Working Draft

A CONCEPTUAL FRAMEWORK FROM WHICH A RANGE SECTOR IS DEVELOPED

by

Pradeep Sircar
and
Burton C. English

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Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011

The Center for Agricultural and Rural Development's Resources Conservation Act, 1980 model (CARD/RCA) did not include a range production sector. After reviewing the 1980 process and its limitations, it was decided that for some alternatives, especially those requiring conversion of lands to cropland, a range sector should be included in the model. This paper outlines some of the assumptions and components developed for a range sector model.

To study range resources in a systematic manner, it is necessary to develop a uniform framework of land base and range management levels. The basic conceptual framework and procedures used in this study were developed by a team of experts from the USDA's Forest Service. It is known as the Forest-Range Environmental Production Analytical System (FREPAS) (Kaiser et al, 1972). The development of range resource inventories and outputs is documented in Forest Service (1977).

Different sections of this paper are devoted to the definitions and rationale used in the development of the range model.

Land Base

The term "forest-range" covers all nonfederal land in the 48 contiguous states, that is in native and natural grasslands and forest lands, if at some stage of their natural succession, or if in response to management, they produce vegetation that is grazable by livestock.[1] Excluded are croplands, publicly owned commercial and noncommercial forest lands and woodlands leased for grazing, transportation system lands, improved pasture, and major waterways. The vegetative cover on

[1] Federal land could also be included in the model, if desired.

the nation's forest and range lands is diverse, due to a complex set of interactions, including climatic factors, topography and soil factors. The classification system for the forest-range land base used in this paper is based on vegetation. Closely related plant communities have been aggregated into a single ecosystem. Rangeland ecosystems are based on potential natural plant communities (PNC) termed "phytocoenoses" (Kuchler, 1964). Table 1 shows ecosystem classification and ecological groups by geographical regions of the contiguous United States. Detailed description of each ecosystem can be found in "Vegetation and Environmental Features of Forest and Range Ecosystems" (Garrison et al., 1977).

This potential natural plant community is the basis for land units. Thus, a PNC is the vegetation community that would exist if man were removed from the scene and plant succession were compressed into a single moment. It is a valuable parameter in the model because it reflects the biological potential of a relatively uniform environment.

Within each PNC delineation, the land areas have been further subdivided so that data could be analyzed on a production and condition basis. For the range ecosystems, productivity classes (PC) are expressed in terms of traditional concepts of herbage production. Condition class as (CC) are based on vegetation cover, composition, and vigor, as well as soil factors. For the forest ecosystems, productivity and condition classes are defined in terms of volume of wood produced and timber stand size class. Categories for estimating the productivity of an acre of forest-range ecosystems and for reporting conditions are shown in Table 2.

Table 1. Ecosystem groups and ecosystems by name

Name	Name
Western Forest	**Great Plains**
Douglas fir	Shinnery
Ponderosa pine	Texas savana
Western white pine	Plains grasslands
Fir-spruce	Prairie
Hemlock-Sitka spruce	
Larch	**Eastern Forest**
Lodgepole pine	
Redwood	White-red-jack pine
Hardwoods	Spruce-fir
	Longleaf-slash pine
Western Range	Loblolly-shortleaf pine
	Oak-pine
Sagebrush	Oak-hickory
Desert shrubs	Oak-gum-cypress
Southwestern shrubsteppe	Elm-ash-cottonwood
Chaparral - mountain shrub	Maple-beech-birch
Pinyon - juniper	Aspen-birch
Mountain grasslands	Wet grasslands
Mountain meadows	
Desert grasslands	
Annual grasslands	
Alpine	

Table 2. Productivity and condition classes of forest-range ecosystems

Forest ecosystems	Range ecosystems
Productivity	
Wood	Herbage
Cubic feet per acre per year	
120+	First quartile (high)
85 to 119	Second quartile (moderately high)
50 to 84	Third quartile (moderately low)
0 to 49	Fourth quartile (low)
Condition	
Timber	Range
Nonstocked	Good
Seedling, sapling and pole	Fair
Saw timber	Poor

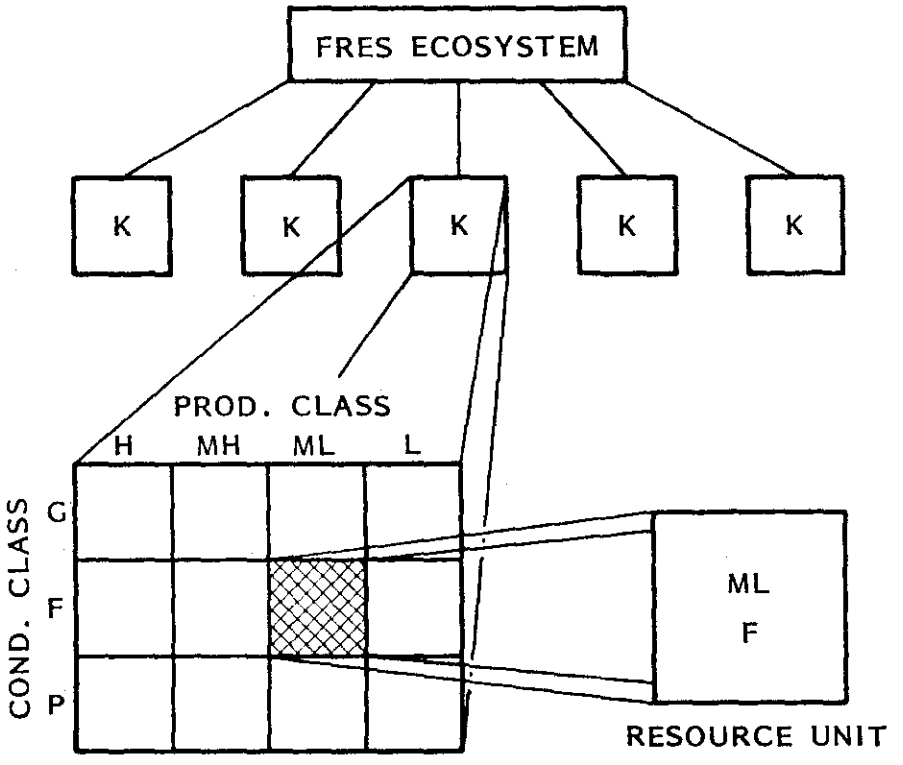
Acreages are finally compiled by "resource units" (Figure 1). A resource unit identifies the acres of a particular ownership by productivity class (PC), condition class (CC), ecosystems, and region. Thus, the land inventory provides important dual properties: analysis could be accomplished on an ecological basis; and it could be transformed to meaningful geographic units for evaluation and presentation. Complete expansion of the land classification yields 3,852 resource units but not all combinations exist. Data have been collected for 2,000 resource units.

Range Management Levels

A management level is a feasible action or combination of actions a decision-maker may elect to implement. A management level is a concept and is independent of location. When implemented in a given location on an individual resource unit, a set of appropriate practices to meet the level of management is specified and resource output predicted. Implied in the set of management levels defined for range, are production goals as implemented through appropriate practices applied to the ground.

Range practices used to develop management strategies

Practices are specified treatments of range lands or mechanical structures necessary to achieve a particular management objective or level. Practices are defined and costs determined for each practice in each potential natural vegetation community (PNC) by resource unit (RU). For range management, 17 practices have been defined. Definitions and background rationale are presented in this paper.



K = Ecosystem
H = High, MH = Moderately High, ML = Moderately Low, L = Low
G = Good, F = Fair, P = Poor

Figure 1. Disaggregation of ecosystems into resource units

Definitions

1. Fertilization - Application of nutrients or any type of soil additive by any means to improve soil productivity for grazing purposes.

2. Irrigation - Includes installation of systems and structures to supply water to moisture deficient areas.

3. Water control - This practice centers around draining or regulating the water table. Bog or marsh drainage to improve forage (AUM) production and accessibility to livestock.

4. Mechanical vegetation manipulation (low cost) - This practice includes low cost woody or herbaceous vegetation control or manipulation such as bush hogging, mowing, light disking or other low cost mechanical activities.

5. Mechanical vegetation manipulation (high cost) - This practice uses heavy machinery to control or manipulate woody vegetation such as dozing, chaining, plowing, and shearing.

6. Vegetation manipulation (chemical) - Includes practices where herbicides are used as the primary agent for control of undesired brush species. Noxious farm weed control is included where needed for forage enhancement or to complement other range practices. Application can be by aerial or surface techniques and in liquid or granular form.

7. Vegetation manipulation (biological) - Biological measures pertain to the use of insect, fungi, virus, etc., in the control of unwanted brush species.

8. Vegetation manipulation (fire) - Includes use of prescribed burning for the purpose of destroying rough herbaceous residue, improve nutrient content and increase forage production.

9. Debris disposal - Includes disposal of debris resulting from some other treatment to increase forage yield, to make forage accessible to livestock, and to provide access for additional range treatment.

10. Mechanical soil treatment - This is the physical disturbance of the soil through practices such as chiseling, pitting, contour furrowing, or other mechanical methods. These methods are designed to accomplish a variety of objectives such as preparing a seed bed, increasing water inflitration, controlling erosion, or the improving micro-climate.

11. Seeding - includes all seeding that is performed in conjunction with other treatments. Seeding methods include drilling, broadcasting, and/or other techniques.

12. Rodent control - This practice is used to reduce rodent population density in order to improve range productivity. This technique is applied along with seeding.

13. Insect and disease control - This practice is used to control insect infestation and disease detrimental to forage and range resources. All treatment methods are included in this category.

14. Small water developments - Includes small dams, pits, minor spring development, shallow wells, and small water "catchments" which would make a single stock watering site.

15. Large water development - Includes deep wells, trick tanks, spring developments, large dams, seeps, ditches having water storage and distribution systems.

16. Fences - Includes reduction of tree canopy to provide space for remaining healthy trees. Only that portion of thinning that exceeds the requirements for tree production and is performed to increase forage production is considered a range practice. Only those costs in excess of tree production requirements are included.

Management Strategies

From the almost infinite number of management alternatives, five management strategies are defined. Intensities vary from no livestock to maximum livestock production.

Strategy A--Environmental management without livestock[1]

Livestock is excluded by fencing, riding, public education, and by incentive payments. The environment is preserved from natural or other man-caused disasters. Resource damage is corrected to maintain a stewardship base. The total cost of applying this strategy is borne by other functions (for example, watershed, recreation, timber management).

Strategy B--Environmental management with livestock

Livestock is permitted at present capacity of the range environment. Investments for range management are minimal and only to the extent required to maintain the environment at a stewardship level in the presence of grazing. Costs of correcting resource damage resulting from past abuse are charged to other functions. Resources are protected from natural catastrophies.

[1]Management Strategy A is not considered because it does not include livestock production.

Strategy C--Extensive management of environment and livestock

The goal is to maintain full plant vigor and to achieve full utilization of grazable forage. Techniques such as fencing and water developments are applied as needed to obtain improved grazing systems and range conditions. Relatively uniform livestock distribution and plant use are considered. No attempt is made to maximize forage production by cultural practices such as seeding and fertilization.

Strategy D--Intensive management of range environment and livestock

All available technology and practices for range and livestock management are considered and used as they may be cost efficient to improve livestock production, quality, and utilization. Production of forage is maximized subject to the constraints of multiple use of range resources and maintaining the environment. Existing vegetation may be replaced with improved forage species. Better growing conditions and structural modifications can be made to accommodate complex livestock management and practices. Advanced livestock management practices are commonplace.

Strategy E--Environmental management and livestock production maximized

The goal is to maximize production of livestock while maintaining soil and water resources. Improved forage species may be introduced. This level requires large investments for construction and implementation of improvements, cultural practices, and animal husbandry; but all practices used must be cost efficient. Multiple range-resource use is not a constraint.