

## 10 years experience with mitigation measures on the lake of Sempach

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The lake of Sempach, with a surface area of 14.4 km<sup>2</sup>, a maximum depth of 87 m and a catchment area of 61.9 km<sup>2</sup> is highly eutrophic. Untreated sewage caused a first phosphorus load of the lake. Beginning 1960 intensive farming with high animal stocking caused an additional phosphorus input. 1984 the phosphorus content in the lake reached the maximum level of 160 mg P/m<sup>3</sup>. At that time a remarkable fish kill related to eutrophication occurred. This was the starting point to take measures.

At first the treatment of sewage had highest priority and in the 80's the system was mostly completed. At that time investigations on the tributaries showed, that 85 % of the annual phosphorus load originate from agricultural land. In 1993 integrated agricultural production and a direct payment program connected to this production method was introduced by the Swiss Government. One of the main criteria in this direct payment program is the equilibrium of the phosphorus and nitrogen balance at the farm level. At present 99% of the farmers in the catchment area participate in this program. Although this program limits the application of phosphorus, it is not sufficient to reach the goal of less than 30 mg P/m<sup>3</sup> in the lake. Therefore in 1999 a Swiss program for regional projects in the catchment area of lakes and ground waters was started. This program makes it possible, to pay farmers for measures to improve water quality additional to the integrated production.

Farmers who participate in this program get an additional direct payment of € 185 /ha and year and have to realise the following measures:

- Buffer strips of at least 5 m width along all rivers and open drainages
- At least 5% of the farm area is not fertilized
- The nutrient balance is below 100%, for over fertilized plots the limit is by 80%
- Soil samples of all plots are analysed at an interval of 5 years
- No manure is applied during wintertime
- Soils are covered during wintertime
- All crops on plots with a slope of more than 18% must be sown without tillage
- The percentage of beets, potatoes and corn in the crop rotation must be less than 20%
- The infrastructure on the farm yard has to be as such, that no nutrients are washed off
- Farmers participate at least once a year in the educational program concerning the lake restoration

Beside above package farmers can realize the following additional measures:

- Installing ponds as nutrient traps for drainage and runoff water
- Program to close pig and poultry units

With the combination of lake external and internal measures the concentration of phosphorus in the lake could be reduced to less than 30 mg P/m<sup>3</sup> in 2005.