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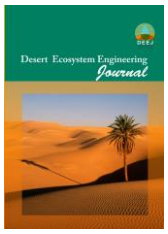

Modelling the impacts of climate change on the soil CO2 emissions in arid rangelands (Southern Iran)

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Extended Abstract

Introduction: Carbon stored in soils particularly in arid rangelands soils is the most significant carbon sink in terrestrial ecosystems. In arid rangelands, Soils have special places in both carbon sequestration and mitigate global warming. Therefore, any small change in the soil organic carbon (SOC) leads to a significant impact on the CO_2 concentration in the atmosphere. Studies have shown that the climate change alters soil temperature and moisture conditions and subsequently affects soil respiration and carbon dioxide emitted from it into the atmosphere. Arid rangelands of Iran have taken a large part of the country. Modeling the effect of climate change on CO_2 emissions from soil in arid rangelands is an essential management solution that potentially leads to the reduction of the CO_2 emissions and the mitigation of its impacts on the climate change and global warming. Since evaluating the impacts of climate change on soil CO_2 emission in long-term is difficult without the use of a modeling tool. Moreover, studying of soil CO_2 emission under present or projected future scenarios of climate change through the use of simulation models is useful as decision support system. The primary purposes of this study were: 1) evaluating the performance of the RothC model simulations with the measured SOC stocks which is the most widely used model in the soil carbon studies and soil CO_2 emissions and 2) determining the impacts of three different climate change scenarios on soil CO_2 emissions in the arid rangelands of Ghir-o-Karzin's BandBast in south of Iran.

Materials and Methods: In this study, 80 soil samples were collected by randomized sampling method during four successive months (April to July of 2014) from a depth of 0-20 cm of soil. Also, two cylinders were collected beside each soil puddle (160 samples) for determining the soil bulk density in the arid rangelands of BandBast. After that, soil texture, soil bulk density, and soil organic carbon were measured by the Hydrometry method, the Core method and Walkley and Black method, respectively. Then, soil organic carbon (SOC) stock at depth of 0-20 cm was calculated. Initialization, calibrating and validating of the RothC model were performed by the use of weather data for 32 years as well as site-specific data (soil and plant data) of arid rangelands of BandBast. Finally, the effect of three climate scenarios on soil cumulative CO_2 emissions and soil real CO_2 emissions was simulated in the case study. Climate scenarios were including P scenario (refers to the 'no climate change' conditions or present climate condition consisted of the average monthly precipitation and mean monthly temperature during the period of 1983 to 2014), CCH1 scenario (refers to the

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climate change conditions with projected annual precipitation and the mean annual temperature decreased by 6.69% and increased by 9.96%, respectively) and CCH2 scenario (refers to the climate change conditions but with further decreases in rainfall and increase in temperature compared to the scenario CCH1 and also with projected annual precipitation and the mean annual temperature decreased by 10.93% and increased by 12.53%, respectively).

Results: Statistical comparisons between the simulated and measured data such as determination factor (R^2= 0.76) and performance efficiency (PE= 0.69), shows that RothC model accurately simulated the SOC stocks and therefore can be employed to simulate CO_2 emissions from soils in the arid rangelands of BandBast. The simulation results of RothC model during 36 showed that the cumulative and real values of CO_2 emissions from soil to atmosphere would increase by 3.62 and 4.53%; and 3.15 and 3.78% under CCH1 and CCH2 scenarios, respectively compared to P scenario. In the CCH2 scenario, With the highest increase in temperature and the highest decrease of precipitation in soil CO_2 emissions (cumulative and real) was higher in comparison with a CCH1 scenario. Result also showed that the trends of the soil real CO_2 emissions in arid rangelands of BandBast would decrease under the climate change scenarios (CCH1 and CCH2) during 36 years (2014–2050 period).

Discussion and Conclusion: Generally, the simulation results of the model showed an increasing trend for the CO_2 emissions for future climate change scenarios (CCH1 and CCH2) in comparison with P scenario in the arid rangelands of Ghir VA Karzin's BandBast. Climate change with decreasing annual precipitation and increasing temperatures have a significant effect on SOC and its decomposition and might enhance the release of CO_2 from soil to the atmosphere. The trends of the real CO_2 emissions from soil decreased in both climate change scenarios (CCH1 and CCH2) during 36 years. Based on recent researches soil carbon pools will be resistant against further decomposition over time and it could be due to existing dehumification effect. Therefore, investigate of organic mineral complex and humus complex compounds in the soils of BandBast rangelands is recommended for future researches.

Keywords: Global warming, Carbon sequestration, Soil carbon, RothC model, Arid rangelands.