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Evaluating soil contamination risk impact on land vulnerability and climate change in east Azerbaijan, Iran

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Increased land degradation is one possible, and important, consequence of global climate change. As reported by IPCC, warming is likely to be well above the global mean in central Asia, the Tibetan Plateau and northern Asia, above the global mean in eastern Asia and South Asia, and similar to the global mean in Southeast and west Asia. Following these variation, agricultural face will abruptly be transformed in Iran which has been located in Middle East, west Asia. During 1951 to 2003 several stations in different climatological zones of Iran reported significant decrease in frost days due to rise in surface temperature. Also, some stations show a decreasing trend in precipitation (Anzali, Tabriz, Zahedan) while others (Mashad, Shiraz) have reported increasing trends. Based on land evaluation methodologies, a semi-empirical model named Pantanal within the new MicroLEIS DSS framework is used for assessing limitations for vulnerability of an area about 9000ha located in east Azerbaijan province of Iran is closed to Tabriz. The Pantanal approach is a land vulnerability evaluation model based on three kinds of information: I) monthly meteorological data; II) soil survey data; and III) agricultural management information. The major discussed agro contaminants were phosphorous, nitrogen, heavy metals and pesticides. Climate data such as mean average maximum and minimum temperatures for each month and total annual precipitation for last 20 consecutive years (1986-2006) were collected from Ahar meteorological station. The second scenario is based on projected changes in surface air temperature and precipitation for west Asia for the 2080s. In West Asia, climate change is likely to cause severe water stress in 21st century. In details, the mean temperature (ºC) will increase 5.1, 5.6, 6.3 and 5.7 in winter, spring, summer and autumn respectively, in the future scenario at the study area. On the other hand, total precipitation will decrease 11 and 25 percent in winter and spring, while will increase 32 and 52 percent in summer and autumn. As most of the arable land that is suitable for cultivation in the study area is already in use, chemical fertilizers application will widely obvious to increase crop production. According to 88 study points identified by grid survey method (44 consecutively profiles and augers), Typic Calcixerepts are the most dominant subgroups in the studied area. Altitude varies from 1300 to 1600m with a mean of about 1450m, and slope gradients vary from flat to more than 10%. The attainable contamination risk for two hypothetical scenarios was estimated for the natural conditions of selected soils, under current Ahar climate conditions and calculated amount according to IPCC report by application of the Pantanal model. Results showed that 32%, 25%, 4% and 27% of total studied area were classified as V1, V2, V3, and V4 vulnerable land due to phosphorous while it will not be changed by climate change. Also, attainable vulnerability classes because of heavy metals will be constant too, but the whole area subdivided as: V1 and V3 in a total of 57% and 31%, respectively. Nitrate is the major nitrogen derived pollutant and the main source of groundwater contamination because of its high mobility. According to the obtained results, nitrogen risk impact on land vulnerability will decrease by climate change while in the future scenario more than 55% of total area will classify as none vulnerable area. Assessing pesticide and climate change impact presents those four vulnerable classes: V1, V2, V3, and V4 in a total of 1%, 2%, 28% and 57% studied are while they will change to 1%, 2%, 49%, and 36%. In other words, 19% of total area will be improved by climate change.