Wetland restoration of marginal arable land: A Mediterranean experience

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During the 20th century many wetlands in Europe and elsewhere were drained and converted to arable lands. Before drainage, most of these wetlands had functioned as nutrient sinks that protect water quality downstream. The alteration of these wetlands had transformed the natural nutrient sinks into nutrient sources which jeopardize downstream water resources. The removal of this crucial nutrient sink had usually resulted in increased nitrate and phosphorous loading into waterways. Other consequences of the drainage included rapid oxidation of the exposed peat soils which lead to loss of top soil by dust storms especially in dry climate regions of the Mediterranean basin. To reverse some of the negative consequences of the drainage and to minimize nutrient loadings to water resources downstream a reconstruction project was implemented in the mid 1990s which replaced 600-ha farm land with a shallow lake-wetland complex. The main mechanism of nutrient removal using this complex is denitrification of the nitrate-rich water draining into the lake. The phosphorous is partially removed by adsorption onto lake-wetland sediments, alas high sedimentation rates would shallow the lake requiring periodical sediment removal. Nutrients excess that are released from this complex to waterways are partially diverted from the main river system via network of canals and pipes and are pumped back into the surrounding mountains for farming. Decadal monitoring of the lake-wetland complex showed high efficient in N removal. For example, during the first half of 2008 about 30 ton of N were denitrified and removed from the Jordan River, 2.8 ton of N were pumped back to the surrounding mountains while 5.5 ton of N were released downstream. About 2.2 ton of N was unaccounted for and represents the uncertainty in the seasonal N budget. The rate of denitrification has increased in 2008 compared with previous years due to the prolonged draught. Lower denitrification rates were reported in wetter years due to shorter residence time. During the same period about 0.47 ton of P entered the complex while 0.55 ton of P was released. Hence, the lake-wetland complex is shown to act as a P source. Pumping 0.09 ton of P for irrigation in the surrounding mountains had approximately equaled the excess P released during this period. About 0.2 ton of P was unaccounted for and represents the uncertainty in the seasonal P budget. The P loading was highly correlated with suspended material in this system and exhibit high seasonal fluctuations.