

# Computer Optimization Planning—Allocation of Ranch Resources to Meet Livestock Requirements and Integrated Ranch Information Needs

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## Introduction

The purpose of this presentation is to discuss some recent developments in automating the analytical process and improving the decision making process in ranch operations. In this paper I will discuss some aspects of the computer based analytical model "COPLAN," describe how it is applied specifically to cow-calf operations and conclude with a discussion about how several computer programs including "COPLAN" can be used in an integrated ranch information system for the cow-calf operation.

Ranch management planning has normally been accomplished through traditional planning procedures. First the planning problem is identified, then the available resources are inventorized. Second, the resources are evaluated in relation to the present operation. Third, alternative management strategies are developed depending on the goals of the manager. Fourth, the strategies are compared and the most acceptable management strategy is finally selected. Fifth and finally, the selected strategy is implemented.

The procedures for accomplishing this are well known. It should not be necessary to discuss them here. It should be noted, however, that the entire process is normally accomplished manually without aid of automated data files or computerized analytical tools.

Computer Optimization Planning model (COPLAN) was developed to be an integral part of this planning process. Alternative management strategies can be derived for balancing dry matter and protein requirements of each kind

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*Syposium paper presented at the 12th Annual Convention, American Association of Bovine Practitioners, San Antonio, Tx., November 30, 1979.*

*This paper represents solely the author's views and is not intended to represent those of the Science & Education Administration, USDA.*

and class of livestock with the seasonal availability of feeds and forages. These strategies will provide a basis for management decisions by the rancher.

There are many farm management planning systems available, however, COPLAN is the only rangeland/pasture-livestock requirement analysis system available that attempts to deal with some of the economic and dynamic problems of a ranch operation through an entire 12 months period. COPLAN, therefore, fills a void in the kinds of resource planning tools available to the ranching industry.

## COPLAN

COPLAN is a framework for organizing the rancher's knowledge and other basic information about feeds, forage and livestock and costs to analyze various alternative management strategies. Because it is a "logical" framework, the basic model can be used throughout the country.

There are four basic components to COPLAN. These are:

- a set of data entry forms,
- a mechanism called a "matrix generator" for building the data into the proper mathematical arrangement,
- a method for mathematically arriving at a strategy for allocating the least cost forage and feed production alternatives to meet the nutritional requirements of the livestock,
- a report writer for printing on a computer terminal printer the least cost management strategy.

**Because of the logic behind the COPLAN framework, the planner and rancher have absolute control over every numerical value that enters into the analysis. However, this means that considerable information must be available or developed from knowledge and experience for use in the model.**

Data requirements for COPLAN can best be described by reviewing major data input from requirements.

- Extent of the resource base is described by the acreage in

each management unit (pasture, field, etc.).

- Management seasons for the year based on physiological functions of the animals and phenologic stages of the feed and forage are developed to define the dynamics of forage production and animal requirements in the annual ranch management cycle.
- Available dry matter and protein content of range and pasture forage as well as supplemental feeds, by season, for all management treatment alternatives to be considered within each management unit and associated management costs are developed and input.
- Alternative sources of protein supplement and purchase or production costs are input.
- Dry matter and protein requirements for each kind and class of animal on the ranch, by management season are also part of the input data.
- Expected calving and weaning percentages, death losses and management costs for each class of brood stock and sires are input.
- Expected market prices for offspring, e.g., calves or yearlings, for each seasonal size category must be estimated and input.
- Expected market price for any feed or forage considered for sale from the ranch must be input.

When all data has been completed and coded on the proper data input forms, it is entered into a computer through a portable computer terminal. This means that the planner could input the data directly from the rancher's office or kitchen table via the telephone. At the present time, however, most of the data entry work is done from the office of the planner. For example, the Soil Conservation Service has ready access to COPLAN through the USDA Computer Center at Fort Collins, Colorado. Normally, the planner will enter the data set and verify the information away from the ranch. Ranchers are too busy to wait around for 2 hours while the data is cleaned up and verified.

On a subsequent visit, the existing ranch operation is output and validated with the rancher and an initial set of management strategies are developed. From that point on, depending on the complexity of the operation, the interaction involving the rancher will become very intense as various alternative management strategies are developed.

COPLAN only derives strategies, it does not create entire management plans. The model does not derive an ultimate plan for each rancher, because there are too many uncontrollable variables. The strategies however, allow the rancher to perceive flexibility in the management plan as decisions are being made about long and short term management actions of the ranch.

The potential for providing many management strategies to an individual rancher is constrained only by the size of the data set and the complexity of the questions asked. The first group of questions encountered by the planner revolve around market price changes or changes in purchased feed costs. If the price of calves or yearlings drops \$.10 per pound what does that do to a management strategy? Following the

rather predictable economic questions, are questions related to the kinds of management alternatives that can be applied and what are the resultant strategies.

Some examples could be related to the management of brush. If 60 percent of the acreage of brush is removed in 2 grazing units and the expected per acre increase in forage is approximately 70 percent more than currently is available, how does this effect the overall forage balance for the entire ranch? More important is the question regarding cost. As brush management gets more and more expensive, what are the tradeoffs to controlling smaller patches of dense brush and leaving the more extensive areas of low density brush within a pasture. The prorated impact on increased available forage can be quickly computed. There were several areas in south central Texas for example, where the total suppression of brush was not an optimal strategy, yet by selectively managing the most dense area in each pasture, an optimal strategy was derived that indicated an increased return to variable costs.

It is important to reiterate that COPLAN evaluates all proposed alternatives for every management unit on the entire ranch, all at the same time. The strategy derived in any particular analysis or computer run is based on a "least cost" optimization. Quite often, a proposed management alternative for one or more range land units would result in an abundance of summer forage with tremendous potential for increasing the herd size. However, if the increased costs of providing additional supplemental feeds and winter forage cause a reduced net return to variable costs, then perhaps the alternatives are not so ideal. It is only when a computer based program such a COPLAN can be brought into an analysis that the entire ranch can be evaluated as an integral unit.

**The veterinary practitioner can also benefit from the use of this kind of model when attempting to show the effects of preventive herd health programs, pregnancy testing, vaccination programs and herd breeding testing programs. Changes resulting from increasing live birth percentages or improving weaning percentages can be demonstrated. One of the most striking examples of how COPLAN can illustrate the effect of both herd health management and forage resource management is through strategies where herd sizes are reduced and the quality of the forage improved, resulting in more marketed beef per animal unit and a higher net return to variable costs.**

Not every rancher is able to fully utilize the capabilities of COPLAN, however. Experience has shown that a small proportion of ranchers have a better analytical model in their mind than COPLAN can provide. Conversely, there is a group of ranchers that misunderstand and often mistrust the analytical capability a computer can provide. Within these two groups, however, are ranchers that are willing and interested in using the analytical assistance of the computer as they make long and short term management decisions.

As with any new methodology, there are also spinoff effects from the use of COPLAN. Most of the effects are

positive. One key effect of using the logical framework of COPLAN for developing the ranch data is an improved perspective of the animal requirement-forage production relationship. The data requires the rancher and planner to develop quantitative values about what the cow, calf, heifer, and bull need, season by season, through the year. Data about quality and quantity of available forage in each of those management seasons must also be developed. When completed, seasonal fluctuations in weight of brood stock relative to dry matter and protein requirements are clearly illustrated, along with the fluctuations in available dry matter and protein quality of the forage sources.

Resource planners who have used the COPLAN methodology for a period of time, then stop using it, find that their approach to planning is significantly changed due to the influence of the logical, analytical framework, of the model.

One additional characteristic resulting from planners and ranchers interacting with computer based analytical tools like COPLAN is the identification of knowledge gaps and research needs. Experience in the application of COPLAN throughout the U.S. has indicated that much more information is needed regarding nutritional quality of the major native grasses, season by season, throughout the entire year. Additional information is also needed about native protein sources for grazing range animals during periods of the year when dormant range forage is not thought to be of high quality.

#### **Integrated Ranch Management Information System**

As previously discussed, COPLAN is one of many models available to the ranch operator. Currently these models must be accessed through several different vendors or Universities often at considerable expense or delay. There is a definite need for a computer based system that can integrate several kinds of management models in an "integrated ranch management information system."

Resource management models, such as COPLAN, can and should be integrated into ranch management systems packages, along with other information and management models. For example, on-line market information now exists through systems like Cattle-Fax. Ranch accounting systems are also available that have simple information input and produce highly sophisticated accounting records. Programs also exist for maintaining annual inventories of capitalized equipment, etc.

**Additional computer programs are also being developed that will be highly valuable to the rancher. Some of these models will include probabilistic agricultural weather, forage growth and physiology. Record keeping programs for herd management, breeding and pasture maintenance**

**are also being developed.**

Integrated ranch management systems have the potential for providing an entire array of readily available information to the rancher. It is important to note that this is not something very futuristic. Ninety percent of the components, such as COPLAN are in existence today. All that is needed is the developed market potential to encourage nationwide computer system companies to develop and make an integrated system available to ranchers.

What would the rancher's investment be? A \$3,000.00 portable terminal is all that is required. Major data input can be done by mail to a central point. Minor updating, however, and queries can be done as quickly as it takes to make a long distance phone call. The only other costs would be subscription and computer service costs.

#### **Summary**

**The cow-calf industry, today, is among the most complex of corporate business operations. The unknown and undefined variables that continually impact the rancher are many. Through the use of computer based resource management tools, attempts are being made to provide an improved method for aiding the ranch decision maker.**

Herd health management likewise involves much more than treating the sick animal. It involves the integration of resource management, livestock management, preventive medicine, in addition to diagnosis and treatment of sick and injured animals. It also involves the integrated efforts of a team of professionals in the agricultural livestock sector with the livestock producer, his manager and employees. Each professional is working toward the same goal, maintenance of a healthy, viable, highly productive resource whether that resource is the land base with its renewable assets or the livestock base with its renewable assets. Active involvement of the veterinary practitioner with Extension Service, Soil Conservation Service and Federal land management specialists can provide a highly effective team to the rancher. It is through the use of computerized analytical mechanisms such as COPLAN that the improvements in herd health management can be brought to the forefront.

COPLAN has been presented as a one-of-kind model for use in the resource management process. It does not represent a radical departure from what is currently being done in planning and decision making on ranches. However, the way in which the data is developed and analyzed does require a more intense interaction between rancher and planner.

**COPLAN is only one of a large number of existing computer models that have the potential to be developed into an integral ranch management information system.**

*Editor's note: for a discussion of Dr. Evans's paper, please refer to the Proceedings, 12th Annual Convention, American Association of Bovine Practitioners. p. 146-150.*





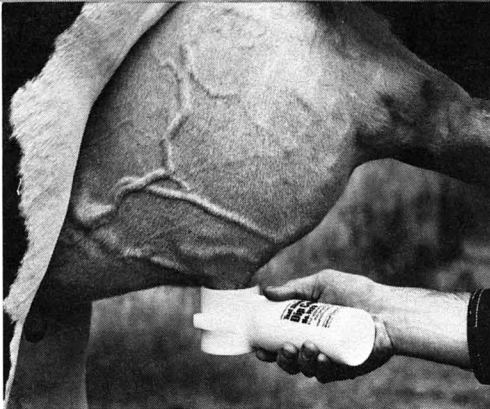
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