Grazing for Soil, Climate and People

Innovative Approaches to Livestock Management that Restores Ecosystems, Mitigates Global Warming, and Enhances Food Security

The Need for Sustainable Livestock Solutions: "For millennia, livestock farming[1] has provided food, clothing, power, manure and income and acted as assets, collateral and status. In 2018, there was a global stock of 38.9 billion farmed land animals[2]. This has created a challenge: there is a need to increase the availability of livestock derived foods to satisfy the unmet nutritional requirements of an estimated 3 billion people[3], and reduce stunting, wasting and anaemia[4]. Yet some methods and scale of livestock production systems around the world pose severe tests to stay within the safe operating zone of planetary boundaries[5], especially with regards to biodiversity, climate change, biochemical flows[6]. It is important to ensure healthy levels of intake of meat[7], eggs and dairy across all populations and achieve science-based animal health and welfare within the One Health framework. A re-balancing of consumption may help populations of high livestock product intake. With strong population growth concentrated mostly among the socioeconomically vulnerable populations in the world, the sustainability[8] challenge is more urgent than ever before."

Overview: Human civilization has been built on livestock from the beginning of the bronze-age more than 5000 years ago[9] and remains the bedrock of food security for modern societies[10]. Livestock is the millennial-long proven method to create healthy nutrition and secure livelihoods, a wisdom embedded in cultural values everywhere. Innovative approaches to livestock management that work in harmony with nature provide solutions for the challenge of today. They can restore degraded ecosystems, sequester atmospheric carbon, and meet the nutritional demands of humanity. Grasslands, when properly managed, provide many social and environmental services[11] and can improve the sustainability of livestock production[12]. Climate-smart options for forage-based systems (*i.e.*, systems depending mainly on grazing) can foster soil health and soil fertility[13] restore grazing lands[14] sequester carbon, increase biodiversity, and provide extensive ecosystem services). The names and modalities vary, but they all manage livestock in concert with nature. They include Holistic Planned Grazing, *Rotatinuous* grazing concept, Pastoralism, Silvopastoral systems (SPS) and improved forages (grasses and legumes) among others.

Soil Carbon and Climate: Livestock, when managed for soil health, are vital to mitigating climate change by stimulating grassland plants to sequester carbon. The coevolution of ruminant ungulates and perennial grasses over the last 19 million years is believed to have resulted in the sequestration of 596 Pg C (petagrams / gigatons of carbon) into newly formed mollisols, leading to Cenozoic Cooling[15]. The management of livestock for ecological as well as social and economic benefits is referred to in literature as Holistic Planned Grazing[16] [17] and Adaptive Multi-Paddock (AMP) Grazing[18]. Grazing of this type has been found to sequester carbon in soil at the following levels: 1.2 tons carbon per acre per year (tC/ac/yr)[19], 1.5 tC/ac/yr[20] and 0.93 tC/ac/yr[21]. In a best-case scenario, Teague et al. (2016) calculates the drawdown potential for AMP grazing in North America is 0.79 gigatons of carbon per year (GtC/yr). To put this into context, 0.79 GtC is 44% of yearly US greenhouse gas (GHG) emissions, which is 6.5 billion tons CO2e based on the EPA GHG inventory for 2019[22]. Worded more simply, nearly half of all US GHG emissions could be offset in North American soil using regenerative grazing. These elevations in soil carbon concentrations are coupled with other improvements in rangeland ecology, such as increases in nitrogen stocks[23], soil moisture[24], and fine litter cover and forage biomass[25].

Practices/technologies:

Improved forages: Improved grasses and legume forages are an appropriate example of climate-smart technologies as can increase productivity and offset some of the yield losses linked to climate change. Tropical forages, when properly managed (*e.g.,* planned grazing), can accumulate large amounts of carbon in soil, fix atmospheric nitrogen (legumes), inhibit soil nitrification and reduce GHG emissions[26].

Holistic Planned Grazing: Holistic Planned Grazing allows land and livestock managers to plan for, honor, and enhance the complexity of their unique context and achieve their desired outcomes[27]. Considerations include the type of environment being managed (perennially humid to dry environments), typical growing seasons, the ecoregion and type of vegetation and wildlife habitats present, water availability and distribution, culture and tradition, manager's financial capabilities, etc. No plan looks the same across farms, families, communities, regions, or year to year. Holistic decision making uses best information and knowledge, empowering each land steward. Key to the success of the grazing plan is the daily monitoring of plants, soil surface conditions, animal performance and overall desired outcomes. Annual monitoring of ecosystem health indicators of biological diversity is conducted to

inform management using Ecological Outcome Verification methodology (EOV)[28]. The efficacy of Holistic Planned Grazing has been extensively studied and verified across a wide range of ecological factors[29]. Gosnell (2020) finds that peer-reviewed studies evaluating Holistic Planned Grazing (HPG) show the practice results in less use of herbicide and pesticide[30 31], increased on-farm biodiversity[32 33], improved forage and livestock production[34 35], reduced bare ground[36], improved stream and riparian health[37], improved soil respiration, topsoil depth, organic matter, and overall soil health[38 39 40], improved soil–water content, water holding capacity and hydrological function[41 42 43], and improved nutrient availability and retention[44]. By extension, increases in soil carbon inherent in improved farm and rangeland ecologies helps to mitigate climate change[45 46 47]. These metrics enable the food and fashion) industry to inform their sourcing strategies. Savory global network partners with more than 50 corporations—a number rapidly growing—who are investing in holistic planned grazing technical assistance and EOV measurement on more than 2 million hectares through Hubs. The Land to Market program assists corporations with access to supply from EOV verified landbases, associated data for their own impact accounting needs, and storytelling[48].

***Rotatinuous* grazing concept:** *Rotatinuous* is an innovative grazing management concept that is environmentally sound, economically viable[49], technically and socially feasible for smallholders[50]. This grazing management is a key strategy to reduce the environmental impact of grazing through lower methane (CH_4) emissions systems, with 64% less CH_4 production per area and 170% less CH_4 emission per unit of the animal product, when compared to the traditional rotational stocking[51]. *Rotatinuous* grazing concept also allows a greater intake of a high-quality diet of animals and herbage accumulation leading to better nutrition and immune stress response, promoting animal welfare[52].

Pastoralism: Large ungulates in extensive pastoral grazing systems as a means of livelihood is one of the oldest viable and potentially sustainable grazing systems if properly managed, has considerable economic, ecological, and socio-cultural importance and provides ecosystem services (*e.g.*, maintaining and even enhancing rangeland biodiversity), and maintains ecological integrity (*e.g.*, act as a carbon sink) [53 54].

Silvopastoral systems (SPS): Silvopastoral systems, which include trees (leguminous or not), increase forage quantity and quality, promote animal welfare, and diversify farm income. SPSs also have positive impacts for the recovery and conservation of biodiversity at farm and landscape level since the more heterogeneous structure provides habitat for fauna and flora and serves as wildlife corridors [55]. The SPS allow the intensification of cattle production based on natural processes and are recognized as an integrated approach to sustainable land use and reduce pressure on forest [56 57 58 59].

Producer Viability: some technologies, innovative methods, and knowledge that enable farmers, especially small producers, to make livestock production more competitive, profitable, sustainable, and resilient are: *The Ranch Systems and Viability Planning (RSVP)*[60] project provides technical assistance, training, monitoring tools and cost share for adopting new practices. It monitors baseline and post-adoption) soil carbon, water infiltration, plant diversity and abundance and biodiversity. *GANSO*[61] (GANaderia SOstenible = Sustainable Livestock) is an initiative in Colombia committed to the professionalization of livestock activity through technical and financial assistance (Including SPS). It combines the intensification of livestock production with forest plantations and agricultural crops and the restoration and conservation of ecosystems. In addition, GANSO facilitates market-based climate action by certifying beef farms with sustainability standards and connecting them with retailers that sell certified beef with a premium price that consumers pay to reward producer committed to sustainability.

Why it Works-Four Levers of Change: These examples of pioneering solutions rest on four levers of change delivering the tools to achieve sustainable livestock systems and reach SDGs as follows: 1) *Build on Diversity* (Foster context relevant diversity): Recognize, reclaim, adapt to and utilize the full diversity of livestock products and production systems around the world including integrated crop-livestock, silvo- and rangeland pasture, smallholder, indigenous communities and regenerative agricultural systems. 2) *Accelerate Innovation*: Innovation in livestock farming opens up new solution spaces. Enormous progress is being made in circularity of resources flow, protecting biodiversity, production efficiency, reducing GHG, restoring soil health and quality of foods and services provided. 3) *Enhance Financing*: Enabling innovation and novel finance mechanisms requires updating and improving accounting systems in global trade arrangements and market and consumer engagement[62]. 4) *Enable Producers*: For these changes to lead to action on the ground, farmer-driven and regionally appropriate strategies should be enabled and developed for nature-positive production within planetary boundaries to provide healthy diets. These can be inspired by similar strategies already produced by several countries[63]. Appropriate accounting tools, financing and governance mechanisms should be specified in the roadmaps[64].

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