**Moving from nitrogen ignorance to knowledge over time**

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**Abstract**

Once upon a time there was enough naturally occurring nitrogen (N) to provide food for the world’s peoples. Then there was not in the western regions. Now there is due to the Haber-Bosch process. But this transition from plenty, to scarcity, to plenty has come with a tremendous environmental cost. The first step in actual knowledge attainment for N, was its discovery in 1772. Basic and applied knowledge about N has been accumulating ever since. We now know what needs to be done to maximize the benefits of N (feeding the world) while minimizing its impacts (the nitrogen cascade). On the food production side, we know how to increase nitrogen use efficiency and decrease food waste. The challenge is to get this information to producers together with the mechanisms to implement the needed changes. On the food consumption side, people have it in their power to stabilize the amount of N needed to grow food at current levels by eating to nutritional guidelines for protein. The challenge is to educate those involved in food production and consumption.

<For the full paper, please contact James Galloway; jng@virginia.edu>