STATE OF THE PLAY ANALYSIS FOR POLICY BRIEF REPORTS

Nutritrade – Voluntary Nutrient Offsetting Scheme for the Baltic Sea

A Flagship project of the EU Baltic Sea region strategy

EUROPEAN UNION
European Regional
Development Fund

Interreg
Central Baltic

NutriTrade
Nutrient Offsetting for the Baltic Sea

BACKGROUND

For certain stakeholders, policy makers in particular, policy briefs will be the most important written outlet of the results of the project. Depending on how we will proceed with the analysis on survey data in Sweden, the work package Institutional development will publish two or three Policy Brief reports, two of which are summarized in this deliverable. First, there will be a policy brief on the unit of nutrient pollution permit as well as utilization of transition models in rules of crediting/trading. Second, there will be a policy brief on legal aspects in using nutrient credits in environmental permitting process. Third, it may be possible that we publish a Policy Brief on the survey results in Sweden.

This report projects information that is relevant for the future policy briefs. Many project activities have contributed to generating information for this report, and many of the activities overlap with those described in Deliverable .T2.8.1 - First stepping stones: using the pilot activities and previous experiences in future implementation of the designed mechanisms. This report focuses not in describing the meetings but condensing the contents of future policy briefs. Particularly, the report has been influenced by various stakeholder meetings: one-on-one meetings with policy makers but also individual polluters, the workshop in Sweden "Low-hanging fruits in eutrophication management of the Baltic Sea?" held in February 2016. Also the ongoing writing process of the first policy brief with environmental lawyers has contributed to the report.

POLICY BRIEF UNIT OF TRADE

Metric

Let us illustrate the importance of a correct metric, i.e. a metric the reflects the eutrophying potential of phosphorus (P) loading as closely as possible, with an example. Assume there exists some true and precise bioavailability for particulate phosphorus (PP) in a given water body, receiving nutrient loading from a given watershed. The P limited water body suffers from eutrophication (we should relax the P-limitation assumption later). To improve the water quality, a policy program is established that targets at 10% reduction in bioavailable P loading.

The loading consists of PP and soluble reactive phosphorus (SRP) from agriculture and SRP from a WWTP. The initial PP loading from agriculture is 82 kilograms, and the initial SRP loading 18 kilograms [you can think of tons instead of kilograms]. The initial SRP loading from the WWTP is 56 kg. PP from agriculture is the most important part of the initial anthropogenic TP loading, comprising about 53% of it.

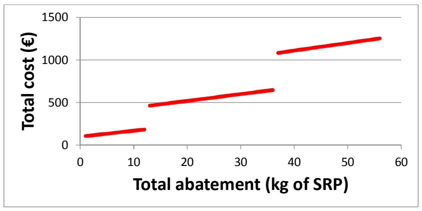
The amount of total bioavailable P (henceforth eutrophying P or EPU) loading depends on the bioavailability of PP. If the bioavailability of PP is 80%, PP comprises 47% of EPU. If the bioavailability of PP is 40%, the share drops to 31% and if it is 10%, PP comprises only 10% of anthropogenic EPU loading. This affects the way we should weight different measures when we try to achieve the goal of 10% reduction. The higher the contribution of PP on EPU, the relatively more emphasis should be given to measures affecting PP loading and vice versa. An unfortunate feature of most conservation measures reducing PP is that they tend to increase the SRP loading (Dodd and Sharpley 2016). This further increases the importance of the bioavailability of PP on cost-effective P abatement policies.

What do we mean by (static) cost-effective P abatement policies? We mean achieving a given (politically set) abatement target with the least possible costs by choosing the combination of currently available conservation measures. Henceforth, we call this the optimal combination of measures.

To illustrate the effect of bioavailability of PP on optimal combination of measures, consider three abatement measures: 1) intensifying the SRP abatement from the point source (WWTP) 2) adopting permanent vegetative cover to cut down PP loading (increases SRP loading) 3) depleting soil P by increasing the acreage where (a fixed amount of manure) is applied to. This gradually decreases the risk of SRP loading.

The effect of bioavailability can be best illustrated by considering the deterministic case. Adding stochasticity would merely add complexity to exposition but not change the sensitivity of optimal combination to changes in PP bioavailability. For a deterministic model, we can express the costs and abatement achievements with monotonic and (partially) continuous functions.

Intensifying WWTP abatement increases costs for each unit. In addition, there are certain thresholds that require lumpy investments if crossed. The resulting abatement cost function is a step wise function.



Adopting permanent vegetative cover (assume that there is none initially) has a fixed cost for each hectare. The initial loading is heterogeneous (say, uniform distribution between 0.1 and 4 kg/ha). Assume that we can identify the parcels most susceptible to erosion and adopt the management practice first there, and that the conservation practice results in fixed percentage reduction in PP loading. The resulting abatement cost function for PP is increasing and convex. For each hectare in permanent vegetative cover, the SRP loading increases with a fixed amount.

Hauling manure beyond the economically feasible threshold increases costs. However, the economically optimal threshold is environmentally seen too close to the animal facility, increasing the P accumulation in soil. Longer hauling distances thus gradually deplete soil P and thus decrease SRP loading.

Denoting the abatement cost functions by c_{wwtp}, c_{vc} and c_{manure}, the problem of finding the cost-effective combination of wwtp abatement, adopting vegetative cover and increasing manure hauling distances can be written mathematically as:

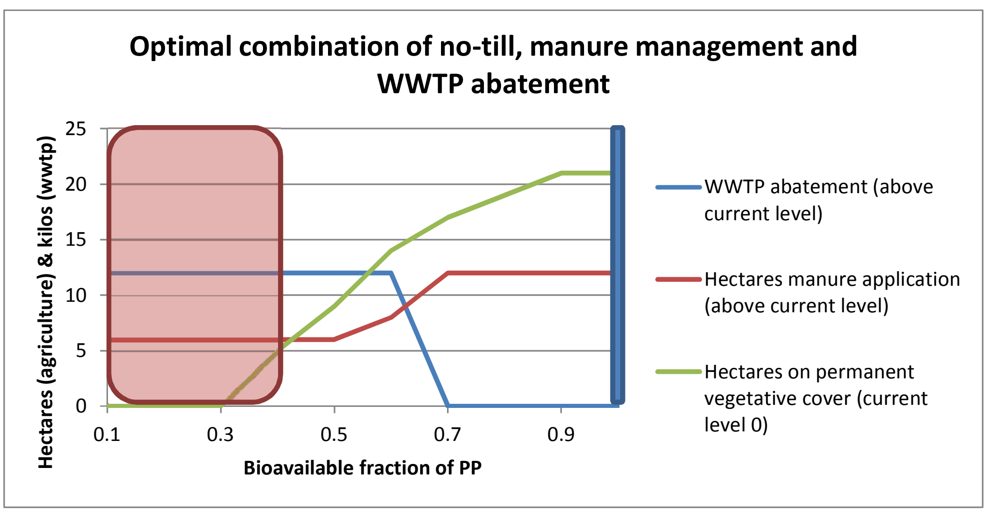
$$\min_{wwtp,vc,manure} c_{wwtp}(a_{wwtp}) + c_{vc}(a_{vc}) + c_{manure}(a_{manure})$$

$$s.t. L_0 - a_{wwtp} - a_{vc} - a_{manure} \leq \hat{L}$$

Where a stands for abatement expressed in EPU, L_0 denotes the initial EPU and $\hat{L}$ the target level of EPU loading.

The optimal combination for different (true) values for PP bioavailability can be written down as partial derivatives of a Lagrangian function. They can also be solved numerically (here, using Matlab). For each bioavailability coefficient at the time, the numerical solution constructs all possible combinations of measures and calculates the associated costs and the resulting total PO4-EP loading values. From these, it considers those satisfying the constraint ($L_0 - a_{wwtp} - a_{vc} - a_{manure} \leq \hat{L}$). Finally, it picks up the least cost option out of the feasible combinations. The same procedure is done for each value of bioavailability of PP.

Below a(slightly stylized) figure depicting the optimal combinations for bioavailaibility values between 0.1 and 1. Each point on the horizontal axis denotes the bioavailability. The graphs denote the optimal levels of abatement for each of the measures. The abatement cost functions are illustrative, yet they follow different literature sources. Finding sufficiently precise abatement cost function is at the heart of the analysis.



For instance, the graph says that if 30% of PP becomes ever bioavailable in the receiving water body, in this case the 10% reduction in EPU would be achieved with the least costs by increasing the WWTP abatement by 12 kilos, by extending manure hauling acreage by six hectares and by not adopting permanent vegetative cover.

The blue region (at bioavailability = 1) denotes the area where the current practice of setting the bioavailability implicitly to one (i.e. setting the target in terms of TP=SRP+PP). There, the optimal combination includes no additional WWTP abatement, some additional manure hauling and extensive adoption of permanent vegetative cover. If the true bioavailability would, however, be in the light red region, the emphasis would be on increasing WWTP abatement and manure hauling – not in permanent vegetative cover.

Our example shows the following:

Defining the unit of protection targets defines the unit of trade. Getting this as close to the true eutrophying potential of nutrient loading is crucial for water protection to be i)efficient ii) effective

Transition coefficients

For trading or for using nutrient credits in permitting process, we have to take into account the spatial character of load reductions. If an abatement action is taken in place A, what rules should we follow when acknowledging the credit in location B, if there is some nutrient retention between A and B. This is a question we have been answering in a work by Natalia Kuosmanen. She proposes using a transparent macro-level approach to modelling nutrient budgets, which has a number of direct implications for possible policy scenarios.

Her accounting method was particularly designed to model multiple interacting stocks of nutrients, such as nitrogen and phosphorus, for the case of the Baltic Sea region. It is based on the dynamic nutrient balance approach, which allows calculation of empirical budgets in different basins of the sea and in its water layers. Compared to the existing toolbox of the eutrophication research, this approach provides additional informational benefits, which can be useful in assessing the ecological status in the sea and designing abatement policies:

- It builds a connection between nutrient stocks on the land and the nutrient stocks in the sea through nutrient runoffs from agricultural lands;
- It allows to compare and contrast the empirical evidence from the direct measurements, such as nutrient concentrations, with estimated nutrients stocks in the sea;
- It proposes a transparent framework for analyzing the development of nutrient stocks in different basins and different water layers over time and for forecasting the future development of nutrient stocks under alternative policy scenarios.

Besides the potential applications of this approach listed above, the developed approach could also be useful for estimating the marginal benefits of abatement in different basins of the Baltic Sea, taking into account the transition of nutrients to other basins. Abatement of nutrients in any basin will affect the other basins as well, but the marginal benefits of abatement are not the same across all basins. Reliable information on marginal benefits of abatement in different basins would be needed to design cost efficient policy measures that can target the abatement activities to regions where the net benefits are the highest.

As the core element of this kind of work, it must be based on scientifically sound modelling. Natalia's work is currently being peer-reviewed in an academic journal. More detailed results concerning e.g. the transitions coefficients that should be used in crediting between regions, will be provided as soon as the model is verified by the academic community (i.e. it is accepted for publication).

POLICY BRIEF USING CREDITS IN ENVIRONMENTAL PERMITTING

One of the main objectives of the project is to develop flexible mechanisms for the protection of the Baltic Sea. The project so far has illuminated how this can be done in the two main branches of marine protection: voluntary and governmental. Voluntary policies will culminate in launching the Nutribute-platform which will enable individuals and public and private entities to allocate funding for cost-effective nutrient abatement; and those undertaking nutrient abatement actions to obtain financing. The potential utilization of flexible mechanisms in governmental marine protection in Sweden and Finland is covered in deliverable 3.10.1 of this project "Report on possible application areas of nutrient trading in Finnish and Swedish water protection policy".

The project will generate concrete results: most importantly the nutrient abatement actually conducted in the pilots and the existence of the Nutribute-platform. For developing the governmental policies, the main results are more abstract: synthesizing the current state of marine protection and making recommendations for future development. The core of this will be summarized in a policy brief with the working title "Utilizing nutrient credits in permitting processes – potential benefits and needs for legislative changes".

The Policy Brief will be prepared jointly with Nutritrade project, Sara Kymenvaara from the University of Eastern Finland and researchers Antti Belinskij and Jussi Kauppila from the Finnish Environment Institute. This deliverable summarizes shortly what the policy brief will contain.

Basically, the Policy Brief utilizes all deliverables so far. However, its sharpest angle will be environmental permitting. The approach stems from meetings with Raija Aaltonen from the Regional State Administrative Agency of Southern Finland, Esa Lehtinen from the Centre for Economic Development, Transport and the Environment, Uusimaa and particularly with Mikael Wennström representing the environmental authorities in Åland and the expert of environmental law, Sara Kymenvaara.

Governmental Environmental Regulation

Governmental regulation is dealt with in more detail in other deliverables, particularly 3.10.1. To recap, environmental permitting process is the most likely area where nutrient credits could be utilized. Agricultural non-point pollution is intensively regulated by EU Common Agricultural Policy and there is thus very little room for drastically different overlapping instruments. The most important tool of national (and hence more flexible) governmental environmental protectiono is an environmental permit.

Interestingly for nutrient trading, the role of environmental permits is about to change because of a recent legislative interpretation, the Weser ruling (C-461/13) if the European Court of Justice. This will generate the approach for our Policy Brief.

Weser Ruling And Its Interpretation

Weser ruling strengthens the role of WFD-specific water quality criteria in environmental permitting processes. The interpretation of their new role may differ between member states. Assessing the eventual impact of the new/expanding economic activity on water quality criteria will be at the core of the permitting process. If the activity increases pollution that poses pressure on (critical) water quality criteria it cannot be permitted.

Adopting the harsh interpretation puts economic actors in different positions. There are differences in sizes of surface water basins, and the pressure an individual actor can potentially impose on water quality. Also, the water quality criteria could have been selected differently in different water bodies of littoral countries of the Baltic Sea.

The coexistence of economic activity and environmental protection might call for more flexibility in the permitting process. Compensating for increases in nutrient loading with measures that reduce loading by the same amount might provide economic actors with some flexibility while meeting the water body specific restriction of not increasing the loading of critical pollutants. Permit applicant would be offered an option to pay for higher nutrient abatement at other sources within the water body so that the net effect would be neutral (or decreasing the total load, depending on risk preferences). The applicant would thus earn nutrient abatement credits and use these in the application procedure.

Currently, Finnish environmental regulation does not explicitly acknowledge the use of nutrient credit in environmental permitting process. In the policy brief, we will describe how the interpretation of Weser will affect the pressure in environmental permitting process. We will cover the topics of verification and additionality of nutrient credits; whether the role of credits will be technical and applicable using mathematical formulae and models, or whether it is conceptual and case-specific; the spatial aspects of permitting which is tightly linked to definitions of water districts as defined by the Water Framework Directive; and we will make recommendations on following administrative and legislative moves to be made to enable nutrient credits to enter governmental policies.

The Ålandic Water Act and its ongoing revision will be used as a point of reflection, as well as the upcoming (most likely by the end of year 2017) EU guidelines for Weser interpretation in river basin management plans. The proposal for the revision would allow operators or beneficiaries provide compensatory measures or pay for measures through some yet undetermined financial instrument. The situation is intriguing for the Nutritrade-project. The need for flexible mechanisms in the form of nutrient credits has never been so clear in Finnish institutional environment of water protection.

The tentative contents of the policy brief will be

1. Interpretation of the Weser-ruling
2. Concrete effect on point-source pollution and polluting activities
3. Utilization of nutrient credits, key issues such as verification and additionality of abatement
4. Next steps for environmental authorities
    a. Flexibility in permitting process
    b. Creating regulation for the utilization of nutrient credits
    c. Clarifying the role and interdependence of WFD program of measures and nutrient credits
    d. Regional aspect
    e. Treatment of new vs old permits
    f. Examples from other countries
5. Alternatives for nutrient credit regulation
6. Suggestions for improving regulation in Finland

References

Dodd, R. J., & Sharpley, A. N. (2016). Conservation practice effectiveness and adoption: unintended consequences and implications for sustainable phosphorus management. Nutrient cycling in agroecosystems, 104(3), 373-392.