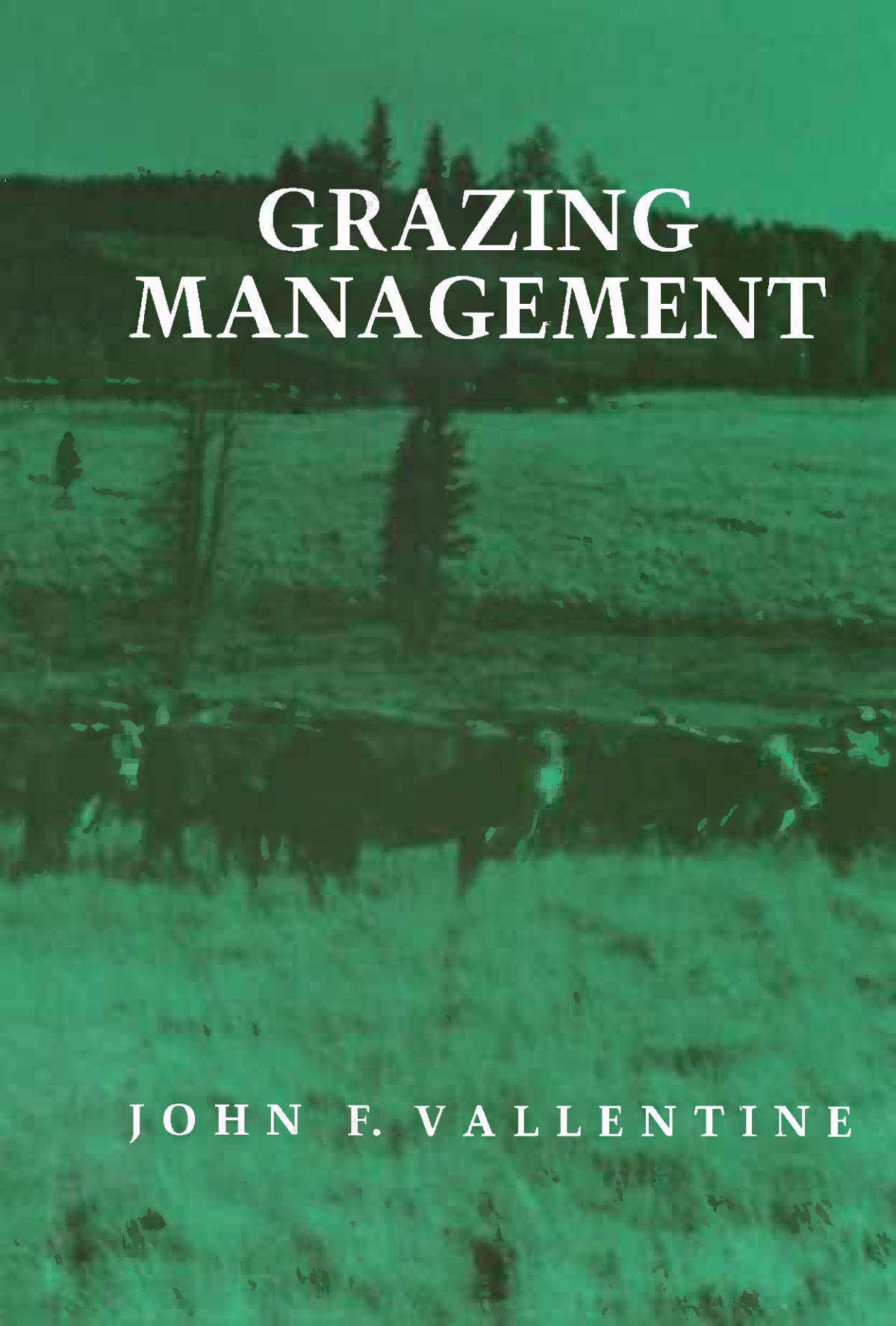
GRAZING MANAGEMENT



JOHN F. VALLENTINE

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ACADEMIC PRESS, INC.
Harcourt Brace Jovanovich, Publishers
San Diego New York Berkeley Boston London Sydney Tokyo Toronto

Cover photograph courtesy of the
University of Arizona College of Agriculture.

This book is printed on acid-free paper. ∞

Academic Press, Inc.
San Diego, California 92101

United Kingdom Edition published by
Academic Press Limited
24–28 Oval Road, London NW1 7DX

Library of Congress Cataloging-in-Publication Data

Vallentine, John F.
Grazing management / John F. Vallentine.
p. cm.
ISBN 0-12-710000-8 (alk. paper)
1. Grazing--Management. 2. Range management. 3. Forage plants.
I. Title.
SF85.V35 1990
6332'02--dc20 89-39268
CIP

Printed in the United States of America
90 91 92 93 9 8 7 6 5 4 3 2 1

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PREFACE

Grazing Management attempts to integrate the principles and management techniques that apply to all grazing lands and to all grazing animals. The kinds of grazing land considered range from native and seeded rangelands to temporary and crop aftermath pasture. An attempt has been made to cover big game herbivores with an equivalent intensity to domestic livestock, but only in some areas has this been fully accomplished.

The principles and practices emphasized should apply throughout the world, even though social customs, agricultural policy, and land ownership may restrict unlimited application. A majority of the examples of grazing management provided and much of the literature cited herein are of North American origin. Since grazing management is a rapidly developing science, extensive documentation seemed justified and has been provided. Figure legends have been utilized to summarize salient points in each chapter.

Considerable difficulty was experienced in setting the order of topics, since almost every facet of grazing management interrelates with almost every other facet. The final solution was to follow the order of presentation most commonly followed in my grazing management course at Brigham Young University. Chapter 2 introduces the effects of grazing on forage plants and on the soils in which they grow. Nevertheless, grazing is primarily for the benefit of the grazing animals as expressed through their nutrition, and this is the focus of Chapter 5.

Grazing Management is recommended both as a textbook and as a reference manual. As a textbook the prime audience is expected to be fourth and fifth year university students with a major in range science, animal science, big game management, or agronomy. It should also serve as a comprehensive reference manual for extension and research personnel, grazing land managers, innovative ranchers and farmers, agribusiness personnel, and conservationists generally. Although not primarily designed as a field manual, an attempt has been made to blend the concepts and principles of grazing management with their application.

Although it seemed proper to compile a book about it, the unknowns surrounding grazing management readily become apparent. Many academic disciplines during the past 25 years have refocused attention on grazing

management; new insights have been revealed and these may require grazing managers and scientists to modify substantially their present concepts and practices. It also is readily apparent that grazing management must remain dynamic to accommodate and build upon new principles and applications as they become more fully substantiated and documented.

As a synthesis of the concepts, research data, and application experiences contributed directly and indirectly by many people, it is sincerely hoped that *Grazing Management* properly represents their conclusions.

John F. Vallentine

1

INTRODUCTION TO GRAZING

ROLE AND OBJECTIVES OF GRAZING

Grazing management is the manipulation of grazing animals to accomplish desired results in terms of animal, plant, land, or economic responses. The *grazier* is the person who manages the grazing animals, i.e., the *grazers* (including browsers). These terms have a common stem in the verb *graze* which specifies the defoliation and consumption of standing forage by ungulate herbivores. Grazing of standing forage on range and pasture is the counterpart of machine processing of harvested forage crops (Fig. 1-1), except that the grazing animal is both the consumer and the converter as well as the harvester.

Ranch management is the manipulation of all ranch resources—including not only the grazing resources but also all financial, personnel, and physical resources of the ranch—to accomplish the specific management objectives set for the ranch. In this regard, grazing management is only one aspect, albeit a very important one, of total ranch management. Where animal grazing is a prominent component of a farm operation and involves substantial use of lands for grazing, grazing management will necessarily play a similar role in *farm management*. Emphasis on grazing management is well deserved because of its relatively low cost and potentially great returns per unit of management input (Lewis and Volesky, 1988).

Grazing land management—which principally integrates both range and pasture management—is the art and science of planning and directing the development, maintenance, and use of grazing lands to obtain optimum, sustained returns based on the objectives of land ownership. The effective grazing planner/manager must inventory all sources of available grazing capacity and integrate them into the best animal production system. The management interrelationships of different kinds of grazing lands, when used in a single production system, are great and must not be overlooked or ignored. The use of rangeland is generally comingled

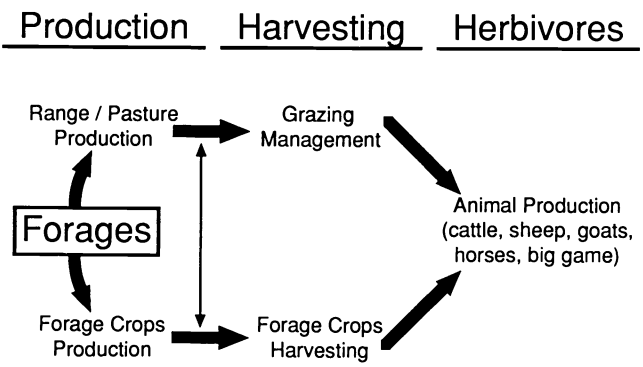


FIGURE 1-1 The dual production–harvesting avenues of forage conversion by herbivores.

with the use of other types of grazing lands and most range livestock and many big game animals use multiple sources of grazing capacity to meet their annual requirements (Vallentine, 1978).

Opportunities to enhance the energy efficiency in the soil–forage–ruminant complex exist in three principal areas:

1. Increase the conversion of radiant solar energy to usable form during growth of the forage plants through photosynthesis, i.e., by enhancing the quantity and quality of forage produced on the site.
2. Increase the consumption of energy fixed by forage plants by the grazing animal (livestock or big game) through optimal management of grazing and reducing forage waste and nonproductive consumption.
3. Increase the conversion of the ingested energy by the grazing animal into products directly usable by humans through improved animal genetics, nutrition, and health.

Savory (1987) has recognized two additional links for completing the grazing resource management and economics chain: (1) the "market link," involving the active marketing of the "packaged product" and conversion into "solar" dollars of new wealth, and (2) the "reinvest link," involving the return of "solar" dollars through reinvestment to strengthen the chain at its weakest link in a constant growth/stability process.

Grazing management, since it is both a science and an art, should be based on both the knowledge of science and the wisdom of practical experience. Because of the intricacies and variability of the animal–forage–land biological system, the management of grazing animals on grazing lands may require as much art as science in making adjustments as needed. The concept of grazing management implies decision making (Fig. 1-2). Profitable decision making requires knowledge about forage plant species, animal responses desired relative to the market, and the forage plant–animal–land interactions (Matches and Burns, 1985).

Computerized grazing models must include not only a biological but

also a managerial counterpart (Christian, 1981). Grazing lands cannnot be managed by computers alone; qualified, trained individuals make good grazing management decisions (Rittenhouse, 1984). Until the data pool becomes large enough to provide reliable numbers for computer input, a reasoned opinion may be more appropriate for many difficult management choices. A precise number with insufficient or inadequate formulation is seldom better than an informed guess and may be even less reliable (Van Dyne *et al.*, 1984a).

Effective grazing management requires a comprehensive plan to secure the best practicable use of forage resources. Such a plan must provide for the daily, seasonal, and annual grazing capacity needs of the livestock and/or big game; it must also seek to match the quantity and quality of grazing animal unit months (AUMs) produced on the ranch or grazing land unit with the AUM needs of the grazing animals associated with it. However, grazing management is much more complex than even this; the grazing management plan and subsequent operational decisions must include a wide variety of economic, managerial, and biological considerations along with their many interactions.

The objectives of the grazing plan should include long-term stability as well as immediate profitability or other economic criteria of production (Morley, 1981). The planning time frame for individual grazing land units must be as long as the projected life of the forage stand, commonly a few

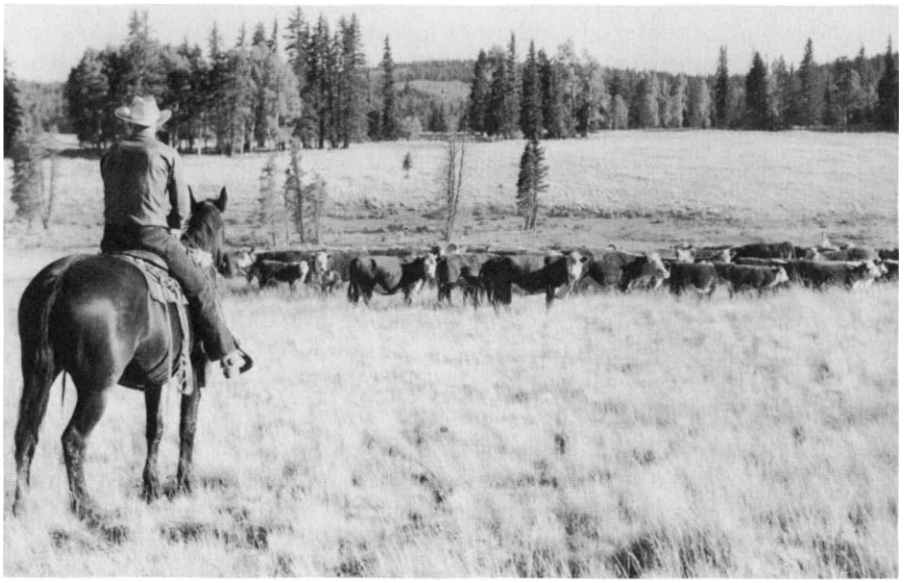


FIGURE 1-2 Grazing management requires decision making based on both the knowledge of science and wisdom of practical experience. (University of Arizona photo.)

weeks to several months for annual pasture, up to 25 years or more for some perennial pastures, or for unlimited continuation for native and seeded rangelands. For the longer term grazing lands, management including stand maintenance must provide for a continuation of desired forage and animal production on a sustained yield basis.

The terminology related to forages and other feedstuffs available for animal consumption must be consistently used. The following are suggested:

Feed—any noninjurious, edible material, including forage, having nutritive value for animals when ingested; synonym, *feedstuff*.

Forage—that part of the vegetation that is available and acceptable for animal consumption, whether considered for grazing or mechanical harvesting; includes herbaceous plants in mostly whole plant form and browse; may be further described as *green*, *ensiled*, *cured*, *weathered*, etc.

Browse—leaf and twig growth of shrubs, woody vines, and trees available and acceptable for animal consumption.

Herbage—aboveground herbaceous vegetation; often expanded to include twigs and leaves of woody plants; may include plant material not acceptable or available to herbivores.

Pasturage—forage harvested directly by the grazing animal from the standing crop; in this sense, synonym, *pasture*.

Forage crops—forage plants mechanically harvested before being fed to animals in the form of hay, haylage, fodder, stover, silage, green chop, etc.

Roughage—plant materials and other feedstuffs high in fiber and low in total digestible nutrients, usually bulky and coarse; synonymous with *forage* only in part.

Concentrate feed—grains or their products or other processed feeds that contain a high proportion of nutrients relative to bulk.

IMPORTANCE OF GRAZING

On a worldwide basis, range is the largest land resource, encompassing about 50% of the land area of the earth (Anonymous, 1985; Busby, 1987). Additional acreage, possibly 5 to 10%, comprises cropland pasture and permanent pasture (Fig. 1-3). Besides the United States, other countries or areas of the world with large expanses of rangeland are Canada, Mexico, South America, the Middle East, Africa, Australia, Russia, and China. Substantial areas of nonrange pasture are found in the British Isles, western Europe, and New Zealand.

Approximately half (50.6 %) the land area of the United States is grazing land (Table 1-1). Total rangeland, both open and forested, constitutes 41.9% of the total land area, while pasture, excluding rangeland, consti-

FIGURE 1-3 Rangelands are estimated to comprise about 50% of the land area of the world and cropland pasture and permanent pasture an additional 5 to 10%. (U.S. Forest Service photo.)

tutes 8.7%. Over 50% of the open (i.e., nonforested) range and nearly 40% of the forested range (also referred to as grazed forest land) are federally owned, while most of the nonrange pasture is privately owned. Grazing lands constitute 64% of the total land area in the West, 48% in the Southeast, 33% in the North Central area, but only 12% in the Northeast. Range constitutes 97% of the total grazing lands in the West, 62 and 57% in the Southeast and North Central area, respectively, but only 14% of the total grazing land in New England. Sixty-five percent of the total forest and rangeland in the United States is grazed by livestock (USDA, Forest Service, 1981).

Grazing lands contribute an estimated 40% of the feed consumed by livestock in the United States, harvested forages about 20%, and concentrate feed, including grains and protein supplements, the remaining 40% (Allen and Devers, 1975). Livestock products provide the major economic return from most range and pasture lands. Compared with harvested or purchased feeds, ranges and pastures provide a relatively inexpensive and energy-efficient feed source for livestock production. The National Research Council (1987) has summarized that both beef cattle and sheep—goats would be a logical addition—are raised primarily as a means of marketing forages, especially those forages that have limited alternative

TABLE 1-1 Grazing Lands of the United States by Category and Region[a]

Regions[b]	Total land area	Cropland pasture[c]	Perennial pasture	Open range	Forested range	Total grazing land	Percent grazing lands
Northeast	111.7	2.4	8.8	0.0	1.7	13.0	12
North Central	481.3	23.5	43.4	78.0	11.9	156.8	33
Southeast	538.0	31.0	66.2	116.3	44.0	257.4	48
West	1120.9	7.4	13.1	592.2	99.7	712.3	64
Total United States	2252.0	64.3	131.5	786.5	157.2	1139.6	51
	(100%)	(2.9%)	(5.8%)	(34.9%)	(7.0%)	(50.6%)	—

[a] Data in million acres. Compiled by John L. Artz and Daniel L. Merkel (USDA, Ext. Serv., 1986).

[b] Northeast: Conn., Del., Me., Md., Mass., N.H., N.J., N.Y., Penn. R.I., Vt., W. Va.; North Central: Ill., Ind., Iowa, Kan., Mich., Minn., Mo., Neb., N.D., Ohio, S.D., Wisc.; Southeast: Ala., Ark., Fla., Ga., Ky., La., Miss., N.C., Okla., S.C., Tenn., Texas, Va., Carribbean; West: Aka., Ariz., Cal., Colo., Ha., Ida., Mon., Nev., N.M., Ore., Utah, Wash., Wyo.

[c] *Cropland pasture* is cropland reseeded and used for pasture at varying intervals.

markets. The combined value of cattle, sheep, and goats to the U.S. national economy is approximately $25 billion annually; this includes the contributions made by forages. By comparison $90 billion is the annual value of all other crops, including forest products (USDA, Forest Service, 1981).

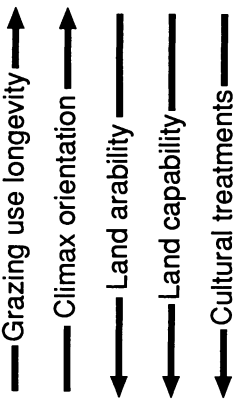
The proportion of total feed obtained from grazing varies with different kinds of livestock: sheep and goats, 80%; beef cattle, 74%; horses, 51%; dairy cattle other than lactating cows, 43%; and milking cows, 18% (Allen and Devers, 1975). Feed for maintenance of breeding herds of beef cattle, sheep, and goats and the production of their offspring comes primarily from grazing lands. Rangelands, together with forestlands, are the largest and most productive habitats for big game animals. At one time or another during the year, domestic cattle and sheep graze on about half of the federal lands in the adjoining 11 western states (Public Land Law Review Commission, 1970). In these states public lands supply about 12% of the total forage consumed, with an individual state high of 49% in Nevada.

KINDS OF GRAZING LANDS

Grazing lands include all land areas devoted to the production of forage from native or introduced plants and harvested directly by grazing animals. An array of grazing lands results from a continuum of soil–site factors, vegetation–forage stands, and management projections and applications.

Use of the terms *wild*, *tame*, *artificial*, *synthetic*, and *natural* when applied to pasture is unreliable in projecting site adaptation, longevity, and even usefulness of forage plant species, and the combinations or variety of forage stands they comprise. The development of improved cultivars of both native and introduced species seems to make such terms almost redundant. Except when required for correlation of concepts, such terms have been avoided here. The terms *improved* and *unimproved* can also be misleading unless precisely defined or described and consistently used thereafter. The case against using *annual* and *perennial* to describe grazing lands, unless fully defined, can be made even stronger since perennial forage species can variously be used for a single year, limited to a specified number of years, or managed for unlimited continuation.

The following classification (outlined in Fig. 1-4) has the objective of describing and correlating the major categories of grazing lands for use in their planning and management. It arranges all grazing lands into broad categories by blending ecological site factors with intended land use and management objectives (Vallentine, 1988). Since grazing lands differ greatly in the following characteristics, these have been used as the principal basis of classification: (1) projected grazing use longevity, (2) climax



I. Long-term grazing lands
   A. Native range
   B. Seeded range (native species)
   C. Seeded range (introduced species)

II. Medium-term grazing lands
   A. Transitory pasture / range
   B. Permanent pasture

III. Short-term grazing lands
   A. Crop-rotation pasture
   B. Temporary pasture
   C. Crop aftermath pasture

FIGURE 1-4 Classification of grazing lands (arrows indicate increasing levels of emphasis).

orientation of the vegetation and its management, (3) arability of the land, (4) land capability and potential productivity, and (5) relative emphasis on cultural treatments. However, boundaries between the categories in the following presentation are artificially abrupt rather than being naturally gradual and transitional.

I. Long-term Grazing Lands

Long-term grazing lands (synonym, *range* or *rangeland pasture*) are mostly nonarable lands on which the present forage stand is projected for unlimited continuation. Ecological principles provide the management basis, but grazing manipulation and cultural treatment inputs may be used to manipulate the forage stand. Cultural treatments may be limited by low site potential and/or cost–benefit considerations but are not excluded. Grazing management levels may vary from extensive to intermediate, but fencing and stockwater developments are generally given high priority. These grazing lands, often environmentally severe, consist primarily of land capability classes[1] IV through VIII but not limited thereto (Fig. 1-5).

A. Native range consists of natural vegetation, predominantly grasses, grasslike plants, forbs, and shrubs; tree overstory may be present or absent. Climax vegetation or a high seral stage is often the objective of management. No substantive artificial reseeding has occurred in the past, and useful, introduced species are minimal. Maintenance treatments will be provided when urgently needed but are presently planned as minimal.

[1]Land capability classes I through IV are suited to cultivation, with I having few limitations and IV the most; classes V through VIII are not suited for cultivation, classes V through VII generally being suited to livestock grazing but VIII only to minimal wildlife use (Klingebiel and Montgomery, 1961).

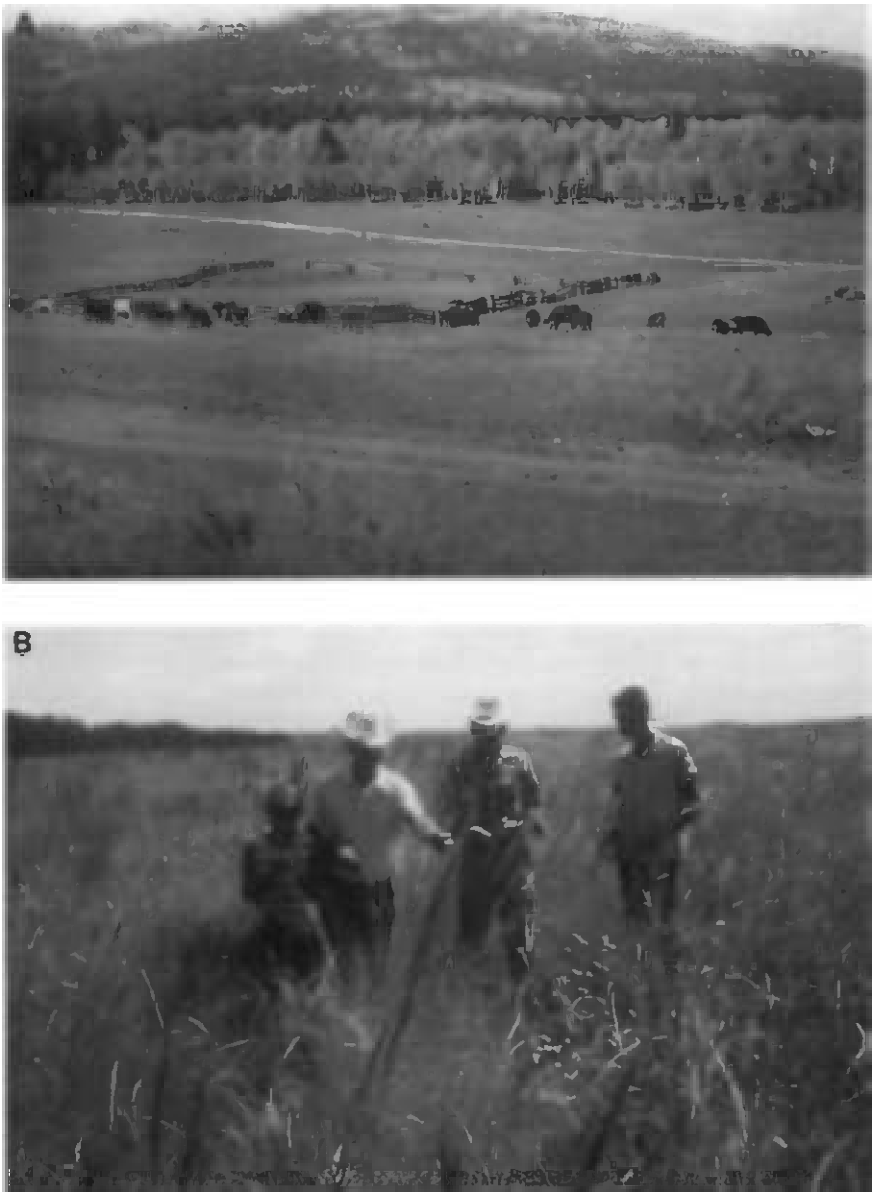


FIGURE 1-5 Examples of long-term grazing lands: (A) native range in the Uinta Mountains, Utah; (B) seeded range (native species) consisting of warm-season grasses in Nebraska.

B. Seeded range (native species) has been treated to enhance or re-establish the natural vegetation by reseeding local strains or seeding new cultivars of native species. Such grazing lands may include interseedings and/or marginal cropland or reclamation sites restored to long-term grazing. Minimal future cultural treatment is projected.