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Hydrological and hydrogeological hazard coming from man-made agricultural transformations of the soils of the Murgia (Puglia, Southern Italy).

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The territory of the middle part of the Apulia Region, named “Murgia”, holds a huge karst aquifer, which constitutes the main water resource of the region. The aquifer is bordered to the W as a result of the presence of the impermeable sediments of the Bradanic trough, while to the E it is bordered by the Adriatic Sea: it thus acquires the characteristics of a coastal aquifer. At low altitudes, i.e. the hills along the coastal border, which coincide with the most populated strip since ancient times, the agricultural use of the land was in terms of extensive fields of olive trees, grapes, almond and fruit trees; in the inner and higher part, land use was characterised by pastures or mainly uncultivated soil, while a small amount of cereal growing was only carried out on the morphologic depressions with significant amount of soil. In the whole area, another important feature of the territory was defined by the high degree of its division into parcels, physically delimited by a very developed network of dry stonewalls. These last, made up by two well squared faces and an inner filling of tout venant, and characterised by a high filtering power and capacity for holding the soil, have been built during centuries by using rock pieces obtained by stone retrieved from the same fields. In such a context, the surface of the recharge area, its high capacity of absorbing rainfall of medium and high intensity (the runoff being basically activated only during highest intensity events), and the low evapotranspiration, consequent to the negligible outcrop of soils, have been preserved in the time in excellent terms until the last decades. Some transformations of the soil cover for agricultural purposes in a few years have become important for the total amount of the implied area, with no negligible consequences on the hydrological balance, both regarding the infiltration

term and the runoff term. We are talking about the “generalised stone crushing” which affects mainly soils and epikarst textures of the “Alta Murgia” and another growing practice, the generalised coverage of the grape fields with plastic sheets (tendoni). The first practice, the crushing of surface rock layers to transform it in a cultivable soil, has been yet object of large studies. The result of this activity is the change of a large part of the original karst landscape into something very similar to cornfields. Land transformation involves also the demolition and crushing of the dry stonewalls, and the flattening of large areas, that become suitable to cultivations of intensive type. The study on the large scale has been carried out through the analysis of multi-temporal aerial photos: it evidenced that, at the end of 2003, 40 The above scenario represents one of the most worrying examples of man-made evolution of textural features of the territory, in the light of the significant variations caused to the hydrogeological elements of water balance, of the speed of the evolution and, finally, of the fact that the Alta Murgia territory should be considered a protected area, to the aims of safeguarding quality and quantity of recharge waters. It is worth highlighting that the concerned aquifer is on now threatened by the consequences of high groundwater exploitation, which triggers, above all in the coastal zones, the salinisation of water resources, and of the release of agricultural polluted waters. Modeling of the hydrological consequences of this kind of agricultural soil transformation has been undertaken; results point out a dramatic reduced amount of the infiltration, since the textural features of the new surface that replaces in part the original epikarst, and the absence of the dividing dry stonewalls, highly increase the evapotranspiration and the triggering of the runoff. The second agricultural practice, the plastic coverage of the large grape fields acts with a different mechanism. This coverage, in fact, concentrates the precipitation, avoiding its infiltration in the soil and transforming almost all of it in runoff. A first simplified analysis evidences that the operation acts as a multiplier factor of the precipitation in the order of about ten. The analysis of the covered surface in a small basin which was affected in recent years by flood pointed out a total amount of about 5Besides the present induced hydrogeological and hydrological hazard, both practices have an other negative effect: the creation of an instable environment caused by the irreversible loss of large amount of soils from the artificial soil covers and by the strong water streams; the soil loss is the closest precursor of the desertification of the area.