

## **CHAIRS' SUMMARY PAPER: Biodiversity**

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### **INTRODUCTION**

The papers, posters, and discussions at this session of the International Grassland Congress generally supported the observations, conclusions, and recommendations of several recent reviews of biodiversity. The following summary provides a broad overview of grassland biodiversity, based on the session in Winnipeg, on existing reviews and on the authors' personal experience and interpretation.

Agricultural expansion, particularly since the 1950s, has greatly reduced the extent of the world's natural grasslands. Remaining grasslands are commonly grazed intensively by domestic livestock, such that few, if any, of the world's grasslands can be considered pristine. These trends of altered vegetation will certainly intensify as the world's population continues to grow and expand; reduced biodiversity and increased rates of species extinction will almost certainly occur. Changes in global climate, whether natural or human-induced, will also affect future grassland biodiversity.

### **NEED FOR BIODIVERSITY**

Four primary reasons are commonly presented for why biodiversity must be maintained (West, 1993). First, diverse ecosystems provide more products, such as food and medicine. Diverse ecosystems also provide better services such as nutrient cycling, soil fertility, and climate control. Diversity is also necessary for aesthetic reasons, as humans inherently value wildlife and natural landscapes. Finally, many people believe that humans have a moral obligation to protect all ecosystems, including the constituent species.

### **GRAZING AND NUMANS ARE NATURAL, PERMANENT COMPONENTS OF THE LANDSCAPE**

Grasslands evolved with, and generally benefit from grazing and browsing, which often enhance vegetation patchiness, structural heterogeneity, and biodiversity. These relationships are true not only for native wildlife, but also for livestock. Managed, moderate grazing by domestic animals can enhance species richness and biodiversity, compared to no grazing. Nonetheless, domestic animals are not functional equivalents of wildlife overgrazing certainly reduces species richness, and significantly alters ecosystem structure and function, as demonstrated in one of the invited papers in this Session.

Humans and their animals affect all grassland ecosystems on earth. Much of the world's grassland biodiversity occurs in intensively managed areas. Grassland biodiversity, therefore, can not be maintained simply by creating parks or preserves. Maintaining grassland biodiversity requires that we develop management programs that apply biodiversity principles to address specific biodiversity objectives.

### **OBSTACLES TO IMPLEMENTING GRASSLAND BIODIVERSITY PRINCIPLES**

Biodiversity is a relatively new science. Terminology, techniques and concepts are still evolving, remain somewhat vague, and are often difficult to apply at the land management level. For example, biodiversity research may occur within a stand, a community, at the landscape or regional levels, or at the microbial level. Reduced biodiversity at the stand level may have no impact on diversity of species or functions that are common across the landscape or region.

Management implications obviously differ among these hierarchical levels. As yet, however, most biodiversity papers offer few or no knowledgeable insights for how their research results should be interpreted at different levels of scale.

Additionally, there are no generally accepted guidelines or principles to indicate the appropriate size of study area, duration of study, or the best techniques to monitor changes in grassland biodiversity, ecosystem process, and ecosystem attributes over time. Biodiversity research needs to develop more explicit, consistent, and quantitative measures for key concepts. For example, no standard unit or measurement exists for equitability (evenness), even though equitability comprises a fundamental component of biodiversity.

Likewise, even though we often assume that ecosystem stability results from higher biodiversity, no standard measure exists to assess this attribute. Even the term biodiversity is very often used inconsistently. Biodiversity sometimes refers simply to species richness, while at other times authors use the term to describe all the variety and processes of life, including species, genetic differences within and among species, and the interactions of these species within communities, ecosystems, and landscapes.

Most grassland biodiversity research has focused on vascular plants and animals, particularly large ungulates. One of the invited papers in this Session demonstrated that very little biodiversity research has been carried out for soil micro flora and fauna, or for ecosystem functions such as nutrient cycling, soil stability, and soil fertility. This gap severely limits our ability to make meaningful predictions regarding the impacts of human activities on the diversity and stability of grassland ecosystems.

### **RECOMMENDATIONS TO MAINTAIN GRASSLAND BIODIVERSITY**

Scientists must resolve and clarify some of the basic principles and premises of biodiversity. We still do not agree on the relative importance and role of species in the ecosystem. We need to resolve (a) whether each species plays a unique, incrementally essential role in ecosystem function, or (b) whether groups of species serve equivalent functional roles, such that not all species are essential. Which of these competing philosophies is most accurate implies very different management approaches and imperatives regarding grassland biodiversity.

We must also determine the extent to which our grassland ecosystems depend on "keystone" and "critical link" species. Management must obviously focus on maintaining viable populations of such species, particularly if no functional redundancy exists with other species within the ecosystem.

Intensive agriculture undoubtedly poses a serious challenge to the future biodiversity of the world's grasslands. Successful biodiversity programs must accommodate the needs of people and cultures to support and feed themselves. Management programs must therefore gain support of the general population. Such support requires that the concepts and implied promises of biodiversity remain plausible and convincing. Much more needs to be known about the

relationships among grassland biodiversity, habitat, and human management practices. For example, proponents of biodiversity argue that diverse systems are inherently more stable than simple systems. Yet intensive agriculture has persisted, productively, in many parts of the world (e.g., Asia and the Middle East) for thousands of years. This apparent contradiction needs to be clarified before land owners and agriculturists can properly manage biodiversity in the interests of sustainability. Landowners who are under social and economic pressure are unlikely to give priority to high levels of biodiversity simply for aesthetic or environmental reasons. Public, private, and political support for grassland biodiversity requires policies and economic incentives for the people who own, use, or live on the land base.

Finally, grassland biodiversity will be maintained only with a cooperative effort. Biodiversity research too often occurs within a single discipline, particularly biology and ecology. Successful biodiversity programs must be based on interdisciplinary research that includes geneticists, biologists, ecologists, naturalists, regional planners, sociologists, and economists. These research teams must also include local and regional land owners and users who are ultimately responsible for, or directly affected by, biodiversity policies and programs.

#### **REFERENCES**

**West, N.E.** 1993. Biodiversity of rangelands. *J. Range Manage.* **46**:2-13.