Global Population and the Nitrogen Cycle

* Nitrogen based fertilizers are so over-used that the nitrogen cycle has begun to change
* Nitrogen is highly valuable (DNA, RNA, protein, …)
* Often in short supply
* Traditional farmers used legumes to create ammonia
  + Limited production
  + Put a capacity on the supportable population
* Consumption of fertilizer and population are correlated
* Nitrogen is notoriously difficult to fix
  + Bacterial fixation is the dominant process
* High nitrate levels can cause “blue baby” disease
* Eutrophication is a common consequence of nitrification
* Modern nitrogen has modified natural nitrogen flows
  + Normal nitrogen atmospheric lifetimes are centuries
  + Microbes acting on fertilizer release nitric oxide
    - Reacts with sunlight by producing photochemical smog
    - Destroys the ozone layer
* Nitrogen fixing bacteria may provide sustainable solution

Summary:

Recent farming strategies involved the use of legumes and feces to fix nitrogen and fertilize soil, respectively. While these methods were sustainable, they could not produce enough fixed nitrogen to support the every growing human population. As the population grew, so too did the consumption of nitrogen-based fertilizers. The nitrogen in these fertilizers (in the form of ammonia) are not chemically identical to those that occur naturally in nature. As bacteria feast on the nitrogen in fertilizers, they release NO2 (Nitrous oxide); this gas destroys the ozone layer and produces photochemical smog when it reacts to sunlight. While bio-engineered nitrogen fixing bacteria may solve the issue, research and development is not close enough to a solution. Meanwhile, our nitrogen cycle spins out of control and fertilizer use becomes even more prevalent.

My thoughts:

I found the history behind traditional ammonification techniques of particular interest. The fact that they would grow legumes beside their crops begs me to question how they would know about the nitrifying bacteria. Perhaps they simply learned that the strategy worked or observes plant growth alongside legumes and decided to apply it. It’s a shame that this brilliant strategy isn’t feasible today. As the population climbs to record highs every year, the world is turning towards the agricultural industry for answers as to how to support the new population. Fertilizers apparently provide a temporary and unsustainable solution to our nitrogen needs.

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| **So what?**  If we continue to consume fertilizers as we do today, we will surely disturb the nitrogen cycle to such an extreme that eutrophication will become a common occurrence and we will observe tragic losses in the populations of our fish and marine life. | **Says who?**  This article was written by Vaclav Smil and published by Scientific American in 1997. |
| **Now what?**  Now we much turn our attention to research and development ventures to provide us with a more sustainable solution to fertilizers. | **What it reminds me of**  This reminds me of a quote:  “Man’s reach exceeds his grasp”  We will die developing alternatives like broken records decaying in an anachronistic record player. Suffering at the hands and wear of time and repeated self-injuries. |