Forages and Pastures: Environmental Impact of Forage-Based Livestock Production Systems

630 Compatibility of beef cattle management with multiple use values on western rangelands. T. DelCurto* and P. Kennedy, *Eastern Oregon Agricultural Research Center, Union Station, Oregon State University*, *Union*.

Beef cattle production in the western United States is dependent on systematic approaches that maintain the biological diversity of native rangelands. In addition, the continued use of these rangelands may depend on our ability to demonstrate that domestic livestock production can be compatible with multiple uses that not only include native vegetation/wildlife diversity, but also focus on water quality, fisheries, and recreation/esthetic values. The purpose of this paper is to quantify research that has evaluated the impact of beef cattle grazing on big game habitat, riparian areas critical to fish habitat, vegetation diversity, logging/grazing interactions, and, although information is limited, insect and bird diversity/abundance. Over 20 years of research will be summarized in respect to the interaction of beef cattle grazing and deer/elk big game herds in the Blue Mountains of Oregon. This research represents decades of collaborative research between the USDA FS Starkey Experimental Forest and Range and Oregon State University. In addition, research focused on the management of beef cattle relative to riparian areas that provide habitat to threatened and endanger fish will be discussed. Finally, a new generation of research will be discussed that uses a food web approach to enumerate the impact of beef cattle grazing on soils, vegetation, insects that feed on the vegetation, insects that prey on other insects, and ground nesting birds that need the vegetation for cover as well as use insects for their primary food sources. This type of research is difficult and often necessitates the need to develop multi-disciplinary and, in some cases, multi-agency teams. However, this type of research approach may be critical to addressing public concerns about the long-term sustainability of beef cattle production on western rangelands.

Key Words: beef cattle, rangelands, multiple use

631 Livestock grazing and endangered species habitat. G. S. Lewis*, C. A. Moffet, and J. B. Taylor, *USDA, ARS, U.S. Sheep Experiment Station*, *Dubois, ID*.

Livestock grazing can improve wildlife habitat, including critical habitat for species listed as endangered. However, that assertion presumes that appropriate and unbiased data have been used to define critical habitat; an appropriate recovery plan has been approved with clear and firm objectives that can be used to develop grazing strategies for habitat conservation; and legal challenges do not result in significant and frequent changes in the recovery plan. The Endangered Species Act (ESA) of 1973 defines endangered species as one that is "in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is "likely to become an endangered species within the foreseeable future." The ESA and amendments "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, provide a program for the conservation of such endangered species and threatened species, and take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth" in the ESA, including "esthetic, ecological, educational, historical, recreational, and scientific value." Also, the ESA describes the process of listing species, determining critical habitat, developing a recovery plan, and delisting species. Nearly 1,900 species have been listed and <50 species have been delisted under the ESA. Even though strategic livestock grazing can benefit wildlife habitat, the scope and vagaries of the ESA and Federal judicial process, combined with institutional opinions of "antiagriculture" groups that livestock grazing is always detrimental, prevents scientists from conducting the well-designed research needed to develop site-specific livestock grazing plans for conserving endangered species habitat. Our presentation will include discussions of these issues and suggestions for how scientists can provide robust data for developing livestock grazing plans that will conserve endangered species habitat.

Key Words: Endangered Species Act, livestock grazing

632 Economic and environmental issues associated with confinement and pasture-based dairy systems. D. A. Clark*[1], S. F. Ledgard[2], P. Gregorini[1], and C. A. Rotz[3], [1]*DairyNZ*, *Hamilton, Waikato, New Zealand*, [2]*AgResearch*, *Hamilton, Waikato, New Zealand*, [3]*USDA-Agricultural Research Service*, *University Park, PA*.

Milk is produced in a continuum of dairy systems from full confinement to full pasture grazing. Climate, available feeds, and milk price: feed cost ratio influence the preferred system. All dairy systems have an environmental impact and inputs to maximize profit may lead to pollution levels unacceptable to society. There is vigorous debate concerning the trade-off between dairy farm profit and air and water quality impacts. Reasoned debate requires good information on the key production, economic and environmental parameters associated with different dairy systems and an agreement on the boundaries of each system. We provide a summary of literature on experiments and modeling of confinement and pasture-based dairy systems as a framework for future analysis and debate. There are few published experimental comparisons of confinement and pasture-based systems that account for both production and environmental parameters, so we make extensive use of modeling studies (e.g., life cycle assessment, Integrated Farm System Model, DairyNZ Whole Farm Model and OVERSEER). Where possible we use experimental data to evaluate model predictions. We compare a subset of possible dairy systems for both economic and environmental performance and identify areas of high sensitivity to factors such as input costs or environmental pollutants. Strengths and weaknesses of different systems are identified and we highlight opportunities for economic and environmental improvements by both component technologies and system redesign. Stored feed systems need to reduce their production costs and environmental footprint. Pasture-based systems need to reach the energy intake levels associated with TMR, and reduce the nitrate and N_2O losses associated with urine patches in grazed pasture. Dairy systems research must ensure that advances in animal and plant breeding lead to simultaneous economic and environmental benefits.

Key Words: dairy production systems, confinement feeding, grazing

633 Forages and livestock production with declining water resources and a changing agricultural industry. V. G. Allen*, C. P. Brown, R. L. Kellison, P. N. Johnson, and C. J. Zilverburg, *Texas Tech University, Lubbock*.

Agriculture is undergoing radical change driven by continued global population growth, a fossil fuel-based energy system, unstable economics and policies, depletion of natural resources, environmental concerns, and dependence on irrigation. Agriculture is the biggest single user of water, largely for irrigated crop production, and demands continue to

escalate. Urban expansion and conversion of prime agricultural land to non-agricultural uses force crop production into more marginal environments resulting in increased resource inputs to ensure production. Such inputs frequently include water for irrigation at non-sustainable rates of use. The semi-arid Texas High Plains is one of the most intensive agricultural areas in the US and is a model for factors driving change. Agriculture conservatively accounts for over 40% of the regional economy but depends heavily on water for irrigation from the Ogallala aquifer. Recharge is negligible, and water demand is expected to exceed supply within the next 10 to 20 years. About 30% of the cotton (*Gossypium hirsutum* L.) and 25% of the cattle on feed in the US are located here primarily in monoculture systems. Recently, the dairy industry and an emerging renewable fuel industry have entered this region placing increased demands on soil and water resources and influencing cropping decisions. Impending water depletion, evolving water policies and laws, and volatile commodity and input prices are contributing to destabilizing agriculture. A 10-year replicated comparison of an integrated crop/forage/beef stocker steer system and a monoculture cotton system demonstrated ($P < 0.05$) that the integrated system required about 25% less irrigation water, 40% less nitrogen fertilizer, improved soil organic carbon and microbial activity, reduced erosion, and was as profitable as the cotton monoculture. Monitoring of 27 producer systems in the Texas High Plains continues to demonstrate water conservation and economic opportunities through integrating forages and livestock into cropping systems but long-term field-scale systems research is essential. Lessons learned here have global significance.

Key Words: water, grazing systems, integrated systems

634 Pasture management strategies to minimize the impacts of grazing on water quality of surface water resources. J. R. Russell*[1], D. A. Bear[1], K. A. Schwarte[1], and M. M. Haan[2], [1]*Iowa State University*, *Ames,* [2]*Michigan State University*, *Hickory Corners*.

Sediment, nutrient, and pathogen loading of pasture streams result from stream bank erosion, direct manure deposition, and\or transport in precipitation runoff. Risks of loading streams with these pollutants may be increased by biotic and abiotic factors that encourage congregation of cattle near streams. Congregation of cattle near pasture streams may be discouraged by management practices that control the temporal\spatial distribution of grazing cattle. Restricting stream access of beef cows either to stabilized crossings in continuously stocked pastures or to riparian paddocks grazed to a minimum sward height of 10 cm in rotationally stocked pastures reduced the proportion of time that cattle spent in and within 33.5 m of the pasture streams by 81% in comparison to continuous stocking with unrestricted stream access. Providing off-stream water or shade may alter the temporal\spatial distribution of cattle in pastures, but efficacy of management practices to alter the distribution of grazing cattle is dependent on pasture size and shape and climatic conditions. The proportion of time that cattle spent in and within 30.5 m of a stream (streamside zone) in pastures with different areas was more highly related to the proportion of pasture area in the streamside zone than pasture shade distribution or botanical composition. In pastures with comparable areas, the proportion of time that cattle spent in the streamside zone was highly related to the proportion of total pasture shade in the streamside zone in the spring and fall, but not in the summer. Stream bank erosion and total coliform concentrations in stream water were not affected by stocking density or grazing management. Reducing pasture stocking density or restricting stream access to stabilized crossings or riparian paddocks limit the risk of sediment, nutrient, and pathogen loading of streams by reducing the proportion of bare and\or manure-covered ground and precipitation runoff in streamside zones.

Key Words: grazing, water quality, beef cattle