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## Holistic approach of soil health in a rangeland in northern Mexico: Development of an index

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### Abstract

Soils are affected by a complex interplay of multiple physical, chemical and biological processes that form its' functionality and resilience to degradation. Soil health indexes have been mostly developed for agricultural lands but they are rarely adopted to rangeland ecosystems. However, rangelands provide important agroecological services including native vegetation as feed source to grazing animals. At the same time, increasing pressure, due to overstocking and the introduction of more aggressively browsing livestock species, threaten the vulnerable ecosystems. In northern Mexico, sustainable rangeland management approaches are being developed testing the impacts of native Criollo cattle in comparison to the meanwhile widely introduced Angus and mixed Angus breeds on vegetation and soil health. Criollo cattle have shown to exert less pressure on the ecosystem and to thrive in harsh conditions, but science-based evidence on soil health states and trends is rare.

The aim of the study is to develop an index to assess soil functionality of semi-dry rangelands in northern Mexico. Specifically, to a) define robust indicators, and b) to develop an index to compare the impact of three cattle breeds namely Criollo, Angus-Hereford and Criollo-Angus. An experiment is being conducted at the “Teseachic” ranch in Chihuahua, Mexico where 2,000 ha were divided into six paddocks with areas between 225 and 400 ha. The paddocks have three control areas of approximately 60 m<sup>2</sup> each, distributed at the bottom, medium and upper terrain. The following soil indicators were obtained: soil aggregate stability, porosity, infiltration, visual evaluation of soil structure, organic carbon, electric conductivity, total nitrogen, active carbon, and pH. Three soil categories corresponding to specific roles the soil performs i.e., soil functions will be evaluated. These are: i) hydrological, focused on the ability of the soil to control erosion and floods; ii) productive regarding food and fiber production; and iii) ecological meaning the capacity of the soil for nutrient cycling and carbon sequestration. This study will allow a holistic assessment of soil health. Additionally, it will provide information about different cattle breed impacts on soil functionalities to promote the adaptation of versatile breeds in a changing climate.

**Keywords:** Criollo cattle, rangelands, soil functions, soil health, soil indicators