COLLEGE OF AGRICULTURAL & LIFE SCIENCES
University of Wisconsin-Madison

UW Extension

2010 Nutrient Watch List

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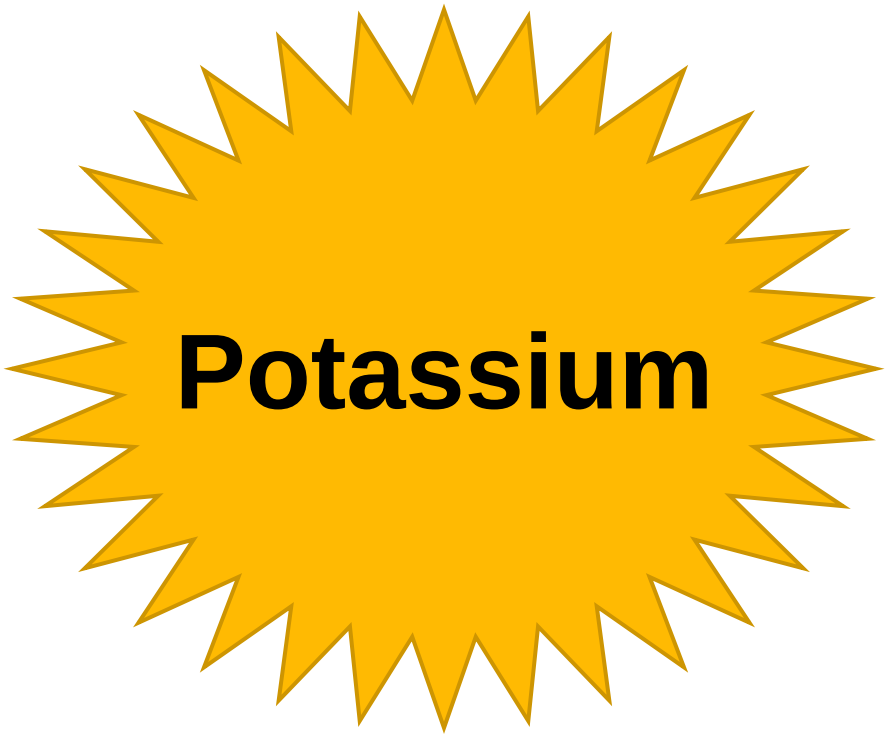
So many nutrient choices……

- Macro: N, P, K
- Secondary: Ca, Mg, S
- Micro: B, Cl, Co, Cu, Fe, Mn, Mo, Na, Ni, Se, Si, V, Zn

#1 on the watch list:



Appearance on list is not surprising given:

- Potash prices increased 4x in the last decade
- Applications have not kept up with recommendations and/or crop removal
  - Hay fields
  - Less K being applied as starter

Evidence of a problem

- In season alfalfa samples submitted to UW SPAL had below optimum K concentration
  - 2009
    - 40% of samples submitted as abnormal in appearance
    - 41% of samples submitted as normal
  - 2008
    - 17% of samples submitted as abnormal in appearance
    - 14% of samples submitted as normal
- In season corn (all growth stages and appearances) samples were low in K
  - 18% of samples in 2009
  - 14% of samples in 2008
- Increasing observations of K deficiency in soybean throughout Wisconsin

Identifying K deficiency – alfalfa

Photo credits: E. Birschbach

Identifying K deficiency – corn

Photo credits: R. Wolkowski

Identifying K deficiency – soybean

Photo credits: C. Laboski

What to do…

- Remind growers that K should not be ignored for too many years
  - K deficiency will result in yield loss
    - Also reduces stand persistence in alfalfa
  - Soil test levels will decline

Marshfield ARS 1998-2001
4 years of alfalfa

Annual K rate	Soil test K
lb K_2O/a	ppm
	136 initial (O)
0	69 (VL)
100	84 (VL)
200	123 (O)
400	266 (EH)

What to do…

- For growers in cash limited situations that have manure
  - Work with them to determine how best to allocate the K in manure between fields
- Remind growers to consider long-term implications

#2 on the watch list:

Function of S in the plant

- S-containing amino acids
- Synthesis of coenzyme A
  - Cellular respiration
- Assimilation of N_2 fixed in nodules

S in soil

- SO_4^{2-} form is taken up by roots
  - This form can be leached
- Primarily held in soil organic matter
  - Must mineralize to be available

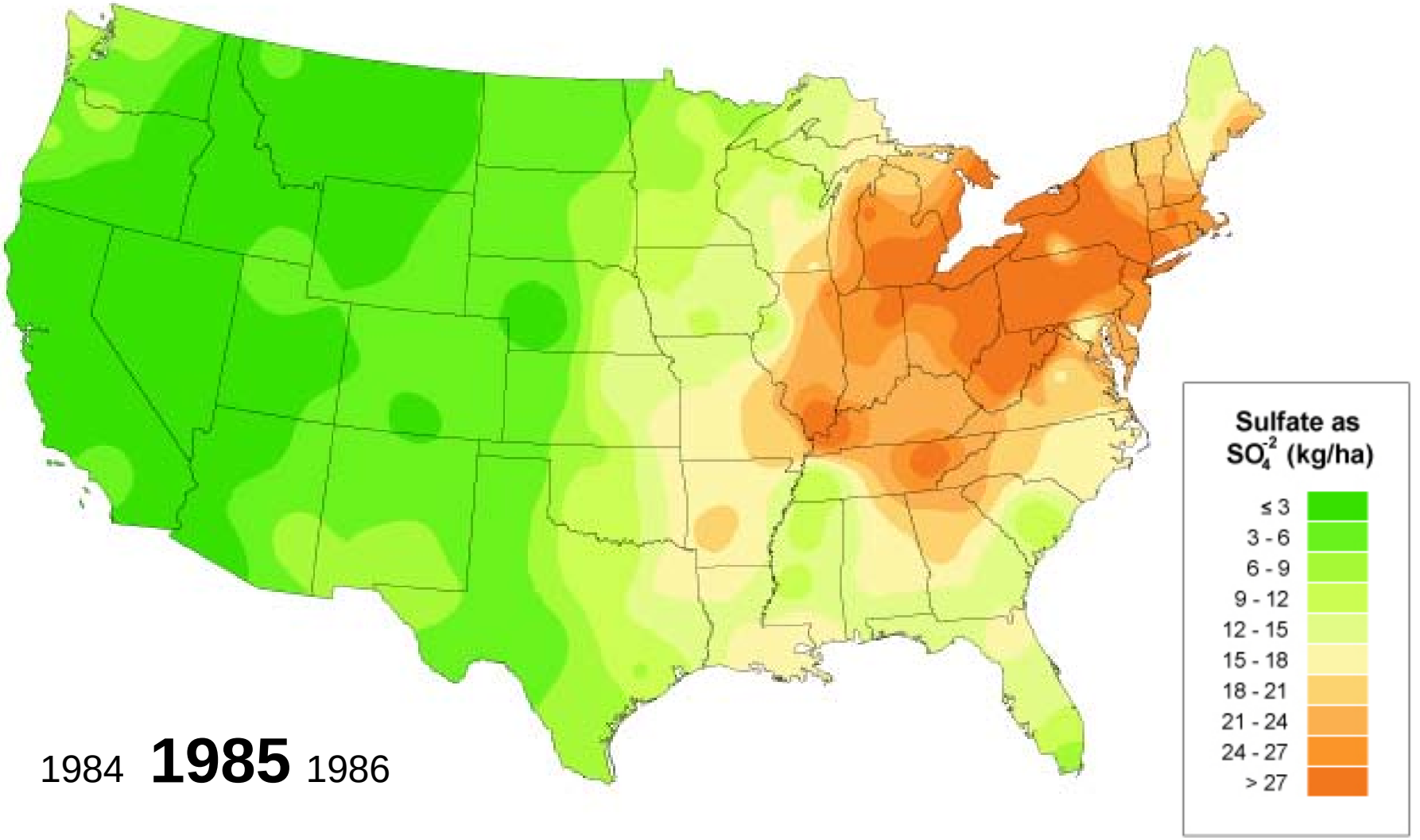
Sources of S

- Plant residues
- Atmospheric deposition
- Manure
- Fertilizer

What do we know about atmospheric deposition of S?

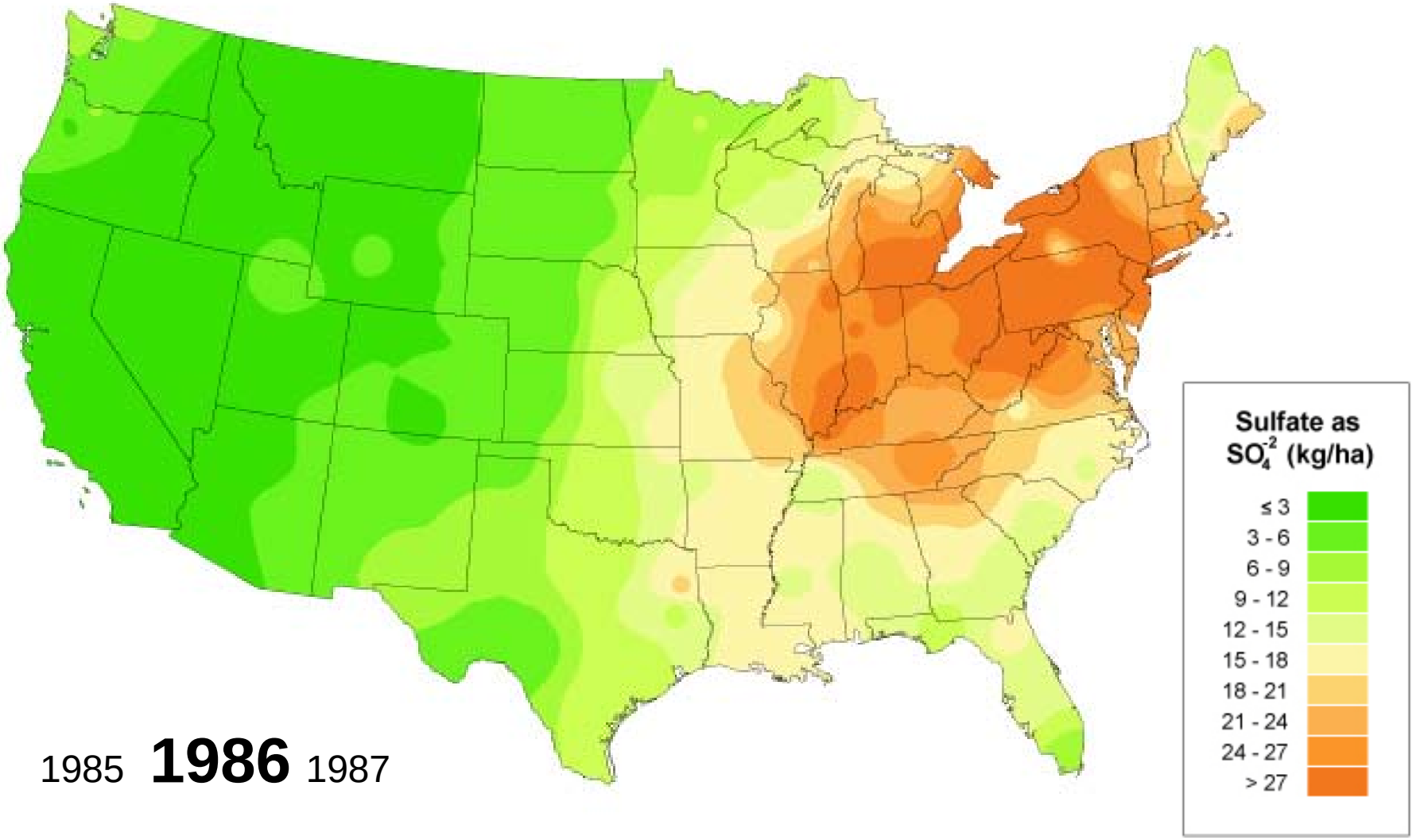
- Clean air act is working
- S deposition is going down

Sulfate Ion Wet Deposition 1985-2005



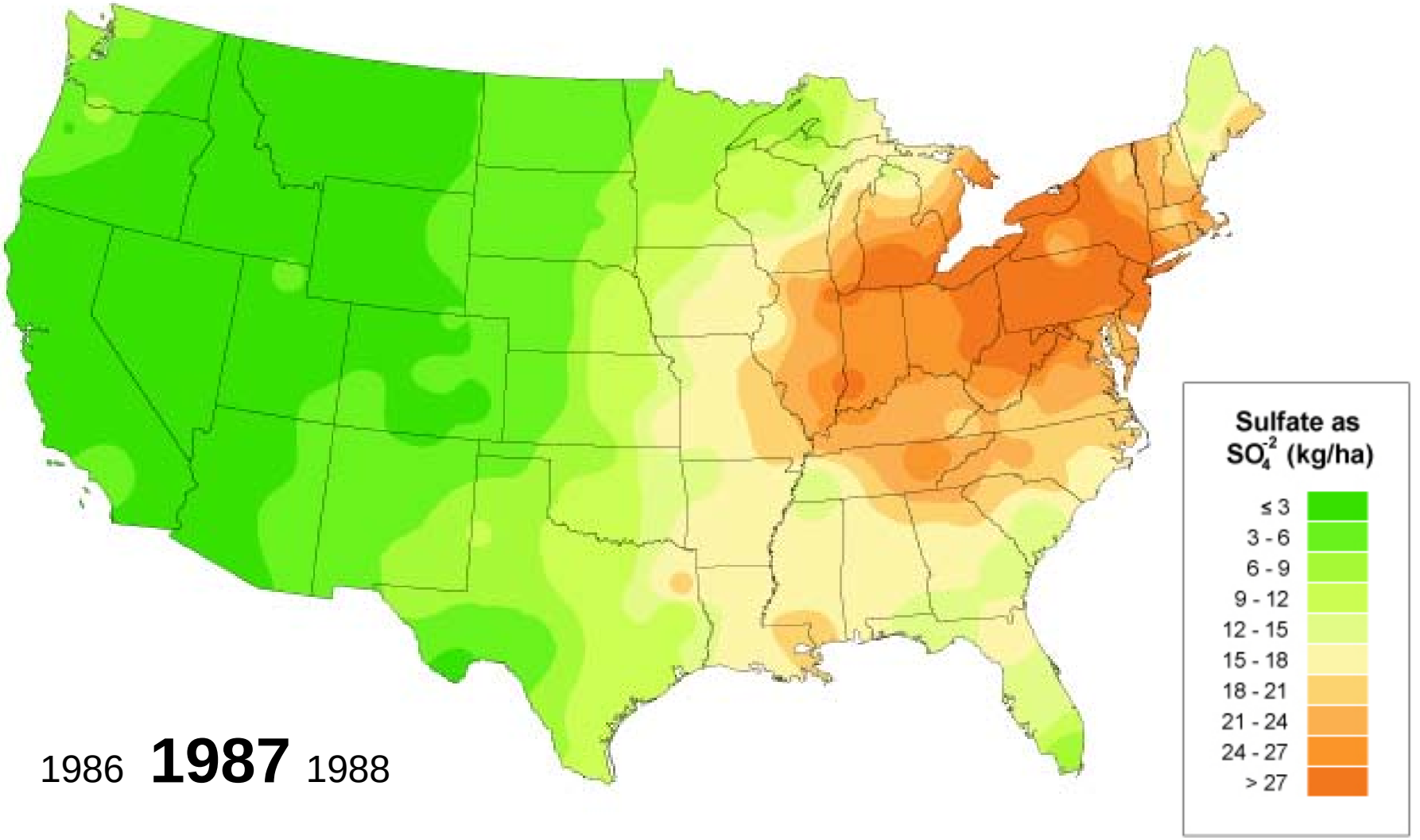
1984 **1985** 1986

Sulfate Ion Wet Deposition 1985-2005



1985 **1986** 1987

Sulfate Ion Wet Deposition 1985-2005



1986 **1987** 1988

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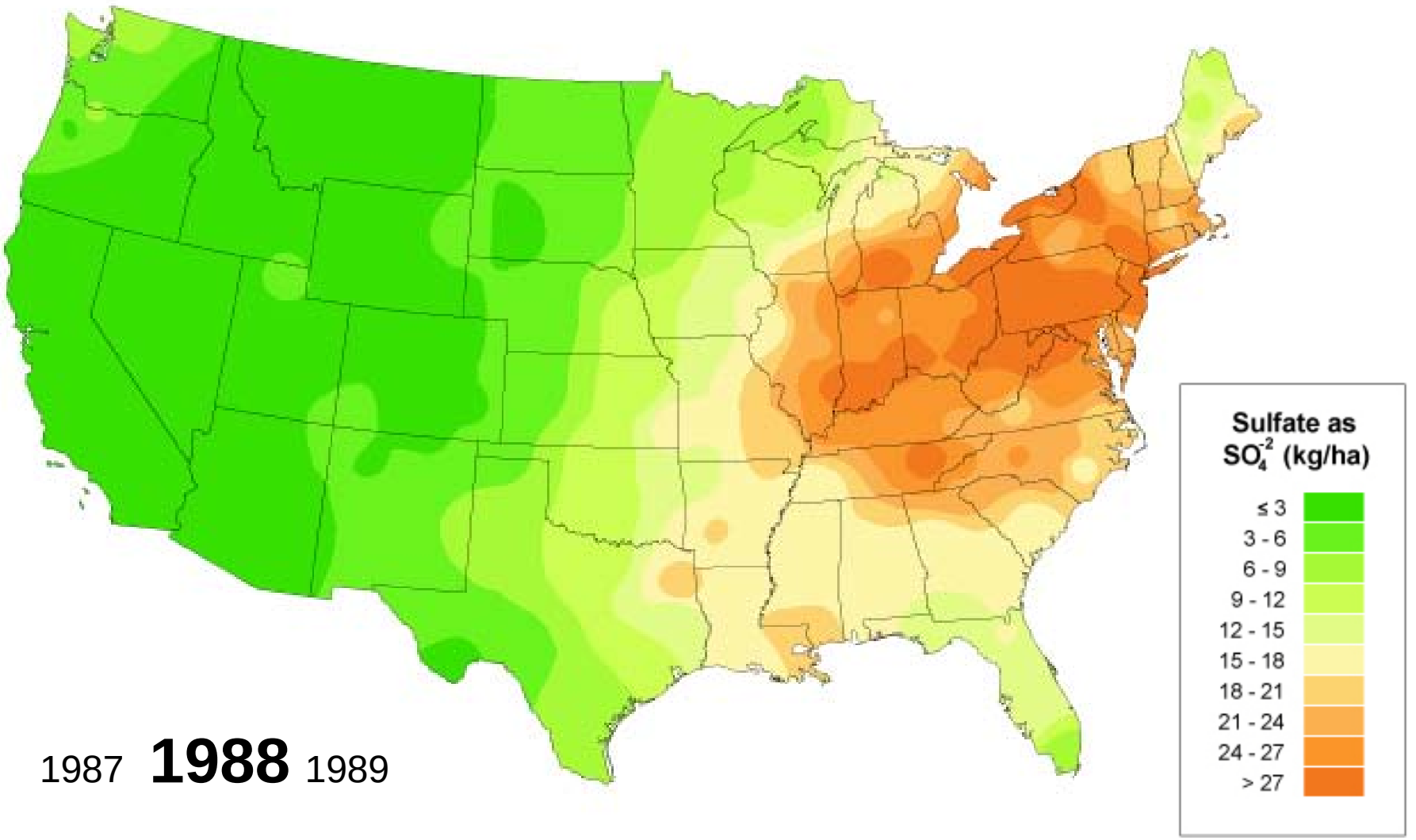
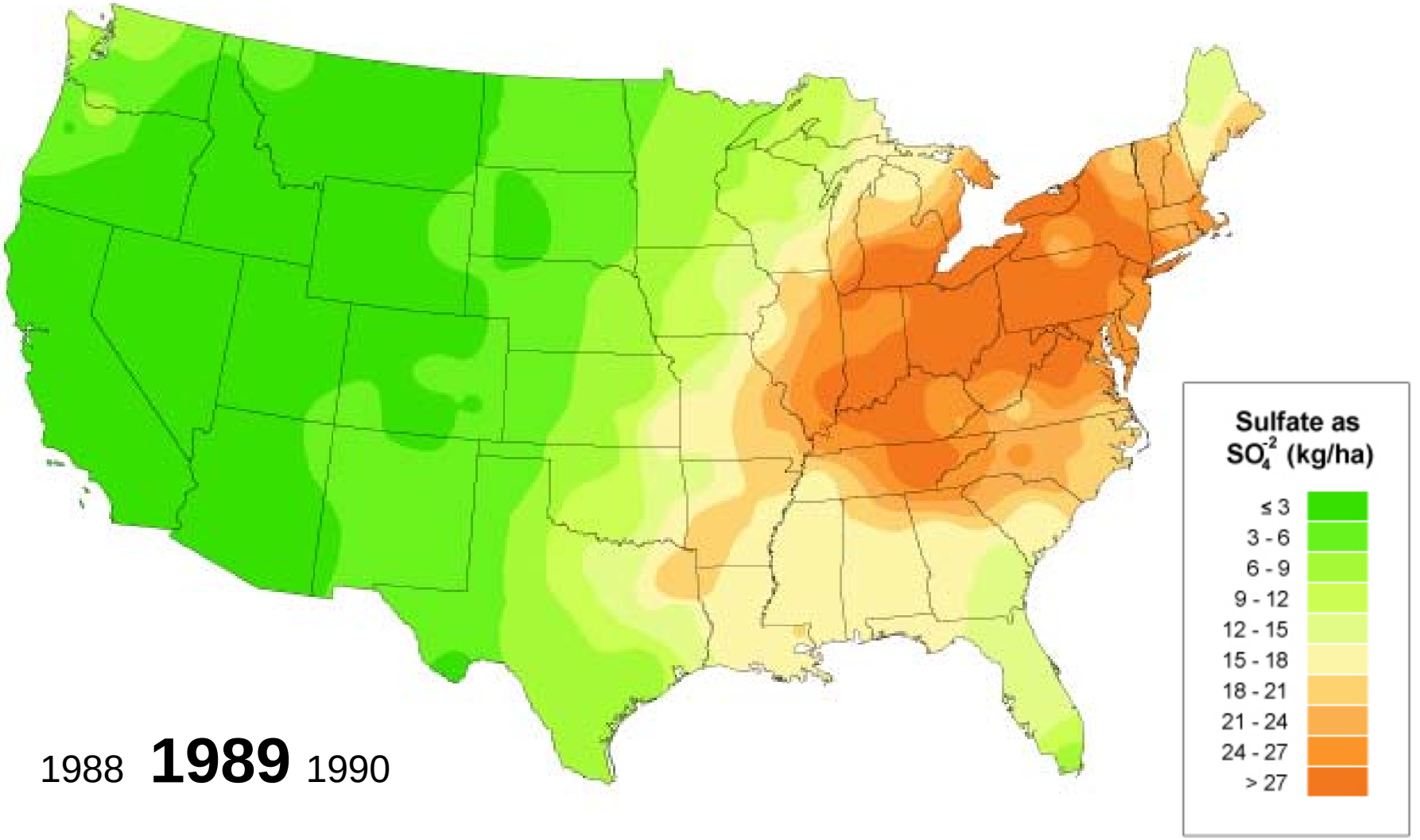


1987 **1988** 1989

Sulfate Ion Wet Deposition 1985-2005



1988 **1989** 1990

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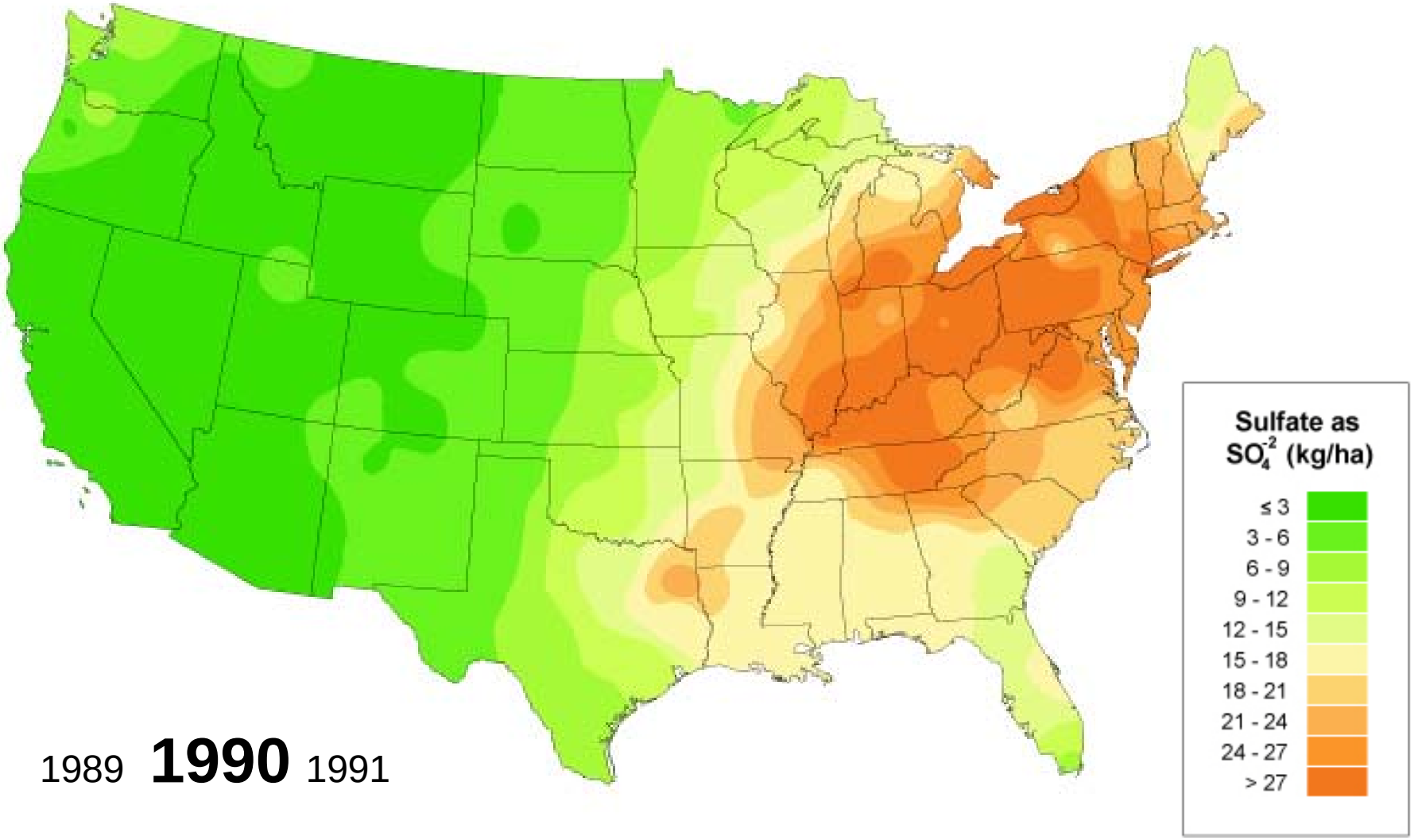

1989 **1990** 1991

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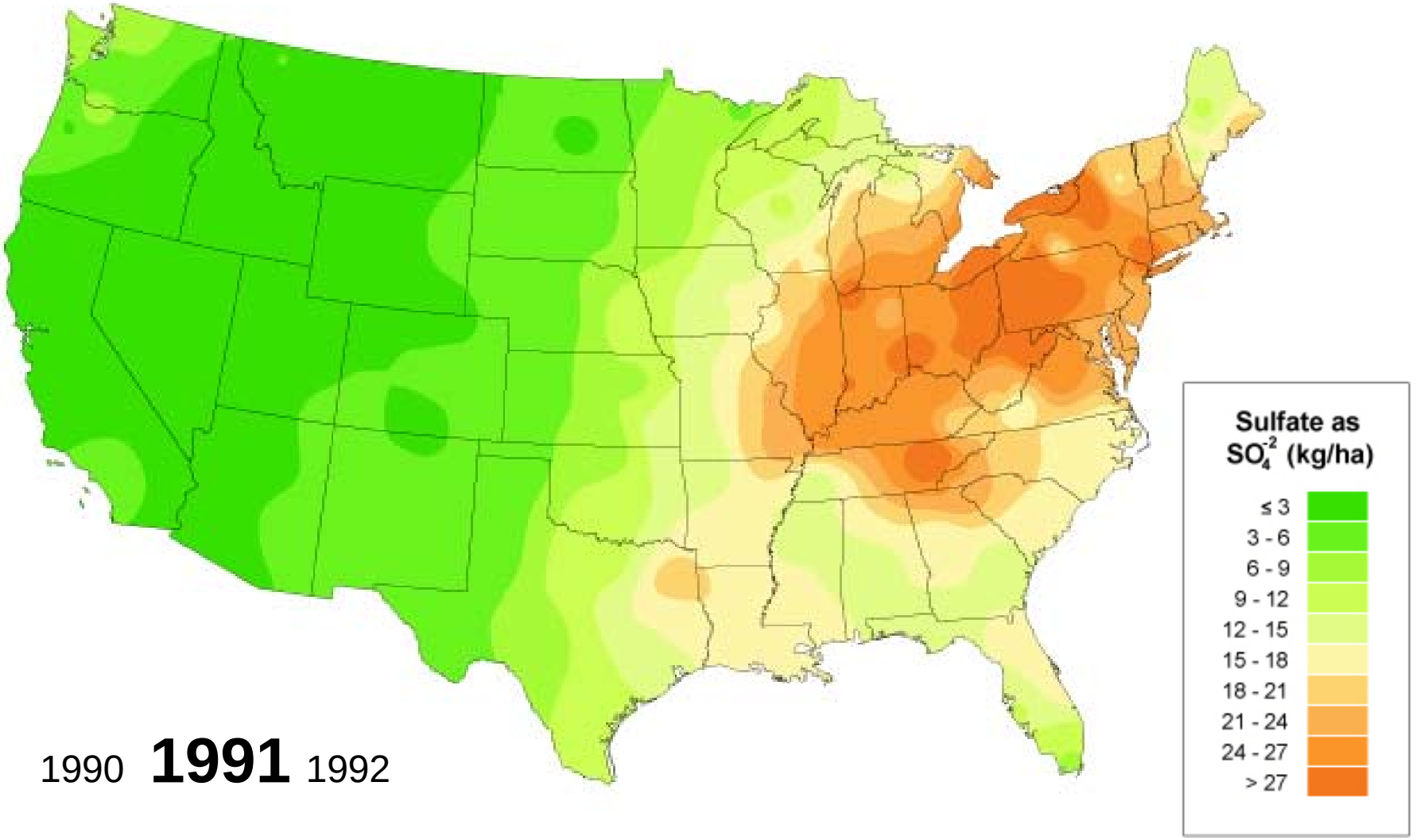

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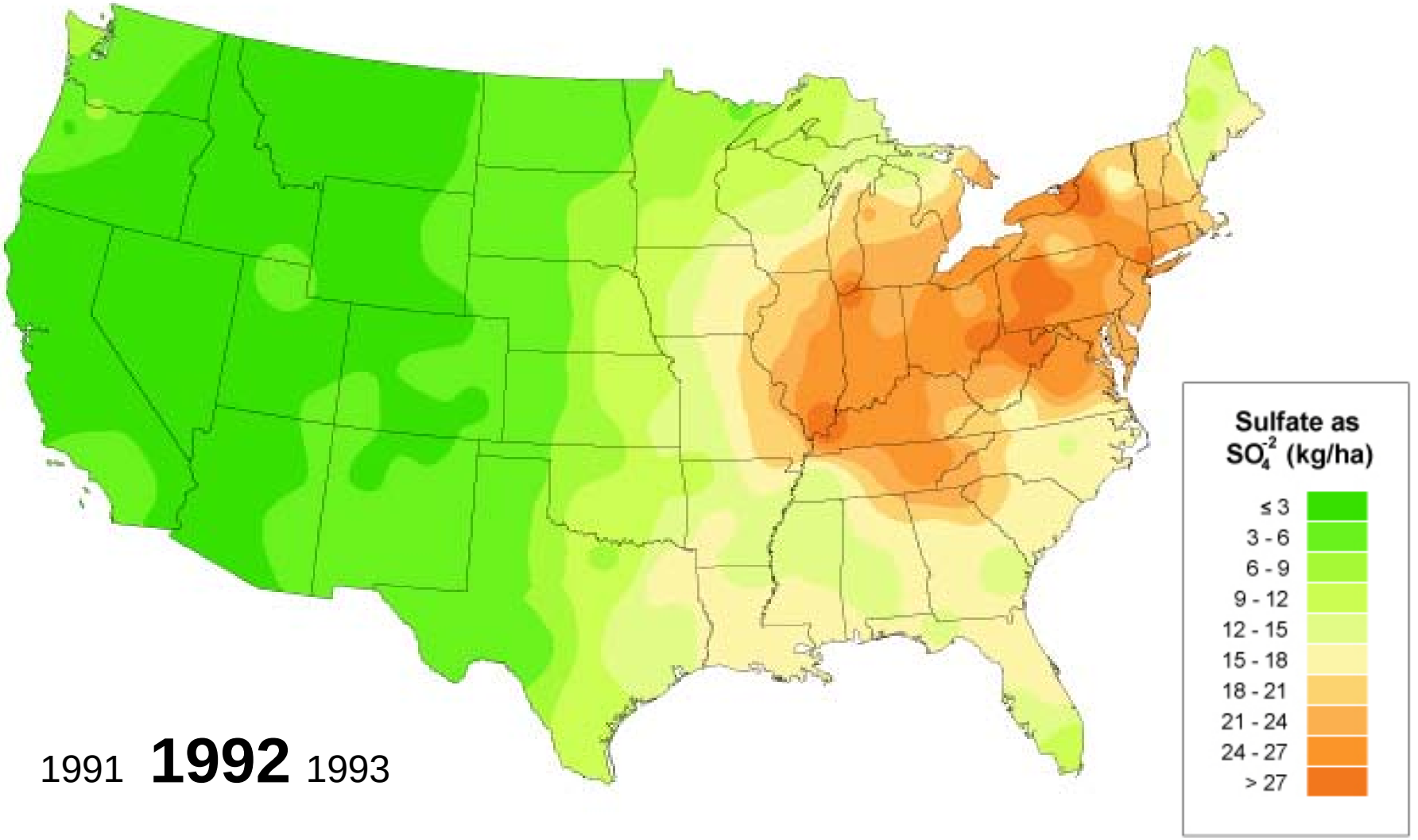

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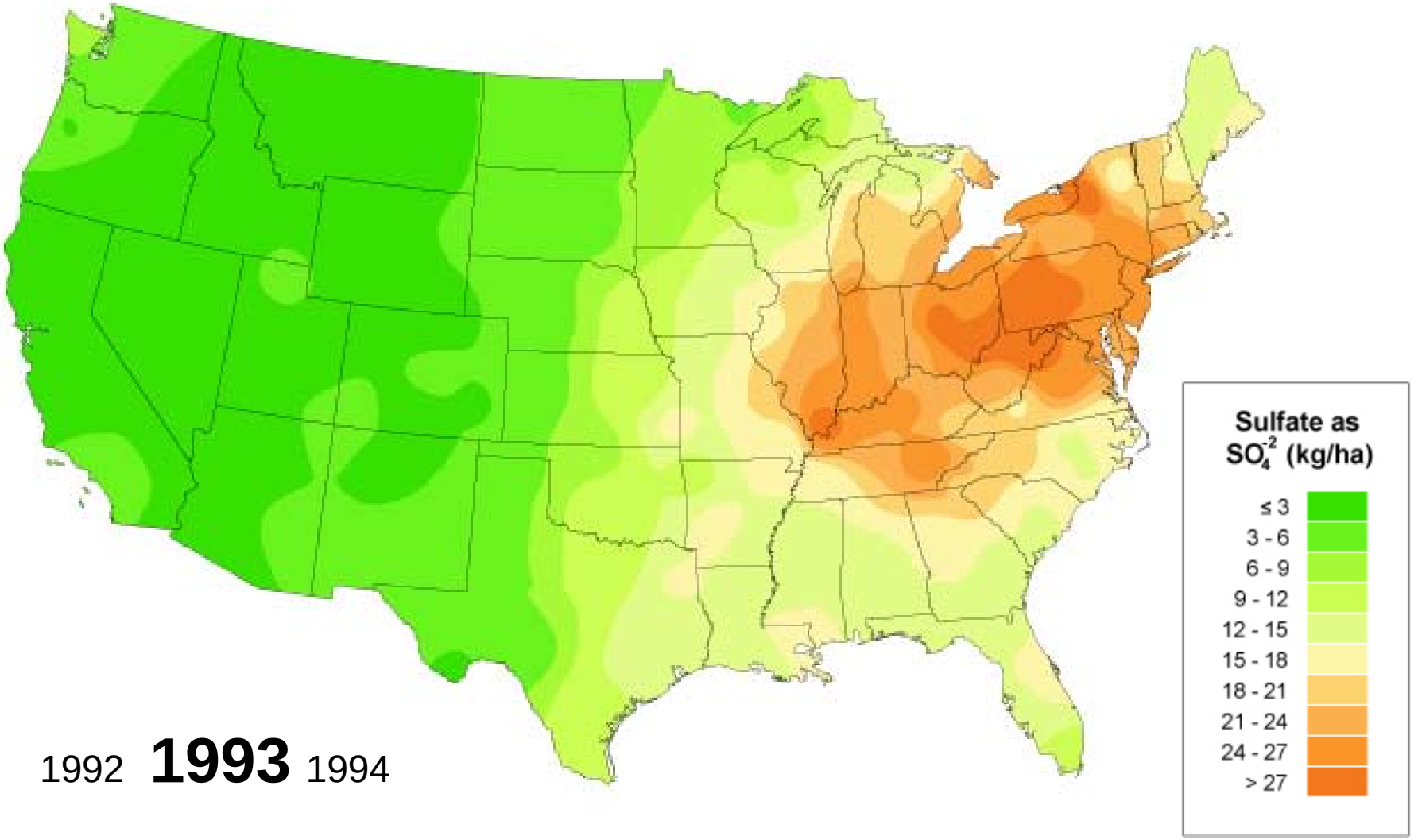

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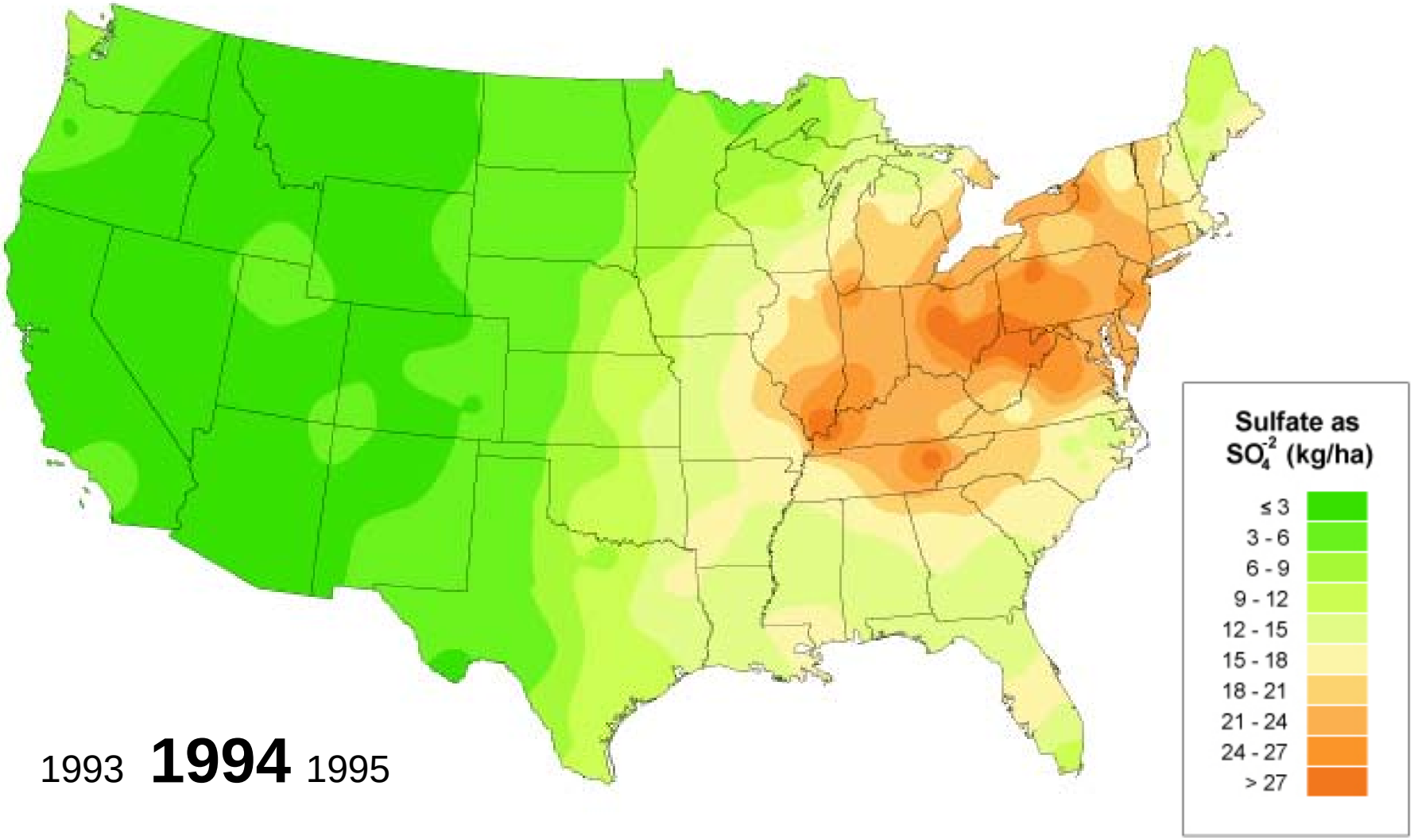

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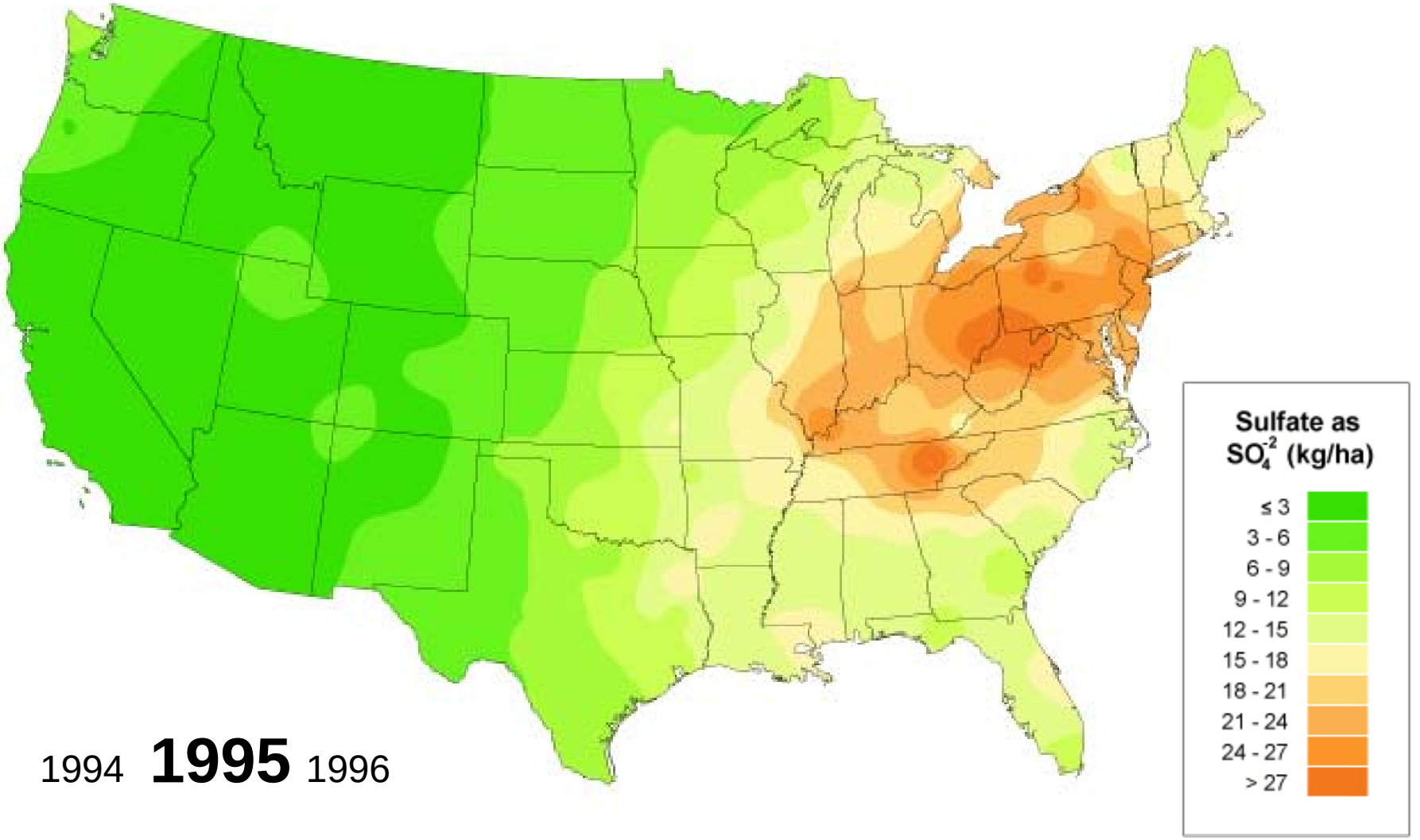

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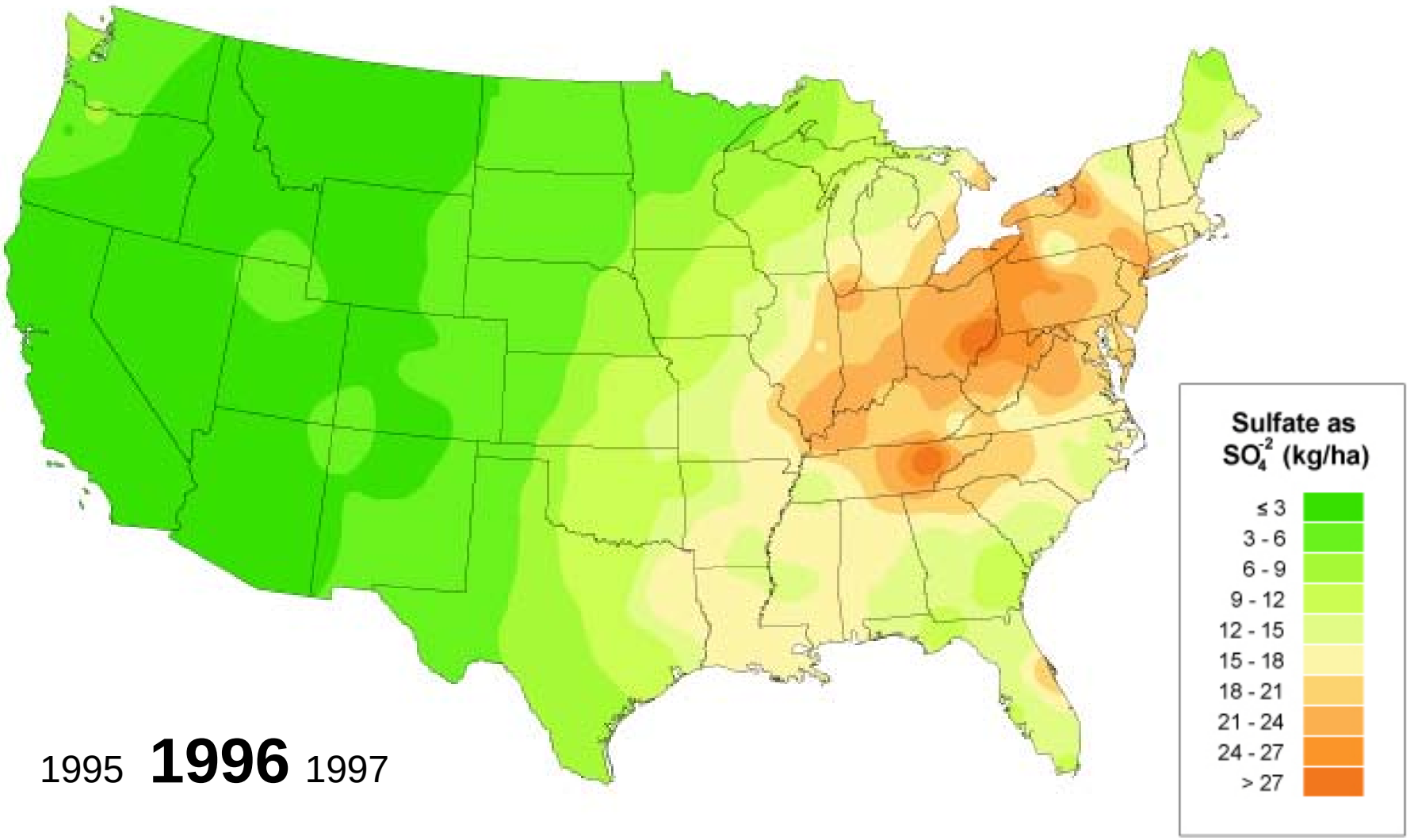

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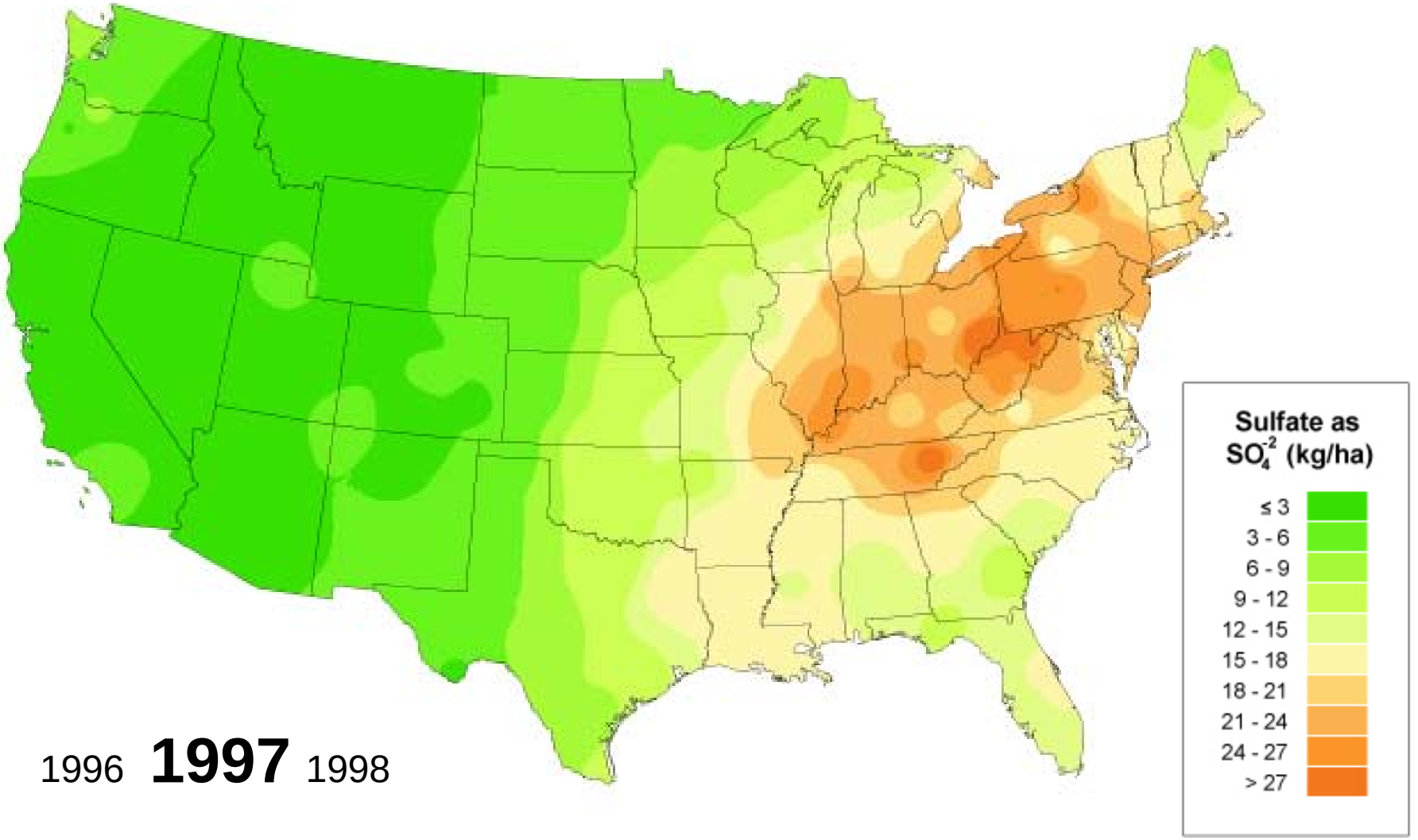

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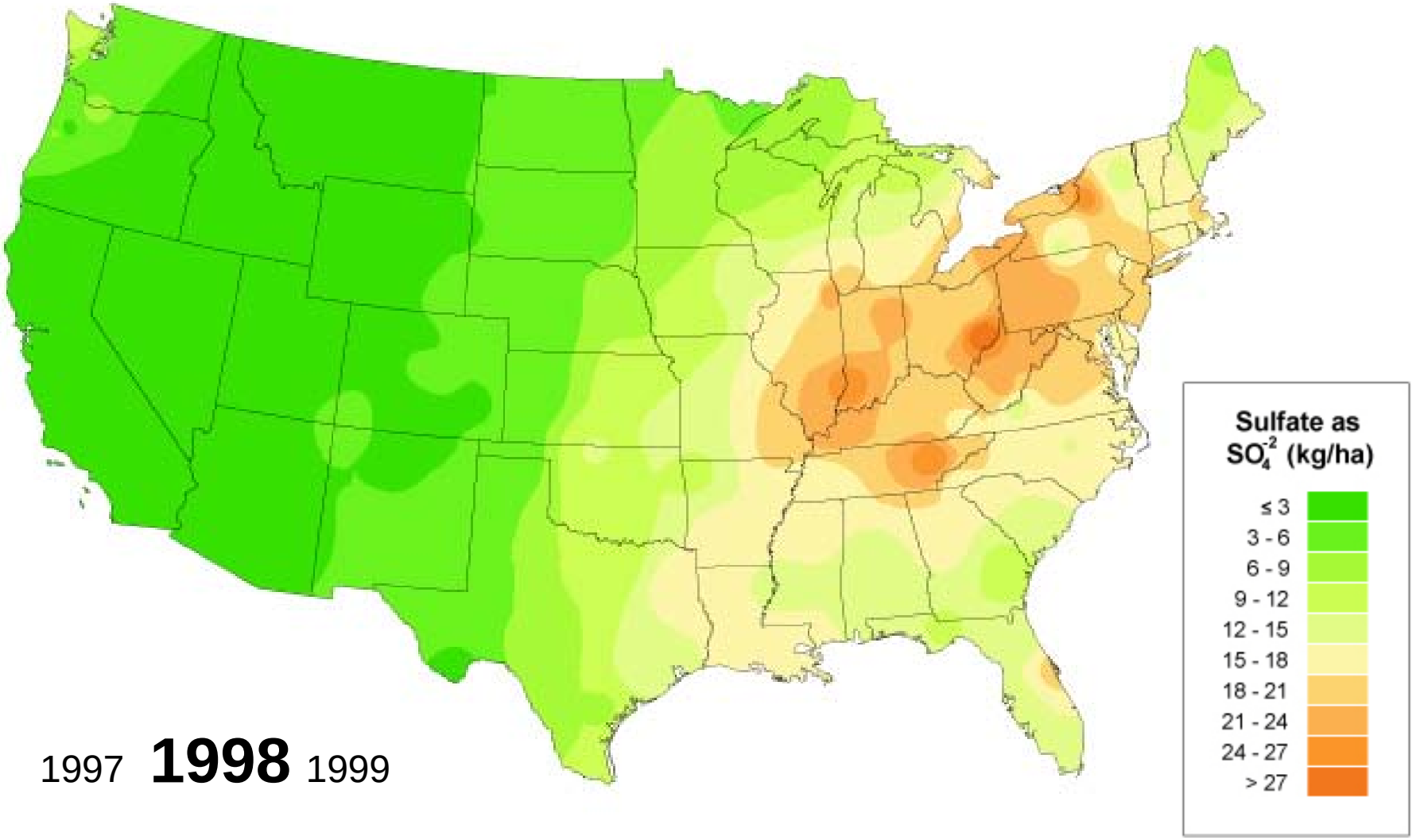

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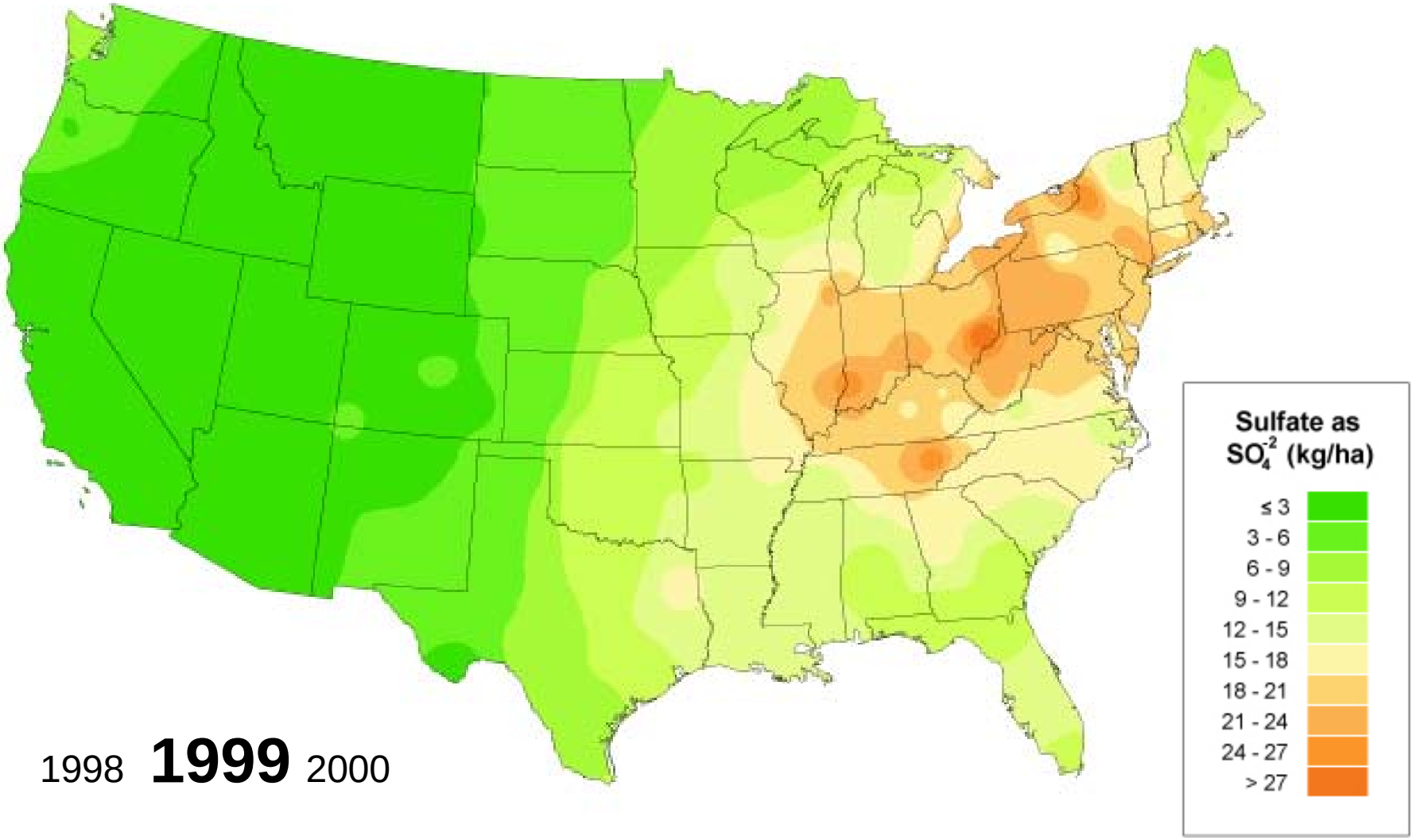

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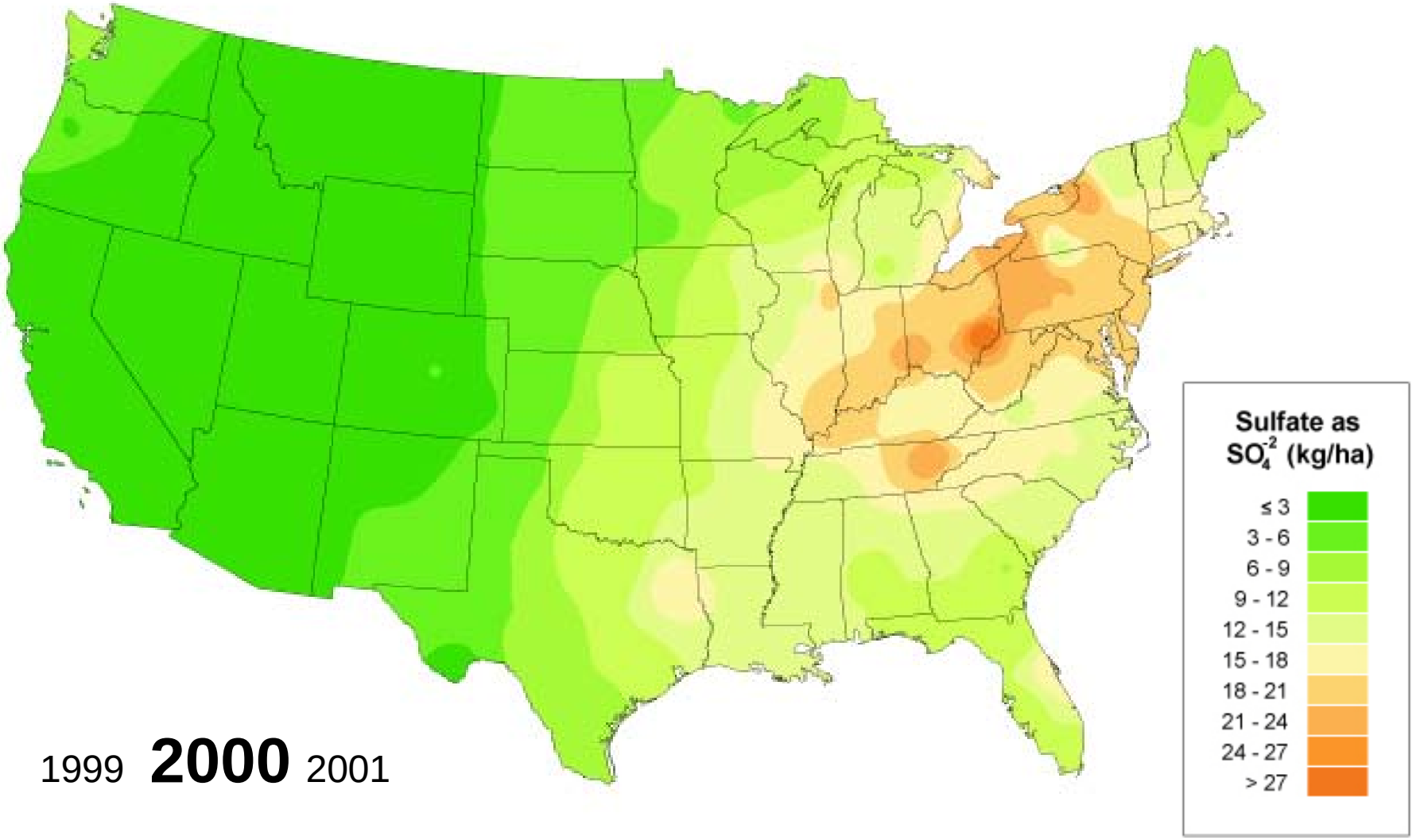

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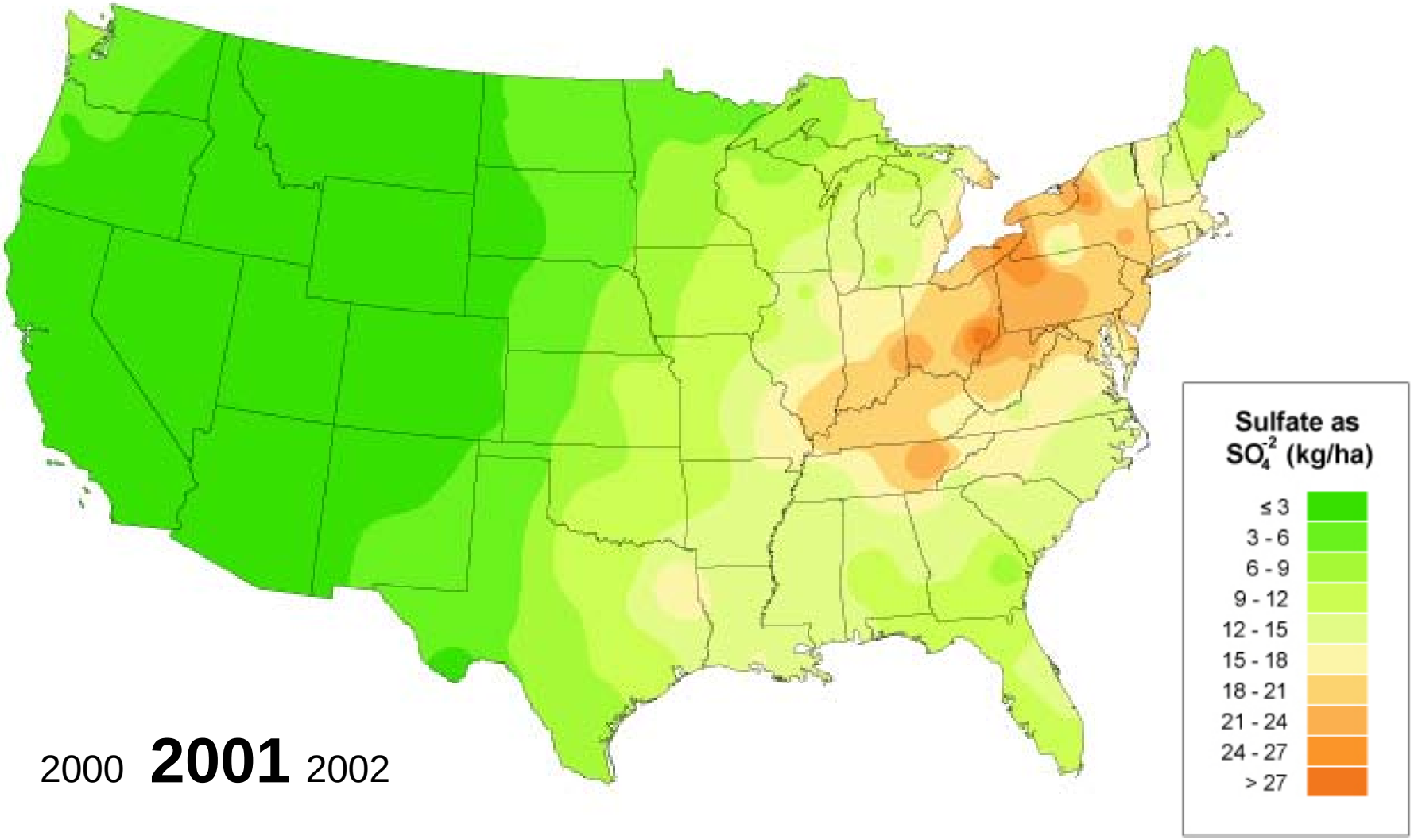

2000 **2001** 2002

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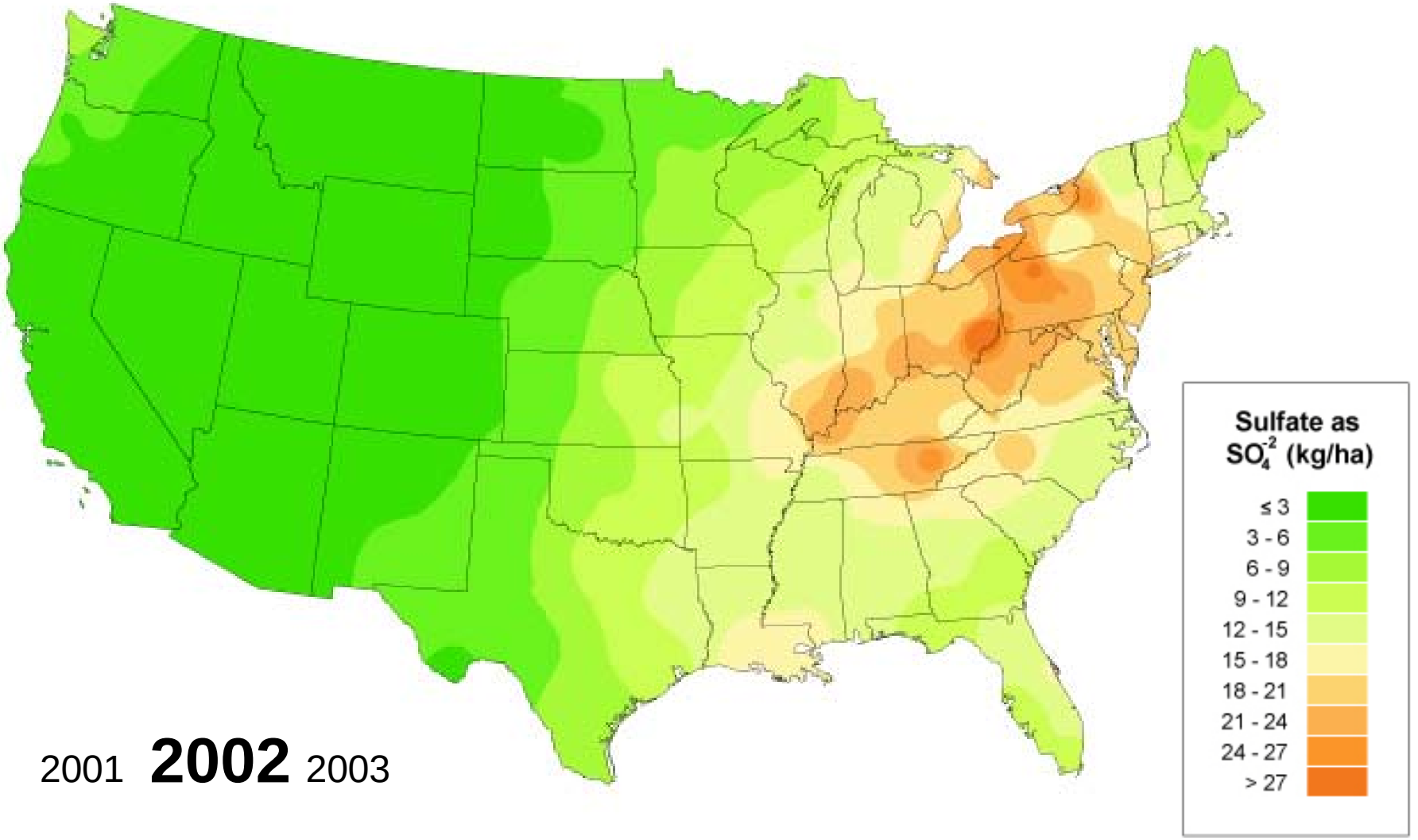
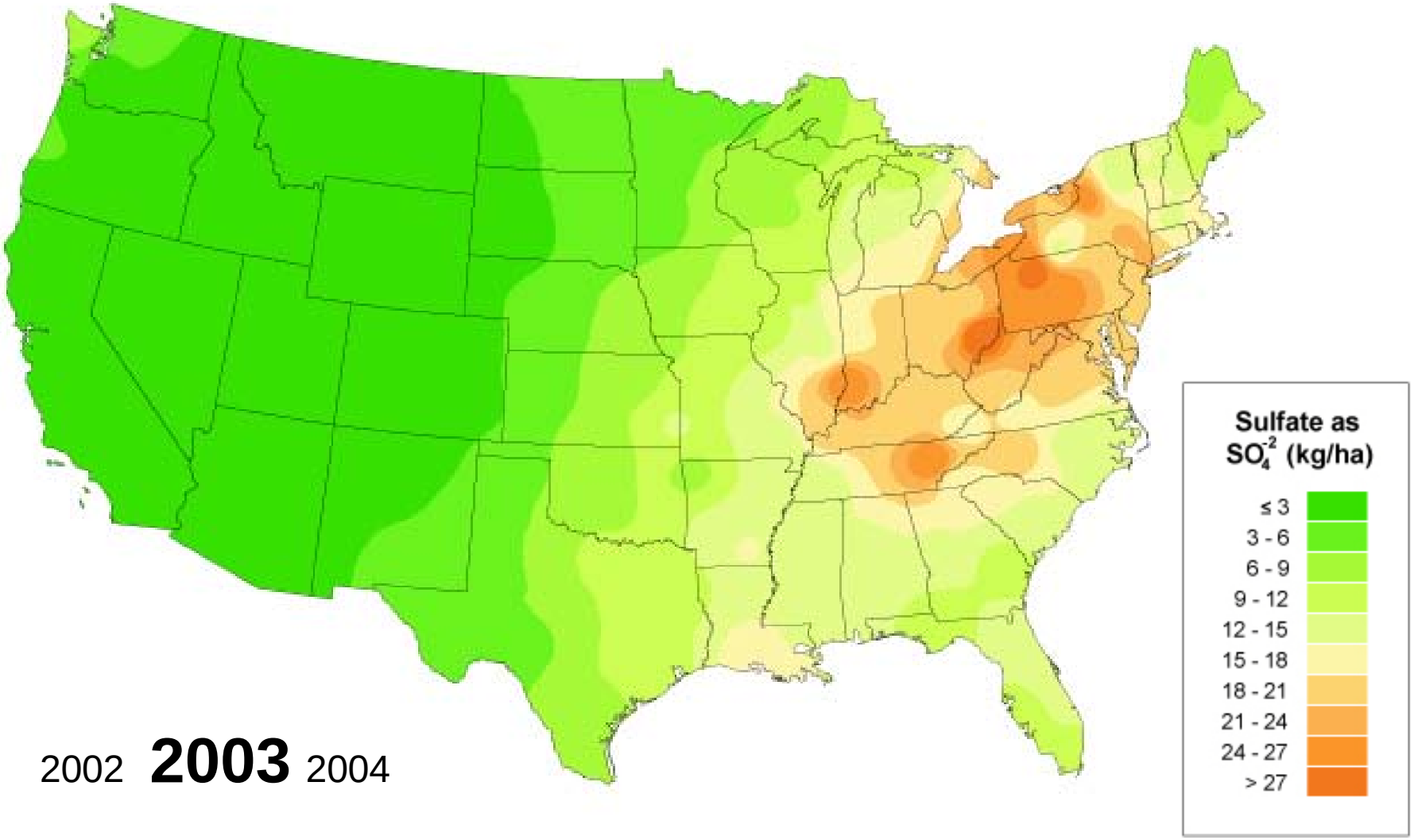


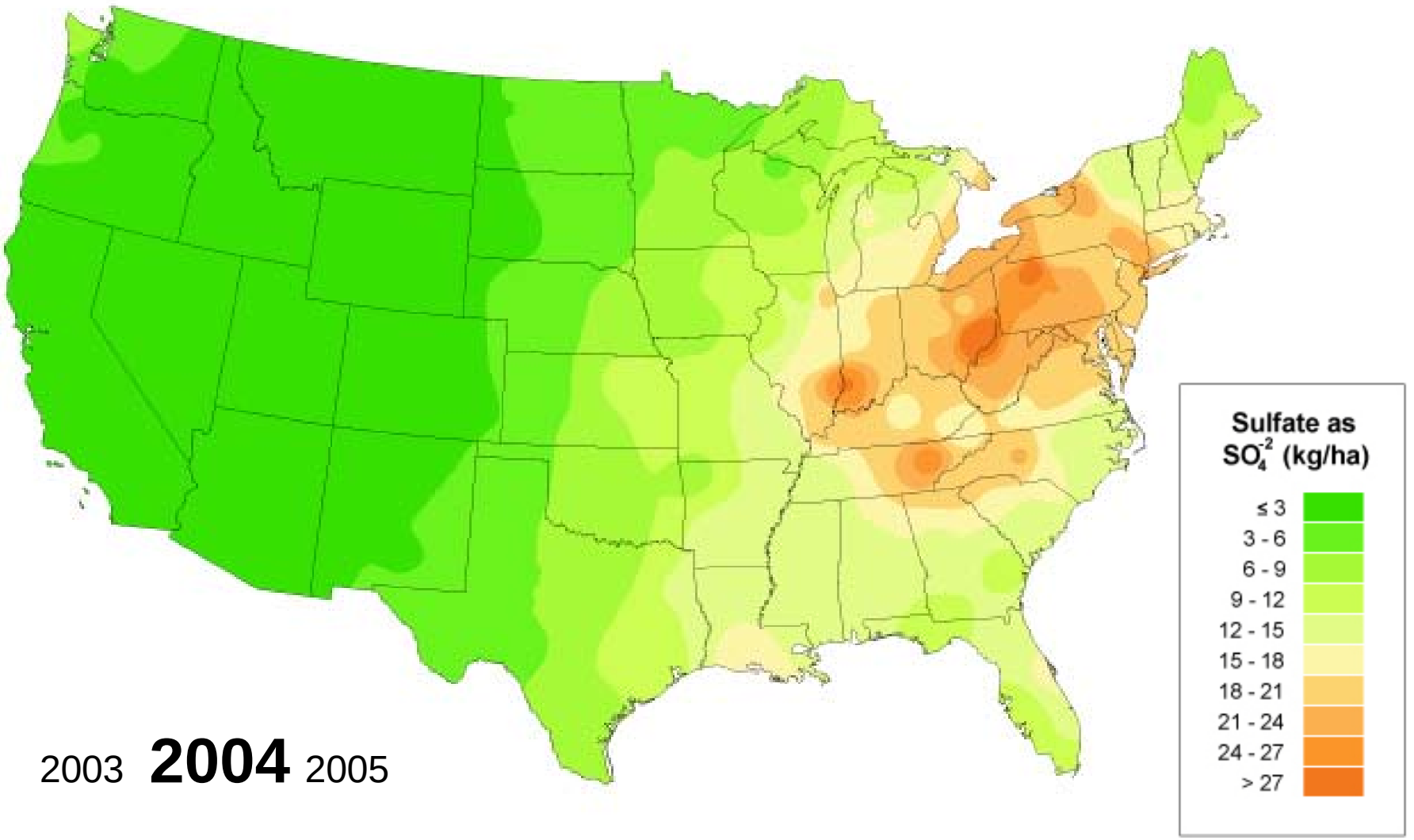
2001 **2002** 2003

Sulfate Ion Wet Deposition 1985-2005



2002 **2003** 2004

Sulfate Ion Wet Deposition 1985-2005



2003 **2004** 2005

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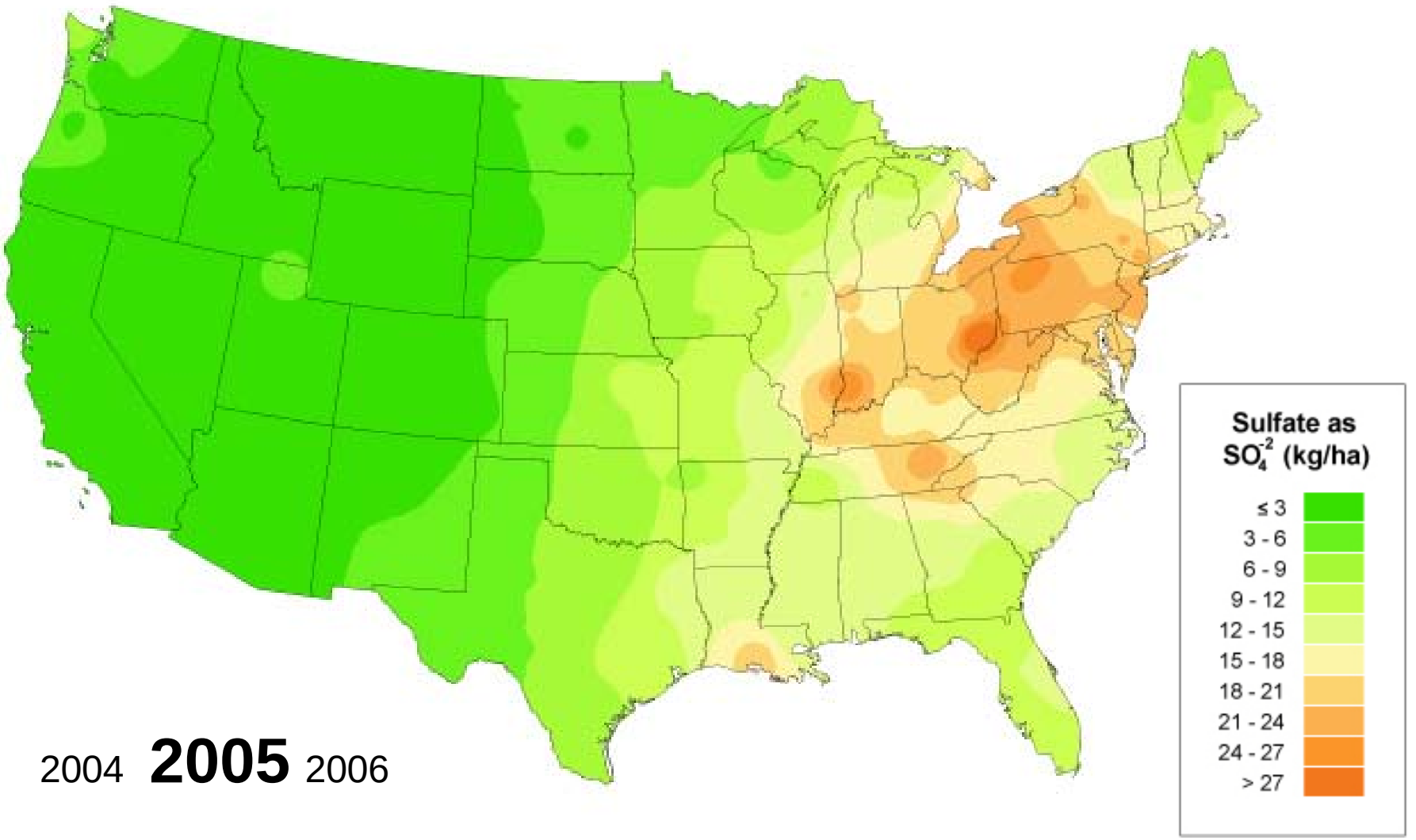
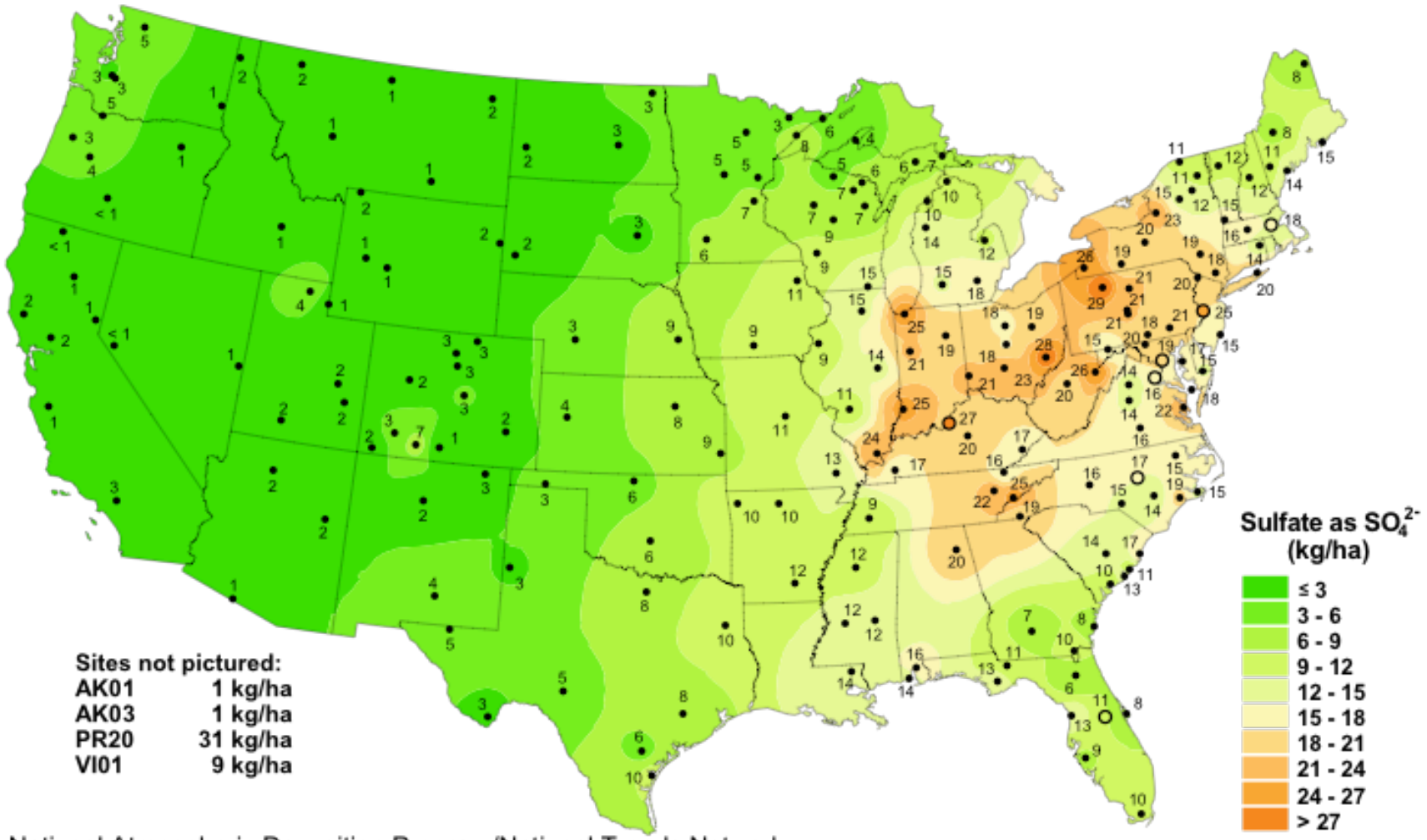


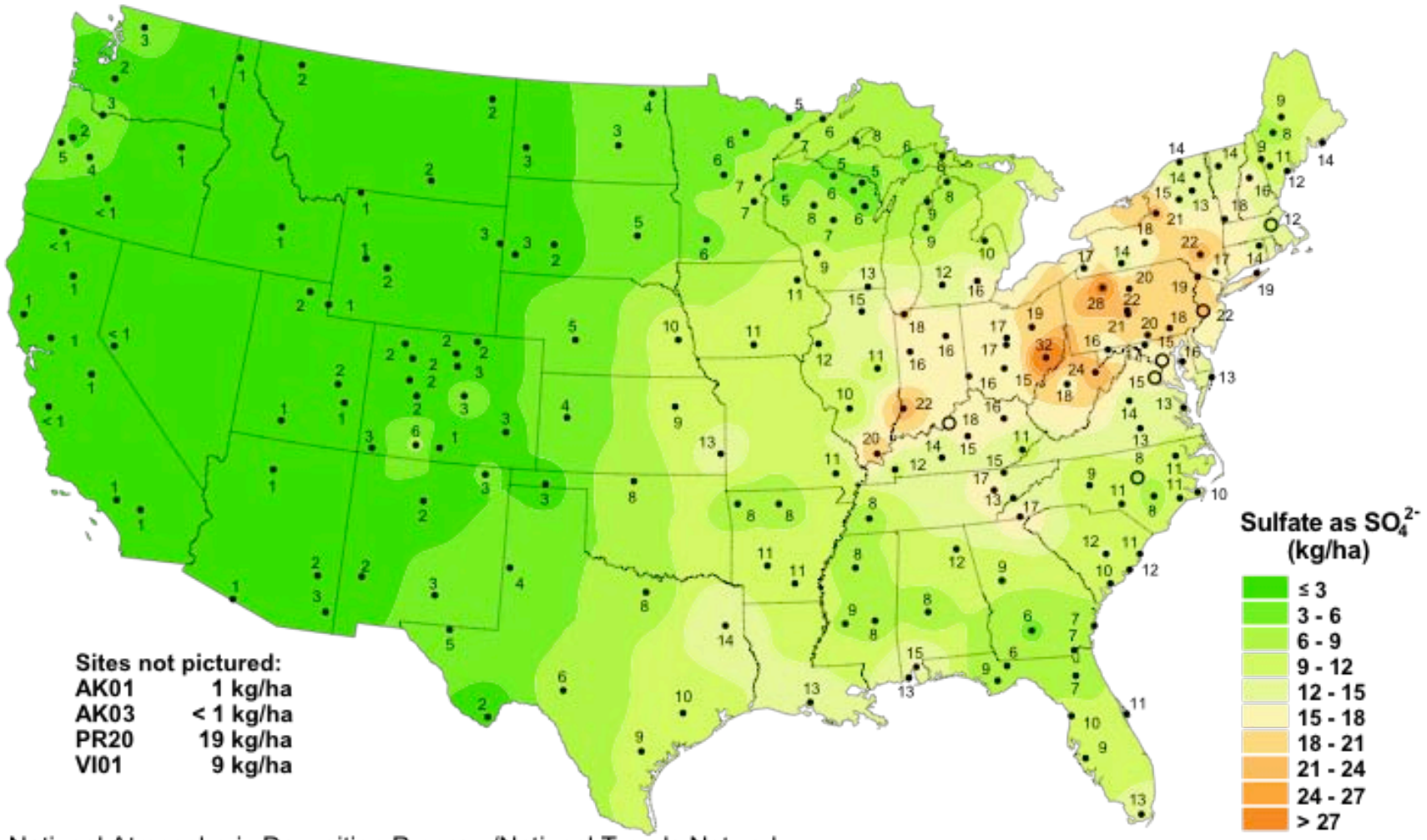
2004 **2005** 2006

Sulfate ion wet deposition, 2006



National Atmospheric Deposition Program/National Trends Network
http://nadp.sws.uiuc.edu

Sulfate ion wet deposition, 2007



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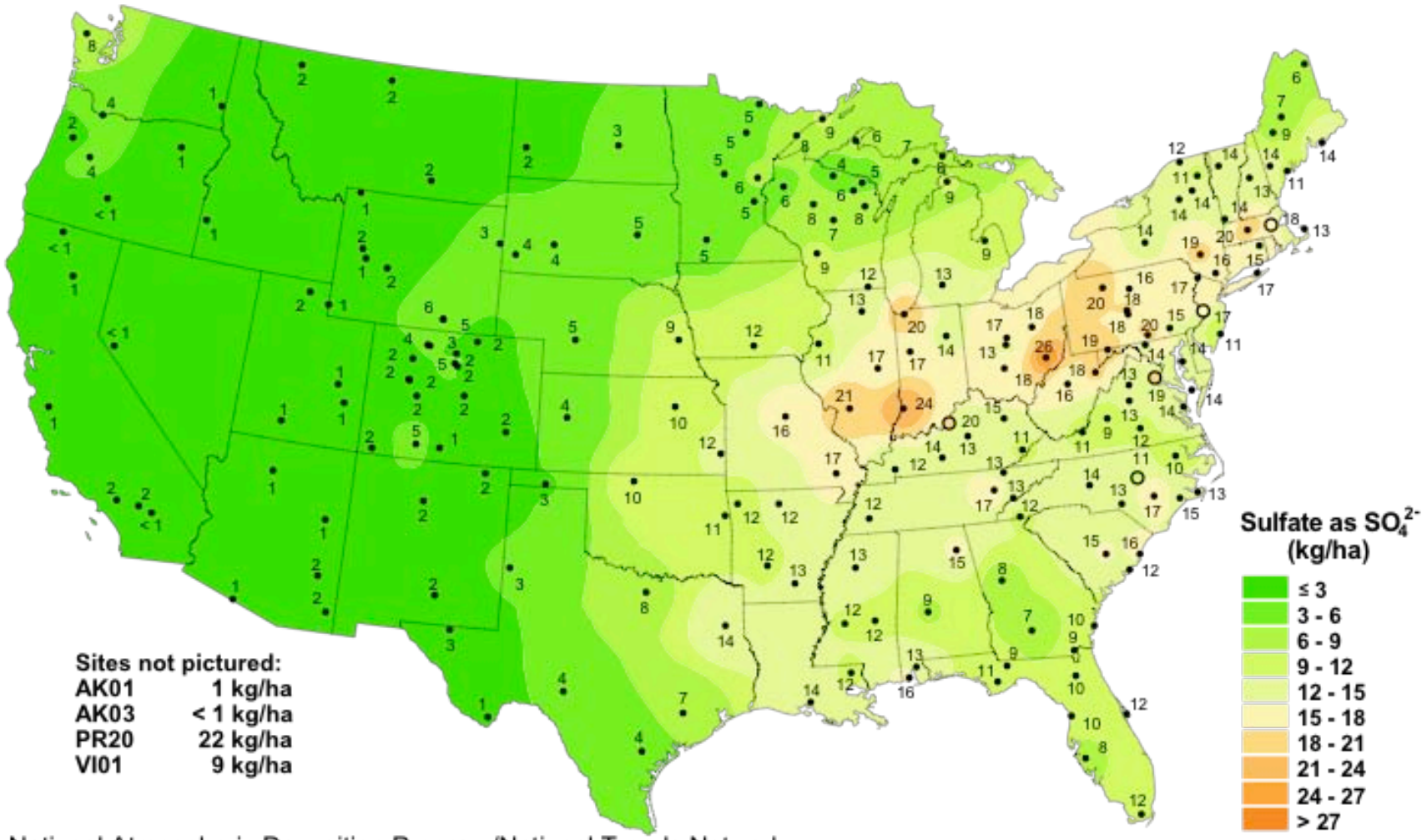
Sulfate ion wet deposition, 2008



National Atmospheric Deposition Program/National Trends Network
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Evidence of a problem

- In season alfalfa samples submitted to UW SPAL had below optimum S concentration
  - 2009
    - 85% of samples submitted as abnormal in appearance
    - 44% of samples submitted as normal
  - 2008
    - 67% of samples submitted as abnormal in appearance
    - 39% of samples submitted as normal
- Less than 10% of all corn samples were deficient in S
- Iowa documenting S deficiency in alfalfa and corn for the past 5-6 growing seasons

Identifying S deficiency – alfalfa

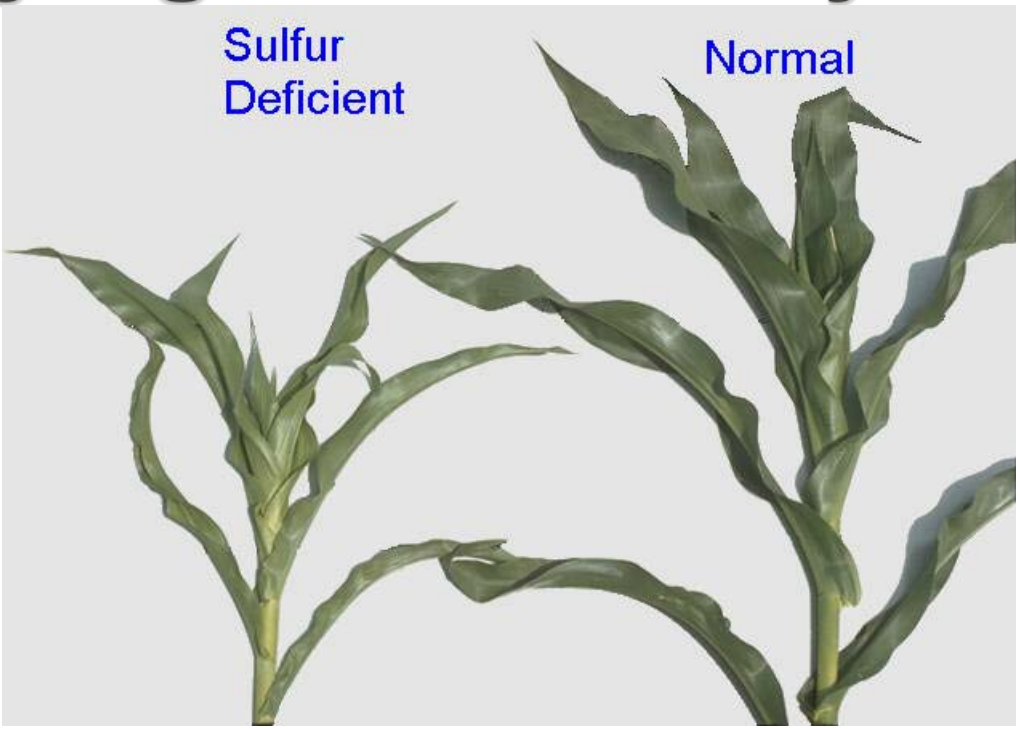
- Yellowing of newer growth
- Stunted growth
- Spindly plants

Photo credits: Univ. of Montana

Identifying S deficiency – soybean

Photo credits: Better Crops 1997. Vol. 81 (3):8-13

Identifying S deficiency – corn



- General yellowing of the foliage with newer leaves being lighter in color
- perhaps also having interveinal chlorosis

Photo credits: R. Hoeft

Evaluating S availability

- S soil tests
  - Not as good at predicting response as soil tests for P or K
- WI Sulfur Availability Index (SAI)
  - Several factors summed to obtain SAI
    - Soil test SO_4-S multiplied by 4
    - Subsoil S – 5, 10, or 20 lb/a based on soil group and subsoil code
    - Precipitation S – 5, 10, or 20 lb/a based on county
    - %OM multiplied by 2.8 lb/a
    - Available manure S

Evaluating S availability

- SAI Interpretation
  - SAI < 30, then deficient
    - Forage legumes
      - Incorporate at seeding 25-50 lb S/a
      - Topdress established 15-25 lb S/a
    - Corn and small grains 10-25 lb S/a
  - SAI = 30-40, then tissue test to confirm need
  - SAI > 40, adequate

Sources of S

- Fertilizer
  - Elemental S requires soil bacteria to transform it to SO_4^{2-}
  - Sulfate forms are immediately plant available
    - Consider price and need for other nutrients in the fertilizer

- Manure
  - Dairy: 1.5 lb S/T or 4.2 lb S/1,000 gal
  - Chicken: 3.9 lb S/T
  - Swine: 2.4 lb S/1,000 gal

Summary

- K & S are nutrients that we will likely see more deficiency in the future

- S may not be an immediate problem in all areas
  - Somewhat dependent upon patterns of atmospheric deposition


Questions?