

Procedures for estimation of the livestock ecological footprint in US drylands

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Introduction The ecological condition and trend of the United States' 3,902,000 km² of Drylands and the extent to which human management actions contribute to degradation are unknown at the national spatial scale (Washington-Allen et al. 2006). Our research seeks to develop procedures for determining the impact or ecological footprint of livestock grazing on the productive capacity of Drylands at the national spatial scale.

Approach The study approach has been to develop a Geographic Information System (GIS) consisting of digital maps of gross and net primary productivity (GPP and NPP), U.S. Department of Agriculture National Agricultural Statistics Office (NASO) national livestock number and distribution maps, transportation and power consumption networks, gridded climatic data, land cover, and land use. Maps of GPP and NPP were derived from annually integrated normalized difference vegetation index (NDVI) from the Moderate Resolution Infrared Spectroradiometer (MODIS) and the Advanced Very High Resolution Radiometer (AVHRR) satellite data. Climatic data, particularly mean annual potential evapotranspiration [MAPET, Zomer et al. (2006)], was derived from the WORLDCLIM dataset developed by Hijmans et al. (2005).

Secondly, a Dryland extent map was generated using gridded population, transportation data, e.g., data of roads and railways, power consumption, land use/land cover and aridity index (AI) data in a subtractive overlay GIS procedure. AI is the United Nations Convention on Desertification's definition of Drylands where AI is the ratio of mean annual precipitation (MAP) to MAPET that is ≤ 0.65 .

Thirdly, the NASO data is used to generate livestock number and distribution maps which are intersected with the dryland extent map to yield a livestock footprint map. Lastly, this footprint map is then converted to an annual requirement of forage map and subtracted from a GPP map to yield a livestock appropriation of net primary productivity map (LANPP).

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