

Agricultural Soil Profile Temperature in Hot and Arid Ecosystem: Can It Be a Useful Indicator of Environmental Change?

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Aridity is usually expressed as a function of rainfall and temperature. A useful "representation" of aridity is the following climatic aridity index: Precipitation/Evapotranspiration. The arid zone (arid index 0.03) comprises dryland areas without vegetation, with the exception of a few scattered shrubs and no farming except with irrigation. Annual rainfall is low, rarely exceeding 100 millimeters, with huge temporal variability. All these descriptions fit well climatic conditions of Kuwait and the larger Middle East region. Almost one-third of the total land area of the world is classified as arid land. Soil temperature change plays an important role in many processes which take place in the soil, and may change in response to atmospheric temperature fluctuations. Soil temperature warming is linked to atmospheric temperature increase through a complicated process of heat transfer. Consequently, soil temperature changes respond differently than atmospheric temperatures, because soil temperature fluctuation is regulated by multiple factors such as: heat capacity; albedo; leaf coverage; soil moisture; and texture. Daytime temperatures can typically reach 45 °C during the "hot" dry season and drop to 15 °C during the night. High temperatures in the surface layer of the soil result in rapid loss of soil moisture due to the high levels of evaporation and transpiration. Deserts ecosystems are most sensitive to even small changes in environmental conditions to the extent that land use pressure has become so serious that dry land agriculture and natural habitats may be threatened in the long term. The primary objectives of this study were to: (1) quantify changes in temperature in the soil profile at different locations under different management practices in the state of Kuwait, and (2) examine whether or not soil temperature fluctuations follow a similar trend to air temperature fluctuations. The findings from this study represent original contribution to our understanding as it sheds some light on whether or not soil temperature changes can be used as a reliable indicator of global climate change.