

Practices of Waterwise Circular Economy in Water Protection: A Case Study on Pyhäjärvi, SW Finland

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Abstract : Here, phosphorus (P) loading to the lake Pyhäjärvi (SW Finland) was reviewed, load reduction targets were determined, and different measures of waterwise circular economy to reach the targets were evaluated. In addition to the P loading from the lake's catchment, there is a significant amount of internal P loading occurring in the lake. There are no point source emissions into the lake. Thus, the most important source of external nutrient loading is agriculture. According to the simulations made with LLR-model, the chemical state of the lake is at the border of the classes 'Satisfactory' and 'Good'. The LLR simulations suggest that a reduction of some hundreds of kilograms in annual P loading would be needed to reach an unquestionably 'Good' state. Evaluation of the measures of the waterwise circular economy suggested that they possess great potential in reaching the target P load reduction. If they were applied extensively and in a versatile, targeted manner in the catchment, their combined effect would reach the target reduction. In terms of cost-effectiveness, the waterwise measures were ranked as follows: The best: Fishing, 2nd best: Recycling of vegetation of reed beds, wetlands and buffer zones, 3rd best: Recycling field drainage waters stored in wetlands and ponds for irrigation, 4th best: Controlled drainage and irrigation, and 5th best: Recycling of the sediments of wetlands and ponds for soil enrichment. We also identified various waterwise nutrient recycling measures to decrease the P content of arable land. The cost-effectiveness of such measures may be very good. Solutions are needed to Finnish water protection in general, and particularly for regions like lake Pyhäjärvi catchment with intensive domestic animal production, of which the 'P-hotspots' are a crucial issue.

Keywords : circular economy, lake protection, mitigation measures, phosphorus

Conference Title : ICWPRW 2019 : International Conference on Water Pollution, Recycle and Wastewater

Conference Location : London, United Kingdom

Conference Dates : October 23-24, 2019