High Impact Publication Selected for Special Recognition in 2020

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Publication Impact: Ecosystem services are the direct and indirect contributions of ecosystems to human well-being. Grassland ecosystems cover more than 40% of Earth's ice-free terrestrial surface, and we hypothesized that grassland management affects delivery of ecosystem services. In order to test this hypothesis, we reviewed and synthesized the existing literature to provide a current assessment of which grassland management practices affect delivery of ecosystem services and to explore the mechanisms of this response. The subset of ecosystem services on which we focused includes soil organic carbon accumulation, amelioration of greenhouse gas emissions, nutrient cycling, and wildlife/pollinator habitat. The literature confirmed our hypothesis that grassland management affects delivery of ecosystem services. We found that increasing management intensity of grasslands through planting more productive species or increasing fertilizer inputs generally increases soil organic carbon accumulation. Increasing the number of plant species or functional groups, especially when legumes are added, often increases soil carbon accumulation. Grazed grasslands generally accumulate soil carbon more rapidly than undefoliated or mechanically harvested grasslands. Low or moderate stocking rates favor soil carbon accumulation relative to high stocking rates, especially in lower-rainfall environments. Relatively high soil carbon accumulation rates observed immediately following conversion of tilled cropland to perennial grassland do not continue indefinitely, and this diminishing rate of soil carbon accumulation over time must be accounted for in life cycle analyses. More digestible forages defoliated at optimal maturity may decrease methane emitted per unit of feed consumed or per unit of animal product. Substituting legumes for nitrogen fertilizer and reducing livestock N excretion through diet manipulation reduce nitrous oxide emissions. Managing grazing to increase uniformity of excreta deposition increases efficiency of nutrient cycling. Species-rich grasslands with flower-rich legumes and forbs increase foraging opportunities for pollinators. Based on this literature assessment, in order to optimize delivery of grassland ecosystem services, management practices that sustain ecosystem function likely need to replace those that maximize short-term resource utilization or economic return. To encourage adoption, such practices may need to be incentivized. With such need in mind, our synthesis provides a clear roadmap for enhancing ecosystem service delivery from grasslands. A tangible result can be prioritization of incentive programs (e.g., from NRCS) aimed at encouraging adoption of practices that reduce impact of grassland-livestock agriculture on the environment and ameliorate its impact on climate change. Initial response to this paper has been very positive, as it has achieved 143 reads (ResearchGate) and 8 citations (Google Scholar) in the few months since it has been published.