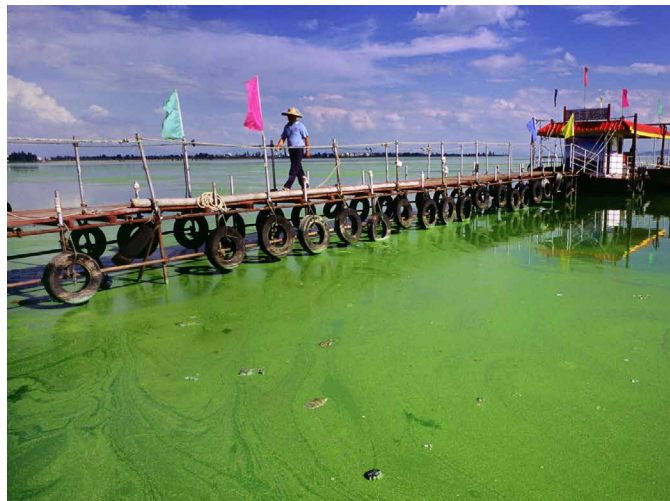
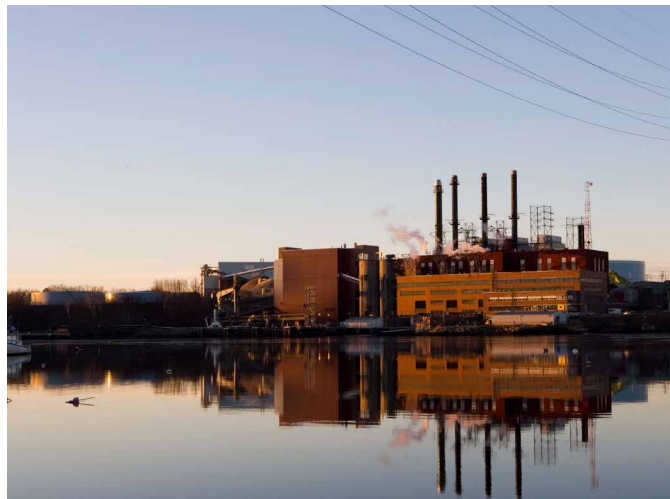




GLOBAL NUTRIENT MANAGEMENT TOOLBOX

The Global Nutrient Management Toolbox is a suite of databases, information, and tools that support actions and policy decisions related to managing nutrients to minimize environmental degradation.

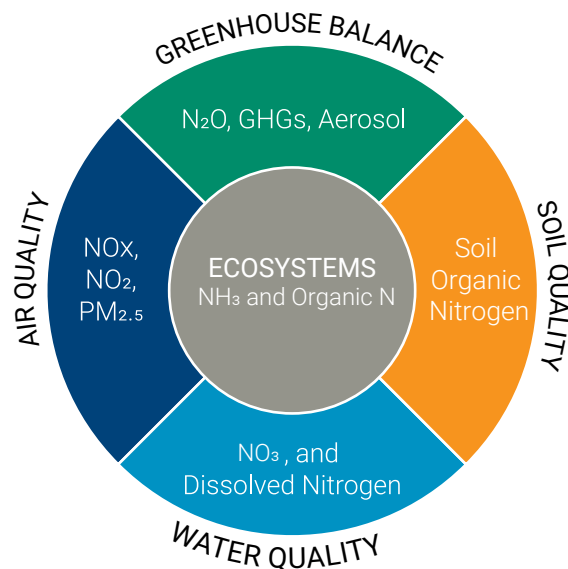


BACKGROUND ON THE NUTRIENT CHALLENGE

Nutrients, nitrogen and phosphorus, are critical for growing crops and feeding the world. However, too many nutrients can harm the environment. Human activities generate around 120 million metric tons of reactive nitrogen each year, two-thirds of which goes unused and pollutes the world's waters and air, contributes to greenhouse gas potential, degrades ecosystems, and negatively impacts soil quality in many regions. Anthropogenic mined phosphorus is also added to the natural cycles. Although phosphorus is a finite resource, nearly half of what is produced goes unutilized and enters waterbodies as a pollutant. On the other hand, some regions, particularly in Africa and parts of Asia and Latin America, do not have enough nutrients to meet their agricultural needs. Soil may be mined, leaving more nutrients extracted than replaced.

There are five key threats stemming from excess or insufficient nutrients which can be referred to as the "WAGES":

- **Water quality.** Excess nutrients running off farm land, cities and discharged from sewage treatment plants create eutrophic conditions which can spur algal blooms. There are more than 500 coastal areas across the globe estimated to be suffering from eutrophication.
- **Air quality.** Nitrogen in the form of nitrogen oxide (NO_x) and nitrogen dioxide (NO_2) are emitted by power plants and vehicles and contribute to smog, ozone, acid rain and human health issues.
- **Greenhouse gas balance:** Nitrogen in the form of nitrous oxide (N_2O) is emitted into the atmosphere from agricultural activities and fuel combustion. N_2O is a greenhouse gas with more than 200 times the global warming potential as carbon dioxide.
- **Ecosystems and biodiversity:** The effects of eutrophication and atmospheric deposition can harm the biodiversity of natural ecosystems. Algae that thrive in eutrophic conditions block out sunlight and consume oxygen, leaving behind dead zones where fish cannot survive.
- **Soil quality:** Excess fertilizer and manure can acidify soils, reducing their quality for crop production. On the other hand, some areas have insufficient nutrients and a lack of fertilizer. Crop harvests without replenishment of necessary nutrients may degrade soils.

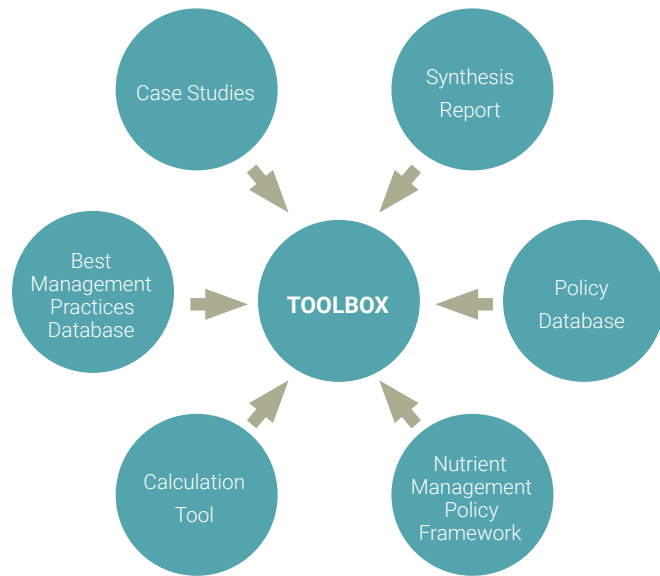


The Global Partnership on Nutrient Management developed a Global Nutrient Management Toolbox to increase attention to and drive action around sustainably managing nutrients across various sectors—agriculture, urban, wastewater and energy. The Toolbox is a collection of promising practices, technologies and policies in use around the globe, and it provides a basin-scale model to assess current loads and simulate future scenarios. Decision-makers and practitioners alike who are considering nutrient management interventions can use the Toolbox to inform their decisions and maximize environmental, economic and social benefits.

Nitrogen and phosphorus fertilizer use has increased substantially since the 1960s and is projected to increase by 40-50 percent through 2050 in order to feed the planet's growing population. We face a nutrient challenge to produce more food and energy while at the same time decreasing our pollution and lifting more than 500 million smallholder farmers in developing countries out of poverty. How we handle this challenge has significant implications for our ability to meet the Sustainable Development Goals, produce enough food while protecting our environment and health, and reduce poverty.

EXPLORE THE GLOBAL NUTRIENT MANAGEMENT TOOLBOX

The toolbox serves as an information portal on the subject of nutrient management, providing three kinds of resources: (1) searchable databases of more than 200 nutrient management practices and policies in use around the world, (2) case studies and reports on how priority best practices are being implemented to achieve nutrient management objectives, and (3) a calculation tool for assessing a river basin's current and potential future nutrient load based on changes in management actions. The Toolbox is a valuable resource for policy makers, extension agents, and other professionals and practitioners across the agriculture, aquaculture, wastewater and urban sectors.



Nutrientchallenge.org/gpnm-toolbox

The Global Nutrient Management Toolbox was developed by Global Partnership on Nutrient Management partners—the World Resources Institute, the Energy Research Centre of the Netherlands and the Global Environment and Technology Foundation—to demonstrate effective practices and policies for nutrient management.

The Toolbox was developed with funding support from the Global Environment Facility through the Global Foundations for Reducing Nutrient Enrichment and Oxygen Depletion from Land-Based Pollution, in Support of the Global Nutrient Cycle (GEF-GNC) Project.

USING THE TOOLBOX TO MEET SDGS

Sustainable nutrient management is embedded in various Sustainable Development Goals (SDGs). For example, good nutrient management can improve soils and yields, thereby increasing food production and economic development. It can help protect ambient water quality and ecosystems. And SDGs for responsible consumption and production, sustainable cities and climate action can all provide co-benefits for nutrients.



END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE | *Nutrient use efficiency, where applications of fertilizer are in balance with plant uptake to minimize losses, can help achieve Target 2.4 of sustainable food production systems.*



ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL | *Targets 6.3 aimed at reducing water pollution and 6.a aimed at supporting wastewater treatment and reuse are strongly linked to minimizing nutrient leakage to the environment.*



ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS | *Targets 12.2, 12.4, and 12.5 aim to sustainably manage natural resources, chemicals, and waste. The sound management, including reducing and reusing, of both phosphorus – a finite resource - and nitrogen can help prevent their release to air, water, and soil.*



TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS | *In development of their national policies and strategies to address climate change and meet Target 13.2, national governments should include plans to manage nitrous oxide.*



CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT | *Nutrient pollution is explicitly mentioned in Target 14.1 to prevent and reduce marine pollution from land-based activities.*



PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS | *Nutrient use efficiency can help to achieve Target 15.3 by preventing crop harvests from depleting soils of nutrients, thereby helping to avoid land degradation.*

As countries strive to meet these SDGs, the Toolbox can be a valuable resource for exploring options to protect freshwater and marine resources while maintaining or increasing food production and economic development. Of particular interest is SDG 14 which calls for countries to “conserve and sustainably use the oceans, seas and marine resources for sustainable development.” Within this goal, target SDG 14.1 aims to reduce marine pollution from land-based activities, including nutrient pollution by 2025. The Index of Coastal Eutrophication Potential (ICEP), which uses information on riverine nutrient loads to estimate the potential for eutrophic conditions to develop in the coastal zone, is one of the indicators for monitoring this target. The

Toolbox Calculator provides an ICEP score for about 6,000 river basins globally and allows the user to evaluate how this ICEP value would change under alternative management scenarios that change nutrient discharges, like halving untreated wastewater or reducing fertilizer applications.

ADAPTING THE TOOLBOX TO LOCAL CONDITIONS

The Toolbox was designed to have global application, but differences in climate, landscape, politics, economy and other factors can affect the suitability of directly applying the information in the Toolbox to decision making. To facilitate this process, there are various components of the Toolbox that allow the user to customize the inputs or results.

- *BMP and Policy Database*: Search filters allow the user to search for BMPs and policies that are relevant to their individual criteria. For example, users can choose to search for results that apply to certain regions, sectors or climatic zones.
- *Toolbox Calculator*: Users can replace the default global datasets with more accurate local data when available. Inputs may include population, fertilizer use, connection to sewage and septic systems, and geospatial maps of land use and population density. Future scenarios may also be run to explore the potential effects of locally proposed policies and land use changes. The box below gives an example of adapting of one of the toolbox functionalities to a more local setting.

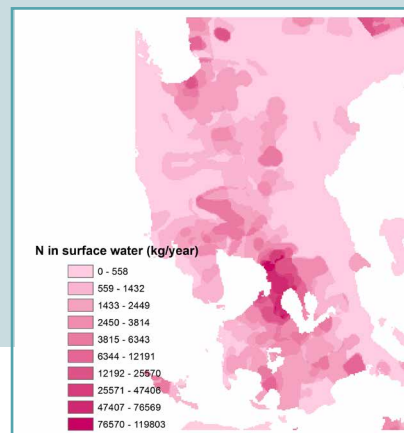
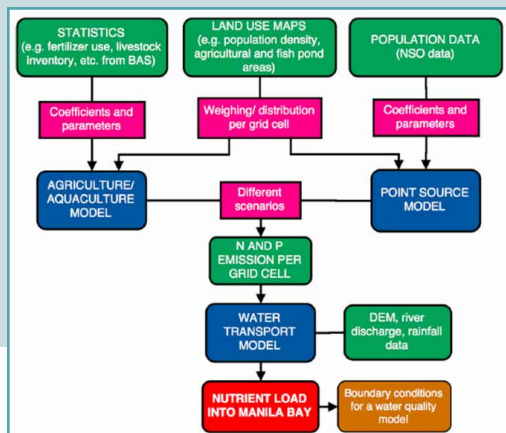
Scaling Down the Toolbox Calculator to a Local Setting: Manila Bay Case Study

Researchers from the University of the Philippines scaled down the Global NEWS Model, which powers the Toolbox Calculator, to develop the Manila Bay Nutrient Load Model. The Nutrient Load Model (1) estimates the amount of nutrient load to Manila Bay from various sources, (2) determines the efficiency of sewage connections, treatment, and phosphorus reduction in detergents, and (3) identifies possible policies or strategies for nutrient load reductions.

Data on population, fertilizer use, wastewater production and treatment and other inputs were obtained from the Philippine Statistics Authority and Bureau of Agricultural Statistics. The model was run using a combination of these localized data, where available, and the default global data. It was used to evaluate the current nutrient load amounts and sources and to explore the nutrient loading reduction potential of policy actions for consideration by relevant national authorities in the Philippines.

The researchers identified where in the basin nutrients are coming from and distinguished the proportion of loads by source. Domestic sources were the primary contributor of nutrient loadings to Manila Bay, and loads are only projected to increase. Therefore, sewage treatment should be the focus for reducing nutrient loads. Scenarios suggested that a ban on phosphorus in detergents would help reduce phosphorus loads as much as tertiary treatment, but at a lesser cost.

Similar exercises can be conducted in other regions around the world where input data are available.



CONSIDERATIONS WHEN USING THE TOOLBOX

The Global Nutrient Management Toolbox is designed to be a 'go-to' resource to aid decision makers around the world in the promotion of more sustainable nutrient management practices. Due to variations across geographies and sectors, knowledge gaps, and a variety of other factors, users of the Toolbox should consider the following:

- The information collected, particularly for the databases, was largely based on what was easily locatable online and, in this regard, will not consider all possible scenarios.
- Information sources were largely limited to those in English and by extension from English-speaking countries.
- Availability of cost estimates for implementation of improved nutrient management practices is an important consideration for promotion and adoption of best practices and policies, but information is limited. Further, cost estimates where available may not translate easily to other regions.
- The Toolbox resources are largely focused on nutrient management in agriculture, with less information about other sectors like transport, fisheries, etc.
- The Toolbox is designed primarily to help decision-makers address problems of excess nutrient leakage to the environment, and utility for decision making for areas with challenges associated with nutrient deficits may be limited.
- The Nutrient Calculator uses global datasets which may not be as accurate as finer-resolution local data, and lacks locally specific BMP efficiencies.

OPPORTUNITIES FOR ENHANCEMENTS

The Global Partnership on Nutrient Management aims to continue to enhance the Toolbox functionality over time based on feedback from the user community and GPNM partners.

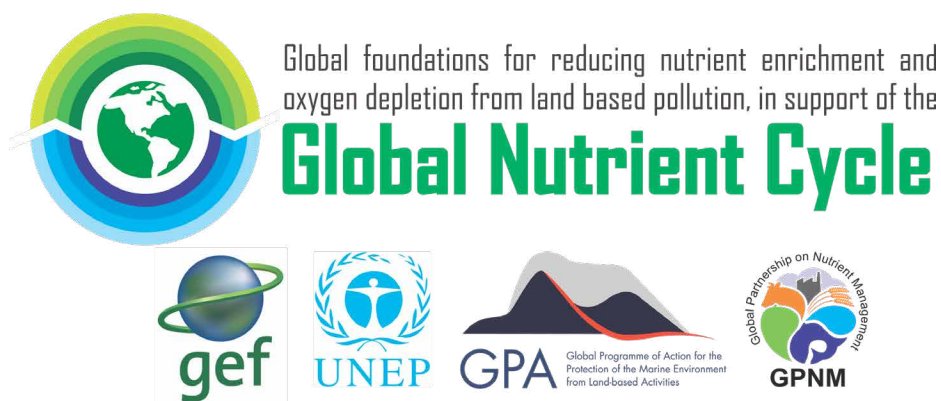
Potential future enhancements include:

- Updating the Toolbox with recent learnings or new approaches. The intention is to continue to populate the database through user and GPNM partner contributions.
- Expanding the search capabilities to other languages. The GPNM will continue to rely on the user community to contribute resources in native languages.
- Adding a Toolbox Calculator optimization feature that allows for entry of user-specified management options based on location-specific data to evaluate nutrient load scenarios.
- Building an enhanced analytical link between the BMP and Policy Database and the Toolbox Calculator to be able to evaluate nutrient load scenarios from implementation of selected BMPs and policies.
- Incorporating additional information about costs and regional applicability of management options.

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