

DATA TO THE NUTRIENT BALANCE OF FERTŐLAKE

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The way and distribution of pollutants loading our water resources can be classified into two main groups:

- the point-like pollution, and
- the non-point like pollution

The point-like pollution sources load the recipient in a concentrated form through one or a few effluents, inspite of the non-point like pollutions, which have a regional character, expressing the impact of the whole catchment area on the recipient, including wet and dry depositions as well.

The regional pollution is determined by natural factors and human activities on the catchment area, but both factors have an interaction too. We have to note, that beside the human activities the determining factors are the natural affects, because these transmit and transport the pollutants to the recipients.

The main forms of non-points like pollutants are:

- wet and dry deposition, namely precipitation and dust,
- pollutants transported by runoff
- pollutions transported by ground water

For quantitative analysis of the above mentioned loads two general methods can be applied:

- in case of a small catchment area the indication of pilot project area and monitoring as much as possible of water quality parameters
- in case of a larger area by means of material-balance as i.e. calculations.

Both of these methods involve a lot of suppositions and estimations. In our present approach the combination of the two methods was used.

1. The positive side of the nutrient balance

In 1981 the point-like pollution sources of the Hungarian catchment area respectively the data of water quality of the Rakos Brook have been reviewed on the basis of the North-Transdanubian DWA. Moreon, 1982 - 1983 non point like pollution sources of Lake Fertő were investigated in order to obtain newer information/data on its nutrient balance. The results and their validity are for the Hungarian part of the lake only.

1.1 Deposition

Since 1964 chemical analysis of rainfall have been carried out. Results were presented by Scientists of the Hungarian Metereological Survey.

1.1.1. Wet deposition

To eliminate errors while using open rain gauges an automatic rain gauge-type was developed and in 1978 installed on shore of Lake Fertő at Fertorakos. During dry periods this gauge is closed and thus the impacts of top soil originated dust or other pollution sources are eliminated. Results were discussed and issued by HORVATH (1981 Central Institute for Atmospheric). Comparisons of analytical data from both types of gauges show a 100 % error of the open one against the closed.

1.1.2. Dry deposition

In the case of inorganic nitrogen the dry deposition was estimated of about 482,2 mg/m²/year, which gives 36,2 t/year of inorganic nitrogen on the Hungarian lake surface. For both areas it says, that 5 t are falling on the open water and about 30 t on the reed belt.

In regard to the income of phosphorus same values were used as for calculation of the wet deposition, namely 0,5 t/year. The total nutrient income of the Hungarian part of the lake being deposition was estimated for 1,0 t P-PO₄ and about 110 t inorganic nitrogen yearly.

The areas utilized for agriculture intensively can be classified as 64 % plough land 12,1 % vineyard, 2 % garden and fruit plantation, while 9,4 % meadows as well as 8,9 % are pasture land.

As a total from the whole catchment area 61 % are utilized intensively. Both, artificial and natural fertilizers are used. In all farms in which an intensive agriculture takes place 723/t/year nitrogen and 573/t/year phosphorus in form of artificial fertilizers are used, while for the same catchment area on plough-land 17 615 t a year natural organic fertilizer were distributed.

1.2. Pollutions transported by runoff

Generally, nutrients supply of natural waters by means of run off is a central problem of eutrophication processes all over the world. Recently VOLLENWEIDER (1968) summarized present knowledge. According to our experience one of the main effects is the length of the period between the fertilisation and the first rainfall causing a runoff. Moreover, the authors found phosphorus to be mobilized less than nitrogen.

In case of Lake Balaton 0,5 % phosphorus and 4 % nitrogen have been calculated to be originated from artificial fertilizers. Austrian authors estimated 35 - 70 kg/km² dissolved phosphorus to be washed out and transported by runoff, while according to Dutch investigations (catchment area 74 % agricultural area, 26 % forest) a loss of 18 kg/km²/Year nitrogen was assumed to take place by runoff.

On the other hand agronomists think, that the load to recipients transported by runoff and erosion of phosphorus is not more than 1-2 % and 5-10 % nitrogen of the used artificial fertilizers. According to JOLANKAI, who carried out a special pilot project on a small catchment area of Lake Balaton 5,5 % phosphorus and 6,6 % nitrogen of the utilized fertilizers came to the recipient. On our own data it can be shown that phosphorus concentration of runoff waters is near to those of other surface water after sedimentation took place, whereas concentration in nitrogen is far more higher compared to the Rakos Brook or other recipients.

Drainage canal N ^o	Conduct. / μ S	K ⁺ mg/l	Organic NO ₃ ⁻ mg/l	NO ₃ ⁻ mg/l	Tot. N mg/l	PO ₄ ⁻⁻⁻ mg/l	Tot. P mg/l
1.	410	47	11,6	52,1	14,3	1,09	0,75
2.	970	27	6,1	28,8	7,7	1,74	0,66
3.	860	78	10,6	47,0	12,8	2,21	0,90
4.	530	54	26,2	116,0	32,3	2,21	0,94
5.	1350	12	20,1	89,2	25,4	0,42	0,66

In regard to the Hungarian Lake catchment area first estimations took a 3 t phosphorus and 30 t nitrogen supply from artificial fertilizers in account.

Investigations on the amounts of runoffs values of 2,5 - 5 t phosphorus and 110 t nitrogen were obtained. While the values for phosphorus are in agreement with the estimates, the amount of nitrogen was 4 times higher using the runoff approach method.

Since 110 t nitrogen would have been 15 % in excess of the total amount used as fertilizers on the whole catchment area, the present authors took into account a 6 % runoff coefficient. In total the load of the lake from fertilizers can be expressed in an amount of 3 t phosphorus and 30 t nitrogen.

1.3. Pollution transported by groundwater

In order to be able to evaluate loads in nutrients as an effluent by groundwater any data were available and it was supposed that in the case of Lake Fertő groundwater discharge as a source of an enrichment of nutrients can be neglected.

Non point like load on the Hungarian catchment area is about 4/5 t phosphorus and 140 t nitrogen according to our opinion.

2. The negative side of the balance

In the negative scale of a balance drainage and reed management have to be taken in account.

2.1 Drainage

Within hydrometeorological conditions the water balance of the lake is positive and long year average results in a surplus of 48,5 millions m^3 water, which can be drained. Calculating with 0,150 g/m^3 phosphorus in average in the lake water the amount of phosphorus which possibly could be removed by drainage is about 7 t a year.

Same considerations in regard to the nitrogen-compounds are rather difficult. Up to now in our investigations during sommer period is it was impossible to detect nitrat-nitrogen at all or in very small portions only. Therefore on the nitrogen cycle further investigations are required.

2.2. Reed management

On the Hungarian part of the lake reed management takes place in a very intense way. During the last 8 years 2 million sheaves were harvested yearly, i.e. 13 846 t/year, but in 1979 the harvested crop was 2.2. millions sheaves.

3. Conclusion

On the basis of our investigations during 1981 point like phosphorus load of the Hungarian catchment area did not exceed 2 t/ year, while the non point like nutrient supply can be estimated for 5 t phosphorus and 140 t nitrogen.

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [BFB-Bericht \(Biologisches Forschungsinstitut für Burgenland, Illmitz 1](#)

Jahr/Year: 1984

Band/Volume: [51](#)

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