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## Winter-time nutrient load is challenging long-term water protection measures - urgent need for new tools

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Lake *Säkylän Pyhäjärvi* (SW Finland) is an example of a large and shallow lake suffering from eutrophication. During the last 20 years the quality and general usability of water in Lake Pyhäjärvi have shown considerable variation driven by both a variety of human activities and climate-related factors such as wet and dry years. The lake has been thoroughly studied for decades and has been the object of comprehensive restoration activities both in the catchment and in the lake since the 1990s. Lake Pyhäjärvi has been the target of an intensive restoration programme since 1995 when the Pyhäjärvi Protection Fund (PPF) was created by local municipalities, private industries and local associations to act in collaboration with regional environmental and agricultural authorities. Since 1995, nearly all farmers in the catchment have committed to the Finnish Agri-environmental program to implement basic water protection measures. In addition, such intensive catchment management practices as buffer zones, sedimentation ponds, and wetlands have been introduced. New innovative treatment methods such as filter ditches and sand filters were also constructed and tested for their ability to remove phosphorus (P) from runoff waters. PPF has also been active in promoting waste water treatment in the rural catchment.

Currently, restoration work is facing new challenge: increased winter time nutrient load from the catchment. P load was especially high in winters 2006/2007 and 2008/2009. Most of the water protection measures (wetlands, buffering stripes, filter systems) work insufficiently in winter flood situations. Thus, new technical solutions should be developed for both flood management and nutrient removal in winter time. Also, environmentally friendly cultivation practices should be developed and implemented.