SEVENTH FRAMEWORK PROGRAMME

THEME 6: Environment (including Climate Change)

Adaptive strategies to Mitigate the Impacts of Climate Change on European Freshwater Ecosystems

Collaborative Project (large-scale integrating project)

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PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
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CO	Confidential, only for members of the consortium (including the Commission Services)	

Abstract

As part of REFRESH WP6 Task 6.3 (Scoping the solutions) two stakeholder workshops were held within the Vltava catchment, Czech Republic. The purpose of these was to explore the views of local stakeholders concerning water protection measures and adaptation strategies under a changing climate. This report presents the views of stakeholders from the Lomnice and Skalice sub-catchments following a workshop held on 31st October 2011 in Mirovice and from the Lipno reservoir catchment from a workshop held on 28th November 2011 in Lipno. Stakeholders were invited to help identify and evaluate measures for improving water quality in the eutrophied Orlík reservoir and the Lipno reservoir. Both workshops were organised by the Biology Centre AS CR, v.v.i. (BCAS), Faculty of Economy of the University of South Bohemia in Ceske Budejovice (FE-USB) and SORP (League of municipalities of the Písek region).

As in the Norwegian demonstration catchment (Vansjø-Hobøl – see Deliverable 6.8) some management measures have already been agreed and put into practice in these catchments (mainly addressing soil and nutrient losses as specified in Good Agricultural and Environmental Conditions (GAEC)). However, serious problems remain, particularly with phosphorus concentrations.

The upper Vltava River catchment is large and heterogeneous in nature. Three sub-catchments are being analysed in REFRESH. Two of these, Lomnice and Skalice, are similar, located close to each other in a predominantly agricultural region. The third, the Lipno Reservoir catchment, is located in the upper Vltava catchment, in a protected area. To accommodate these differences it was decided to hold two separate workshops.

The report is divided into three parts

1) Report from Workshop I – Mirovice 10/2011 (Lomnice and Skalice subcatchments)
2) Report from Workshop II- Lipno 11/2011 (Lipno subcatchment)
3) Comparison of both workshops and final conclusion

The measures currently practised and potentially available in these sub-catchments fall into two categories, systemic measures and domain/field measures. The systemic measures require institutional support (regional, state) or political will. The domain/field measures can be taken directly by stakeholders or representative organisations.

Most stakeholders at the Mirovice workshop (the Lomnice and Skalice catchments) recommended to increase pressure on the controlling authorities and executive institutions to play a greater role, with greater efforts to find the funding to build and reconstruct the sewage treatment plants and to identify efficient ways to realise landscape improvement or conservation goals (measures which would help to increase retention ability of landscape: the diversification of the landscape, the subdivision of the larger plots of land, grass growing, creation of new and conservation of old landscape elements, the construction of artificial wetlands and the revitalization of natural wetlands).

Most stakeholders at Lipno would recommend an increase of pressure on the controlling authorities and executive institutions to deal with problems of non-registered pollutions sources.

Contents

1. Introduction

This report presents the opinion of stakeholders group from two sub-catchments Lomnice and Skalice held on 31st October 2011 in Mirovice and the opinion of stakeholders group from the subcatchment surrounding the Lipno reservoir held on 28th November 2011 in Lipno, where stakeholders were invited to help to specify and evaluate measures for improvements of water quality in the eutrophicated Orlík reservoir and the Lipno reservoir, respectively. Both workshops were organised by the Biology Centre AS CR, v.v.i. (BCAS), Faculty of Economy of the University of South Bohemia in Ceske Budejovice (FE-USB) and SORP (League of municipalities of the Písek region).

Similar to Norwegian case, some mitigation measures have already been agreed and set into operation in these catchments (mainly these concerning soil and nutrient losses as specified in Good Agricultural and Environmental Conditions (GAEC)). Nevertheless, the situation is still alarming, especially when speaking about the main polluting agent, i.e. phosphorus.

The upper Vltava River catchment is quite large and variable area. Three sub-catchments have been chosen for description. Two of them, the sub-catchments of Lomnice and Skalice, are quite similar to each other, located near each other in a predominantly agricultural land. The third one, the Lipno Reservoir sub-catchment, is located in the very upper part of the Vltava River, in a protected landscape area. To reflect this, we decided to hold two different stakeholder workshops. The organization of both workshops, as well as the writing the bulk of this report was the responsibility of Berenika Policková; the Lipno workshop report was written by Hana Svejdarova.

The report is divided into three parts

1) Report of the Workshop I – Mirovice 10/2011 (Lomnice and Skalice subcatchments)
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2. Lomnice and Skalice sub-catchments

2.1 Introduction: the problem, the sources of pollution and suggested mitigation measures

The main problem in the Orlík reservoir is an excessive amount of phosphorus coming to the reservoir, especially during the summer period in such high concentrations, that algae blooms develop and exceed limits for bathing waters. Phosphorus load is thereby the main cause of eutrophication and the key factor for the emergence of the mass of algae blooms in the reservoir (Fig. 1; Hejzlar et al. 2010).

2.2 Purpose of the Workshop

The main purpose of the workshop was to introduce to the stakeholders the problem of phosphorus as a main agent causing the development of algal bloom (though many of them knew this problem either from their own experience or from the conferences about revitalisation of the Orlik reservoir organised four times already), introduce them the possible scenarios in expected climate change and involve them into the solution of phosphorus reduction.

The workshop was lead by the scientists from our team and by a chairwoman of SORP League of municipalities of the Písek region that also administered the contacts for the whole workshop.

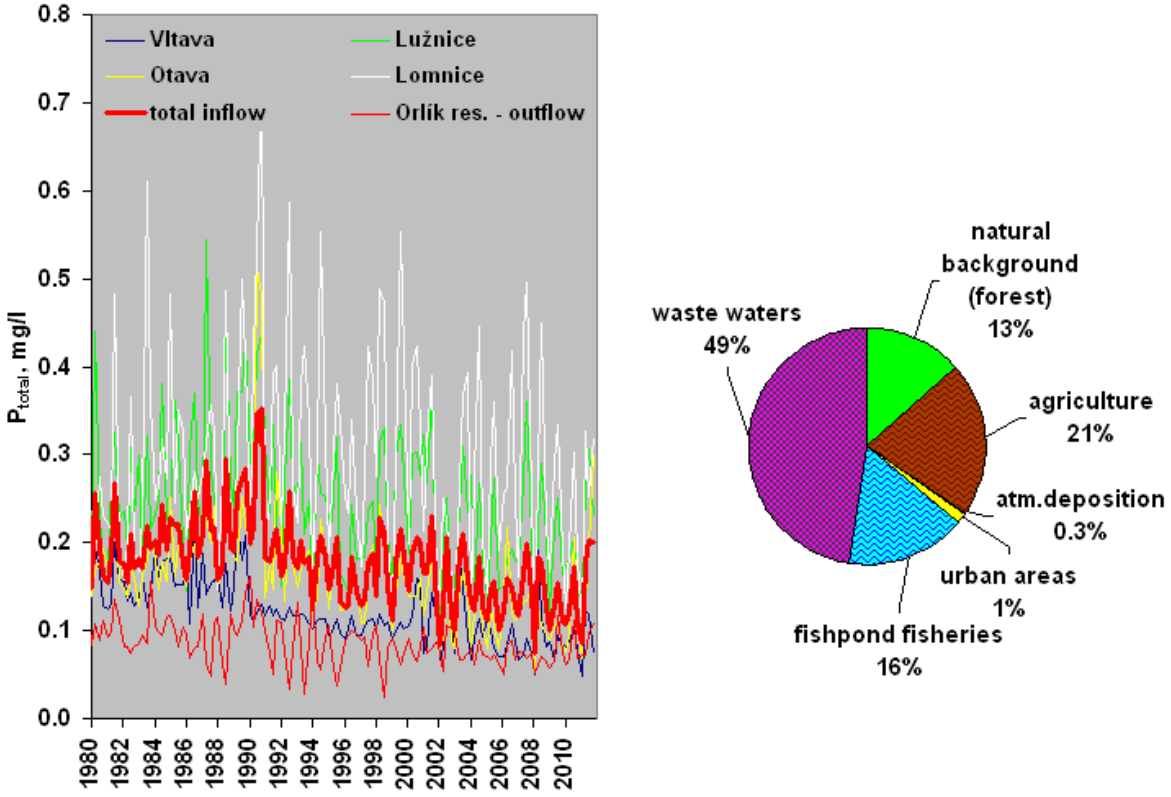


Fig. 1 The time series of phosphorus concentrations in the Orlík reservoir and its major inflows during the last 20 years (left) and the apportionment of P sources in the Orlík catchment during vegetation period of the year (V–X) in 2007–2009

2.3 Identification of pressures/problems - the issues (water environment, environmental interests and legislation; more emphasis on the description of main pressures)

The study of Hejzlar et al. 2010 on the evaluation of nutrient sources in the Orlík catchment showed three main sources of phosphorus pollution:

1. Municipal wastewaters (discharged to streams and rivers from registered as well as non-registered sources)

2. Fishery management of ponds

3. Losses from agricultural areas.

From the scenario calculations of the balance study of phosphorus and nitrogen sources in the catchment area of the Orlík reservoir (Hejzlar et al. 2010) it is clear that the concentration of phosphorus without eutrophication effects in the Orlík reservoir (i.e. less than ca 0.06 mg l^{-1} in the tributaries) cannot be achieved without efficient removal of phosphorus from sewage (at ~ 90%), and at the same time without limitation of phosphorus losses from ponds with intensive fish production. The negative impact of the fishpond fisheries can be seen especially in the summer period, when (from the perspective of phosphorus) it has nearly the same effect as wastewater discharges.

2.4 Stakeholder identification

2.4.1 Screening / mapping of stakeholders

As there are three main sources of pollution in the sub-catchments of Lomnice and Skalice (municipal waste waters, fisheries, and agriculture), it was decided to invite stakeholders from these three groups (plus one additional group – institutions and concerned stakeholders). These are presented in Table 1.

Table 1. Impact/influence of stakeholders in the subcatchments of Lomnice and Skalice on environmental state

X – big impact; (x) – smaller impact

Institution	Impact on environmental state	Can initiate measures	Influenced by environmental state
Mirotice	X		(x)
Ostrovec	X		(x)
Mirovice	X		(x)
Blatenská ryba	X		(x)
AGPI	X		
Agro-Ostrovec	X		
ČEVAK	(x)	(x)	(x)
District deputy from town Strakonice		X	
LRH Michálek (Wood company Michál	(x)		(x)
Regional deputy/representative from the Bohemian Regional Authority		X	
SORP (League of municipalities of the region Písek)		X	(x)

2.4.2 Principles for stakeholder identification

Invited organizations included subjects that either directly contribute (to a certain degree) to phosphorus pollution in the Orlík catchment or are involved in solving the consequences of excessive phosphorus inputs into the reservoir.

The group of individuals/groups/organizations who are influenced by the deterioration of water quality in the Orlík reservoir was not included in the workshop. The reason was that a large number of various organizations with different interests belong to this group (e.g. sport fishing associations, tourists, hotel owners, companies for free-time activities etc.) and thus, it was considered as hardly productive to involve all of them is workshop discussions.

Another significant point is that there is no NGO or individuals interested in water state and phosphorus pollution from the point of view of nature conservation. There are organizations taking care for handicapped animals, education of nature conservation or land trusts, but no one dealing directly with water protection.

Table 2. Division of stakeholders in the subcatchments of Lomnice and Skalice into levels of power and interest

	Low power	Medium power	High power
High interest	• Agro-Ostrovec • LRH Michálek (Wood company Michálek)	• Mirovice	• district deputy/representative from Strakonice municipal authority • SORP (League of municipalities of the Písek region) • Regional deputy/representative from the South Bohemian Authority
Low interest		• Mirotice • Ostrovec • Blatenská ryba • AGPI	• ČEVAK

2.4.3 Identification of the key stakeholders participating in the workshop

Invited and present stakeholder are summarised in Table 3.

The excused subjects were from the fishery companies and smaller agriculture companies, but nevertheless more than 80% of invited deputies participated in the workshop. All invited representatives of institutions took a part in the meeting. All stakeholders were very active during their work and presentations of their measures.

Table 3. Stakeholders invited/present – the Mirovice meeting

Source – deputy	Invited	Present
deputies from municipalities /mainly mayors /	1. Mirotice 2. Ostrovec 3. Mirovice	1. Mirotice, mayor 2. Ostrovec, mayor 3. Mirovice, mayor
deputies from fishery companies	4. Blatenská ryba 5. Dvur Lnare 6. Les Orlik 7. Rybarstvi Lnare	4. Blatenská ryba (two deputies)(managers)
deputies from bigger as well as smaller agricultural business	8. AGPI 9. Zemedelstvi Manhal 10. Martin Kral 11. Agro-Ostrovec	5. AGPI (two deputies – *Deputy headmaster* and his assistant) 6. Agro-Ostrovec (agronomist)
deputies from institutions and concerned stakeholders	12. ČEVAK (Czech water supply and sewers - subsidiary firm of AG energy) 13. MZE (Ministry of Agriculture CR – two district deputies from the towns of Písek and Strakonice) 14. LRH Michálek (Wood company Michálek) 15. Regional deputy from the South Bohemia Regional	7. ČEVAK (head ingeneer) 8. district deputy from Strakonice town(magistrate) 9. LRH Michálek (Wood company Michálek)(technologist) 10. Regional deputy from the South Bohemia Regional Authority (director of Regional Authority) 11. SORP (League of

	Authority 16. SORP (League of municipalities of the Písek region)	municipalities of the Písek region, the headmistress)
		Altogether, 13 stakeholders (persons) were present

2.4.4 Stakeholder relations

Some stakeholders knew each other, but some were just introduced in the workshop. No specific pressures associated with stakeholder relations were estimated or observed.

2.5 Preparation before the workshop

All stakeholders were invited either personally or by phone, then informed by e-mail about the purpose, time and place of workshop, activities supposed to be done in the group works and the list of other invitees.

A presentation of phosphorus problem in the Lomnice/Skalice sub-catchments and the whole Orlík catchment was prepared as a brief introduction – even for those who were not familiar with the theme.

Possible mitigation measures for reduction of phosphorus export from the Lomnice and Skalice to the Orlík reservoir were prepared (one specialised thematic list for each group– e.g. agricultural mitigation measures for people from agriculture, etc.) to be evaluated after the brainstorming in the first part of the group work I.

List of criteria (to be evaluated) for each group was also prepared for the group work II.

2.6 Workshop programme

The programme of the workshop was as follows:

16.00 Arrival. (coffee)

16.05 Welcome to stakeholders at the workshop by Ivana Ocaskova from SORP (League of municipalities of the Písek region) (as in the Norwegian case the representative of this organisation later on joined the group of Institutions and concerned stakeholders as one of the stakeholders). A brief mutual introduction of all stakeholders

16.10 Introduction of the workshop and time schedule by Miloslav Lapka

16.15 Presentation of the "Phosphorus theme" by Josef Hejzlar and Berenika Polickova

16.35 Group work I - "Trying to find the measures"

17.10 Leaders of groups presented the result of group work I.

17.30 Coffee break (with open sandwiches and fruit)

17.40 Group work II – "Evaluation of criteria"

18.20 Leaders of groups presented the result of group work II.

18.45 Plenary session. Presentation of the results of both group works, questions

19.10 Follow up discussion "Why those measures are not being accomplished now?"

19.25 Follow up discussion "Are the causes mainly anthropogenic or natural?"

19.35 Concluding discussion and summarisation

19.45 Acknowledgements and invitation for next workshop

20.00 End of workshop

2.7 Description of the workshop

4.7.1 Group works

Participants were divided into four groups, according to the prevailing interests:

Municipalities (Wastewaters)

Fisheries

Agriculture

Institutions (representing cross/interest in water quality)

Group "moderators" (who introduced the workshop tasks to stakeholders and wrote the records during the group works) were scientist from BCAS and FE-USB, but the group "leaders - speakers" were chosen inside each group – mainly to present the results of group work I and II, according the Workshop programme, to the auditorium.

The most important task for group work I was trying to specify new possible mitigation measures for reduction of phosphorus export from the Lomnice and Skalice sub-catchments to the Orlík reservoir and also evaluate the measures that were prepared by scientists from the Czech REFRESH team.

The task for group work II was to evaluate the criteria for two "best mitigation measures" elected in each group.

After each group work, the results of each group were presented by the group "leader-speaker" and followed by the plenary session and follow up discussion (moderated by Miloslav Lapka). The written records/minutes were made in each group by group "moderator" and moreover there was Eva Cudlinova writing the whole workshop minutes.

2.7.2 Results / proposals on mitigation measures and their (likely) effects

The measures proposed by stakeholders were interesting though not very surprising (see Table 4 and following results), but really surprising was, how avidly the stakeholders discussed, how intensively they perceived the whole phosphorus problem influencing both sub-catchments, as well as the Orlík reservoir.

Table 4. The mitigation measures proposed by groups of stakeholders

Stakeholders group (main source of pollution)	Measures	The (two) winning measures
Municipalities – waste waters	• Apply the existing legislation and force the representatives of legislation to really act (currently the representatives do not act, even if the polluters are known) • improve the functioning of inspections as well as enforcement authorities (State and County level) • modernize and reconstruct existing sewage treatment plants, to remove the phosphorus • reduce the runoff from the roads • reduce the runoff from the washing agents	**1. Construction and modernization of the existing sewage treatment plants** *(notice of deputy from ČEVAK: It is also necessary to count on sewer system improvements)* 2. The equality of control and enforcement

Stakeholders group (main source of pollution)	Measures	The (two) winning measures
	• restore river flood plains and meanders • improve coordination and coverage of existing system (sewage treatment plants are at the upper reaches of rivers, but they are missing on the lower reaches)	
Fishery companies	• Removal of old loads - de-siltation of ponds • Control of small fishery producers (to identify sources of pollution in the case of smaller ponds, to know who discharges the excessive quantity of P) • Authorisation/permission to use fish feed and manure to increase fish production should be laid down for all sizes of ponds. Currently these permits and limits are applied only for management on large ponds that cover 50% of total fish pond area but represent only 20% of the total number of ponds. • Trapping silt below the pond during fishpond hauling (use of settling tanks downstream – this was implemented in the past) • De-siltation of these settling tanks after fishpond hauling • Regulation of fish density by regulation catches during the season (has been carried out)	**1. Removal of old loads** *(de-siltation)* *(notice of J. Borovec (BCAS) – there would be a need to define the old burden, make a list of the ponds, which could have it, which seems unreal ...)* 2. The equality of control and enforcement of law
Agriculture	1. Legislation and enforcement • Not apply any new action, but respect the current laws purposefully • Everybody should follows the law and regulations • The inspection and control mechanisms operate, but not towards all concerned; it doesn't work the same way for large farmers and small ones (the controllers often say " the small ones would be bankrupted by the penalty"). The same issue holds for fishermen. • Solutions of existing problems about which the inspectors are well-informed. Targeted subsidies (the same package but divided differently – according to individual and specific conditions of each subject/farm; for example land steepness in case of anti-denudation subsidies) 2. Fertilisation • P fertilization is currently minimal (in 1980 it was about 40 kg/ha, in 2010, 4 kg/ha; N is used mainly in liquid form to increase the efficiency) • "P was fertilised in advance to a pool the 1970s and 1980s" • The reduction of P use in agriculture is evident from the comparison of current situation with the state before 1990 (animal production:	**Streamlining of subsidies** (this implies: -equality of control and sanctions, -dividing fields on slopes to decrease erosion -grassing of thalwegs, valley lines)

Stakeholders group (main source of pollution)	Measures	The (two) winning measures
	Cattle 30% reduction, pigs 60% reduction, poultry 60% reduction; i.e. input from agriculture is declining) 3. Reduction of erosion Targeted anti-erosion subsidies The subsidies should really be given to the agricultural subject, which would apply it on part of land, where it is needed. • Dividing of large fields • Other, specific measures based mainly on the GAEC measures: applying of broad-strips crops, greening , i.e. converting arable land into grassland, dividing of big plots, green-buffer zones along streams (from those measures the most important is conversion of valley lines into grassland and dividing of big plots) • Balanced management of crop and animal production, as was in the case of "old" farms – at least at the level of state ownership. 4. Other • Motivation- - external financial motivation – subsidies - internal environmental motivation – "when we would see that measures work" • Data on fertilisation should be reported to River Basin Authorities	
Institutions and stakeholders concerned with water quality, and other interests	1. Sewage treatment plants • Construction of sewage treatment plants • Reconstruction (it is necessary to solve, to take into account also inputs, because the villages have very often not sufficient financial means even for the reconstruction) 2. Agriculture • Apply agro-technical measures to retain P - compliance with the terms and limits of amount. Comply with the conditions of storage of manure • Specified the exact limits for Phosphorus for producers of pollution • Improve farming practices (on land) • To enable the conversion of even leased land into grassland. Enterprises which run their farming on leased land (i.e., 70–90% of all enterprises) cannot convert the arable land into grassland, because land does not belong to them. 3. Fishermen • Specify limits for P for producers of pollution active in this sector 4. Increasing the retention capacity of the landscape • Ecological diversification in the countryside	1. The greatest effect is associated with the **construction of new sewage treatment plants**, but this is a rather expensive option. 2. Compliance with good practice: this is a cheaper option, but we don't know how effective it will be, what percentage of farmers will apply it.

Stakeholders group (main source of pollution)	Measures	The (two) winning measures
	• Dividing of large fields • Converting arable land into grassland, • Grant subsidies for creating new landscape elements. 5. General • Compliance with good practice – the consistent compliance with general binding rules • Putting into wide practice phosphate-free washing powders and tablets to dishwashers	

The group of municipal deputies

In the group of municipal deputies the atmosphere of helplessness, shyness, and misunderstanding which can be described shortly as "Best option is the new sewage treatment plant, when someone pays for it" prevailed. The possibility of retention of water and phosphorus in the landscape, from the range of suggested measures, was rather sceptically perceived. Water is still perceived as something rather dangerous – bound to the floods.

On the other hand, there were only three compliant sewage treatment plants in the sub-catchment of Lomnice. This was the reason why the construction of new sewage treatment plants was proposed, but without a clear vision who should finance it.

Fishermen group

It is necessary to mention that only two representatives from the group of "fishermen" stakeholders participated (moreover both associated with the same company), which might cause a distortion.

According to those two stakeholders, the main problem is siltation and the best solution would be to make such ponds clean, with the help of subsidies.

According to the fishermen, such "de-siltation" of ponds could generate a high effect on the reduction of P (up to 50% reduction). However, this seems to be only an economically purpose-built claim – because greater volume of water in the pond will allow larger production.

According to fishermen stakeholders, a major source of pollution are small producers (accommodation facilities, municipalities…) producing fish on the supposedly large number of small ponds in the whole area. These do not have any permission to use fertilizers and fish feed, nobody controls them, but they produce rather big pollution (control of pollution from small producers can bring high effect > 30%).

Change of semi-intensive management to extensive would have, according to stakeholders estimation, a rather small effect on water cleaning in lower parts of Lomnice and Skalice (max 20%).

Agricultural subjects

The group of agricultural subjects (farmers as well as the agro-cooperatives and bigger agro-companies) discussed actively, even if at the beginning their attitude was rather general and apologetic of agriculture, with a slight fear whether someone is going to blame them as polluters ("fertilizers are expensive").

Since 2010 the erosion control has been bound to subsidy titles, farmers must follow the Nitrate Directive and have to control solid manure storage, with a permitted minimum capacity of storage tanks.

But nevertheless, if farmers would comply with all the measures and directives, there would be much smaller problems with clean water. The stakeholders meant that there is an error in the legislation and it's variation on legal and natural persons (legal persons are facing stricter controls). They also thought that the same problem applies to subsidies which were not well-targeted, with millions being wasted for grassing, but with land grassed in places where it does not affect the purity of water (i.e. at flat lands, while on steep slopes there is still the arable land in many cases).

Quotation: "The best natural sewage treatment plant is pond, meadow or baulk[1] – any dividing of landscape" (woman working as a manager in the agro cooperative AGPI).

Institutions and concerned stakeholders

In this group there was an agreement with the fact that there is a significant need to construct new sewage treatment plants (and reconstruct existing ones), but nevertheless only the sewage treatment plants cannot solve the whole problem.

The most important is to comply with the laws and measures which are already valid - there is enough of general binding rules, and there is no need to add new ones.

Small ponds do not have limits for the discharging of phosphorus, only large ponds do.

2.7.3 Criteria

Some of the measures appeared to be the most important across the groups. We tried to ask stakeholders to evaluate such measures through the "criteria" methodology (their transcription is in the Appendix 1).

Significantly, the main accent on implementation as well as the control is on the state and its relevant institutions. Nearly all the stakeholders rely on "law", "controls" and "suitable recourses", though they did criticize, that those do not operate properly in the Czech Republic (or at least in the Lomnice/Skalice sub-catchments).

Table 5. The most frequent mitigation measures proposed by groups of stakeholders

x important; (x) less (but still) important

Measures	Municipalities – waste waters	Fishery companies	Agriculture	Institutions and concerned stakeholders
Apply existing legislation and force the representatives of legislation to really act (control everybody through the same criteria, impose the "same" sanctions)	X	x	x	x
Construction and reconstruction of sewage treatment plants	X		(x)	x
Dividing of large fields			x	x
Converting arable land into grassland	(x)		x	x
Landscape revitalisation (Dividing, diversifying of landscape, the restoration of the river flood plains and meanders)	X		x	x
Reduce the P export from the washing and dish washing agents	X		x	x

[1] Balk or baulk (in Czech "Mez") is a piece of land dividing two fields, usually grassed or grown with the bush or trees. Most of them in Czech Republic were ploughed away in 1950-1980.

Measures	Municipalities – waste waters	Fishery companies	Agriculture	Institutions and concerned stakeholders
Impose limits on the discharge of phosphorus in small ponds, too. (So far, limits exist only for large ponds)		x		x

Municipalities

The construction of sewage treatment plants is expensive, mainly due to the construction of sewers. For small municipalities it would be an unbearable burden, as they do not have the financial resources (even for co-financing, in the case of a possibility to receive assistance for such projects).

Fishery companies

The subsidy environment is unstable, in the case that if they fertilize and feed less, they are less competitive. Moreover, very often, promised grants and compensations for environmentally friendly behavior eventually failed.

Agricultural subjects

Main objection (and suggested measure resulting from it) was that agri-environment subsidies are not targeted well. Subsidies as for example "grassing", are targeted in an area without the care, generally, and not with the award of specific characteristics of land. Thus, in many cases, subsidies are directed towards flat pieces of land and not plots on steep slopes, which (the latter) contribute much more to phosphorus losses. According to respondents, other subsidies, which are not well targeted, are specific to actions such as dividing of plots, green belts, broadcast crops and soil conservation.

The farmers are well-aware of the subsidy for grassing. "Grassing is a mat for waters" the respondents agreed. But there is a general obstacle in the Czech Republic - most of the land is leased, so the land-use transformation is often not decided by farmers.

Institutions and concerned stakeholders

The absence of high-quality sewage treatment plants creates 50% of the pollution burden. But the measure most needed is to comply with the standards and regulations which are already set. To solve the phosphorus problem, it is also necessary to pay attention not only to economic actors, but also to households and holidaymakers and try to change their behavior.

2.7.4 Follow-up discussion – Why the measures do not work (is it a fault of nature or society)?

The opinions of stakeholder groups on the applicability of measures to improve water quality are given in Table 6.

Table 6. Opinions of stakeholder groups on the applicability of measures

Stakeholder group	Why the measures do not work (is it a fault of nature or society)?
Municipalities	They blame people and the society- legislation and financing. Municipalities will not have enough funds for the construction of sewage treatment plants, (there must be some help from the State and the EU, and it is necessary to review the legislation)
Fishery companies	**"Nature must make profit for us** –*(Manager of Blatenská ryba company)* - This is the reason why nature is devastated. It is difficult to maintain competitiveness and act ecologically; it seems unrealistic to comply with the parameters of organic farming or fishing and at the same time maintain economic competitiveness.

Stakeholder group	Why the measures do not work (is it a fault of nature or society)?
Agriculture	**"Nature is tired in serving human needs."** *(Deputy headmaster of company AGPI)* It is necessary to go back to management, which would operate according to the logic of the "common sense".
Institutions and concerned stakeholders - water quality, other interest	The fault is on the side of society. Everything cannot be checked in detail. Everyone should want to bring some sacrifice. At the beginning there should be some General Agreement of all concerned – about nature, rules, how to act, how to check observance of rules.

2.7.5 Plenary session

The main problem lies in the social system, i.e. in communication. An agreement must exist among multiple players and the measures should be coordinated. Once the agreement is made, everyone must follow it. The moment when one does not comply with the agreement - the others would break it too.

In the contemporary Czech society the people who do comply with the rules of law and behave decently in the framework of legal norms (e.g., do have their own sewage treatment plants) are disadvantaged in comparison with the socially acceptable standard of behavior, where most of the others bypass the law.

A system of positive and negative incentives (subsidies and sanctions) should be set, otherwise there appears a system error. There must be synergy between control and enforcement (it was shown that this is possible; for example in the case of consents for use of wells by natural persons in the Czech Republic in 2010 - there was a radical but fair solution from the side of state administration).

It is also even possible to prosper from the negative forms of motivation for clean water. The first condition is that the rule of law will function, as in Germany, where people are not afraid to point out when they see a contra environmental behavior (e.g., not allow waste disposal).

Nevertheless the fundament of the Czech problem lies probably in the sphere of monitoring and enforcement.

Monitoring and control are fundamental problems. Ineffective control or no control creates an environment where the directives are not respected on a voluntary basis and in terms of actors' own internal beliefs. On the contrary, they are often considered as an obstacle to economic development of the region.

Quotations:

"The economy has to find out, the cheapest way, and not just –"we don't have enough money to pay for it". *(Woman, manager of SORP)*

"The state doesn't function as a barrier (e.g. customs) and introduces completely contradictory measures. Moreover, it reduces the number of control officers". (*Man, deputy headmaster of AGPI Company)*

A problem might lie also in the psychological sphere. Currently, the Orlik reservoir is perceived more or less as "a dirty, not suitable lake for swimming, just for boat trips or fishing".

It is necessary to convince people, especially in the vicinity of the reservoir, but also in the municipalities upstream, that the clean Orlík is more than an opportunity for holidaymakers and recreational industry, and that the Orlik reservoir is the issue of strategic importance- that sometime in future it could serve as the reservoir which supplies drinking water (e.g. as Římov or Želivka).

3. Lipno subcatchment

3.1 Introduction

The third area described here, the Lipno Reservoir catchment, is located in the uppermost part of the Vltava River watershed, where the Vltava springs in the Šumava mountains. The entire Lipno catchment lies in the Šumava National Park, therefore, it carries a lot of specificities in terms of the types of economic activities run here, and the types of activities permitted or prohibited in the area due to the value of wildlife and nature conservation rules. For instance, there is no arable land here because all of it was converted to pastures and meadows, and any development of the settlement is under the auspices of the National Park authority. On the other hand, the existence of the National Park supports the main source of income in the area, namely, the tourism industry.

3.2 Purpose of the workshop at the Lipno catchment

The situation with regards to water quality protection is completely different in the Šumava National Park in comparison to the other sub-catchments. Many measures that we suggest in other parts of the Vltava catchment are already in force in the National Park. There are many restrictions on various economic activities here, especially agriculture. Thus, stakeholders can provide us with a valuable feedback as to where the restriction missed their purpose, and where the rules are not respected in reality. The stakeholders' knowledge of the real life in the area will help us to identify additional measures that should be introduced in this highly protected area.

3.3 Identification of pressures/Problems at the Lipno area

3.3.1 Pressures

The Lipno catchment can be described as a forested land with some proportion of meadows and pastures used for cattle grazing, with some scattered human settlements and a few small towns and villages. In the lower part of the catchment, there is a large water reservoir of Lipno. Tourism is a highly dominating economic activity there.

The catchment comprises of two different parts: The upper part covers all the Vltava tributaries as far as its augmentation by the Lipno dam. The other part of the catchment can be described as an area adjoining the Lipno reservoir itself.

In both parts of the Lipno catchment, i.e. in the mountain part and in proximity to the Lipno reservoir, tourism is the main source of livelihood, though the offered leisure activities have different characteristics in each of the two parts.

In the upper part, summer activities are hiking, cycling, and canoeing on the Teplá Vltava River. In winter, there are good conditions for skiing.

The lower part of the catchment, i.e. the part surrounding Lipno, is mainly a summer resort. Activities offered to tourists are mainly swimming and angling. Some people also visit the area for yachting and windsurfing. In other words the economy of the lower part is greatly dependent on water quality of the Lipno reservoir.

3.3.2 Problems

In the upper part of the catchment, pollution does not cause any serious problems. A completely different situation can be found downstream at the Lipno reservoir. Supply of nutrients, especially of phosphorus, is so high there that it causes eutrophication and cyanobacterial blooms in the Lipno Reservoir. A heavy pollution of water could disable the utilization of the area as a tourist resort.

Some research organizations in cooperation with the Vltava River Board authority identified high phosphorus content in the water as the key reason for the water quality deterioration. The analysis of

the intake of phosphorus by the source gave the following results: diffuse sources – 72% (includes cattle breeding), ambient air deposition – 3%, sewage from the upper part of the catchment - 9%, sewage from vicinity (lower part) of the catchment – 12%, angling – 4%. (Hejzlar et al., 2001).

The above-mentioned diffuse sources can be divided into natural ones, and those with an anthropogenic origin. The natural sources of phosphorus include runoff from forests and unused meadows. The anthropogenic diffuse sources in the Lipno area include cattle breeding, especially open air grazing. Scattered human dwellings and recreational housing facilities, that very often do not have proper waste water treatment practices, present another important source of phosphorus.

3.4 Stakeholder identification

3.4.1 Stakeholders characteristic and reasoning

The Lipno area is characteristic by its national importance in the field of wildlife conservation, because a large National Park is located there. This Park is under supervision and administration of the NP Šumava, an organization established and controlled by the Ministry of Environment.

Another specific feature of the Lipno area is that tourism is the main source of income for the majority of polluters, so they have a great interest in clean water in the Reservoir. This is why there are hardly any considerable conflicts among the stakeholders regarding water quality[2].

The list and the division of stakeholders into three REFRESH categories are summarized in Table 6.

Table 6. The stakeholders and their status in respect to the impact on/influenced by the environment

Institution/ group	Impact on environmental state	Can initiate measures	Influenced by environmental state
Šumava National Park		X	
Ministry of Environment		X	
Ministry of Agriculture		X	
Czech Fishing Association	X	X	X
Vltava River Board		X	X
Municipalities at the watershed	X	X	X
Farmers	X		
Other enterprises			X
Residents			X
ČEVAK	X		

Šumava National Park – nature conservation is the core of its activity, it carries out various research projects on this topic, and regulates tourism in protected areas. It decides which economic or leisure activities are allowed or not allowed in the area, and issues permits for development in the area under its governance.

Ministry of Agriculture – provides state financial support for water management, including a program on "Sewage Systems and Water Treatment plants", administers various programs and directives supporting environmentally-friendly agricultural practices, e.g. the Nitrate Directive.

[2] As a side note, there are heavy fights, sometimes even physical ones, between various stakeholders with respect to cutting the trees in the protected areas due to bark beetle infestation.

Ministry of Environment – provides state financial support through various programs, e.g. "Revitalization of the retention capacity of the landscape". Through its sub-organizations (e.g. Czech Environmental Inspectorate, State Environmental Fund), it applies and enforces environmental protection.

Czech Fishing Association – issues fishing permits for visitors, maintains the fish stock in the Lipno Reservoir. When angling, visitors apply the decoy in the water, which causes non-negligible pollution. The Association has a power to regulate fish feeding.

Vltava River Board, state enterprises – amongst others, it prepares and administers various measures for maintaining the quality of surface water.

Municipalities in the watershed – support or permit various development and economic activities in the area, organize sewage treatment, etc. Very often they prioritize development rather than nature conservation and thus they are frequently in conflict with the National Park administration. With regards to water quality, some towns in the Lipno area have installed highly efficient sewage treatment plants of their own accord to improve the water quality in the Reservoir.

Farmers – cause diffuse pollution through cattle open air breeding. They have to follow the rules issued by the Ministry of Agriculture. In contrast to other economic stakeholders, they do not depend on tourism.

Hotels and restaurants – they are entirely dependent on tourism, thus consequently on the water quality. They are located in build up areas of the settlements. Their sewage treatment is organized due to pertinent settlement rules.

Summer cottages, bungalows and other housing facilities scattered around the Reservoir – they very often do not follow obligatory rules for wastewater treatment, and as a result they are committing to diffuse pollution.

Other enterprises relying on tourism – e.g. boat renting, Yacht Club Frymburk, family entertainment centers, on visitors oriented retail, beauty salons, etc.. They are entirely dependent on tourism while they do not contribute substantially to water pollution.

Residents – are influenced by water quality and tourist flows (indirectly), even if they are not directly involved in the tourism industry.

ČEVAK. JSC – company operating, among others, sewage systems and wastewater treatment in some municipalities at the Lipno area. It has served as a professional and technical support when the towns near the Reservoir decided to improve wastewater treatment efficiency beyond obligatory limits.

Table 7. Power – Interest of the stakeholders

Interest ↑	Hotels and restaurants Scattered housing facilities Other enterprises relying on tourism	NP Šumava Ministry of Agriculture Ministry of Environment Czech Fishing Association
	Residents EIA specialists – professional public ČEVAK	Vltava River Board Municipalities Farmers
	Power →	

3.4.2 Stakeholders participating in the workshop

All stakeholders invited to the workshop were chosen from the companies located at the lower part of the catchment, i.e. the area surrounding the Lipno Reservoir, because in this territory, there is a closer link between water quality and various economic activities.

In total, 11 representatives of various stakeholder groups have been invited. Amongst them were 4 mayors of the towns lying in the proximity of the Lipno Reservoir. No one from this group appeared in the meeting. One of the mayors had sent his statement with regards to heated discussions about forests clearings due to the bark beetle infestation. Though the topic of his letter was out of place, it may shed light on the reasons behind the mayors' absence; this mayor did not distinguish between the REFRESH research team and the militant environmentalists fighting for preservation of wild forests in the area.

Stakeholders attending the meeting represented the following groups:

Group of institutions:

National Park Šumava

Lipensko, Ltd.

EIA Service, Ltd.

ČEVAK, JSC

Group of farmers:

Farma Milná, Ltd. – an organic family farm

Farma Slunečná, v.o.s. - an organic farm and agro tourism business company

3.5 Preparation before the workshop

All stakeholders were invited either personally or by phone, and then an e-mail was sent informing them on the purpose of the workshop, time and place, the activities supposed to be done in the group works and the list of other invitees.

A presentation of phosphorus problem in the Lipno Reservoir was given in order to briefly introduce the topic to the participants who were not familiar with it.

Possible mitigation measures for reduction of phosphorus in the Lipno Reservoir were prepared (one specialized thematic list for each from all four groups – e.g. agricultural mitigation measures for agricultural “actors”, etc.), to be evaluated after the brainstorming in the first part of the group work.

The list of criteria (to be evaluated) for each group was also prepared for the second part of the group work.

3.6 Workshop program

The program of the workshop was as follows:

13:00 Arrival

13:10 Welcome of the participants and introduction of the workshop and time schedule by M. Lapka

13:15 Information on the REFRESH project, its aims, structure, and up-to-now results. Information about water quality in the Lipno reservoir and about predicted consequences of climate changes in the area. (J. Hejzlar, B. Políčková)

13:35 Group work I – "Trying to find the measures"

14:10 Presentation of results by group leaders

14:20 Discussion

14:30 Group work II – "Evaluation of criteria"

14:45 Plenary discussion

15:00 Closing of the workshop

3.7 Description of the workshop

3.7.1 The course of the workshop

At the beginning a short presentation was held to acquaint the stakeholders with the history of water quality in the Lipno Reservoir, and the contemporary status of the nutrient loading and nutrient sources. The forecasted climate change and its consequences in the Lipno area was also mentioned.

After this introduction, stakeholders were divided into two groups, namely, farmers and other stakeholders. Both groups discussed separately the outlined problems and their possible solutions. Then, both groups presented their results to each other and discussed them together. In the end the groups separated again, picked the best solutions and evaluated them according to the given criteria.

3.7.2 Mitigation measures proposed by the stakeholder groups

During the group discussions there was an easy consensus about which solutions are the most effective. It was because some practices in the Lipno area are objectively highly harmful and stakeholders evaluate them as in their everyday lives. They appreciated that they had a chance to publicize what they were dissatisfied with. The most efficient measurements as suggested by stakeholders are listed in Table 8.

Table 8. The measures mostly supported by each group

Stakeholders group	Measure
Farmers	Housing of livestock in the winter
	Reducing the size of herds
Others	Enhancement of retention capacity of the landscape
	Controlled disposal of wastewaters from septic tanks

Reasons for choosing the above measures.

1) **Housing of livestock in the winter**

<u>The problem</u>

The herds of cattle staying outside in winter have a habit to gather together in one place. They thread down the meadows in these places, which causes soil compaction where nothing grows after that.

In winter, the excrements do not soak into the frozen ground and consequently flow out over the surface straight into the water bodies.

When the weather is cold, animals living outside have higher energy needs at about 10 to 15%, thus they also produce more excrements.

Current status

Farms in the area have to declare winter housing capacities for all animals. But in reality, these barns are not suitable for the declared purpose, because they have been built for bound breeding practice in the past. As the result, herds are kept outside the whole winter.

Solution

Adaptation of existing barns to loose housing.

Costs

The reconstruction of barns not satisfying the contemporary needs will be quite expensive. The state should support these reconstructions granting a 50% investment subsidy to priority projects; this subsidy can subsequently be decreased to 20 – 30% of total investment costs.

2) Reduction of the size of herds

The problem

Large cattle herds use grazing on one place and gathering around sources of water, so that they thread the meadow to high extent, which supports the phosphorus outflow.

Current status

In the Lipno area, the typical size of a herd is about 100 animals, but some large farms have even herds of 150 animals or more.

Solution

Large herds should be reduced into the size of 30 – 35 animals and frequently move from one pasture to another. The requirement for smaller herds should be listed in a directive of MoA and should be a necessary prerequisite for the provision of agricultural subsidies.

This measure could lower the contemporary phosphorus runoff to the Reservoir (23%) by 70%.

Costs

It is necessary to install more fencing; also, there are higher managerial demands.

The costs incurred will be offset by improved health of animals and their higher natality. At present, it is possible to receive subsidy for fencing.

3) Enhancement of the retention capacity of the landscape

The problem

Water draining away from the surface to the Reservoir too fast, e.g. via agricultural drainage or through straightened out streams, is not naturaly purified during its route, and the potential retention capacity of the landscape is not utilized.

The current status

Small streams in the Lipno area are usually ditched and narrowed when they pass through agricultural land, sometimes even fortified. Slight slopes are often drained by conduits installed in the 1960s and 1970s, sometimes even earlier.

Farmers do not usually favour the revitalization of streams or dis-functioning of drains, because these adjustments constrain the agricultural utilization of the fields.

Moreover, current legislation is on the side of the farmers and supports agricultural production.

Besides production support, there are other legislative obstructions to a revitalization effort. In the view of the legislation, a straightened part of a brook is a water construction and the pertinent act stipulates that this construction has to be maintained in the original condition by the owner of the land parcel. Thus, if one wants to revitalize a brook on his/her property, he/she has to finance a new construction project, which is costly.

Despite the above, revitalizations are being sometimes fulfilled, often with no subsidies.

Subsidies are often directed to construction of small ponds rather than to revitalizations.

Solution

Revitalization of small watercourses, marches, bushes and other landscape elements. Substantial support by both the legislation and subsidies is necessary. The responsibility of revitalization should be levied/put on the watercourse administrator.

The increased retention capacity could result in a 40% abatement of phosphorus compared to current status.

Costs

Revitalizations are conditioned by high expenses, which could be carried out by the state.

Besides water pollution abatement, revitalizations would bring other important positive effects, e.g. increased water storage capacity of the landscape, which is gaining importance in the light of future climate changes.

4) Wastewater disposal recording

Problem

Small dwellings, which are common in the area, are not connected to the sewerage. Instead, residents are obliged to collect the sewage in septic tanks and to transport it to disposal to a wastewater treatment plant. If they do not follow this procedure, they discharge the unclean wastewater in some inappropriate place and thus they pollute the environment.

Contemporary status

There are many small settlements, cottages and bungalows scattered around the Lipno area. They are supposed to export their sewage into the waste water treatment plants. According to ČEVAK, they do not usually do it. At the same time the National Park does not have a right to inspect them, so in reality there is no enforcement for the proper sewage treatment.

Solution

Compulsory registration of wastewater disposal should be introduced. Municipalities should have the responsibility for the registration and checking.

Costs

Administrative only; they should be carried by municipalities.

4. Summary discussion and conclusions

4.1 Stakeholder feedback on the REFRESH stakeholder engagement process

Some points might serve as indicators of stakeholders´ feedback:

At both workshops, most persons which we invited really took part in the meeting (an exception in Lipno meeting is explained below in section 4.2). The reactions and speeches in plenary sessions showed sometimes wide, sometimes even deeper interest in the topic of water quality in the Orlík reservoir. In the end of both workshops, stakeholders expressed that they are glad that water quality in the Orlík reservoir is being attended and that they could attend.

Higher interest and more concrete and already undertaken measures were seen probably at Lipno, where the present stakeholders apparently had the landscape and water at their hearts, and on the contrary the mayors who might have had an uneasy conscience didn't participate in the workshop.

4.2 Comparison of both workshops

Another type of landscape calls for different types of agricultural mitigation measures (Table 9). At the Lipno sub-catchment the measures were more alive and factual, stakeholders seemed to know much more on what they were talking about, they were even more interested than in Mirovice.

In Lipno the mayors didn't attend the workshop – which is significant and it might be argued that they expressed non-verbally their opinion about the matter of water quality. But we cannot simply say they are not interested in clean water. There is a political case in the Šumava National Park to change the status of the Park and allow cutting timber everywhere, including core zones. Environmental activists and some parts of public are against and want to keep the core zones without cutting and other human activities. The Lipno reservoir is a part of this area and mayors belong to timber cutting" (majority) or "boundless cut" group (minority). So, they were afraid that the topic might have been discussed and other stakeholders would ask them about their clear opinion in the Šumava case.

According to agricultural stakeholders, mayors were afraid to come, because they did not feel comfortable with regards to small villages sewages, and also had some "special interests" as for example in timber cutting or awarding contracts to construction companies without competition; they possibly thought that they would not be able to explain to the deputies of institutions in our meeting easily.

Table 9. Comparison of winning measures according to stakeholder groups and sub-catchments

Stakeholder group	Sub-catchment	
	Skalice – Lomnice	Lipno
Municipalities	construction of new wastewater treatment plants and improvements in the construction and modernization of the existing wastewater treatment plants	They were not present
Farmers	Targeted state subsidies, their long-term stability for maintenance of the landscape	1) Reduction of the size of herds to 30–35 animals 2) Gradually cancelling free winter breeding in the area and convert it to a winter housing
Fishermen	Removal of old burden of phosphorus in fishpond sediments	There are no intensive farms in the catchment – it is not a relevant group
Institution	Construction of new wastewater treatment plants for small settlements	1) Building the wetlands – as for example polders or fish ponds – which do have a very long tradition in Czech lands, or root waste – water purifying plants, small retention basins or broad-base terraces – there are many types of artificially constructed wetlands, which can be used even for the retention of phosphorus (as well as for other ecological benefits) 2) Control of non-registered waste waters

Nevertheless non-agricultural stakeholders were really interested, and had (especially in the group of institutions) a much better view of the topic, than in Mirovice.

Generally the Lipno workshop seemed more consistent, meatier/meaningful.

At the Lipno workshop measures proposed include the diversification of the landscape, the dividing of the big plots of land, grass growing, creating of new and conservation of old landscape elements, the construction of the artificial wetlands and the revitalization of natural wetlands.

Mirovice

In the first workshop in Mirovice the representatives of all four groups agreed on one measure (though it was not "the winning one" for all of them); to really use the existing legislation and force those responsible to act effectively and fairly. The state inspection authorities work, but not in the same way for all. They are more strict towards large enterprises (such as agricultural or fisheries) and less strict towards natural persons (which would be bankrupted by the penalty). High penalties are (at the end of the day) rather counter-productive, as they are not imposed on those who cannot face them.

For the representatives of agriculture, targeting agri-environmental subsidies. of state. They saw it as a sine qua non condition for the other three mitigation action selected and dependent on it. i.e. equality of controlling and sanctions; dividing of big fields (any multiple of 30 m. – depending on technology), and conversion of thalwegs, valley lines into grassland.

In the group of mayors, the winning measure was the construction of sewage treatment plants. The emphasis was on a better system of planning and coordination, in the whole river throughout of stream (even sub-catchment). Nowadays, the sewage treatment plants are located only on the upper reaches of streams, and not on the lower parts of the flow.

The group of institutions hesitated between two measures, because the greatest effect would be reached by the construction and reconstruction of sewage treatment plants, but this measure is very expensive. On the contrary, the observance of good practice is relatively inexpensive, but no one knows how many percent of phosphorus decrease in the cleaning process this measure would do.

Lipno

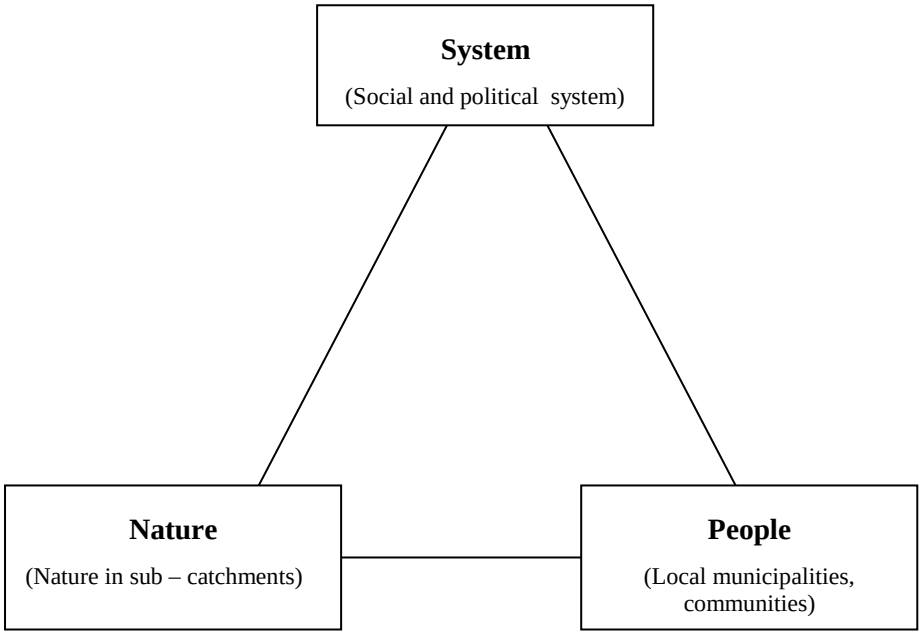
No one from the invited group of mayors took part in the workshop in Lipno (which is in itself a strong evidence of their opinion on the issue of phosphorus reduction).

A group of farmers completely agreed on two measures suitable for this specific landscape area and conditions around the Lipno reservoir: (1) to reduce the size of herds to 30−35 and (2) gradually set aside free winter breeding in the area and convert herds to winter quarters. Both measures will bring a reduction in erosion and phosphorus runoff, but also reduce compaction of soil, local soil degradation and moreover, generate considerable savings to farmers in the form of healthier animals and a larger number of bred calves.

The group of institutions proposed two closely related measures: (1) Building cleaning wetlands and (2) control of non-registered waste waters releases.

4.3 Generalisation

We might find three vectors of contemporary status of phosphorus pollution in the sub-catchments of Lomnice and Skalice as well as of Lipno, but they seem to work in different ways:



Lomnice/ Skalice

People

The legislation and regulations of farming and wastewater management are not observed; there is a lack of discipline and low level of awareness (not only regarding the phosphorus problem, but the whole context as well as environmental awareness; awareness of people's individual roots and societal identification.

Nature influenced by human impact has lost some of its potentialities – as, e.g., regeneration, water and landscape self-purification.

System

Systemically there is almost no coordination – e.g., on upper reaches of streams, wastewaters are purified, but on the lower reaches of streams the sewage treatment plants are missing. The missing coordination can turn the efforts to solve the problem in ineffective way in terms of waste of energy of stakehlodres, waste of their time and waste of financial resources. The state must specify more exactly environmental goals and framework (particularly the problem of phosphorus outflow would be taken more into account) in which economic and agricultural subjects can develop.

The big problem is seen in the unequal attitude to small and big subjects (in all spheres, in all three groups – agriculture, municipalities, as well as fishermen).

The stakeholders seem well aware of the fact that the global changes could strengthen all the negative impacts.

Lipno:

Nature

The nature in the Lipno catchment is on the one hand officially under the protection of the Šumava National Park. However, a lot of arable land, maybe most of it, has been converted into grassland in the past 20 years. So there should be a relatively good status of water coming from the agricultural land, but nevertheless the environmental burden of waste waters from scattered settlements and large agro-cooperatives are quite serious.

People and system

People and system might be even more bound together, even though the linkages are often very vague and concealed.

Climate change and suggested measures

In the case of the Czech Republic climate change is anticipated to bring possible changes in terms of higher concentration of P, increasing extremes in precipitation, generally decreasing the surface of ground water and river flow. This can influence farming, fishing and recreation in the area, as the availability of fresh water could be a barrier on economic activities in future decades. On the other hand who has a reservoir of fresh drinking water has a potential of a great economic profit. We asked stakeholders to evaluate each of the measures from these climate change point of view.

The result was not so clear in terms of stakeholder's perception of possible climate change and measures. The stakeholder's perception of reality is contemporary, not so much oriented into the future. They understand the problem of climate change and aquatic ecosystems in a way that all changes will be stronger, may be quicker, but not fatal, or unexpected. The more important are contemporary legislative, economic and other Problems, than ongoing or future changes in environmental conditions. On the other hand, some stakeholders declare that contemporary economic conditions and the orientation towards economic profit are going against the environment (fishery companies in Mirovice meeting), but they do not see strong relationships between such a behaviour and climate changes. This picture is similar to the ambivalent perception of global climate change in the Czech Republic. The main controversy is connected with the question if human activities increase climate change and if government is responsible for the measures for mitigation of climate change.

Generally, stakeholders believe that climate change should lead to different responses in environmental conditions but they do not project their solution in the form of proposed measures.

To the direct question they respond that all of the mitigation measures suggested in both meetings are also applicable in the future under possible climate change.

All sub-catchments:

In all three sub-catchments there is waste water cleaning in the municipalities, but not in scattered settlements (Lomnice and Skalice have significantly less sewage treatment plants than Lipno, but even

the status in Lipno is not ideal – somewhere the plants do clean well, elsewhere they are without the III degree, in some plants the results are even very unsatisfactory – e.g.Volary, Nová Pec). Everyone knows about the lack of sewage water cleaning in scattered settlements, but mayors either do not know how to deal with it, or partially they do not want (it is too complicated), as they are partly involved in other interests, which are (in consequence) contradictory to fresh water.

4.4 Lessons learned

The stakeholder workshops analysed above can also be associated with some general findings. It is clear that all measures are bound to the particular social, cultural and political systems. We tried to identify the issues which do prevent improvements of water quality in the Orlík catchment. These include:

1. Paternalism – relying on the state ("the state wants pure water – let it pay for sewage treatment plants", "the state doesn't give us good conditions, let it pay the subsidies…")

2. Permanency – the actors claim to behave the same way in the same system, just maybe with small corrective actions supported by the state.

3. Substitution – paradoxical fact when, in spite of paternalism and permanency, stakeholders are in an active role in observing and complying with state regulations of water quality and force the state to comply with those laws and regulations. This is a substitution of state administration by the civil society.

4. The general trend of concentration (agriculture, fisheries, recreation) and the associated increase of scale, which deteriorates water quality.

5. Misunderstanding of the broader context of "water, landscape, healthy life" (leads, e.g., to the pronouncement: "Who needs clean water in the Orlík" – The first workshop in Mirovice – man, group of institutions).

6. Unpopular directives on decreasing the outflow of nutrients, their ineffectiveness in terms of weak, unequal control, the problem to reach this limits of directives on the one hand, and be economically effective on the other.

7. Different rules Unequal environment for different interests, lobbyism, corruption, economic pressure as a priority, the quality of the water is not the topic number one for the representatives.

Another lesson learned, though many of stakeholders are really active, is that there is still a deficiency of local leaders who would have specific concern in the good ecological state of waters and water quality. For example when we tried to find a "nature conservationist focused on water ecosystem, or at least water purity" we didn't find anyone in the whole two sub-catchments of Lomnice and Skalice. Importantly, four years the SORP (League of municipalities of the Písek region) has been organizing the conferences about revitalisation of Orlík basin and has been popularizing the whole issue of phosphorus pollution.

The most significant, from the social system perspective point of view , is the will and interest in the clean water issue in Orlík catchment and reservoir. On the other hand in the social system there are many obstacles that hinder compliance with the relevant directives and regulations. We believe that the key to their understanding lies in the understanding of several basic facts, including:.

1. Clean water in Orlík and its sub-catchments should be a basic "cross"-interest.

2. There is a correlation between the quality of water, the quality of landscape and the potential of the wider area to become a good place to housing, business and overall social development.

3. The costs of the clean water today are much lower than relevant future costs.

4. Clean water itself in the Orlík reservoir, with regard to the current and expected global changes (not only of the climate, but also economic, demographic, and social), will become a valuable strategic resource for the future.

5. Local and regional municipalities are acting as ambivalent forces: should be a positive driving force in terms of giving an example of good practice (for example building progressive saving water system) or negative driving forces in terms of being a part of net of political and economical corruption.

4.5 Policy Recommendations

The measures could be divided into two groups, i.e., systemic measures and domain/field measures. The systemic measures depend on superior institutions (regional, state) or on political will, the domain/field measures can be directly applicable by stakeholders or institutions that represent (Table 10).

Most stakeholders at Mirovice workshop (the Lomnice and Skalice catchments) would recommend the increase of pressure on the control and executive institutions to act properly, making a bigger effort to find the money to build and reconstruct the sewage treatment plants and to find an efficient way to realize the landscape element construction or conservation (i.e. measures which would help to increase retention ability of landscape: the diversification of the landscape, the dividing of the big plots of land, grass growing, creating of new and conservation of old landscape elements, the construction of the artificial wetlands and the revitalization of natural wetlands).

Most stakeholders at Lipno workshop would recommend to increase pressure on control and executive institutions to act properly, namely in the sphere of non-registered pollutions sources.

Table 10. Generalisation of measures suggested by stakeholders

Systemic measures	Domain/field measures
Use of the existing legislation and forcing the representatives of legislation to really act (control everybody with the same criteria and impose same sanctions)	Construction and reconstruction of sewerage treatment plants
Small ponds are not required to limit discharges of phosphorus, only large ponds do – to solve this situation	Dividing of big fields
Support to the enhancement of retention capacity of the landscape (dividing fields, diversifying of landscape, the restoration of river flood plains and meanders)	Converting arable land into grassland
Reduction of phosphorus export from the washing and dish washing agents	Landscape revitalisation
	Housing of livestock in the winter
	Reducing the size of herds
	Disposal of wastewaters from septic tanks

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Appendix -"Wining measures and their criteria evaluation"

Municipalities	M
Fishery companies	F
Agricultural subjects	A
Institutions and concerned stakeholders	I

Measure: Put to use the existing legislation and force the representatives of legislation to really act (control everybody with the same "meter", the same sanctions as well)

Technical		Institutional		Effectiveness		Economic	
Can the present farming practices apply the measure relatively easily? ***(+, - or 0)***	***M:+*** ***I:+*** ***A:+***	Who should bear the costs – farmers/'polluters' or the society through subsidies, or the consumers? (**1** - polluters' **2** - farmers **3** - society through subsidies, / **4**- the consumers)	***M:0*** ***I:3*** ***A:3***	How much does the measure reduce the pressure? **(0 –100%)**	***M:70%*** ***I:???*** ***A: 15%***	Is/will (be) applying the measure costly? ***(+, - or 0)***	***M:-*** ***I:-*** ***A:-***
Would it require major changes in farming practices and the existing technology? ***(+, - or 0)***	***M:-*** ***I:-*** ***A:+***	Should applying the measure be a voluntary action or compulsory ? **1** - voluntary **2** - compulsory?	***M:2*** ***I:2*** ***A:2***			How ? **1.** investment **2.** maintenance **3.** loss of agriculture land **4.** other	***M:4*** ***I:4*** ***A:2***
Does the measure work everywhere or only in specific locations? **1.** everywhere **2.** or only in specific locations ?	***M:1*** ***I:1*** ***A:1***	Which authority/organisat-ion is responsible for the measure to be applied? ****Czech Environmental Inspection, Ministry of agriculture, Regional authorities, Ministry of environment***	***M: **** ***I:*** ***A: State***	How large coverage is needed in order to gain substantial results?	***M: Every-where*** ***I:*** ***Every-where*** ***A: Whole state***	Can this measure bring some other profit (-even side effect, by product or ecological service – other than reduction of P? (+, - či 0)	***M:*** + ***I:***+ ***A:+***

		Who will educate people about the use of the measure? ***Czech Environmental Inspection, Ministry of agriculture, Regional authorities, Ministry of environment***	***M: **** ***I: Control autho-rities*** ***A: State***			***Which?*** ***M: Sanctions*** ***I: reduction of other pollutants (NO3, etc.)*** ***A:***	

Climate change :
Would the measure be applicable also in the future (under the WP1 scenarios and/or with the climate change)?
(*in case of Czech subcatchments mainly increase of temperature, less water – i.e. lower dilution of P*)
M: yes, it would
I: ???

A: yes

Motivation:
What would be for you (or anyone who should apply the measure) a motivation to start to carry out the measure?
M: Financial benefits, the conditions to act, control and transparency

I: ???

A: sanctions

Measure: Landscape revitalisation (dividing, diversifying of landscape, restoration of river flood plains and meanders)

Technical		Institutional		Effectiveness		Economic	
Can the present farming practices apply the measure relatively easily? ***(+, - or 0)***	***A:+*** ***M:-***	Who should bear the costs farmers/'polluters' or the society through subsidies, or the consumers? (**1** - polluters' **2** - farmers **3** - society through subsidies, / **4**- the consumers)	***A:2*** ***M:3***	How much does the measure reduce the pressure? **(0 –100%)**	***A:50%*** ***M:30%***	Is/will(be) applying the measure costly? ***(+, - or 0)***	***A:*** ***-*** ***M:+***

Would it require major changes in farming practices and the existing technology? ***(+, - or 0)***	***A:-*** ***M:+***	Should applying the measure be a voluntary action or compulsory? **1 -** voluntary **2** - compulsory?	***A:2*** ***M:2***			How ? 1. investment 2. maintenance 3. loss of agriculture land 4. other ***A: organisation heftiness***	***A: * 4 - organisation*** ***M:1,2,3***
Does the measure work everywhere or only in specific locations? 1.everywhere 2. or only in specific locations?	***A:1*** ***M:2***	Which authority/organization is responsible for the measure to be applied? ***A*Ministry of agriculture*** ***M** Ministry of agriculture, Vltava River Board, state***	***A: **** ***M: *****	How large coverage is needed in order to gain substantial results? ***A**** ***LFA(***Less-favoured areas) ***M***** ***maximum possible***	***A: **** ***M: *****	Can this measure bring some other profit (-even side effect, by product or ecological service – other than reduction of P? (+, - či 0)	***A:+*** ***M:-***
		Who will educate people about the use of the measure? ***** Ministry of agriculture, Vltava River Board, state***	***A:*** ***M: *****			***Which?*** ***A: Nicer landscape***	***A:*** ***M:***

Climate change : Would the measure be applicable also in the future (under the WP1 scenarios and/or with the climate change)? (*in case of Czech subcatchments mainly increase of temperature, less water – i.e. lower dilution of P*) ***A: Yes*** ***M: Yes***
Motivation: What would be for you (or anyone who should apply the measure) such a motivation to start to carry out the measure? ***A: Targeted subsidies, inner motivation – to see the measure works as it should*** ***M: Ministry of agriculture, Vltava River Board, state***

Measure: Construction and reconstruction of a sewage treatment plants

Technical		Institutional		Effectiveness		Economic	
Can the present farming practices apply the measure relatively easily? ***(+, - or 0)***	***I:+*** ***M:0***	Who should bear the costs farmers/'polluters' or the society through subsidies, or the consumers? (**1 -** polluters' **2 -** farmers **3 -** society through subsidies, / **4**- the consumers)	***I: 1, 3*** ***M:1***	How much does the measure reduce the pressure? **(0 –100%)**	***I:50%*** ***M:90%***	Is/will (be)applying the measure costly? ***(+, - or 0)***	***I:++*** ***M:+***

Would it require major changes in farming practices and the existing technology? ***(+, - or 0)***	***I:0*** ***M:0***	Should applying the measure be a voluntary action or compulsory ? **1** - voluntary **2** - compulsory?	***I:2*** ***M:2***			How ? 1. investment 2. maintenance 3. loss of agriculture land 4. other	***I:1,2*** ***M: 1,2***
Does the measure work everywhere or only in specific locations? 1.everywhere 2. only in specific locations?	***I:1*** ***M:1***	Which authority/organization is responsible for the measure to be applied? ***I: *Ministry of environment*** ***M: **State and municipalities***	***I: **** ***M: ********	How large coverage is needed in order to gain substantial results?	***I: Every-where*** ***M: Every-where***	Can this measure bring some other profit (-even side effect, by product or ecological service – other than reduction of P? (+, - či 0)	***I:+*** ***M: +***
		Who will educate people about the use of the measure? ***I: * Ministry of environment and municipalities*** ***M: **State and municipalities***	***I: **** ***M: ********			***Which?*** ***M:*** ***Reduction of sediments and silts*** ***Financial effect,*** ***Effect for environment***	

Climate change :
Would the measure be applicable also in the future (under the WP1 scenarios and/or with the climate change)?
(*in case of Czech subcatchments mainly increase of temperature, less water – i.e. lower dilution of P*)
I:Yes
M: Yes

Motivation:
What would be for you (or anyone who should apply the measure) such a motivation to start to carry out the measure?
I: -
M:Penalties