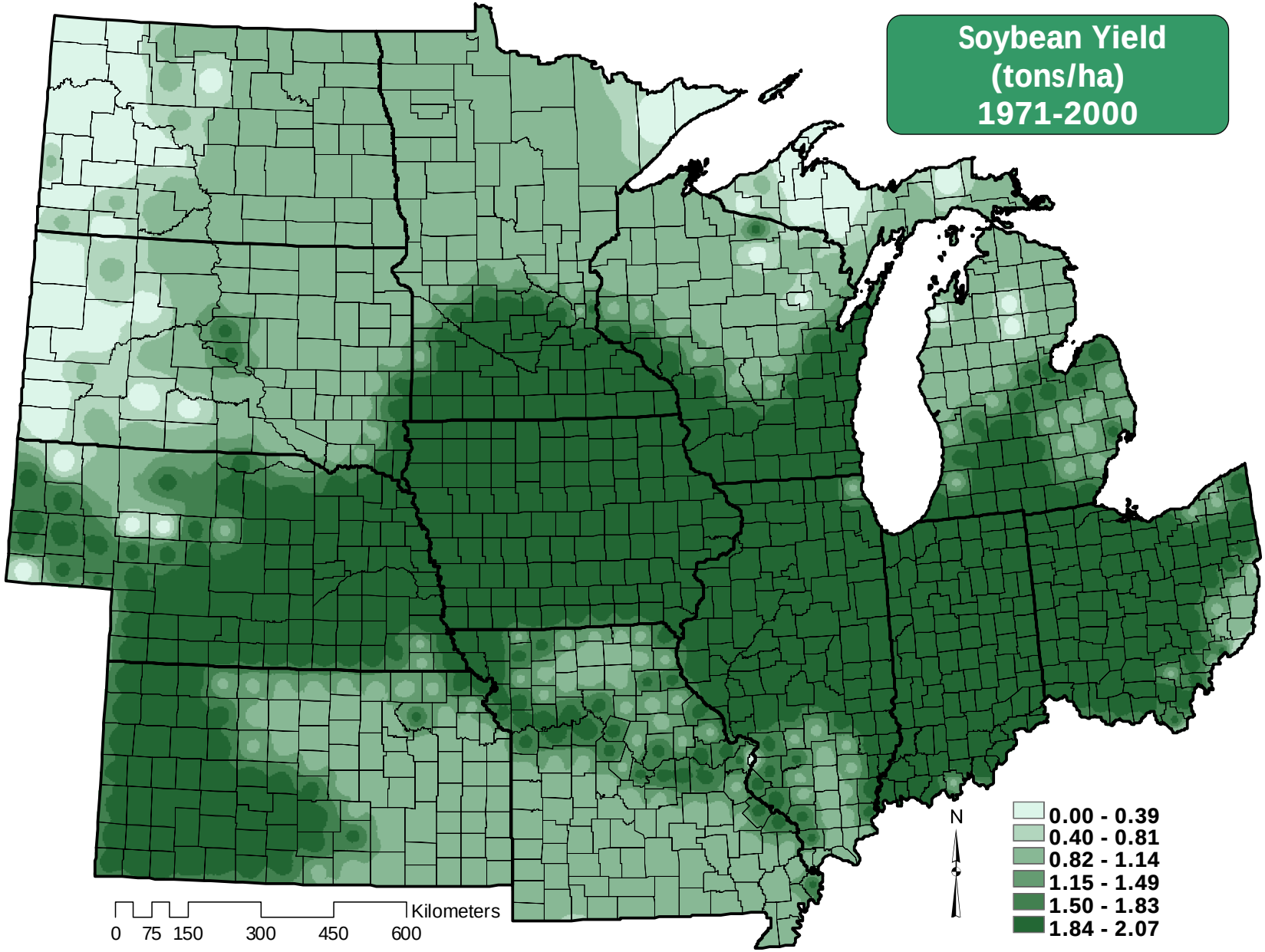


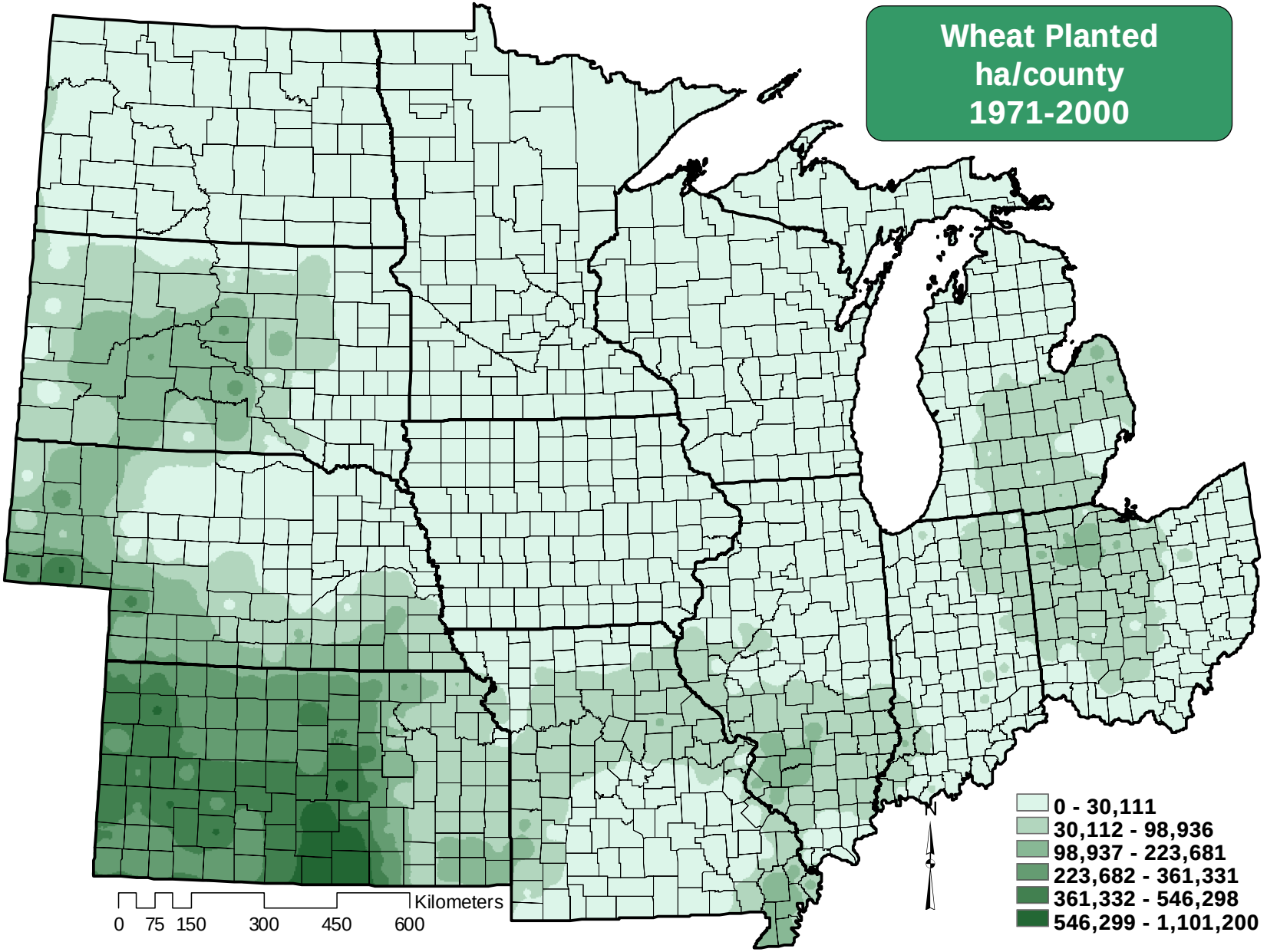
SOIL (10 cm Variables)

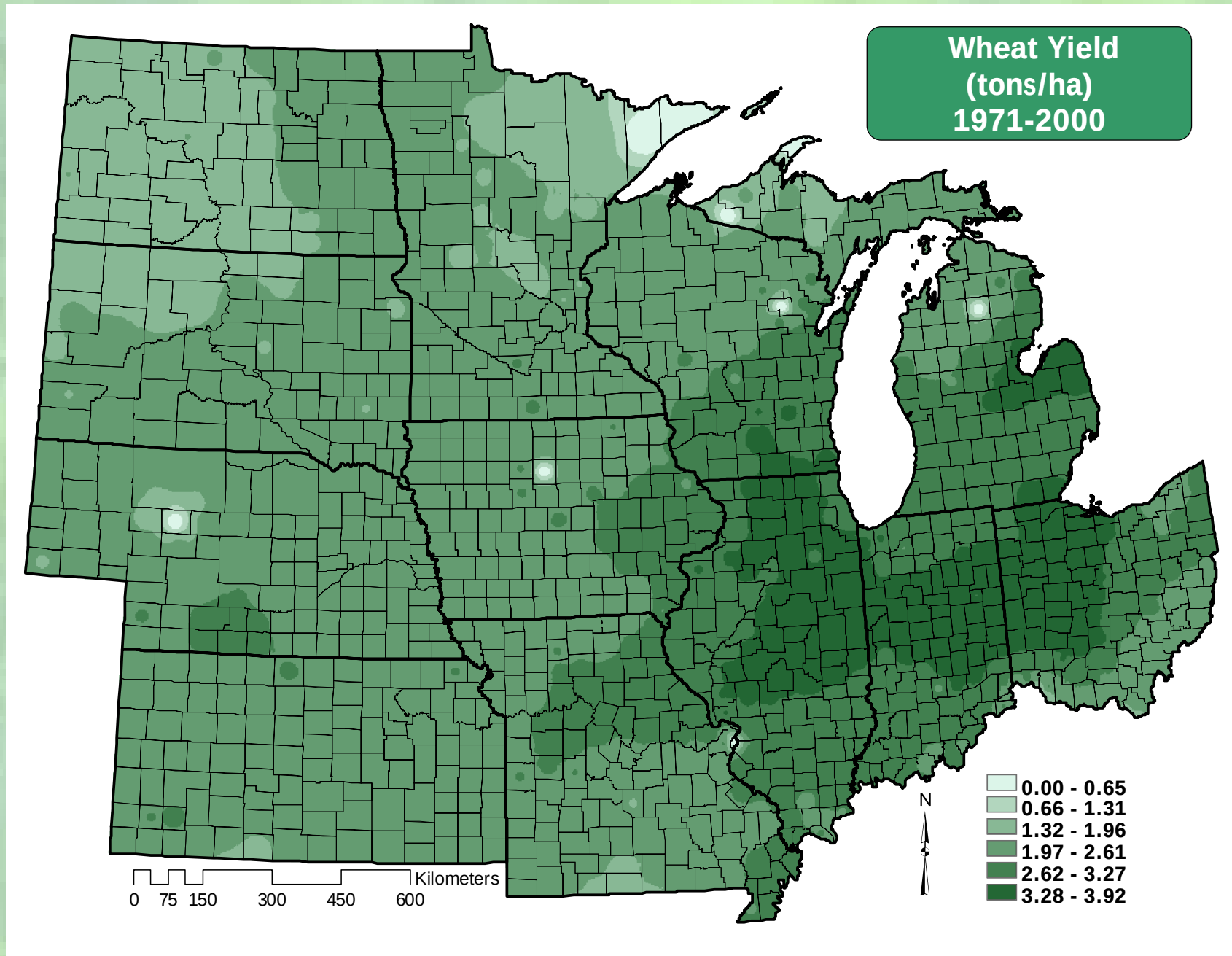

Corn Planted
ha/county
1971-2000
0 - 53,460
53,461 - 126,968
126,969 - 217,182
217,183 - 317,420
317,421 - 437,705
437,706 - 855,362
N
Kilometers
0 75 150 300 450 600


Corn Yield
(tons/ha)
1971-2000
0.00 - 2.11
2.12 - 3.88
3.89 - 5.08
5.09 - 6.21
6.22 - 7.23
7.24 - 9.64
N
0 75 150 300 450 600
Kilometers


Soybean Planted
ha/county
1971-2000
N
0 - 42,411
42,412 - 113,095
113,096 - 189,434
189,435 - 277,083
277,084 - 398,660
398,661 - 723,809
Kilometers
0 75 150 300 450 600


Soybean Yield
(tons/ha)
1971-2000
N
0.00 - 0.39
0.40 - 0.81
0.82 - 1.14
1.15 - 1.49
1.50 - 1.83
1.84 - 2.07
0 75 150 300 450 600
Kilometers


Wheat Planted
ha/county
1971-2000
0 - 30,111
30,112 - 98,936
98,937 - 223,681
223,682 - 361,331
361,332 - 546,298
546,299 - 1,101,200
N
0 75 150 300 450 600
Kilometers


Wheat Yield
(tons/ha)
1971-2000
0.00 - 0.65
0.66 - 1.31
1.32 - 1.96
1.97 - 2.61
2.62 - 3.27
3.28 - 3.92
N
0 75 150 300 450 600
Kilometers

Metadata and Documentation

Climate Data

The monthly files contain the following data:

State fips code	N/A
County fips code	N/A
Longitude	Degrees
Latitude	Degrees
Maximum daily temperature	°C
Minimum daily temperature	°C
Daily temperature range	°C
Precipitation	mm
Growing degree days 7.2 °C (45 °F)	°C
Growing degree days 10 °C (50 °F)	°C
Heat stress 30 °C (86 °F)	°C
Heat stress 32.2 °C (90 °F)	°C
Heat stress 35 °C (95 °F)	°C
Cold stress	°C
Heat precipitation ratio	°C/mm

The monthly climate variables represent the 30-year (1971-2000) mean for the month. Base 7.2C (45F) growing degree days were computed using the base temperature without an upper cap. Base 10C (50F) growing degree days were capped with the maximum temperature at 30C (86F). Three heat stress variables were computed since there was no consensus for the base. Iowa and South Dakota preferred 30 °C (86 °F), while Nebraska suggested 35 °C (95 °F), and Illinois has typically used 32.2 °C (90 °F). Cold stress was computed using 0 °C (32 °F) as a bottom threshold and 10 °C (50 °F) as an upper threshold. The heat stress was computed using the maximum temperature and the cold stress with the minimum temperature. The heat precipitation ratio, was computed using the monthly sums of the base 10 °C growing degree days and precipitation.

The yearly file contains the following data:

Column	Variable	Description	Units
1	StFps	State fips code	N/A
2	CFps	County fips code	N/A
3	Lon	Longitude	Degrees
4	Lat	Latitude	Degrees
5	lSpr28	Last spring -2.2 °C	Day of year
6	lSpr30	Last spring -1.1 °C	Day of year
7	lSpr32	Last spring 0 °C	Day of year
8	fFal32	First fall 0 °C	Day of year
9	fFal30	First fall -1.1 °C	Day of year
10	fFal28	First fall -2.2 °C	Day of year
11	GSeaLen	Growing season	Days
12	mxExtrem	Maximum temperature °C	
13	mnExtrem	Minimum temperature °C	

Growing season length was the difference between the first fall 0 °C and the last spring 0 °C
temperatures. The extreme maximum and minimum temperatures are the means for the 30 years,computed by determining the highest maximum daily temperature, and the lowest minimum
daily temperature each year.

Metadata and Documentation

Soil Data

Steven E. Hollinger, Ph.D.Illinois State Water Survey

Soil Variables

Stf - State fips number

Cof - County fips number

Drain - Drainage classification (see below for drain number and drainage classification).

WtDep (cm) - Depth to water table

BRDep (cm) - Depth to bed rock

RootDep (cm) - Rooting depth of soil

PAV (cm) - Plant available water in top 2 meters of soil.

OM (kg m-2) - Organic matter mass in top 2 meters of soil. (Can be converted to kg ha-1)

Drainage number and classification

1 - Excessively well drained
2 - Somewhat excessively well drained
3 - Well drained
4 - Moderately well drained
5 - Somewhat poorly drained
6 - Poorly drained
7 - Very poorly drained

US CROP DATA

1970-2000

Corn, Soy and Wheat

Data source

National Agricultural Statistics Service (http://www.nass.usda.gov:81/ipedb/). I

All practices 85,460Irrigation 12,012Non irrigated 10,249

Data organization

Year	Records	Year	Records	Year	Records	Year	Records	Year	Records
1970	1521	1977	2010	1983	2051	1989	2297	1995	2024
1971	1506	1978	2028	1984	2330	1990	2201	1996	1954
1972	1871	1979	2055	1985	2295	1991	2164	1997	2056
1973	1915	1980	2012	1986	2272	1992	2172	1998	2067
1974	1981	1981	1977	1987	2224	1993	2113	1999	1941
1975	1953	1982	1983	1988	2253	1994	2053	2000	1972
1976	1949								

Note. The NASS raw data has non irrigated information for only few states. Thus in building the table I assumed that for the rest of the States the “all practices data” reflected primarily non irrigated use. Thus in creating the table "*corn_nonirrigated*" the available non irrigated data was used to and fill the rest of the counties with data from the "*corn_AllPractices*" table.

METADATA