Global Hypoxia Challenges and Nutrient Management Best Practices:

Promoting Low Cost Solutions

Session Summary

Background

The 2009 the World Summit on Food Security stated that the world must produce 70 percent more food by 2050 than currently produced to sustain a world population of 9 billion. This growth will require an annual increase in crop production of 44 million metric tons, implying intensification of food production and fertilizer use.

Hypoxic "dead zones" of low oxygen have increased globally by almost nine-fold since 1969.[1] There is widespread scientific agreement that changes in the global N cycle and increased nutrient loading, primarily caused by non-point source pollution (i.e., agricultural activities and storm water runoff) are directly linked to these "dead zones" and other significant impacts on our water resources. Approximately 40 to 50 GEF project managers, ministerial representatives and private sector and other national and regional experts attended this 90 minute review to showcase the GEF's significant contribution to building on-the-ground adoption of low-cost, low-technology nutrient management solutions. The session was held on Thursday November 20, 2011.

Objectives

The objectives include:

- Building awareness of the Global Partnership on Nutrient Management (GPNM) and its value proposition for GEF focal points and PMs, including:
    - Providing tools and resources to Large Marine Ecosystem (LME) projects to address land based sources of pollution
    - Developing potential regional pilot projects to increase on-the-ground adoption of nutrient management policies and practices
- Highlighting GEF investments and case studies especially in Central and Eastern Europe and Central Asia
- Offering key next steps for addressing nutrient challenges in key "hot spots", including the GEF/UNEP recently launched "**Global foundations for reducing nutrient enrichment and oxygen depletion from land based pollution, in support of global nutrient cycle"**
- Receiving feedback regarding the "test ready" nutrient management policy tool box

[1] Diaz, 2010.

GEF Contribution to Low Cost, Low Tech Solutions

The following are a summary of the key contributions from GEF projects:

- Potential stress reduction from 38 GEF inventoried projects in Central and Eastern Europe is approximately 13,020 tons per year N and 4,510 tons per year P based on MONERIS[2] load estimates. These numbers reflect reductions due to agricultural and wetland impacts but not waste water treatment plants. While overall figures for GEF projects are not large, they should be seen as catalyzing change by demonstrating what can be achieved. It is expected that further replication through other financial resources would increase reductions more efficiently in new projects based on the lessons learned from the past projects. At the same time the results also highlight the need to monitor projects, collect data and implement appropriate operations and maintenance to assure that real reductions, comparable to those estimated by MONERIS, will be seen in water quality.
- The GEF leveraged its more than $122 million in investment with approximately $400 million in co-finance in the inventoried projects in Central and Eastern Europe.
- Small demonstrations as part of large GEF investments in the region have provided local nutrient reductions and economic benefits. The results show that low cost interventions can accomplish substantial nutrient reductions and can catalyze scaling-up and replication of best management practices.
- GEF support for the Global Partnership on Nutrient Management (GPNM) will help build capacity among policy makers and small holder farmers in key nutrient "hot spot" regions in the developing world to increase adoption of nutrient management best practices. These efforts will assist in reducing the impact of land based sources of pollution such as nutrient related dead zones in coastal ecosystems.
- More effective nutrient management practices promoted by the GEF will help address global food security issues while also protecting coastal and fresh water resources.

Discussion Summary

The following summarizes the key discussion points from each speaker:

Jacqueline Adler, UNEP

Ms. Adler provided background for the session including an introduction to GPNM and the new GEF/UNEP project to frame the challenges and opportunities. The GPMN will:

- Bring together governments, scientists, the private sector, NGOs and UN agencies into one Platform to raise awareness of nutrient issues and broker integrated approaches and solutions to address nutrient management challenges.
- Major actions in 2012 include:

[2] The MONERIS model, developed by ICPDR calculates the emissions of N and P to the surface water, by different pathways as well as the instream retention in the surface water network Through MONERIS the nutrient loads within the Danube river network has been calculated for today and a scenario has been developed for 2015.

- Development of a "Policy Toolbox" based on the review of nutrient best management practices (in partnership with USDA and GETF)
- Development of a training module for the "policy toolbox" targeting PMs and policy makers (in partnership with USDA and GETF)
- Launch of new GEF project "Global foundations for reducing nutrient enrichment and oxygen depletion from land based pollution, in support of global nutrient cycle"
- Begin to implement pilot projects (i.e., Philippines (Manila Bay), India (Chilika lake) and Thailand (Trang Province))
- Holding workshops with policy makers to test the "policy toolbox" (3rd Inter-governmental Review meeting of the GPA in January 2012)

Panel one

This panel provided a detailed summary of the GEF's investments in Central and Eastern Europe and outcomes from the Living Water Exchange: A GEF/UNDP project to promote nutrient reduction best practices in Central and Eastern Europe. Panel discussion focused on best practice solutions and the need to consider how bringing production and practices to scale are connected. Key discussion points are as follows:

- Chuck Chaitovitz, project manager, Living Water Exchange offered the context of GEF involvement in the region and outcomes from the project and the global work to inventory best practices in developing world "hot spots." Key issues raised include:

  - Agricultural activity must intensify as population grows in coming decades and to meet the 1 billion people facing chronic hunger today.
  - This will mean increasing use of fertilizer – whether organic or inorganic.
  - Proper nutrient management best practices must be scaled-up to ensure the long-term stewardship, conservation and sustainable management of our soil health and water resources.
  - There are more 500 million farmers globally of 1 to 2 hectares (UNEP). We have found that the scale of production and practices for the majority of small holder farmers in the developing world is such that collaboration among farmers to share equipment and experiences could be helpful in focusing on higher value crops and implementing sustainable best agricultural practices.
  - The hypoxic zone on the northwest shelf of the Black Sea increased 1,000 fold since the 1960s.
  - The Living Water Exchange inventoried 38 nutrient relevant projects and 138 nutrient management best practices. Management measures and implementation of tertiary wastewater treatment along with the collapse of the Soviet economies resulted in the virtual elimination of the "dead zone" by 2003.
  - The GPNM has begun inventorying best practices from key nutrient "hot spot" regions in the developing world. The inventory consists of 291 nutrient management best

management practices predominantly for agriculture. The research supporting these practices comes from over 55 organizations including the GEF, UNDP, NRCS, EU and the World Bank. As you know, a significant amount of the research was conducted in the Danube River Basin in Central and Eastern Europe. Another area that has considerable information about nutrient reduction is the Chesapeake Bay watershed in the U.S. In total, the inventory contains work from 55 different countries in North and South America, Europe, Africa and Asia. The research suggests improvements in agriculture, aquaculture, livestock, manure and wastewater practices to reduce the level of nutrients entering our soils and waterways.

- Dr. Tom Simpson, Water Stewardship, Inc. provided a summary of the best practice synthesis and the system of eight best agricultural practices based on the best practices inventory from projects in the region:

    1. Nutrient management
    2. Manure management
    3. Wetland restoration/creation
    4. Riparian buffers – establish treatment to streams
    5. Conservation tillage/erosion control
    6. Cover crops – small grain cover crops, including clover and vetch
    7. Grazing management – including simple activities such as keeping cows out of creeks
    8. Ecological/organic production systems

  Please see http://nutrient-bestpractices.iwlearn.org/nutrientdb/frmSearch/BEPs.pdf for a summary of these practices.

    - Key issues discussed included:

        1. Develop whole farm or catchment water quality protection program to achieve target
        2. Use a systems approach that identifies BMPs and matches them to key "intervention" points
        3. Implement BMPs over time based on impact, cost and farmer interest
        4. *Make operation and maintenance a critical element in pollution control plan*

- Ms. Olena Marushevska, NGO Zakarpattya Oblast organization of All-Ukrainian Ecological League showed a movie and summarized the outcomes and challenges from the LWE demonstration project, "Best practices of Fertilizers Reduction from Agricultural Lands in Upper Tisza basin, Ukraine." Key discussion points included:

- This demonstration project was located in the Upper Tisza basin. It is very warm and has micro climate where "land is golden." There has been significant development of green houses, which have created impervious surfaces and run off is full of nitrates
- The goals of the project included developing nutrient management practices and establishment of riparian zones.
- The riparian zones were created by planting trees to provide:
    1. Erosion control
    2. Flood control
    3. Plums and revenue source
- The project mapped the present N, P, acidity, humus contains, calcium, manganese, zinc, lead contains in soils of farmers and surface water.
- We purchased equipment to measure nitrates in vegetables for wide public as well as sanitary-epidemiological services (laboratory)
- We also reduced N in the water through treatment in the riparian zones.
- Our accomplishments included:
    1. Planted 750 trees
    2. Establishing a 6 km riparian buffer area
    3. Conducting media outreach
    4. Promoting laws in the Ukraine to measure nitrates in products

For more information on this project, please visit http://nutrient2.iwlearn.org/demostration-projects/ukraine-best-practices-of-fertilizers-reduction-from-agricultural-lands-in-upper-tisza-basin. For the video, please visit http://www.youtube.com/watch?v=m8JMyvNrYVU.

Panel two

This panel focused on other regional case studies, specific needs for information and solutions and how the new GEF/UNEP project can deliver solutions. Panel discussion was on diagnosis, prevention and remediation - what are the implications for GEF-IW projects, the pilot project in Manila Bay and introduction of the "test ready" nutrient reduction best practice "tool box." Key discussion points included:

- Dr. Peter Whalley, Danube/Tisza, Regional Projects provided perspective on the Danube Regional Project findings and outcomes from the Tisza. Key issues raised:

    - There are significant experiences from the DRP and Tisza:
        1) Nutrient reduction
        2) Problems in reaching farmers
        3) Flood plains
    - We created a value proposition for farmers, and we must convince farmers/landowners of benefits
    - We had to answer "Who are the owners of the land?"
    - We worked on demonstrating the benefits to the local communities.

- We need to change attitudes of the policy makers at the local level.
- There is value to small demonstrations to show we can achieve reductions, and that we can bring it to scale.
- We had eight demonstration farms in Serbia, and reduced 14 tonnes of N and 8 tonnes of P.
- Farmers saved money also showing economic value of conservation activities.
- Connect small demonstration projects to a larger project with policy implications is an effective model to bring practices to scale.

- Raphael Lotilla, PEMSEA offered a summary of the Manila Bay pilot including the key nutrient challenges.
    - Manila is one of the global nutrient hot spots.
    - Mangroves, sea-grasses, coral reefs, mudflats, beaches, seaweeds have all declined substantially under the pressure of coastal development. Over-exploitation of fisheries and the contamination of fish and shellfish is a major concern. There are significant human health risks associated with fecal coliform, heavy metals and pesticides.
    - Increasing river nutrient export and massive increases in aquaculture production have led to very large increases in loading of nitrogen and phosphorus, while transport of dissolved silica has probably decreased or been stabilized by increasing dam construction in river systems. Levels of nutrients which favor algal blooms are high in Manila Bay. Nutrient enrichment and changes in nutrient stoichiometry are likely the major causes of the increased occurrence, frequency and extent of algal blooms in the coastal seas of the Philippines.
    - The algal blooms create ecological as well as human health risk. Morbidity and mortality cases due to paralytic shellfish poisoning related to toxic algal blooms have been reported. Nitrogen loading from the aquaculture farms also stimulates eutrophication, contributing to the increasing evidence of fish kills. Solid wastes entering the Bay via river and drainage systems result in loss of amenity value and are carriers of pathogens.
    - *The Manila Bay Coastal Strategy* was formed to serve as a common framework for all stakeholders to address environmental problems, achieve balanced and sustainable development, and improve the quality of life.
    - Public private partnerships are being adopted as a key delivery mechanism in the development and implementation of investments in environmental facilities and services, notably those identified in the coastal strategy and operational plan.

- Christian Susan (UNIDO), Guinea Current LME provided a case study from Africa:

    - The key nutrient challenges in West Africa are:
        - Sanitation
        - Industrial Wastewater
    - Nutrients have presently limited implications in the region.

- Hypoxia was local mainly in coastal lagoons Now it is transboundary between Ghana and Côte d'Ivoire.
- Nutrient loading can be attributed to industrial and domestic wastewater with limited agriculture implications.
- But agriculture will have to intensify in the future. Côte d'Ivoire is aiming to help farmers revive their cocoa plantations with a US$5 million experimental research station, due to be operational by January 2013. And if arable land is reduced due to climate change, we must develop approaches to implement best agricultural practices.
- Solutions may be wastewater collection and centralized treatment, but given the financial constraints small scale demonstrations of decentralized ecological and onsite sanitation technologies might be better suited. The Transfer of Environmentally Sound Technologies is an efficient and effective approach to significantly reduce nutrient loads and pollution from industrial wastewater
- For constructed wetlands, we need to determine the scale and scope needed for prevention.

- *Erno Fleit, Hungary: Reduction of Nutrient Discharges - under WB-GEF Strategic Partnership provided a summary of outcomes to-date including:*

  - There are two types of wastewater treatment addressed by the project:
    1) Enhance point source and tertiary treatment
    2) Restore wetlands for N removal
  - Wetlands serve as buffer for some P issues as well.
  - The restored wetlands had comparable performance to the wastewater treatment facility, and present many advantages including lower energy and operations and maintenance costs. Secondary treatment followed by disinfection is needed prior to using the wetlands for nutrient removal and further polishing of the wastewater. Wetlands reduce pathogen loads but do not replace disinfection needed at wastewater treatment plants
  - Key issues:
    1) Policies and partnerships
    2) Wastewater treatment systems
    3) Low cost
    4) Demonstration of benefits and costs
    5) Sources of information
    6) Multiple benefits of the wetlands – polishing, biodiversity, etc.

- Chuck Chaitovitz, GETF – Introduction of the “test ready” tool box for feedback from the audience. The “test ready” tool box will help decision makers – farmers, policy makers and extension agents –to identify measures that will provide specific reduction opportunities.

Questions and Answers

The following are the questions and answers from participants in the session:

Ray Dowbenko

What is most important? How do you define domestic wastewater? Is it a mixture of all the effluent? The cultural changes for such a system are big.

Christian Susan

The data need for such a system is substantial. Marginal costs are included.

Phil Weller

We have a regional model on the Danube called Moneris.

Data is a difficult issue. It is very specific to a location.

What we did not have is the response to the efforts on the Danube for the Black Sea. There is a need to link coasts to the river basins. This would be a good outcome from the tool box.

Such a connection would involve:

1) Purchasers in the supply chain upstream
2) Manufacturer actions

Chuck

The GPNM will develop the tool box at the global level and then pilot region specific or local pilots like the one discussed in Manila Bay. We will be then collecting data and building a local model.

This is essentially a model of models so we would welcome the opportunity to work with you. I agree that linking rivers and coasts is essential.

Ray Dowbenko

Management has stated that we should be engaging in supply chain partnerships, including providing fertilizer for sugar growers, such as Coca-Cola. We would like to work with ICPDR.

We have also heard that there is no depletion of P globally. The key questions are who owns the P.

Is there 50 kg per hectare? 250 kg per hectare?

We must link to P supplies

Vincent Sweeny

Will you be linking to the GPA?

Chuck
Absolutely. Our intention is have a session similar to this at the GPA review in January to build awareness and receive feedback.

Ray Dowbenko
You should talk to phosphate mining people for the data. There is between 30,000 to 100,000 years in the current mining situation.

Alex ?
There is a global gap. We please visit Retailers.org

Tracy Hart
Chuck Chaitovitz held a follow-up conversation with Tracy Hart of the World Bank regarding specific feedback on the toolbox. The following are the key questions and discussion points:

- Can you search by watershed or hypoxic zone as well as change in emissions?
- Can you select multiple measures or systems of measures?
- What will baseline of data be and how will it be determined?
- Will we access the data directory so the examples will be transparent?
- We must reference specific examples so the database does not seem like a "black box."
- The outputs must be able to provide context so – why are we coming up with specific examples and numbers?
- We must include projects, timeframe, investments and how many measures lead to the reductions
- We must show mapping to different models.
- Present and pilot with key World Bank staff.
- We will have a cross sector approach?

There is also a need to raise silicate balancing as a key issues as in the Yellow Sea LME.

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