Ecological Applications, 3(1), 1993, pp. 24–26

GRAZING OPTIMIZATION: A PLEA FOR A BALANCED PERSPECTIVE[1]

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Abstract. Compensatory plant growth may be a significant ecological process that minimizes the reduction of primary production in direct proportion to the severity of defoliation in some species and systems given the appropriate combination of environmental variables. However, the potential benefits of compensatory growth should not obscure the well-established ecological processes governing the sustainability of grazed systems in the face of large scale environmental degradation and a rapidly expanding human population. The sustainability of grazed systems is a more fundamental issue than grazing optimization.

Key words: compensatory plant growth; degradation of grazed systems; domestic grazers; grazing management; grazing optimization hypothesis; plant–animal interactions; sustainability of grazed systems.

The two-decade-old debate addressing the beneficial effects of herbivory on primary productivity has most frequently focused on the coevolutionary relationships between plants and animals (e.g., Owen and Wiegert 1981, Mack and Thompson 1982, Coughenour 1985) or the physiological and ecological mechanisms associated with the process (e.g., Hilbert et al. 1981, McNaughton 1983, 1992). Painter and Belsky's treatment diverges appreciably from these two themes by addressing the potential consequences of grazing optimization or compensatory plant growth on rangelands grazed by domestic herbivores. My response emphasizes the need for a balanced perspective concerning the occurrence and potential significance of grazing optimization in relation to land use issues and grazing management policy.

Compensatory growth, either defined as partial or overcompensation (Belsky 1986), had been documented for both individual plants and communities to a limited extent. *Kyllinga nervosa,* a C_4 sedge from the Serengeti (McNaughton et al. 1983), and *Ipomopsis aggregata,* a herbaceous dicot from the Intermountain West (Paige and Whitham 1987), are perhaps the most notable individual plant examples, while *Andropogon greenwayi* grasslands of the Serengeti (McNaughton 1979) and intertidal graminoid vegetation near Hudson Bay (Hik and Jefferies 1990) are widely recognized community examples. Nevertheless, it has also been well documented that compensatory growth does *not* occur in all species and systems or in response to all combinations of environmental variables (Ellison 1960, Belsky 1986, Detling 1988). Therefore the more appropriate question appears to be "With what frequency and magnitude does compensatory growth occur in a diversity of grazed systems?", rather than whether or not the process occurs. Compensatory growth may be a significant ecological process that minimizes the reduction of primary production in direct proportion to the severity of defoliation in some species and systems, given the appropriate combination of environmental variables (McNaughton 1983, 1985). However, the potential benefits of compensatory growth should not obscure the well-established ecological processes governing the sustainability of grazed systems.

The ecological processes associated with the degradation of grazed systems are well documented, although the cause–effect relationships are not entirely understood (Archer and Smeins 1991, Briske 1991). Late-successional dominants are replaced by mid- or early-successional species, including ruderals and unpalatable perennials, associated with a concomitant loss of primary and secondary productivity, species diversity, plant cover, and soil. Environmental degradation in grazed systems is frequently exacerbated by socioeconomic constraints in both developed (Conner 1991) and developing countries (Sandford 1983). Consequently, environmental degradation frequently results from the attempt of humans to maintain a desired number of animals or to produce a sufficient amount of animal products for subsistence agriculture or economic profitability, rather than from the inherent instability of grazed systems. While compensatory plant growth may potentially optimize primary production in grazed systems, it very likely has a negligible effect on the threshold limits defining system stability. In the face of large-scale environmental degradation and a rapidly expanding human population (Lubchenco et al. 1991), the sustainability of grazed systems is a more fundamental issue than is grazing optimization.

It is important to recognize that much of the data collected in support of the grazing optimization hy-

[1] Manuscript received 20 May 1992.

pothesis were from grazed systems where herbivore density and movement were *not* directly regulated by humans (e.g., McNaughton 1979, 1985, Paige and Whitham 1987, Hik and Jefferies 1990). In these systems, primary production and herbivore density often fluctuate widely in response to annual climatic variation. Conversely, herbivore density and movement are often controlled in intensively managed systems, and precautions are taken to minimize deleterious consequences on animal production. Consequently, the intensity of grazing in these systems may frequently exceed the optimal intensity required to consistently stimulate primary production, as indicated by the grazing optimization hypothesis (Briske and Heitschmidt 1991, Oesterheld et al. 1992).

Compensatory plant growth is assumed to increase as the time interval between successive grazing events increases (Hilbert et al. 1981, Georgiadis et al. 1989, Oesterheld and McNaughton 1991). However, the time interval between grazing events is frequently minimized in intensively managed systems because high animal numbers are sustained with supplemental feed during periods of limited primary productivity and animals are rapidly moved back onto rangelands immediately following the resumption of plant growth (Briske and Heitschmidt 1991). These differences between plant–animal systems may also partially explain why the grazing optimization hypothesis originated with researchers working in extensively managed, rather than intensively managed, systems, and why the hypothesis receives limited support from most natural resource managers.

The argument presented by Painter and Belsky indicating that the concept of compensatory plant growth has substantially influenced land use issues and grazing management policy is premature and founded largely on circumstantial evidence. For example, none of the federal land management agencies, including the Bureau of Land Management (BLM 1985), the USDA Forest Service (1984), and the Soil Conservation Service (SCS 1976), consider compensatory plant growth as a criterion for designing or evaluating grazing management strategies. Natural resource managers, including agency personnel, frequently implement grazing management strategies to minimize the potentially detrimental consequences of grazing on the composition, diversity, and productivity of plant communities. Occasional reference to compensatory plant growth by natural resource managers is often intended to support the proported benefits of various management strategies, rather than to form the basis for development of a specific management strategy (e.g., Savory 1988).

Painter and Belsky conclude by cautioning scientists to clearly communicate information and perceptions concerning compensatory growth because of the potential for misinterpretation by the popular press. An alternative conclusion is that the popular press has more or less accurately perceived the debate that has occurred, and continues to occur, within the ecological community. Therefore, we need to assume partial responsibility for the misconceptions concerning compensatory growth to the extent that they may occur. Misinterpretation of scientific information by the public represents an inherent risk to the scientific community because peer evaluation, debate, and alternative hypotheses development are integral components of science. However, it is the responsibility of individual scientists to evaluate and present ecological issues with an objective, balanced perspective to minimize the potential for misinterpretation and to effectively promote scientific advancement.

ACKNOWLEDGMENTS

I gratefully acknowledge the comments and suggestions of S. Archer, J. K. Detling, R. K. Heitschmidt, J. S. Murphy, and J. H. Richards.

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