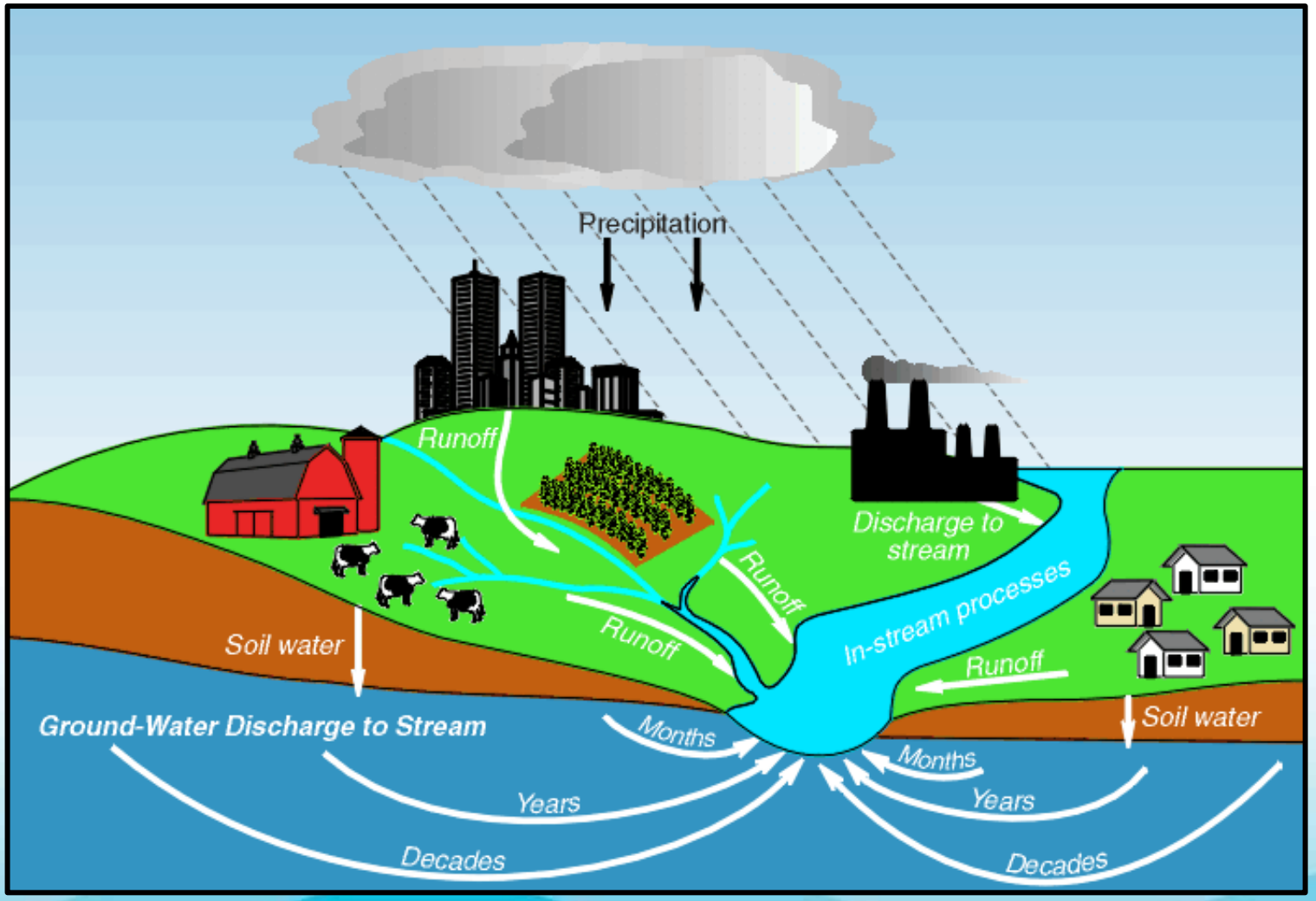
Using Molecular Biological Tools to Address Nitrogen Transformation in Groundwater

Molecular Tools to Navigate Your Diagnostic Exploration

microbialinsights

NITRATE IMPACTS

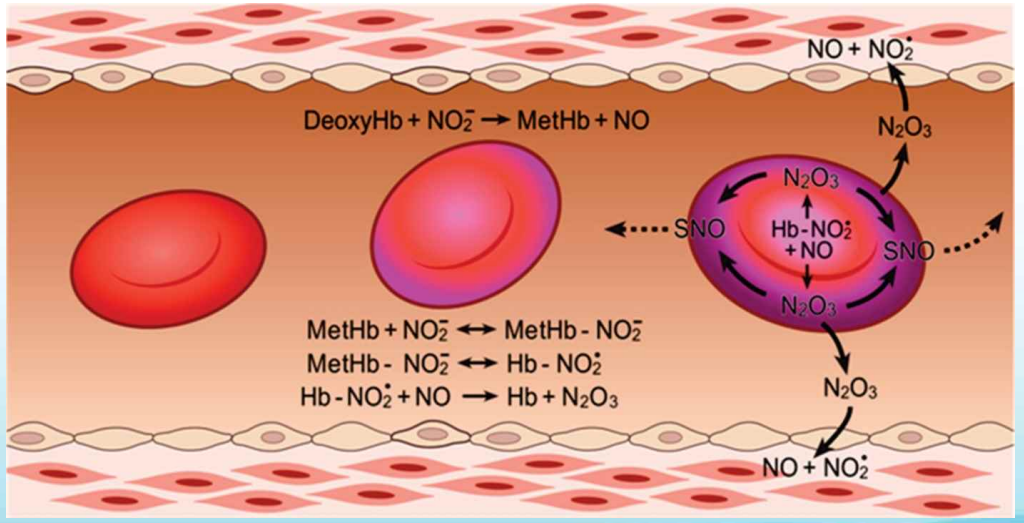


Discharge, Nitrate Load, and Residence Time of Ground Water in the Chesapeake Bay Watershed,
USGS Fact Sheet FS-150-99

NITRATE IMPACTS

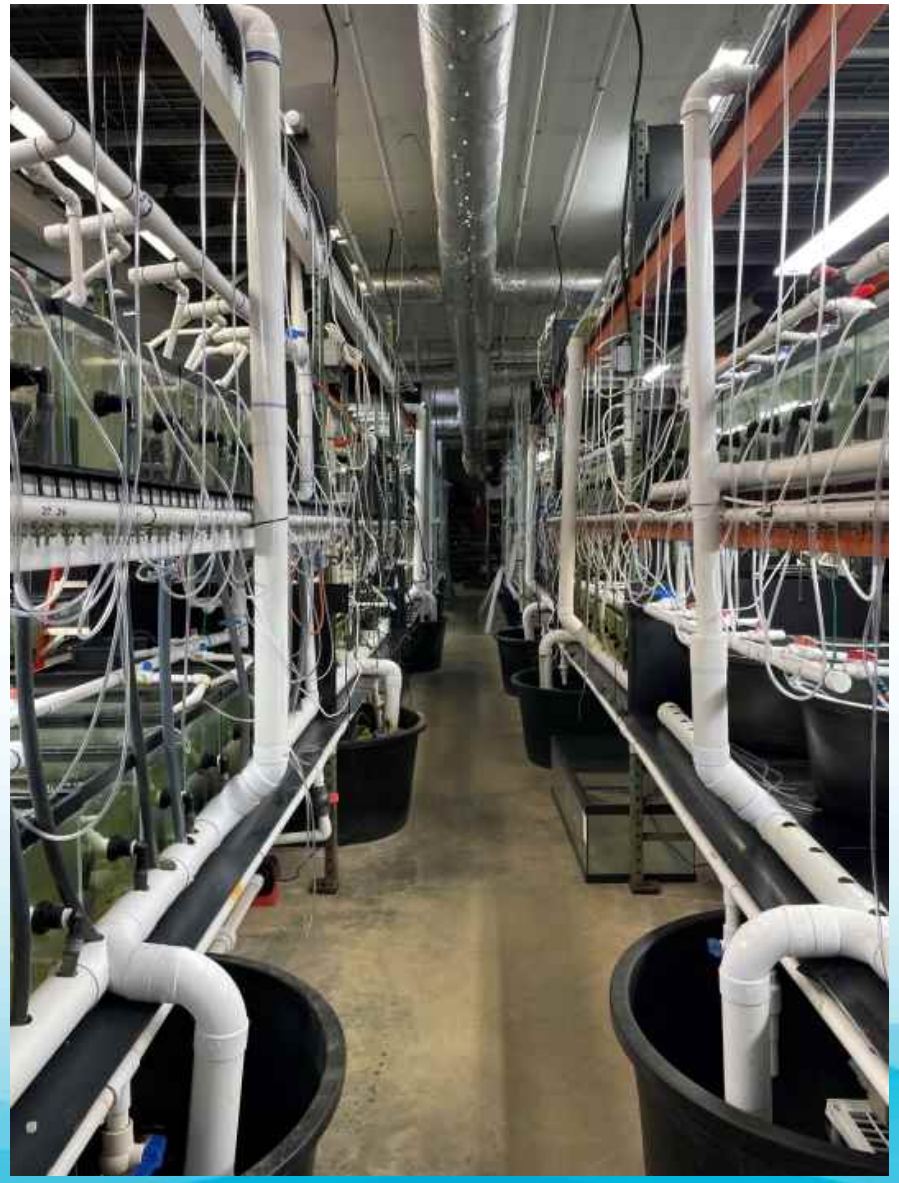
worldatlas.com

sierraclub.org



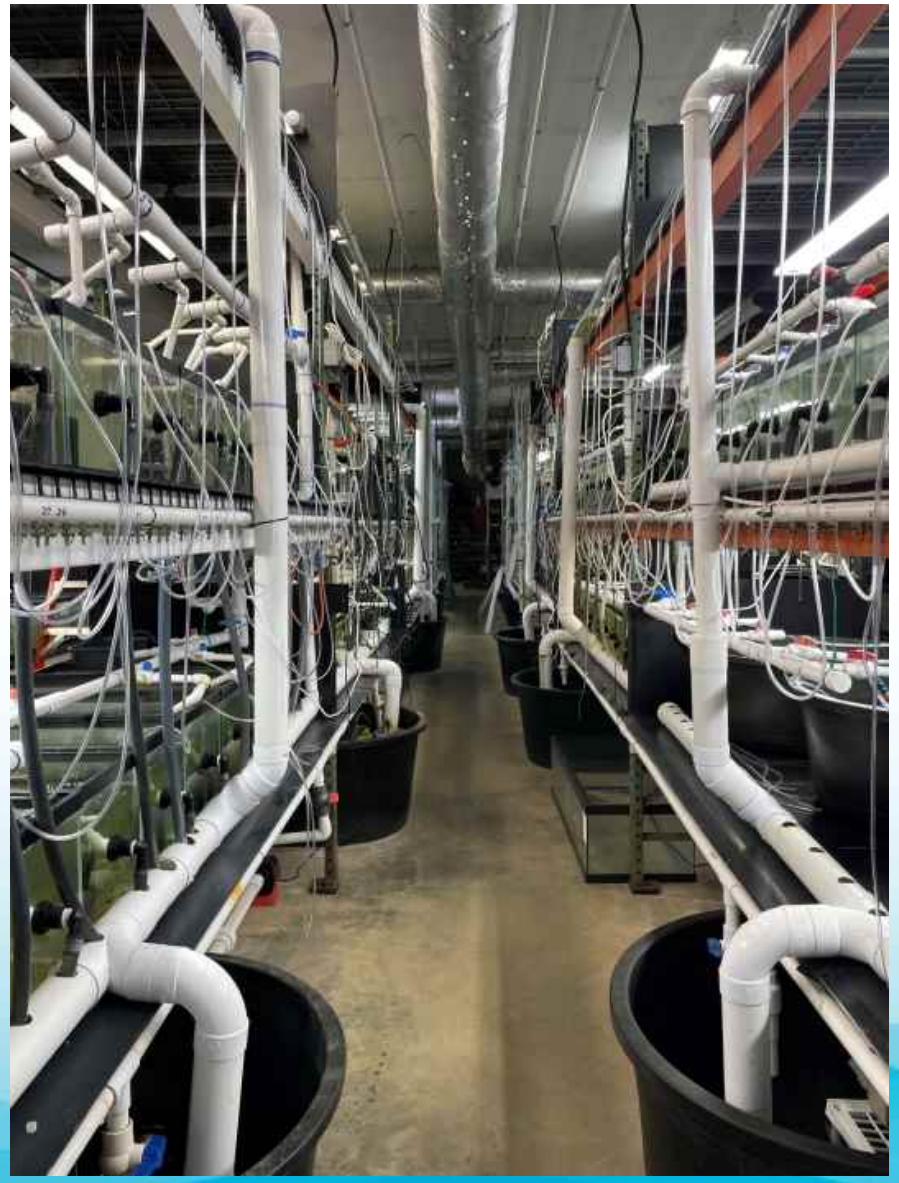
https://pubs.acs.org/doi/10.1021/ar800089j

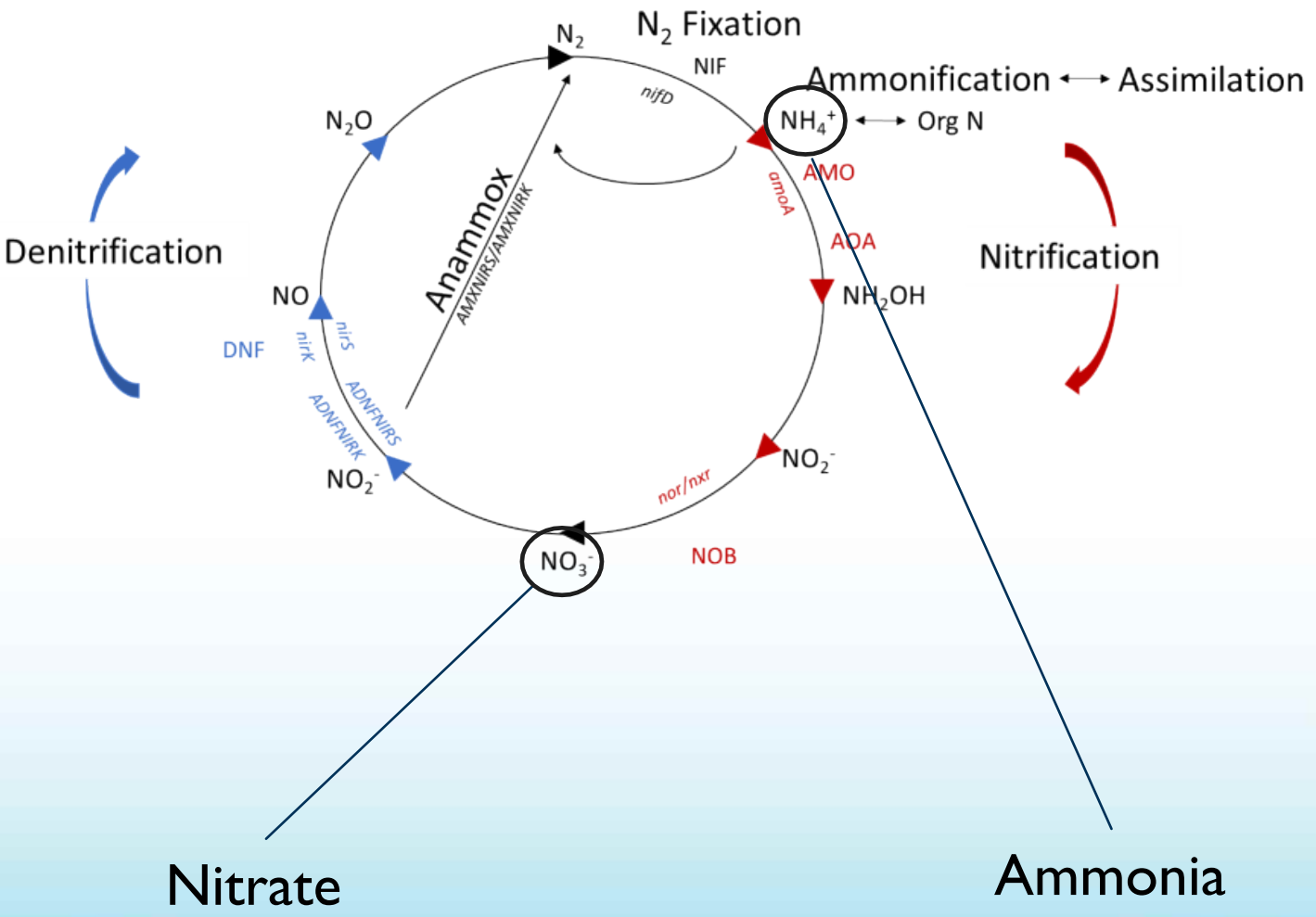
NITRATE IMPACTS



Conservation Fisheries, Inc.

NITRATE IMPACTS





AEROBIC OR ANAEROBIC

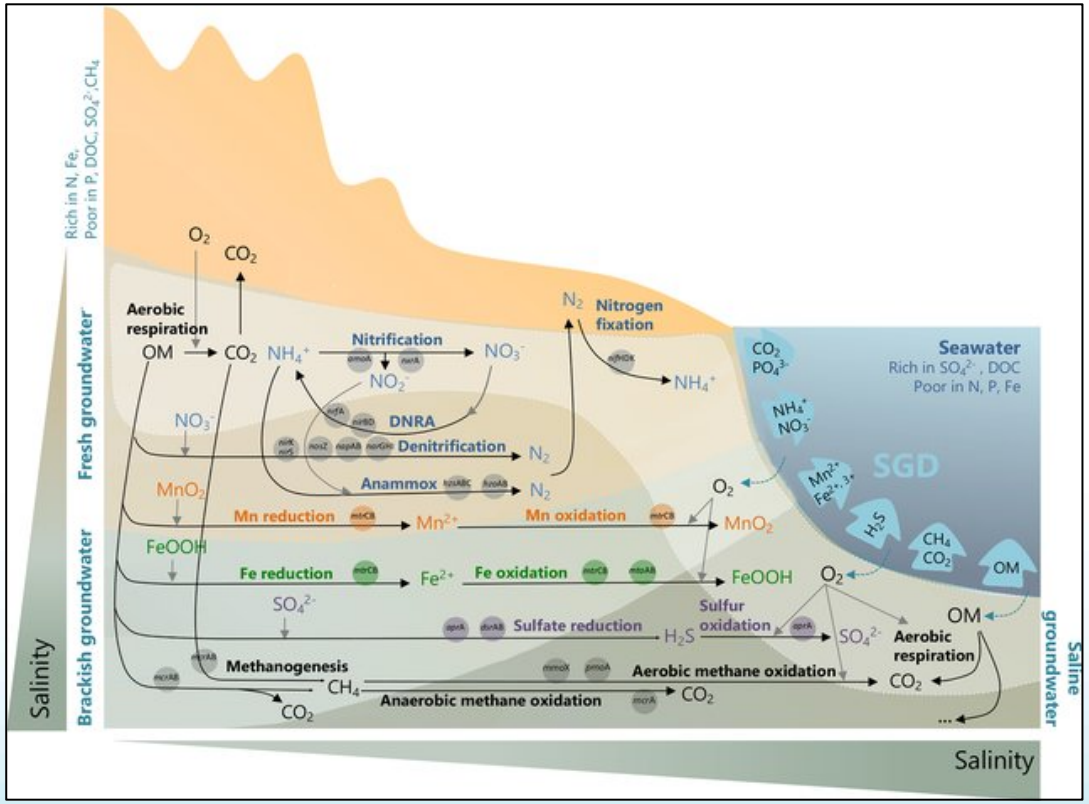
QuantArray-BGC

Nitrogen Cycle

Iron and Manganese Reduction

Sulfur Reduction

Methanogens



Ruiz-González et al. The microbial dimension of submarine groundwater discharge: Current challenges and future directions. FEMS Microbiology Reviews (2021).

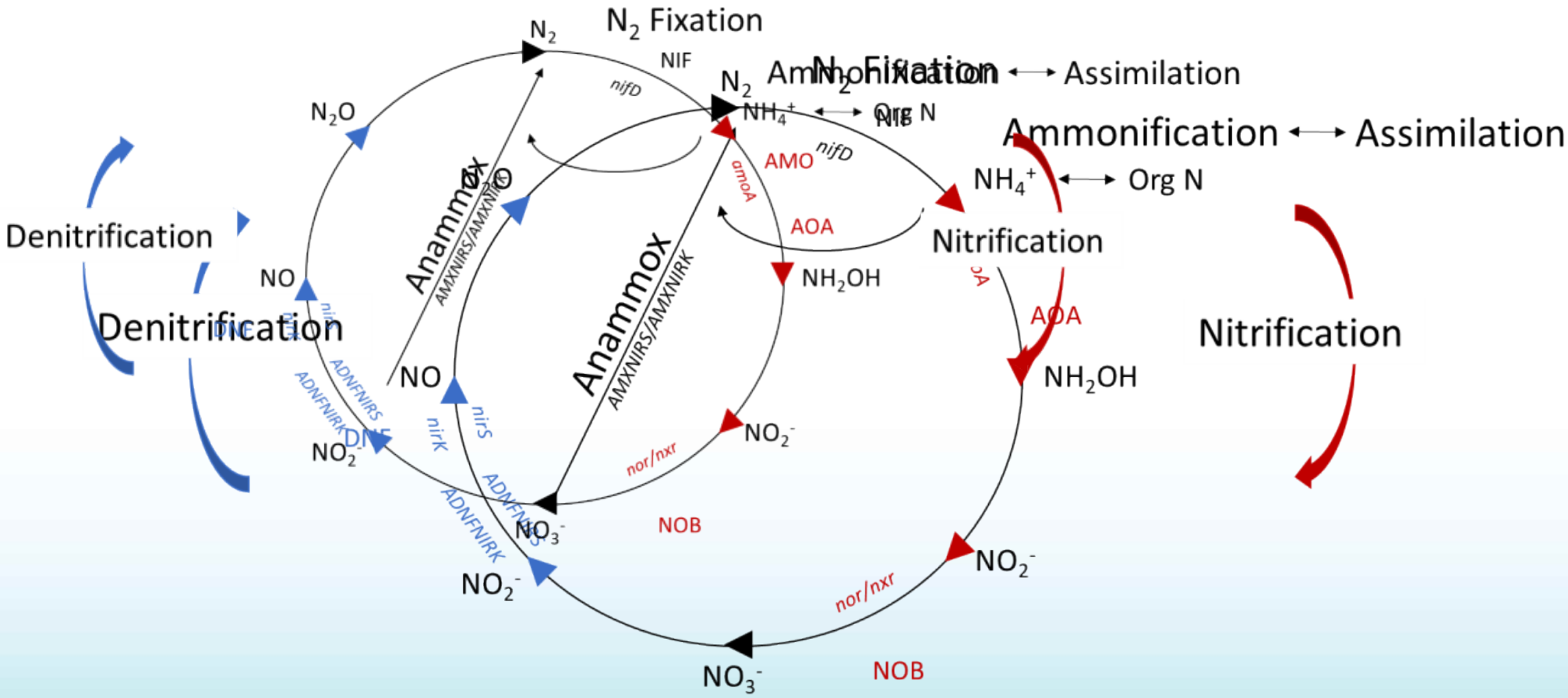
Iron and Manganese Oxidation

Sulfur Oxidation

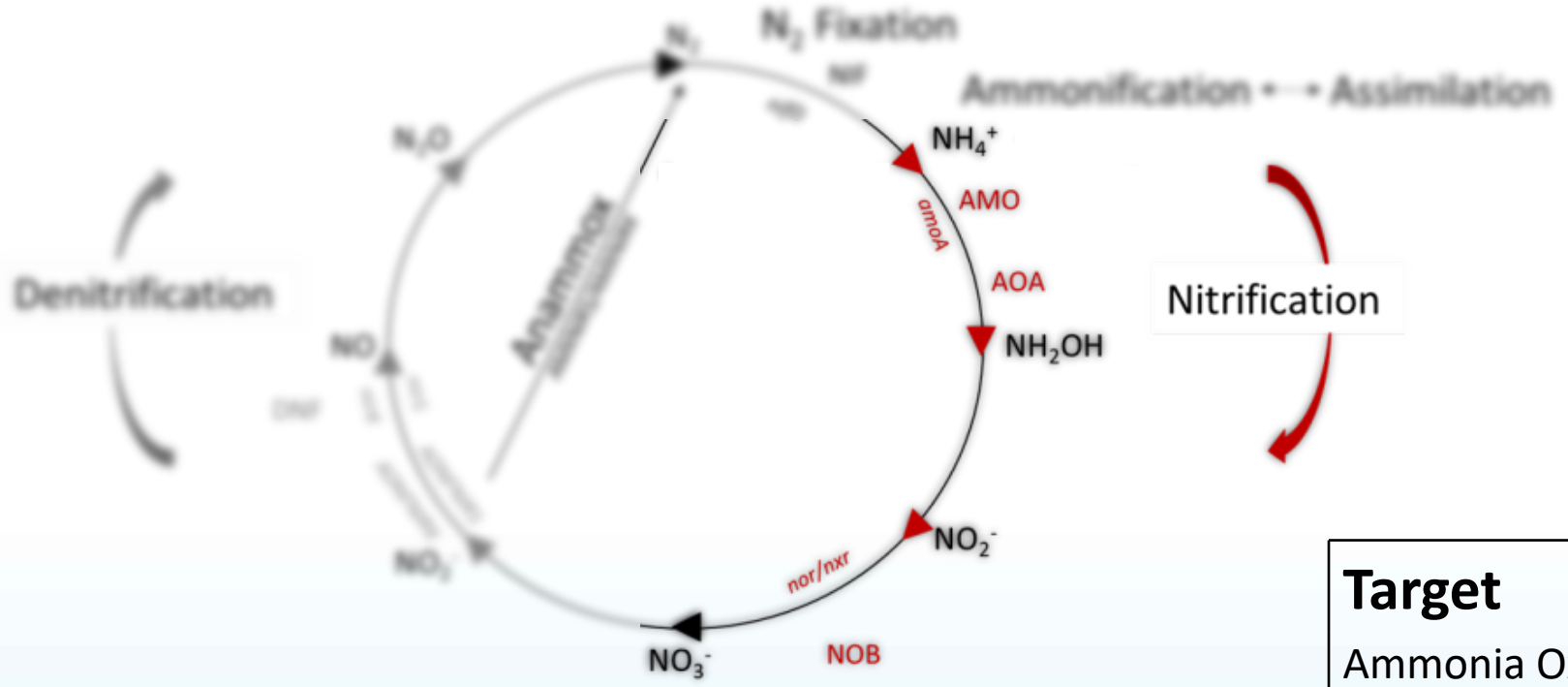
Fermenters

Acetogens

Nitrogen Cycle Gene Targets

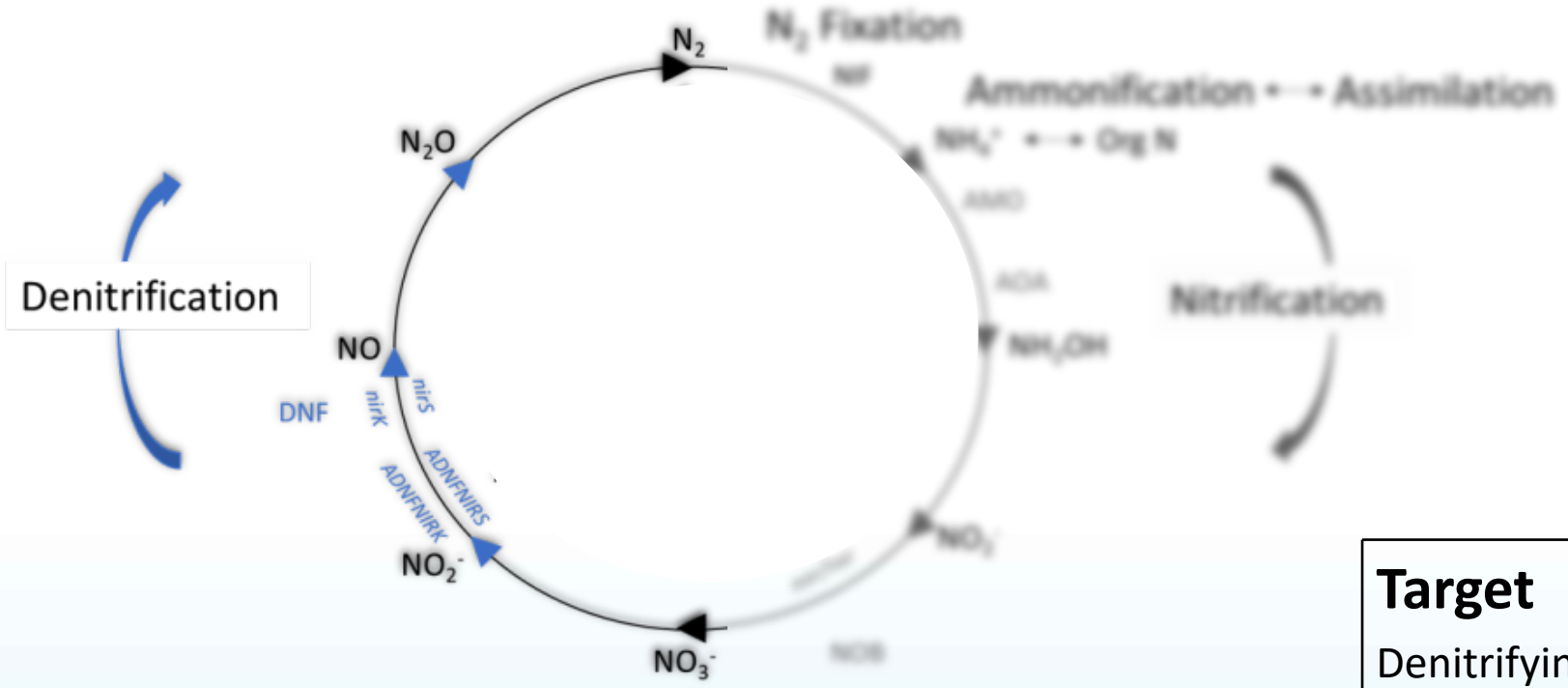


Nitrogen Cycle Gene Targets



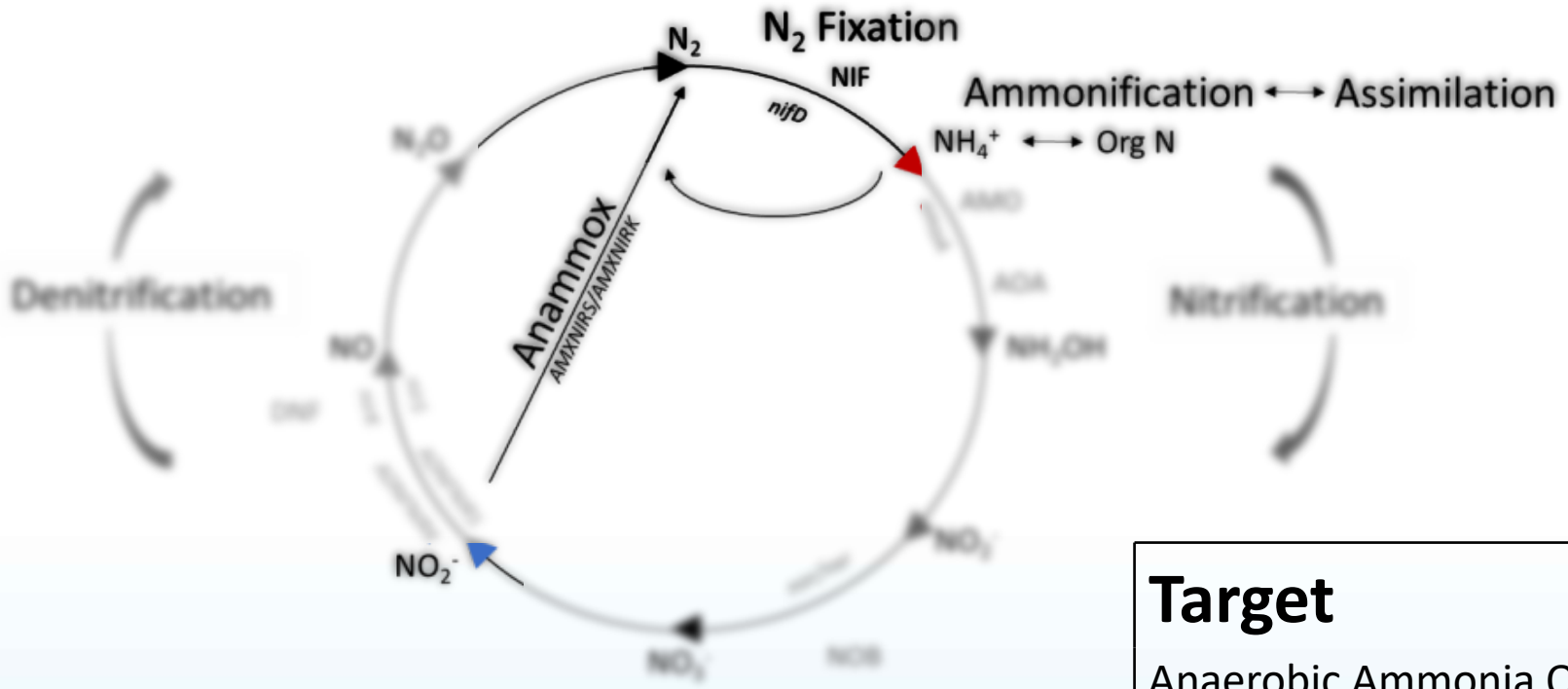
Target	Code
Ammonia Oxidizing Bacteria	**AMO**
Ammonia Oxidizing Archaea	**AOA**
Nitrite Oxidizing Bacteria	**NOB**
Nitrite Oxidizing Bacteria	**NOR/NXR**

Nitrogen Cycle Gene Targets



Target	Code
Denitrifying Bacteria	DNF
Archaeal Nitrate Reducers	ADNFNIRK
Archaeal Nitrate Reducers	ADNFNIRS

Nitrogen Cycle Gene Targets



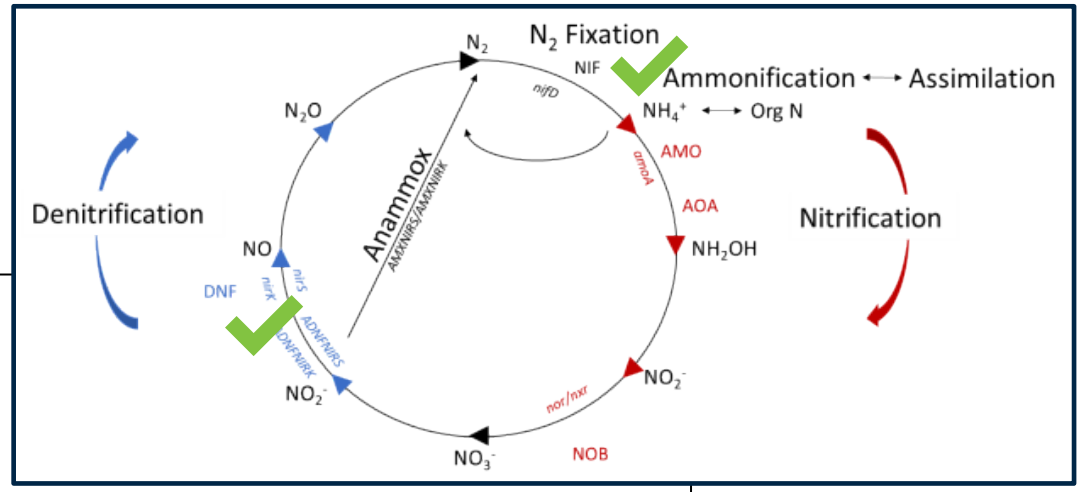
Target	Code
Anaerobic Ammonia Oxidizing Bacteria	**AMXNIRS**
Anaerobic Ammonia Oxidizing Bacteria	**AMXNIRK**
Nitrogen Fixing Bacteria	**NIF**

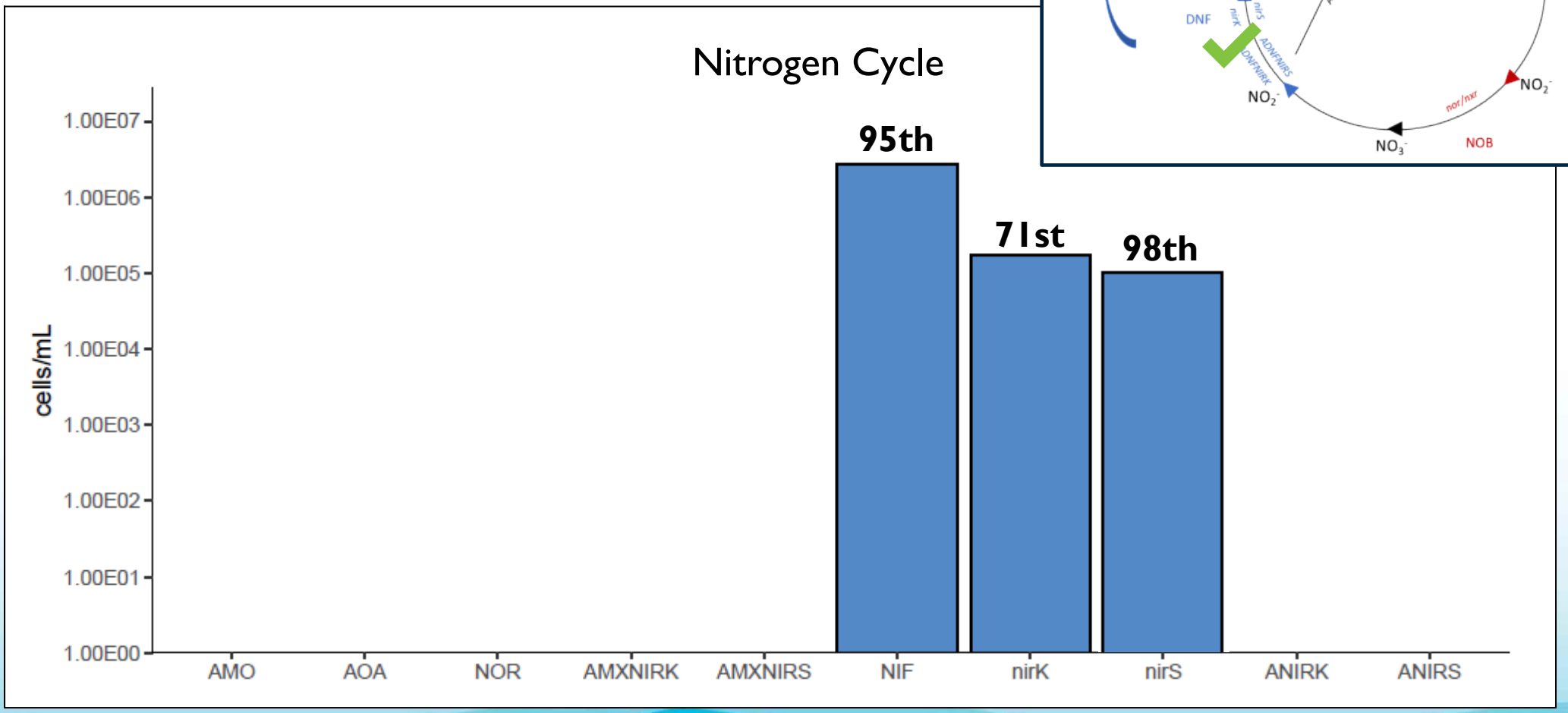
NITROGEN CYCLE GENE TARGET APPLICATION

AGRICULTURAL RUNOFF

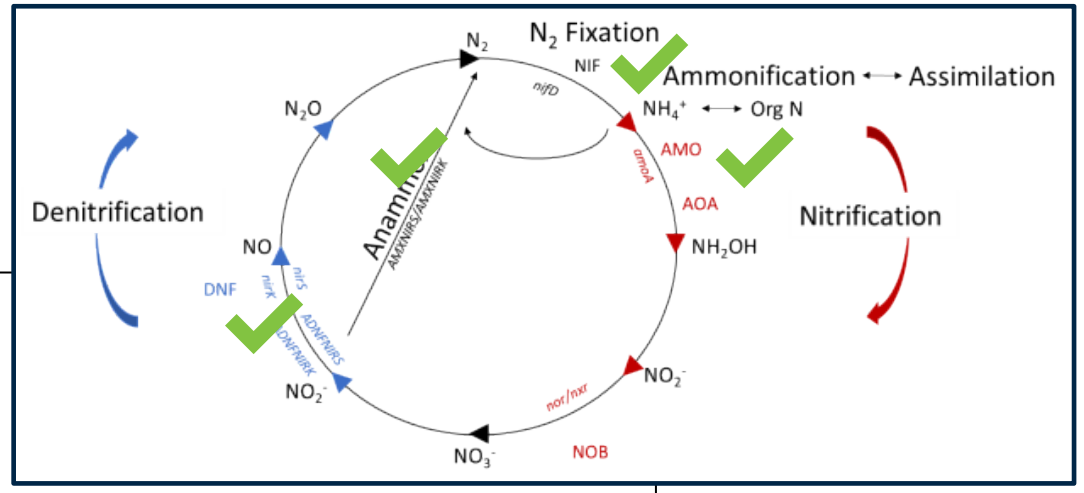
- **Groundwater samples taken (MW1, MW2) between property and public access**
- **Nitrate decreasing downgradient**
  - **[NO_3^-] = 5 mg/L at MW1**
  - **[NO_3^-] = 3 mg/L at MW2**

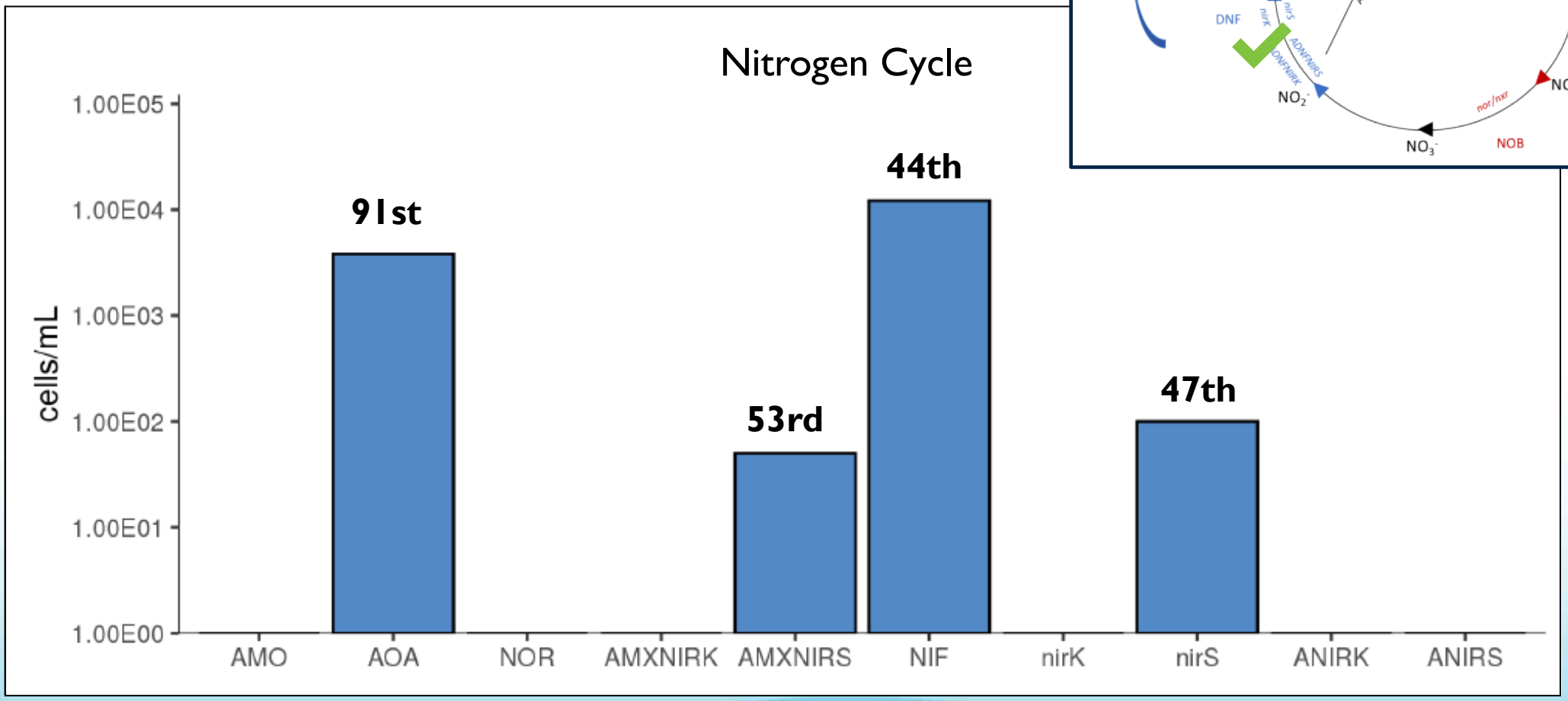
Nitrogen Cycle Gene Targets – MW1





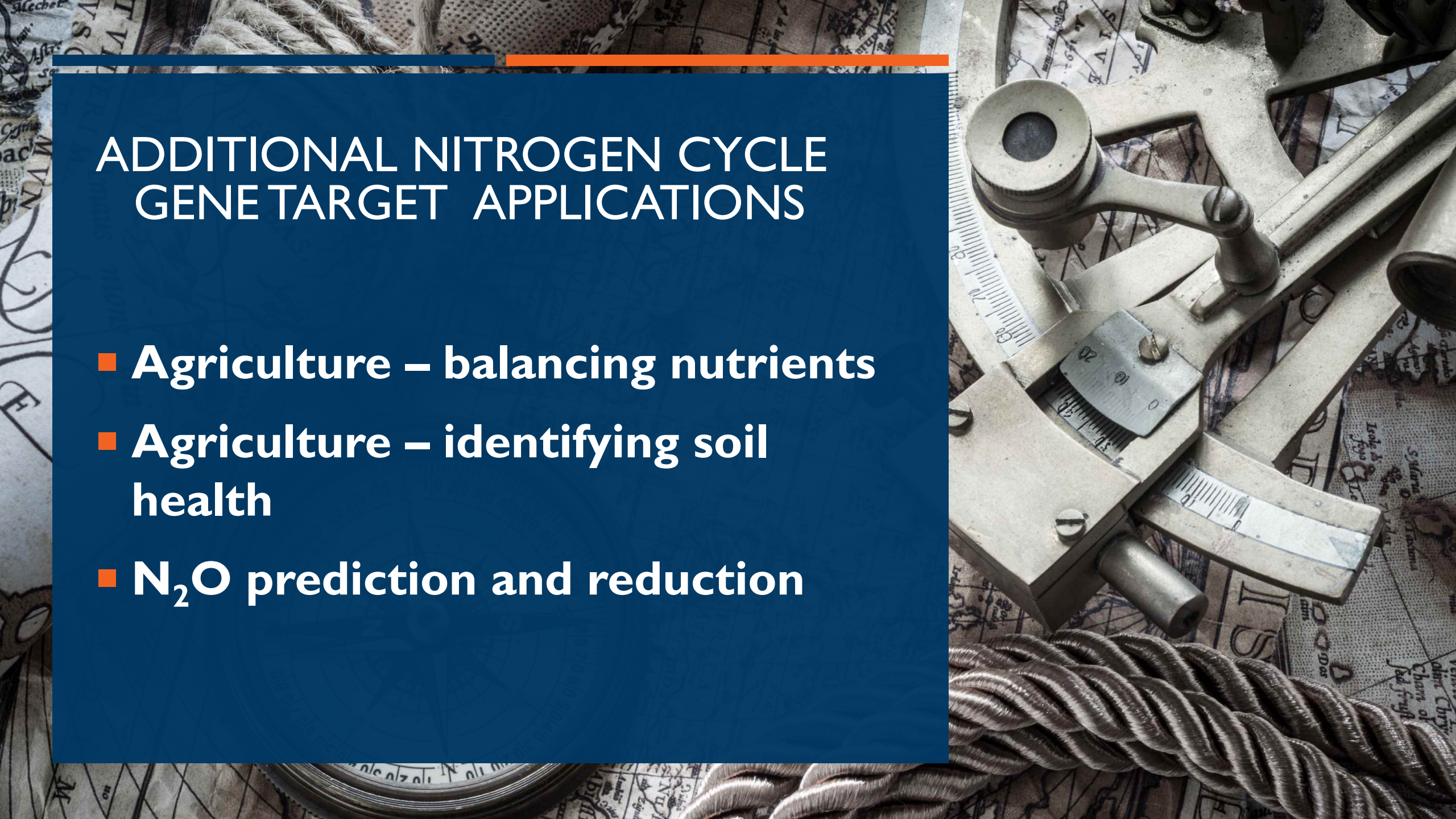
Nitrogen Cycle Gene Targets – MW2





ADDITIONAL NITROGEN CYCLE GENE TARGET APPLICATIONS

- **Agriculture – balancing nutrients**
- **Agriculture – identifying soil health**
- **N_2O prediction and reduction**



THANK YOU!

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