The Global Nutrient Management Toolbox
Moving 'Nutrients Science' to Policy, to ACTION

LBSA Workshop for the Nairobi Convention GEF-WIOSAP Project
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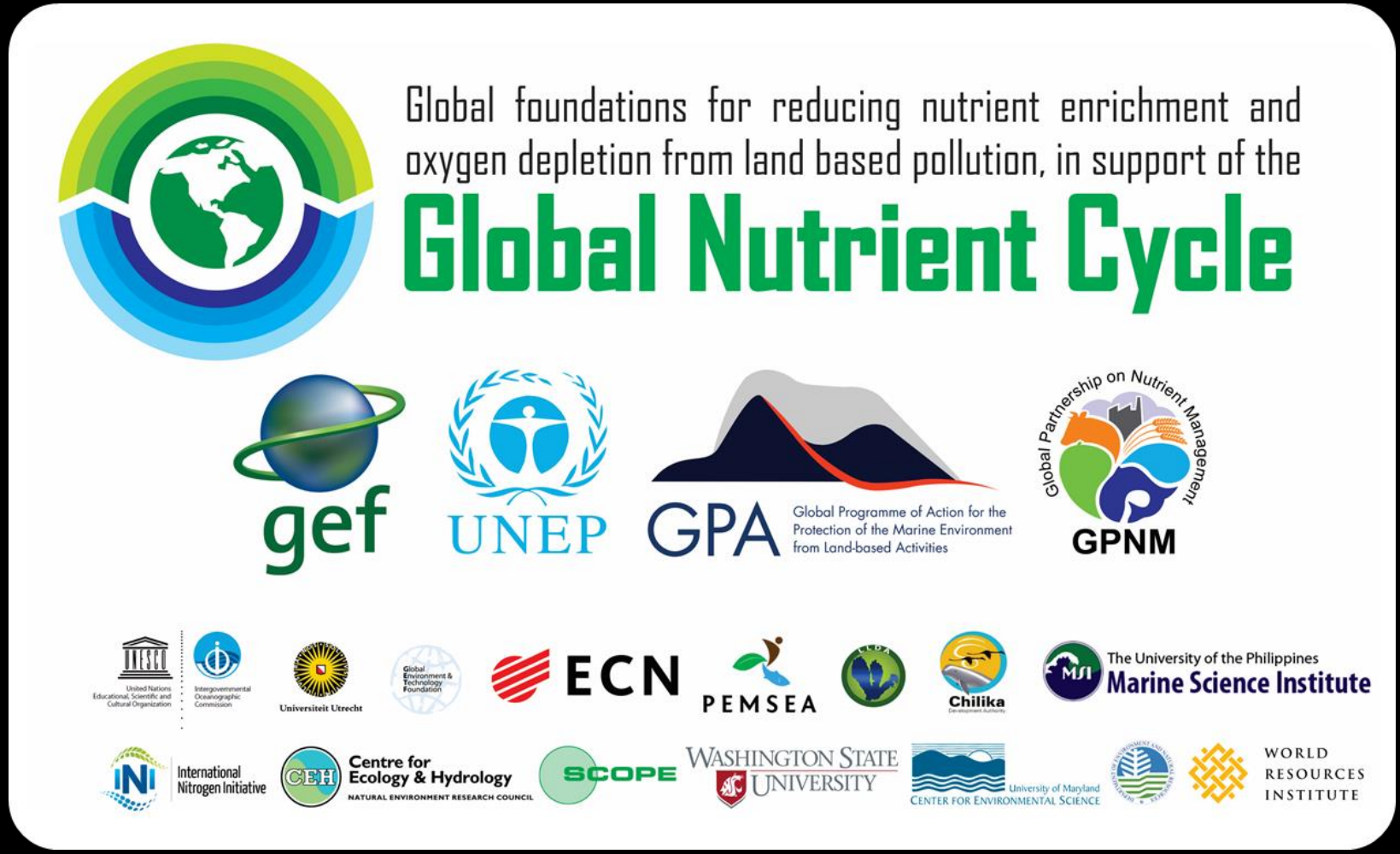
Moving ‘Nutrients Science’ to Policy, to ACTION

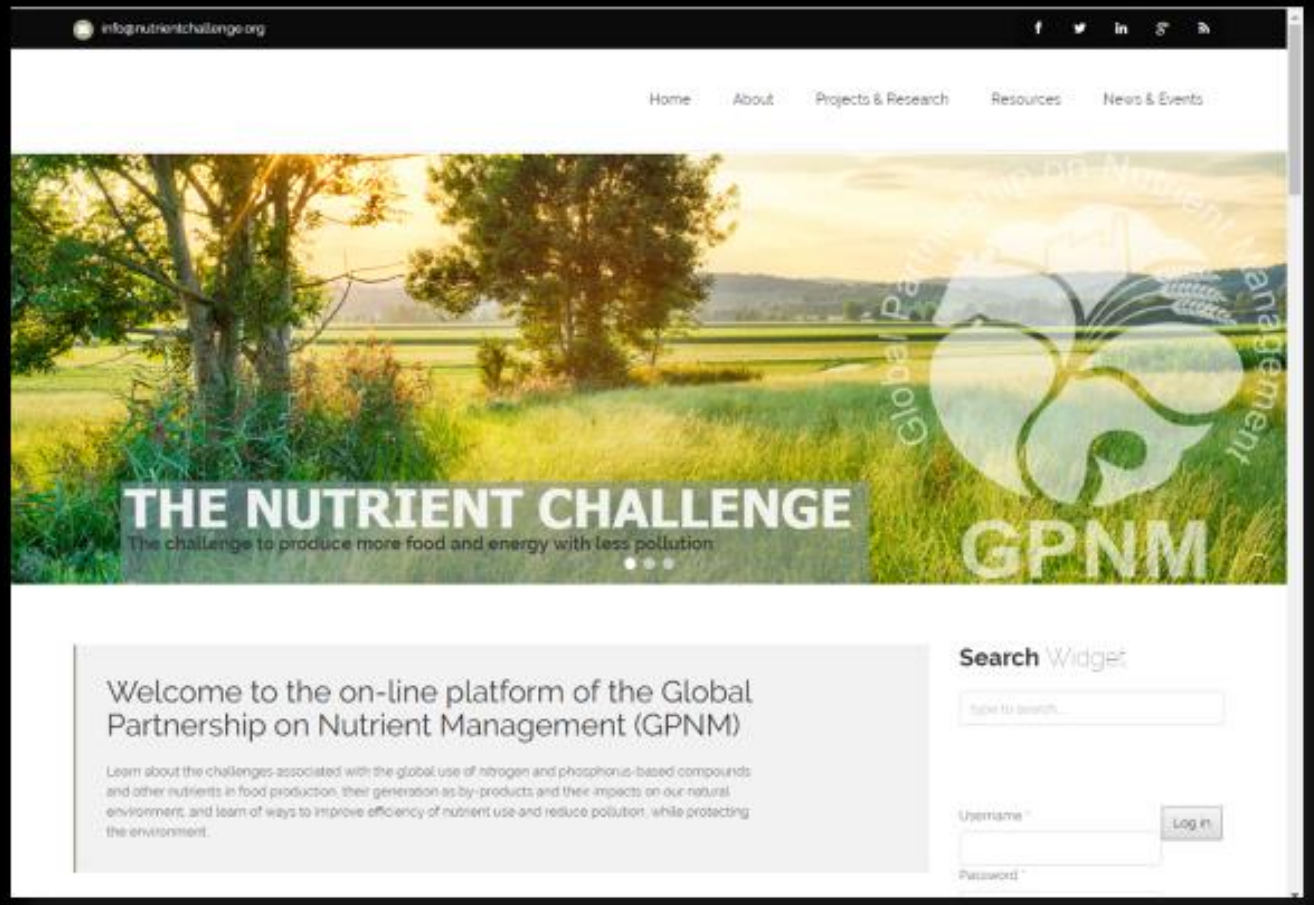
- **Package of tools** to technical and policy enablers
- **Strengthening of a Global Partnership on Nutrient Management** (GPNM)
  - Conduit for delivery of tools to global interests



Knowledge on Nutrients to the World!

Global Nutrient Management Toolbox

http://www.nutrientchallenge.org/gpnm-toolbox



Introduction to the GPNM Toolbox

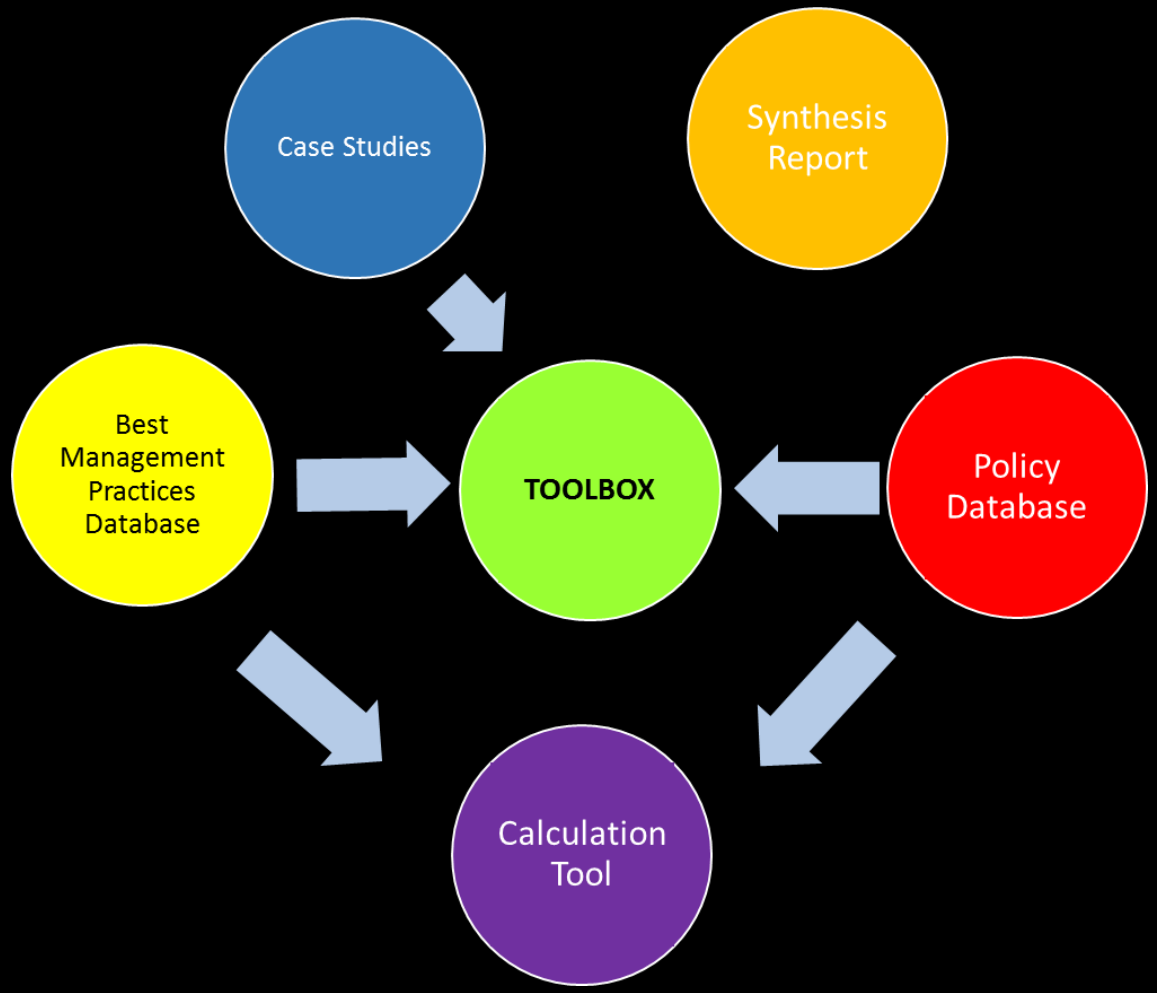
- Purpose of the toolbox is to…
- **demonstrate policy and technological options, which offer potential solutions for managing nutrients to decision makers and practitioners alike**
- Core knowledge delivery for the Global Partnership on Nutrient Management (GPNM)
- Dynamic resource to be built by partnership contributors
- **….including YOU!!!**

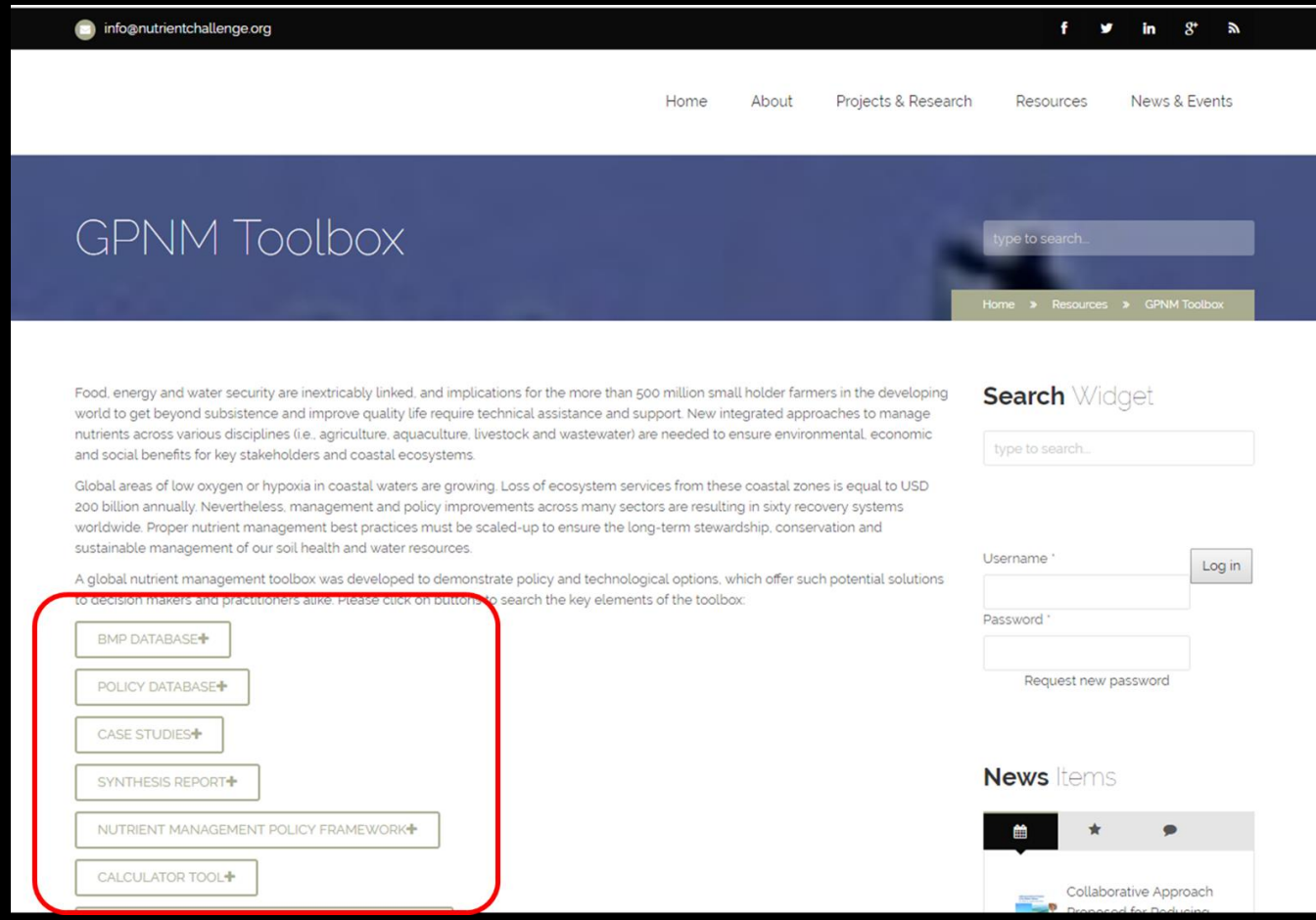
Global Nutrient Management Toolbox

Features:

- Best management practice database
- Policy database
- Case studies
- Synthesis report
- Nutrient management policy framework
- Nutrient flux calculator tool

Elements of the toolbox





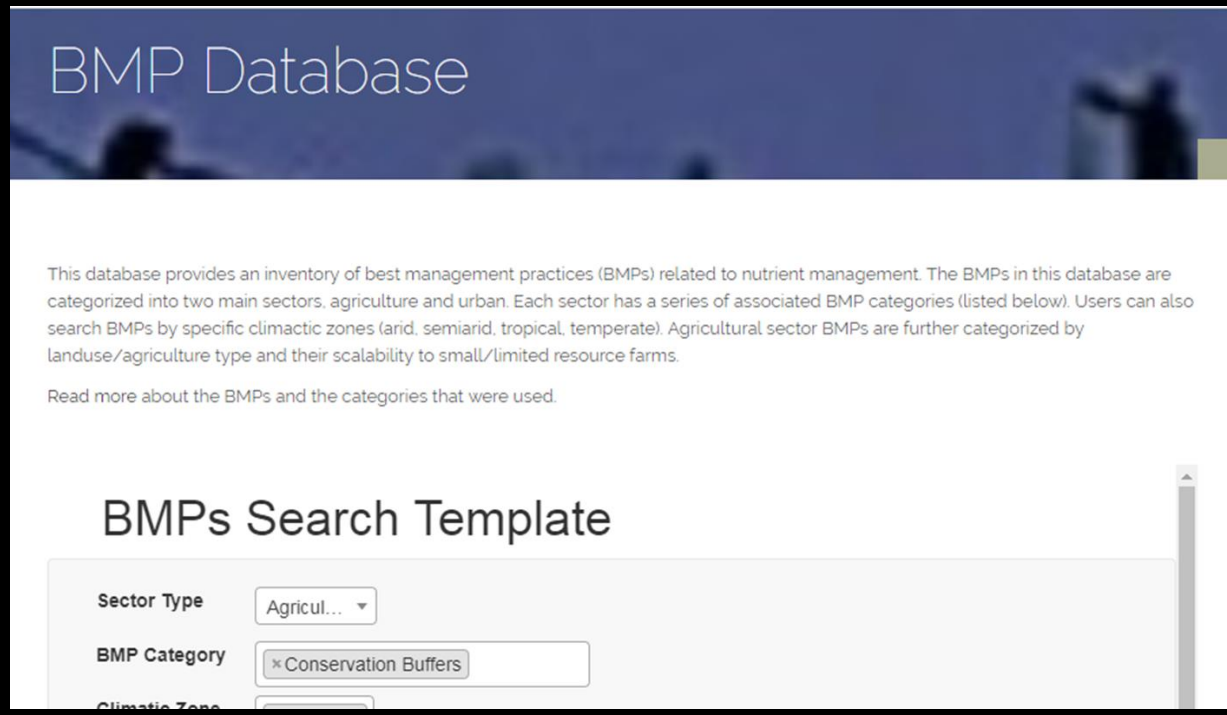
Part A

Best management practice database
Policy database
Case studies
Synthesis report
Nutrient management policy framework

Best management practice (BMP) database

http://www.nutrientchallenge.org/bmp-database

- Examples of practices that reduce nutrient losses across agriculture and urban sectors
- Information about each practice such as a description, considerations for adoption, nutrient reduction effectiveness estimates and regional applicability.
- Use database to identify and research options for possible nutrient-reducing practices that could be implemented on farms and in cities.



Best management practice (BMP) database

Practices searchable by: sector

Agriculture

Practices searchable by: category

- Conservation buffers
- Erosion control
- Drainage control
- Irrigation management
- Grazing management
- Wetland creation
- Etc.

Urban

- Detention
- Filtration
- Infiltration
- Septic management
- Urban erosion control
- Urban stream restoration
- Etc.

Best management practice (BMP) database

Practices searchable by: climatic zone

- Arid
- Semiarid
- Tropical
- Temperate

Practices searchable by: land use/agriculture type

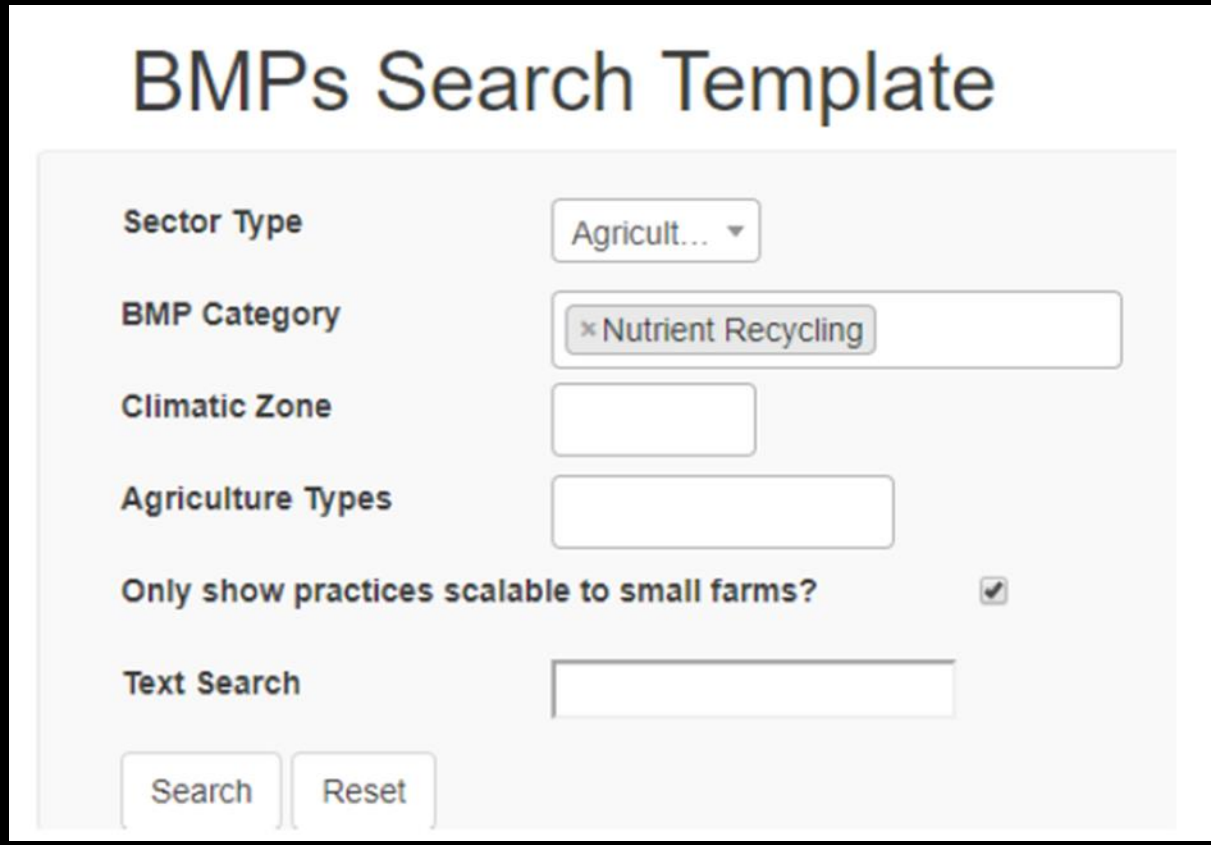
- Animal confinement
- Fodder
- Palm oil
- Pasture
- Rice
- Row crop
- Small grains

Practices searchable by: scalability to small farms

Only show practices scalable to small farms?

Searching the BMP Database

- Choose a sector: agriculture or urban.
- Limit your search within that sector to a particular BMP category or climate zone.
  - The database includes more than a dozen BMP categories from which to choose. Agricultural practices have additional search criteria that may be used: agriculture types and scalability to small farms.
- Choose more than one item from each drop-down menu
  - For example, here we show a search for nutrient recycling agriculture BMPs that are scalable to small farms



Searching the BMP Database

- After clicking “Search,” relevant BMPs meeting the search criteria will be displayed.
- The entry for each practice includes key information such as the land use type, applicable climatic zones and regions, pollutants treated, a description and references
- Results can be viewed on the website; user can click to download “My Results” or “All BMPs” to an Excel spreadsheet

Agricultural Waste Composting

Category: Nutrient Recycling
Practice Type: Management
Landuse/Agriculture Type: Row Crop, Fodder, Rice
Climatic Zones: Temperate, Tropical, Semiarid
Regions: North America, South Asia, Europe
Pollutants Treated: Nitrogen, Phosphorus, Sediment

Description: Agricultural waste products (unused portions of crops or waste products from processing) including have the potential to contribute nutrients and should be managed in a manner that prevents nutrient contamination to surface and ground waters. Consideration should be given to the amount of raw waste generated, the nutrient content of the waste product, and recognition that nutrient loading depends on the way in which the waste is handled after harvest. Most vegetable waste, such as sweet corn fodder, cull ears and husks can be used as a green manure by applying it to production fields. [1]

Scalable to small farms? Yes

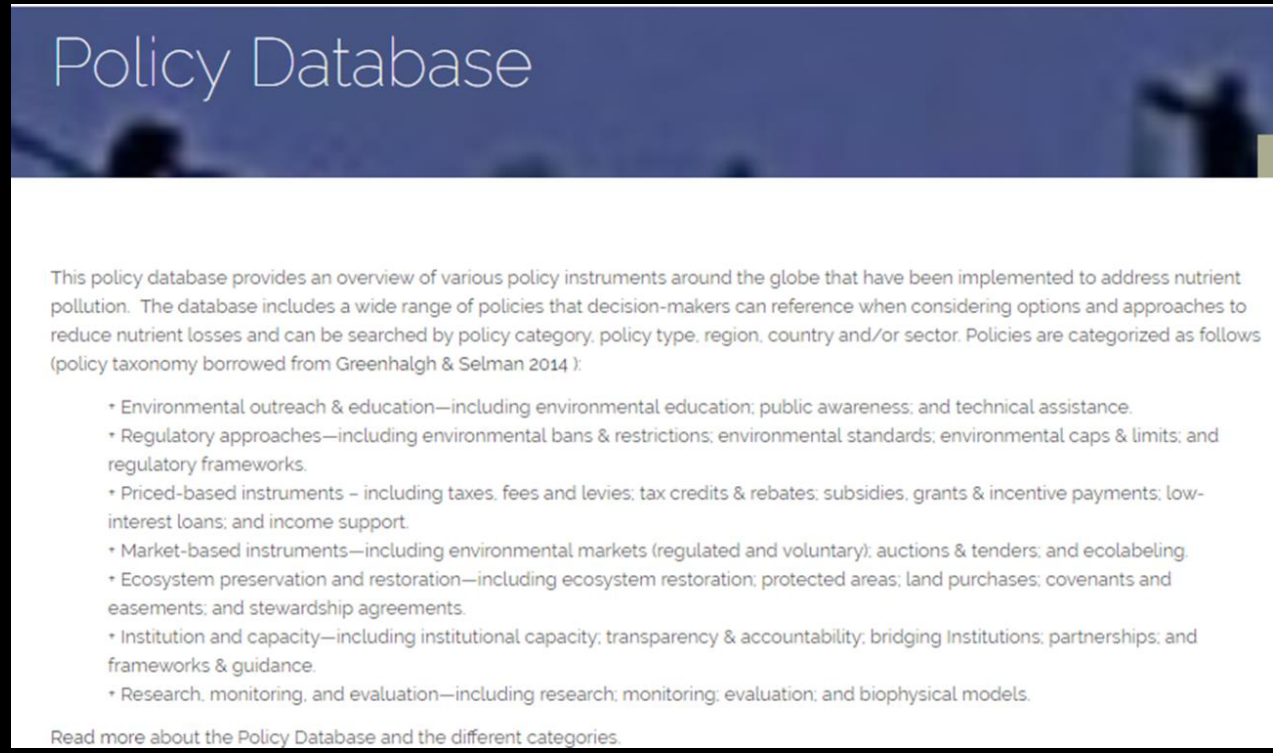
[1] Selman, Mindy, and Suzie Greenhalgh. "Eutrophication: Policies, Actions, And Strategies to Address Nutrient Pollution." WRI Policy Note, Water Quality: Eutrophication And Hypoxia. Sept. 2009. Web. Feb. 2014. http://pdf.wri.org/eutrophication_policies_actions_and_strategies.pdf.

A compost heap handles vegetable and other plant waste on an organic farm (Saucier, Miss.). Photographer: Stephen Kirkpatrick. Photo Courtesy of USDA NRCS.

Policy database

http://www.nutrientchallenge.org/policy-database

- Examples of policy instruments implemented to address nutrient pollution from agriculture, aquaculture, fisheries, transport, urban and wastewater sectors.
- Policies organized into seven categories:
  1. Ecosystem restoration and protection
  2. Environmental outreach and education
  3. Institutions and capacity
  4. Market-based instruments
  5. Price-based instruments
  6. Regulatory approaches
  7. Research, monitoring and evaluation



Policy database

Practices searchable by: region

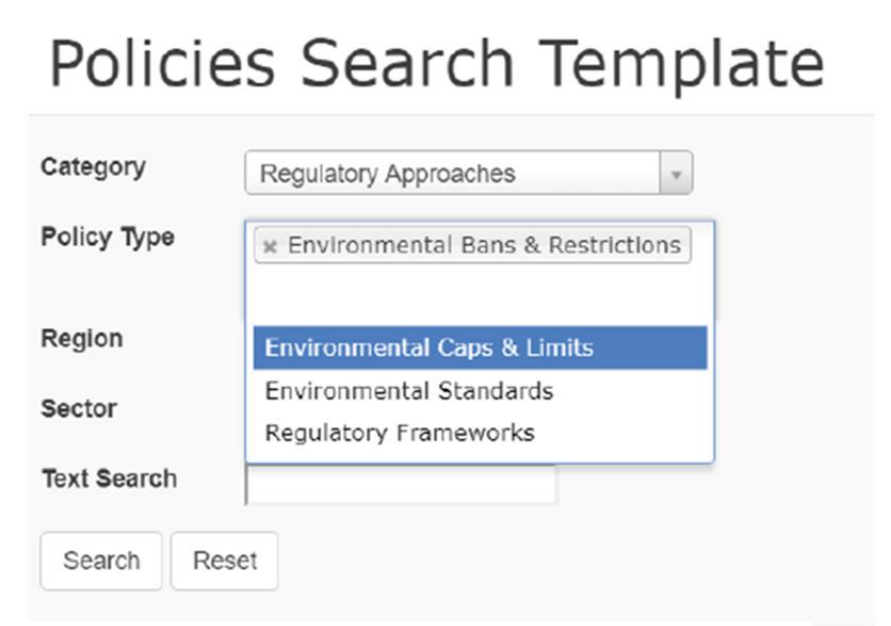
- Asia
- Europe
- Middle East
- North America
- Oceana
- South America

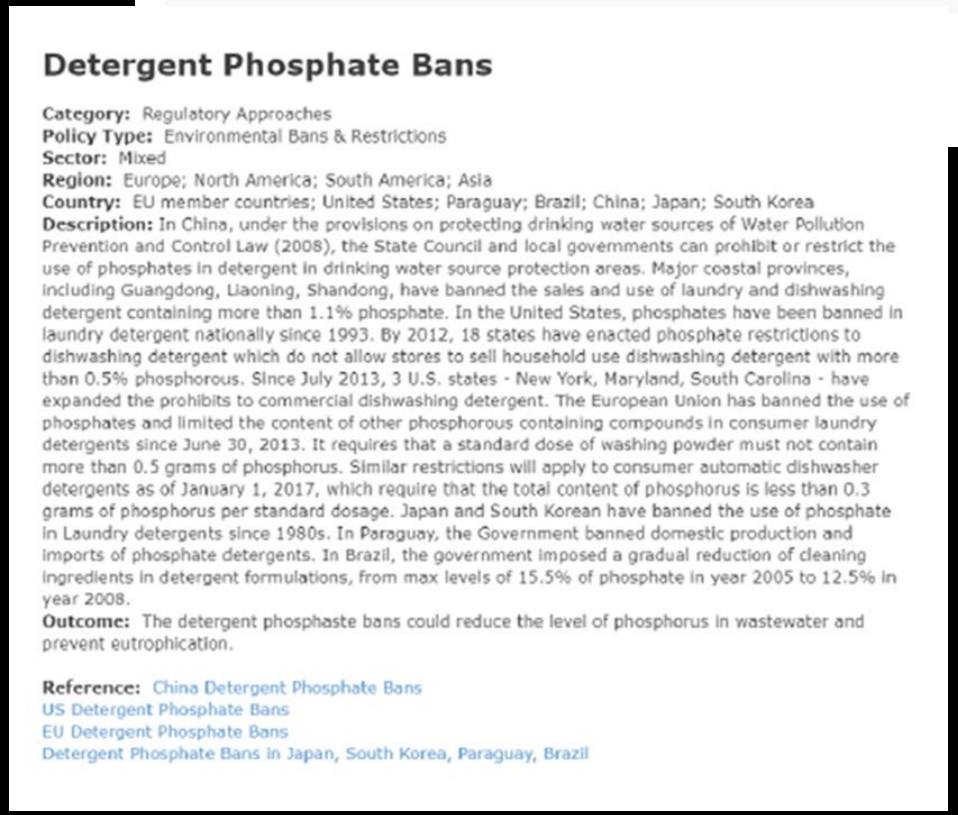
Practices searchable by: sector

- Agriculture
- Aquaculture
- Fisheries
- Mixed
- Transport
- Urban
- Wastewater

Searching the Policy database

- Entries searchable by category, type, region and/or sector
- Explore approaches in other parts of the world that may be applicable to your country/region
- Choose one or more of the seven policy categories from the drop-down menu.
- Search for a specific policy type(s) within that category
  - May limit search to policies in specific regions or sectors
- After clicking on “Search,” results will be displayed
- Also choose to download “My Results” or “All Policies” to see the policies of interest in an Excel-based format.
- Entry includes the regions and countries where this policy has been implemented, a brief description, information about realized or anticipated nutrient outcomes of the policy and references





Detergent Phosphate Bans

Category: Regulatory Approaches
Policy Type: Environmental Bans & Restrictions
Sector: Mixed
Region: Europe; North America; South America; Asia
Country: EU member countries; United States; Paraguay; Brazil; China; Japan; South Korea
Description: In China, under the provisions on protecting drinking water sources of Water Pollution Prevention and Control Law (2008), the State Council and local governments can prohibit or restrict the use of phosphates in detergent in drinking water source protection areas. Major coastal provinces, including Guangdong, Liaoning, Shandong, have banned the sales and use of laundry and dishwashing detergent containing more than 1.1% phosphate. In the United States, phosphates have been banned in laundry detergent nationally since 1993. By 2012, 18 states have enacted phosphate restrictions to dishwashing detergent which do not allow stores to sell household use dishwashing detergent with more than 0.5% phosphorous. Since July 2013, 3 U.S. states - New York, Maryland, South Carolina - have expanded the prohibits to commercial dishwashing detergent. The European Union has banned the use of phosphates and limited the content of other phosphorous containing compounds in consumer laundry detergents since June 30, 2013. It requires that a standard dose of washing powder must not contain more than 0.5 grams of phosphorus. Similar restrictions will apply to consumer automatic dishwasher detergents as of January 1, 2017, which require that the total content of phosphorus is less than 0.3 grams of phosphorus per standard dosage. Japan and South Korean have banned the use of phosphate in Laundry detergents since 1980s. In Paraguay, the Government banned domestic production and imports of phosphate detergents. In Brazil, the government imposed a gradual reduction of cleaning ingredients in detergent formulations, from max levels of 15.5% of phosphate in year 2005 to 12.5% in year 2008.
Outcome: The detergent phosphaste bans could reduce the level of phosphorus in wastewater and prevent eutrophication.

Reference: China Detergent Phosphate Bans
US Detergent Phosphate Bans
EU Detergent Phosphate Bans
Detergent Phosphate Bans in Japan, South Korea, Paraguay, Brazil

Case Studies

http://www.nutrientchallenge.org/case-studies

- **Highlight interventions** practitioners to achieve nutrient management objectives at a catchment or other local scale.
- **Examples:** voluntary programs for farmers to practice better management of land and water resources, demonstrations of new methodologies for quantifying reductions in nutrients and models of inter-country cooperation around transboundary waters
- Each case study provides **background on the issue, objectives, description** of the intervention and the **outcomes**
- Many case studies represent **successful pilot programs** that others can learn from, adapt and replicate

Case Studies

Detecting Effects of BMPs on Rain Events Generating Nonpoint Source Pollution

Name: Detecting Effects of Best Management Practices (BMPs) on Rain Events Generating Nonpoint Source Pollution (NPSP) in Agricultural Watersheds using a Physically-Based Stratagem

Location/Terrain: Conesus Lake, NY, USA

Crop(s): Livestock, cover crops and others

Nutrient(s): Nonpoint source pollution (NPSP)

Rationale: This research documents a methodology for confirming reductions in NPSP resulting from implementation of agricultural BMPs. It employs that methodology to confirm the success of BMPs implemented.

Zollweghabcs.pdf

Impacts of Manure Management Practices on Stream Microbial Loading

Name: Impacts of Manure Management Practices on Stream Microbial

Overview

Name: Danube River Basin: Boosting Capacities for Nutrient Reduction and Transboundary Co-Operation

Location/Terrain: Danube River Basin (17 countries)

Crop(s): Various crops and livestock production

Nutrient(s): Nitrogen and phosphorous

Rationale: Nitrogen and phosphorus levels from agriculture, municipal and industrial sources have seriously degraded the Black Sea ecosystem.

Issue(s) of Concern/Challenges:

Nitrogen and phosphorus levels from agriculture, municipal and industrial sources have seriously degraded the Black Sea ecosystem, disrupted fisheries, reduced biodiversity, posed threats to humans and resulted in billions of dollars of losses to the economies of Black Sea littoral countries.

Practice Objectives:

The objective is to reduce nutrient loading into the Danube River and its tributaries and to improve water quality in the Danube and Black Sea.

Practice Description:

All farmers larger than 5 hectares and/or 5 animal units should calculate their resource economy every year by April 1 of the preceding year and covering at least the resource economy for nitrogen and phosphorus. Farmers should ensure soil sampling every five years. Crop rotation and fertilizing plans should be prepared every year for all larger farms.

Livestock numbers should be limited to ensure that nitrogen content in the manure is no more than 170 kg/ha. There should be storage capacity for at least six months of production of livestock manure at the farm. Spreading manure from October 15 to March 1 should not take place. Proper technology and technique should be used for spreading livestock manure.

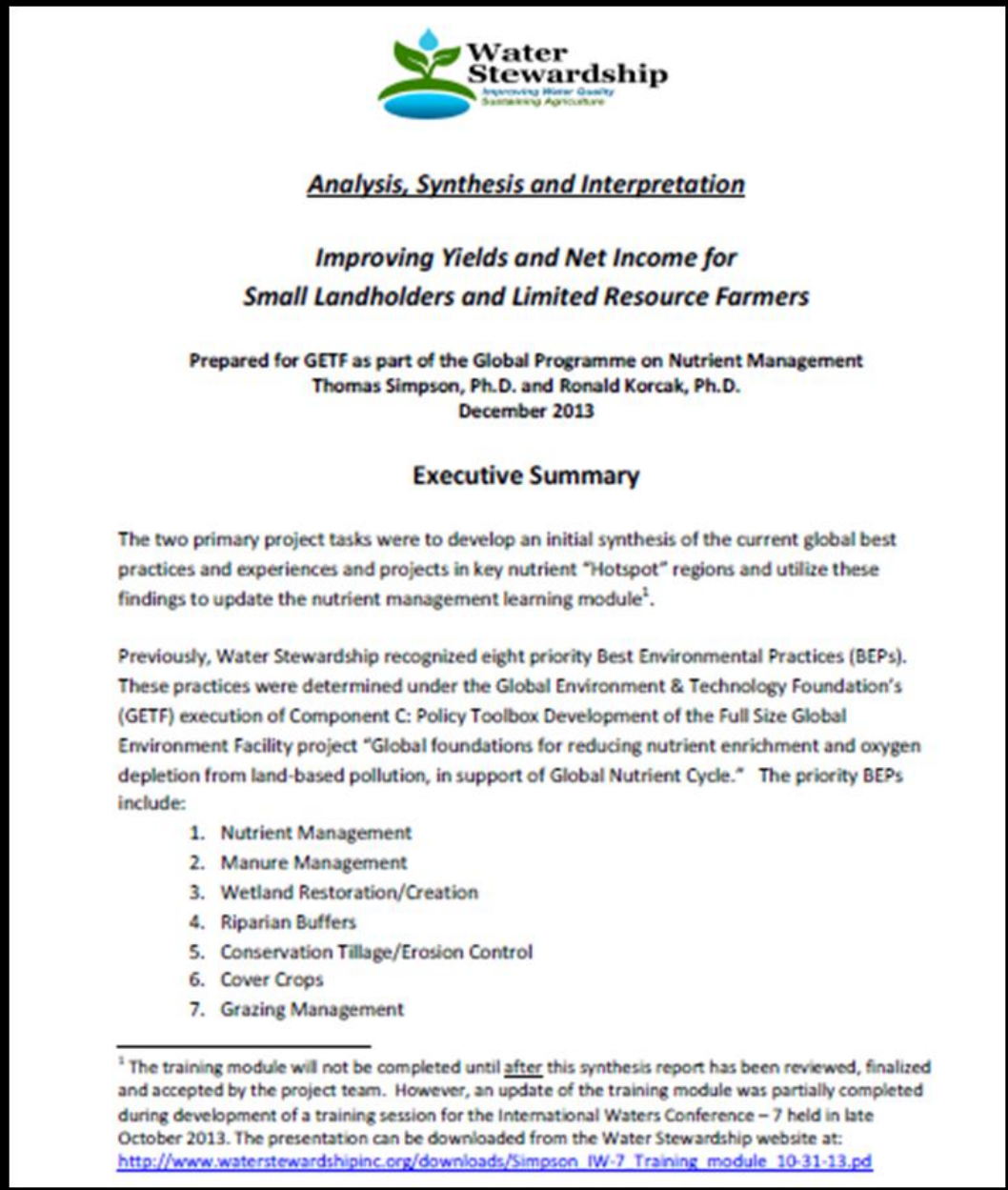
Outcomes:

- Reduced nitrogen by 14 tonnes/year on eight demonstration farms
- Reduced phosphorus by 2 tonnes/year on eight demonstration farms

Synthesis Report

http://www.nutrientchallenge.org/synthesis-report

- Considers 8 high-priority best environmental practices
  - **examine scalability of practices** for smallholder and limited resource farmers in key **nutrient "hotspot" regions**: Chilika Lake, India; Lake Victoria, Africa; and Manila Bay, Philippines
- Identify scalable practices that could be considered priorities to incentivize or otherwise promote through various approaches



Water Stewardship

Analysis, Synthesis and Interpretation

Improving Yields and Net Income for Small Landholders and Limited Resource Farmers

Prepared for GETF as part of the Global Programme on Nutrient Management
Thomas Simpson, Ph.D. and Ronald Korcak, Ph.D.
December 2013

Executive Summary

The two primary project tasks were to develop an initial synthesis of the current global best practices and experiences and projects in key nutrient "Hotspot" regions and utilize these findings to update the nutrient management learning module[1].

Previously, Water Stewardship recognized eight priority Best Environmental Practices (BEPs). These practices were determined under the Global Environment & Technology Foundation's (GETF) execution of Component C: Policy Toolbox Development of the Full Size Global Environment Facility project "Global foundations for reducing nutrient enrichment and oxygen depletion from land-based pollution, in support of Global Nutrient Cycle." The priority BEPs include:

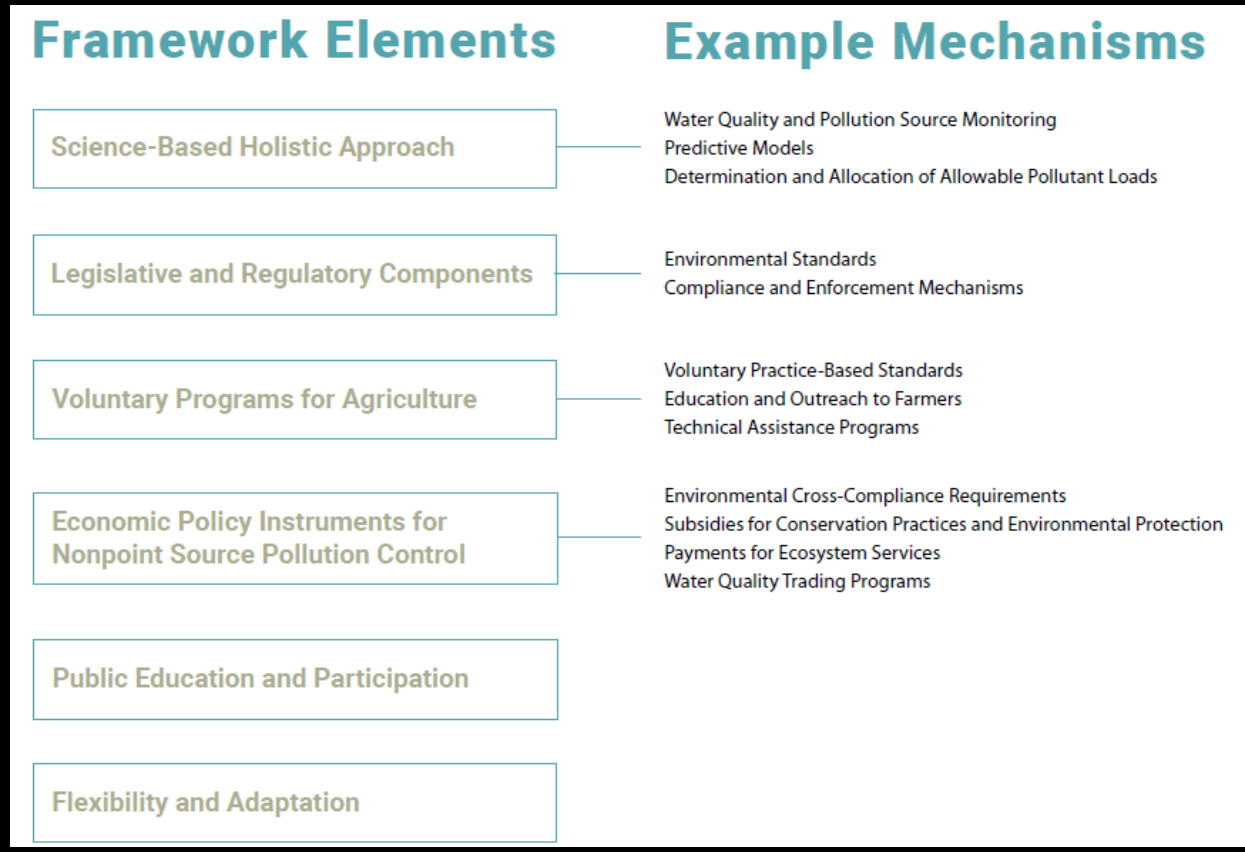
1. Nutrient Management
2. Manure Management
3. Wetland Restoration/Creation
4. Riparian Buffers
5. Conservation Tillage/Erosion Control
6. Cover Crops
7. Grazing Management

[1] The training module will not be completed until after this synthesis report has been reviewed, finalized and accepted by the project team. However, an update of the training module was partially completed during development of a training session for the International Waters Conference – 7 held in late October 2013. The presentation can be downloaded from the Water Stewardship website at: http://www.waterstewardshipinc.org/downloads/Simpson_IW-7_Training_module_10-31-13.pd

Nutrient Management Policy Framework

http://www.nutrientchallenge.org/nutrient-management-policy-framework

- Inform nutrient management policies and present **opportunities for scaling up the implementation** of key best practices
- Designed to be a workable framework for a country or region looking to develop a nutrient management policy.
- Provides **information on key components of a nutrient management policy**
  - includes examples of specific mechanisms within each element
- Framework shares **specific examples of promising strategies** recently piloted in two developing countries, India and the Philippines



Part B

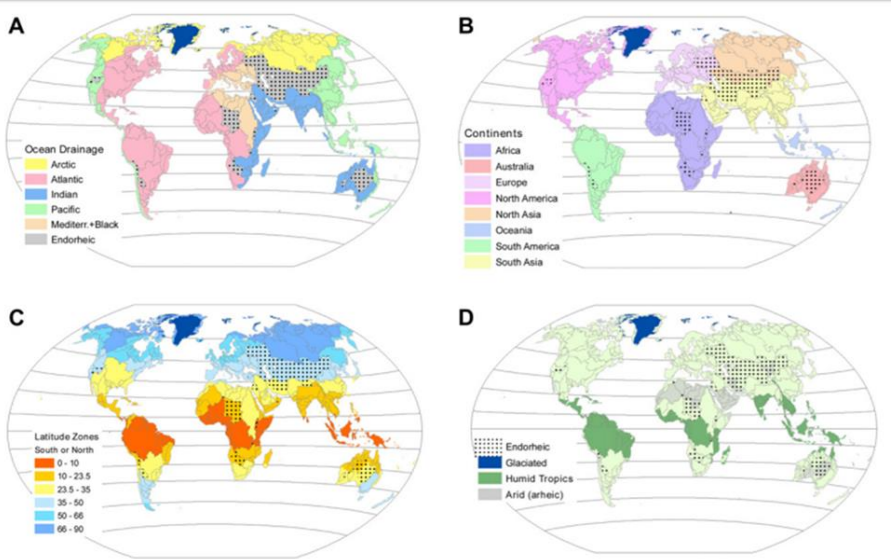
Nutrient flux calculator

UN environment
United Nations Environment Programme

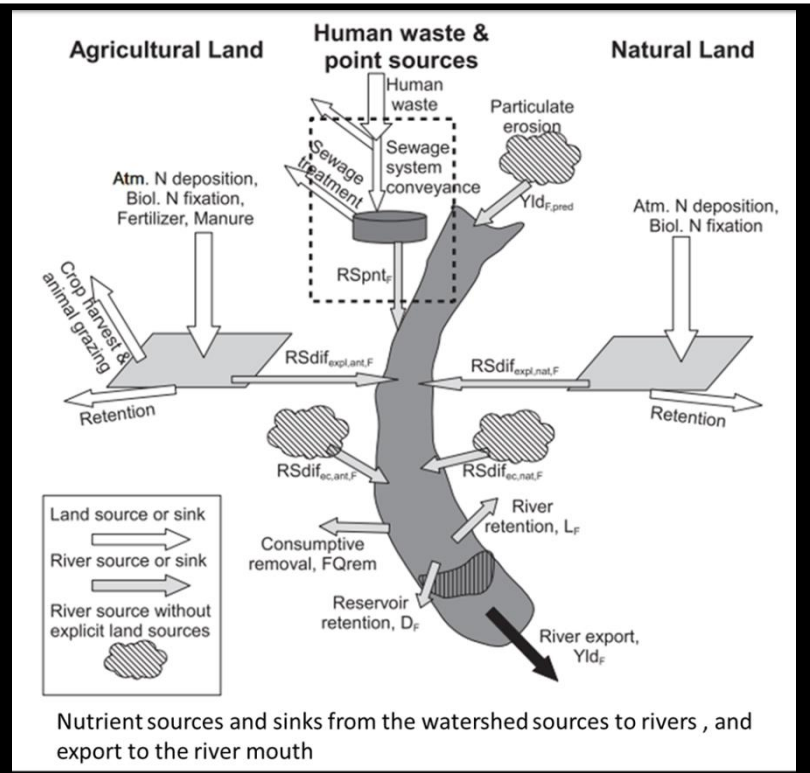
GPA
Global Programme of Action for the Protection of the Marine Environment from Landbased Activities

Nutrient calculator - predicting nutrient loads from river basins

- Uses the **Global Nutrient Export from WaterSheds (NEWS) model** to estimate the current status of total nitrogen and phosphorus loads (i.e., dissolved inorganic, dissolved organic, and particulate) in more than 5,000 major river basins around the world.
- **Evaluate nutrient loading implications of changes in management decisions** by selecting measures such as implementing agricultural best management practices or increasing sewage treatment.



Regions used in NEWS 2, representing aggregations of basins. Every map shows permanently glaciated regions (dark blue), endorheic basins (stippled), major basin boundaries and latitude bands

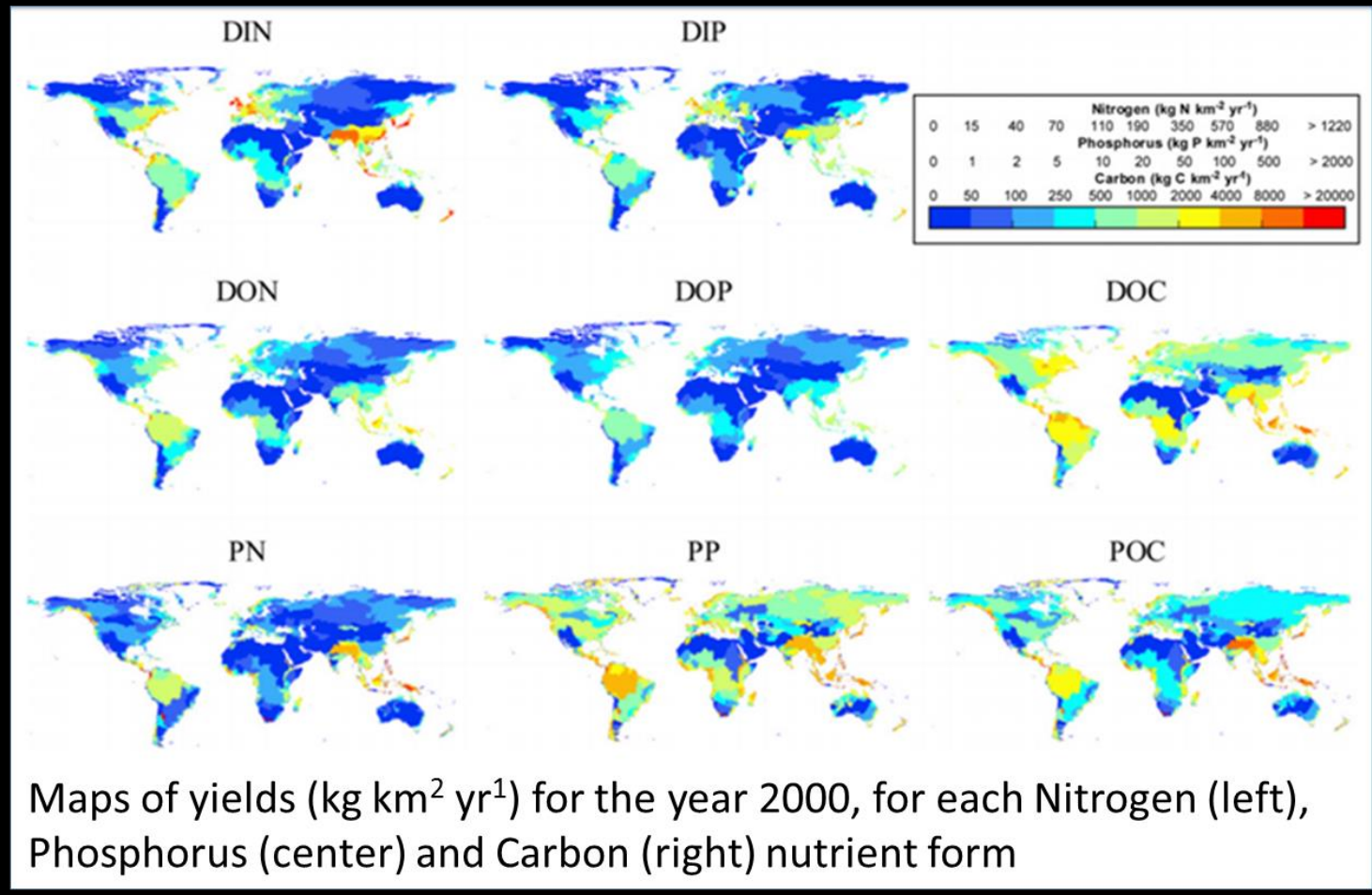


Nutrient sources and sinks from the watershed sources to rivers , and export to the river mouth

Predicting nutrient loads from river basins

- **Global NEWS** is a global, spatially explicit, multi-element and multi-form model of nutrient exports by rivers.
- **Key reference:** Global Nutrient Export from WaterSheds 2 (NEWS 2): Model development and implementation

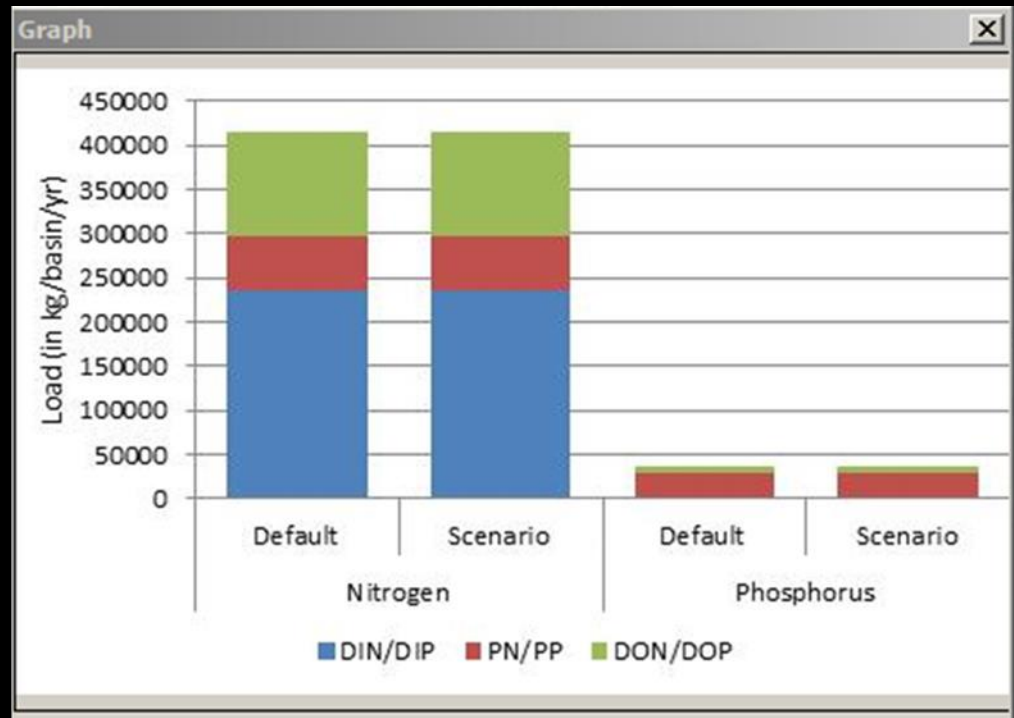
http://staff.washington.edu/emilio m/pubs/Mayorga2010-EMS-GlobalNEWS2.pdf



Maps of yields (kg km^2 yr^1) for the year 2000, for each Nitrogen (left), Phosphorus (center) and Carbon (right) nutrient form

Predicting nutrient loads from river basins

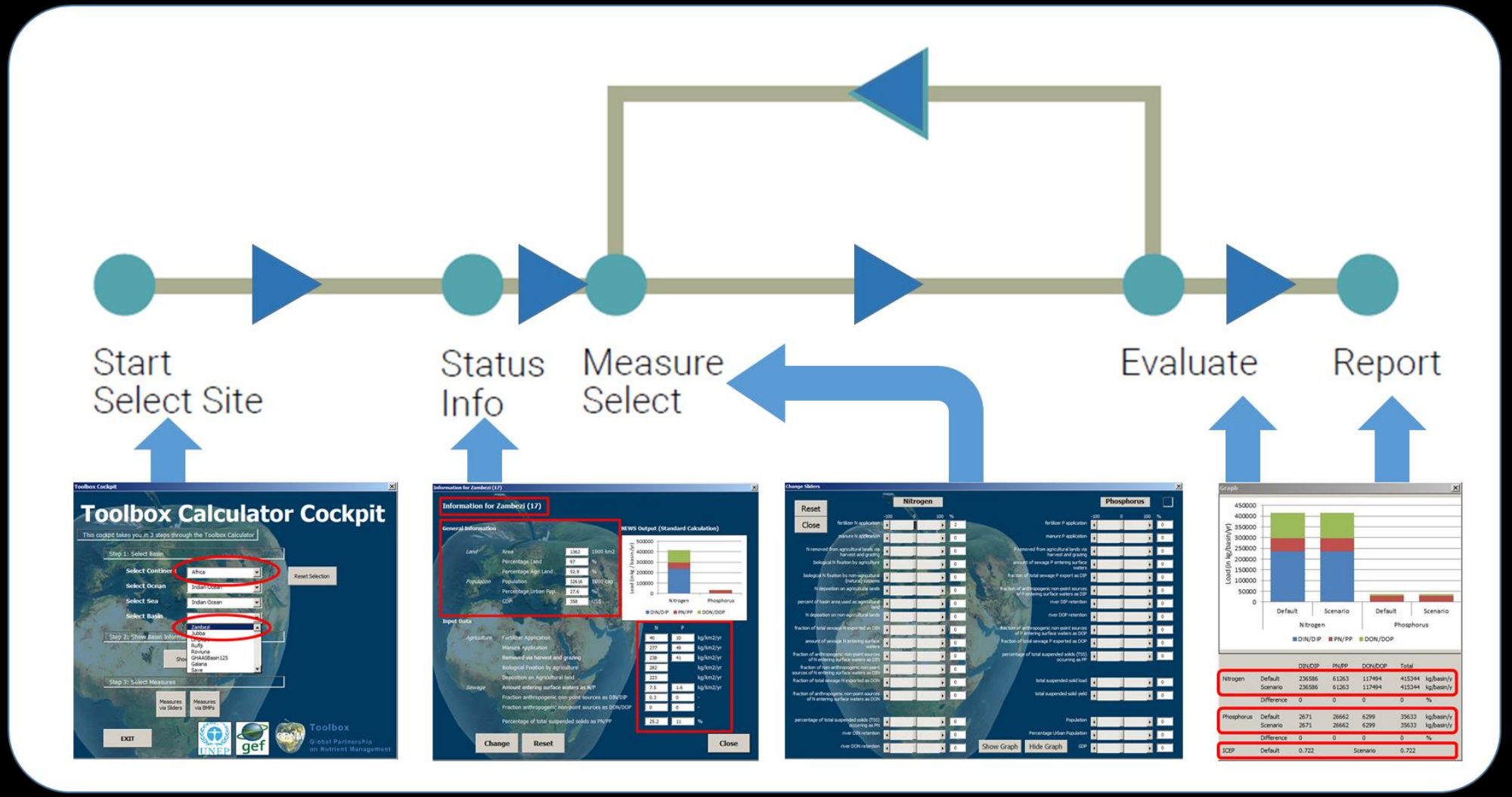
- Each bar presents nitrogen and phosphorus loading rates in kg/basin/yr for the **"default," or baseline conditions compared to the future "scenario."**
- Bars divided by nutrient pollutant form:
  - sum of **dissolved inorganic N** (DIN), **particulate N** (PN) and **dissolved organic N** (DON) = **total nitrogen**
  - sum of **dissolved inorganic P** (DIP), **particulate P** (PP) and **dissolved organic P** (DOP) = **total phosphorus**
- Percent difference between the two scenarios is also presented.
- Bottom: **Index of Coastal Eutrophication Potential (ICEP)** results
  - Positive ICEP values indicate this potential for harmful algal blooms or eutrophication.



		DIN/DIP	PN/PP	DON/DOP	Total	
Nitrogen	Default	236586	61263	117494	415344	kg/basin/y
	Scenario	236586	61263	117494	415344	kg/basin/y
	Difference	0	0	0	0	%
Phosphorus	Default	2671	26662	6299	35633	kg/basin/y
	Scenario	2671	26662	6299	35633	kg/basin/y
	Difference	0	0	0	0	%
ICEP	Default	0.722		Scenario	0.722	

Predicting nutrient loads from river basins

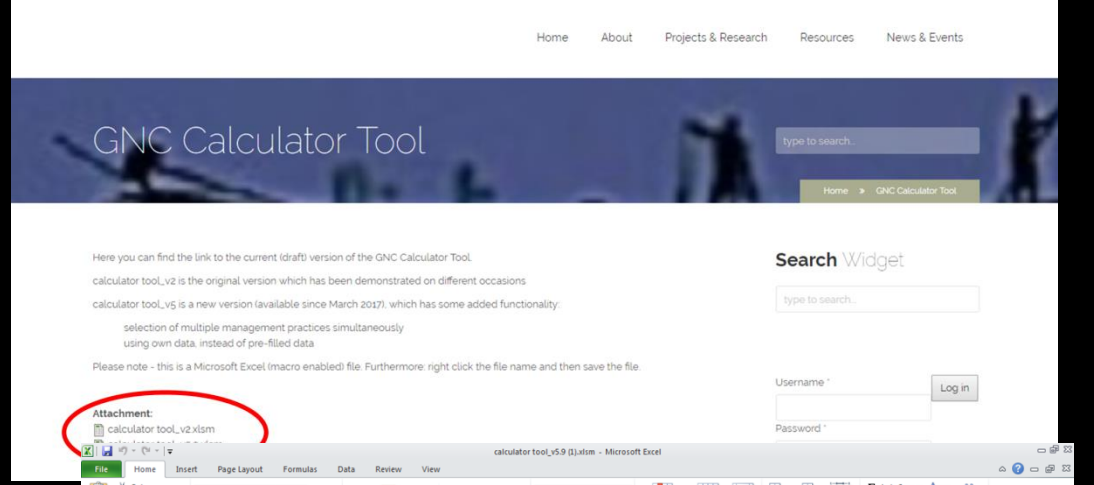
Nutrient calculator Process Flow

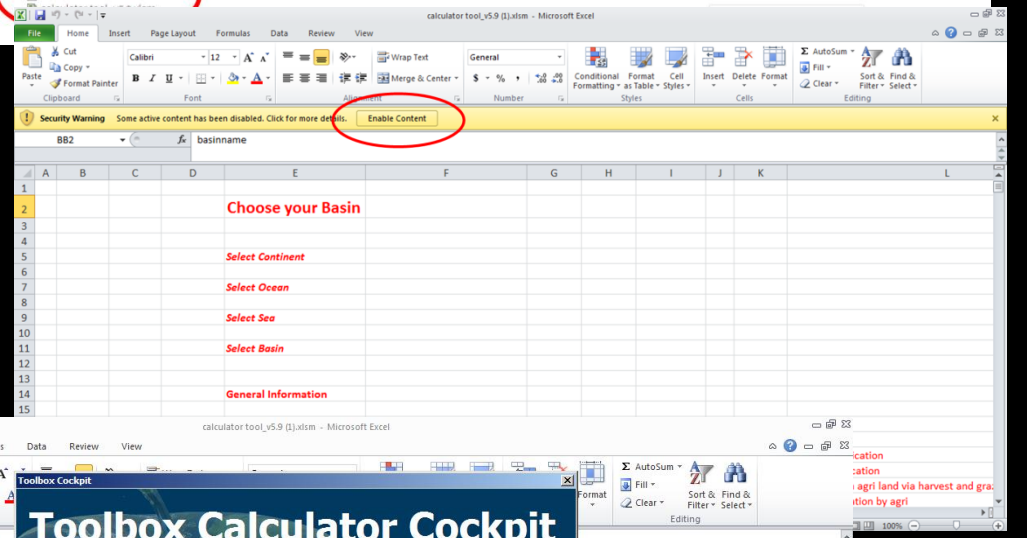


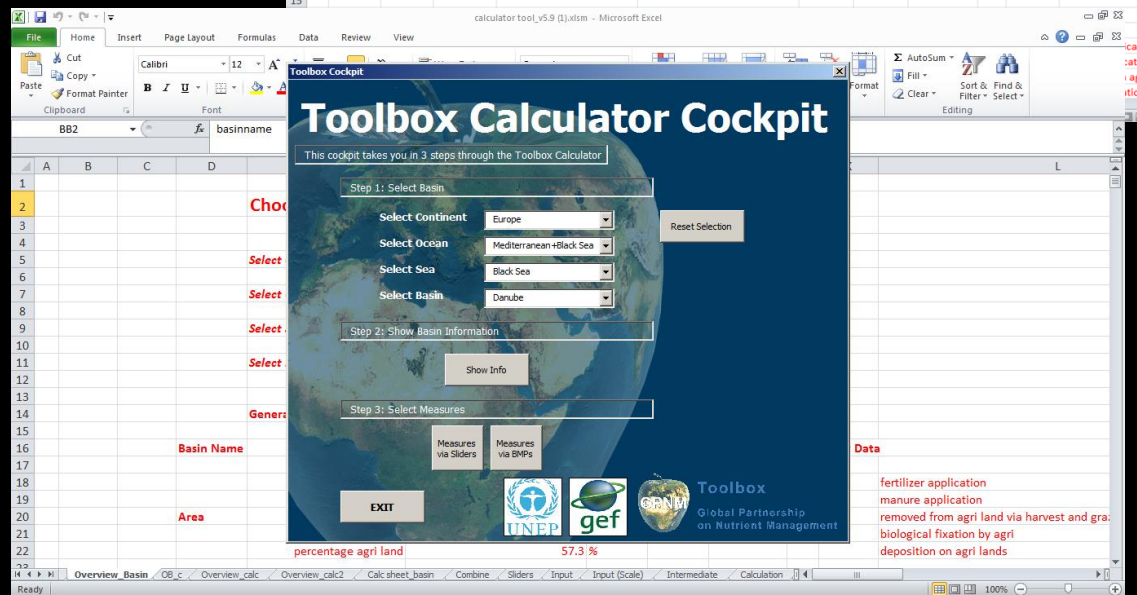
Accessing the Nutrient Calculator

http://www.nutrientchallenge.org/calculator%20tool

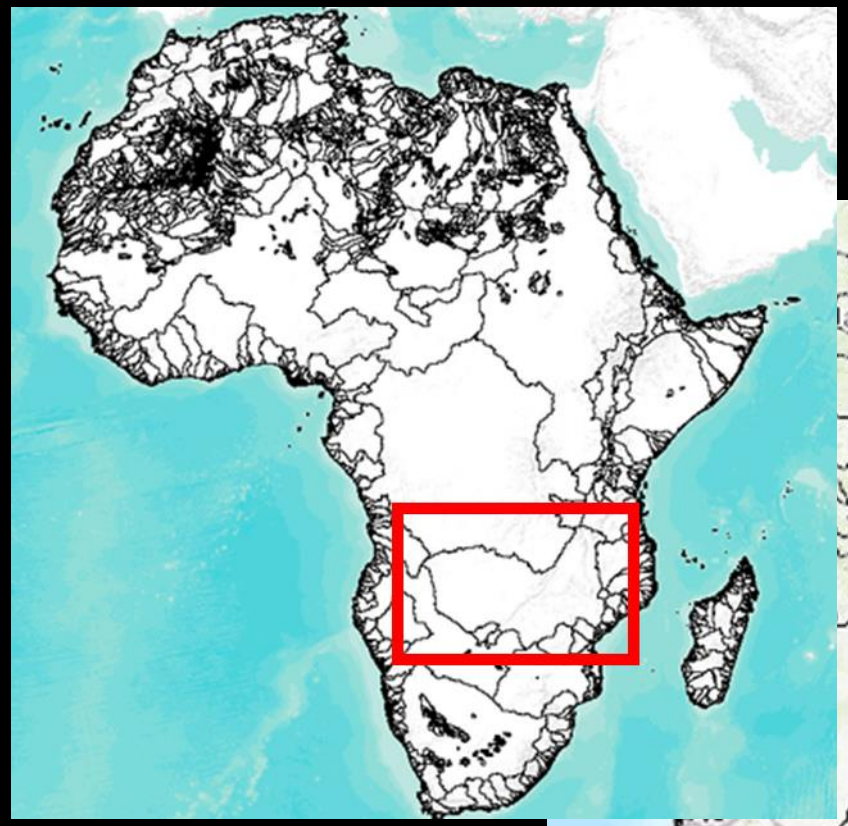
- Click on Excel file; use calculator tool_v5.9.xlsm
- File will download
- Open the Excel file, you will see the above image of the back end of the calculator
- Click Enable content
- User interface will open it.

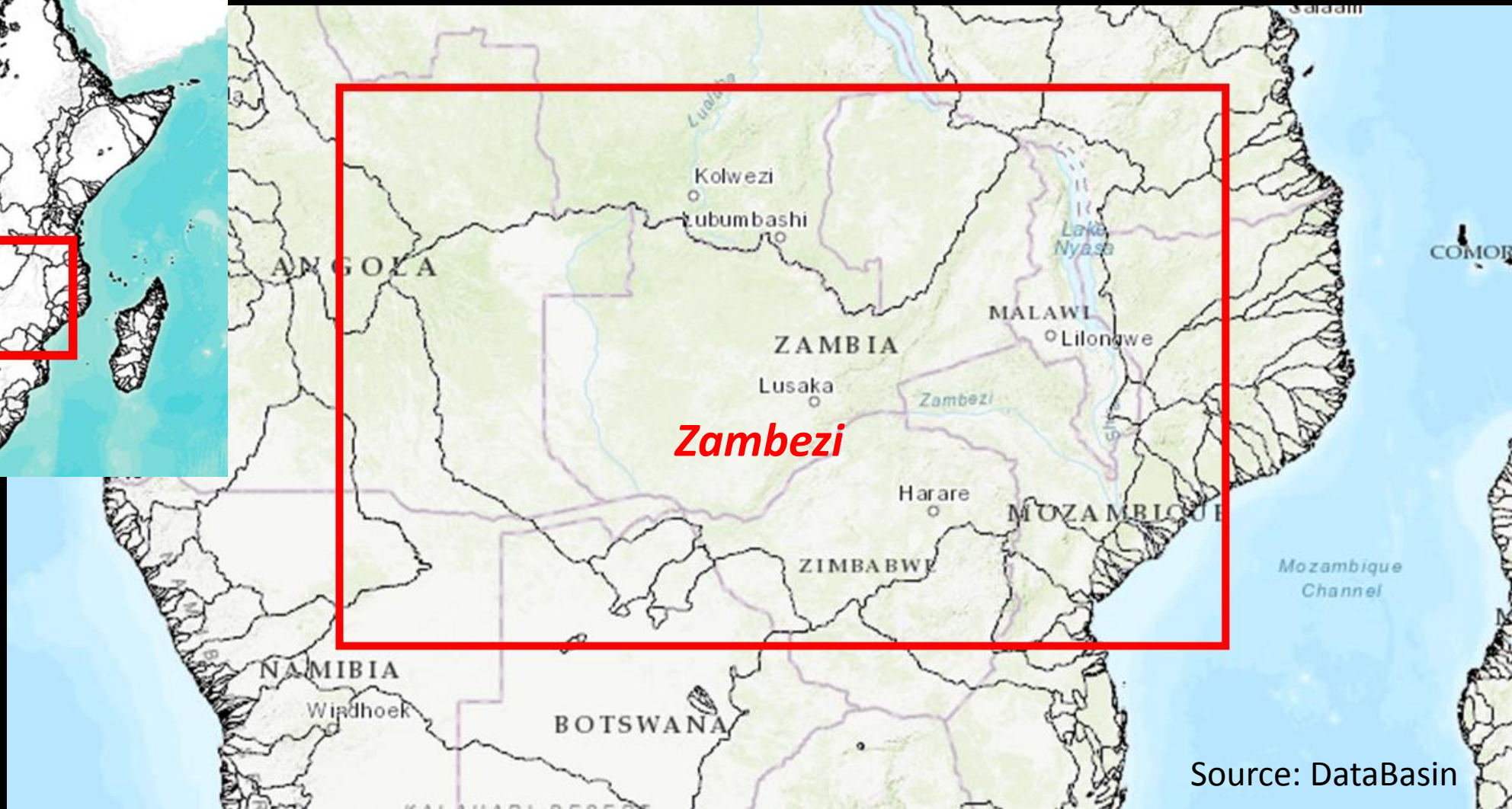






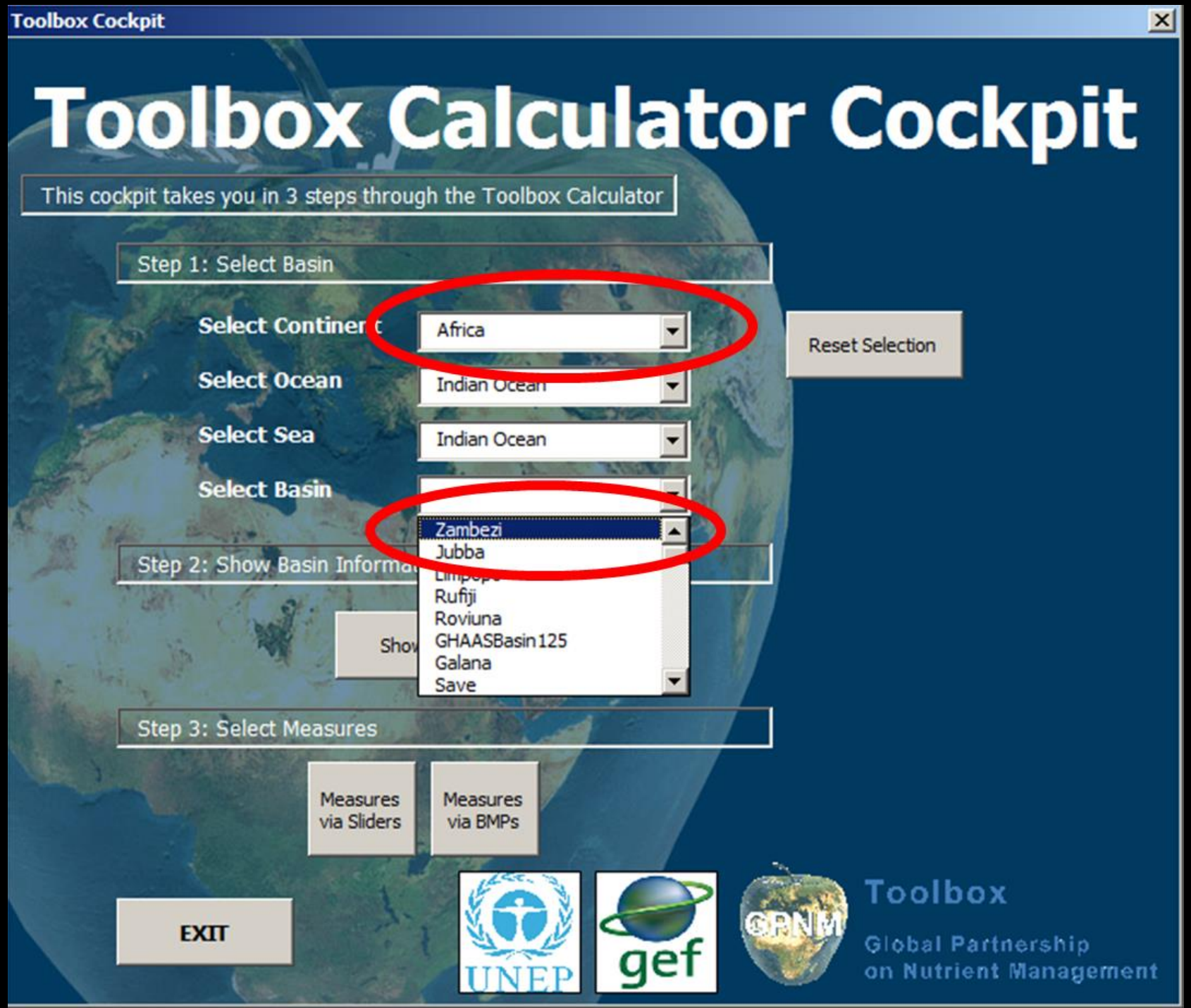
Let's explore!!
Example – Zambezi River





Source: DataBasin

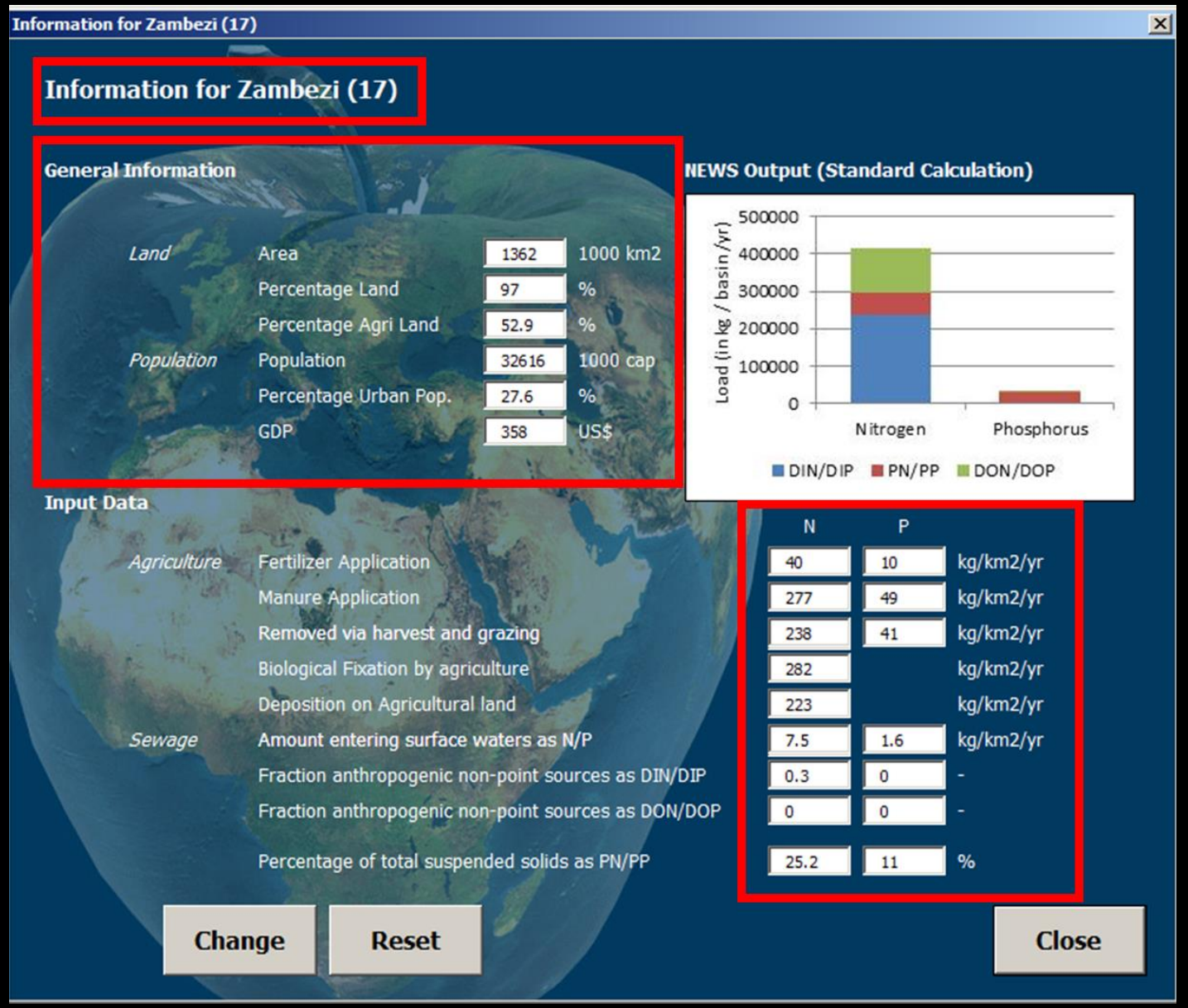
Opening screen
>>**Select the basin**



General information on basin of interest

- Input data on agriculture and sewage, total loadings of N and P in kg/basin/yr
- Data displayed represent default values from the Global NEWS model's 2000 baseline

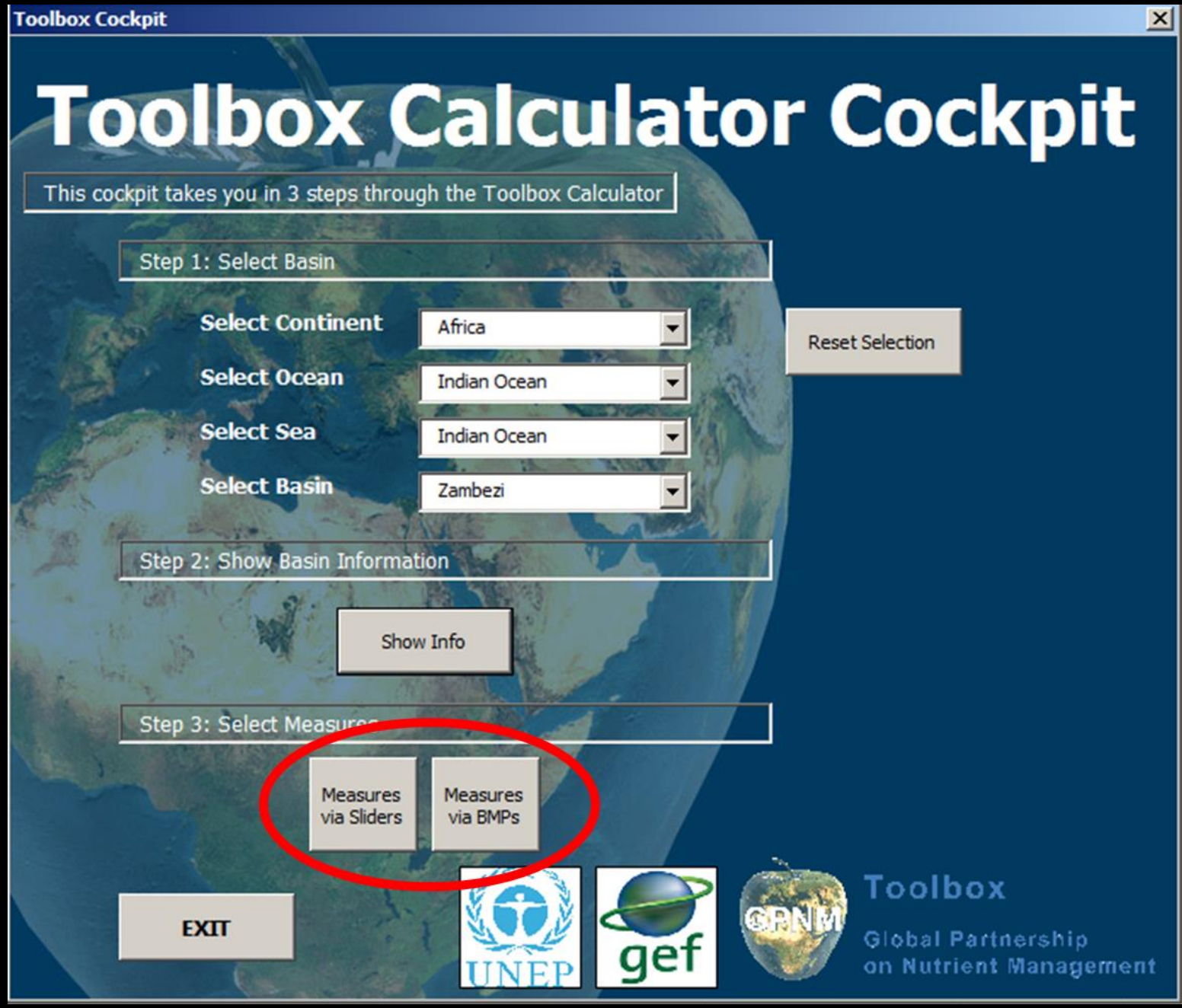
User may edit fields in white boxes if they have better data for the basin of interest. Default values may be returned by selecting the "Reset" button. Closing and re-opening the application will also reset the values.



Scenario evaluation

Two ways to evaluate scenarios

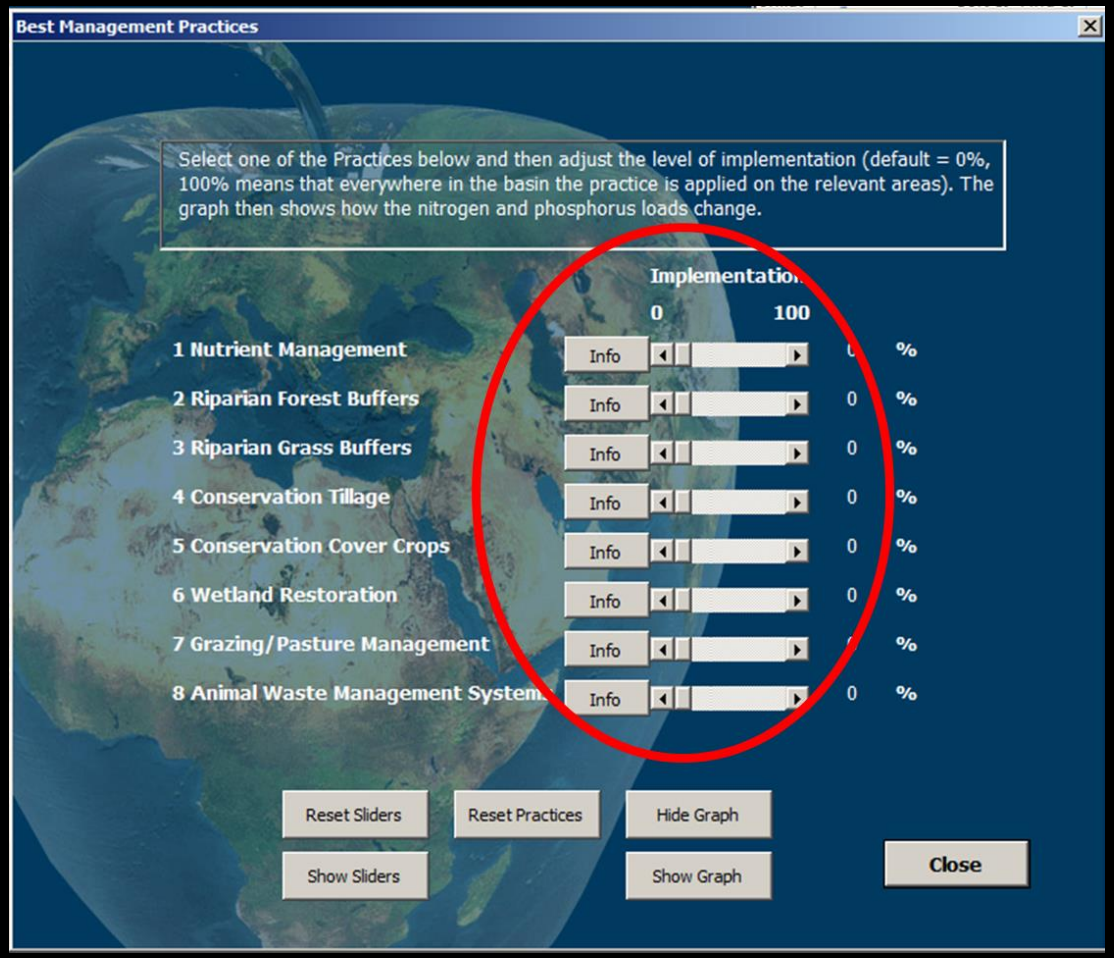
1. Measures via ‘sliders’
2. Measures via BMPs

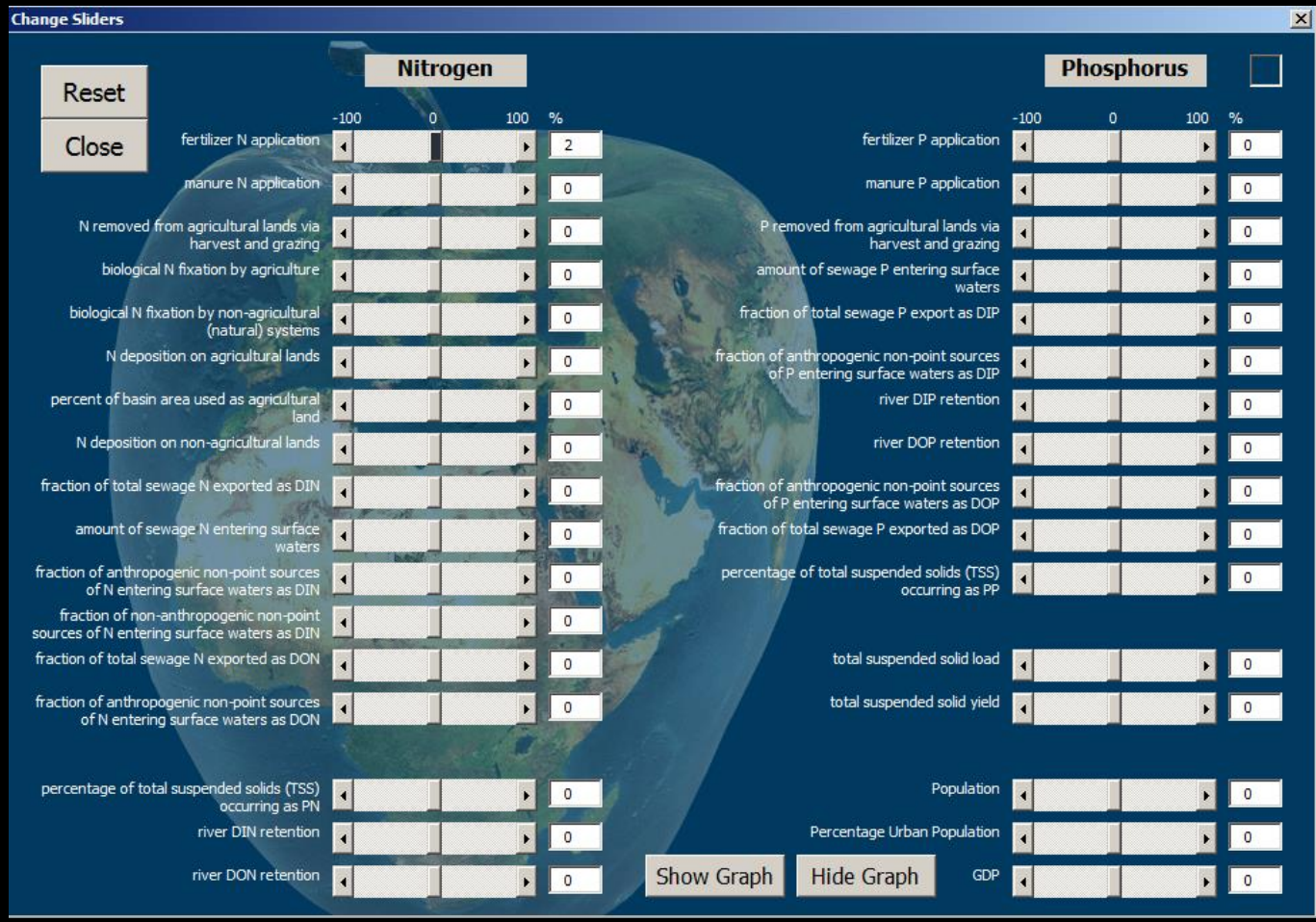


Scenario evaluation

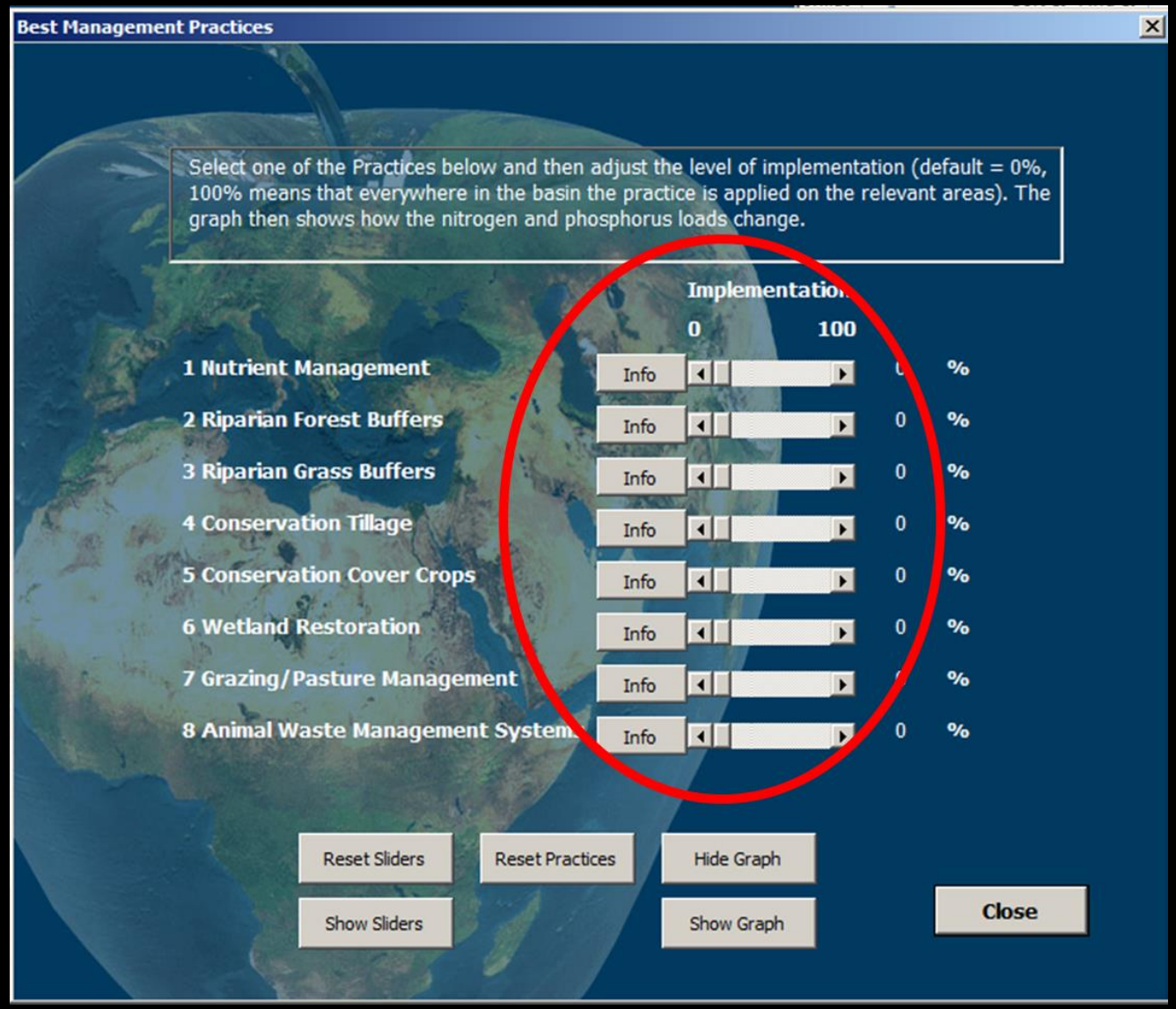
Measures via 'BMPs': User specifies level of implementation by % for up to eight agricultural best management practices (BMPs) within arable lands in basin. Does not include measures from the wastewater or other point sources.

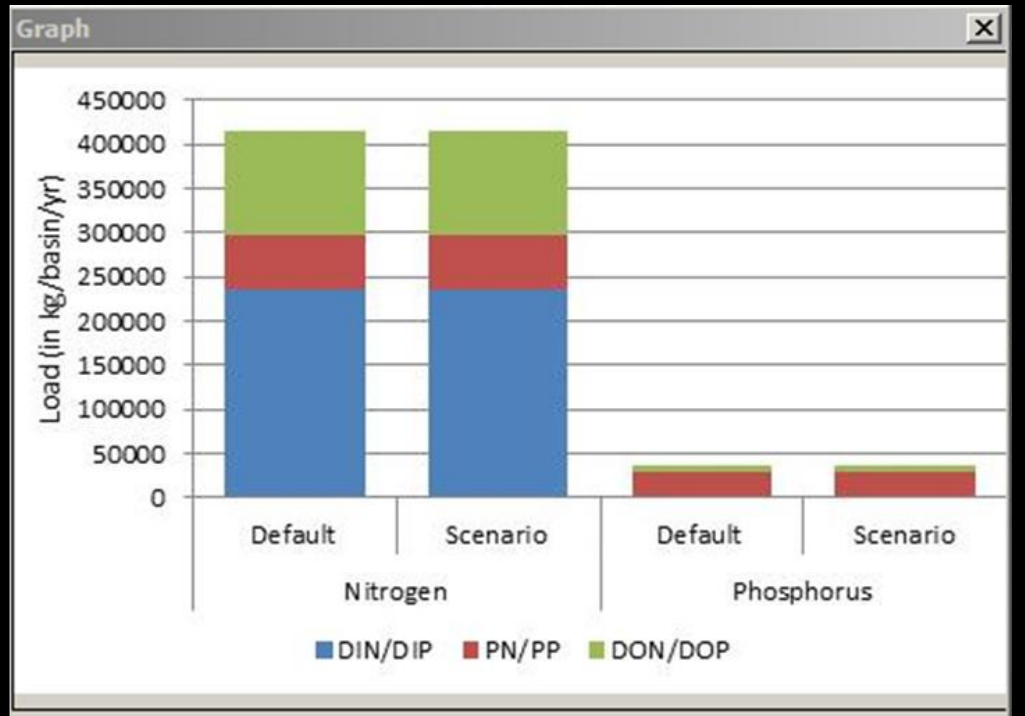
Measures via Sliders: Selection of actions by relative % of implementation to adjust N and P loads. These actions, in agriculture or wastewater sectors, include changes such as different fertilizer applications, varying biological nitrogen fixation and simulating the amount of sewage entering surface waters.





Scenario evaluation

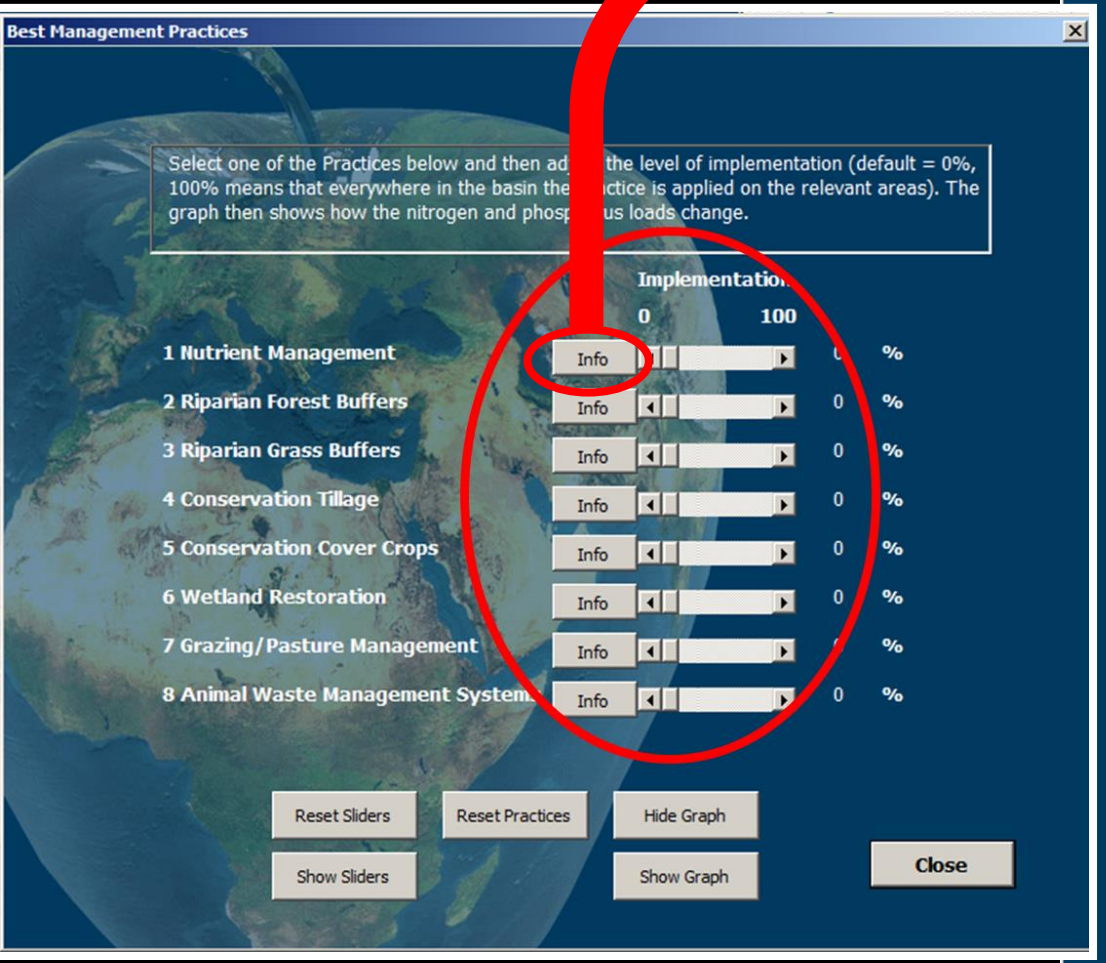


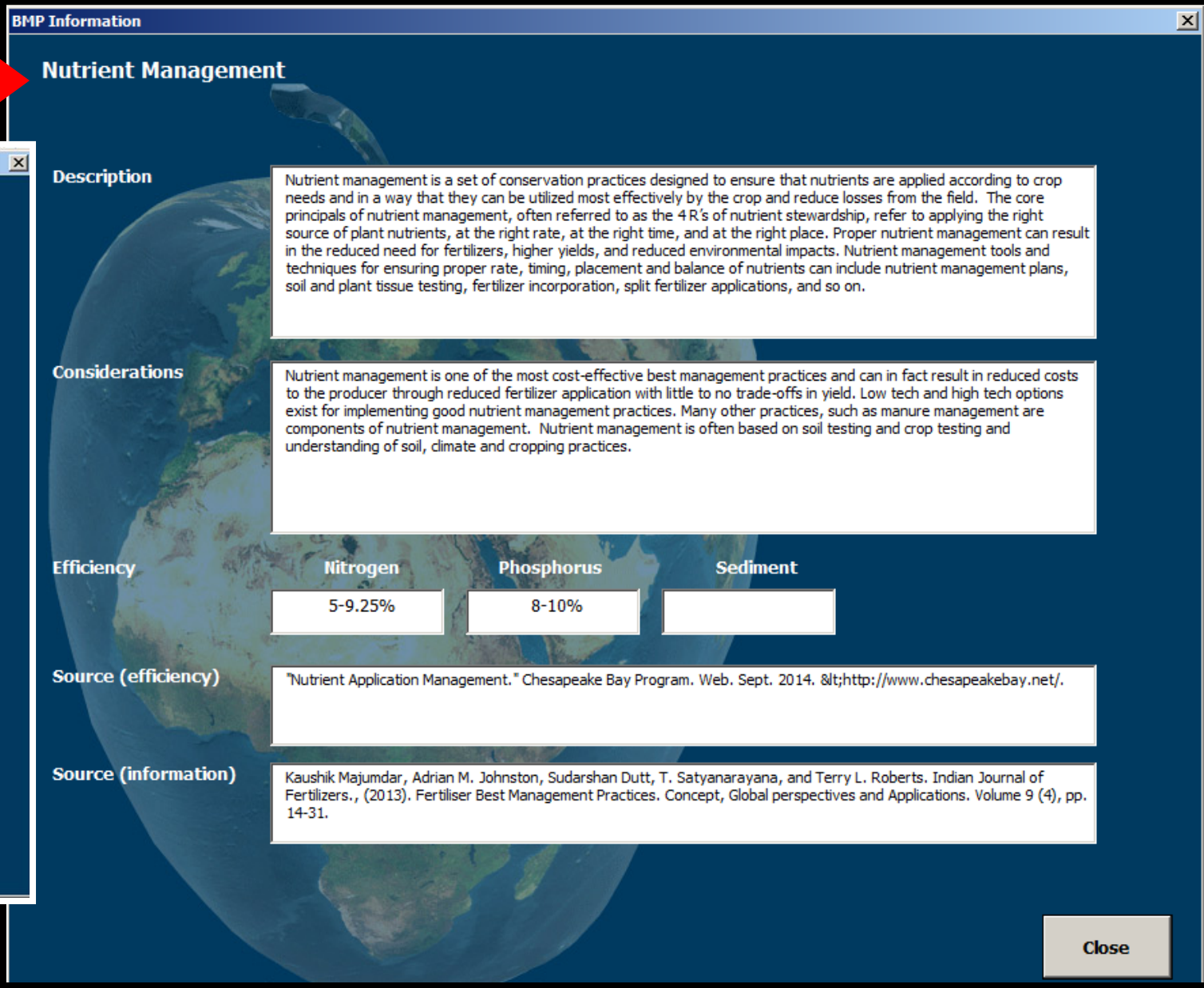


		DIN/DIP	PN/PP	DON/DOP	Total	
Nitrogen	Default	236586	61263	117494	415344	kg/basin/y
	Scenario	236586	61263	117494	415344	kg/basin/y
	Difference	0	0	0	0	%
Phosphorus	Default	2671	26662	6299	35633	kg/basin/y
	Scenario	2671	26662	6299	35633	kg/basin/y
	Difference	0	0	0	0	%
ICEP	Default	0.722		Scenario	0.722	

1. **Default** estimates of N and P
2. **Scenario** estimates – generated based on implementation of BMPs

Information on the best management practice

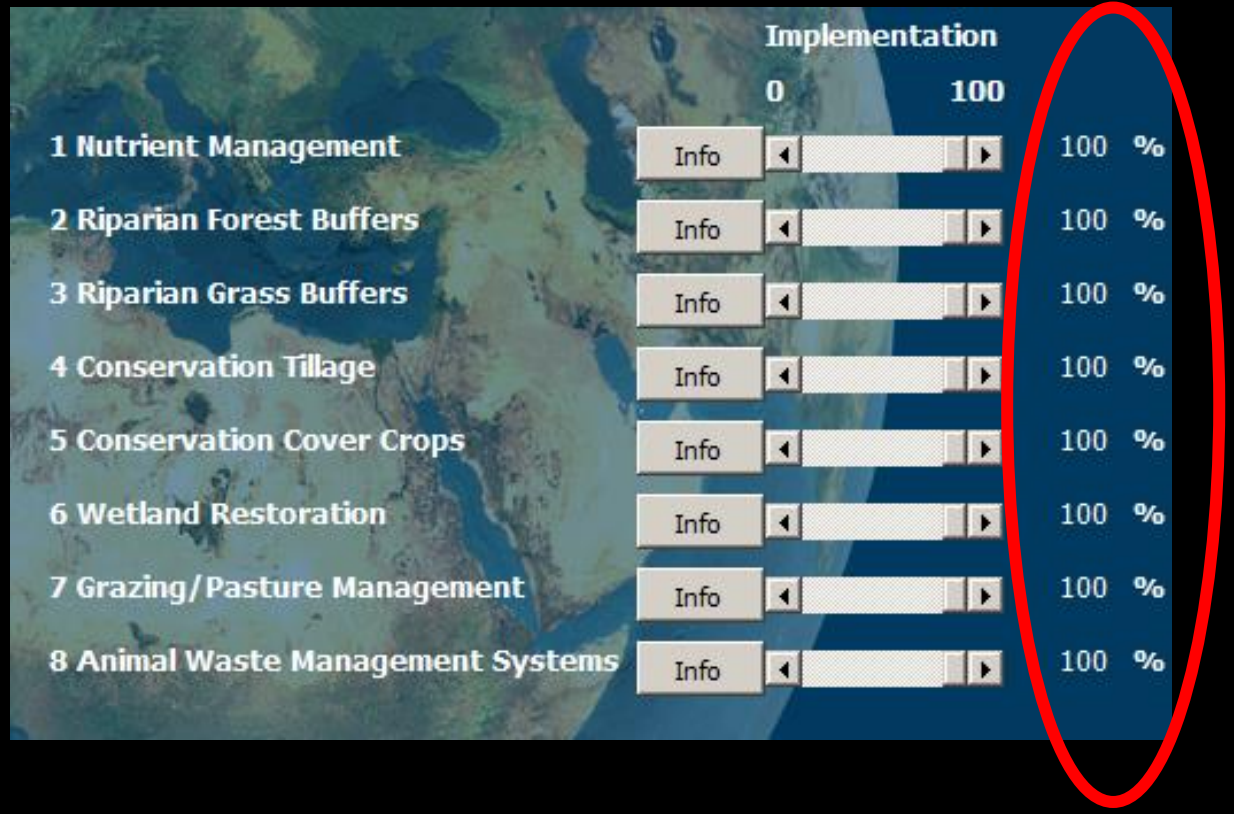


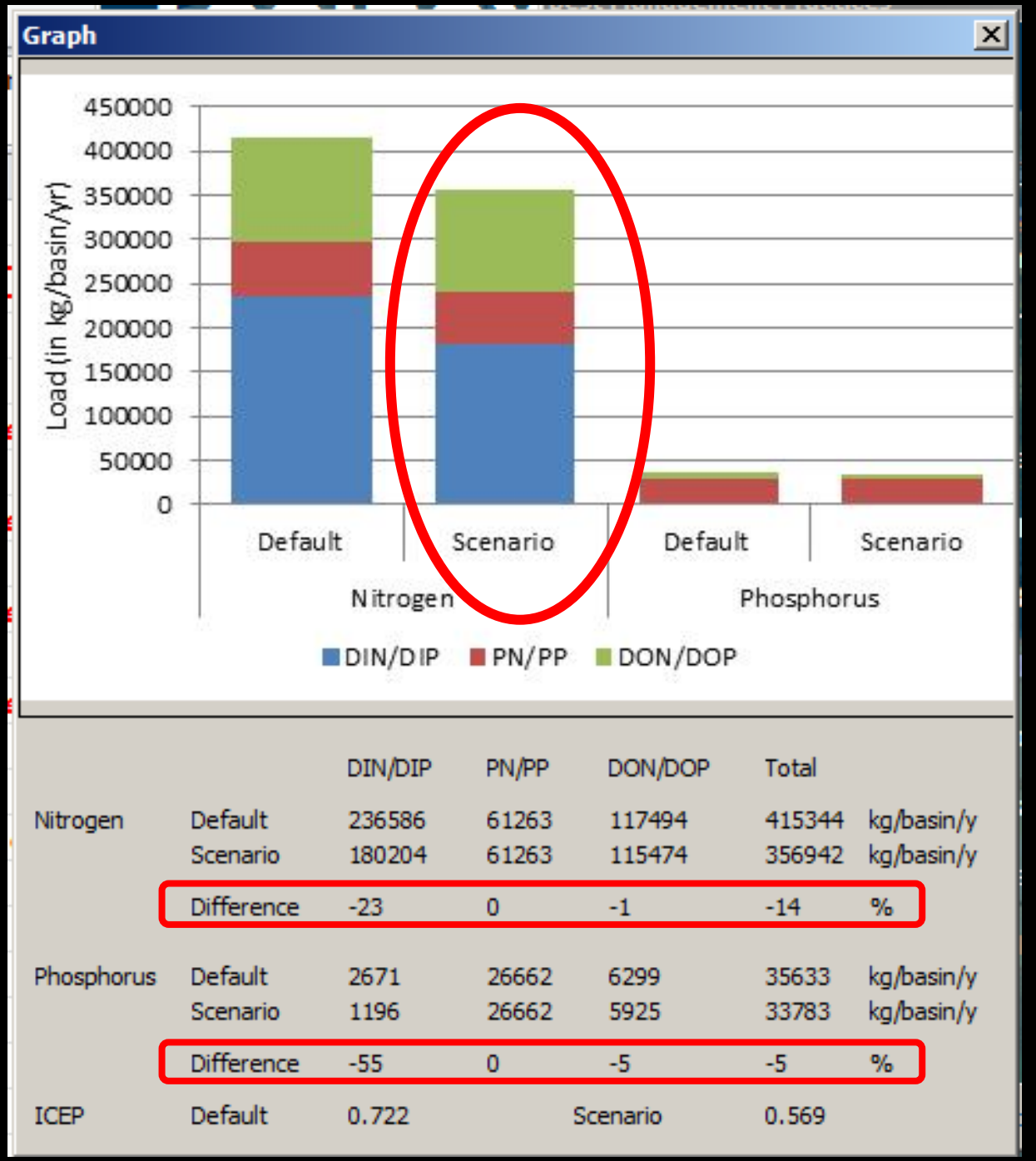


Measures via BMPs

Scenario evaluation

Move the sliders – In this case 100% implementation of best management practices





		DIN/DIP	PN/PP	DON/DOP	Total	
Nitrogen	Default	236586	61263	117494	415344	kg/basin/y
	Scenario	180204	61263	115474	356942	kg/basin/y
	Difference	-23	0	-1	-14	%
Phosphorus	Default	2671	26662	6299	35633	kg/basin/y
	Scenario	1196	26662	5925	33783	kg/basin/y
	Difference	-55	0	-5	-5	%
ICEP	Default	0.722		Scenario	0.569	

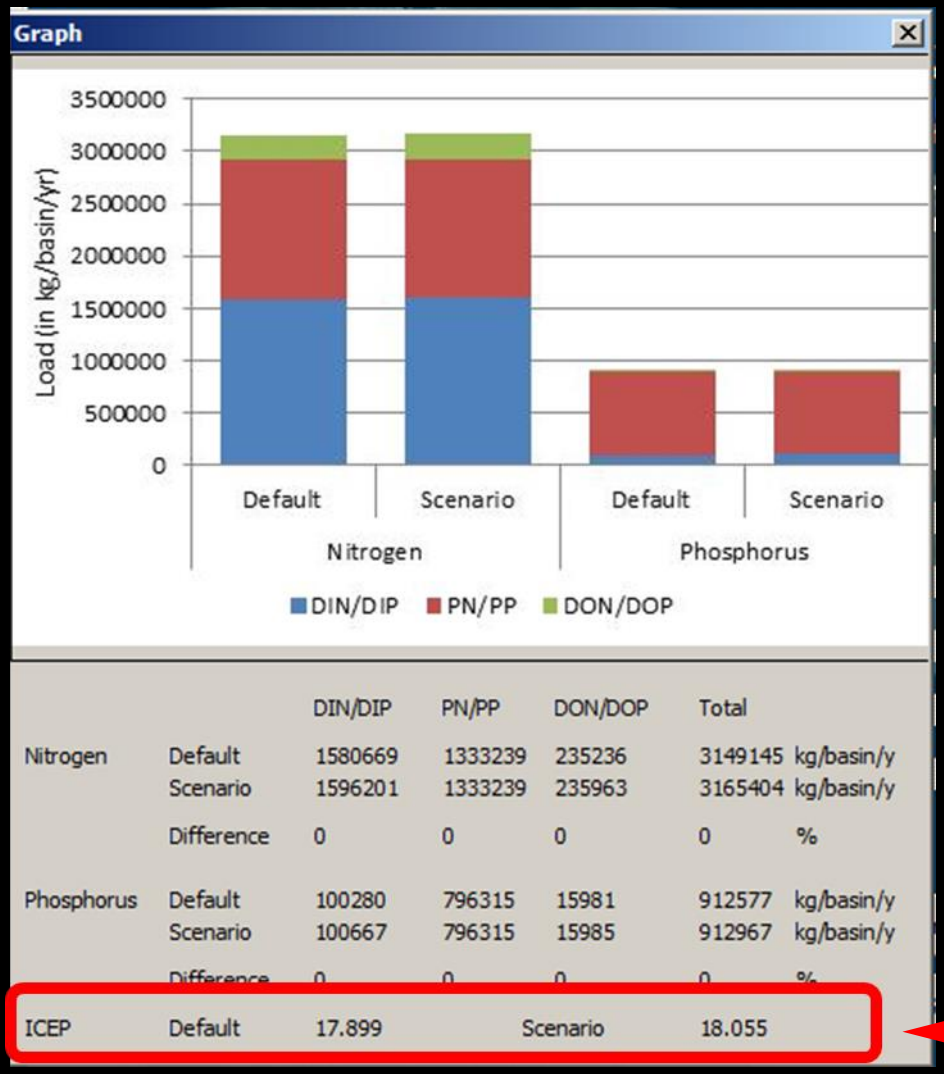
Predicting coastal eutrophication
Ecosystem impacts

- ICEP is an indicator for monitoring SDG target SDG 14.1
- **Indicate relative dominance between diatoms and algal species (leads to eutrophic conditions)**
- Positive ICEP values indicate this potential for harmful algal blooms or eutrophication.

- Researchers have suggested the following categorization - g**auge level of risk of eutrophication** in coastal waters
  - > 5: Highest risk
  - 1 to 5: High risk
  - 1 to -1: Medium risk
  - -1 to -5: Low risk
  - <-5: Lowest risk

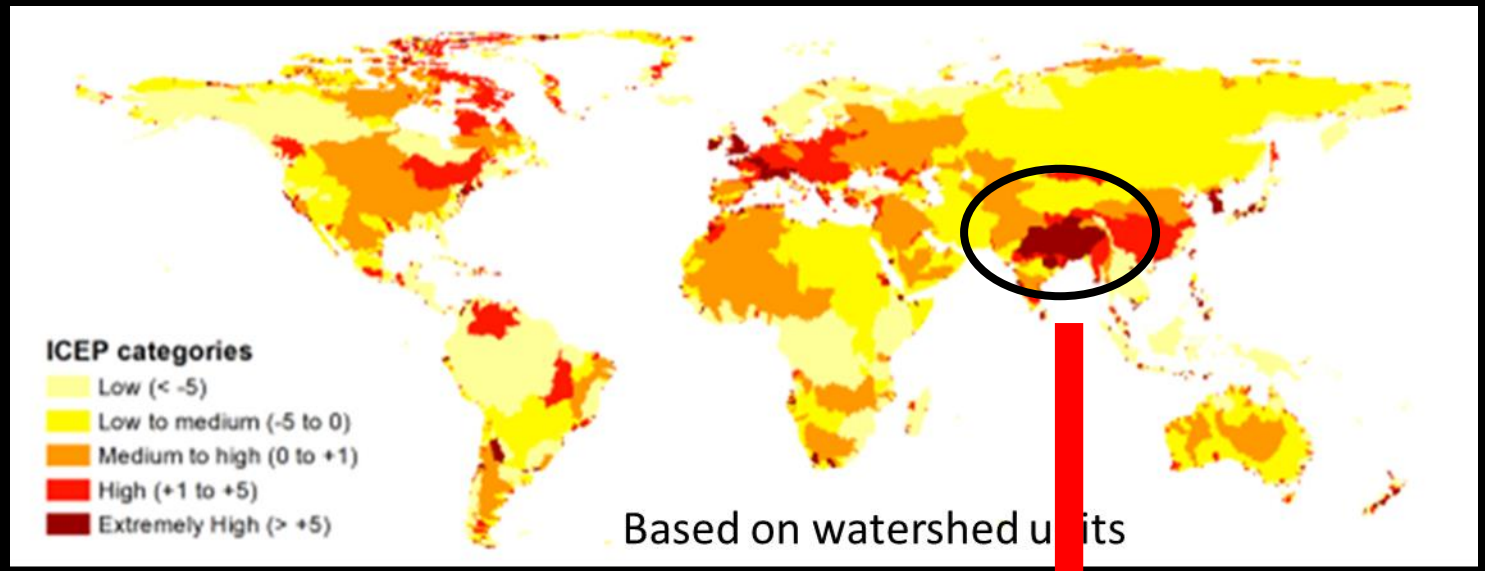
Predicting coastal eutrophication

Example of the **Ganges Basin**; high nutrient loading delivery



		DIN/DIP	PN/PP	DON/DOP	Total	
Nitrogen	Default	1580669	1333239	235236	3149145	kg/basin/y
	Scenario	1596201	1333239	235963	3165404	kg/basin/y
	Difference	0	0	0	0	%
Phosphorus	Default	100280	796315	15981	912577	kg/basin/y
	Scenario	100667	796315	15985	912967	kg/basin/y
	Difference	0	0	0	0	%
ICEP	Default	17.899		Scenario	18.055	

- **Index of Coastal Eutrophication Potential**
- Ratio between delivery of N, P and Si from watershed
- **ICEP value: 17.9 (> 5: Highest risk)**

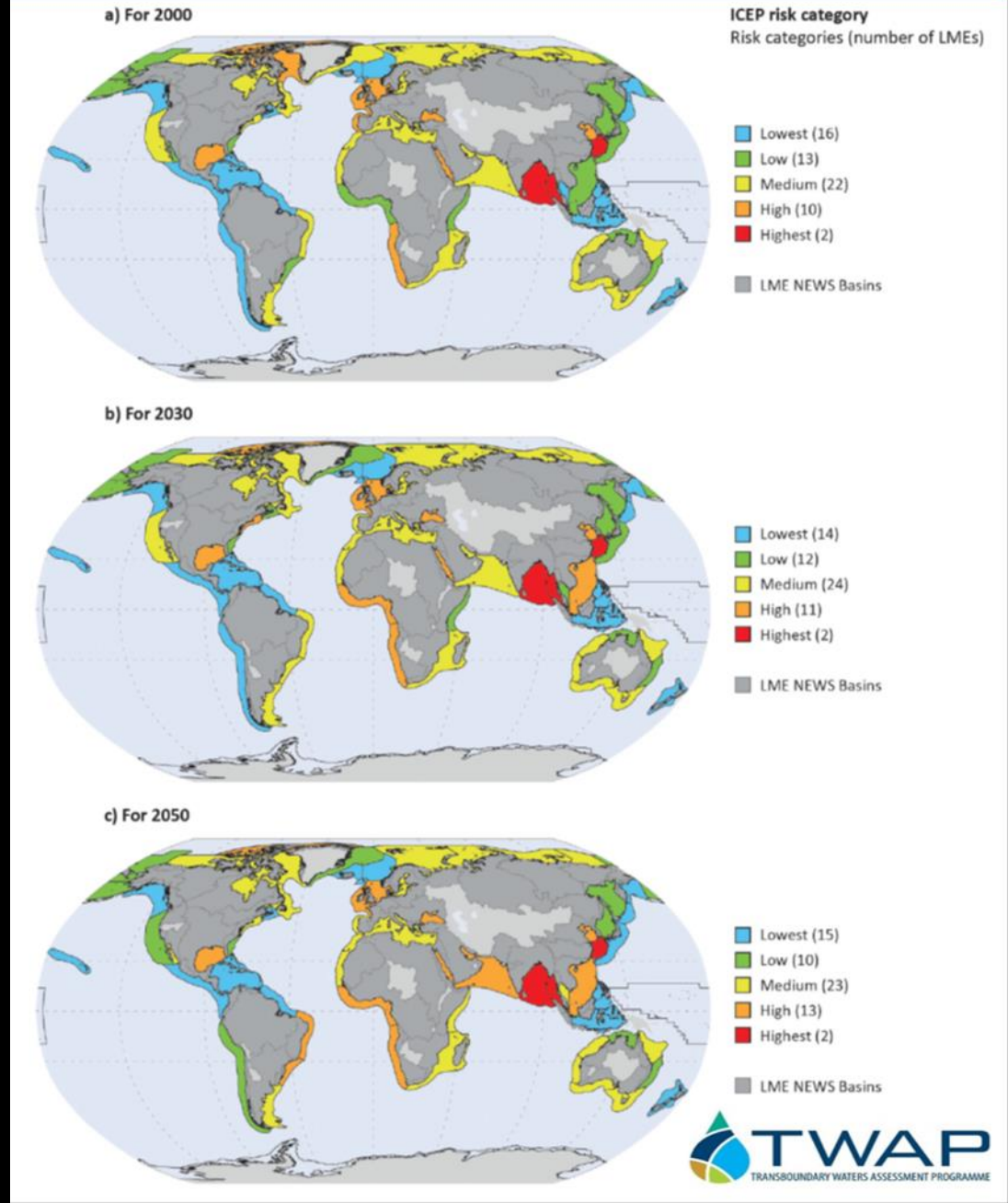


Predicting coastal eutrophication

Global-scale policy considerations

- Future scenarios by large marine ecosystems based on ICEP values (TWAP project)
- NOTE: the spatial influences over the LME is note uniform!
- (maps are illustrative)
- Impacts will be related to coastal ecosystems in receiving environments in river discharge areas
- Value: support regional-scale policy to address land-based pollution

Figure 7.12 Index of Coastal Eutrophication Potential (ICEP) risk categories for LMEs for a) 2000, b) 2030, and c) 2050. Based on the ratio of nutrients (N and P relative to Si) entering LMEs from rivers, potential for non-siliceous harmful algae blooms is 'high' or 'highest' in 12 LMEs. The risk is most evident in portions of southern and eastern Asia, Western Europe and Gulf of Mexico, although also applying to LMEs in a number of other regions. If current trends continue, the potential for non-siliceous harmful algae blooms will have increased in 12 LMEs by 2050 relative to 2000 conditions.



What can we take from this?

- Use tool as a starter for understanding LBS loading from point and non-point sources from river basins
- Contribute to work in improving the tool
- Developers collaborating to expand functionality to allow users to include local data
- Use in conjunction with local datasets
- Contributions to the SDG target 14.1; also 6.3 on freshwater quality
- Contribute to the LBSA protocol

Contribution to… SUSTAINABLE DEVELOPMENT GOALS

Core SDG targets

- Target 6.3 – good ambient water quality
- Target 14.1 – reduced nutrient pollution in the marine environment

Resources and contact information

Collaborators in GPNM Toolbox development and support

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Global NEWS Model development, nutrient modelling

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For more information visit us at

https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/addressing-land-based-pollution

UN environment

United Nations Environment Programme

GPA

Global Programme of Action for the Protection of the Marine Environment from Land-based Activities