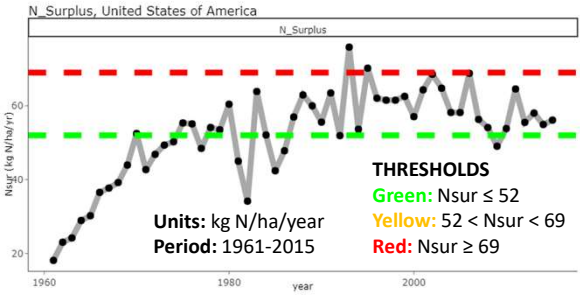


USA

Looking at the Data (N Surplus)?

N Surplus is the sum of the of individual crop surpluses (N inputs – N yields) per harvested area.

DATA BASIS
Data on fertilizer application for individual crops come from IFA. Production volume and harvest areas are based on data from FAO of the United Nations (UN). Nitrogen uptake was calculated from crop-specific production volumes and nitrogen concentrations.



THRESHOLDS
Green: Nsur ≤ 52
Yellow: 52 < Nsur < 69
Red: Nsur ≥ 69


Units: kg N/ha/year
Period: 1961-2015

6

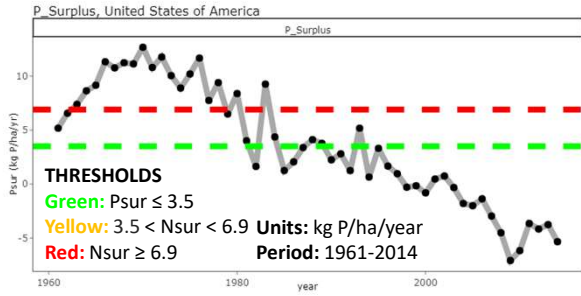
Looking at the Data (P Surplus)?

Similar concern can be given to Phosphorus Surplus, the sum of the of individual crop surpluses (P inputs – P output) per harvested area. Inputs include applied fertilizer and manure while output is the amount of P in harvested crops

DATA BASIS
P surplus is reported by Zou et al., 2020*. Harvested area is reported by FAOSTAT.



USA



THRESHOLDS
Green: Psur ≤ 3.5
Yellow: 3.5 < Psur < 6.9
Red: Psur ≥ 6.9

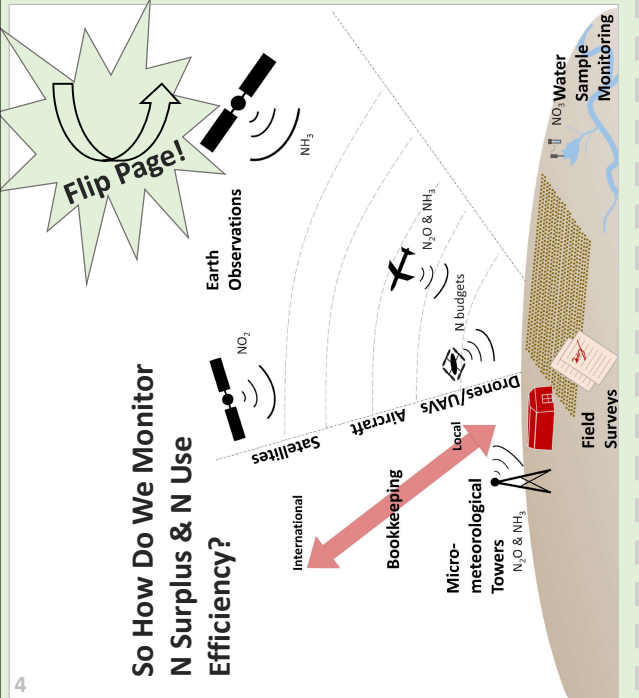
Units: kg P/ha/year
Period: 1961-2014

*Zou, T, Zhang, X, Davidson, EA (2020). Improving phosphorus use efficiency in cropland to address phosphorus challenges by 2050 (Earth & Space Science Open Archive)

7

1

So How Do We Monitor N Surplus & N Use Efficiency?



International Bookkeeping

Local

NO₂

NO₃ Water Sample Monitoring

Field Surveys

Micro-meteorological Towers

Aircraft

Drones/UAVs

Earth Observations


Satellites

N budgets

N₂O & NH₃

NH₃

Use the QR Code to Visit Our Dashboard!



4


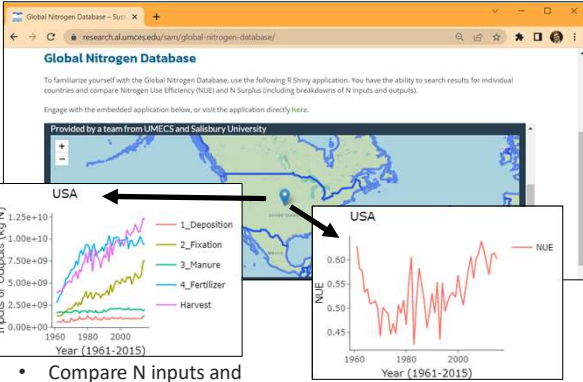
9

2

1

Engage With The Data Yourself!

- View Score Reports & many other SAM products results for over 150 countries!

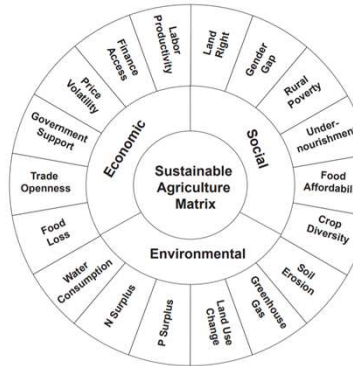



- Compare N inputs and outputs across countries
- How efficient our we with nitrogen usage?

8

So What Do We Do? Sustainable Agriculture Matrix (SAM)

- SAM is an assessment of agricultural sustainability at the national & global scale
- Released in '21, SAM covers over 150 countries using 18 inter-related & measurable indicators (including N Surplus)
- Each indicator is normalized, and a traffic light color scheme is applied to show their relative sustainability conditions.
- We intend to iteratively improve upon SAM by integrating feedback from experts (including you!) with regional expertise



What Do You Think The National Average Scores Are for the United States?

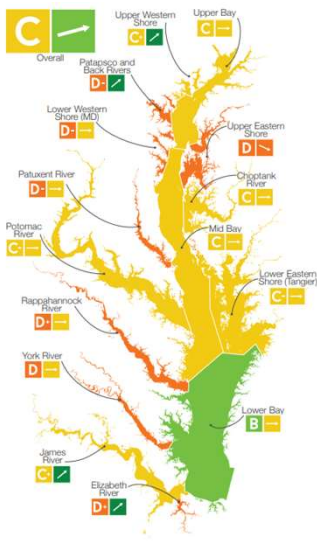
Apply the traffic light color scheme to this blank score report and look at the front page for the Solution!

5

3

Consider Additional Score Reports

Members of our team, & additional colleagues from UMCES have also been instrumental in region-specific reports that also monitor the affects of N Pollution to watershed health!



Health trends

- Significantly improving
- Slightly improving
- No change
- Slightly declining
- Significantly declining

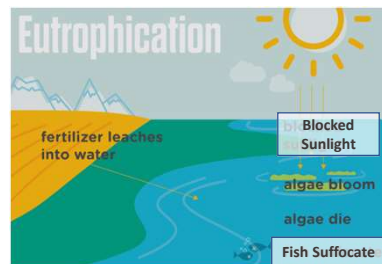
10

Four Reasons To Care (UN Environmental Programme)

- N is a key contributor to **climate change**
 - N₂O gas 300x more potent at warming the atm. than CO₂.
- N pollution is a threat to **human health**
 - NH₃ emissions, reduces air quality & increases adverse effects on human health.
- N waste weighs on the **economy**
 - These human & ecosystem damages cost the global economy between \$340 billion to \$3.4 trillion annually
- N pollution is disrupting **life on land & underwater**
 - Most influential global driver of human-made biodiversity decline after habitat destruction & the emission of GHGs.

Using N more efficiently in food production is key to reducing the surplus N released into the environment.

Effects of N: Algal Blooms



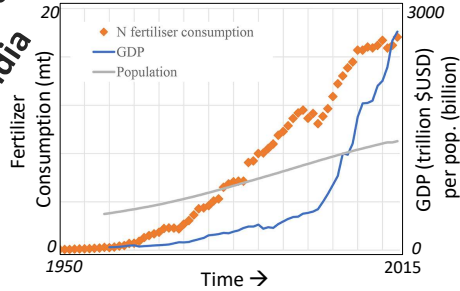
*UDEQ, 2023, Utah's Approach for Addressing Nutrient Pollution: Nutrients in Utah's Waters <https://deq.utah.gov/water-quality/nutrients>

3

4

The explosion of nitrogen, N, use is attributed to our ability to create synthetic fertilizer from atm. N, or N₂. This has coincided with increased ag. productivity, rapid population growth, & reduction of hunger-related issues. But it comes at a cost.

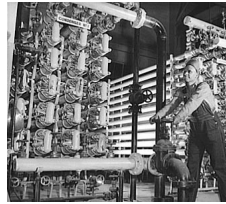
Consider Data from India



Möring, Andrea, et al. "Nitrogen challenges and opportunities for agricultural and environmental science in India." *Frontiers in Sustainable Food Systems* 5 (2021): 505347.

From the News:

An operator adjusts a gate valve in the ammonia condenser section of the TVA's synthetic ammonia plant in Muscle Shoals, Alabama... during the war, the nitrogen was used for bombs. After the war, it was used for fertilizers.

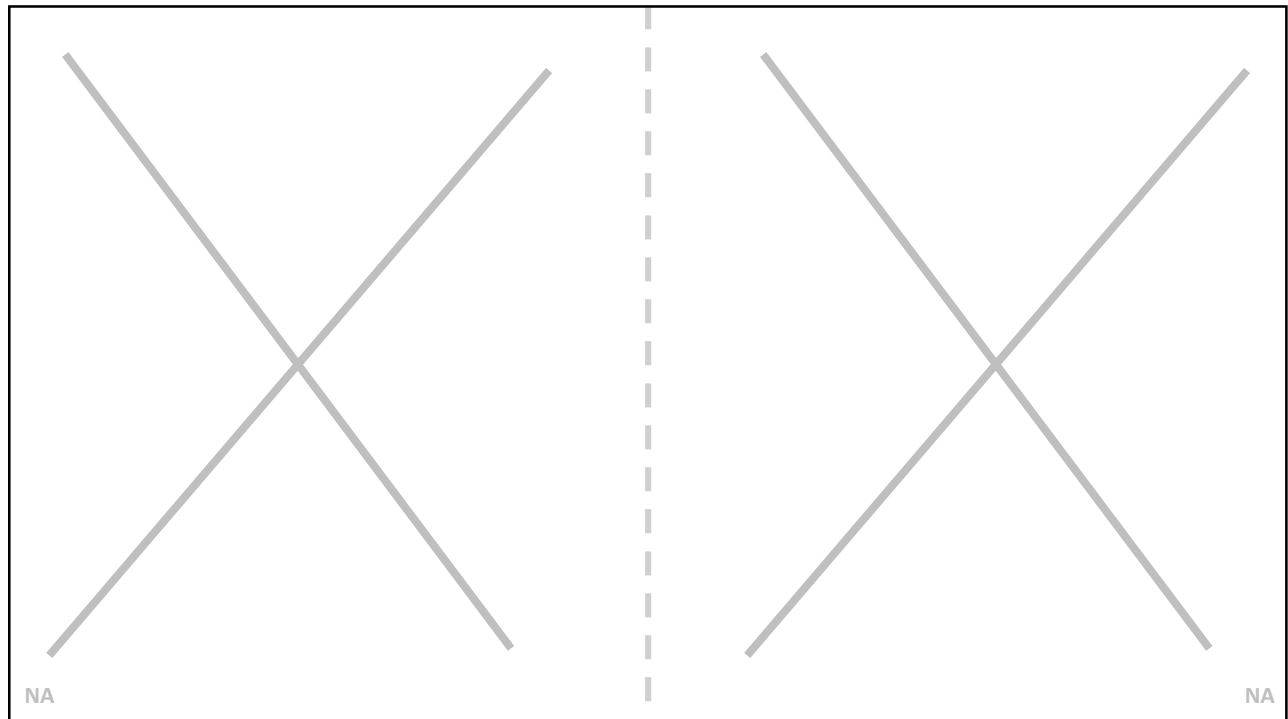


2 https://livinghistoryfarm.org/farminginthe40s/crops_04.html

But Wait! There's more!



Consider Our Colleagues' 2021 Chesapeake Bay Watershed Report Card!



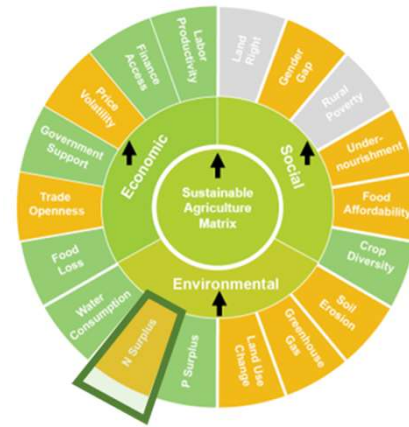
Thanks for Reading!

Interested in Sharing Your Expertise w/ the Environmental Science and Policy Lab at the UMCES' Appalachian Laboratory?

Please Contact:
 Kevin Jackson (Faculty Research Assistant)
 kevin.jackson@umces.edu

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Stewards of the Chesapeake Bay Watershed



Sustainable Agriculture: Nitrogen Surplus

1