CHAIRS' SUMMARY PAPER: Grazing Systems Ecology

R.D.H. Cohen[1] and G.E. Maraschin[2]
University of Saskatchewan, Department of Animal & Poultry Science, 72 Campus Drive, Saskatoon, SK., Canada S7N5B5
Universidade Federal do Rio Grande do Sul, Faculdade de Agronomia, Depto. De Plantas Forrageiras e Agrometeorologia, Cx Postal 776, 91510-970 Porto Alegre RS, Brazil

PLENARY SESSION

Stuth et al. stated in their plenary paper "Once a proper stocking rate has been assessed relative to the desired mix of domestic and wild herbivores, a grazing regime can be designed which facilitates the desired effects." Today's emphasis on biodiversity and sustainability, compels us to include "non traditional" herbivores and non herbivores in this assessment because, they too, are part of the ecology of grazed grasslands. For example, small rodents and grasshoppers are a source of food for many grassland game birds and we therefore need to vigorously debate the ecological consequences of actions such as the biological control of grasshoppers before implementation creates yet another erosion of biodiversity. We should remember that most of the world's grasslands consist of native species and while we might accept that biodiverse croplands, and seeded grasslands, are unhealthy grasslands, biodiverse native grasslands are healthy grasslands. Thus, Stuth et al. made the point that "Grazing management must be flexible enough to accommodate a high degree of complexity." They also stated "Managerial ability is as much a part of grazing systems as biology, husbandry and economics." The task of the grassland manager is all the more difficult because, while grasslands have national boundaries, the biodiversity of grasslands is vastly international. For example, many species of grassland birds migrate from Canada to South America and back on an annual basis. Grassland management in one continent in one hemisphere can therefore influence biodiversity in another continent and hemisphere. Grassland scientists have a responsibility to join forces with biologists to ensure that grazing management protects and enhances biodiversity.

In their paper, Stuth et al. stated, "As the amount of land area available for livestock diminishes and the degree of human intervention increases, smaller scale processes such as patch grazing and nutrient cycling /availability increase in importance within the research agenda," with greater concerns for ecologically based planning of grazing management. The Congress was reminded of the words of Provenza (Session 5), "In ecology, the sum of the parts does not equal the whole." Grassland science is an ecological science and ecology is an applied science and must ultimately have relevance to the end user. Grasslands have many end users. Stuth et al. provided considerable food for discussion in their statement, "We find little acceptance and application of the narrow set of grazing systems that have been developed in the research community. The very act of conducting research on grazing systems makes the assumption that all landscapes are the same (no significant rep effect) and that motivations for grazing systems are essentially the same across land holdings." They consider that the importance of overall grazing pressure (on the ecological process) far exceeds that of grazing method and have listed landscape visioning at the top of their hierarchical list of managerial considerations of grazing ecology, providing many compelling examples why they consider this to be so important. Landscape visioning requires that animals be matched with the environment and spatial distribution of grazing pressure controlled. The ecological challenge is to identify the appropriate variables to measure which best serve the decision making process in terms of time, accuracy and perceived value to the land manager. Stuth et al. commented, "How grassland scientists transfer ecological knowledge to the decision maker to influence their actions is still a major ecological issue." They elucidated clearly why this transfer of ecological knowledge is important. Donnelly and Moore, in the second plenary paper of the session, elaborated on how this could be done. Stuth and Donnelly and their co-authors have a strong conviction that models linked together to form Decision Support (DS) systems provide a very powerful tool for land planners and users to assess the ecological consequences of their decisions on a holistic basis.

Donnelly and Moore opened their paper by quoting Seligman (International Grassland Congress 1993) as being pessimistic about the progress in using models to manage grasslands because models were difficult to use and difficult to relate to on farm practical applications. But Donnelly and Moore are much more optimistic. They cited: advances in computer hardware and radically new software as factors which have made models easier to use; and more comprehensive integration with local environment, management inputs and economic inputs as factors which have made it easier for users to apply to their own experience and practice.

They also cited other factors which have increased the use of and demand for DS tools. These include the increased emphasis on: sustainability of grazing systems; use of rangelands for water catchment and recreation; and on biodiversity and wildlife conservation. Donnelly and Moore cited four examples of DS tools which are currently in use in different countries: GLA - Grazing Lands Application package (USA); Stockpol (New Zealand); GrazFeed (Australia); Nutbal (USA) and there are others, some of which have been discussed at this congress. They argued that to be successful, DS tools should have three features: they should be generic; they should be able to analyze complex situations with relatively simple inputs; and they should be easy to operate and user friendly.

Other factors leading to greater acceptance and use include faster access to weather data (CD technology). But they also drew attention to some problems which limit acceptance. These include: lack of consistency in data formats even within a single country; some countries (UK and Canada) now regard weather as a commercial commodity rather than a public resource; weather data are almost always incomplete; and lack of commitment towards maintenance, upgrading, training and technology transfer with respect to DS tools. There are, however, some successes and they cited the official agreement between the New South Wales Department of Agriculture and CSIRO in Australia with respect to the GrazFeed DSS as a major step forward in the acceptance and use of DS tools. Because of this, GrazFeed has reached an impressive number of end users in a short space of time.

Donnelly and Moore briefly described the GRAZPLAN suite of DS tools which include MetAcces, LambAlive, GrazFeed, GrassGro and GrazPlan. This suite of DS tools is remarkably generic. For example, GrassGro requires only the development of parameter sets for each plant species of interest to the user to be valid in countries as climatically different as Australia and Canada (GrassGro has been remarkable successful in predicting production of perennial native and seeded pasture grasses and legumes as well as annual cereal crops such as winter wheat and barley in Saskatchewan). Donnelly and Moore distinguish this suite of DS tools from others as being developer driven rather than user driven.

Technology transfer and risk analysis is the cornerstone of a DS tool and Donnelly and Moore reported remarkable success with The PROGRAZE project in which 3,800 graziers/ranchers in the high rainfall regions of New South Wales have been exposed to training in the use of GrazFeed in the last 4 years (15% of all potential clients). Donnelly and Moore provided examples of the application of DS tools in the decision making process. GrazPlan (Australia) and StockPol (New Zealand) have been used by industry to set forward contracts for specific lamb and beef markets. These DS tools have also been used to provide risk analysis assessment, on farm decision support for cooperating landholders; implementation of drought relief policy by government and environmental decision making with respect to the emission of greenhouse gasses.

Finally, Donnelly and Moore visualized four areas in which future development and use of DS tools will occur:

- Use in property (range) management courses;
- Whole farm integration of DSS with respect to decision making for perennial pastures, annual pastures, annual crops and livestock enterprises;
- The development and use of DS tools via the Internet;
- The adaptation of DS tools for educational purposes.

POSTER PAPERS

The poster paper of Buckmaster et al. provided data for grazing management aimed at maximizing nutrient intake for livestock grazing orchardgrass (*Dactylis glomerata* L.) pastures. It provided evidence for validation of forward grazing, such as grazing first with lactating dairy cows followed by replacement heifers and finally dry cows to maximize production in various classes of livestock. The poster paper of Kothmann and Hinnant complemented both lead papers and described a tool for dynamic determination of stocking rate in a current year. It differs from GrassGro in that it requires current data input and its main application is deciding present stocking rate whereas GrassGro requires historic weather data and one of its main applications is risk analysis. Spatz and Fricke provided quantitative data with respect to the influence of light on succession of shrubs invading grassland areas. It complemented the paper of Donnelly and Moore who commented, "In GrassGro, the model of competition between companion species in a sward is, as yet, rudimentary." Bruynooghe et al. presented a small part of a larger data set evaluating a recently developed tetraploid cultivar of crested wheatgrass under grazing. It complemented the paper of Donnelly and Moore in that it forms part of a validation data set for this grass in the development of the GrassGro DS tool in Canada. The poster paper of Anderson et al. was a reminder that agricultural land is more than an ecosystem for managed crops and livestock and that management for wildlife is necessary to protect biodiversity and to prevent conflict. McDonald and Jones argued that paddock means of pasture yield and composition can be inadequate or misleading due to spatial variability within pastures at the patch, community and landscape levels. This linked with the plenary paper of Stuth et al. and also with papers in Sessions 2 and 5 (Intake and Foraging Behaviour). Iijima et al. reported on the ecology of an "undesirable" species (broadleaf dock) and its effect on a "desirable" species (orchardgrass). Quirk & Stuth expanded on their thesis that grazing pressure is more important than grazing system in the ecological process. They reported that dietary composition is adequately predicted from regression relationships with field proportions of preferred and undesirable species. Anderson et al. drew attention to the high cost of measuring vegetation responses to grazing in conventional research designs and they argued the case for nested paddock designs which reduce costs and permit comparisons of animal performance among whole pasture treatments and vegetation responses to grazing intervals. Finally, Patterson & Espie reported finding diploid, triploid and tetraploid genotypes of white clover which have persisted at high levels of productivity after centuries of grazing and cutting without fertilizer in the Caucasian Mountains of Georgia and suggested that further evaluation of this legume for use in temperate montane pastures is warranted.

DISCUSSION OF PAPERS AND POSTERS

Humphries (Australia) suggested that reluctance to use DS tools may be associated with cultural and personality differences between farmers and scientists. The panel did not disagree but Moore indicated that they had found GrassGro to be a good tool because of its interactive nature which improved the learning process and broke down the cultural/personality barriers.

A delegate from the Falkland Islands asked the panel how they priorize their research in view of the reduced resources (funding) available. Donnelly said that they worked with other groups such as State (e.g. New South Wales) Department of Agriculture extension and research personnel and that this had brought a different dimension and increased the overall resource base. Moore added that research networking among groups has lead to more effectiveness with respect to obtaining funding. His advice: "Work on a broad front and negotiate hard." Quirk commented that the initial enthusiasm in Queensland did not lead to uptake by producers or even extension personnel and that their emphasis is now to use DS tools to teach the biology behind the models.

Poppi (Australia) commented that they are using GrazFeed extensively at the University of Queensland in their teaching program. [Chairman's note: There are other examples. Bellotti (University of Adelaide) and Cohen (University of Saskatchewan) are using GrassGro in their teaching programs]. Poppi also asked Stuth how he developed the equations for the nutritional base in NUTBAL. Stuth replied that they had used animals with esophageal fistulae and lab analyses to build an extensive data base over time and that ranchers/advisors contact the laboratory and discuss what samples they need and how to collect them. These samples are then shipped to the laboratory and within 48 hours the laboratory provides the quality information which is placed in the NUTBAL DS tool and supplementary feeding strategies are recommended. (Chairman's comment: This differs from the GrassGro approach in which the quality and quantity of herbage on offer and its intake are predicted on a daily time step from climate data and the user can choose any number of management strategies such as provision of a supplement from a slate of alternatives, stocking rate adjustments, movement of animals to another paddock or pasture type and so on and determine the outcome in terms of pasture and animal production and marginal returns on the investment in the management option).

Garden (Australia) suggested that there was a conflict of approach between the two plenary papers in that Stuth stressed the need for complexity and advised caution when over simplifying whereas Donnelly stressed the need to simplify a complex system to make it understandable. Donnelly replied that their approach was not to simplify the underlying models, which were very complex, but to remove the complexity of the system from the user to make it simple to use. Stuth agreed, adding that proof of success was when a user said he now understood what his cattle on his land could produce if he implemented a particular management program. Stuth then added “We must keep in mind that the tools which are developed must have value to the user.”

Bellotti (Australia) noted that Stuth had emphasized the human element but that most DS tools emphasize the biology and he wondered if there was any way that the human element could be put into DS tools. Stuth said that their DS tools were allowing decision making with respect to vegetation use because the tool was used to assess the impact of that decision on the vegetation. Donnelly responded that they were attempting to hide the biology in the underlying models in order to emphasize the impact of the human decision aspect.

A delegate from the United Kingdom suggested that perhaps the poor acceptance of DS tools may be because they don’t address the type of decisions that have to be made on the farm such as: should I remove the animals? should I give them more area? should I supplement them? and if so with what? Donnelly responded that GrazFeed and GrassGro allow day to day tactical decision support for exactly the purposes described by the delegate and that GrazFeed is being used by advisors to respond, over the telephone, to these questions. He expects that GrassGro, which was released in Australia just before the Congress, will be used in the same way.

A delegate from Argentina asked the panel what indicators should be measured to determine land health. Stuth replied that there was a scientific debate on this subject and that few people are prepared yet to list the important indicators of range condition. There was also a response from the floor to this question indicating that we must move from single focus management to multiple value management and that this has created a challenge with respect to indicators of range condition.

DIRECTIONS FOR THE FUTURE

Grassland Scientists must not lose sight of the fact that theirs is an ecological science in the fullest sense. If we do, we run the risk of repeating old mistakes which lead to land degradation and loss of biodiversity as has been reported by Stuth et al. and others in plenary and poster papers earlier in the congress.

Grassland ecology is complex and the importance of DS tools to harness, understand and interpret this complexity will undoubtedly increase. Education with respect to their use will be very important.

Grassland scientists should also remember that theirs is an applied science and must therefore serve the needs of the land manager whether it be for agriculture, wildlife management, recreation, water management or, more commonly, a combination of these.

Agricultural use of grasslands is primarily for meat and fibre (wool, mohair) production. Dr. Pinstrup-Andersen, in his address at the opening session in Winnipeg, forecast that the demand for meat will increase substantially by 2020. He also alluded to the inadequate provision of research funding by developed countries for developing countries. Blair et al. (Session 10) provided data on the enormous increase in beef and sheep numbers in south east Asia. Failure to research the ecology of the world’s grasslands can only lead to increased land degradation. Grassland is almost always not a directly marketable commodity and as such, lacks an identifiable industrial conglomerate from whom financial support can be requested. Many government agencies in developed countries now provide research funding only when there is evidence of matching funding from industry. Industry and governments have difficulty funding research into a resource for which they perceive no direct market value. It is our responsibility to convince them that to ignore grassland ecology research as a bona fide need will be environmentally, socially and economically dangerous.