



The Nitrogen Cycle for general cropping systems

A FEW KEY CONCEPTS

In order of abundance, the three main types of nitrogen in soil are:

Organic nitrogen ●

Nitrate ■

Ammonium ●

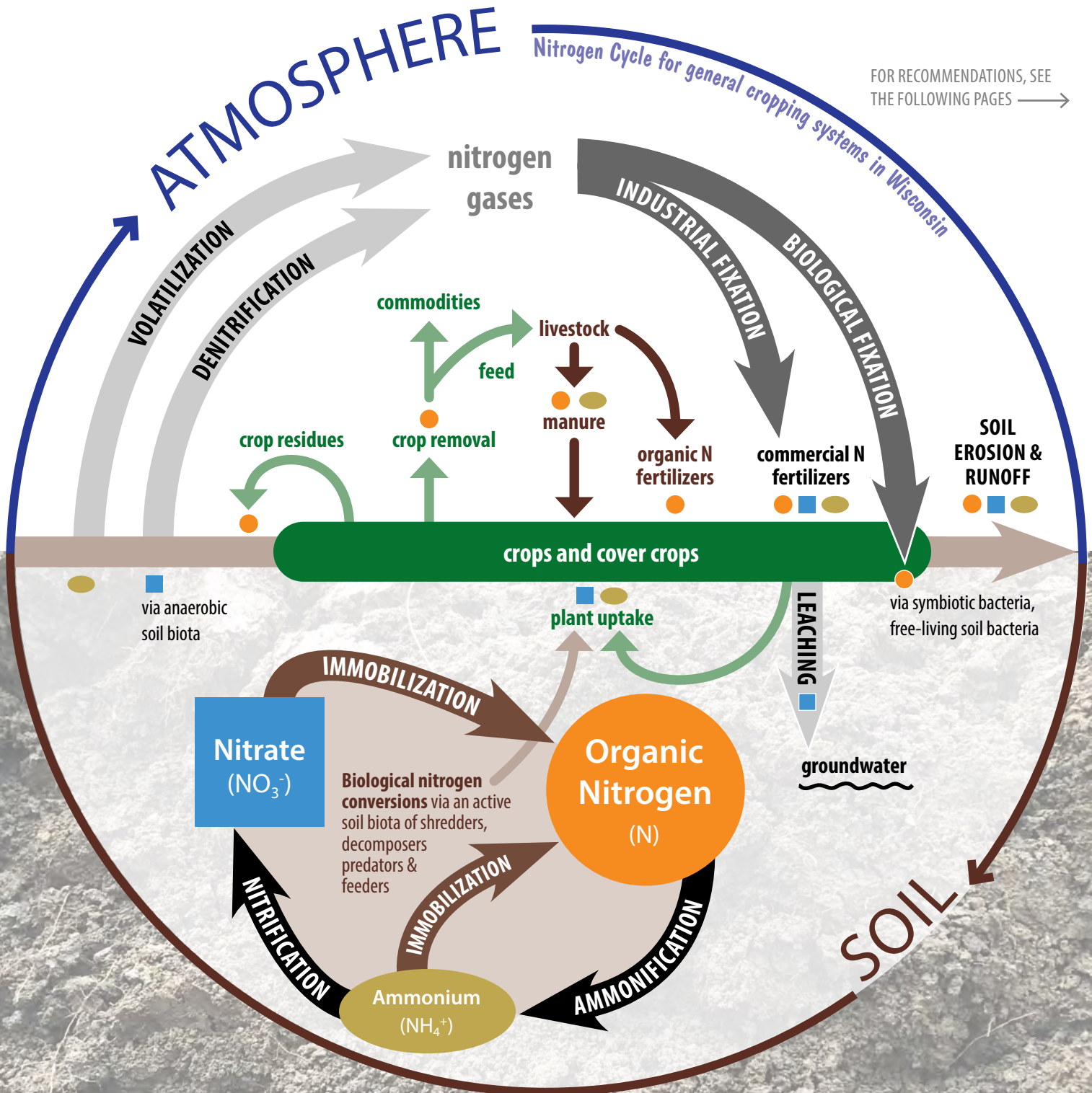
Organic nitrogen ● is not plant available.

It must first be converted in the soil via ammonification (mineralization) with the main product being ammonium ●

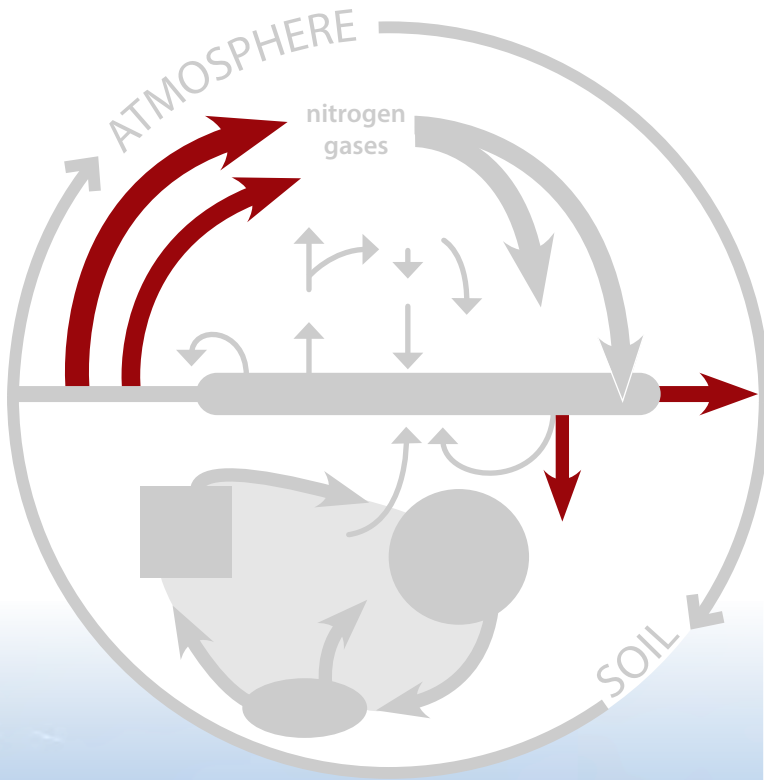
From there, the process of nitrification produces nitrate ■

Nitrate ■ and ammonium ● are plant available.

Most of the plant available nitrogen is in the nitrate ■ form.



What you can do to Reduce nitrogen losses



VOLATILIZATION

- 1 Incorporate or inject ammonium-based fertilizer and manure applications
- 2 Plan ammonium-based fertilizer applications when precipitation or irrigation is anticipated
- 3 Consider using a urease inhibitor with non-incorporated urea fertilizers where appropriate

DENITRIFICATION

- 4 Avoid fall applications of nitrogen fertilizers and manure where possible
- 5 Apply nitrogen when plant uptake is likely; avoid times and areas when soil is saturated
- 6 Use agronomic practices to improve/protect soil aggregation and drainage

SOIL EROSION & RUNOFF

- 7 Maintain year-round soil cover with crop residues, cover crops or perennial vegetation
- 8 Use cropping practices to improve/maintain soil aggregation and infiltration capacity
- 9 Practice contour and/or strip cropping on sloping fields
- 10 Utilize controlled drainage, bioreactors and edge-of-field nitrogen reduction practices

LEACHING

- 11 Use soil maps to determine soil type and geologic variability within a field; reduce or eliminate applications in vulnerable areas
- 12 Apply nitrogen at recommended rates and times, utilizing all appropriate legume and manure credits
- 13 Irrigate at proper rates based on soil, plant and weather conditions
- 14 Plant cover crops to tie-up residual and mineralized nitrogen
- 15 Utilize perennial crops in highly susceptible areas

What you can do to Improve nitrogen efficiencies

GENERAL

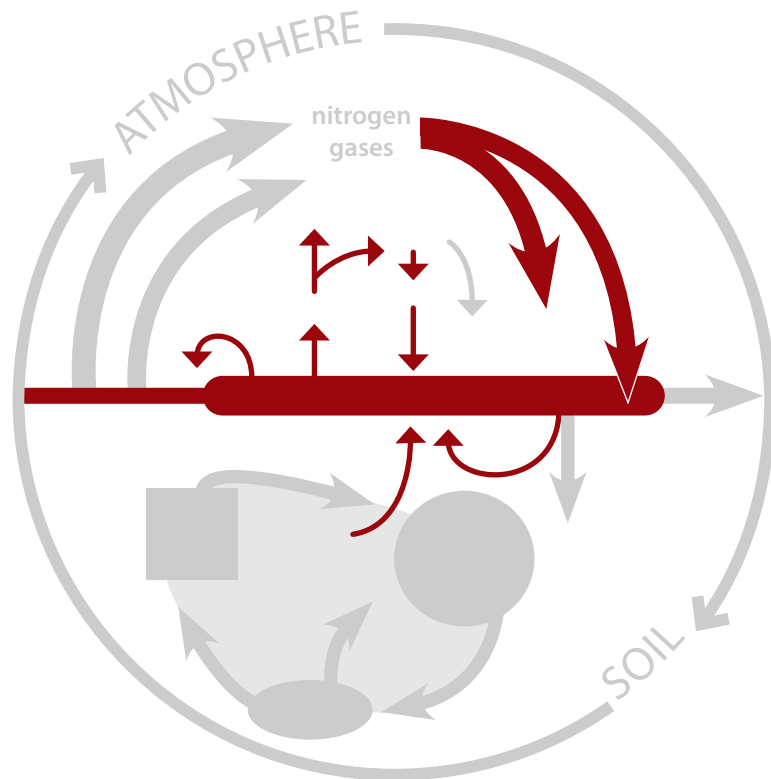
- 1 Understand that nitrogen application recommendations for a field are influenced by soil properties — use current soil maps to determine the soil series and soil test results for organic matter content
- 2 Maintain an appropriate soil pH, and phosphorus (P) and potassium (K) fertility
- 3 Account for all nitrogen applications and credits (manure and legume)
- 4 Credit nitrate in irrigation water, if applicable
- 5 Utilize soil nitrate and plant tissue testing to guide nitrogen applications where appropriate
- 6 Follow the 4Rs of nutrient stewardship — right rate, right time, right place, right source
- 7 Observe state/local regulations and setbacks for nitrogen fertilizer and manure applications

MANURE

- 8 Test all manure types regularly to better inform manure nutrient crediting
- 9 Use second and third year nitrogen credits from manure on non-sandy soils
- 10 Consider spring or in-season manure applications vs. fall applications for most crops

COMMERCIAL FERTILIZER

- 11 Select fertilizers based on cost, potential to minimize nitrogen loss, ease of application and crop needs
- 12 Apply nitrogen in split applications to increase potential of crop uptake
- 13 Choose appropriate nitrogen source, rate, timing and placement to minimize seed, root and plant damage



ORGANIC FERTILIZERS & AMENDMENTS

- 14 Consider testing for nutrient content if no analysis is available
- 15 Understand nitrogen release may take weeks, months or years depending on the amendment's C:N ratio

BIOLOGICAL FIXATION

- 16 Properly inoculate legumes including cover crop seed
- 17 Use soybean legume credits in all crops except corn and wheat — for corn and wheat, the soybean rotational credit is automatically integrated into the recommended nitrogen rate
- 18 Determine an appropriate cover crop/green manure nitrogen credit based upon legume density, growth and maturity
- 19 Credit nitrogen from forage legume crops for two growing seasons after termination where appropriate
- 20 Use legume credits for all leguminous vegetables (except soybean) in non-sandy soils

What you can do to Manage transformations

ENHANCE SOIL NITROGEN CYCLING

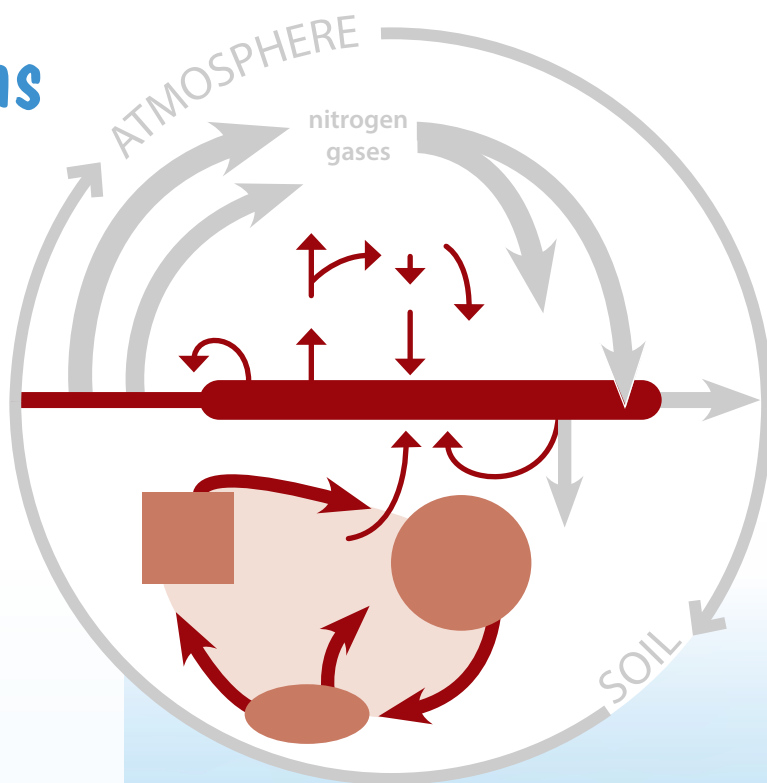
- 1 Use agronomic practices that maintain or increase soil organic matter
- 2 Maintain adequate soil pH and fertility
- 3 Follow proper trafficking guidelines to minimize soil compaction potential
- 4 Promote soil biological communities by practicing key soil health principles when possible — cover the soil, minimize soil disturbance, increase diversity, maintain continuous living plants/roots, integrate livestock

MAINTAIN NITROGEN IN THE AMMONIUM FORM

- 5 Use nitrification inhibitors to temporarily suppress nitrification where warranted
- 6 Apply ammonium-based fertilizers and manures after fall soil temperatures are consistently below 50° F

REDUCE EARLY SEASON NITROGEN IMMOBILIZATION

- 7 Consider early season nitrogen applications to offset immobilization caused by decomposing crop or cover crop residues
- 8 Harvest crop or cover crop residues if immobilization is a concern; consider conservation consequences
- 9 Terminate cover crops when C:N ratios are low; consider impact to other potential cover crop benefits
- 10 Plant cover crop mixes with lower final C:N ratios to hasten decomposition



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