

Agricultural measures to restore the Swiss midland lakes (Sempach, Baldegg, Hallwil)

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INTRODUCTION

After the remediation of the municipal sewage the main part of the phosphorus load, which pollutes the lakes (lake of Sempach, Baldegg and Hallwil), originates from agricultural areas in the catchment areas of the lakes. Since 1999 measures to reduce the phosphorus load from agricultural areas are subsidised by the Swiss government within the ordinance of water protection. This program is based on a voluntary participation of the farmers under the charge of the department of agriculture and forest in collaboration with the department of environment and energy of the canton Lucerne.

MAIN MEASURES OF THE PROGRAM

The general program (Table 1) includes 5 m buffer-strips on waterways, no fertilisation on at least 5% of the agricultural area, no open soil during wintertime, direct sowing of corn and cereals above a gradient of 18%, maximum of 20% corn, beet, potato of the arable crops, improving of drainage systems and infrastructure on farm yards, soil sampling each 5 year, Limited phosphorus fertilization according to soil-P- analyses and further education.

Table 1 The main measures of the program and their compensation.

Measure	Compensation
General program (lake contract)	300.- Fr/ha
Buffer strip	9.- Fr/a (excluding first 3 m)
Phosphorus fertilization 80 - 100 %	15.- Fr /kg P ₂ O ₅
No-tillage and strip sowing	200.- / 300.- Fr/ha
Improving of drainage systems	Planning costs
Retention ponds	Building and maintenance cost
Closedown of swine / poultry units	Payment of residual amortisation
Alternatives in production	30% of the investment (max. 20'000.- Fr)

P PROJECT SITUATION 2008

Participation

- 78% of the area in the catchment area is in the lake contract
- 573 farms (72%) are under contract

Compensation for measures taken on the farm

- 2008 a total of sFr. 5.7 Mio was paid to the farmers
- 50% for lake contract, 30% for reduced P fertilization (P < 100%)
- 78% are financed by the Swiss government, 22% by the Canton of LU

Development of agriculture

- Animal density has been stabilized, but pig production has slightly increased since 2004
- Export of manure out of the catchment area has increased

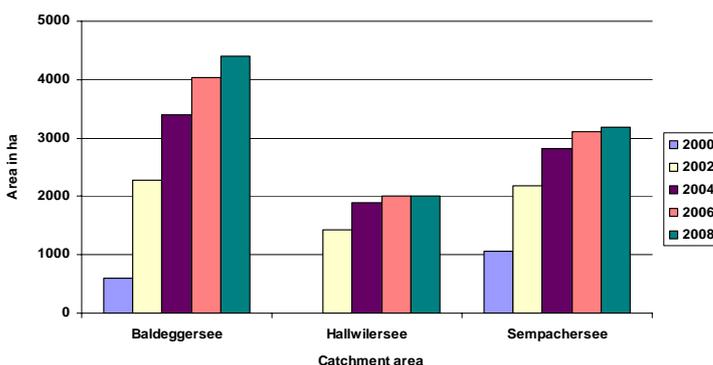


Fig. 1 Participation in the Phosphorus Project 2000 - 2008

PHOSPHORUS FERTILISATION

- 2008 only 84.5% of the demand of the plants was applied according to the P-nutrient balance, a total of 40'425 kg phosphorus was not applied.
- A total of 14'850 kg phosphorus (as manure) has been exported.

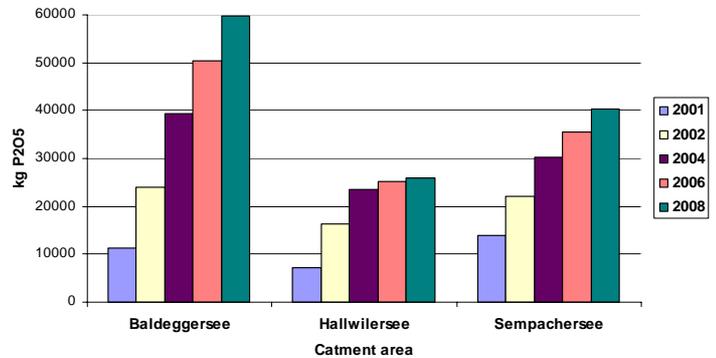


Fig. 2 Not used Phosphorus between 80% and 100% 2001 - 2008

SITUATION OF THE LAKES

- Artificial mixing in winter and the hypolimnetic oxygenation in summer are still applied. In the lake of Sempach air is used for the oxygenation, in the other two lakes pure oxygen.
- Within the last years the average phosphorus content has decreased very rapidly and is now in the lake of Sempach and Baldegg at 26 mg/m³ and in the lake of Hallwil at 20 mg/m³ (Figure 3).
- Up to the year of 2003 the input of soluble phosphorus from the catchment area could be reduced. In the dry year of 2003 the lowest value since 1986 could be reached. Since 2003 the input increased again according to the inflow of water. The input of phosphorus was above the target value.
- The target value of 4 mg oxygen per litre at any time and any depth of the lake could be reached, except for some short periods.
- However the aim of natural spawn whitefish is not yet achieved.

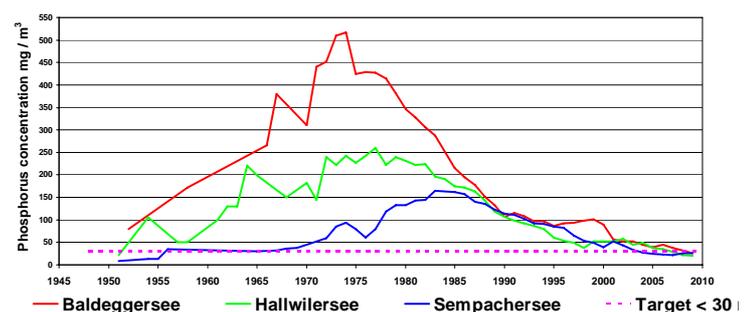


Fig. 3 Average phosphorus concentration in Lake Sempach 1980 -2009

Conclusions

- The project of restoring the Swiss midland lakes is a good example of teamwork between politicians, communities, authorities, researchers and the inhabitants of the catchment area. Thanks to the contribution of all these peoples, it is clearly visible, that the condition of the lakes is much better than it was 25 years ago.
- As can be seen, important steps for improvement of the lakes have been taken. Long term measures, however, are necessary in order to maintain the healthy condition of the lake.
- Now we are preparing in detail the measures for the next six year period from 2011 -2016.