



WORLD
RESOURCES
INSTITUTE



GLOBAL TOOLBOX FOR NUTRIENT MANAGEMENT

GEF IWC8 • Nutrient Management Training Roundtable
May 9, 2016

SARA WALKER

INTRODUCTION TO THE TOOLBOX






The purpose of the toolbox is to demonstrate policy and technological options, which offer potential solutions for managing nutrients to decision makers and practitioners alike.



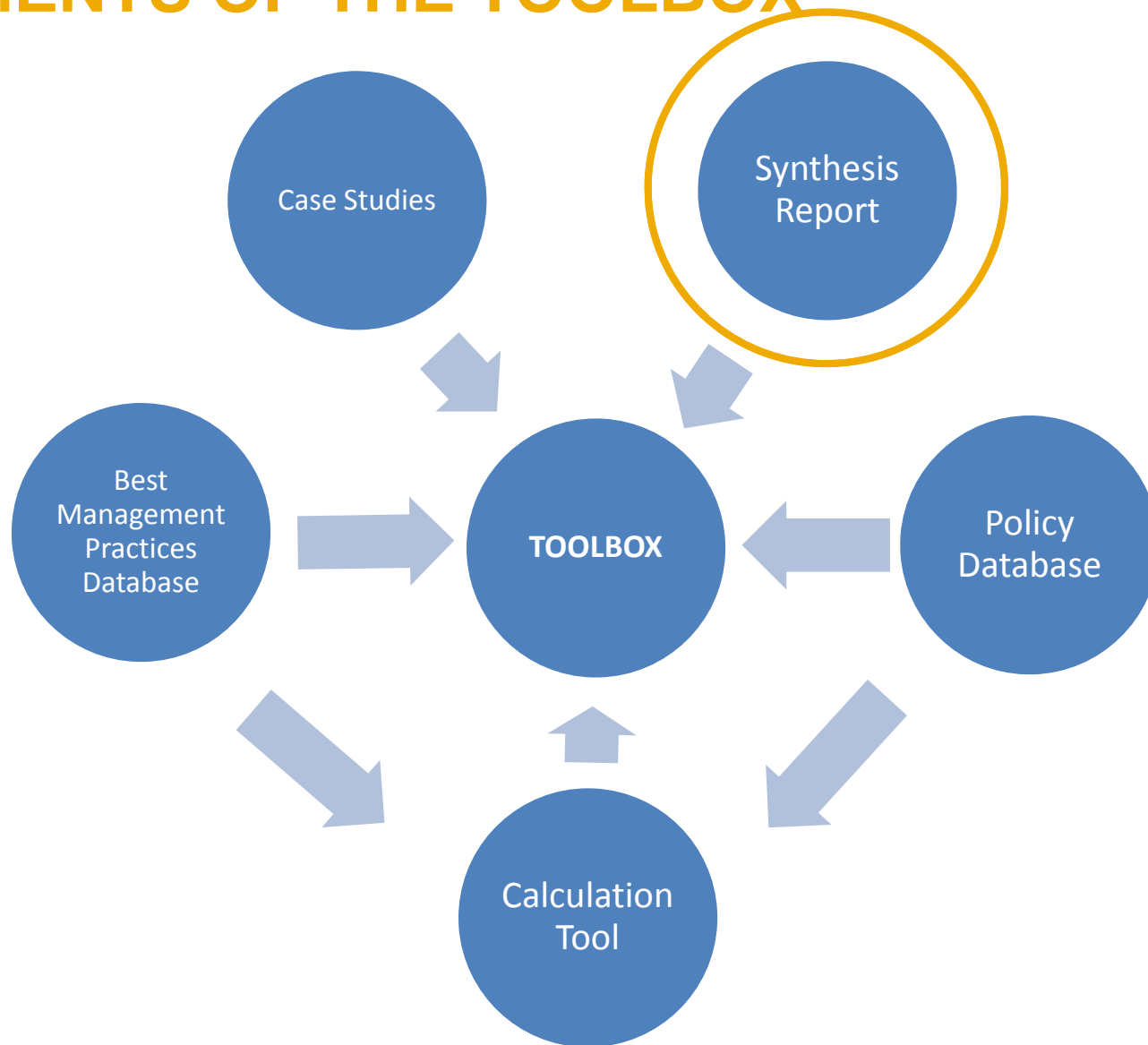
THE TOOLBOX CAN HELP TO MEET SUSTAINABLE DEVELOPMENT GOALS

Sustainable nutrient management and the



- **Goal 2:** Incorporate concept of nutrient use efficiency (NUE) where application of nitrogen and phosphorous fertilizers are based on plant requirements, and that there is adequate nutrient replenishment to mitigate soil degradation.
- **Goal 6:** Minimize excessive nutrient (reactive nitrogen and phosphorous) leakage to the environment to reduce adverse environmental conditions and pollution; Encourage nutrient recycling e. g. wastewater reuse and capture of nutrients for recycling into other productive sectors - strengthen circular economies and enhance cleaner production efforts.
- **Goal 13:** Reduce airborne emissions from volatilized nitrogen compounds (with greenhouse gas potential) released from agricultural and livestock production systems in particular. An emerging issue is the potential increasing persistence and occurrence of prolific harmful algal blooms triggered by altered ocean and surface water body dynamics.
- **Goal 14:** Reduce nutrient loading to the marine environment from land-based sources that include agricultural runoff (crop and livestock production), discharge of untreated domestic and industrial wastewater.
- **Goal 15:** Enhance nutrient use efficiency toward reducing land degradation where nutrient removal through crop/biomass harvest exceeds replenishment.

ELEMENTS OF THE TOOLBOX



SYNTHESIS REPORT



Water Stewardship
Improving Water Quality
Sustaining Agriculture



Analysis, Synthesis and Interpretation

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

Prepared for GETF as part of the Global Partnership 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 module¹.

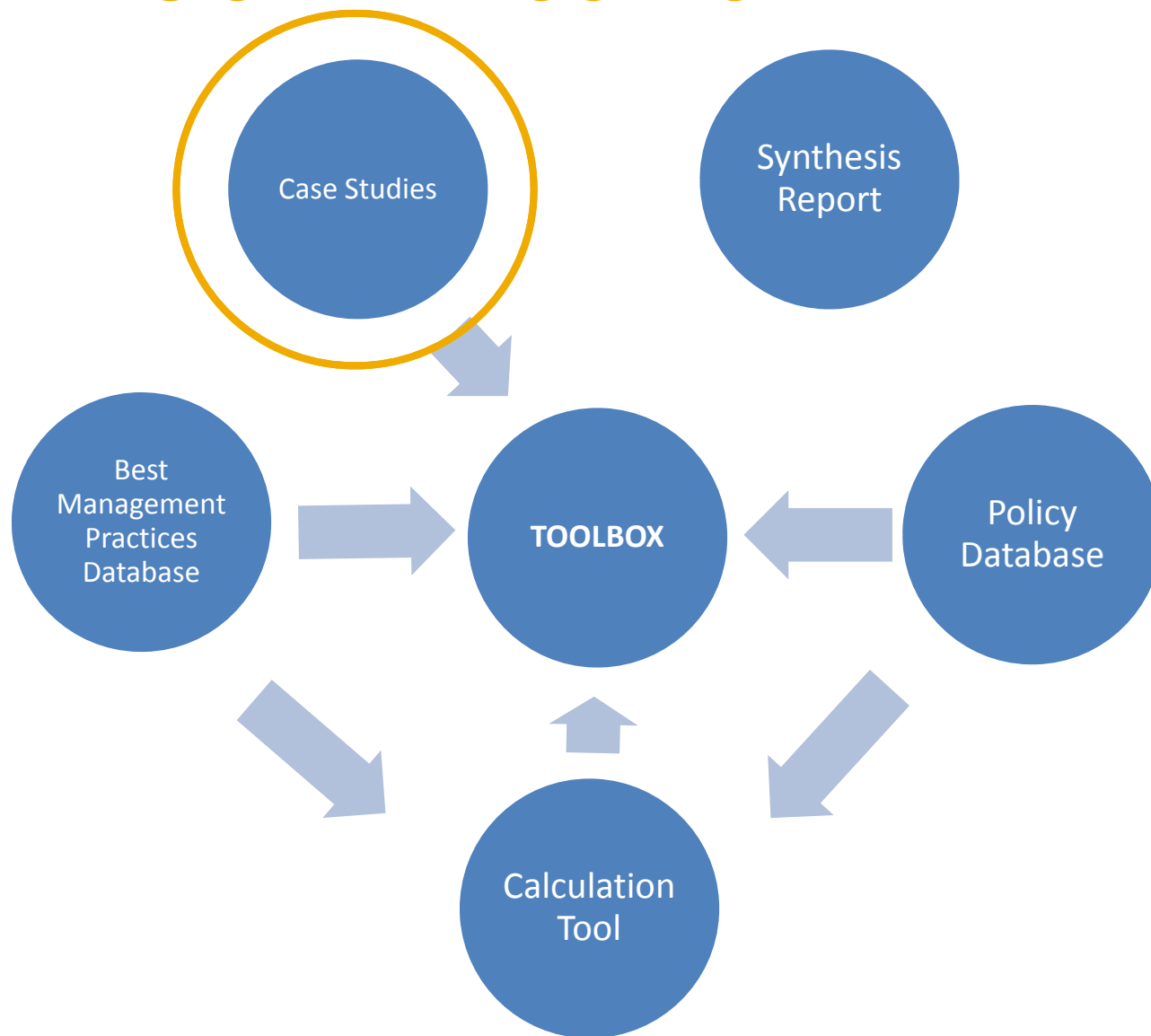
Previously, Water Stewardship recognized eight priority Best Environmental Practices (BEPs). These practices were determined under the Global Environment & Technology Foundation’s (GETF) execution of Component C: Policy Toolbox Development of the Full Size Global Environment Facility project “Global 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

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.pdf



ELEMENTS OF THE TOOLBOX




CASE STUDIES

Case Studies

[Home](#) > [Resources](#) > [Case Studies](#)

Romania: Agricultural Pollution Control Project



Name: Romania: Agricultural Pollution Control Project

Location/Terrain: The aim is to design an integrated intervention covering the entire nation; the pilot project is in Calarasi County.


Crop(s): Various Crops and Livestock

Nutrient(s): Inappropriate storage and use of livestock manure and lack of nutrient management systems.

Rationale: Agricultural and household nutrients and other agricultural pollutants discharged into the Danube River and Black Sea.

[Romania Agricultural pollution Control Project.pdf](#)

Riparian Buffer Strips Perform Well In Iowa Study



Name: Riparian Buffer Strips Perform Well in Iowa Study

Location/Terrain: Bear Creek, Story County, Iowa


Crop(s): Nonspecific cropland near water sources

Nutrient(s): Nitrate and Phosphorous

Rationale: Use riparian buffer strips to reduce nitrate and phosphorous runoff.

[Riparian Buffer Strips Perform well in Iowa Study.pdf](#)

The Right Source And Rate Of Potassium (K) For Processing Tomatoes



Name: The Right Source and Rate of Potassium (K) for Processing Tomatoes

Location/Terrain: Xinjiang, China

Crop(s): Tomatoes

Nutrient(s): Potassium (K)

Rationale: Due to years of omission of K in nutrient management in production of tomatoes in the region, yields were restricted by inadequate K.

CASE STUDIES

GLOBAL PARTNERSHIP ON NUTRIENT MANAGEMENT BMP Case Study

Overview

Name: Croatia: Agricultural Pollution Control Project

Location/Terrain: Croatia: Danube River basin

Crop(s): Various crops and livestock

Nutrient(s): Nutrient overloading from fertilizers, especially nitrates

Rationale: Reduce nutrient discharge from agricultural source to surface and ground water bodies.



Issue(s) of Concern/Challenges:

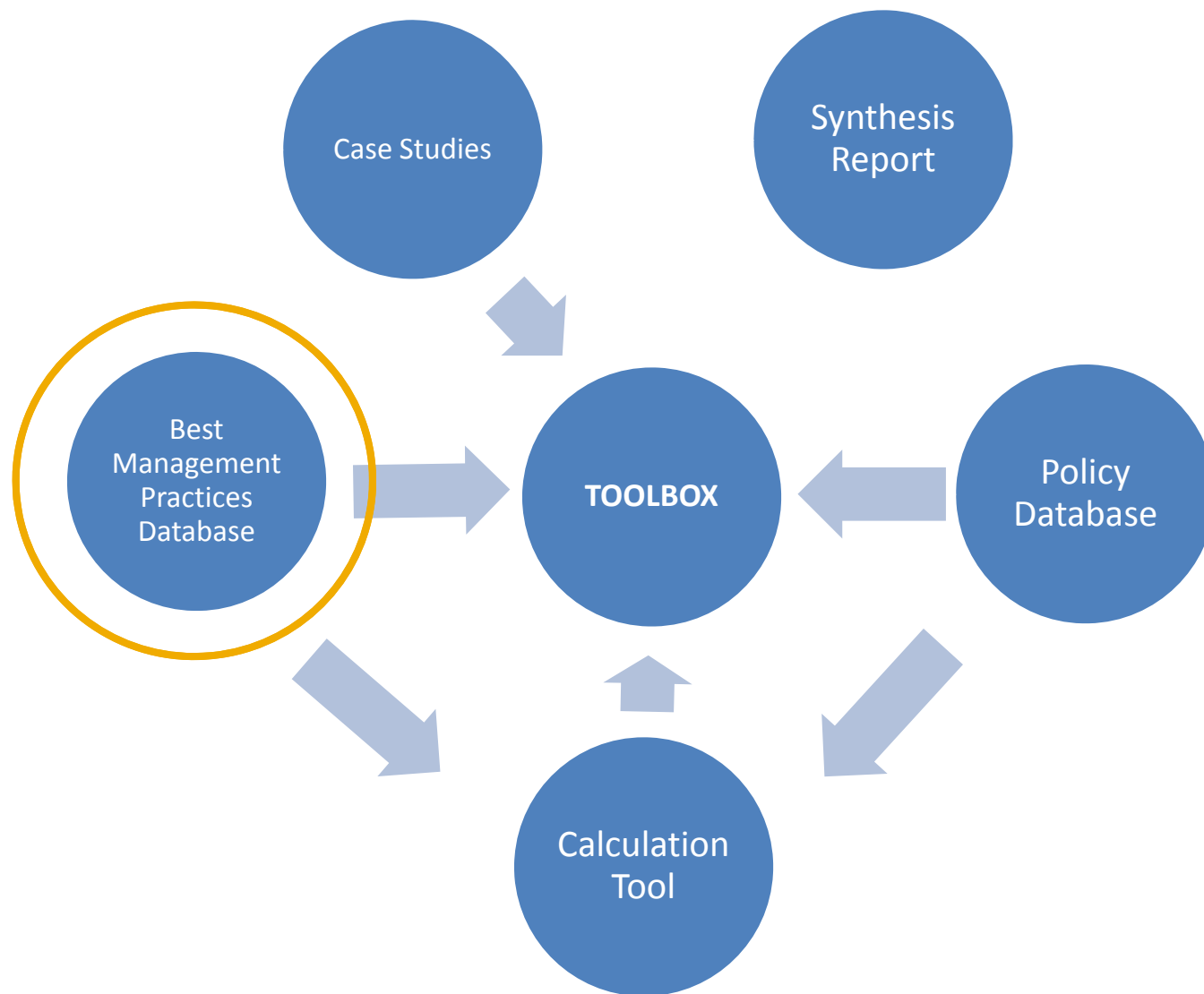
The heavy use of fertilizers, soil erosion and compaction, poor maintenance of soil organic matter, small numbers of households/farms familiar with good agricultural practices and no subsidies for environmentally friendly farmers has led to nutrient discharges infiltrating into surface and ground water bodies.

Practice Objectives:

To significantly increase the use of environmentally friendly practices by farmers in the Danube River basin in order to reduce nutrient discharge

Practice Description:

ELEMENTS OF THE TOOLBOX



BEST MANAGEMENT PRACTICES DATABASE

Practices searchable by: sector

Agriculture

Urban

Practices searchable by: category

- Conservation buffers
 - Erosion control
 - Drainage control
 - Irrigation management
 - Grazing management
 - Wetland creation
 - Etc.
- Detention
 - Filtration
 - Infiltration
 - Septic management
 - Urban erosion control
 - Urban stream restoration
 - Etc.

BEST MANAGEMENT PRACTICES DATABASE

Practices searchable by: climatic zone

Arid	Tropical
Semiarid	Temperate

Practices searchable by: land use/agriculture type

Animal confinement	Rice
Fodder	Row crop
Palm oil	Small grains
Pasture	

Practices searchable by: scalability to small farms

Only show practices scalable to small farms? ☐

BEST MANAGEMENT PRACTICES DATABASE

BMP Database

This database provides an inventory of best management practices (BMPs) related to nutrient management. The BMPs in this database are categorized into two main sectors, agriculture and urban. Each sector has a series of associated BMP categories (listed below). Users can also search BMPs by specific climactic zones (arid, semiarid, tropical, temperate). Agricultural sector BMPs are further categorized by landuse/agriculture type and their scalability to small/limited resource farms.

[Read more about the BMPs and the categories that were used.](#)

BMPs Search Template

Sector Type

Agricu... ▼

BMP Category

Climatic Zone

x Tropical

Agriculture Types

x Rice
Animal Confinement
Fodder
Palm Oil
Pasture
Row Crop
Small Grains

Only show practices to small farms?

☐

Text Search

Search

Reset

[Download: My Results](#) | [All BMPs](#)

← Previous

1

2

3

4

Next →

BEST MANAGEMENT PRACTICES DATABASE

— Previous 1 2 3 4 Next →

Leaf Color Chart (Real Time Nutrient Management)

Category: Nutrient Management

Practice Type: Management

Landuse/Agriculture Type: Rice

Climatic Zones: Tropical

Regions: South Asia

Pollutants Treated: Nitrogen

Description: The Leaf Color Chart (LCC) is a simple and inexpensive tool that relates the color of rice leaves to critical nitrogen content and allows for real time nitrogen management. LCC-based real time nitrogen management can be practiced in rice production by monitoring leaf color in 7 to 10 day intervals during the growing season.

Fertilizer N is applied wherever the leaves are less greenish than the threshold LCC value, which corresponds to critical leaf N content. LCC-based real time N management maintains optimal yields and results in higher N-use efficiency and less N applied as compared to using blanket N application recommendations.¹

Implementation Considerations: The LCC was originally developed for rice production, but has also been adapted to maize and wheat production. It is an extremely low-cost and accessible test for measuring nitrogen deficiencies in real time.

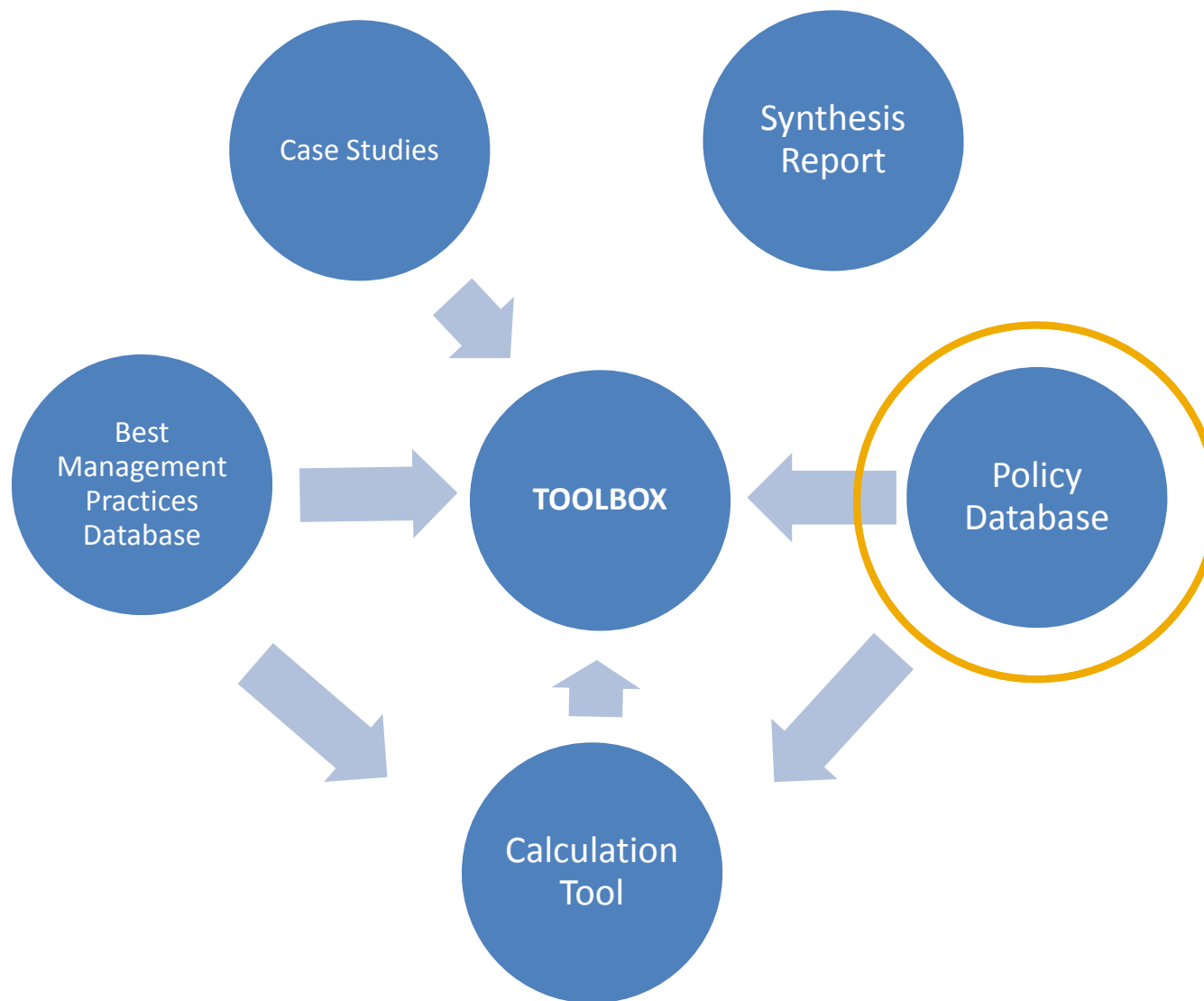
Scalable to small farms? Yes



Leaf Color Chart (LCC) for Fertilizer N Management in Rice. Photo courtesy of Bangladesh Rice Knowledge Bank/IRRI.

¹ T.K. Srivastava, A.K. Singh and V. Visha Kumari. Indian Journal of Fertilizers., (2013). Fertiliser Best Management Practices in Sugarcane. Volume 9 (4), pp. 96-108

ELEMENTS OF THE TOOLBOX




POLICY DATABASE

Policies searchable by: category

- Environmental outreach & education
- Regulatory approaches
- Price-based instruments
- Market-based instruments
- Ecosystem restoration and protection
- Institutions & capacity
- Research, monitoring, & evaluation

POLICY DATABASE

Policies searchable by: type

- Environmental outreach & education
 - **Regulatory approaches**
 - Price-based instruments
 - Market-based instruments
 - **Ecosystem restoration and protection**
 - Institutions & capacity
 - Research, monitoring, & evaluation
- 
- The diagram uses blue curly braces to group sub-categories under four main policy types. For 'Regulatory approaches', the sub-categories are environmental bans and restrictions, environmental standards, environmental caps & limits, and regulatory frameworks. For 'Price-based instruments', the sub-category is regulatory frameworks. For 'Market-based instruments', the sub-categories are ecosystem restoration, protected areas, land purchases, covenants & easements, and stewardship agreements. For 'Ecosystem restoration and protection', the sub-categories are land purchases, covenants & easements, and stewardship agreements.
- environmental bans and restrictions
 - environmental standards
 - environmental caps & limits
 - regulatory frameworks
 - ecosystem restoration
 - protected areas
 - land purchases
 - covenants & easements
 - stewardship agreements

POLICY DATABASE

Practices searchable by: region

Asia	North America
Europe	Oceania
Middle East	South America

Practices searchable by: sector

Agriculture	Transport
Aquaculture	Urban
Fisheries	Wastewater
Mixed	

POLICY DATABASE

Policy Database

This policy database provides an overview of various policy instruments around the globe that have been implemented to address nutrient pollution. The database includes a wide range of policies that decision-makers can reference when considering options and approaches to reduce nutrient losses and can be searched by policy category, policy type, region, country and/or sector. Policies are categorized as follows (policy taxonomy borrowed from Greenhalgh & Selman 2014):

Policies Search Template

Category	<input type="text" value="Price-Based Instruments"/>
Policy Type	<input type="text" value="× Subsidies, Grants & Incentive Payments"/>
Region	<input type="text" value="× Asia"/>
Sector	<input type="text" value="× Agriculture"/>
Text Search	<input type="text"/>
<input type="button" value="Search"/> <input type="button" value="Reset"/>	

POLICY DATABASE

Download: [My Results](#) | [All Policies](#)

Direct Payments for Environmentally Friendly Farming

Category: Price-Based Instruments

Policy Type: Subsidies, Grants & Incentive Payments

Sector: Agriculture

Region: Asia

Country: South Korea

Description: Korea's direct payments for environmentally friendly farming were introduced in 1999 to compensate for the reduction of yields brought by the adoption of environmentally friendly farming practices. State government provides supports to local governments to finance facilities and equipment in designated environmentally friendly farming areas. In addition, a pilot program providing direct payments for environmentally friendly livestock practices was introduced in 2004. It was continued for nine hundred livestock-producing farm households with a budget of KRW 5.8 billion (USD 6 million) in 2006.

Outcome: During the period 2001-2005, 191 environmentally friendly areas were built up. In 2006, the payment per hectare for environmentally friendly farming was increased to between KRW 524 and 794,000 (USD 548 to 831) for dry fields and between KRW 217 and 392,000 (USD 227 to 410) for paddy fields. About 27,000 farm households who produced low-chemical, chemical-free and organic products received total payments of KRW 11.4 billion (USD 11.9 million) in 2006.

Reference: [Direct Payments for Environmentally Friendly Farming](#)

Organic Agriculture Act of 2010

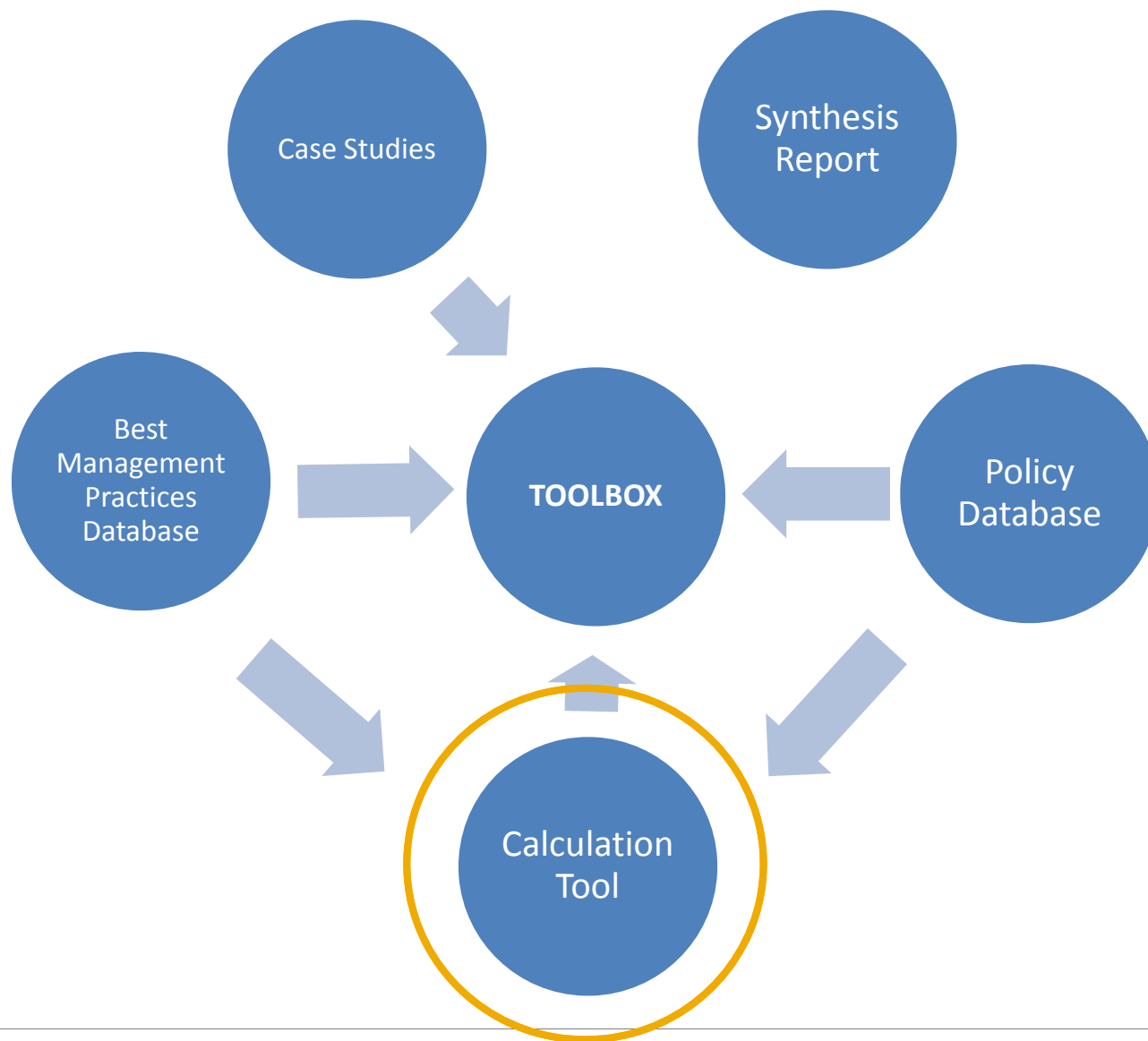
Category: Price-Based Instruments

Policy Type: Subsidies, Grants & Incentive Payments; Tax Credits & Rebates

Sector: Agriculture

Region: Asia

ELEMENTS OF THE TOOLBOX



CALCULATION TOOL

- Estimates nutrient export from major river basins globally
 - Based on Global NEWS model
 - Local level evaluation possible with local data inputs
- Evaluates alternative scenarios for managing nutrients across sectors

CALCULATION TOOL

Step 1

User defines area of interest:

- Continent
 - Ocean
 - Sea
 - Basin

CALCULATION TOOL

Toolbox Cockpit

Toolbox Calculator Cockpit

This cockpit takes you in 3 steps through the Toolbox Calculator

Step 1: Select Basin

Select Continent: South Asia

Select Ocean: Pacific Ocean

Select Sea: Pacific Ocean

Select Basin: Mekong

Reset Selection

Step 2: Show Basin Information

Chang Jiang

Amur

Huang He

Colorado (Ari)

Mekong

Columbia

Zhujiang

HUN/Liao

Show

Step 3: Select Measures

Measures via Sliders

Measures via BMPs

EXIT

UNEP

gef

GPNM

Toolbox

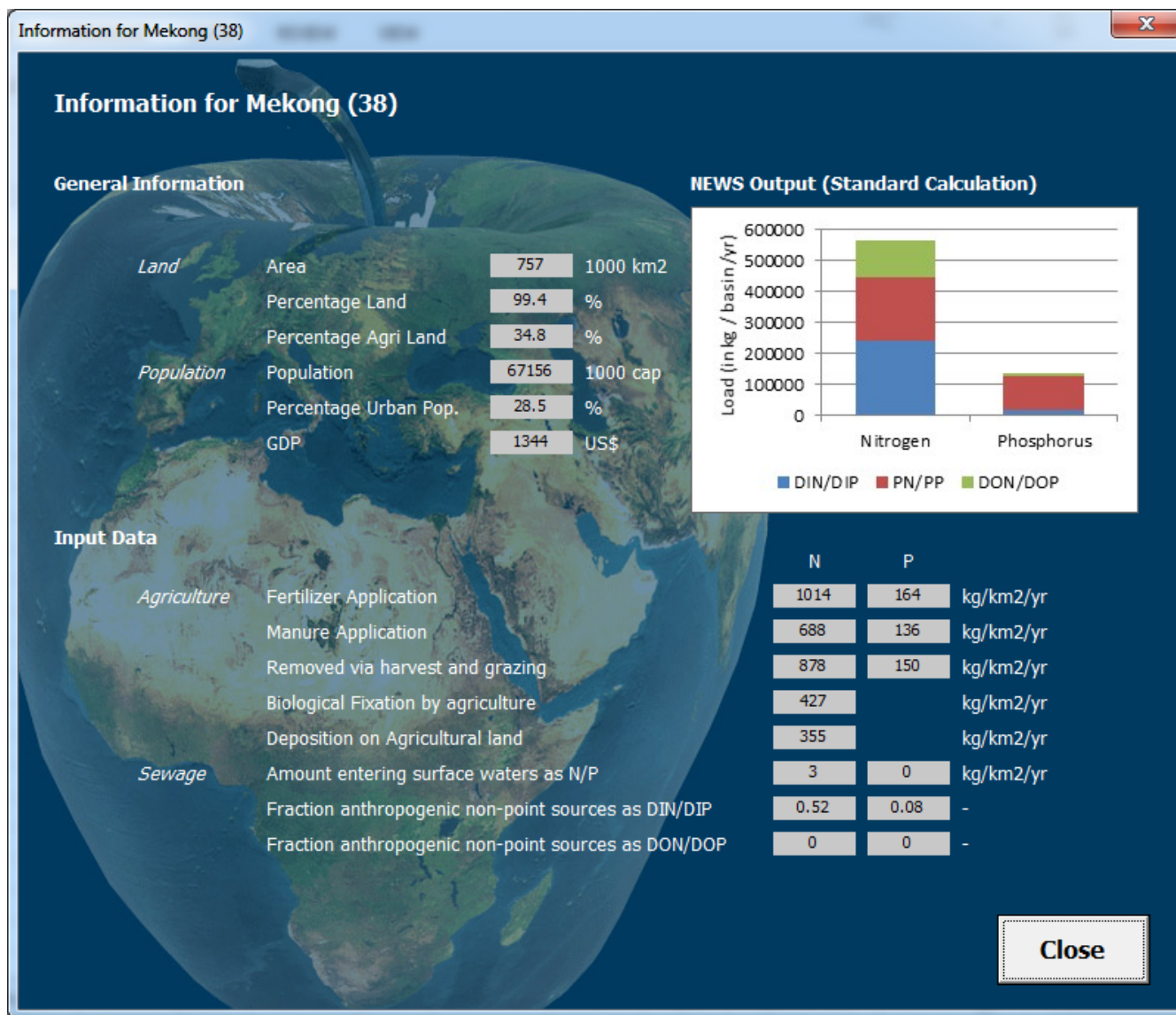
Global Partnership on Nutrient Management

CALCULATION TOOL

Step 2

- Based on geographic selection, tool provides data on:
 - Land area
 - Population
 - Gross domestic product
 - Agricultural activities
 - Wastewater

CALCULATION TOOL



CALCULATION TOOL

Step 3

User selects measures to run scenarios:

- Measures via sliders
 - increase/decrease agricultural inputs, sewage treatment, etc.

OR

- Measures via BMPs
 - increase/decrease BMP implementation

CALCULATION TOOL

Select measures via sliders

Change Sliders

Nitrogen

Phosphorus

Reset

Close

fertilizer N application -100 0 100 % -42

manure N application -16

N removed from agricultural lands via harvest and grazing 0

biological N fixation by agriculture 0

biological N fixation by non-agricultural (natural) systems 12

N deposition on agricultural lands -26

percent of basin area used as agricultural land 0

N deposition on non-agricultural lands 0

fraction of total sewage N exported as DIN 0

amount of sewage N entering surface waters -40

fraction of anthropogenic non-point sources of N entering surface waters as DIN 0

fraction of non-anthropogenic non-point sources of N entering surface waters as DIN 0

fraction of total sewage N exported as DON 0

fraction of anthropogenic non-point sources of N entering surface waters as DON 0

percentage of total suspended solids (TSS) occurring as PN 0

river DIN retention 0

river DON retention 0

fertilizer P application -100 0 100 % -42

manure P application -16

P removed from agricultural lands via harvest and grazing 0

amount of sewage P entering surface waters -40

fraction of total sewage P export as DIP 0

fraction of anthropogenic non-point sources of P entering surface waters as DIP 0

river DIP retention 0

river DOP retention 0

fraction of anthropogenic non-point sources of P entering surface waters as DOP 0

fraction of total sewage P exported as DOP 0

percentage of total suspended solids (TSS) occurring as PP 0

total suspended solid load 0

total suspended solid yield 0

Population 0

Percentage Urban Population 0

GDP 0

Show Graph Hide Graph

CALCULATION TOOL

Select measures via BMPs

Best Management Practices

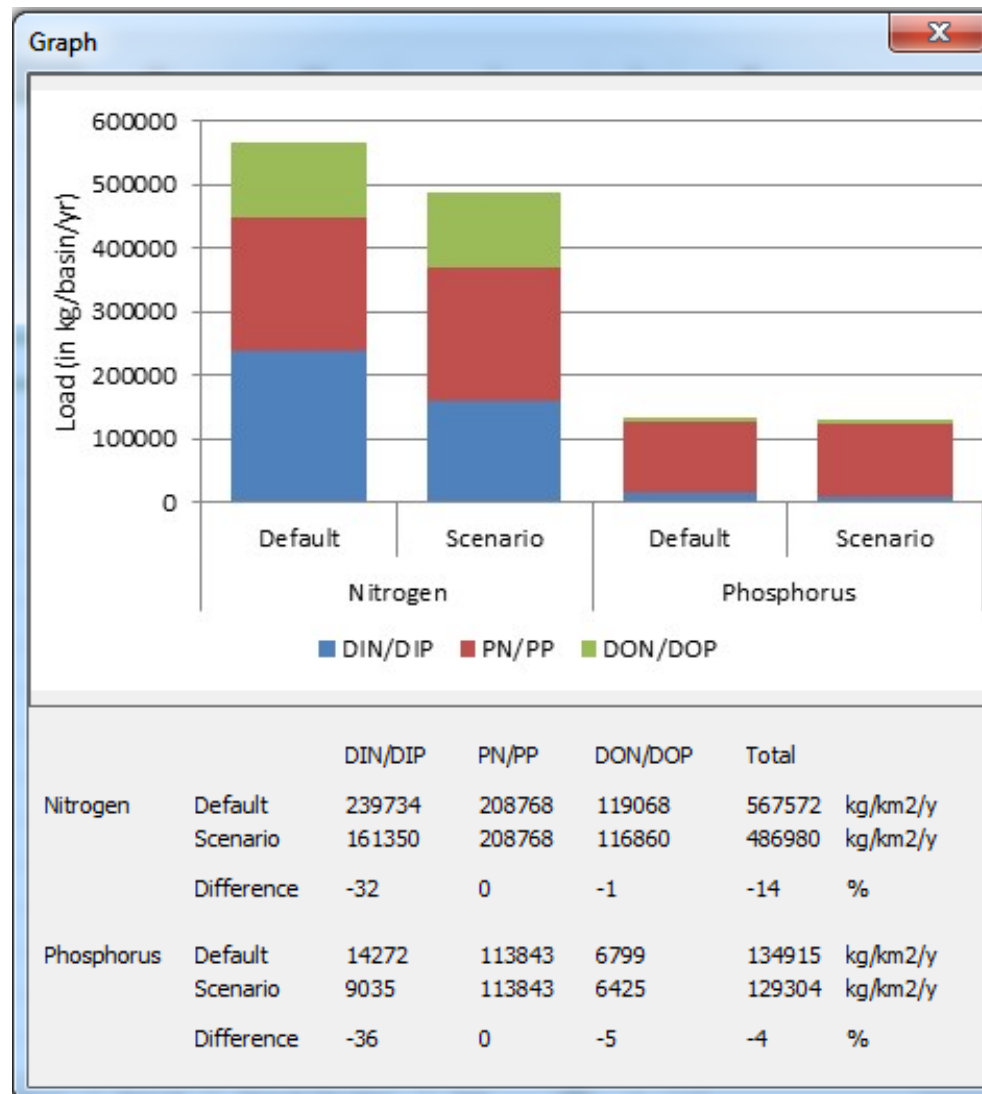
Select one of the Practices below and then adjust the level of implementation (default = 0%, 100% means that everywhere in the basin the practice is applied). The graph then shows how the nitrogen and phosphorus loads change. Currently only 1 Practice can be evaluated at the same time.

		Implementation		
		0	100	
<input type="radio"/> 1 Nutrient Management	Info	<input type="range"/>	<input type="range"/>	0 %
<input type="radio"/> 2 Riparian Forest Buffers	Info	<input type="range"/>	<input type="range"/>	0 %
<input type="radio"/> 3 Riparian Grass Buffers	Info	<input type="range"/>	<input type="range"/>	0 %
<input type="radio"/> 4 Conservation Tillage	Info	<input type="range"/>	<input type="range"/>	0 %
<input checked="" type="radio"/> 5 Conservation Cover Crops	Info	<input type="range"/>	<input type="range"/>	25 %
<input type="radio"/> 6 Wetland Restoration	Info	<input type="range"/>	<input type="range"/>	0 %
<input type="radio"/> 7 Grazing/Pasture Management	Info	<input type="range"/>	<input type="range"/>	0 %
<input type="radio"/> 8 Animal Waste Management Systems	Info	<input type="range"/>	<input type="range"/>	0 %

Reset Sliders Reset Practices Hide Graph

Show Sliders Show Graph Close

CALCULATION TOOL



CURRENT CALCULATION TOOL LIMITATIONS

- Number of best management practices limited
- Inability to simultaneously simulate nutrient reduction effects of multiple best management practices
- Data inputs best suited for global, regional assessments
- Estimates nutrient export but no link to water quality impacts

UPCOMING ENHANCEMENTS TO CALCULATION TOOL

- Linking BMPs in BMP database to Toolbox Calculator
- Adding capability for stacking BMPs in Toolbox Calculator
- Adding capability for users to enter their own local data in the Toolbox Calculator
- Linking nutrient loading levels to hypoxia

THANK YOU!

Sara Walker

swalker@wri.org

+1 202-729-7824

WRI.org

Image: Chesapeake Bay Program



WORLD RESOURCES INSTITUTE

INTERACTIVE ROUNDTABLE SESSION

14:00 to 14:30

- Divide into small groups of 3-5 people per computer
- Follow instructions on handouts

nutrientchallenge.org/toolbox2/gpnm-toolbox

14:30 to 15:00

- Report back to larger group with your responses