Land Use Impacts on Private Well Water Quality

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Many local, regional and/or state agencies in the Northeast and New England have or are considering laws or land use regulations to limit or ban the use of nitrogen fertilizers on turfgrass sites like lawns, golf courses, parks, sports fields and sod farms.

The nitrogen fertilizer restrictions are in response to the increasing level of nitrates in surface and/or ground water in urban and suburban watersheds where lawns in the broad sense make up a major part of the landscape.

Nitrogen & Groundwater Protection

Suffolk County Comprehensive Water Resources Management Plan (Jan 2008)

- **Nitrate levels have increased in all three aquifers over the study period from 1987 to 2005**
  - **Nitrate concentrations of PWS wells screened in the upper glacial aquifer increased by 38% (to an avg 3.38 mg/L)**
  - **Nitrate concentrations of PWS wells screened in the Magothy aquifer increased by 67% (to an avg 1.6 mg/L)**
- **Nearly 10% of private wells exceed drinking water MCL**

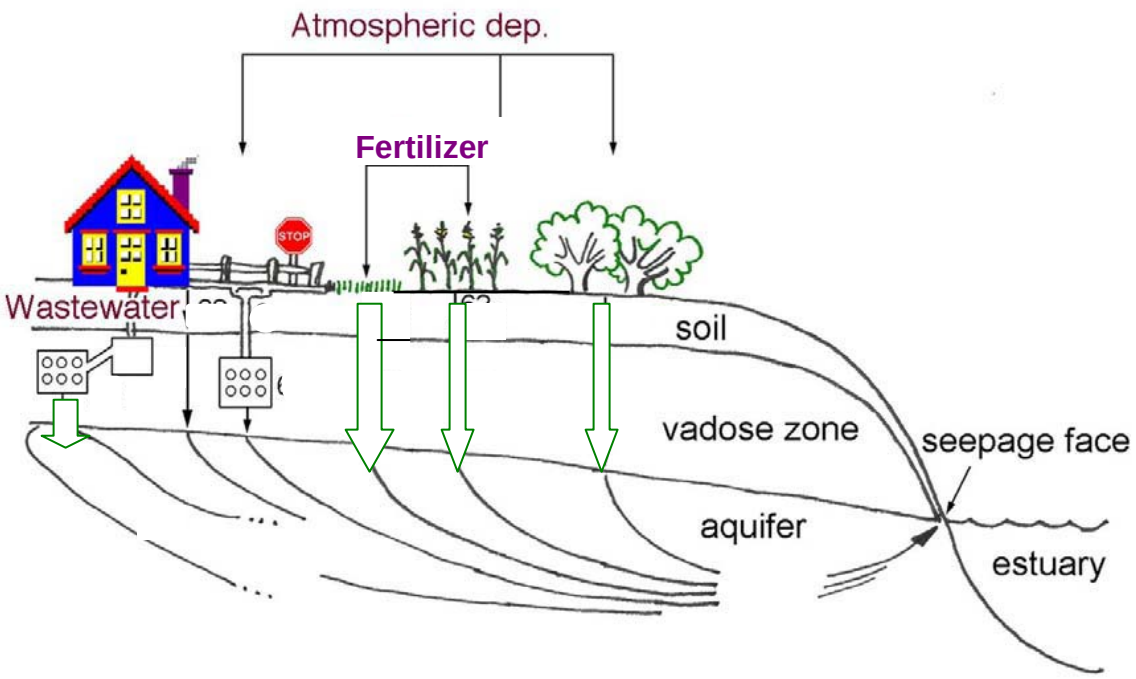
Nitrate Concentration in Private Wells

Years	# Samples	# >10 mg/L	% >10 mg/L
1972-1983	18,870	1,447	7.7
1984-1994	27,115	1,961	7.2
1997-2006	10,277	994	9.7

Land use regulations that limit the size of a lawn are based on estimating the nitrate loading rate into groundwater by assuming an application rate and percent leaching (ranging as high of 25 to 50% of the amount of fertilizer nitrogen applied, 25% used on Cape Cod, MA).

Sources of Nitrogen

Nitrogen source diagram



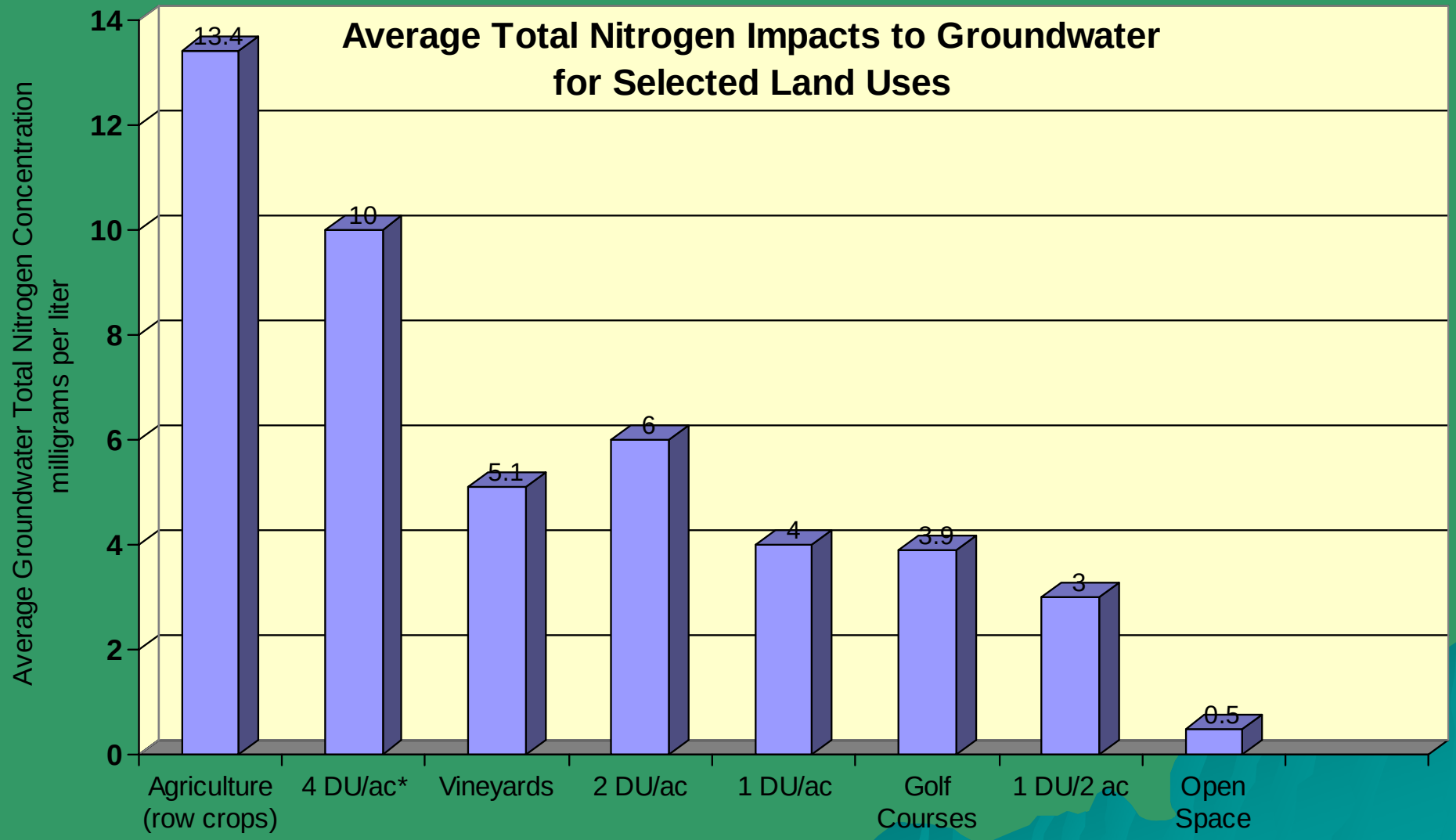
Impacts to Groundwater Quality from:

- Atmospheric Deposition
- Wastewater (sewage disposal systems)
- Fertilizer
- Soil organic matter

Sources of Nitrogen-Long Island-NY

- **Studies have shown that residential use of fertilizers contributes approximately one-half of the total nitrogen load to groundwater from medium density residential development**

Sources of Nitrogen-Long Island-NY



The purpose of this talk is to:

1. review of all the published scientific literature appropriate to the Northeast and New England on nitrate leaching from turfgrass sites

2. Show expected leaching information that can be used for land regulations and best management practices for well water protection

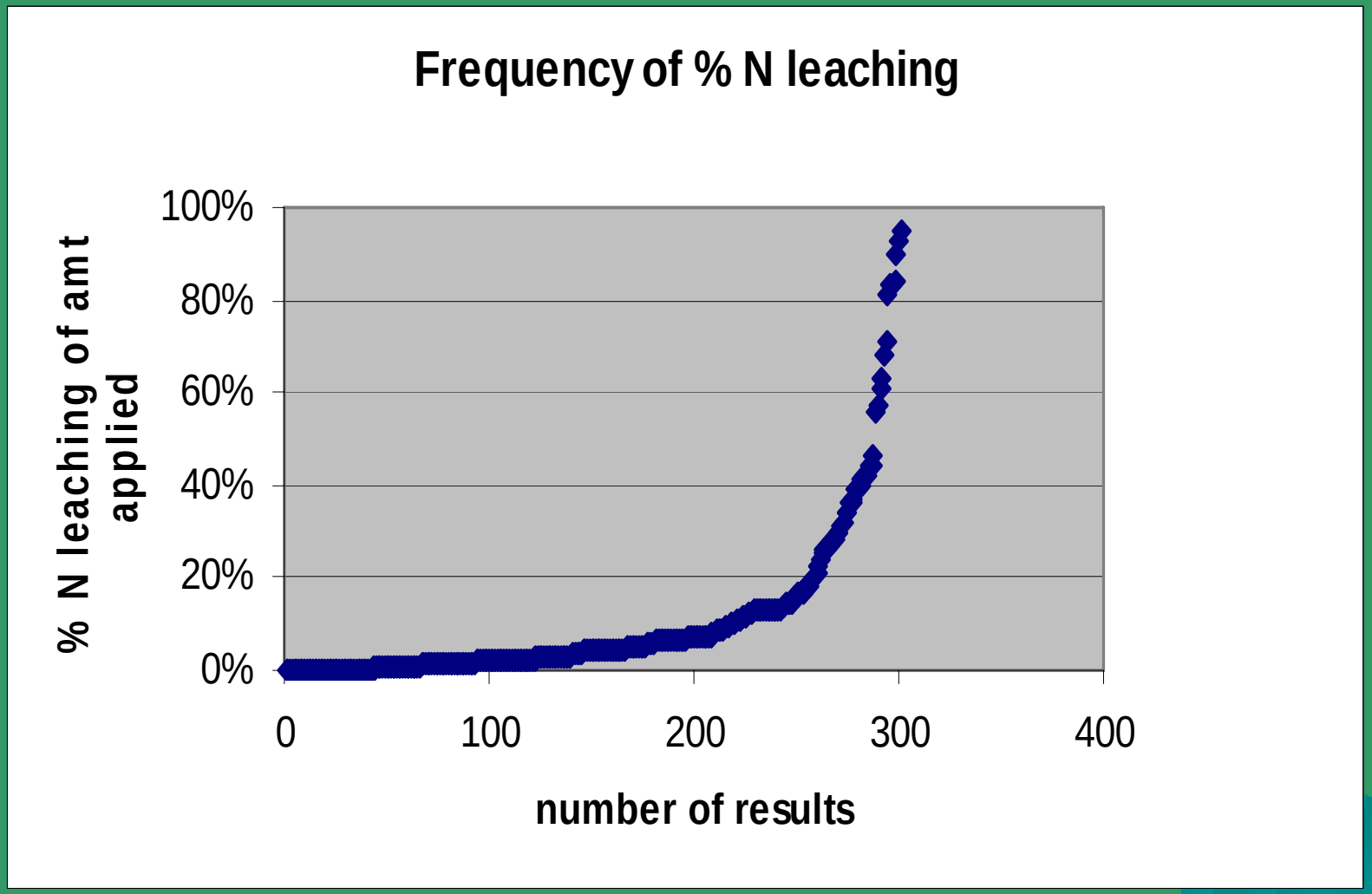
Scope of Scientific Literature:

1. All research journal articles published (1980-2009) on the leaching of fertilizer nitrogen applied to cool-season turfgrasses. There were 35 research journal articles published .
2. Ten of the 35 studies were conducted on golf course type conditions, while most of the studies were done on lawn type turf.

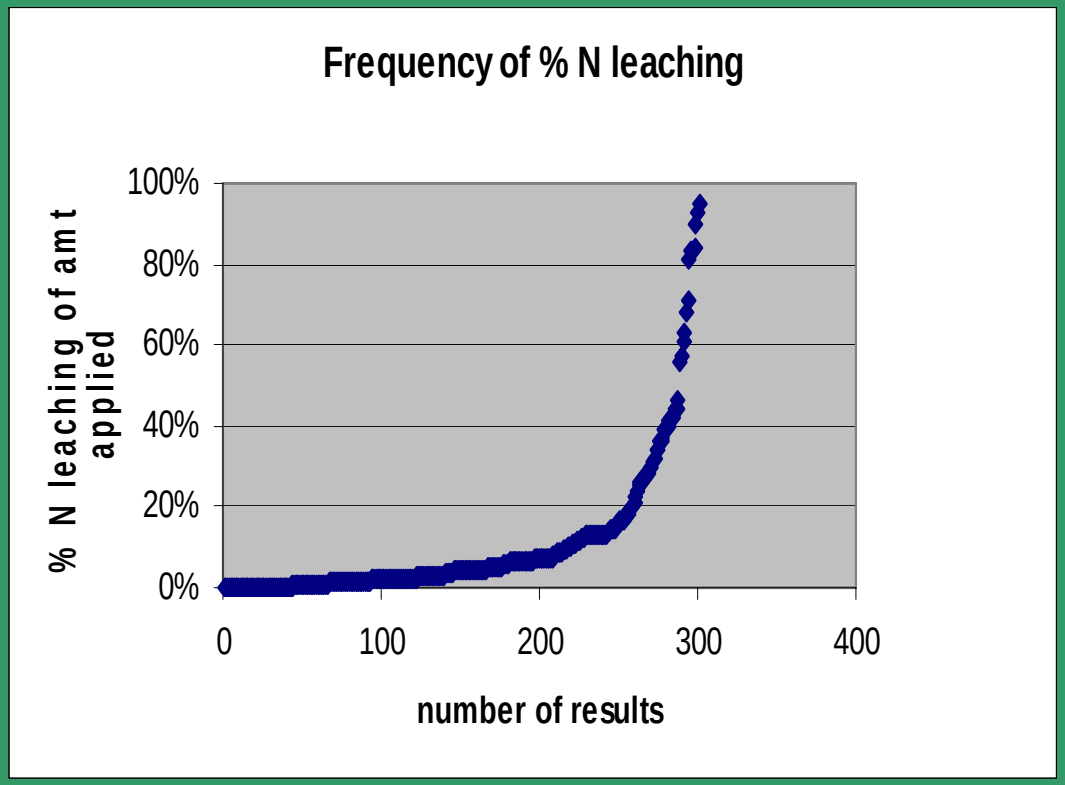
Scope of Scientific Literature:

3. type of studies: greenhouse soil columns to field studies of an entire golf green (1/3 acre), but most were small collections sites (5” to 12” dia.) on small field plots (<100 sq.ft.). Silt loam to sand soils.
4. Data is % nitrogen leached (mostly as nitrate) of the amount applied and nitrate loading rate (lbs./acre/yr or kg/ha/yr)

RESULTS-all data points (302)



RESULTS-all data points (302)



Mean=10.5%

Medium= 4.15%

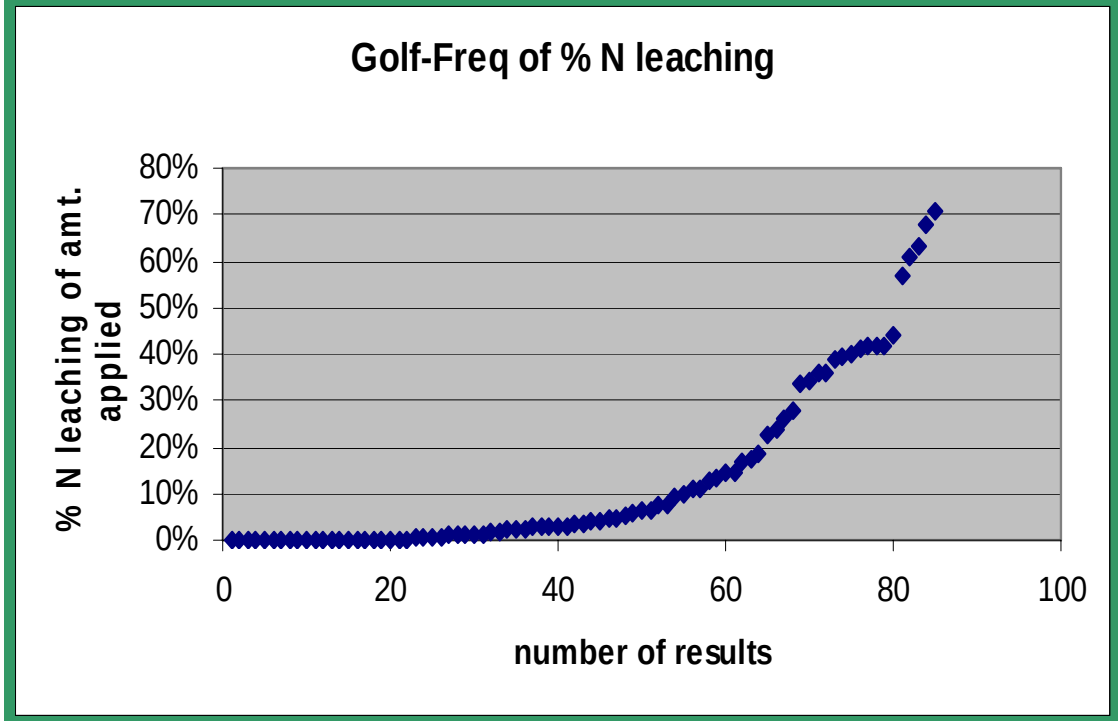
Range of 0-95%

11% above 25%

2/3 <10%

Field studies only, mean= 8.8% N leached of the amount applied

RESULTS- all golf courses (87)



Mean=13.3%

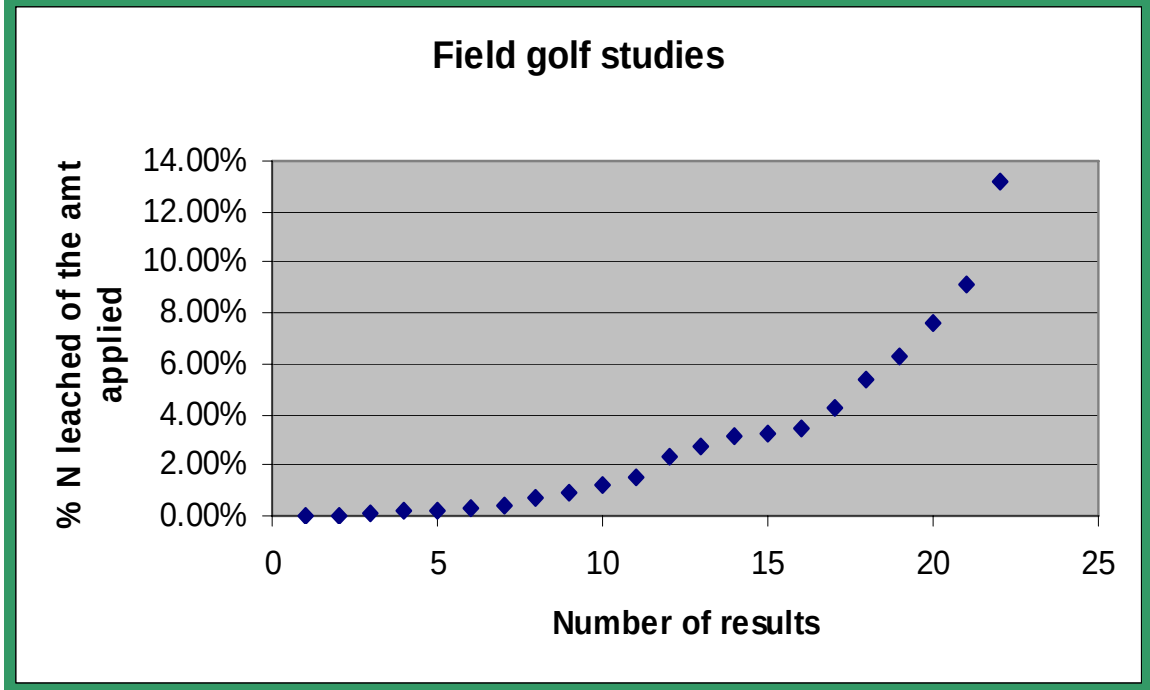
Medium= 3.2%

Range of 0-71%

22% above 25%

2/3 <10%

RESULTS-field studies golf courses (21)



Mean=3.0%

Medium= 2.3%

Range of 0-14%

none above 25%

Only 1 <10%

RESULTS-for lawns

Mean from all studies: 9.4%

Mean for field studies only: 9.6%

What about just sandy coastal type soils (21 studies)

Mean from all studies: 11.1%

Mean for golf course studies only: 10.0%

Mean for lawns only (20 studies): 11.1%
N leached of the amount applied

Yearly Loading Rate

The annual nitrate loading rate was generally below 22 lbs of N/acre/per (24 kg of N/ha) and only 8 % of the over 300 data points were above 44 lbs of N/acre per year (49 kg of N/ha)

Summary

Realistic nitrate leaching rates was found to be about 10 % of the amount of fertilizer applied per year, a 25% value would have 2.5 margin of safety factor build in.

The annual nitrate loading rate <22 lbs of N/acre/per (24 kg of N/ha)

BMP Summary

1. limit irrigation to the amount lost by evapotranspiration;
2. Wait to fertilizer to after germination
3. exclude nitrogen fertilization application at normal rates and with soluble sources from past November 1;

BMP Summary

1. use a rate of nitrogen appropriate for the turfgrass species and use.
2. Long term, slow release fertilizer sources had a similar amount of nitrate leaching as water soluble sources, however, under very rainy conditions, slow release sources had less nitrate leaching.
3. As sites mature (>10 yrs old), fertilize less up to ½ as much

When You're Putting Fertilizer on Your Lawn, Remember to Keep it on Your Lawn.

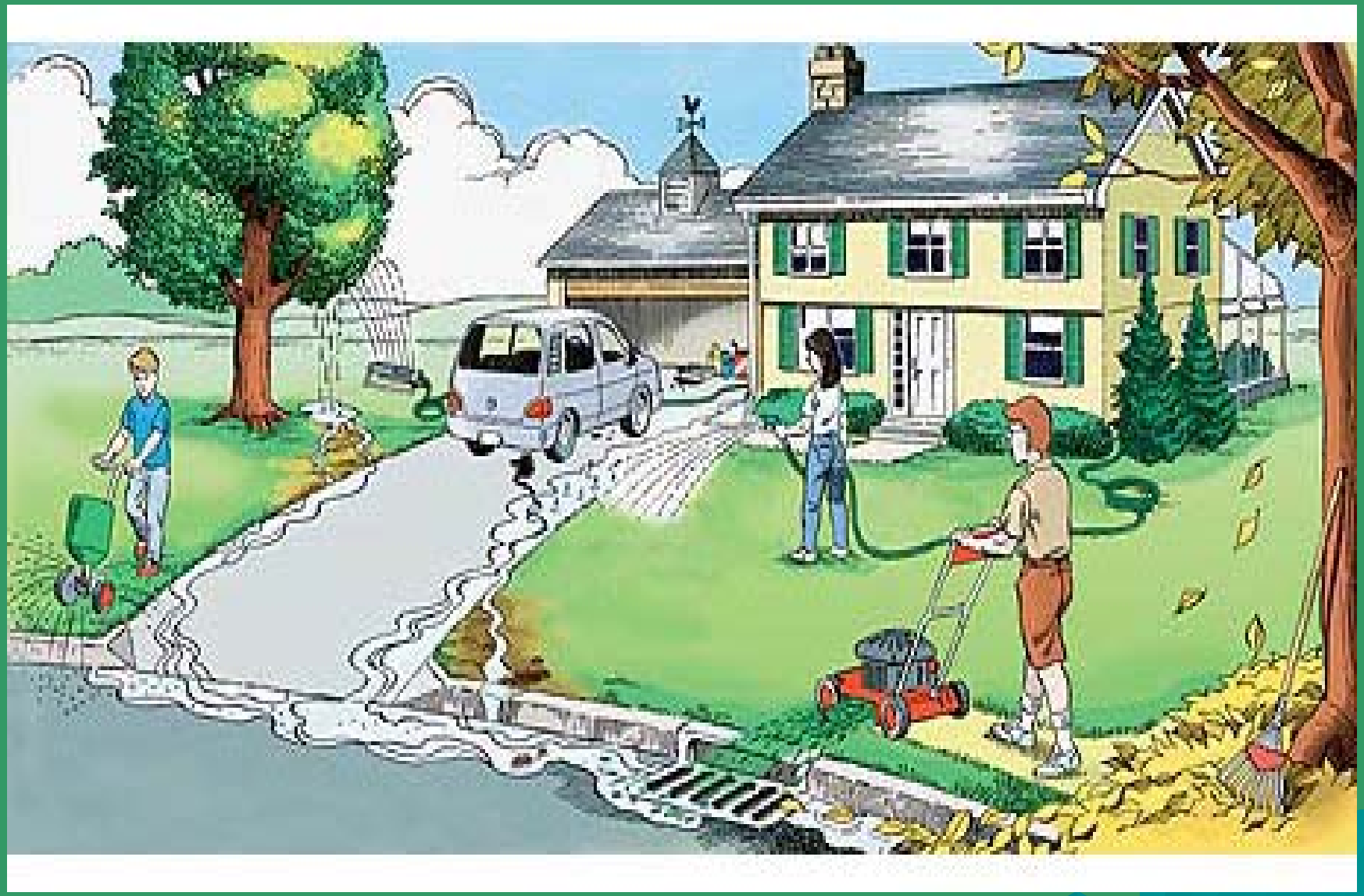
We put fertilizers and pesticides on our lawns. Sprinklers and rain wash them away, and they can wind up in our lakes, streams and the ocean. Fertilizers in water can cause too much algae to grow. Algae use up the oxygen that fish need to survive. If used improperly, pesticides can harm plants and animals in water.

It's a pattern that you can help prevent. Consider alternatives to these products. Use pesticides and fertilizers sparingly. Please visit www.epa.gov/region2 to find out what else you can do.

EPA United States Environmental Protection Agency

Thanks to the Washington State Department of Ecology, King County and the cities of Bellevue, Seattle and Tacoma for the use of this image.

Best Management Practices?



Bad practices

- **Grass clippings blown into street and storm drain. From there, they are washed into surface waters where their high nitrogen and phosphorus levels can pollute streams, rivers and lakes. Use mulching mower, returns clippings to lawn where they belong.**

Leaves raked into street also end up in storm drain, causing pollution.

Boy using rotary spreader leaves fertilizer on paved surface where it will get washed into storm drain, causing pollution.

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Bad practices

Weak turf by corner of driveway leaves soil unprotected. Sediment can wash into storm drain causing pollution.

Sprinkler left unattended overwaters "dog walk" area. In top picture, girl cleans up after dog promptly, before feces can damage turf or get washed into storm drain.

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- Woman overwaters lawn causing runoff down driveway. In top picture, she is using a coffee can to measure how much water will infiltrate into lawn before runoff occurs. That way, she can calculate how long she can run sprinklers without overwatering lawn.

Fluids from leaky van and improperly stored and handled products in the garage are washed down the driveway and into storm drain causing pollution.

Downspout from house discharges into driveway, washing pollutants and soil from weak turf along the edge of the driveway into the storm sewer. Better option in top picture is to discharge in spot where water can soak into the soil while moving away from house.

Good Practices