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Tracing experiment in the histosol of the Ljubljana marsh, Slovenia

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The Ljubljana Marsh is a 16 000 ha area located south of Ljubljana in central Slovenia (45˚ 58'N, 14˚28'E). Since the establishment of the extensive drainage system back in 1825 the landscape has been shaped by peat excavation and agriculture. Today, fen grasslands cover 65% and cornfields 25% of the area. Few remaining bogs are scattered among fens as isolated areas not exceeding 20 ha.

Since the registration of the Ljubljana Marsh as a part of Natura 2000 network, restoration projects employing re-wetting strategies are underway. In previous research, concerned with the effect water table level on nitrogen mineralization and phosphorus leaching into ground water and surface waters, a network of piezometers was established on a 1 ha area of fen grassland on histosol. The network consists of 12 points arranged in a grid (approx. 25m x 25 m) with sets of 5 piezometers (inserted to a depth of 60, 120, 180, 240 and 300 cm) at each point. Seasonal dynamics of P concentrations in ground water and surface waters indicated rapid vertical transport with preferential flow and very slow or negligible lateral transport.

In order to examine the groundwater and pollutant flow-paths more precisely, a tracing experiment using uranine (MERCK) as a tracer was started in June 2007. Uranine (250g in 90l of water) was sprayed on the surface of 1x3 m along the set of piezometers at the point with the highest water table. Concentrations of uranine were measured in piezometers at various depths. At the point of application, uranine was detected

in ground water (180-300cm) as early as 0,5 hour after application. Concentrations peaked 20 hours after application, then gradually declined from 10 000 to 100 μg/l during the next 1500 hours and remained in the range 10 – 100 μg/l thereafter. In the surrounding piezometers first appearance and peak concentrations of uranine were detected between 400 and 1400 hours after application and remained in the range 1 – 10 μg/l thereafter.

Due to shallow groundwater flow the direction of which is related to the depth of the parallel drainage ditches it was established that in general the tracer spreads in radial direction. However due to the high anisotropy of the histosol the spreading is very irregular. Breakthrough curves detected at particular piezometers are also very irregular. Non-uniform are also depth concentration profiles. Appearance of the tracer and its concentrations are very much related to the rainfall events. After 180 days from the start of the experiment the tracer still appears in all piezometers.