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DEVELOPMENT, USE, AND BENEFITS OF THE ANIMAL DAMAGE CONTROL MANAGEMENT INFORMATION SYSTEM

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ABSTRACT: The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC) Management Information System (MIS) is in the process of being updated to a relational database format on an IBM-compatible microcomputer. The background of the MIS, the development process, the information that is collected, how the information is used by program managers, and the cost benefits of the automated system are addressed.

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BACKGROUND

Animal Damage Control is responsible for protecting American agriculture from wildlife damage by managing wildlife animal conflicts with agriculture, industry, natural resources, public health and safety, and other activities of man. ADC protects livestock, field crops, and aquaculture from depredation by predatory animals, birds, and field rodents.

In 1978 the United States Department of Interior (USDI), Office of Audit and Investigation (OAI), conducted a review of the Animal Damage Control (ADC) program. The conclusion reached by the review team was that the information on operational activities was inadequate to effectively monitor the program.

In response to the OAI review, ADC formed a task team to develop a Management Information System (MIS) plan. Their recommendations and functional data requirements were published in A Conceptual Plan for the Animal Damage Control Management Information System, May 1, 1979 (Packham et al. 1979).

In September 1980, Integral BioMedical Engineering, Inc., of Sacramento, California, was contracted by the United States Fish and Wildlife Service (USFWS) to design, develop software, and provide technical support for an automated MIS (American Management Systems, Inc. 1985). The hardware centered around a Hewlett-Packard (HP) 9845T desk top computer. The menu-driven system was custom programmed in HP extended BASIC. Each state was to have a separate, though standardized system. Initially, only California participated in the automated system. In 1981, Texas and Utah were added, and in 1983 the system was expanded to include New Mexico, Oklahoma, and Arizona.

Before expansion into other states could be implemented, the ADC program underwent a major change. In December 1985, it was transferred from USDI, FWS, to the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS). By October 1986, the contract for outside assistance in the development and maintenance of the system ended; maintenance and development became in-house functions.

The transition from the Department of Interior to the Department of Agriculture, coupled with major advances in computer technology, dictated a need to revise the 1979 conceptual plan. A new task team was appointed. Their recommendations were put forth in A Conceptual Plan for the Animal Damage Control Management Information System, July 31, 1987 (Larson et al. 1987).

Following the guidelines of the 1987 Conceptual Plan, the MIS is being updated and enhanced. The basic foundation of the original system has been maintained, while the database schema has been redesigned using relational database theory. The new system continues to be menu-driven with the added flexibility of ad hoc queries.

The ORACLE relational database package running on an IBM-compatible micro computer is the main stem of the new system. Customized error-checking routines are being written in the C programming language. Information is filled out by field personnel and sent to the state office for processing. The bulk of the data is scanned into the system using optical mark readers. The remaining information is input via the keyboard. The database is stored on 20-megabyte removable cartridge disks (RCDs). Output reports may be sent to the computer screen, a disk file, or the printer.

Eight states have been earmarked as pilot states. These include New Hampshire and Louisiana, in addition to the six states using the prototype system. For the pilot states, the new system will be implemented in three phases. The three-phase implementation, which began in January 1990, will cover a 1-year period. In 1991, nationwide implementation will begin. When fully implemented nationwide, information will be collected in all 50 states. Collected information will be processed in 1 of 27 sites.

DEVELOPMENT

The development of the MIS, from its inception to the present, has been evolutionary. A working group, made up of ADC managers from the national, regional, and state levels, has provided the driving force. As the working group has identified MIS requirements, the technical staff has developed the software. The MIS development, as guided by the working group, functions in a changing environment. Outside factors markedly influence the decisions on system configuration and data requirements (Fig. 1).

Advances in computer hardware and software are ongoing. These advances impact the decisions on the hardware configuration, database schema, data input modes, and the operator interface.

Political and social attitudes affect the information requirements placed on ADC managers. Requests for program information come from special interest groups, the

media, national, state and local governments, and outside organizations. The nature of these requests impact the data requirements placed on the MIS.

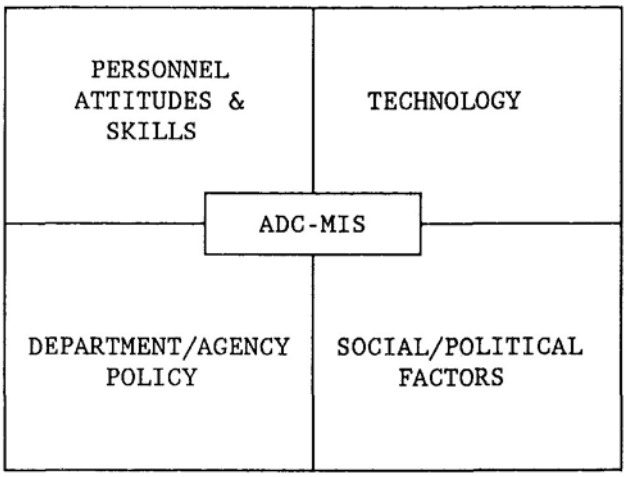

Figure 1. Factors which influence the development of the Animal Damage Control Management Information System.

Department and Agency budget constraints and procurement restrictions limit the program's flexibility. Directives are in place which set hardware and software standards and dictate how some day-to-day business transactions are handled. The MIS must operate within these guidelines.

The skills and attitudes of the work force are integral in determining the way information is collected, processed, and retrieved. As personnel become more comfortable with computer technology, begin using the management applications of the MIS, and become more skilled in retrieving data, the demands placed on the MIS will increase.

The evolutionary development approach, feedback and input from different levels of the ADC program, and the diversity of the working group have laid the framework for a well-integrated MIS which can handle the diverse data requirements of the ADC program. It will continue to evolve and be enhanced in response to the demand for new data requirements and decision support tools by ADC managers.

INFORMATION

The MIS does not provide all of the information needs of the ADC program. It is a tracking system for operational and technical assistance activities of the program.

The four data requirements identified by the 1979 and 1987 Conceptual Plans are: resource inventory data, damage and loss data, control effort data, and trend analysis data. Information on property, resources, equipment and control methods, personnel effort, and time are combined to meet the first three data requirements. Data analysis and trend analysis are a by-product of the system. Summary data for this purpose can easily be extracted from the system by making use of the relational database schema.

The core of the MIS is real property (Fig. 2). All operational work is tracked by property. Many of the output reports may be rolled up by property to provide summary data on land class, counties, state, and special groups.

Before any work is done in the field, an Agreement for Control of Animals must be completed. Using the Agreement for Control, a unique five-digit number is assigned to the property. Also identified are the ADC specialist authorized to work on the property, the acreage, the target species, the control methods which will be used, the date the agreement becomes effective, and the county, state, and land class of the property.

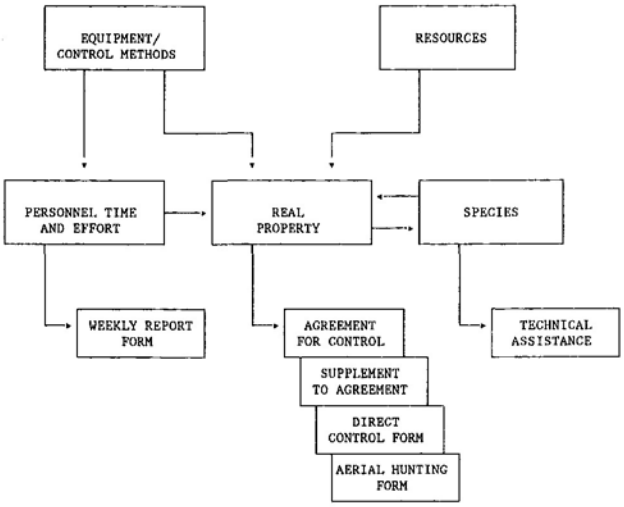

Figure 2. Key entity and data input relationships of the ADC-MIS.

A Supplement to the Agreement is compiled annually for each property. The supplement provides a monthly inventory of the resources protected. It also provides information on the amount of a resource lost to all causes over the given time period, the loss to depredating species, and the dollar value of the loss.

Once a property has been assigned a five-digit agreement number and entered into the system, information on control efforts conducted on the property can then be recorded. Each time an ADC Specialist works on the property, the time spent is recorded along with information on verified damage, species taken, methods used, and equipment and/or chemicals placed on the property.

Technical assistance information is recorded, as well as direct control work. Primarily, technical assistance data is tracked by species and type of assistance provided rather than the specific property. However, before the information is accepted by the system, a five-digit agreement number is necessary.

Each ADC Specialist prepares a Weekly Report Form. It is used to record information on his or her starting and ending times each work day, vehicle use, per diem rates, equipment assigned, and fur salvage. Since these are administrative data, they are not tied to a particular property.

Besides the five-digit code used to identify a property, codes are used throughout the system to identify such information as personnel, aircraft, damage types, counties, land classes, methods, species, equipment inventory, units of measure, and tasks performed by personnel. Reference files, which correlate labels with the codes, are used for output reports to enhance clarity.

USE BY PROGRAM MANAGERS

The primary focus of the MIS is to provide ADC managers with information on program effort, costs, and effectiveness. For this reason, it is essential that the data be standardized.

Information generated by the MIS serves a variety of managerial needs. The generated reports are the basis for a historical account of ADC's wildlife control efforts. The output reports provide records on the resources protected, the effort expended in protecting the resource (documenting personnel time and methods used), the damage incurred to the resources, and the species responsible for the damage. These reports serve as a key to ADC's response to inquiries from Congress, state and local governments, organizations, and interested citizens.

Analysis of the data can be done to study impacts of national and local ADC management practices. This can help program managers more quickly identify strengths and weaknesses in the program and respond to changing environmental conditions.

Special reports can be prepared by sending MIS output to data files. These files can then be used directly with other software packages. The files can be imported into word processors, narrative added, and special reports developed. Using modems and communication packages, the data files can be transmitted over the telephone lines for other users. The files can be used with graphical packages to prepare slides, overhead transparencies, and graphs for presentations and publications.

By producing more accurate, professional looking, and timely reports, the credibility of the Animal Damage Control program is enhanced. It lends credibility to cooperative efforts and provides impetus for funding and future work.

COST BENEFITS

Presently, when ADC managers want unique and specific information, they must task their staffs with gathering the information, making the computations, and presenting the requested information. This is a rather long and costly process which is not responsive to the managers needs. Hence, they normally only request specific and unique information when situations, cooperators, or higher officials demand it. To gather such information is too costly and time consuming for it to be used in routine decision-making.

Interviews with key managers at the regional and state level have been conducted. All personnel interviewed had direct access to one of the prototype systems at some time in their career. They identified three cost benefits apparent from their use of the prototype system:

1. Cooperators are willing to pay more when more current, useful and detailed information generated from the MIS is available and provided. Based on past experience, it is estimated that the MIS would generate annually up to $2.3 million of cooperator monies.
2. The MIS collects, retrieves, and makes available considerably more information than is possible with a manual system. This is information that the ADC managers say they have to have at their disposal. Manually collecting and retrieving data is a very labor-intensive effort. It is estimated that $1.5 million could be saved each year in collecting and retrieving ADC information presently gathered without the benefit of the MIS.
3. The MIS provides additional desirable information. As new demands are placed on the program, the ability to have these data readily available is becoming more important. If this information has to be collected manually, it could cost up to $3 million per year.

These three areas alone indicate as much as a $6.8 million a year benefit of the MIS. The MIS only has a stated system life of 10 years. Thus, over the life of the MIS, $68 million in benefits could be realized. If the system life is extended 2 to 5 years beyond that, another $22 million ($6.8 million x 3.5 years) in benefits is possible.

The Animal Damage Control Management Information System is a valuable tool. Output reports generated by the prototype system have enhanced the credibility of the program with advisory groups, members of Congress, and officials of other governmental agencies. The newly redesigned system will go even further and provide more decision support tools. Under the guidance of end users, both management and field personnel, it will continue to evolve to meet the ever-changing needs of ADC managers.

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