

LOC 10-9/5
C. 1
COLORADO STATE PUBLICATIONS LIBRARY
LOC10.9/5 local
Burns, Robert/The Colorado land use clas
3 1799 00000 5942

LESLIE J. SAVAGE LIBRARY
WESTERN STATE COLLEGE OF COLORADO
GUNNISON, COLORADO 81230

DOCUMENT

The Colorado Land Use Classification System

July, 1976
Robert Burns
Information Services Report Number 5
Department of Local Affairs
COLORADO DIVISION OF PLANNING

CONTENTS

| | |
|---|----|
| Preface..... | 1 |
| Introduction..... | 1 |
| Theoretical Basis..... | 3 |
| Categories: Definition and Description..... | 5 |
| First-Order Categories..... | 6 |
| Second-Order Categories..... | 6 |
| Definition of First-Order Categories..... | 9 |
| Definition of Second-Order Categories..... | 14 |
| Third-Order Categories..... | 19 |
| Mapping..... | 22 |
| Selected References..... | 25 |

RECEIVED

FEB 08 1996

STATE PUBLICATIONS
Colorado State Library

Preface

This land use classification system has been under development since November, 1974, and has been based on previous land classification efforts in Colorado and throughout the United States during more than a decade. In the last year the Division of Planning and the author have received comments about the system from a variety of sources within Colorado and throughout the United States. The system has been tested in Morgan County, in Pueblo County and at several other locations in eastern Colorado.

Comment about the system has generally been favorable, although certain problems, deficiencies and inconsistencies have been noted, some of which have been only partly resolved. Nevertheless, the Division of Planning believes the costs of further delay required for further modifications of the system would exceed the benefits to be gained from such a delay. No system would ever be ideal for all purposes, and the Division believes we now have a system which will be generally satisfactory from most regional, county and municipal planning needs, and which will facilitate communication about, and coordination of, planning throughout the state. Therefore, this system, even with its recognized deficiencies, is proposed as the standard for land use classification in Colorado.

Many persons participated in the development of the system through contributions of ideas, information and criticism, and by testing the application of the system in mapping land use. Special acknowledgment seems due to Philip H. Schmuck, Director of the Division of Planning, and Louis F. Campbell, Jr., State Cartographer within the Division, who initiated the development of the system and actively supported the later efforts to develop it. Gene Fisher of the Pueblo Regional Planning Commission provided useful criticisms leading to refinements in the system. Robert Lumpkin, Morgan County Land Use Administrator, and David Burke, formerly planner for the East Central Council of Governments, initiated the use of the system in their regions and provided useful comments leading to improvements. Finally, Roger Dwyer and Mac Strain of the U. S. Geological Survey and Linda Driscoll, mapping consultant and contractor, facilitated the development of the system through their participation in its use in a pilot mapping project in Pueblo County. All final decisions and adjustments to the system were made by the author, however, who must therefore accept responsibility for whatever deficiencies it may contain.

This document was financed, in part, through an urban planning grant from the Department of Housing and Urban Development under the provision of Section 701 of the Housing Act of 1954, as amended.

PART 1, INTRODUCTION

The land use classification system presented and discussed in the following pages has been developed to meet the need for a comprehensive statewide frame of reference for describing and mapping land use. The system is intended to provide a logical and clearly defined method of classifying land use to meet the needs of local, regional, and state planners and others concerned with land use. It constitutes one of several subsystems to eventually be incorporated into a larger state geographic information system.

Land use is only one of the parameters that should be included in such a system, but the location, area, and spatial relationships of land use are important factors in the human environment. As the land use classification system is the means by which an infinite variety of data are organized into comprehensible information, its design is critical to perception and analysis of landscape. Classification is the first stage of analysis, and the usefulness of any analysis of land use depends on the assumptions that are designed into the classification system. Therefore, it seems to follow that a land use classification system must be based on a careful identification of the most significant landscape categories of land use in terms of their social, economic, and other environmental interrelationships.

Various systems of classifying land use have been developed and several have been considered for general use in land use planning in Colorado. However, examination of many of these systems revealed conceptual difficulties that seriously limit their usefulness in describing and analyzing Colorado land use. Therefore, the Colorado Land Use Classification System has been developed specifically to deal with the characteristics of the Colorado landscape for planning purposes.

Purpose

The Colorado Land Use Classification System is intended to provide a basis for describing, mapping and analyzing the Colorado landscape according to:

1. General landscape characteristics,
2. Human environment,
3. Conservation of land resources,
4. Economic development, and
5. Public and private costs related to land use.

The proposed system is expected to be useful for monitoring land use change and for studies required by state and federal programs for development, planning and regulation. It can also provide the basis for graphically expressing plans or expectations for future land use patterns.

It should perhaps be reemphasized that land use is only one of several parameters that should be considered in land use planning, but that the other variables should be considered and mapped in separate subsystems of a total geographic information system. These other variables include vegetation, geologic structure, landforms, land ownership, land management and other social, economic and demographic information, as well as other parameters. Abstracting each of these themes contributes to clarity in mapping and analysis while maintaining the possibility of recombining information in various ways for specific purposes. In some cases land use categories have been developed to coincide with other parameters such as zoning categories or natural land characteristics. This has been done where such classification seemed likely to enhance the usefulness of the system without violating its theoretical basis or detracting from its consistency.

This classification is designed for application at a range of scales for different levels of planning and analysis of landscapes. It was originally developed primarily for compilation and mapping at a scale of 1:24,000 using the U.S.G.S. Topographic Series base maps and 1:24,000 quadrangle centered aerial photo enlargements for compilation. The first and second order categories also appear amenable to presentation on the new U.S.G.S. 1:50,000 County Map Series.

For municipal and local land use planning and analysis, the system has been adapted to large scale mapping. This facilitates the use of maps of different scales for analyzing areas including both intensive and extensive land use, making county maps compatible with maps of the included municipalities at larger scale, for example.

This manual is written primarily for the user of the Colorado Land Use Classification System. The manual begins with this introduction and proceeds with an explanation of the theoretical basis of the system and its distinguishing characteristics in Part II. Part III is a definition and description of the categories, and Part IV discusses the application of the system for regional or municipal mapping.

PART II. THEORETICAL BASIS OF THE SYSTEM

The fundamental criteria on which the Colorado Land Use Classification System is based are logical consistency, comprehensibility, and relevance to land use analysis and planning. Logical consistency is closely related to the definition of the basis for classification and the scope of the classification system. Comprehensibility is related to the number of categories used and their relationship to each other. Relevance is a function of category selection according to usefulness in analyzing land use planning problems.

Other classification systems in common use were analyzed in the process of developing this system, and their structures and categories have influenced this system to some extent. However, all these existing systems were found lacking in logical consistency, comprehensibility, or relevance. This led to the problems such as:

1. Difficulty in classification owing to the existence of more than one human activity on the same area.
2. Problems in presenting the information in map format which could effectively reveal major land use relationships.
3. Lack of information content relevant to land use analysis and planning.
4. Problems in classifying areas which are temporarily "unused" or in which little modification had occurred.
5. Inclusion of information other than land use, such as vegetative cover, which obscures land use information, or is substituted for it.

To avoid these problems it was necessary to develop a theory, or a set of organizing principles, which would limit the scope of the classification system while allowing for the inclusion of information relevant to land use analysis and planning. Thus, the decision was made to limit the basis of the system to land use as defined by Clawson and Stewart (1965); ".... man's activities on the land which are directly related to the land."

Human activity alone does not provide a satisfactory basis for classifying "land use." Many human activities have little direct relation to land and many areas of land are used for a variety of human activities. The best basis for land use classification appears to be the concept of the "cultural landscape." This may be defined as the condition found on the earth's surface as a result of the cumulative effect of human activity. This approach provides a logically consistent basis for classification. However, the cultural landscape may be divided into an infinite variety and number of categories. Comprehensibility, at least for presentation of areal and spatial relationships in map format, requires that the entire landscape be divided into about nine or ten major categories. More categories tend to obscure spatial and areal relationships, and fewer categories provide less capability to include relevant information. Nine to ten major categories were chosen as an appropriate balance between comprehensibility and information content.

Relevance to planning is the basis for the major categories to be included in the system. The criteria for defining the categories include social, economic, and other environmental considerations. These may be important because of their intensity or their extent. Thus, some of the major categories represent intensive land use in relatively small areas, while others represent extensive use over large areas. Either may be important for planning.

In summary, the design criteria on which the Colorado Land Use Classification is based may be considered as follows:

- 1) The system should provide for maximum differentiation among a limited number of landscape units on the basis of their usefulness in presenting information about human use of the land.
- 2) Spatial and areal relationships among land use categories should be indicated as clearly as is consistent with a balance between comprehensible presentation and information content.
- 3) Classification based on cultural landscape units avoids the problem of classifying areas in which more than one human activity is significant, and bases the classification on the human activities that account for the present character of the landscape unit.
- 4) The landscape units chosen as the major categories are chosen for maximum relevance to planning on the basis of their effect on human environment. This effect may be related to the extent of the areas involved, or to the intensity of land use and its environmental effect.

PART III CATEGORIES - DEFINITION AND DESCRIPTION

The Colorado Land Use Classification System is a hierarchical system based on major, or first-order, categories divided into subcategories. The subcategories include second and third order levels and may be extended to more detailed classification. The first- and second-order categories are expected to be useful for regional or county land use classification, while the third-order categories provide enough detail for municipal land use planning.

The first- and second-order categories are presented and described first, followed by the third-order categories. In considering these categories their use in land use mapping should be kept in mind. For small scale mapping of a county or region at 1:24,000 or 1:50,000, the first- and second-order categories are appropriate. For mapping at 1:24,000, a minimum area of about five acres is suggested. This minimum mapping area, together with the definitions of the categories, deals with the problems that would be caused by mapping in excessively fine detail. At about 1:12,000 some modification of the system is appropriate as the minimum mapping area may become the individual land parcel, or a fraction of an acre. This will be discussed in more detail in Part IV. on mapping symbols and procedures.

Categories included in some classification systems have been omitted from this one because the information is included on the base map to be used. Thus, for example, airports and railroad yards are simply included in the "transportation" subcategory at the second-order level because the kind of transportation feature is obvious from its location, form and representation on the base map. Also, there are no categories for "scattered" or "clustered" residential areas. Isolated houses do not account for the characteristics of the landscape unless residential land use is contiguous over a substantial area, such as the 5-acre minimum mapping unit. Thus, a farmhouse occupies land classified as "agricultural," not "residential."

All the major categories have certain common features. One of these is the first subcategory, designated undifferentiated, miscellaneous or "not elsewhere classified" (N.E.C.). This category is intended to be used for areas in which no more specific description is provided for, either because the first-order category is considered an adequate description or because the variation within the area makes more specific classification infeasible or inappropriate. Used with the minimum mapping scale, this category eliminates the need for excessively detailed, and often irrelevant, classification. When more specific information is desired, the options are to use a larger mapping scale with a smaller minimum mapping area, or to use point or line symbols to indicate the location of certain features regardless of their area.

Another feature common to the major categories deals with the problem of "vacant" land, or land which is being converted to other uses. The last, or ninth, subcategory of each main category includes such land. This is land that is no longer used for the purpose which has given it its present or previous characteristics, but which has not been sufficiently changed by another use to warrant its classification in another category.

First Order Categories

| | |
|-----|---|
| 010 | Urban and community functions |
| 020 | Residential |
| 030 | Heavy industry, transportation, and utilities |
| 040 | Resource extraction |
| 050 | Developed recreation |
| 060 | Irrigated farmland |
| 070 | Unirrigated farmland |
| 080 | Range grazing |
| 090 | Low impact land use |
| 100 | Major military installation |

Second Order Categories

| | |
|-----|---|
| 010 | <u>Urban and community functions</u> |
| 011 | Undifferentiated or miscellaneous, N.E.C.* |
| 012 | Urban core functions |
| 013 | Wholesale, warehousing, or light industry |
| 014 | Major public buildings and grounds |
| 015 | Health or public services |
| 016 | Post-secondary education |
| 017 | Elementary or secondary education |
| 018 | Large-scale or high-impact retail or service |
| 019 | Vacant land or buildings, or areas being converted in the community center area. |
| 020 | <u>Residential</u> |
| 021 | Undifferentiated or miscellaneous, N.E.C. |
| 022 | Large residential estate (less than one dwelling unit per acre) |
| 023 | Low to medium density suburb (1-4 dwelling units per acre) |
| 024 | Urban or dense suburban (5-8 dwelling units per acre) |
| 025 | Semi-detached, or densely grouped housing (more than 8 dwelling units per acre) |
| 026 | Multiple-unit "garden apartment" (3 levels or less) |
| 027 | Multiple-unit "elevator apartment" (more than 3 levels) |
| 028 | Mobile home residential |
| 029 | Vacant land or buildings formerly used for residence or pending development or conversion, in the residential area. |

*N.E.C.: not elsewhere classified

- 030 Heavy industry, transportation and utilities
- 031 Undifferentiated or miscellaneous heavy industry N.E.C.*
 - 032 Transportation or communication
 - 033 Electric power generation or transmission
 - 034 Water collection, treatment, or storage
 - 035 Sewage treatment
 - 036 Solid waste disposal
 - 037 Stockyard or packing plant
 - 038 High-polluting industry, N.E.C.
 - 039 Vacant land or buildings in industrial area
- 040 Resource extraction
- 041 Miscellaneous or N.E.C.
 - 042 Gravel pit or clay pit - operating
 - 043 Quarry - operating
 - 044 Gravel pit, clay pit, or quarry - no longer operating
 - 045 Surface mining
 - 046 Subsurface mining
 - 047 Oil or gas fields or wells
 - 048 Timber removal (logging)
 - 049 Mining waste, tailings, or mines no longer operating
- 050 Developed outdoor recreation
- 051 Undifferentiated or miscellaneous, N.E.C.
 - 052 Park or playground
 - 053 Campground
 - 054 Ski area
 - 055 Golf course
 - 056 Equestrian sports, horse maintenance, training or showing
 - 057 Participant sports, N.E.C.
 - 058 Spectator recreation area
 - 059 No longer operating, or being converted to other use
- 060 Irrigated farmland
- 061 Undifferentiated or misc., N.E.C.
 - 062 Irrigated hay or pasture
 - 063 Irrigated row crops or grains
 - 064 Irrigated orchard
 - 065 Truck farming (produce)
 - 066 Specialty production (e.g. greenhouses)
 - 069 No longer in production, or being converted to other use

*N.E.C.: not elsewhere classified

070 Unirrigated farmland

- 071 Undifferentiated or misc., N.E.C.*
- 072 Unirrigated hay or pasture
- 073 Unirrigated grain production
- 077 Livestock production or feeding
- 078 Submarginal or casually grazed
- 079 No longer in production, or being converted to other use.

080 Rangeland

- 081 Undifferentiated or misc., N.E.C.
- 082 Unimproved grazing
- 083 Improved grazing
- 088 Submarginal or casually grazed
- 089 No longer used for grazing, or being converted to other use

090 Low impact land use

- 091 Undifferentiated or misc., N.E.C.
- 092 National Park (undeveloped preservation areas)
- 093 National Forest Wilderness
- 094 Undeveloped watershed protection
- 095 Undeveloped flood plain
- 099 Being developed for other use

100 Major military installation

- 101 Undifferentiated or misc., N.E.C.
- 109 No longer operating, or being converted to other use

*N.E.C.: not elsewhere classified

Definition of First Order Categories

010 Urban and Community Functions

This category includes the various commercial, service, institutional, light industrial and other combinations of land use that are normally found in intricate complexes at central locations. They represent the "commercial center" or "central business district" of the community, or the various subcenters and strip or scattered developments that provide similar services. This category may also include some residential use where it exists in areas which are predominantly commercial, service, or light industrial.

The subcategories (second-order) are designed to allow for differentiation in more detail than the major categories, without unnecessary concern about the problems posed by the great range of activities within the central business district. Even so, it will frequently be difficult to precisely establish the boundaries between certain subcategories, such as "urban core functions" and "wholesale, warehousing and light industry." Because of the gradient that often exists between these areas, the boundary may be somewhat arbitrary, based on an estimate of the dominant use. An indication of the approximate area and location of these land uses is considered desirable even though their exact boundaries may be problematic. In some cases, the subcategories may coincide with zoning.

020 Residential

This category includes the large areas of most communities which are devoted almost exclusively to residential use, perhaps including small areas where services are provided for the local neighborhood. Because purely residential land use is significantly different in landscape and economic effect from that of the "commercial center," a separate major category is provided for it.

The subcategories of this category are based on the characteristics of structural type, density and location by which different types of neighborhoods are usually described. This is consistent with the basis of the classification system on visible landscape differences having significant social, economic and other environmental effects. It is also consistent with commonly-used zoning practice, supplementing, rather than substituting for, zoning or census information.

Scattered residential land use is included in the appropriate subcategories of the "residential" category where the total area occupied by residential land use which can be distinguished from surrounding areas of other land uses exceeds the minimum mapping area (e.g., five acres at 1:24,000)

Similarly, clustered development should include any surrounding land whose primary function is to provide open space for the residents of that development. However, where dwellings are scattered throughout an area classified according to some non-residential use, and do not occupy the minimum mapping area chosen for the scale used, they should not be differentiated, as they would not account for the predominant characteristics of the landscape unit. In urban areas where houses or apartments are included in an area predominantly commercial or industrial, the "undifferentiated or miscellaneous, N.E.C." category may be used to indicate the entire land

use and landscape complex. Scattered houses in rural areas are shown on the U.S.G.S. 1:24,000 and 1:50,000 series which serve as base maps for land use mapping at these scales.

Transient accommodations are classified as "retail or service," rather than "residential." Areas occupied by institutional housing are classified according to the appropriate institutional category.

030 Heavy Industry, Transportation and Utilities

This category is characterized by land uses that have very pronounced social, economic and other environmental effects in spite of the generally small areas they occupy. They often are the features representing critical economic functions of community support facilities. They also frequently have significant actual or potential visual impacts or polluting effects. Finally, they are frequently associated with the use of natural resources. Thus, their location, even more than the area they occupy, is of critical importance for planning.

Heavy industry has been variously defined. For this classification, it is defined as any industry which produces more severe environmental impacts than a similar area occupied by commercial, service, or light industrial activities, or peculiar impacts such as smoke, dust, noise or visual effects. Thus, industries having characteristic large plants such as oil refineries, or outdoor storage, such as construction, would be classified as heavy industry. Those which occupy large areas, but generally have impacts similar to commercial areas, such as the IBM plant near Boulder or the Kodak plant near Fort Collins are probably best classified as light industry, in spite of their size and the traffic they generate. In fact, however, their impacts are probably less than those of areas of similar size used for commercial activities, such as large shopping centers.

The subcategories such as "transportation and communication" include only the areas in which these functions, or associated maintenance activities, are actually occurring. Offices associated with these industries but not actually located at their functional sites are simply classified among the "retail or service" or "civil government institution" category. Highway maintenance facilities should be classified as "transportation."

040 Resource Extraction

This category includes land uses similar to heavy industry in their environmental and economic significance, but "resource extraction" is more closely related to the use of natural, or land-based, resources. The resource extraction process itself has characteristic effects on the land, and furthermore, is directly dependent on the existence of natural resources and the manner in which they are removed.

The category includes the areas in which resource extraction processes--mainly mining, quarrying, drilling or timber harvesting--are presently occurring. It also includes the sites whose characteristics have been determined by these processes and which have not been reclaimed or converted to other uses. Thus, for example, a gravel pit or quarry from which material is no longer being removed would remain classified as "gravel pit, quarry or claypit--no long operating," until it was reclaimed for some other use, such as "developed recreation."

The subcategory "timber removal" includes land on which this activity accounts for dominant characteristics, such as clearing patterns and road systems. Where land from which timber has been removed has reverted to an essentially natural condition--a process which usually requires several decades--it may be classified as "low impact land use." Long-abandoned mining sites or homesteads, which have reverted to near-natural conditions, may be similarly classified as "low impact land use."

050 Developed Outdoor Recreation

This category includes land on which the primary use is recreation, and on which recreational activity accounts for dominant characteristics of the land. The category includes all developed municipal, county, state, federal or private parks, campgrounds, ski areas, golf courses, or other recreational facilities involving large land areas. It includes playing fields, shooting ranges and major sports stadiums. It does not include areas that are undeveloped except for primitive trails, roads, and campsites, such as wilderness areas of national forests and national parks. These areas should be classified as "low impact land use."

060 Irrigated Farmland

Water is a critical resource in Colorado, and irrigation depends on its availability. Furthermore, irrigated land is several times as productive as unirrigated land, and often provides hay crops critical to livestock operations on unirrigated rangeland. For these reasons, together with the increasing importance of food production and the more general environmental values of maintaining irrigated agriculture and the pastoral economy, irrigated farmland is considered important enough to warrant identification as a major land use category.

It may be difficult to differentiate between artificially irrigated and natural subirrigated* hayland in mountain valleys. As the economic values, environmental effects and dependence on water availability are similar whether irrigation is natural or artificial, naturally subirrigated lands should be classified as "irrigated farmland."

070 Unirrigated Farmland

This category includes both extensive grain production and concentrated livestock production operations. It also includes rotational livestock grazing on lands which are periodically plowed and planted or which are occasionally mowed for hay ("Unirrigated hay or pasture"), and grazing lands which were once cultivated but are presently submarginal for cultivation and have reverted to more extensive use ("submarginal or casually grazed"). These lands are sometimes difficult to differentiate from rangelands, but because of their economic and environmental similarity,

*Naturally subirrigated land has a water table high enough to make ground water available to vegetation. It generally includes pasture and hayland or natural meadows in mountain valleys.

the misclassification that could result is not serious, and large expenditures of effort to achieve precise differentiation are not recommended. Where areas of a section (640 acres) or less are closely intermixed with lands that have been cultivated and cannot be identified satisfactorily as "rangeland," the "submarginal or casually grazed" subcategory would appear appropriate.

The subcategory "livestock production or feeding" includes all farm livestock operations other than grazing, such as cattle feeding, dairy farms, poultry production, fur farming and other livestock production. However, with a five acre minimum mapping area, most intensive livestock operations will not be differentiated from the surrounding land used for more extensive agricultural production.

080 Rangeland

This category includes land on which domestic livestock graze on "natural" vegetation which maintains itself from year to year without periodic plowing and replanting or artificial irrigation. The category includes, in addition to native grassland, open woodlands which are used for grazing and mountain meadows which are grazed by domestic stock but not mowed for hay. (Those that are mowed for hay should be classified as "irrigated hay or pasture.") The essential difference between rangeland and pasture is that pasture is more intensively managed, often in rotation with hay or other crops. Rangeland is less intensively managed, although usually fenced and often with stock watering facilities. The subcategory "improved grazing" indicates more intensive management. This includes brush removal, furrowing, basin listing, and reseeding, but these improvement measures are only occasional and not regular management practices.

090 Low Impact Land Use

This category includes areas with landscapes essentially unaltered by human activity. Such lands have important environmental functions as watersheds and recreational lands. They also include environmentally critical areas: high altitude tundra and meadows, steep rocky slopes, avalanche paths, and undeveloped floodplains. The category contains such diverse areas as legislatively-reserved wilderness and municipal watersheds. Although these areas have important recreational functions, they are differentiated from "developed outdoor recreation" because of their essentially natural character, relative absence of structures, low-intensity recreational use, and usually large areas.

Definition of the category is complicated by the presence of scattered inclusions of other land uses. Most essentially-undeveloped areas include at least a few trails, and sometimes a few roads. They may also include areas where mining, timber removal or grazing by domestic stock has occurred. Where these uses are in evidence, the appropriate category would, of course, be "resource extraction" or "rangeland." Roads, trails, power lines and ditches are adequately represented by the linear symbols on the base map. Included developments such as dams or irrigation works can be differentiated if they occupy more area than the minimum mapping unit, but they also are indicated on the U.S.G.S. 1:24,000 or 1:50,000 base maps.

The subcategories provide for differentiation between National Forest Wilderness and wilderness areas of National Parks because of subtle differences in management objectives between these two subcategories.

100 Major Military Installation

This category indicates the manner in which the classification can be extended from 100 to 999 to include new or special land use categories if these become desirable for inclusion for a state or local information system. At present, however, simply delineating and labeling such areas appears preferable, in view of their limited number, especially as some military installations, such as the Pueblo Ordinance Depot and the Air Force Academy may be more appropriately classified as industrial or educational.

Definition of Second-Order Categories

Many of the second-order categories are more or less self-evident, and contribute to the definition of the first-order categories. However, experience has indicated a need for supplementary definition of some of the second-order categories. These selected definitions are as follows:

010 Urban and Community Functions

011 Undifferentiated or Miscellaneous, N.E.C.*

Includes mixed land uses where none of the other subcategories adequately describes the use, where no single use category predominates, or where residential use is significant, but the area cannot be classified as "residential" because other uses predominate. Where residential and other uses are mixed and cannot be readily separated at the mapping scale used, any area in which more than about thirty percent of the land is used for non-residential purposes, should be classified in this subcategory. Schools, churches and individual neighborhood businesses, such as corner service stations and neighborhood grocery stores, drugstores, and small shopping centers should be included in "residential," unless their areas exceed the minimum mapping unit.

012 Urban Core Functions

This subcategory includes areas of relatively intense administrative, business, retail and service activities, usually in close spatial association. The category usually will apply to the central area of the community, although it may also be found descriptive of some satellite centers. Many satellite centers, however, are oriented toward sales and service of large appliances, automobiles and other space-consuming activities. These space-consuming activities should be classified in a different subcategory intended especially to describe them--(018) "Large-scale or high impact retail or service." The (012) "Urban core functions" subcategory also includes all office functions including government offices which neither happen to be located in characteristic monumental public buildings, nor provide critical services related to their location in the community, and do not occupy large areas for characteristic activities. These governmental, public and quasi-public functions are classified in other subcategories.

*N.E.C.: not elsewhere classified

013 Wholesale, Warehousing or Light Industry

This area will often be difficult to separate from "transportation" and from "retail or service." Precise delineation is not critical--an approximation will adequately indicate the location of these functions. In some communities, use of the "undifferentiated or miscellaneous, N.E.C." category to describe the entire central area may be more appropriate. Light industry is defined as that which does not involve characteristic structures outside the building and does not produce characteristic sounds or effluents. It is frequently located in the wholesale or warehousing areas of the city, or may be intermixed with retail and service functions. Light industry also includes "clean" industries at locations outside the municipal center.

014 Major Public Buildings or Grounds

This subcategory is reserved for public and quasi-public buildings, and their surrounding grounds, which have an essentially monumental nature. It includes the capitol, courthouses, city halls, and some major museums, libraries and auditoriums. However, where museums, libraries, or government offices are located in buildings essentially similar to the surrounding office or other buildings, they should not be differentiated from these other areas. It should be reemphasized that this category (014) "Major Public Buildings..." is reserved for landmark buildings, usually surrounded by associated grounds. The category also includes cemeteries, whose function is essentially monumental, even though they may not include major buildings.

015 Health or Public Services

This subcategory includes land used for public or quasi-public functions which may occupy substantial areas and have characteristic structures, and the location of which is often relevant to planning or administration. These areas are not generally monumental, however, which separates them from the preceding subcategory. Where these activities occur in areas occupied by similar activities, and have no observable characteristic differences from these activities, there may be no purpose in separating the areas they occupy. For example, a U. S. Forest Service Ranger Station usually occupies a large area and has characteristic structures, equipment and parking facilities. Some of these, however, and most U. S. Forest Service Supervisor's Offices, are essentially undistinguishable from other offices, and need not be differentiated in mapping land use.

016 Post-Secondary Education

This subcategory includes junior colleges, colleges, universities and trade schools and other institutions of higher education. These are differentiated from "elementary or secondary education" because of differences in landscape impact and function related to their regional, rather than neighborhood, importance.

017 Elementary or Secondary Education

This subcategory includes all schools, public or private, which are intended primarily for education through the high school level.

018 Large-Scale or High-Impact Retail and Service

This subcategory is to be used to describe land used for retail and service activities which generally occupy more space than the activities generally associated with the "urban core" area. It includes large supermarkets, shopping centers, automobile sales and service and service stations. It also includes building supply retail, farm machinery or construction equipment sales and service.

019 Vacant Land or Buildings, or Areas Being Converted in the Community Center

This category is provided for areas on which the previous use has been discontinued, whether or not new development is presently occurring.

020 Residential

021 Undifferentiated or Miscellaneous, N.E.C.

This category is provided for classification of areas of mixed residential uses which cannot be conveniently classified in any of the other categories. It could include areas of varying density, or where single and multiple unit houses are mixed.

022 Large Residential Estate

This category includes estates having less than one dwelling unit per acre. All the land used essentially for residential activities should be included. Where the area includes woodland or land used only for the personal livestock and gardens of the residents, and not for farming for market sales, the entire area would be classified in this residential subcategory.

023 Low to Medium Density Suburb

Suburban areas having lots larger than the usual city residence with one to four dwelling units per acre.

024 Urban or Dense Suburban

Single family housing typical of the older urban residential neighborhood, also found in high density suburbs having five to eight houses per acre (usually seven or less). May also include some apartments, duplexes or other multiple-unit houses, but if these predominate, the following category will usually be more appropriate.

025 Semi-detached or Densely-grouped Housing

Includes areas occupied by row houses, townhouses, duplexes or other multiple-unit houses including areas where older single-unit houses have been converted to multiple-unit to achieve a residential density equivalent to more than eight dwelling units per acre, except as classified in the following subcategories.

026 Multiple-unit "Garden Apartment"

Areas occupied by multiple-unit residential structures of relatively low, light construction, usually without elevators and not exceeding three levels in height. The lowest level may be partially underground.

027 Multiple-unit "Elevator Apartment"

Areas occupied by multiple-unit residential structures generally known as "high-rise," "elevator" or "security" apartments. These are usually of steel and masonry construction, have elevators, and are usually more than three levels high. This type of structure, as well as the preceding, frequently occupies less than the minimum mapping area, and would therefore be included in other residential categories. Where only isolated apartment buildings exist, classification should be based on the dominant residential or other subcategory. Where scattered apartment buildings are a significant part of the total "residential" or "urban and community complex," the "undifferentiated or miscellaneous" subcategory should be used.

028 Mobile Home Residential

Areas occupied by relatively fixed "mobile homes" used for "permanent" residence. Areas used mainly for temporary mobile home parking should be classified (012) "retail or service," unless their function is mainly recreational, in which case they may be classified as "campgrounds" (053). Where mobile homes are commonly intermixed with other residential types, the (021) "undifferentiated or miscellaneous" category may be used.

029 Vacant Land or Buildings Formerly Used for Residence (or pending development or conversion in the residential area)

Land areas within areas classified as "residential" which have been formerly used for residence or which have never been developed, but which can no longer be classified according to their former use. In urban areas this category may include "urban renewal" areas. In most of Colorado it is more likely to include parts of partially-developed subdivisions.

030 Heavy Industry, Transportation and Utilities

031 Undifferentiated or Miscellaneous Heavy Industry N.E.C.

This subcategory includes all land used for heavy industry (see definition of first order category), which cannot be properly classified in any of the other subcategories.

032 Transportation or Communication

These land uses are grouped and not further subclassified because their specific nature (e.g., highway, airport, rail yard, antenna field) is indicated on base maps or on thematic maps separate from the land use map.

038 High-Polluting Industry N.E.C.

This subcategory is provided as a planning tool to allow mapping the location and area of industrial land uses which create problems associated with noise, fumes, dust or other effluents which affect land use alternatives outside the area so classified. This should be useful in minimizing conflicts between such industry and other activities.

070 Unirrigated Farmland

072 Unirrigated Hay or Pasture

This subcategory includes lands which have been cultivated, or which are regularly plowed and reseeded as pasture, or which are used for any combination of pasture and hay production. (By contrast, see 078 following.)

077 Livestock Production or Feeding

This subcategory is provided to permit identification and location of land used for large confined livestock operations, such as large dairy farms, poultry farms, or feedlots. Most such operations are part of other farming activities, however, and the area used for confined livestock operations will not exceed the minimum mapping area (e.g., 5 acres), and thus need not be mapped.

078 Submarginal or Casually Grazed

This subcategory, by contrast with (072) "Unirrigated Hay or Pasture" is reserved for land which still shows evidence of having been cultivated, but on which grazing is very extensive or marginal owing to low productivity. This subcategory may also include land on which agriculture was attempted and abandoned so long ago that the land is presently almost indistinguishable from surrounding rangeland. As such, land is ecologically and economically similar to rangeland, frequently the 088 "Submarginal or Casually Grazed" subcategory, expenditure of effort to differentiate between 078 and the appropriate "Rangeland" subcategory are not recommended.

Note:

For clarification of other subcategories, refer to the definitions of the main (first-order) categories.

Third-Order Categories

Third-order subcategories have been developed only for the (010) "Urban and Community Functions" category. This provides for the finer detail that may be desired for municipal planning, compared to the simpler or coarser texture of land use patterns outside municipalities. No need for finer classification is evident for the other major categories. Instead, specific labeling of areas of special local or state interest is recommended using names of firms, products, or any other identifying information desired. Because of the relatively small number of areas of such special interest outside the area classified as used for "Urban and Community Functions" (010), specific designation should be more useful than numerical third-order classification in these areas.

The third-order subcategories that follow have been developed to be consistent with the basic theory and objectives of the classification system reflecting distinctions based on general landscape characteristics, functions in the human environment, use of land resources, economic development and public and private costs related to land use. The purpose is to provide a basis for analyzing traffic circulation, conflicts among land uses, availability of services at appropriate locations, and other municipal planning problems.

Definitions of the third-order subcategories would appear to be generally evident from the outline. However, these subcategories are intended for large-scale mapping, and thus may be applied to individual parcels of land or to individual buildings. The second-order subcategories of the other major categories are also available for large-scale mapping, and may be used for areas such as small parks or squares (e.g., (052) "Park or Playground,") or parking areas (e.g., (032) "Transportation or Communication.") For municipal planning, additional labeling or symbols may be useful, although much of the additional detail will be evident from the base map.

The third-order subcategories of (010) "Urban and Community Functions" (the only third-order categories that have been developed) are as follows:

0120 Urban Core Functions

- 0121 Miscellaneous or N.E.C.*
- 0122 Food stores, N.E.C. (excluding supermarkets)
- 0123 Non-food retail sales, N.E.C.
- 0124 Non-professional services, N.E.C.
- 0125 Restaurant or other prepared food service
- 0126 Commercial lodging (transient)
- 0127 Entertainment or recreation (e.g., taverns, cinemas, etc.)
- 0128 Administrative or professional offices, N.E.C.

*N.E.C.: not elsewhere classified

0130 Wholesale, Warehousing or Light Industry

- 0131 Miscellaneous or N.E.C.
- 0132 Food products; production, storage or wholesale, N.E.C.
- 0133 Durable goods; storage or wholesale, N.E.C.
- 0134 Durable goods; manufacture, N.E.C.
- 0135 Construction; storage and related activities
- 0136 Grain storage, bulk
- 0137 Open storage, N.E.C.

0140 Major Public Buildings or Grounds

- 0141 Miscellaneous or N.E.C.
- 0142 City or town hall
- 0143 County courthouse
- 0144 Museum
- 0145 Library
- 0146 Auditorium, N.E.C.
- 0147 Church
- 0148 Cemetery

0150 Health and Public Services

- 0151 Miscellaneous or N.E.C.
- 0152 Hospital
- 0153 Clinic or medical center
- 0154 Fire station
- 0155 Police station, N.E.C.
- 0156 U.S. Forest Service station, N.E.C.
- 0157 National Guard or military reserve center, N.E.C.

0160 Post-secondary Educational Institution

- 0161 Miscellaneous or N.E.C.
- 0162 Junior college or other two year post-secondary
- 0163 College or university
- 0164 Vocational or trade school
- 0165 Special school, N.E.C.

0170 Elementary or Secondary Education

- 0171 Miscellaneous or N.E.C.
- 0172 Kindergarten or nursery school
- 0173 Elementary school
- 0174 Junior high or middle school
- 0175 High school
- 0176 Special or remedial schools for children

0180 Large-scale or High-impact Retail or Service

- 0181 Miscellaneous or N.E.C.
- 0182 Supermarket
- 0183 Major appliance or hardware sales
- 0184 Automobile sales (or sales and service)
- 0185 Automobile service (only)
- 0186 Farm implement or construction equipment sales
- 0187 Building or landscaping supply sales

0190 Vacant Land or Buildings, or Areas Being Converted in the
Community Center

- 0191 Miscellaneous or N.E.C.
- 0192 Unoccupied-never developed
- 0193 Land being developed
- 0194 Unused buildings - usable
- 0195 Unused buildings - not usable
- 0196 Unused buildings of recognized historical or architectural value

PART IV MAPPING

The main purpose of the Colorado Land Use Classification System is to provide for mapping land use according to a consistent system to meet needs for state, regional and local land use information. The System is adaptable to a wide range of mapping scales to meet various needs. For general planning purposes, however, a compilation scale of 1:24,000, with the option of producing 1:50,000 final maps, is suggested. This would permit uniform scale land use mapping for the entire state on the 1:50,000 county map series now being produced for Colorado by the U.S. Geological Survey. As a part of its cooperative mapping program, the state also has, or will soon have, complete aerial photographic coverage at 1:80,000, with enlargements coinciding with the USGS 7.5 minute quadrangle series. These 1:24,000 aerial photo enlargement prints will provide a base for compilation which should be useful for local planning and from which information can be transferred to the 7.5 minute quadrangle maps or reduced in scale and transferred to the 1:50,000 County Map Series. The classification system can also be used for mapping land use at larger scales for local community planning. Alternately, by using only the first-order categories, shown with point symbols where necessary, land use in the entire state could be mapped at 1:500,000.

The mapping system used should depend to some extent on the experience, qualifications, and preferences of the person doing the work and the characteristics of the area being mapped. The following procedures are suggested as a basic mapping system, to be modified as local conditions and needs require.

The System is intended for compilation at 1:24,000, using aerial photo enlargements as a base. Some classification should also be possible from the information on these enlargements. However, other information will also be required. This will probably be obtained by a combination of local familiarity, aerial photointerpretation and field checking. The 1:80,000 aerial photographs from which the enlargements are made may be used as one source of land use information, but larger-scale photos are preferable for most areas, if available. For maximum information from this source, stereoscopic interpretation with four-to-six times magnification is suggested.

Compilation consists of delineating first and second order categories on the photoquad enlargement and annotating them according to the numerical code. All areas larger than five acres (about 0.2 x 0.2 inches at 1:24,000) should be delineated if they are occupied by land uses of a category different from that of surrounding areas. Important land uses may be represented by point symbols where the actual area occupied is less than five acres. When mapping at scales larger than 1:24,000 smaller minimum areas can be differentiated. For larger scale mapping--as for community planning--land use may be indicated by individual parcels or parts of parcels.

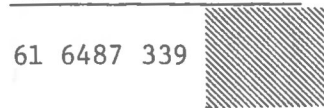
After compilation on the 1:24,000 aerial photo quadrangle enlargements, the information may either be transferred to 1:24,000 USGS 7.5 minute quadrangles, or to the 1:50,000 county map series.

Some adjustment is necessary in tracing land use boundaries from the photoquad to the map because of local relief distortion in the photoquad. This consists of shifting the photoquad on the map to match detail as well as possible while tracing land use boundaries from the photoquad to the map. Features which are satisfactorily delineated on the base map with linear or point symbols need not be further indicated on the land use map. Thus, for example, roads and power lines need no delineation other than that on the USGS quadrangle and scattered houses are adequately indicated on the USGS quadrangles.

For compilation on the photoquad enlargements, only the numerical codes need to be used. For map presentation, however, pattern or color symbols are recommended to emphasize areal and spatial relationships. Because of the costs of duplicating or printing colored maps, the pattern code may be best for most uses. A combination of numerical code symbols and patterns is suggested, using the patterns for first-order categories and numerical symbols for second-order classification. The following color and pattern codes are recommended in the interest of uniformity and consistency.

FIRST-ORDER SYMBOLS

Mecanorma Patterns



61 6487 339

010

Urban and Community functions



61 6487 184

020

Residential



61 6487 348

030

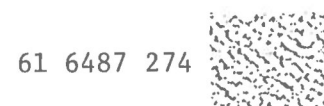
Heavy industry, transportation
and utilities



61 6487 276

040

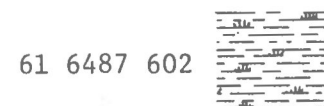
Resource extraction



61 6487 274

050

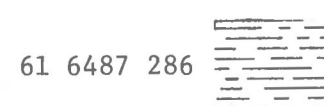
Developed recreation



61 6487 602

060

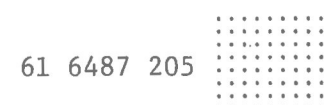
Irrigated farmland



61 6487 286

070

Unirrigated farmland



61 6487 205

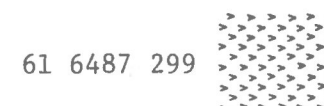
080

Range grazing

(No Pattern)

090

Low-impact land use



61 6487 299

100

Major military installation

Mecanorma Color

61 7012 137
(red)

61 7012 112
(orange)

61 7012 141
(purple)

61 7012 227
(grey)

61 7012 215
(olive)

61 7012 156
(green)

61 7012 228
(tan)

61 7012 117
(yellow)

Light green or
no color
(base map color)

61 7012 186
(ochre)

SELECTED REFERENCES

- Alabama, Planner's Mapping and Classification Guide. Montgomery State Planning Division, 1973.
- Anderson, James R., "Land Use Classification Schemes," Photogram, Engr. April, 1971. P. 379-387.
- Anderson, James R., "Remote Sensing and Land Use Inventory and Mapping." Proc. Am. Soc. of Photogram. Fall Convention 1974. P. 66-71.
- Anderson, James R., E.E. Hardy, and J.T. Roach, A Land Use Classification System for Use With Remote Sensor Data. U.S. Geological Survey Circular 671. Washington, 1972.
- Austin, Morris E., Land Resource Regions and Major Land Resource Areas of the United States Agriculture Handbook 296. Washington, U.S. Dept. Agr. 1972.
- Clawson, Marion, and C. Stewart, Land Use Information. Baltimore, Johns-Hopkins Press for Resources for the Future, Inc., 1965.
- College of Forestry and Natural Resources, Colorado State University, Colorado Environmental Data Systems. Final report to Colorado Dept. of Natural Resources, 1972.
- Colorado Land Use Commission, A Land Use Data Base Structure. Denver, 1973.
- Horne, William W., "Why LUNR?", Proceedings of the Kodak Seminar on Aerial Photography as a Planning Tool. 1974.
- Mollahan, Kent. "Land Use Classification Project." Denver, Federation of Rocky Mountain States, 1971.
- Nez, George. "Toward a Common System of Land Use Classification." Tech. Paper No. 17, Denver, Federation of Rocky Mountain States, 1972.
- Postweiler, R.A., et. al., Western Mountain Region Study. Boulder, Univ. of Colo. Business Research Division, 1972.
- Urban Renewal Administration and Bureau of Public Roads, Standard Land Use Coding Manual (First ed.) Washington, 1965.