

CHAIRS' SUMMARY PAPER: Grasslands in Arid and Semi-Arid Regions

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LEAD PAPERS

Both lead papers focused mainly on the African tropics, and also made cross-references from other regions. The paper by Seligman and Noy-Meir highlighted the state of knowledge, challenges and opportunities to sustainable use of the arid and semi-arid grasslands. The paper argued that although many would like to advocate or believe that livestock production, based on pastoralism in the arid or semi-arid regions, is environmentally degrading and unsustainable, and therefore, dying out as a way of life, the reality is that, millions of people through the centuries have continued to derive a livelihood by their ability to cope with the boom and bust cycles of these ecozones. For those scientists and others, who are used to unidirectional ecological trends, the complexities of arid and semi-arid grasslands have been difficult to grapple with, but they have found much easier to pass judgments that the grassland-pasture systems are unsustainable. There is no doubt that in Africa and in other developing regions, urbanization, changing values, increasing human population, encroachment of grazing lands have, in some instances, contributed to grassland degradation. Nonetheless, evidence of permanent damage to grassland is rare and on the contrary, arid and semi-arid grasslands have been found to be more resilient than previously thought. The versatility of botanical responses, operating at different non-equilibrium vegetation states, is a principle adjustment and defense mechanism against degradation of ecosystems that are constantly subject to episodic and chance events. This suggests that the sustainability of arid and semi-arid grasslands requires constant adaptation or preparedness to respond to the ebb and flow of opportunities in grassland conditions. Such a continuous adaptation process, according to Seligman's paper, is "adaptive sustainability". This concept however will have to withstand the growing political and other stake-holder pressures to devote these grasslands for different economic uses, such as ecotourism, conservation, cultivation, urban and infrastructure development. Although such uses appear conflicting with livestock production, they are also opportunities for diversification. However, multiple and compatible land-uses will materialize only if we bring in refined goals, participation of different stake-holders and new paradigms to our analysis of sustainability. This is the biggest challenge.

The second paper by Otsyina, et al. reviewed the multiple uses of trees and shrubs and trees that are most common in feeding and grazing systems across the arid and semi-arid tropics. The paper emphasized the need for introducing and integrating fodder tree species for landscape rehabilitation and as a way of improving livestock feed quality. Nutritive values for different components (leaves, fruits, seeds etc) of browse species, including the anti-nutritional considerations were also presented. The paper discussed the contribution of browse to livestock production and methods and constraints for establishing them in the farming systems. Criteria for selecting trees for different circumstances and feeding systems, such as silvi-pastoral, alley farming and fodder banks were also discussed and research gaps were identified.

POSTER PRESENTATIONS

There were 19 posters in this session, dealing with a variety of subjects. Evaluation, screening and adaptation of trees in moisture

stressed conditions, and alley farming for multiple uses, one being the use of the tree-herbage for livestock feed supplementation, were the main themes of most posters. One of them also considered the usefulness of browse seeds as a feed supplement. The need for maintaining a level of phytomass was emphasized by some for arresting and restoring grassland from degradation, particularly at watershed scales. The usefulness of MIDAS model for assessing complex interactions in mixed crop-livestock systems was the focus of a poster from Australia.

DISCUSSION POINTS

- To what extent do we have to re-evaluate beliefs, ideas and hypotheses about sustainability of arid, semi-arid grasslands and pastoral systems?
- What are the conflicting or complementary demands on grasslands and what option/strategies are available or needed for sustainable use?
- What will be the impact of global warming on these lands and livelihood of people depending on them?
- How do we monitor spatial and temporal trends and what indicators do we have or need to analyze systems integrity, resilience, efficiency and effectiveness?
- Do we have enough tree and browse materials and techniques for integrating them into production systems?
- How could feeding systems, based on tree/browse pastures be improved and adapted by farmers?
- What are the nutritional and environmental implications of neutralizing 'toxicity' from browse species?
- What chances do we have for new technologies to be adapted? What is different from our previous efforts and what needs to be done?
- Most posters reported plot level evaluation, but sustainability assessment goes beyond plot/farm levels. What criteria, who are the players and how do we mobilize them?

GENERAL COMMENTS

1. Grasslands in the arid/semi-arid ecozones show little change during the "normal" years. Reduced capacity of grasslands and rangelands in these zones, particularly in Africa, is what is commonly reported and it is associated with a variety of processes and mechanisms and the way in which the land area is managed. Significant shifts in the rangeland composition seem to occur with particular events such as intense fires or drought, or a sequence of such events may interact to bring about the change. As management is likely to have a major impact on the vegetation, during such times, knowledge about the magnitude and nature of such events that determine a "threshold" could be critical for designing better options for managing the rangelands. As rainfall declines and its variability increases, the response of the

rangelands is more event-driven and management immediately after rainfall events, and in some instances during extended dry periods, tend to determine the overall ability of the range to recover. Varying thresholds can result from climatic events, and under these circumstances, range recovery is non-linear. Hence there is a need for flexible strategies or models that take account of the “state and transition” of the rangelands for prompting drought-evading (destocking for example) as well as lush-coping actions (restocking for example) to capitalize on the increased vegetative growth should rainfall exceed the normal levels. Continued research is therefore needed to provide a range of alternatives, which are sufficiently flexible to take account of the changing ecological and socioeconomic conditions encountered by the producers.

To develop management principles for wider adoption, understanding of the mechanisms and consequences of range- and grasslands degradation alone may not be sufficient, unless we also identify the events which cause changes and how events can be converted into opportunities for improving productivity and conservation of such lands. In this effort, procedures for monitoring vegetation change and to relate vegetation descriptors with animal production and soil condition will be helpful, particularly to develop long term grazing management. Sustainable management of arid and semi-arid grasslands therefore needs to take a broader view, as suggested in Seligman and Noy Meir’s paper, to include growing pressures for alternative uses. Research and development paradigms need to use a holistic framework in which issues related to grassland use such as pastoralism, changing societal attitudes and behaviors, mechanisms of social changes, policy issues etc. can be combined with economic and technological efficiency considerations for attaining equity and protection of the environment.

Apparently, most problems for the inherent vulnerability of the arid and semi-arid grassland zones are not technical but lie within the social and political domains. Nonetheless, many countries currently facing environmental and social problems in arid and semi-arid areas continue to take decisions with a short-term perspective. Here we see a role for the scientists who are engaged in arid and semi-arid grassland rangeland research. They should strive to improve the understanding (among the policy and decision makers) that well managed range- and grassland systems do positively contribute to production increases of the associated croplands and environmental safety (close proximity of grazinglands and croplands can be environmentally friendly as wastes from one is cycled through the other). This to become reality, a more global vision of resource production, distribution and management will be needed, and in the center of it, all people (and not restricted to save the interest of one country or the privileged) should be recognized as a part of the world’s ecological systems.

2. The benefit of the environmental, aesthetic and productive value of trees in pastures to be gained from integrating woody plants are increasingly recognized by scientists, farmers and the farming community. However, forests and density of woody perennials are declining at an alarming rate leading to land degradation and failure of production systems which are causing serious concerns in many countries. Agroforestry is considered as a practical way of introducing trees into production systems. However, at present there are not many tree species for agroforestry combinations with arable and pasture crops. To make them attractive and compatible in smallholder enterprises, trees need to be identified based on (a) planting configuration and canopy characteristics to provide adequate light environments for associated species (b) less

competitiveness for water and nutrients and (c) commercial and multipurpose value, including trees to provide livestock feed, edible fruits, medicinal or oil products. Complementarity between animal and tree components in agroforestry systems, particularly those systems with forage tree legumes, has increased world-wide interest. Leguminous trees are attractive in agroforestry-livestock systems because of their longevity, flexibility of management, and ability to retain or produce green and good quality herbage at times of moisture stress. Because of the deep-rooted character, most tree legumes can use moisture and nutrients from deeper in the soil profile to stay alive and produce while other herbaceous and graminaceous feed sources, particularly in the semi-arid and arid zones, have long dried out. Adaptation of tree species or search for new germplasm adaptable to diverse climatic and edaphic environments and farming systems have therefore become a major research interest. Tree legumes are also known for the very high nutritive value, excellent palatability, digestibility and balanced chemical composition of protein and minerals. However, high concentrations of condensed tannins in the tree herbage may reduce the availability of protein to livestock. How negative effects of tannins and other anti-nutritional factors of tree herbage can be minimized in order to improve performance of livestock fed on them has also become a major research interest at present. Tannins are secondary metabolites that nature has devised to protect plants from destruction by insects and browsers. Obviously, condensed tannins and other “toxins” have an environment-protection function. What will be the environmental impact of de-toxifying tree herbage for the benefit of livestock needs to be properly ascertained, and this should be a major consideration within the holistic analytical framework proposed above for analyzing sustainability of the arid and semi arid grasslands. History is full of anecdotes of introduction and exchange of trees for various reasons, ranging from a symbol of friendship between countries to imposing conquerors’ will on the occupied lands. The least scientists can do is to evaluate the pros and cons of our actions so that we do not contribute to spreading technologies that may affect ecosystems in an undesirable way. Let us remember this as we strive our search for “new” trees, and also remind those who hasten to destroy trees the “spirit” of the mother nature which provided them to us so that we use them equitably, particularly with those who are yet to come.