RANGE & WILDLIFE HABITAT APPLICATIONS (PARALLEL SESSION)

A REMOTE SENSING APPLICATIONS FOR RANGE MANAGEMENT

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Background

Ten years ago, there was a lot of speculation as to what the prospects were for the Earth Resources Technology satellite, scheduled for launch in 1972. A few of us in range science, were excited about the possibility of using this new information source for inventorying and monitoring the earth's most extensive renewable natural resource-rangeland.

Some of us had worked with large scale colored infrared aerial photos. We had seen the U2, Apollo and Gemini photographs, but our imagination was not good enough to dream of the prospect of seeing rangeland over the entire world.

During the past decade, there has been a lot of studies on the use of remote sensing for the management of rangeland. What is the status of this technology now? Where are we today? I am going to explore some of the possibilities and indicate where I think we are.

Before doing that, however, what are some of the things that range people do that make remote sensing important to them? The Range Manager or Rancher needs to know how much and what kind of vegetation is available. Additionally, the rancher has to determine this by eyeballing the pastures as he rides through them. Ranch conservation is a guess too. But he usually validates his estimates with some flipflops. It is usually only the researcher or technician doing a formal inventory that sets up an elaborate sampling scheme to determine in a verifiable way, what kinds and amounts of vegetation are growing on the range.

We say that good range management is based on sound ecological principles. Ecologically, the Manager wants to follow the condition and trims of the resource he is managing. Over the past 40 years, many methods for measuring range condition have emerged. They have one common characteristic - to acquire information over time requires that someone visit these sites repeatedly. Since rangelands are those lands that are too dry, too rocky, too shallow or too steep to support cultivated agriculture, range production levels dictate that rangelands are managed with

minimum capital output. However, that should not minimize their importance. We have nearly a billion acres of rangelands in the US alone. They are a primary source of red meat, they support most of our wildlife herds, and they are a source of water and their vegetation literally holds this old world of ours together.

Thus, it is crucial that these multiple-use lands are managed carefully, and for maximum sustained use. It is obvious that remote sensing can play an important role in improving the management of rangelands and consequently in maintaining their vitality.

I want to concentrate on the use of satellite information for range management today. I want to recognize the increased use of color and infrared photographs. For the most part, it is being used as a sampling mode to reduce the cost of acquisition. It can be useful in monitoring range condition in trim as well as in multiple stage sampling approaches. However, trained personnel are needed to handle the interpretation procedures.

When I was at Texas A&M, we set up a low budget procedure for the University of Texas Lands Department. We used 35 millimeter photography for taking 1:6000 scale over test sites within their leases. The procedures proved to be adequate, but they are not being employed. Why? One reason is, they just do not have the staff to do the amount of photoacquisition and interpretation that would be required to implement the procedures for some of the 130 leases covering more than 2.1 million acres. Most land management agencies, including large ranches, do not like to think about setting up new procedures. Actually, they are seeking a source of information, not procedures for collecting more data. I think this has been a problem with the implementation of Landsat data in the range management process.

Many reports document the usefulness of manual interpretative Landsat imagery for rangeland applications. Generally, they indicate that broad soil vegetation landscapes can be mapped about as well manually as they can through computer processing. We used a hierarchal classification scheme to map land use and cover types over a 250 km area, covered primarily by rangeland. Accuracy assessment indicated 81% correct classification for the 18 vegetation types involved. Similar results were reported for a 21 class vegetation map of a district in Northwestern Arizona.

Classification at this level, whether by manual interpretation or by digital analysis, appears to be necessary if any attempt is to be made

to use MSS digital data for quantitative assessment of vegetation conditions. Studies indicate that Landsat MSS-derived green vegetation indexes accurately measure the amounts of green-standing crops. We found these MSS data products to be sensitive to seasonal changes in vegetation and growth conditions. They provided the measurements taken within a uniform vegetation soil system. Other Researchers found it necessary to sample within the vegetation classes to accurately determine standing crop biomass in the California desert conservation area.

Another approach to the use of Landsat MSS data for range management is change detection. We are looking into the possibility of using greenness change within a growing season for monitoring the dynamics of vegetation production.

Probably the most important concept to emerge from the digital analysis of Landsat data is the use of Landsat as a sampling frame for renewable natural resource inventories. Two researchers reported the concept as applied in the Arizona Vegetation Resource Inventory Project at the Arid Lands Conference in LaPaz, Mexico. The project area was located in Northwestern Arizona and encompassed approximately 2.5 million acres. Vegetation of the area ranged from Mojave Desert shrub to coniferous forest. Landsat MSS data and digital terrain data, were used to develop the classification and a data base for the project area. All of the pixels falling within the area were classified, using both control clustering and unsupervised clustering techniques to derive 76 spectrally separate classes. After the computer process had been aggregated to represent some 9 cover classes, post-classification refinement utilized digital terrain data to improve the classification accuracy. By using terrain data, overall accuracy was increased from 54% - 73%. In addition to a vegetation map of the surveyed area, tabular information was produced describing the vegetation and terrain conditions for each type.

These data are on a geo-based reference base, and they can be analyzed quickly to produce information for the planning process, including one identifying zones for specific management activities, two, for discovering areas where conflicts and management practices may occur and three, where management action may complement one another.

The entire project cost 16 cents an acre. Costs associated with accomplishing the detailed mapping in the project were about 7 cents per acre, including the establishment of the digital data base. The cost of producing application overlays was only about six cents per one hundred acres. We are currently working with the BLM in implementing this technology in their soil and inventory vegetation method. We believe that Landsat vegetation information, when merged with soils and digital terrain data, will define their basic sampling unit.

As an added benefit, the resource unit will add a data base that can be easily manipulated to produce information and maps for planning many aspects of their management program.

Summary

In summary, I think we have really determined over the past 10 years, as to how best to use remote sensing in the field of ranch management. We are not necessarily at a point where we can relax. We do, however, have some approaches that appear to be cost effective, statistically verifiable, and useful for more than mapping vegetation only. The geo-based data files derived from using Landsat data as a sampling framework will provide a readily accessible information source for many range related activities.