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Analysis of the Effects of Deicing Chemicals on Ground-Water and Surface-Water Quality in the Glaciated Northern U.S.

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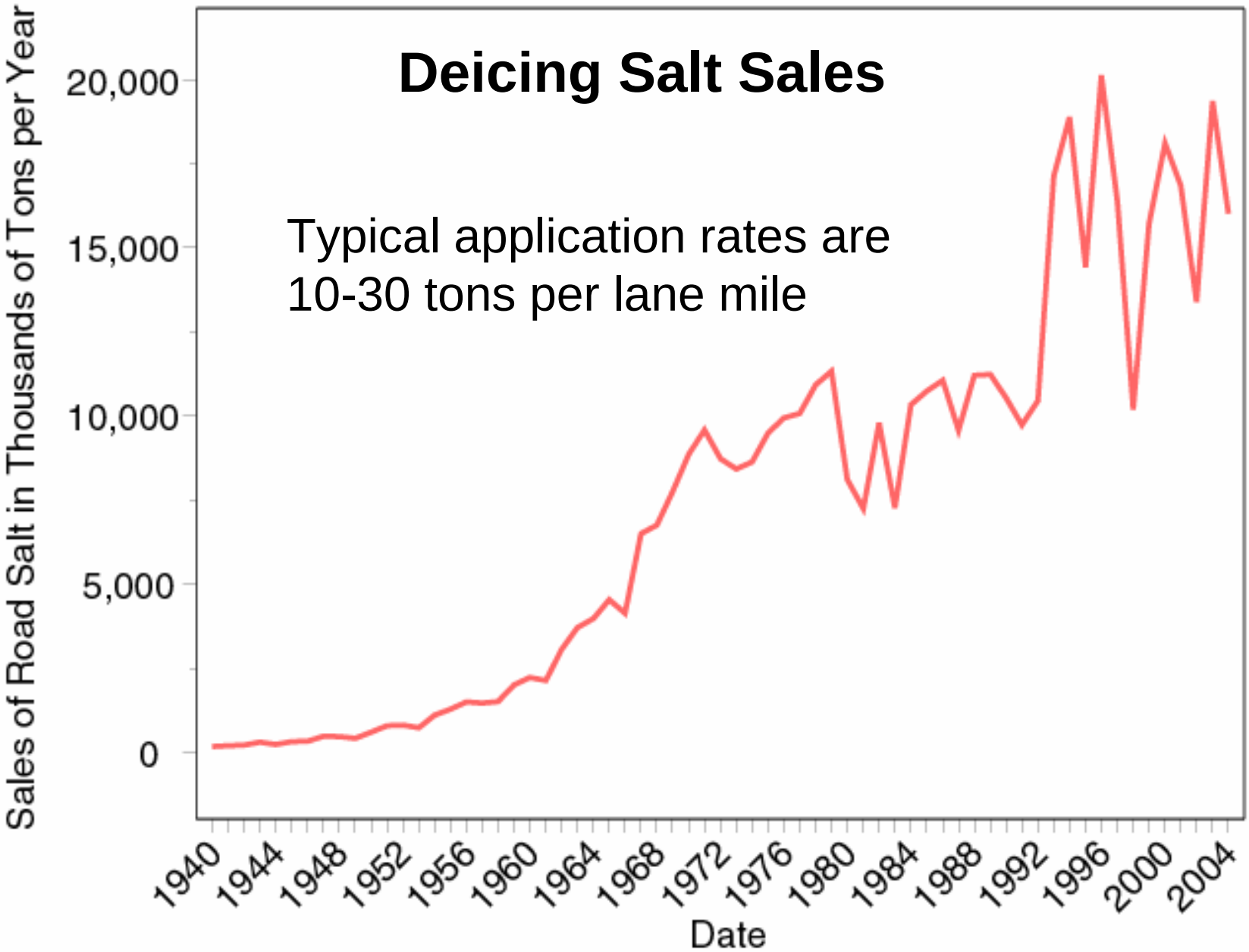
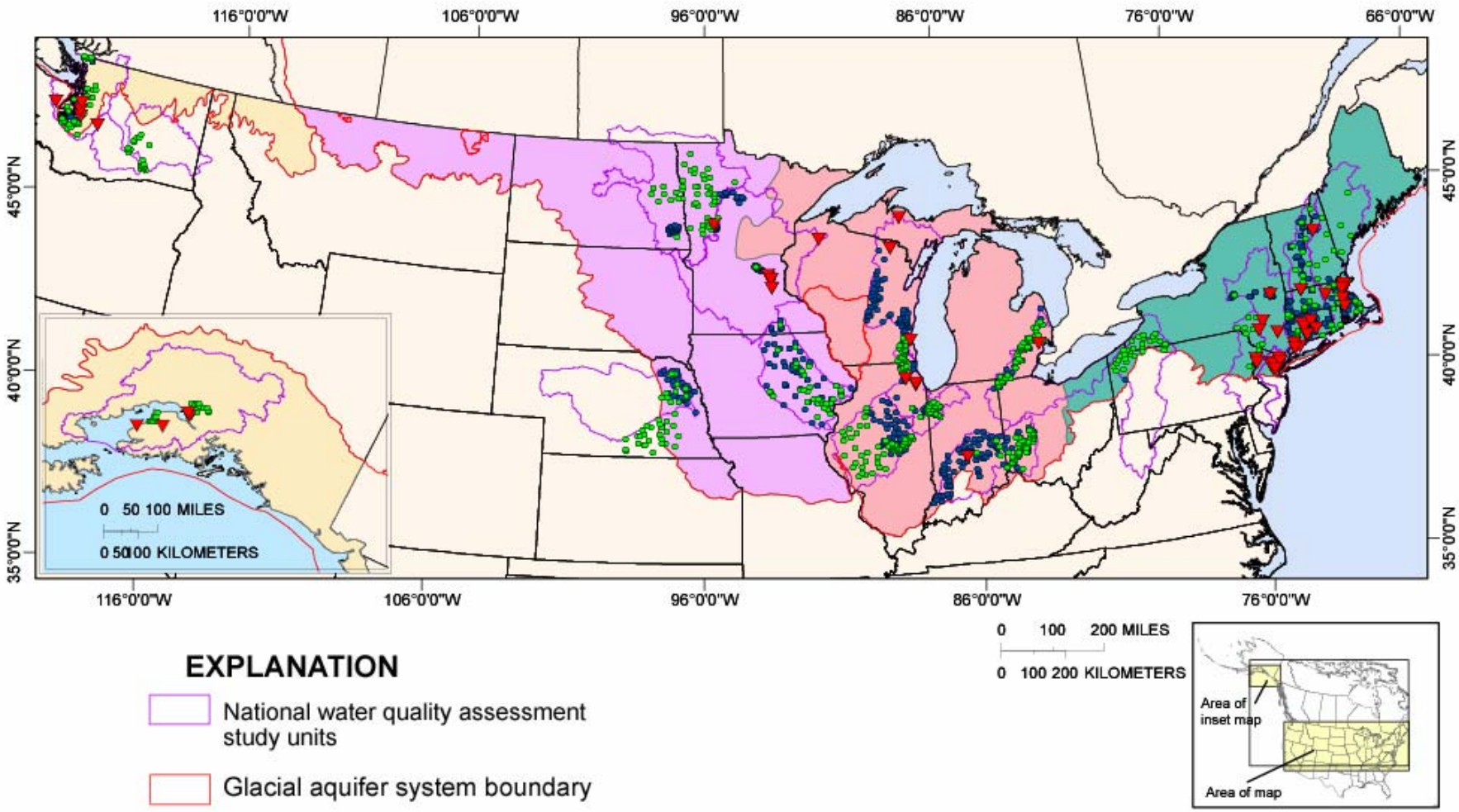
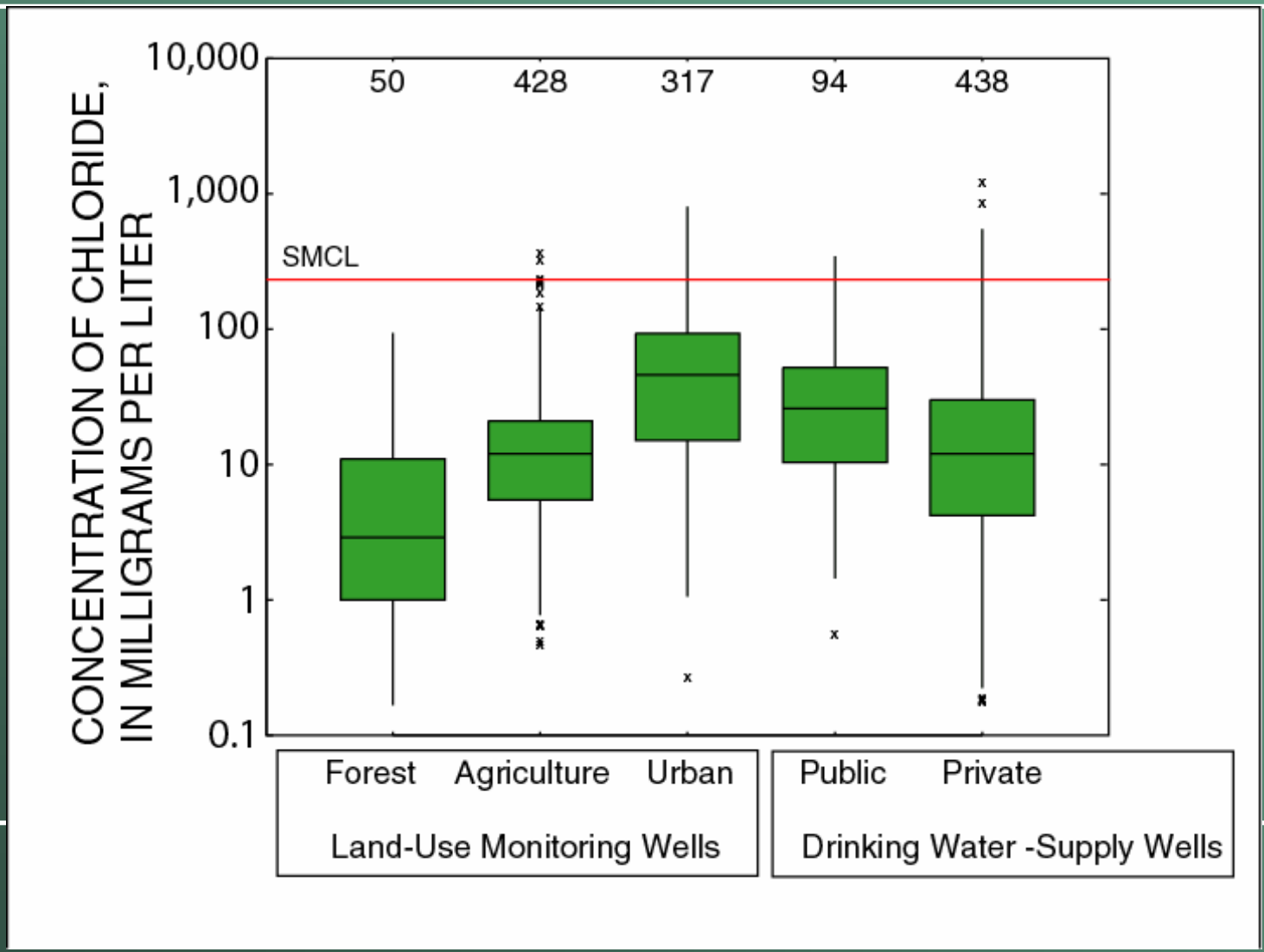
NATIONAL WATER-QUALITY ASSESSMENT PROGRAM

U.S. Department of the Interior
U.S. Geological Survey


Deicing Salt Sales
Typical application rates are
10-30 tons per lane mile
Sales of Road Salt in Thousands of Tons per Year
20,000
15,000
10,000
5,000
0
1940
1944
1948
1952
1956
1960
1964
1968
1972
1976
1980
1984
1988
1992
1996
2000
2004
Date


116°0'0"W
106°0'0"W
96°0'0"W
86°0'0"W
76°0'0"W
66°0'0"W
45°0'0"N
40°0'0"N
35°0'0"N
0 50 100 MILES
0 50 100 KILOMETERS
0 100 200 MILES
0 100 200 KILOMETERS
Area of inset map
Area of map
EXPLANATION
National water quality assessment study units
Glacial aquifer system boundary
Region
Central
East
West
West Central
Surface water-quality monitoring station
Land-use well network wells
Drinking-water well network wells

Chloride in Ground Water



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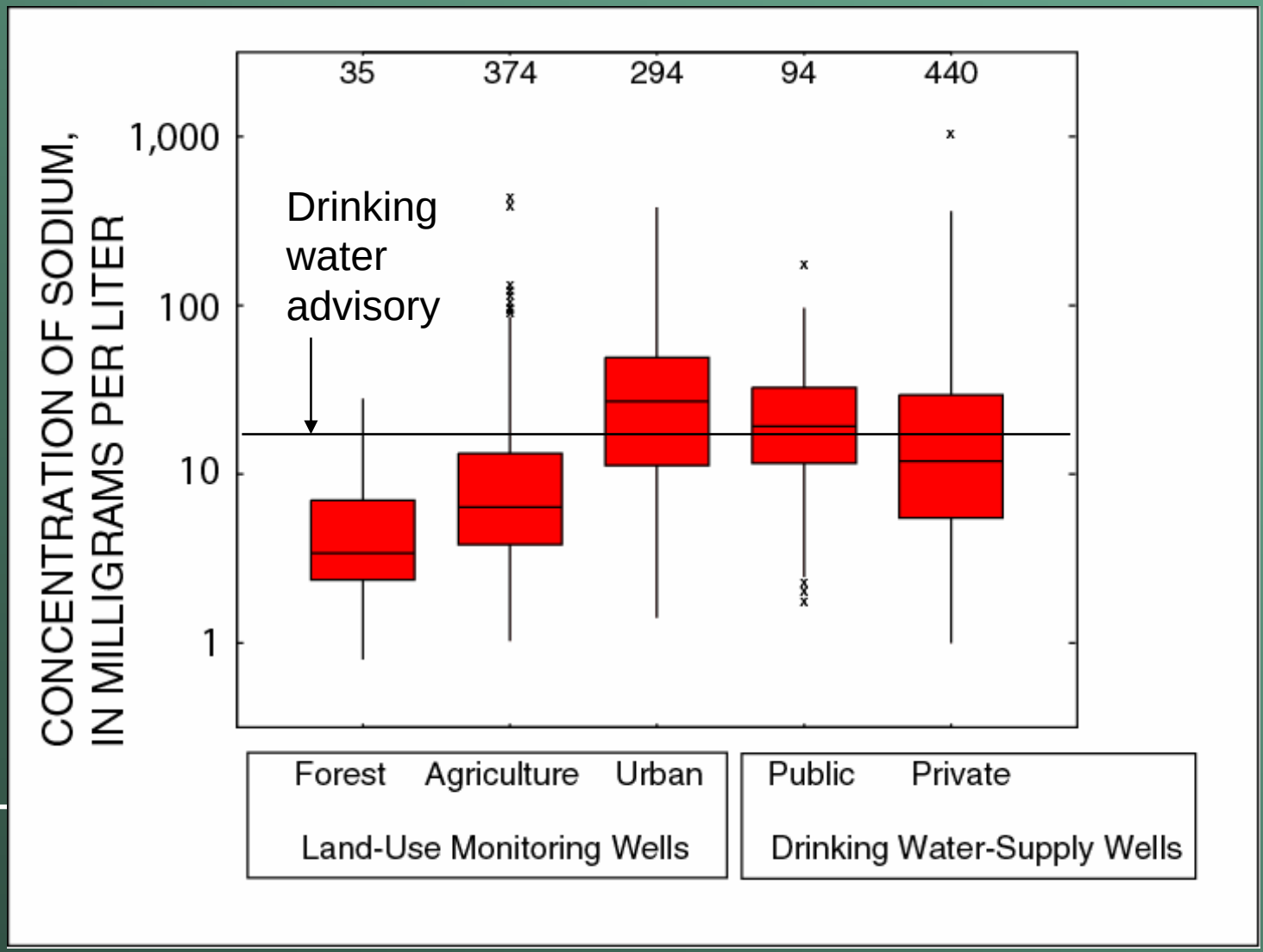
Sodium Ground Water



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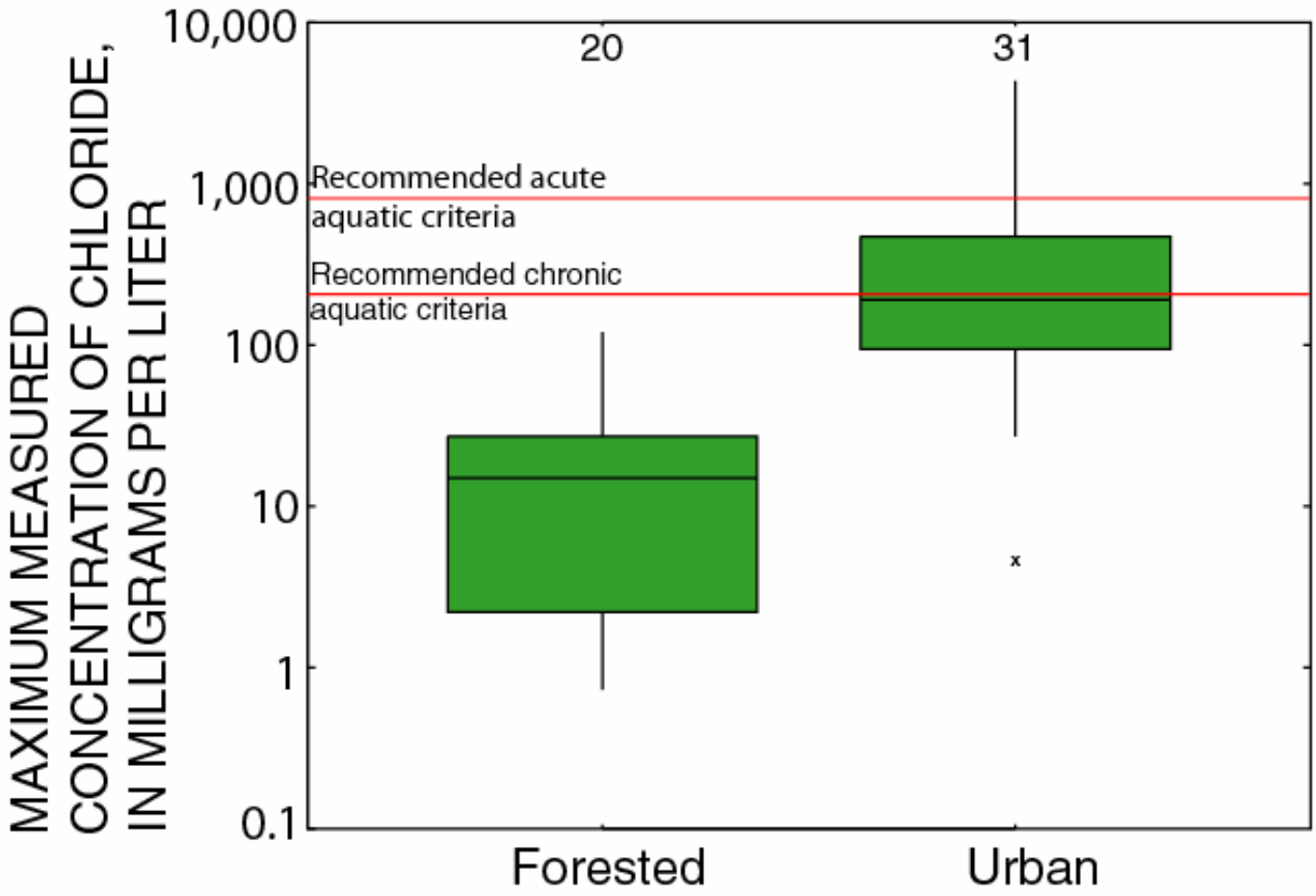
Maximum measured chloride concentrations in surface water– forested and urban watersheds



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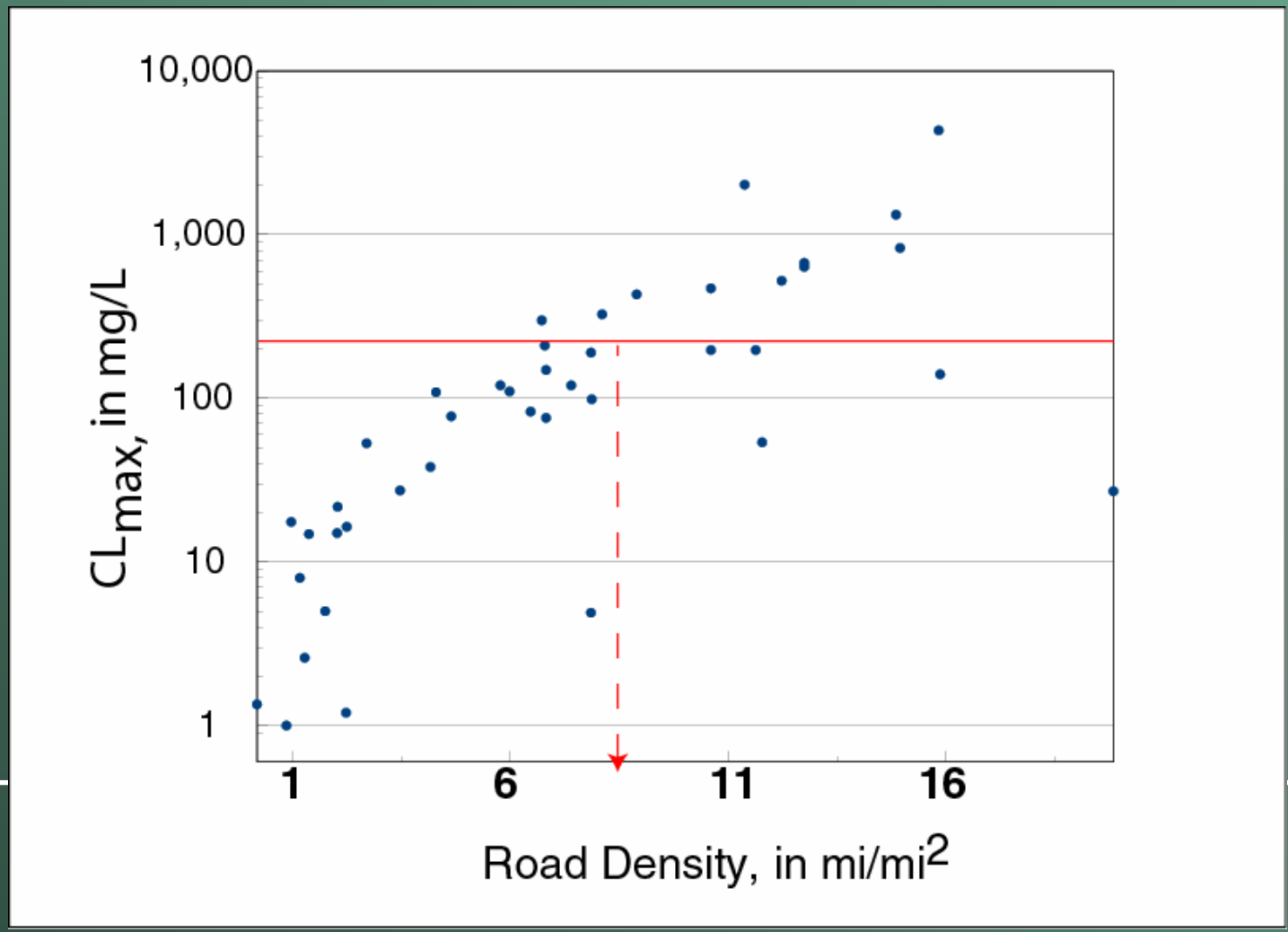
Relation of basin road density to maximum measured chloride concentrations in streams



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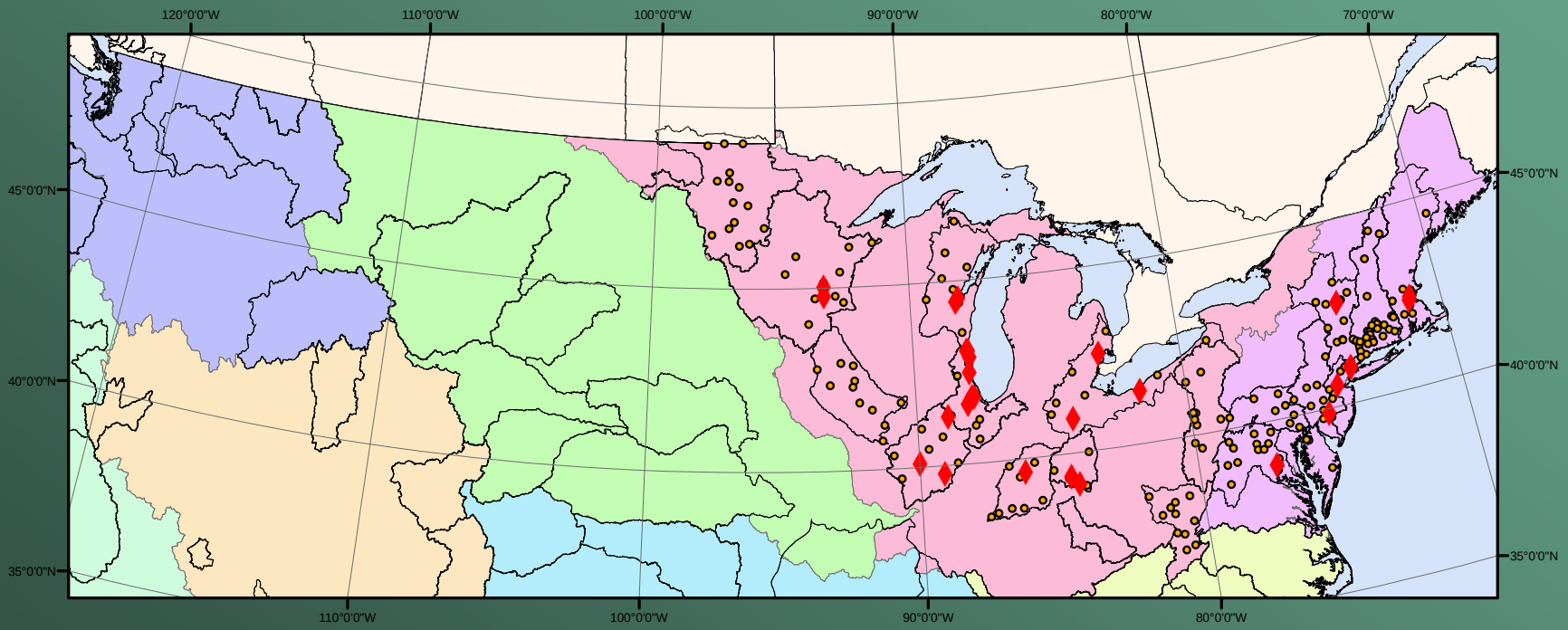
13 % of 212 NAWQA sites had chloride values exceeding 230 mg/L



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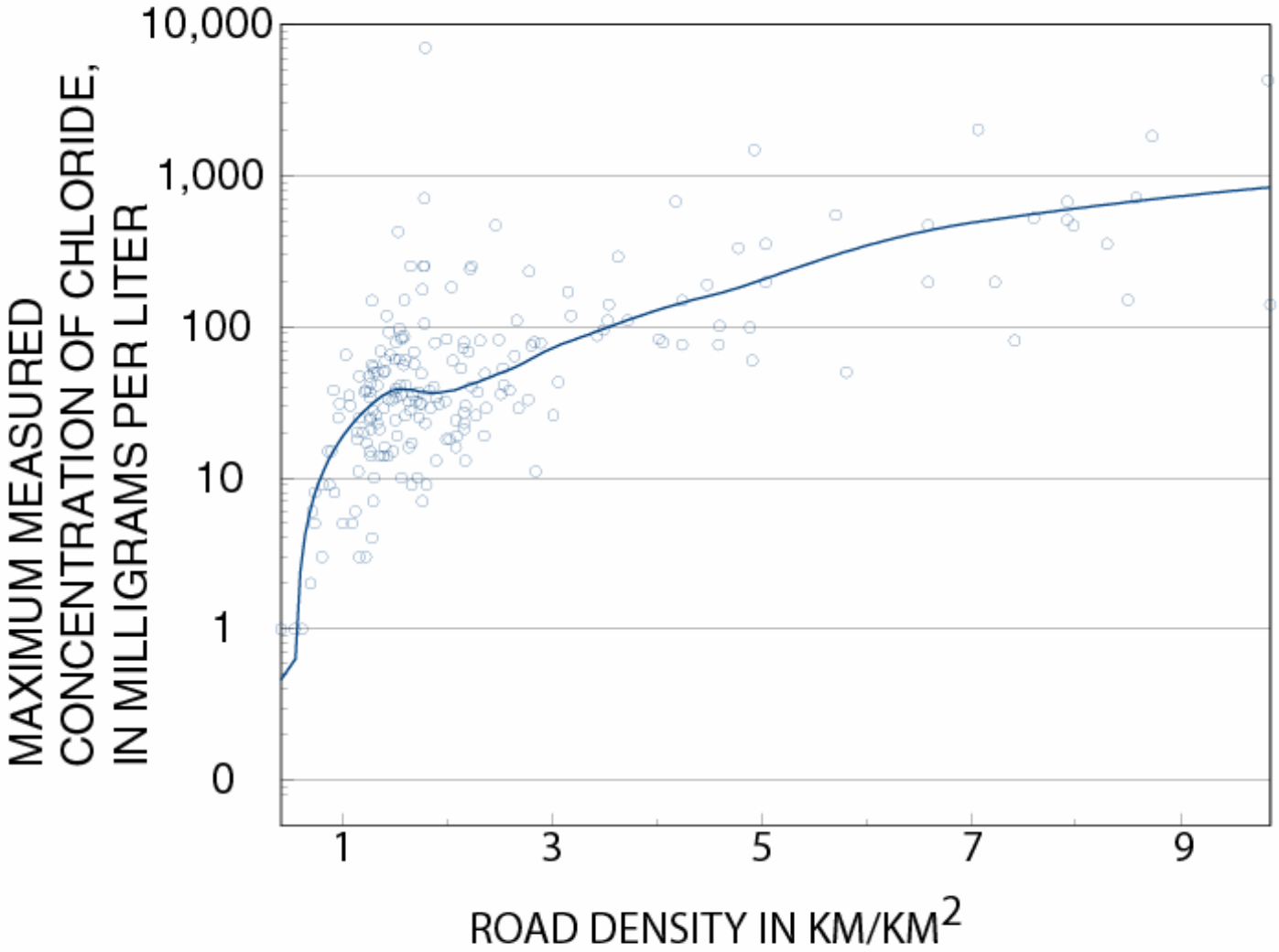
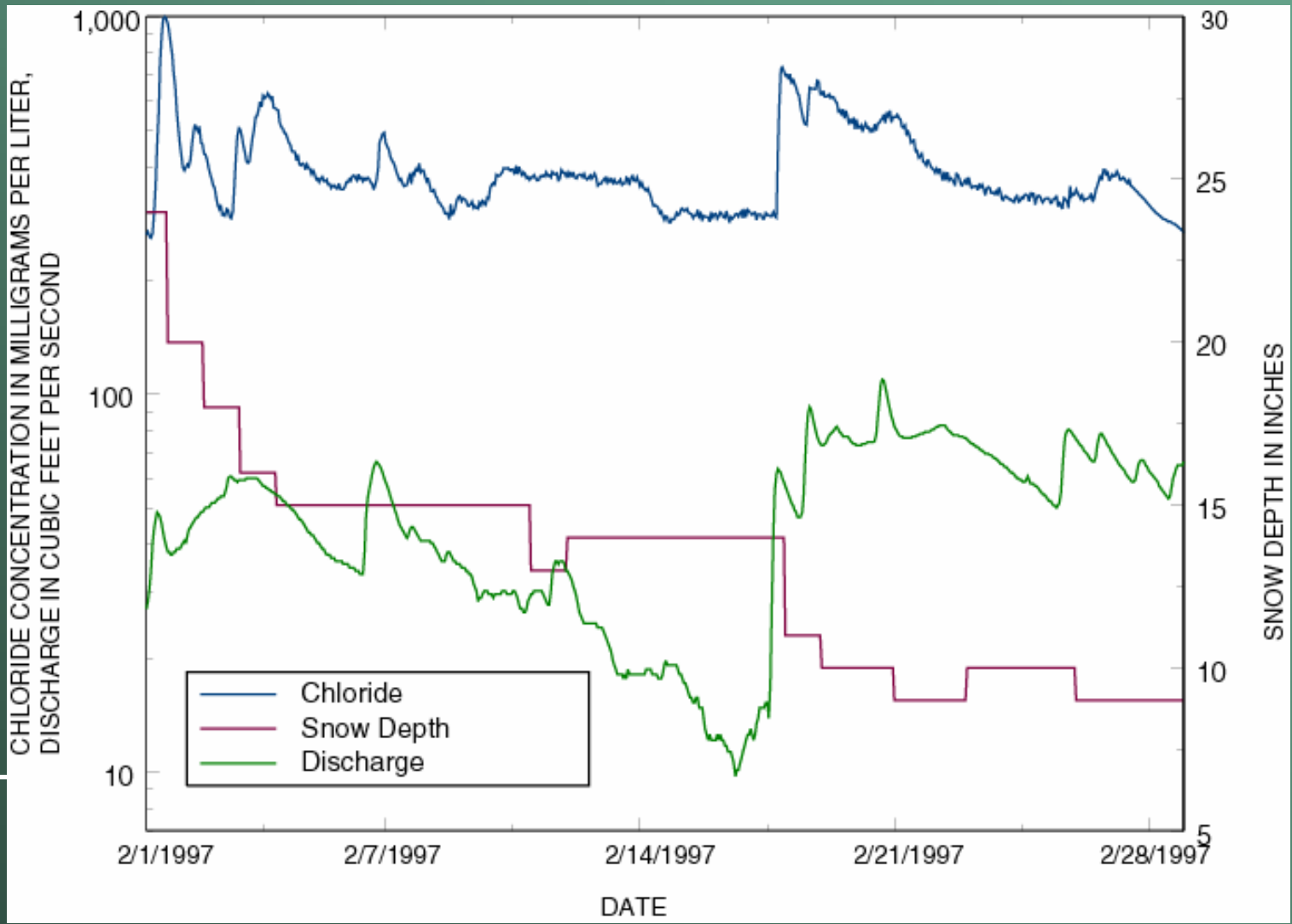
Larger data set shows similar relation to road density



Exceedences of recommended criteria generally occurred during winter months

Shingle Creek Minneapolis, MN



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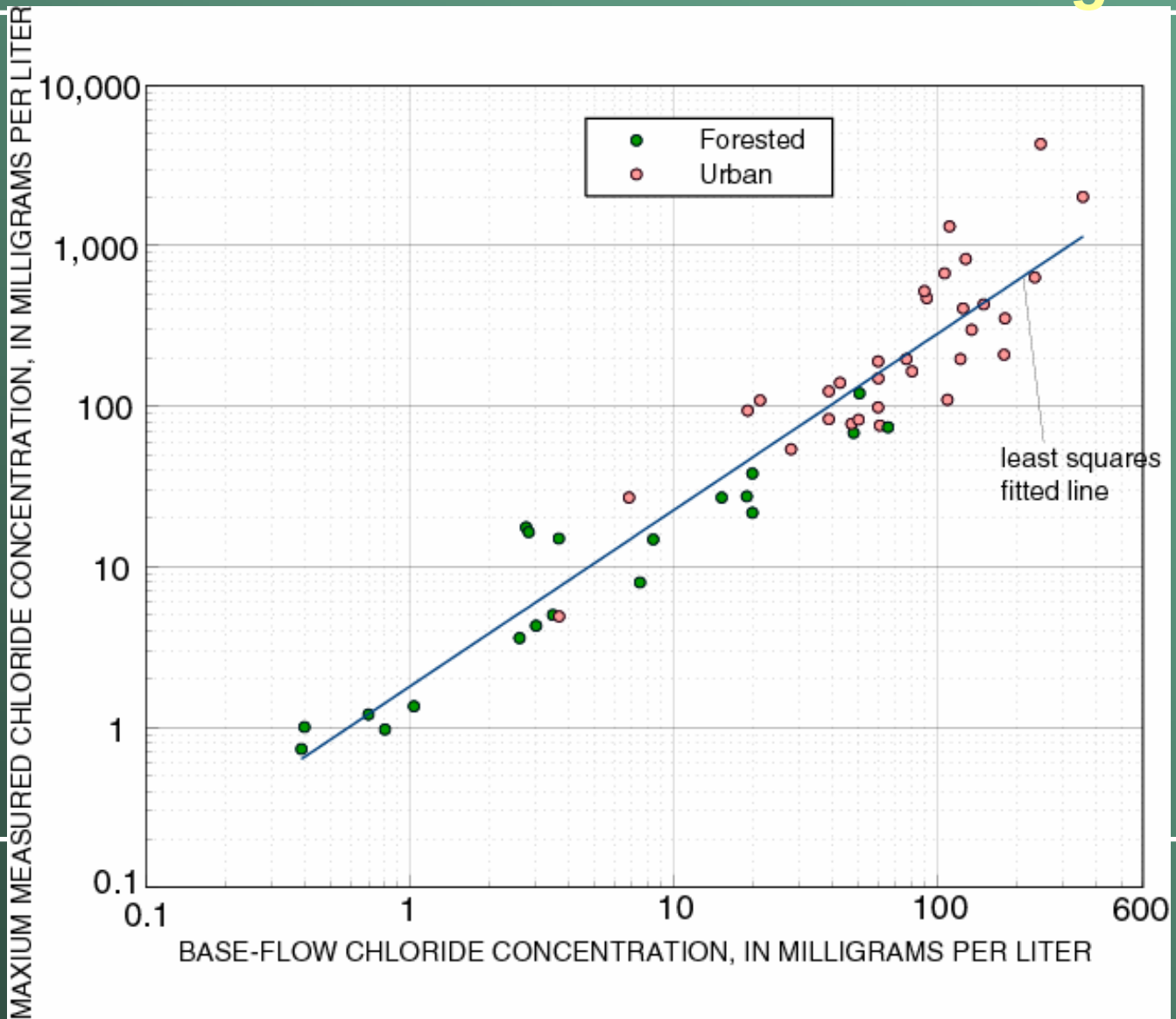
Base-flow concentrations of 75 mg/L or greater were indicative of sites with maximum measured chloride concentrations >230 mg/L



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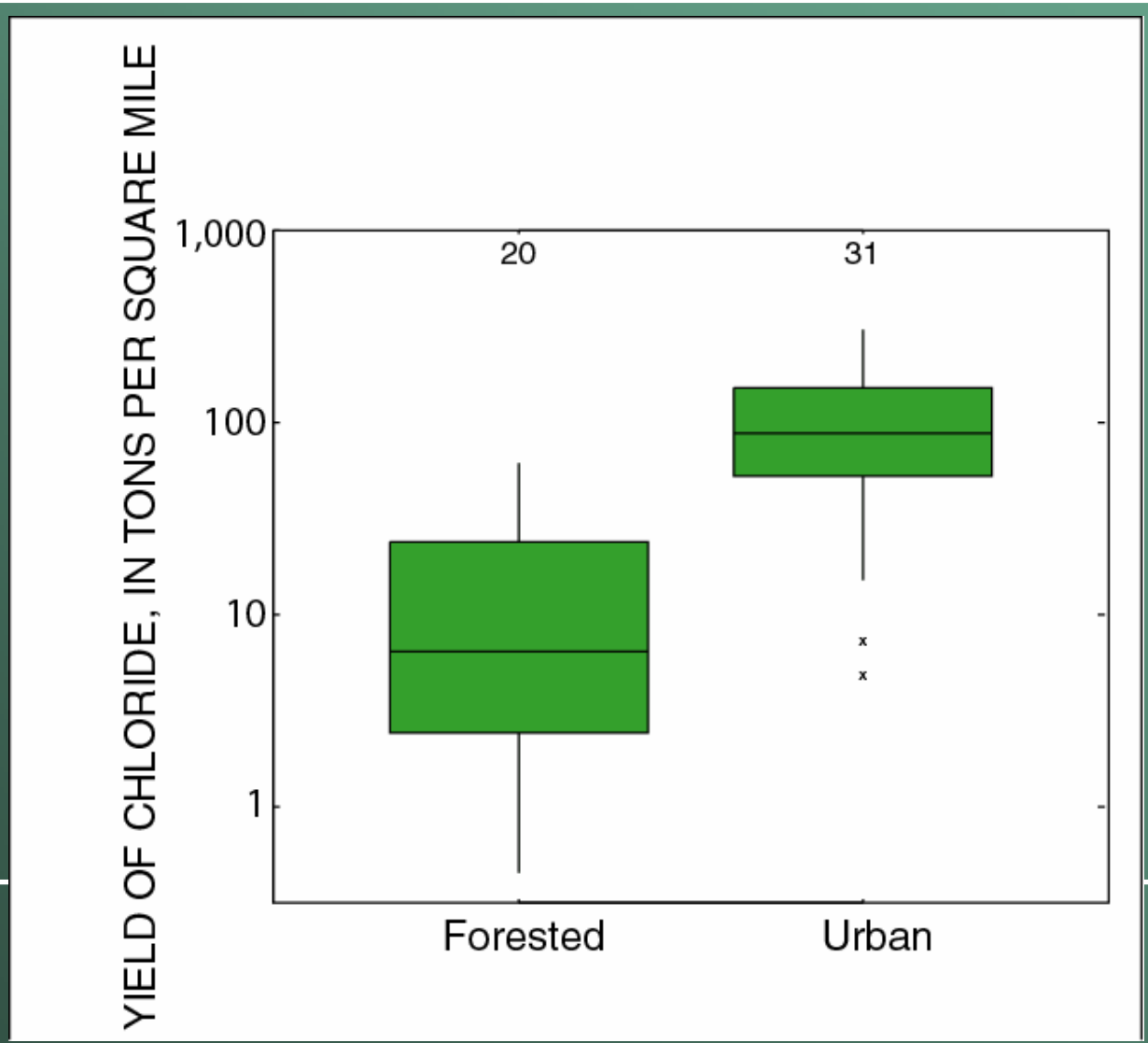
Chloride loads were estimated at 51 stations



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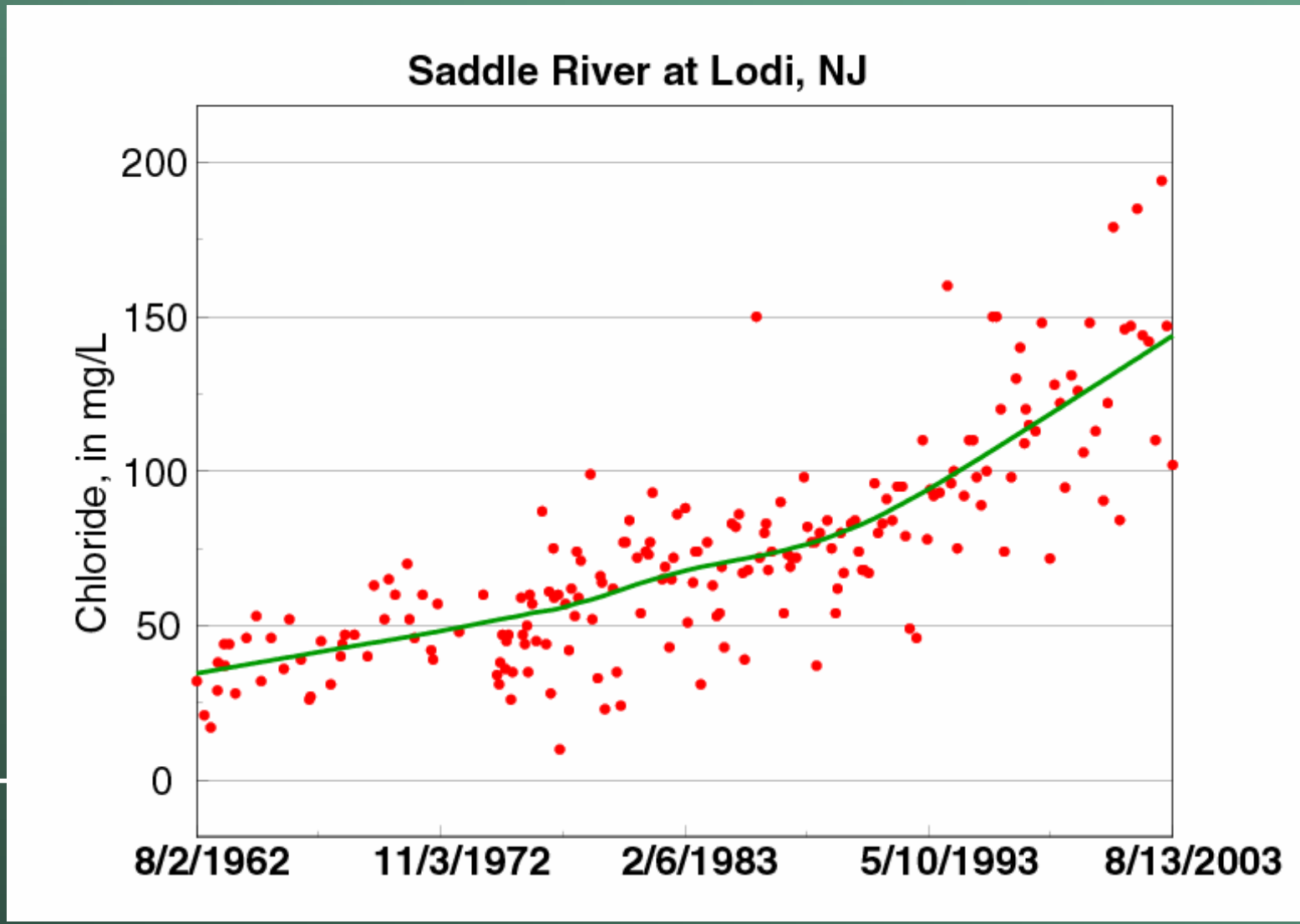
Example: Trend in Chloride Conc.



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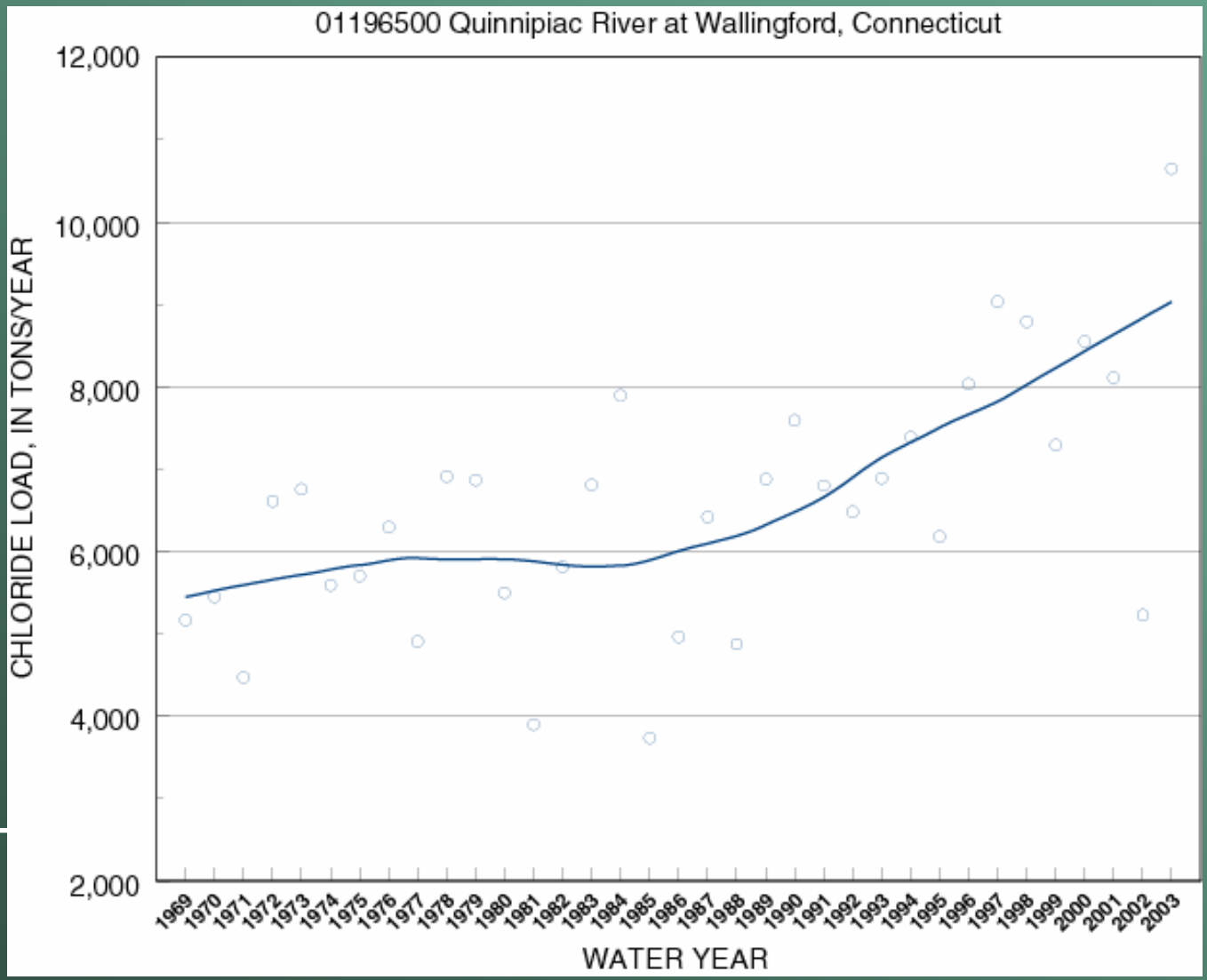
Trends in Chloride Load Were Apparent at Many Stations with Long-Term Record



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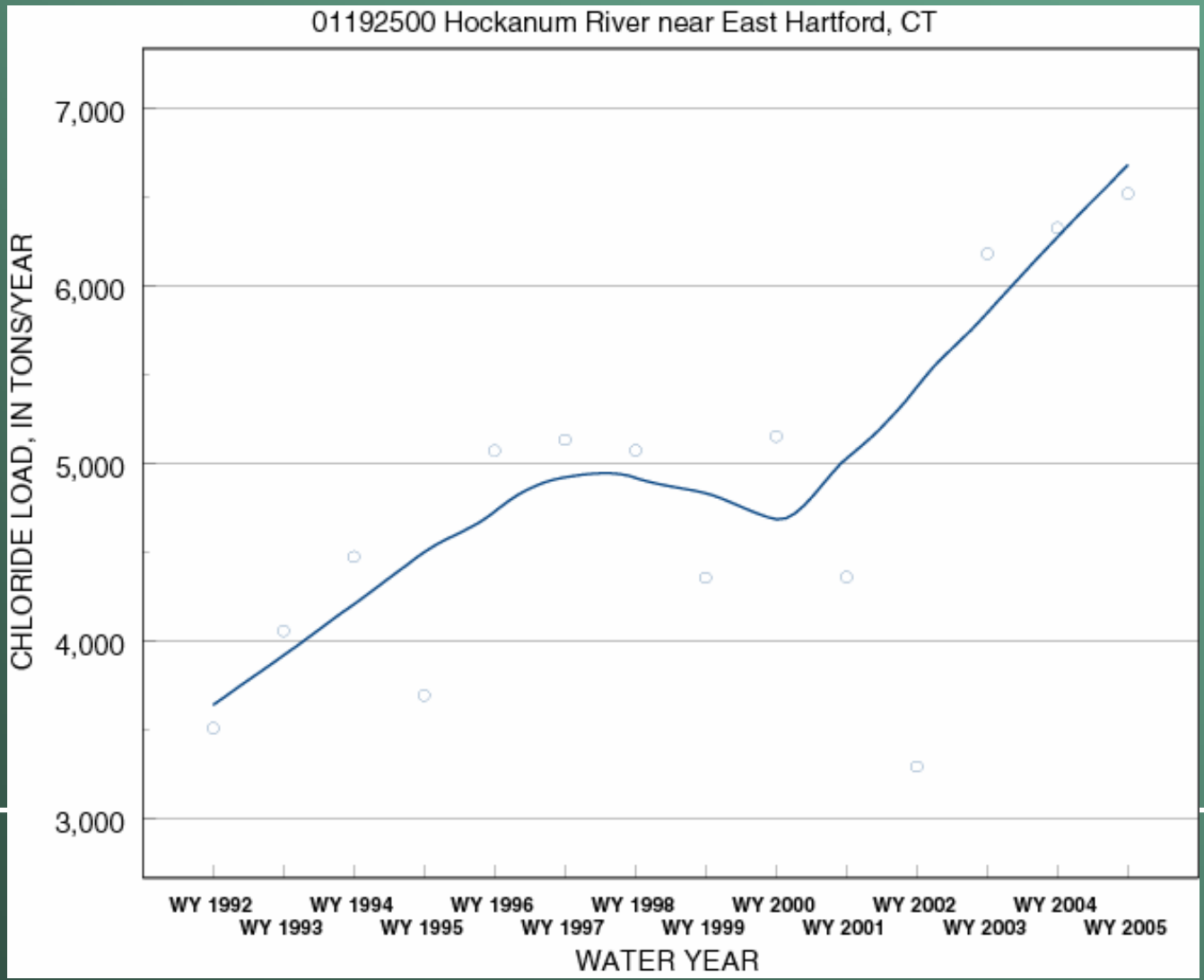

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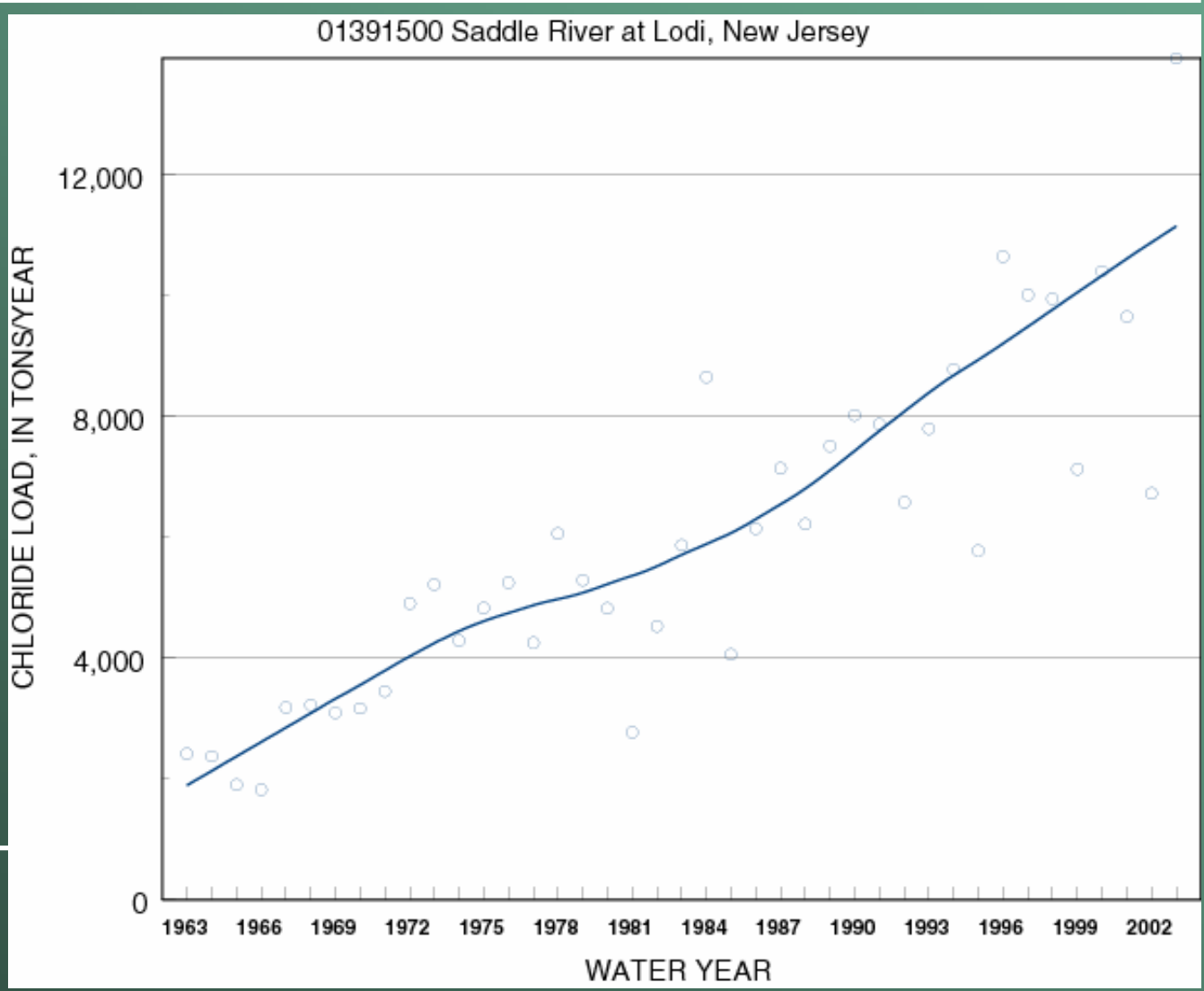

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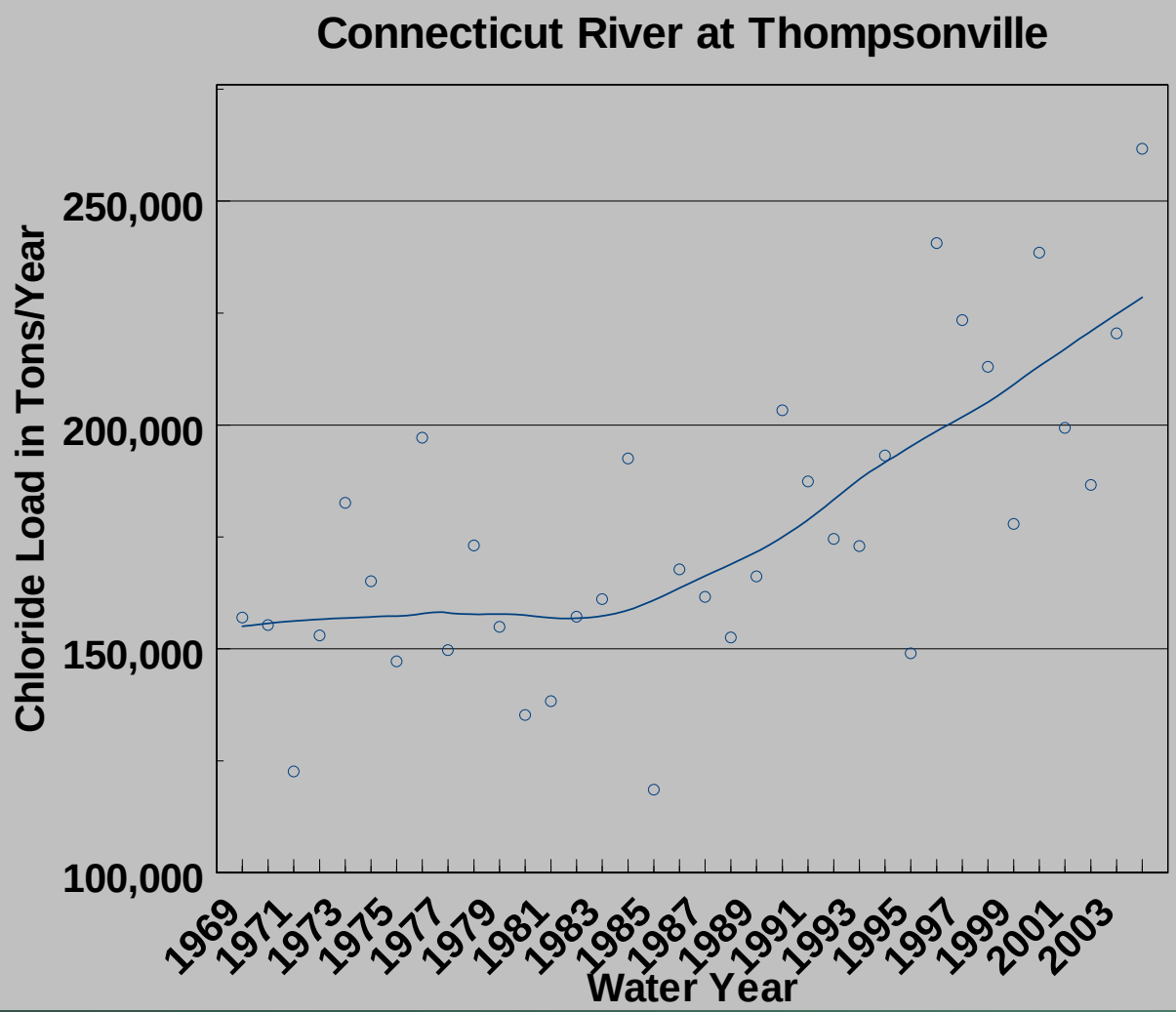
Trends in Chloride Load Were Apparent at Many Stations with Long-Term Record

Concentrations are still low



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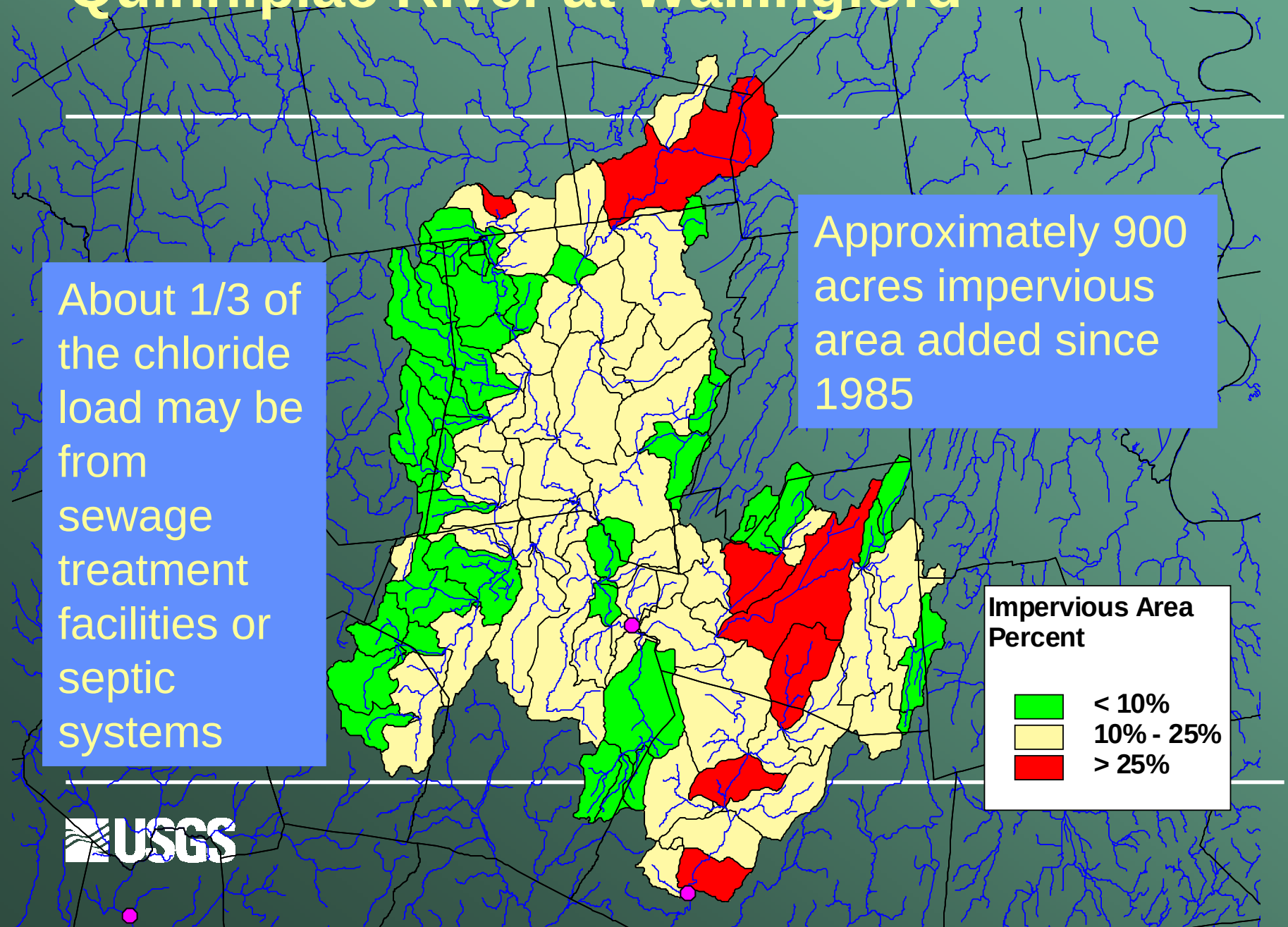
Quinnipiac River at Wallingford



About 1/3 of the chloride load may be from sewage treatment facilities or septic systems

Approximately 900 acres impervious area added since 1985

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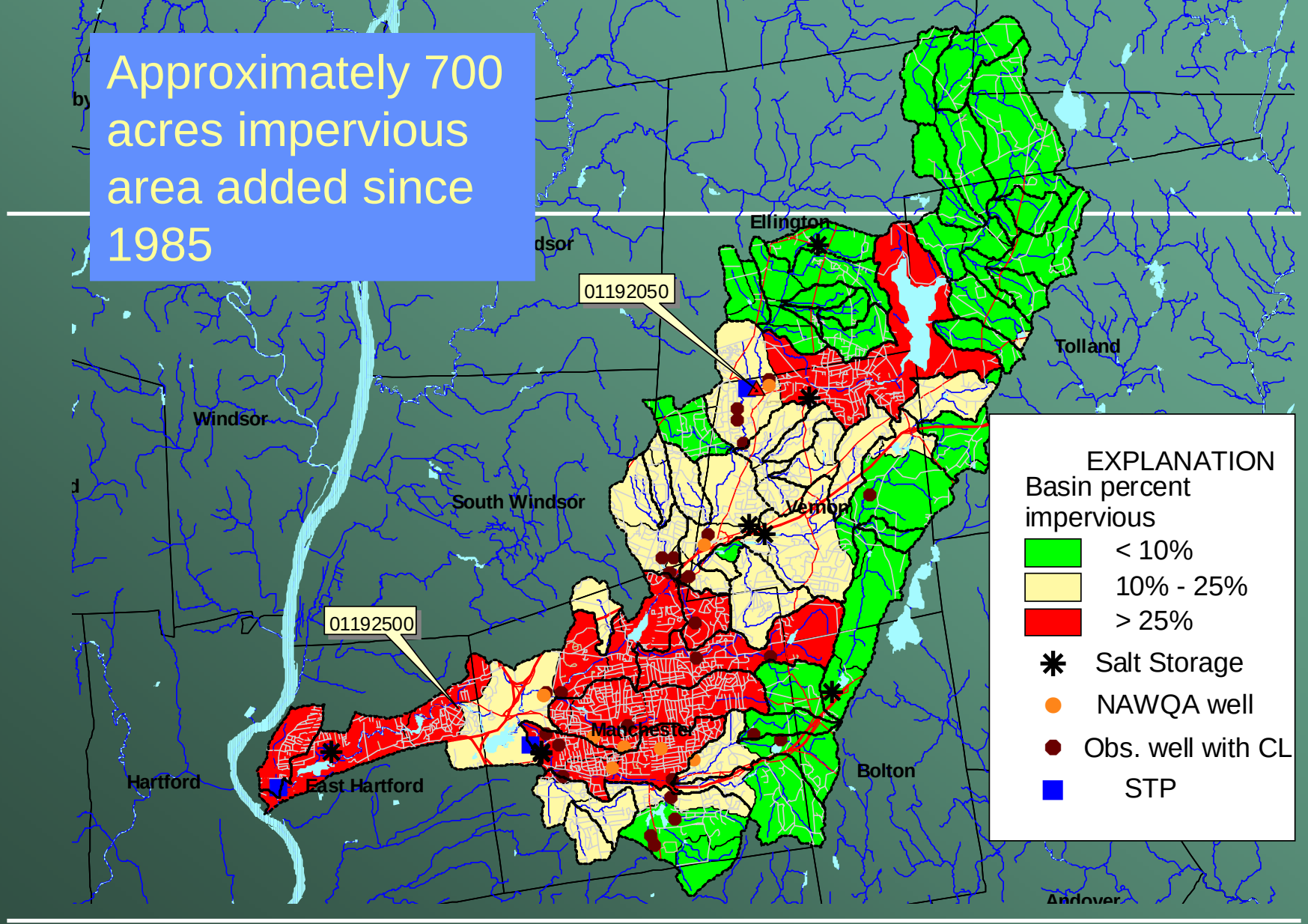

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Hockanum Basin Impervious Areas, 2002

Basins With Potential for Chloride Impairment Based on Road Density

Simple Connecticut Example