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INFORMATION REQUIREMENTS FOR EVALUATION AND MANAGEMENT OF LAND RESOURCES

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For resources to be managed wisely, there must be accurate and timely information. Land, with all its various features (soils, vegetation, geology, topography, and surface and subsurface water) constitutes the resource base for both agriculture and forestry.

The Soil and Water Resources Conservation Act of 1977 (RCA) -- Public Law 95-192 -- directed the Secretary of Agriculture of the United States to promote the attainment of the policies and purposes expressed in RCA by:

(1) appraising on a continuing basis the soil, water, and related resources of the Nation,

(2)developing and updating periodically a program -- based on the current soil, water, and related resources appraisal, and

(3) providing to Congress and the public, through reports, the information developed.

This 1977 authority, coupled with the assessment of Forest and Rangeland situations in the U.S., required by the Resource Planning Act (RPA) pertaining to the U.S. Forest Service work provided without doubt, expanded responsibility within USDA to acquire and evaluate natural resource information for decisions for the management of land resources.

The RCA, for example, that I helped draft for Congress, in the Appraisal section (5) of the Act stated:

> In recognition of the importance and need for obtaining and maintaining information on the current status of soil, water, and related resources, the Secretary is authorized and directed to carry out a continuing appraisal of soil, water, and related resources of the Nation. The appraisal shall include, but not be limited to --
>
> (1) data on the quality of soil, water, and related resources, including fish and wildlife habitats;
>
> (2) data on the capabilities and limitations of those resources for meeting current and projected demands on the resource base;
>
> (3) data on the changes that have occurred in the status and condition of those resources resulting from various past uses including the impact of farming technologies techniques, and practices;
>
> (4) data on current Federal and State laws, policies, programs, rights, regulations, ownership, and their trends and other considerations relating to the use, development, and conservation of soil, water, and related resources
>
> (5) data on the costs and benefits of alternative soil and water conservation practices; and
>
> (6) data on alternative irrigation techniques regarding their costs, benefits, and impact on soil and water conservation, crop production, and environmental factors.
>
> The appraisal shall utilize data collected under this act and pertinent data and information collected by the Department of Agriculture and other Federal, State, and local agencies and organizations. The Secretary shall establish an integrated system capable of using combinations of resource data to determine the quality and capabilities for alternative uses of the resource base and to identify areas of local, State, and National concerns and related roles pertaining to soil and water conservation, resource use and development, and environmental improvement.
>
> The appraisal shall be made in cooperation with conservation districts, State soil and water conservation agencies, and other appropriate citizen groups and local and State

agencies under such procedures as the Secretary may prescribe to insure public participation.

I. WHAT DO WE KNOW ABOUT THE LAND?

Figures for this paper are derived primarily from analysis of the 1977 National Resource Inventory (NRI). More current data would have been used, but the 1982 NRI will not be released until late in 1983. Because of progressive refinements in the reliability of land resource survey methods since prior inventories, experts anticipate the 1982 NRI will be the soundest data base ever compiled on the Nation's agricultural resources.

The Soil Conservation Service instructions (Rev. May, 1980) for carrying out the NRI, 1981-1982, required 38 single spaced pages. The Primary Sample Unit and Point Data Worksheet (Rev. Dec., 1980) issued by the Iowa State University was seven pages. They are available for perusal at SCS offices throughout the Nation. Preliminary indications from USDA officials indicate that the data from the 1982 NRI are generally consistent with the 1977 survey and that some critical indicators of resource degradation and loss may have been understated in the relatively crude estimation procedures in the past.

Prior to RCA, the USDA already had a long history of natural resource fact and data findings including:

(1)soil surveys made to inventory the Nation's basic soil resources and to determine land capabilities and conservation treatment needs;

(2) two Conservation Needs Inventories of the late 1950s and 1967 to help assess the soil, water, and watershed problems at the time of these rather primitive appraisals;

(3) Inventory and Monitoring action initiated by the Rural Development Act of 1972 to provide soil, water, and related resource data for land conservation uses and development, guidance of community development, identification of prime agricultural producing areas that should be protected, land use in protecting the quality of the environment, and to issue inventory reports of resource conditions. These authorities and subsequent funding produced the 1977 NRI.

There are 2,262,683,000 acres (916,386,000 hectares [ha]) of land area of which 1,511,963,000 acres (612,345,000 ha) are non-federal -- primarily privately owned -- in this Nation. As Figure 1 shows, about 27 percent is rangeland, 27 percent is cropland, 25 percent is forest, and 9 percent is pasture land. The remaining 12 percent is urban and built-up areas, farmsteads, roads, and highways, barren land, permanent snow and ice, mined land, other land in farms and rural land.

The use of this land is ever-changing. Since early settlement, varying levels of demand and changing government policies have influenced land use patterns. Over the past 50 years, there have been substantial fluctuations in how U.S. agriculture utilizes land and water resources. In some regions, relatively few changes are evident, both in what farmers and ranchers produce, and the farming and ranching methods they employ. However, in most parts of the country, millions of acres (ha) have moved into or out of food and fiber production and the mix of crops grown and farming methods used has shifted dramatically.

II. WHAT DO WE NEED TO KNOW ABOUT THE LAND?

We need to know much more about the land than its size, and percentage of use. Land is more than space -- and beyond the land surface there is an important third dimension -- the depth and quality of the soil. Its agricultural production potential also relates to location, slope, climate , availability of water, and several other important factors.

The National Cooperative Soil Survey carried out by USDA, land grant universities, and states for nearly a century has identified over 20,000 different kinds of soil on about two-thirds of our land that has been scientifically surveyed. The Land Capability Classification System developed by USDA is one of a number of interpretation groupings of soils -- primarily for agricultural purposes. That capability classification begins with individual soil mapping units. In this classification, the arable soils are grouped according to their potentialities and limitations for sustained production of the common cultivated crops without specialized site conditioning or site treatment. Non-arable soils (soils unsuitable for long-term sustained production of cultivated crops) are grouped according to their potentialities and limitations for producing permanent vegetation (grass and/or trees) and according to the risks of damage if mismanaged. See Figure 2 for additional data on acres and percentages of rural non-federal land in each capability class, 1977.

Figure 3 shows that not all regions of the U.S are naturally endowed with high quality land. The Corn Belt, with 76 percent of its land classed as suitable for cropland, is the best endowed agricultural region -- not only in this Nation, but in the World. We need to finish the Soil Surveys as soon as possible. In the Inventory and Monitoring work, the 1977 NRI gave states the option

of mapping the entire primary sample unit (PSU) in accordance with the standards and procedures of the National Cooperative Soil Survey -- or of determining the specific soil map unit at individual sample units. This meant that uniform soil survey interpretations were made for each sample unit.

For the 1977 NRI, the Statistical Laboratory at Iowa State University selected random sample areas known as Primary Sample Units (PSU) for each county in each state. Most PSU's in midwestern, southern, and western states were 160 acres (65 ha); most in eastern states were 100 acres (40.5 ha). They did range from 40 to 640 acres (40.5 to 259.2 ha).

Three points were selected at random within each PSU (only two points were used in PSU's of 40 acres). The Soil Conservation Service (SCS) field specialists and technicians examined about 200,000 sample points, collected and compiled the data. Quality control checks, including re-examination of more than 6,000 sample points, and special computer checks for consistency were made by SCS State Office Staffs and the ISU Statistical Lab.

The NRI provided much of the data used in preparing the 1980 RCA Appraisal required by PL 95-192. However, for the 1982 NRI, the collective experience of all prior work has been fully utilized to the extent that time, funding, and technical resources allowed. A million primary sample units represents a four-fold increase in 1982 over 1977.

What additional resource information is needed to manage land and related resources?

The stunning photographs taken by Apollo astronauts revealed in a dramatic fashion the complexity of the total environment. This led to the development of the earth observation satellite programs which were designed to provide additional physical resource information about our planet.

In late 1973, my co-workers were ecstatic when the first cloud-free mosaic of the entire United States gave us an overview of this country never seen before. That joint SCS-NASA effort was remote sensing at its most exciting and revealing for the resource planners and managers of land and related resources.

We have advanced in several ways, as you know in the past decade to fill many data voids. However in spite of budget and personnel restraints, more information is needed.

At this point in this paper, I will simply outline the key activities to be addressed in more detail at the time of the Symposium.

(1) An earlier inter-agency agreement for inventories and classification of natural resources should minimize duplication of data, enhance exchange of data, expedite technology transfer, and increase the efficiency of resource appraisals.

This joint venture of five federal agencies -- SCS, Forest Service, Bureau of Land Management, Fish and Wildlife Service, and Geological Survey should be monitored for results.

(2) Soil erosion and programs to reduce the problem emphasize the need to and a plan for targeting resources to high priority areas. A monitoring network is needed to relate accelerated control efforts to the impact on soil loss problems.

(3) Timely domestic crop and land cover acreage estimates at the state, region, and county levels is needed on a precise and cost-effective basis.

(4) Soil quality on benchmark cropland soils as effected by sheet and rill erosion, saline seeps, waterlogging, and soil moisture needs to be refined.

(5) Water quality and the impact of best management practices on sediment reductions and other loadings from agriculture and forestry will require a combination of satellite, aircraft, and ground data to supply accurate information. The acid rain problem also needs more attention.

(6) Air quality and the relation to wind erosion from farm and ranch lands will require additional sensoring in both rural and urban areas.

(7) The quality of vegetation, including stress on selected plants from drought insects and disease and the condition trends of range and pasture vegetation is needed. This includes the quantity and quality of upland game habitats.

(8) The retention of important farm, range, and forested land requires monitoring changes in land use and cover.

(9) Flooding and water related conservation programs suggest a need for real time moisture data for each crop production region.

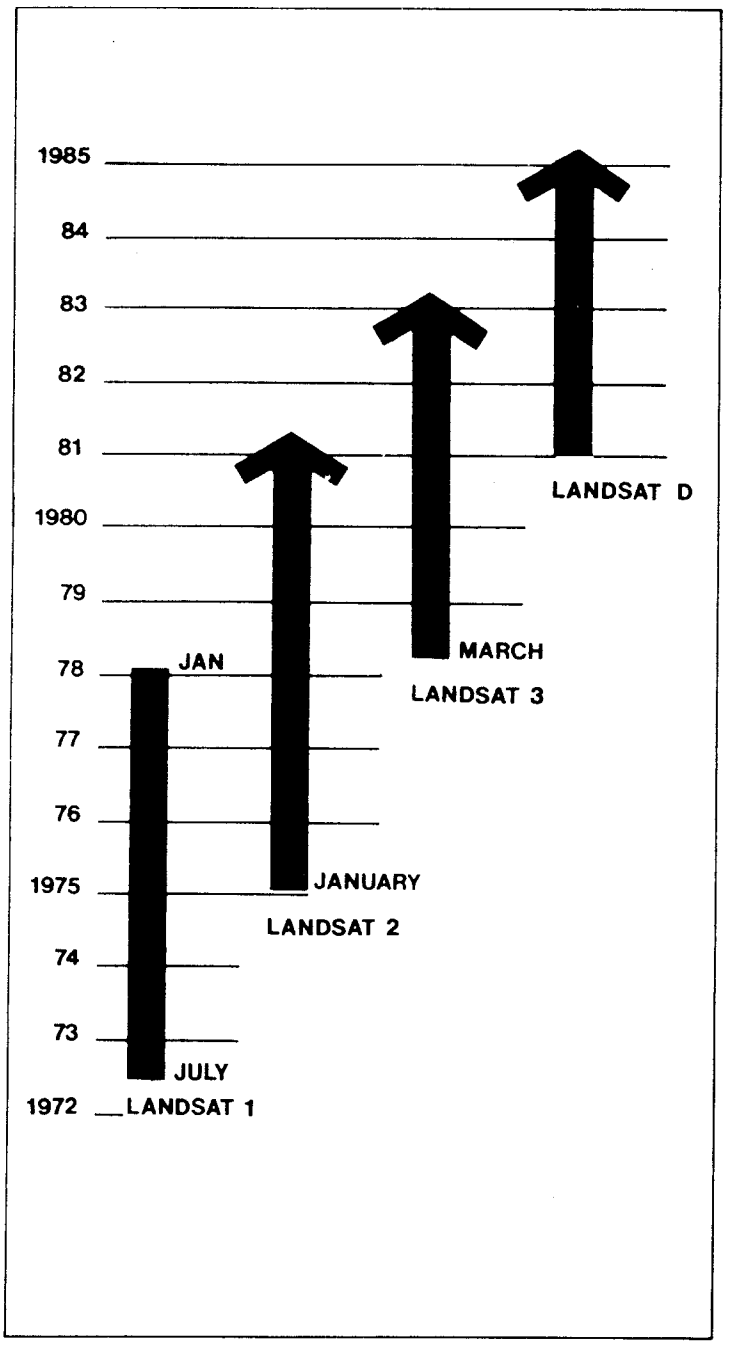
(10) Annual crop production potential in certain foreign nations requires improved technology to provide reliable forecasts for a range of crops.

(11) USDA has in 1983, an array of commodity-reduction schemes on a voluntary basis. Knowledge is needed as to the quantity and quality of soils that were diverted to other uses for long-range planning.

(12) Programs that require implementation need not only information for action but inventorying and monitoring for results, including maintenance needs.

Fact gathering starts because someone wants to know something. Decision-makers usually would like to have more data, more evaluations, more alternatives, as they choose the course of action. However, in

many situations, additional research should be undertaken in order to unlock minds and untie the hands of resource managers of land and related resources.



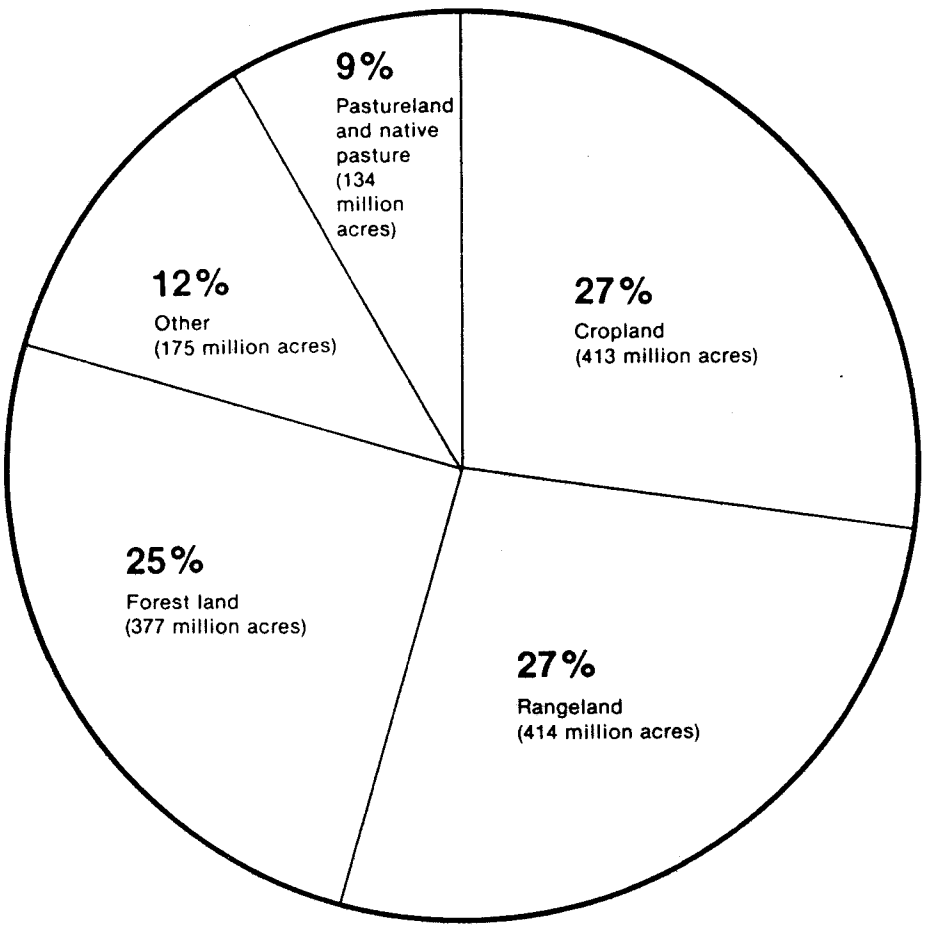


Figure 1.--Use of nonfederal land in the United States and the Caribbean, 1977.

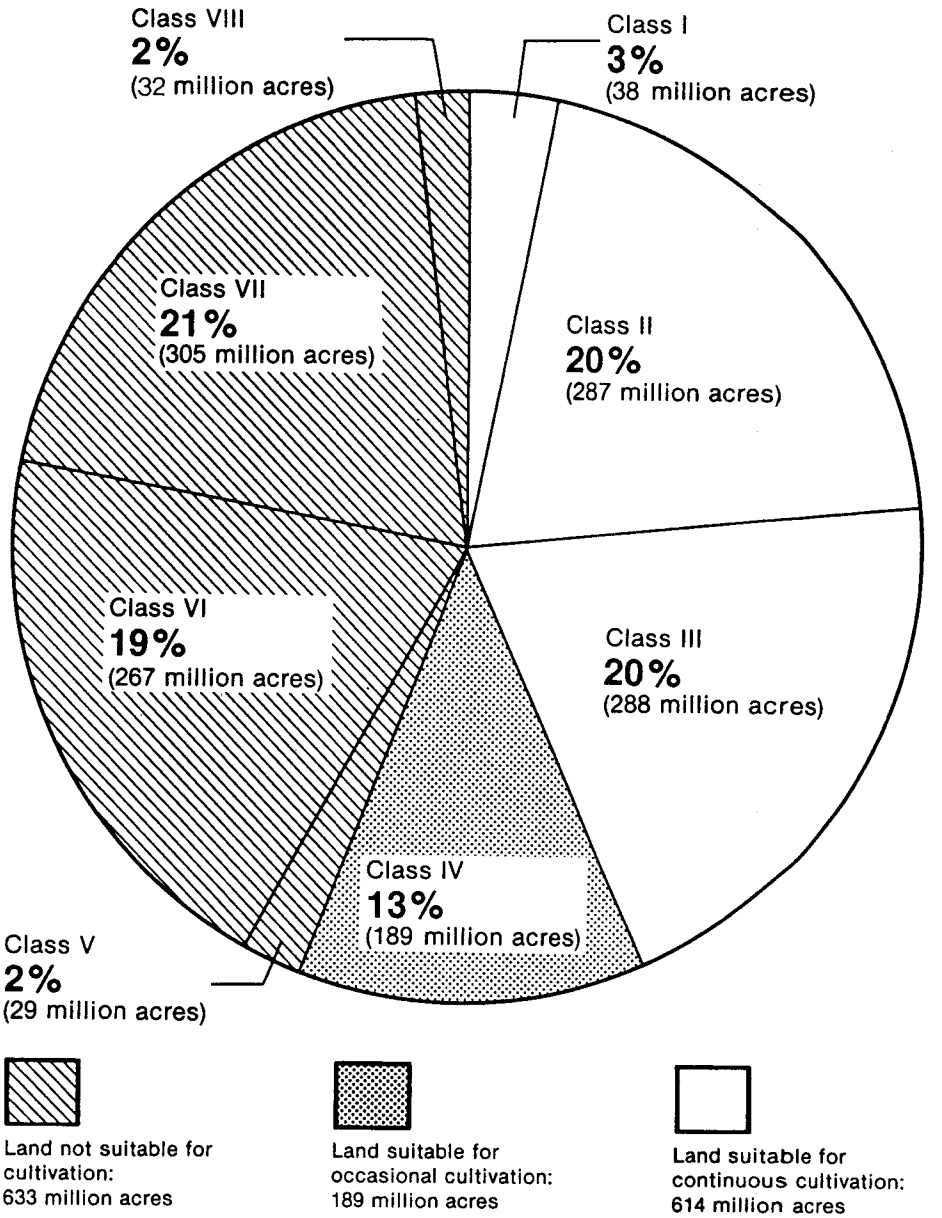


Figure 2. Land Capability Percentages for Nonfederal Rural Land

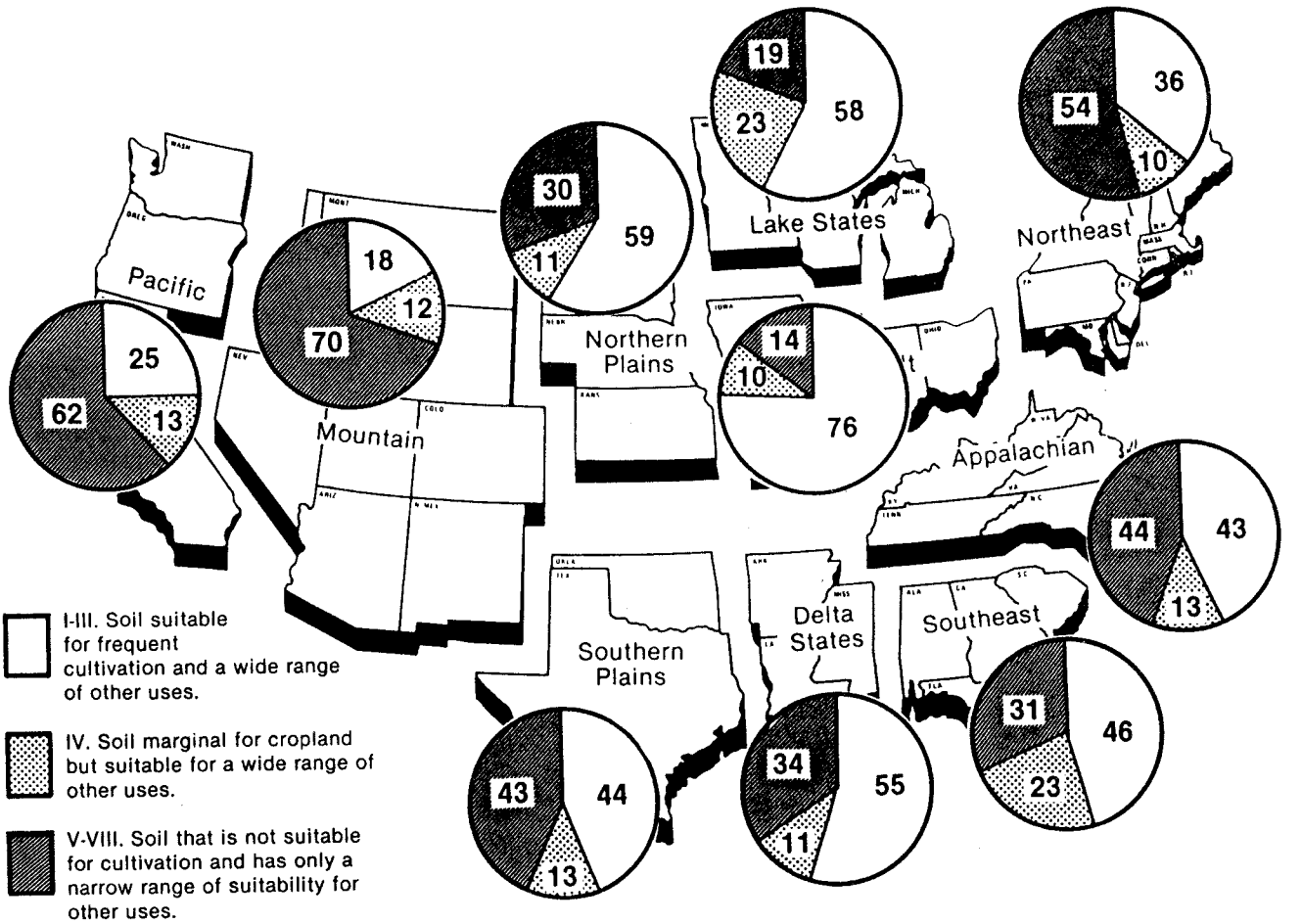


Figure 3.--Percentages of soil in capability classes I-VIII, by farm production region.