SIX-MILE FOLD
Natural Area Study

Department of Geography / University of Colorado

SIX-MILE FOLD

NATURAL AREA STUDY

Gary Heaslet and Dean G. Wilder

Editors

DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF COLORADO

Boulder, Colorado

1970

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FIGURES

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute, and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These included instruction of public school and university students, scientific research, recreation, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt that they would have liked to pursue certain themes in greater depth if they had had more time available. Nonetheless, they join me in expressing the hope that this report provides informative insights on a fascinating part of Boulder County.

The various chapters which appear in this study were originally submitted as special reports by the individuals indicated. They represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency or organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of

Boulder, the Boulder County Commissioners, the Boulder Valley RE-2 School District, and the University of Colorado Foundation for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

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The authors of this study wish to thank all of the people who assisted us in bringing together this information. In particular we wish to thank the librarians from the Western Historical Research Collection of Norlin Library of the University of Colorado, the people at the Boulder County Assessors' Office and the County Treasurer's Office, Harold Nesbitt of the Agricultural Stabilization and Conservation Service, Gary Hansen of Beech Aircraft Corporation, Bob Trenka and Vince Porreca of the Boulder County Planning Office, and Mrs. Anna B. Joder and Don Look of Look Photos for their personal assistance. We also wish to thank Mrs. Nancy Stonington for the cover design of this report, Mrs. Sue Middleton for the typing of the report, and Dr. Donald D. MacPhail for his guidance, assistance, and cooperation in this endeavor. Our thanks also go to Mr. Wilbert J. Ulman for his work with the copy camera and contact printer in the final preparation of the maps for publication.

The Authors

CHAPTER I. INTRODUCTION

Gary Heaslet and Dean G. Wilder

Boulder's rapid growth since the end of World War II has brought a significant change in the natural landscape of the area. Construction of highways, commercial and residential expansion, and building due to rezoning of agricultural areas has blanketed the Boulder area with cultural features. One result of this growth and development is a reduction in the natural attractiveness of the area.

The citizens of Boulder, recognizing the inevitable expansion of their city and its effects on the landscape, have enacted various types of ordinances and legislation that attempt to guarantee the preservation of the natural beauty of their community. The two best examples of this type of policy are the Blue Line and City Greenbelt Programs (City Manager, 1968).

In the process of adopting these programs, which aim to provide natural areas around and within the community, Boulder residents have become more sensitive to their environment. The orientation of most seems to be toward preserving areas for their visual appeal and aesthetic value.

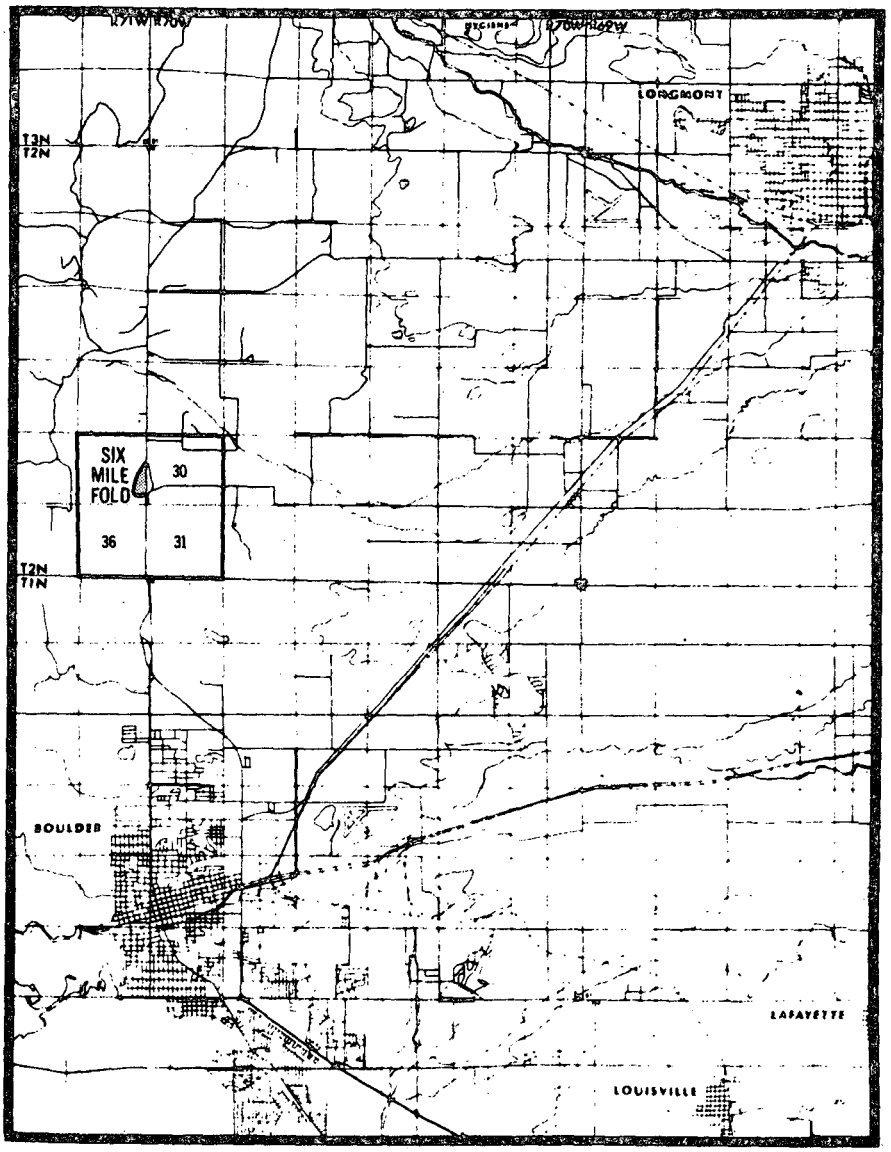
In addition to natural beauty, there are other criteria that should be considered in evaluating natural areas. These include the historical significance of the location, its potential for academic study or research, the possibility of the area serving as a neighborhood or community recreation area, or possibly restricted uses, as in the case of a floodplain.

The members of the Department of Geography seminar on land use decided in January of 1970 to undertake a study of six natural areas within a few miles of the University in an attempt to evaluate their merits for a number of alternate uses. A preliminary survey by the class identified the sites which had the greatest interest to a number of groups within the Boulder community. The main focus of study has been oriented toward identifying and analyzing specific natural areas in the Boulder community having one or more unique characteristics. The purpose of the seminar's activities was to provide a set of reports which would contain the pertinent information regarding each of these locations.

This report deals with the site known as Six-Mile Fold and is broken down into six sections: introduction; environmental survey; past, present, and future land use; land economics; cadastral and land tenure; and conclusions. Each section was prepared by a different team of graduate students, thereby providing a maximum amount of exposure to the various aspects of regional description and analysis.

Six-Mile Fold is located about 4 and 1/2 miles north of Boulder immediately west of Highway 7 (Figure 1). In the past, this area has been

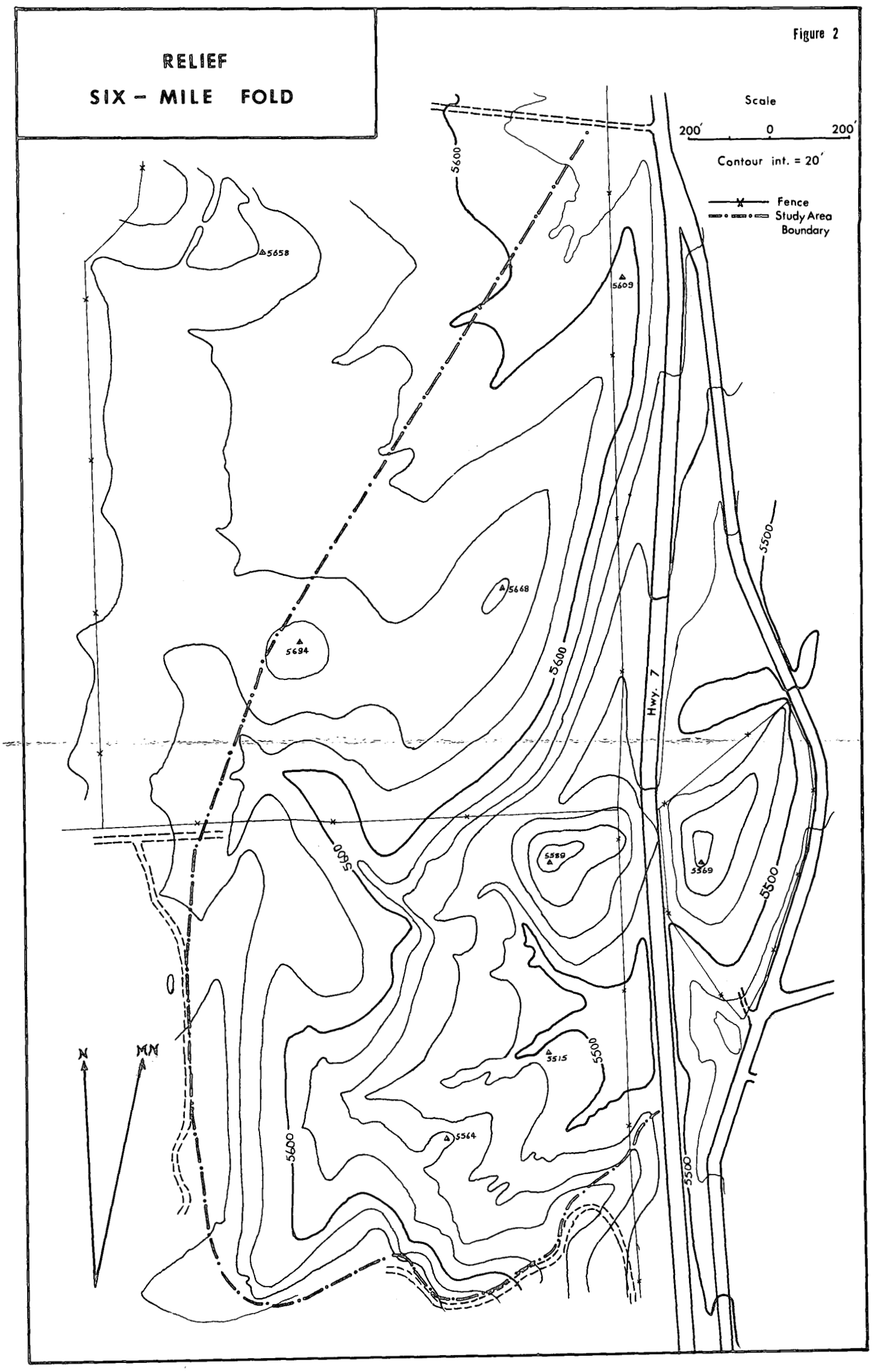
Figure 1



SIX-MILE FOLD
NATURAL AREA SITE

Figure 2

RELIEF
SIX – MILE FOLD



the scene of many field trips conducted by various departments of the University of Colorado (Figure 2B). A wide array of natural phenomena, of interest especially to students of geography, geology, and biology, are present within this relatively confined area. Although most intensively used for freshman sequence courses, upper-class as well as graduate courses have undertaken studies in this natural area with the permission of the landowners.

To illustrate the uniqueness of Six-Mile Fold as an area of interest, the following section will provide a description of the geology, soils, and vegetation found within the area of study. The study area, as shown in Figure 2, occupies approximately 70 acres.

References

City Manager, City of Boulder. 1968. Memorandum to City Council entitled "Plan for Implementing the Greenbelt Program," March 12, 1968. Boulder, Colorado

CHAPTER II. ENVIRONMENTAL STUDY OF SIX-MILE FOLD

Wil. Ulman and Robert Key

Six-Mile Fold owes its name to a long asymmetrical anticline and syncline on the lower slope of the foothills. To the untrained observer in the field, these features might easily go unnoticed. However, observed from the air, the anticline and syncline are visible as a light-toned "S" shaped curve on a dark background.

The foothills, paralleling Highway 7 northbound, are an expression of the upturned western edges of the sedimentary beds which dip eastward to the Great Plains. As the Front Range of the Rocky Mountains uplifted during the Cretaceous period, the overburden of thousands of feet of sedimentary rocks were forced to yield from their former horizontal position. Accompanying this uplift, frequent folding and warping occurred within the sedimentary strata. In this manner, Six-Mile Fold was formed. Where the stress of the slow continuous uplift exceeded the elasticity of the rocks faults and fractures resulted.

The anticline and syncline of the Six-Mile Fold maintain their topographic expression through the relative resistance of the Niobrara formation to erosion (Figures 2A and 3). The entire thickness of the Niobrara formation is approximately 400 feet. Throughout this sedimentary stratum, the uniformity of the formation varies. At the base of the formation lies the Fort Hayes member consisting of 20 feet of medium-bedded to massive, light gray, very fine-grained limestone. The remainder of the formation consists of a less resistant, highly calcareous shale which weathers a dark brown to black and is poorly laminated. Near the top of the Niobrara lies the Oysterbed member. Although considerably less resistant to differential weathering and erosion than the Fort Hayes member, the Oysterbed is more resistant than the middle portion of the formation.

The position of the Niobrara formation within the stratigraphic sequence of sedimentary beds gives rise to the topographic expression of Six-Mile Fold. Directly beneath the Niobrara and surfacing immediately west of Six-Mile Fold is the Benton shale formation, relatively soft and easily weathered and eroded. Thus, it is associated with valleys. Surfacing some distance east of the Fold, is the Pierre formation, also comparatively softer than the Niobrara with relatively little relief. Located between two beds of a less durable nature, the Niobrara naturally stands out in relief. Outcrops of the Fort Hayes limestone are especially visible because of the strikingly white coloration of this member. Easily observed on an air photography or traced in the field, outcrops of the twisted, folded and warped Fort Hayes limestone form the backbone of Six-Mile Fold (Figure 2A).

At the base of the southward plunging anticline and syncline, the Fort Hayes limestone dips beneath the less resistant upper members of the Niobara.

Figure 2A. Aerial view of Six-Mile Fold looking west. The surface trace of the Fort Hays member of the Niobrara formation appears as a light-toned band. It makes a distinct zig-zag at the folded geologic structure (A - S). Where the outcrop makes a sharp curve at the left (A), there is an anticlinal ridge produced by upfolding. The Fort Hays makes another sharp curve (S) which traces the limits of a small structural or synclinal valley produced by downfolding. A small water gap cuts into the outcrop left (south) of "S" and is seen in Figure 4. (Photo courtesy of the Department of Geological Sciences, University of Colorado)

Figure 2B. Under the guidance of a laboratory instructor, an undergraduate class in physical geography from the University of Colorado examines a fault exposed at Six-Mile Fold. Many classes in geology, geography, and biology visit the site each year. (Photo by Dennis Netoff)

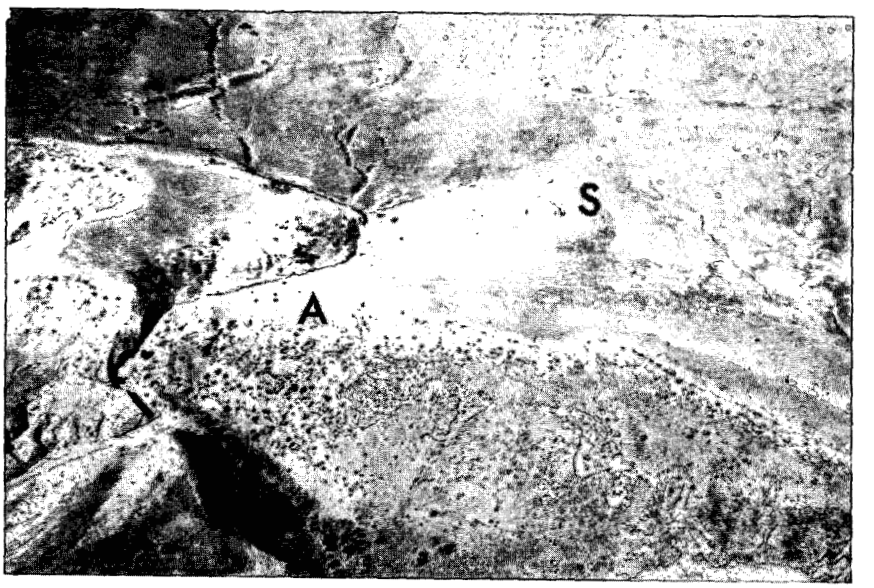
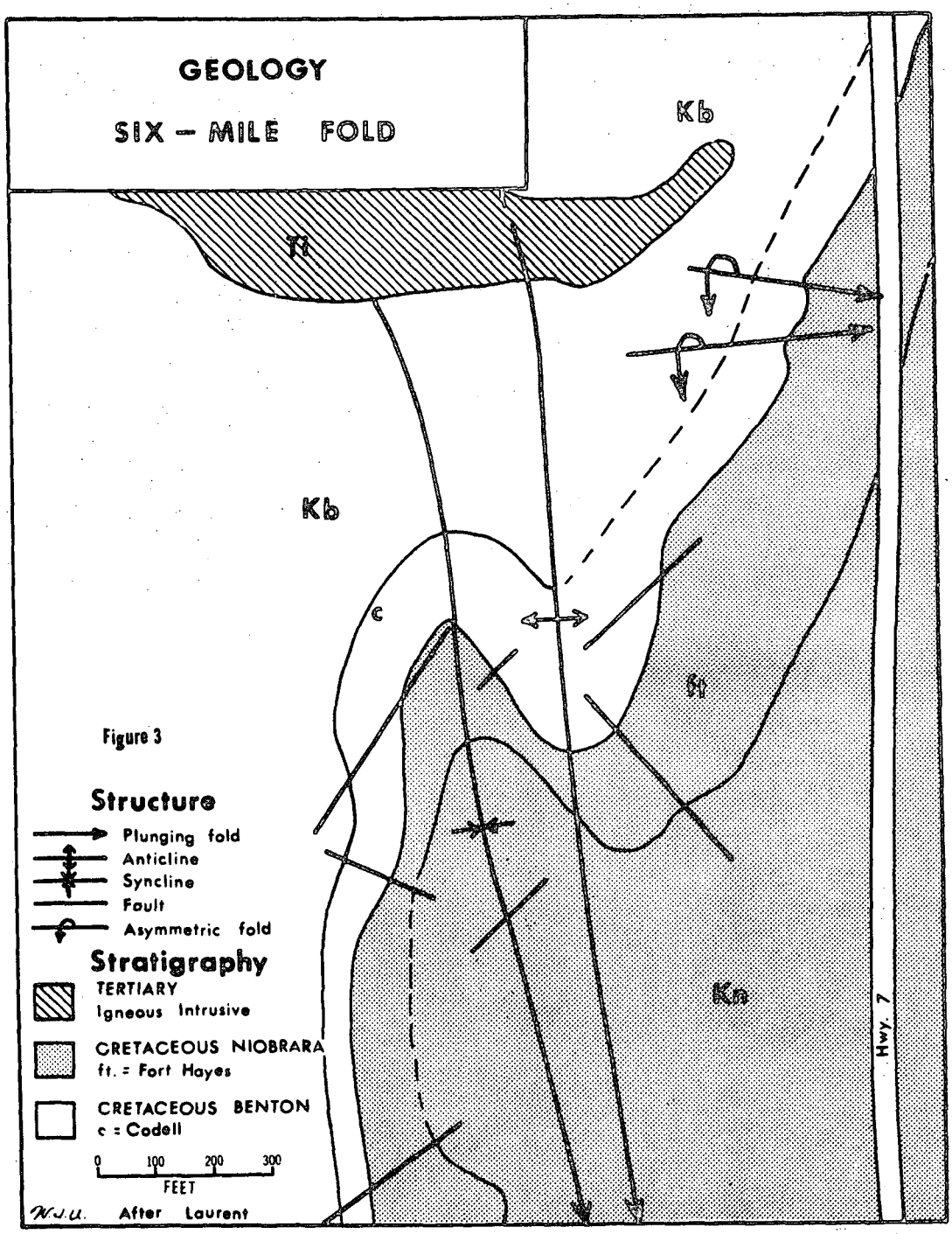


Figure 2A

Figure 2B


GEOLOGY
SIX – MILE FOLD
Kb
Tt
Kb
c
ft
Kn
Hwy. 7
Figure 3
Structure
Plunging fold
Anticline
Syncline
Fault
Asymmetric fold
Stratigraphy
TERTIARY
Igneous Intrusive
CRETACEOUS NIOBRARA
ft. = Fort Hayes
CRETACEOUS BENTON
c = Codell
0 100 200 300
FEET
N.J.U. After Laurent

A structurally controlled stream, which now flows westward at the base of the fold, formerly flowed to the northeast joining the well-marked arroyo channel directly north of the Fold. Stream piracy has since captured the former stream flow diverting the runoff to its present course. Where this stream now crosses the Fort Hayes limestone, its erosive action has cut a small water gap (Figures 2A and 5).

The less resistant portion of the Niobrara formation determines the area immediately south of the anticline and syncline. Only in the extreme southwest corner of the study area does the Fort Hayes member appear again. Here, the limestone beds are seen dipping sharply to the east at an angle of about 55 degrees. This outcrop forms an almost solid eastward dipping wall extending about 400 feet north from the stream entering the southwestern corner of the study area. Where this stream has cut through the Fort Hayes, another water gap has formed. Within this branch, the massive beds of the Fort Hayes limestone are most clearly visible.

Contrasting sharply with the northern two-thirds of the study area, the terrain in the southern portion is very rugged. Here, where the less durable members of the Niobrara formation lie exposed on top of the Fort Hayes, rapid erosion of the softer calcareous shales is manifested in the formation of numerous gullies depicting a badland-like topography devoid of vegetation.

Because all of the sedimentary beds in this area are of marine origin, the Niobrara and Benton are well endowed with preserved fossils (Figure 6). Inoceramus labiatus and Metoicoceral whitei, both fossils of the late Cretaceous age are found in the upper portions of the Benton shales. Exposed in the outcrops of the Fort Hayes member of the Niobrara are numerous Inoceramus deformus, a shell ranging up to 10 inches in diameter (Figure 4). The Oysterbed of the Niobrara derives its name from the abundance of Ostrea congesta pelecypods concentrated within this zone. Fossils found in the Niobrara have also been dated to the upper Cretaceous period.

Several well-defined faults are in evidence in the study area (Figure 2B). Two drag faults offset the smooth linearity of the Fort Hayes limestone outcropping in the "S" shaped curve of the anticline and syncline (Figure 2A). A nearly vertical reverse thrust fault has offset the normal bedding planes of the calcareous shale member of the Niobrara. This fault is located on an escarpment immediately south of the anticlinal nose (Figure 2B).

Facilitated by the semi-arid to steppe climate of the region, the geology of Six-Mile Fold has created a unique area of natural interest to earth scientists. These characteristics are also reflected in the soil development and consequent vegetation diversity found here.

Soils

A study of the soils in the Six-Mile Fold area reveals a diversity of soil types common to this area of Colorado. These soils are of low to moderate fertility, generally unsuitable for agricultural crops, but supportive

Figure 4. Niobrara Fossil

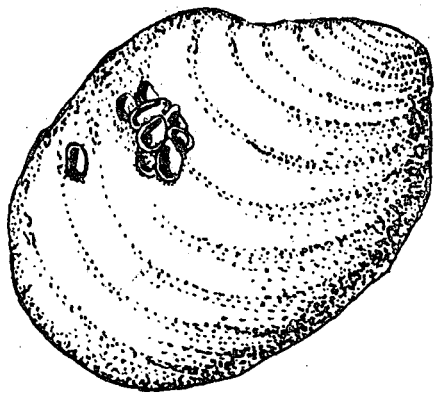
A fossil shell (Inoceramus deformus) is exposed in a rock outcrop of the Niobrara formation at Six-Mile Fold (note arrows).

Figure 5. Watergap at Six-Mile Fold

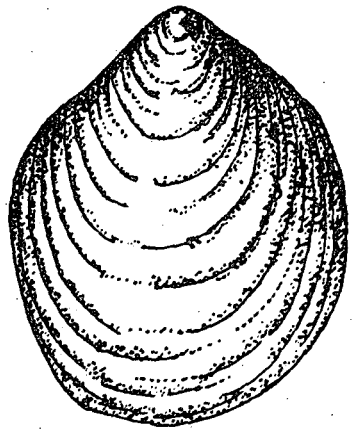
Looking east into the small synclinal valley at Six-Mile Fold (See Figure 2B). The Fort Hays member of the Niobrara formation outcrops in the foreground on the west limb of the syncline. The letter "S" of Figure 2A is located at the left of the small watergap in the Fort Hays (foreground) and off the photo.

Figure 4

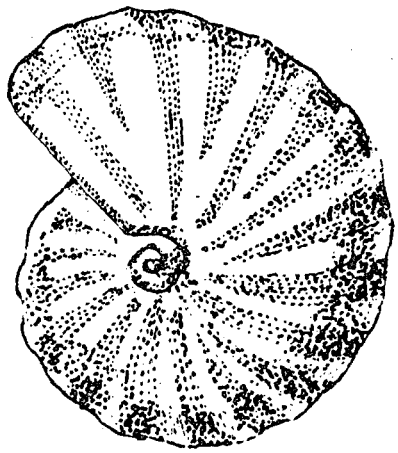
Figure 5



a. *Inoceramus deformis,* with a small colony of *Ostrea congesta* attached, from the Niobrara Formation (x 1/3).



b. *Inoceramus labiatus* from the Benton Formation (about natural size).



c. *Metoicoceras whitei* from the Benton Formation (about natural size).

Figure 6. Selected fossils found in the Six-Mile Fold area.

Source: John and Halka Chronic, "The Geologic Story of the NCAR Site" (Part I), Natural Features of the NCAR Site, p. 6. (Reproduced by permission of the National Center for Atmospheric Research)

of various grasses which make the area suitable for livestock grazing. The most fertile soil is found in the stream basins. This is evidenced by shallow profiles seen on embankments and by the dense growth of grass and shrub vegetation found in these areas.

Existing soil maps show only major soil types and do not indicate detailed sub-groups (Moreland, 1968). The major types and their descriptions are as follows (See Figure 7):

70-DE LaPorte very fine sandy loam (5 to 20%)

These are very shallow, well drained soils with very fine sandy loam or loam surface soils underlain by limestone at less than 20 inches. These soils are on upland slopes. Water intake rate is medium. Water-holding capacity is low. These soils are used primarily for rangeland. Erosion control is important on these soils. They have severe limitations for septic tank filter fields because of shallow depth.

24-C (3 to 5%) 24-D (5 to 9%) Nunn clay loam

These are deep, well-drained soils with clay loam surface soils and clay subsoils. These soils are on terraces and uplands. Water intake rate is low. Water holding capacity is high. These are good irrigated soils and are capable of producing good yields with good management. Slopes of more than five per cent should not be dry-farmed, because of the hazard of erosion. These soils have moderate to severe limitations for septic tank filter fields because of slow permeability. They have fair to good stability for embankments.

51-CD Samsil clay

This is a shallow, well-drained soil with clay or clay loam surface soil and underlain by shale at less than 20 inches. These soils are on uplands. Water intake rate is slow and water holding capacity is low. These soils are best suited for pasture. If irrigated, frequent light irrigations will probably be necessary to maintain sufficient available moisiure and avoid erosion. If not irrigated, proper range use is necessary to maintain desirable grasses and avoid erosion. These soils have severe limitations for septic tank filter fields and for foundations.

79-EF Lefthand stony sandy loam

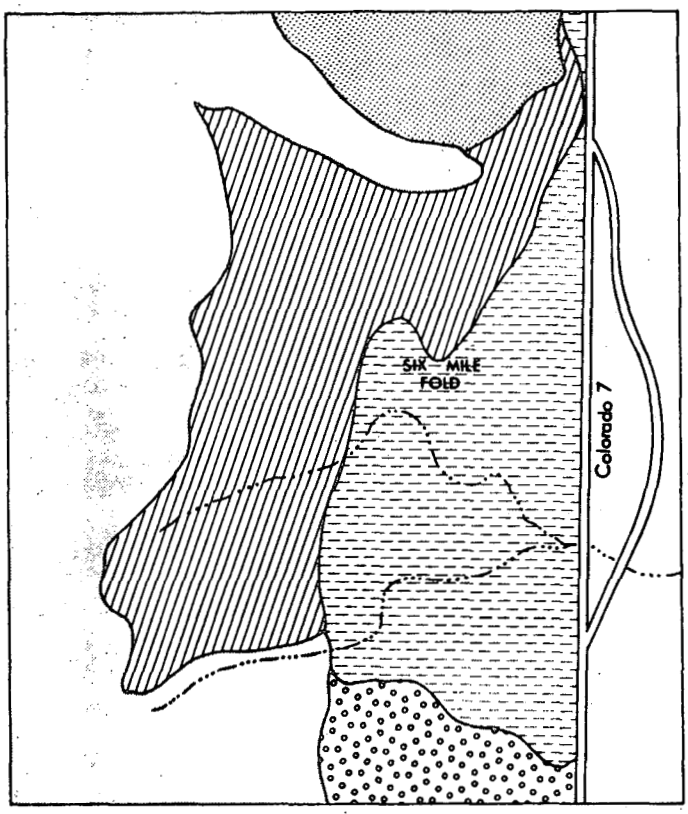
These are shallow, well-drained soils with sandy loam surface soils and underlain by sandstone by less than 20 inches. These soils have many sandstone rocks throughout. Water intake rate is rapid. Water holding capacity is low. These soils are suited only for pasture or range. Erosion control is necessary. These soils have severe limitations for septic tank filter fields. Excavation is difficult without blasting.

Limestone (LS) rock outcrop

These are areas of nearly bare rock outcrop. They include some areas of shallow soils and moderately deep soils that are on such steep slopes as to be unsuitable for anything but very limited grazing for wildlife and recreation.

Figure 7

SOILS
SIX – MILE FOLD



SOIL TYPE

- La Porte very fine sandy loam
- Nunn clay loam
- Samsil clay
- Lefthand stony sandy loam
- Rock outcrop

N

0 600 1200
Feet

Source: Soil Conservation Service

DAK

Vegetation

Six classifications of vegetation can be identified from field examination and analysis of aerial photos (Quick, 1970). These stands of vegetation reflect local variations in soils, the underlying geology, and in micro-climate (Figure 8).

Dense Grasses

Two areas are found at Six-Mile Fold with predominant grass vegetation. Along the northeast boundary on the western side of the anticlinal ridge, the grass is abundant but appears to have been heavily grazed in the past. Few other forms of vegetation are found in this area. The grasses are predominantly the short grass plains types such as Buffalo Grass (Buchloe dactyloides), Blue Grama (Bouteloua gracilis), and Brom (Bromus spp.). Here the soil appears well developed, with good moisture-retention qualities.

Sparse Grasses and Sparse Grasses with Yucca, Skunkbrush and Prickly Pear

These two categories of vegetation are found on the eastern side of the anticlinal area to the edge of the northern creek system. Sparse grass stands also predominate along the southeast portion of the study area. The vegetation is comprised of short grasses and xerophytic vegetation such as Yucca (Yucca glauca), Prickly Pear (Opuntia rafinesquei), and Skunkbrush (Rhus trilobata). In this area the soils are poorly formed, with the limestone occurring very close to the surface. Slopes are steep and moisture is not as available as in adjacent areas.

Skunkbrush, Hackberry and Occasional Wild Plum

This vegetation stand is found along the drainage systems of the two intermittent streams. These areas have the best soil profiles, composed primarily of colluvium, and adequate moisture. A third area is near the southwest corner of the study area. Here the limestone is highly fractured. The vegetation roots penetrate through the fractures where the moisture is available. The fractured limestone causes rapid infiltration of available moisture which then drains down the steep sides of the Niobrara to the stream bottom and watergap below. Vegetation is primarily composed of shrubs such as Skunkbrush, Hackberry (Celtis reticulata) and Wild Plum (Prunus americana).

This vegetation shows evidence of heavy browsing by deer. Raccoon, rabbit and coyote tracks were also found in the vicinity. A Prairie Rattlesnake was also seen nearby.

Willow and Cottonwood

Only two small standsof willow and cottonwood were noted, both near the confluence of the two streams. Willow (Salix spp.) and Cottonwoods (Populus spp.) are normally found in floodplains where the water table is close to the surface. Those found in the study area were small and shrub-like, indicating a relatively poor source of moisture.

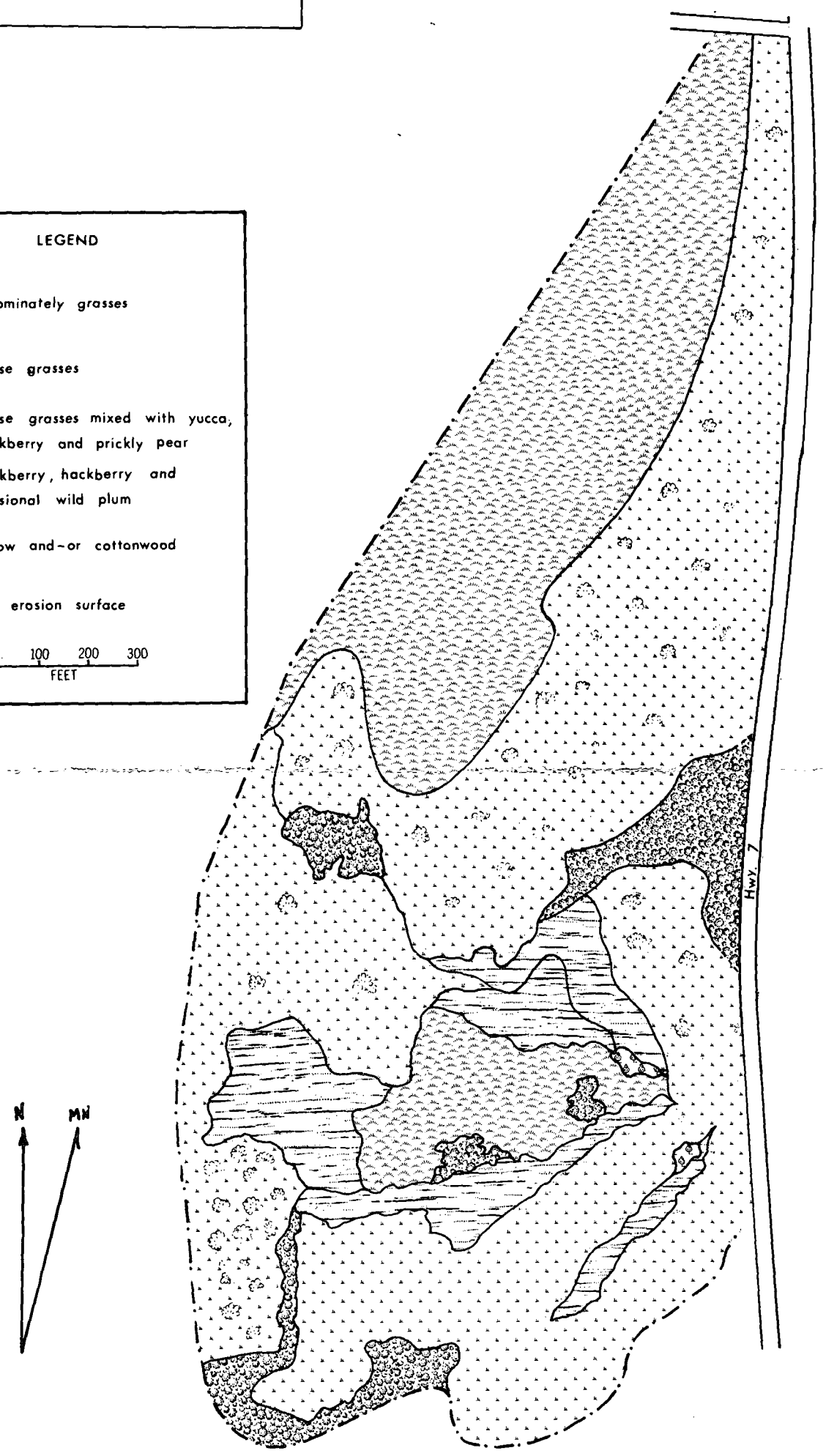
Figure 8

VEGETATION
SIX – MILE FOLD

LEGEND

- Predominately grasses
- Sparse grasses
- Sparse grasses mixed with yucca, skunkberry and prickly pear
- Skunkberry, hackberry and occasional wild plum
- Willow and-or cottonwood
- Bare erosion surface

0 100 200 300
FEET



WJU

Bare Erosion Surface

The last category reflects a lack of vegetation. These erosional surfaces are steep, with less than five per cent occupied by vegetation. Most of the material in this category is limestone outcrop or heavily eroded slopes where little moisutre is available for plants.

Summary

The uniqueness of Six-Mile Fold as a natural area is presented to the viewer as a striking change from the landscape existing immediately north or south. Certain characteristics of interest to both the natural and physical sciences are found within a relatively confined area. Six-Mile Fold is perhaps the most representative of folded strata along the foothills of the Front Range in the Boulder, Colorado area. The site also demonstrates a close inter-relationship between vegetation patterns and soil parent material. This combination of geologic and vegetative features, besides presenting a characteristic gross landscape, also develops a number of micro-environmental sites.

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Quick, Horace F. 1970. Professor, Department of Geography, University of Colorado, Boulder, Colorado. Identified the six categories of vegetation during a field trip at the study area, (March).

CHAPTER III. PAST, PRESENT AND FUTURE LAND USE

Dean G. Wilder, Jim Biggins and Helen Young

Land Use Survey

The Six-Mile Fold site is not isolated. Increasing settlement and use of adjacent land, as well as increasing traffic through the area, may affect the site indirectly. This may occur through potential air and water pollution and, more significantly, through trespassing. Accordingly, the changing land use patterns of the adjacent area were studied in an effort to learn what is happening to the whole area. The area chosen for study was believed to be definitive in terms of the kind of land use that has existed and does exist near Six-Mile Fold and the apparent trends that have occurred.

This area includes all of Sections 30 and 31, Township 2 North, Range 70 West, and the eastern halves of Sections 25 (which includes Six-Mile Fold) and 36, Township 2 North, Range 71 West. The area covers 3 square miles (2,240 acres), with Six-Mile Fold west of the center. The western portions of Sections 25 and 36 include parts of the first hogback at the edge of the foothills. This land has been used only for grazing, and because of its rugged nature, it is doubtful that it will be used for anything else in the near future.

The land use code used by the Denver Regional Council of Governments was followed in designating the types of land use (Figure 9). Land use patterns were determined by field inspection and by use of aerial photographs. The aerial photographs used were taken in 1938, 1956, 1963, and 1969 for the U.S. Department of Agriculture. All of the photos were taken in late summer, to best record agricultural land use. Determinations made from the photographs were plotted on maps at a scale of 1 inch to 1,000 feet.

It must be emphasized that more meaningful impressions regarding specific uses of land can be obtained from the maps than from descriptions. The following paragraphs are intended only to point out apparent trends in land use.

Historical Land Use

1938 - 1956 (See Figure 10)

Colorado Highway 7 (Boulder-Lyons Road or Foothills Highway) runs generally along the range line (R 70-71 W) that separates the eastern from the western sections of the study area. It serves a useful boundary line, because trends in land uses on either side of the highway are somewhat different. The highway itself was altered in this 18 year period: road cuts were made through the sloping ridges near the Six-Mile Fold site, so that

Figure 9

KEY TO LAND USE CLASSIFICATION CODE*

1 RESIDENTIAL

11 Single Family Dwelling

4 INDUSTRIAL

43 Secondary Metal Products Manufacturing, Processing, Fabrication, Assembly

8 PARKS AND RECRECATION

82 Outdoor Sporting, Recreation Facilities

9 AGRICULTURAL

92 Crop Production

93 Animal Production

94 Animal Husbandry Services

95 Pasture, Grazing Land

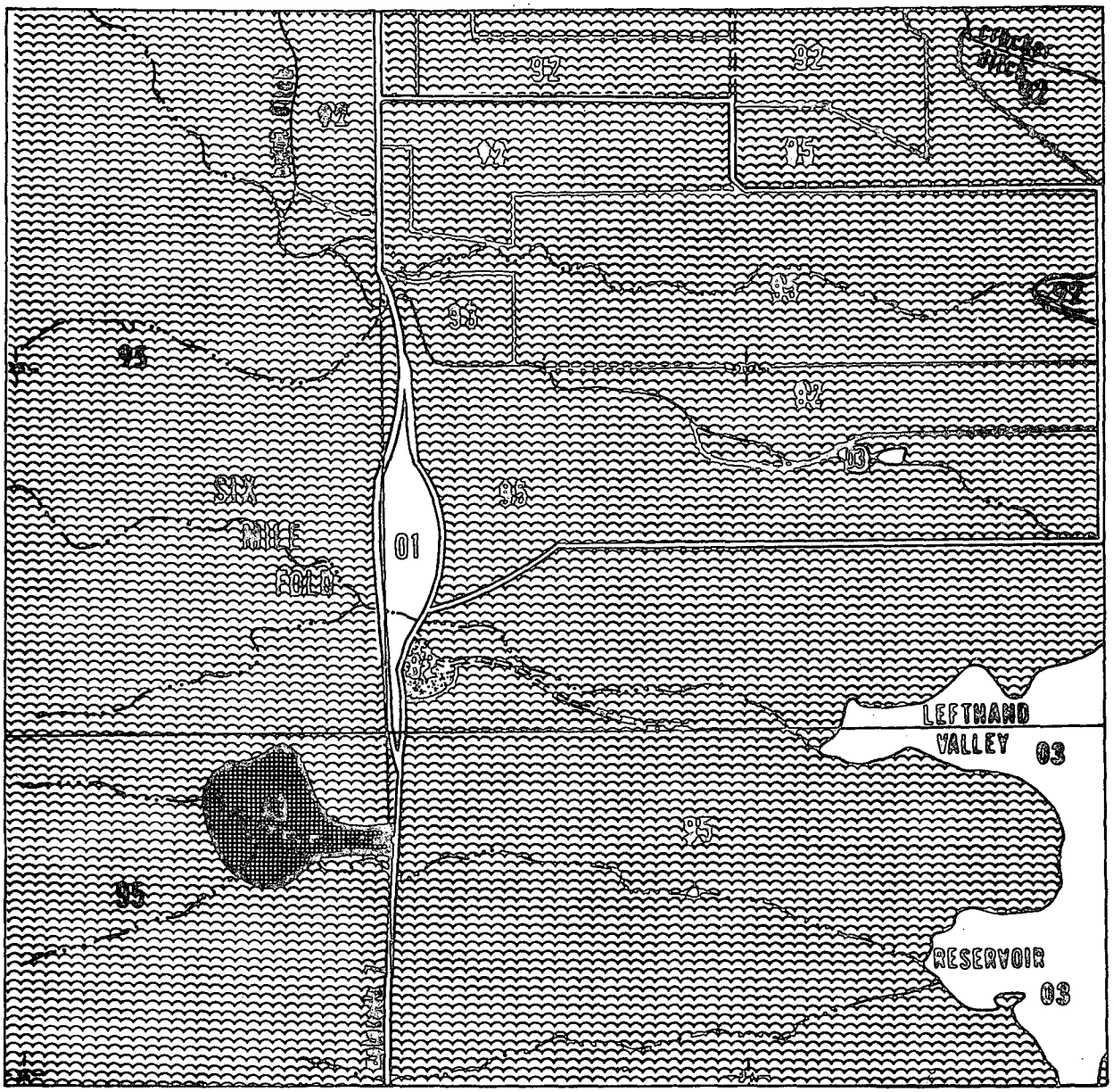
0 VACANT

01 Land

03 Water Area

* Categories are based on those used by the Denver Regional Council of Government.

Figure 10



LAND USE: SIX-MILE FOLD & AREA
1956

N

0 1000 2000
FEET

Location: Town 2 North, Ranges 70 & 71 West

the highway could take its present course between Sections 25 and 30. Minor changes were also made in the road that branches off to Niwot. Prior to 1956, there was an east-west road across the middle of Section 31; it was abandoned before 1956. It joined a road that was along the eastern boundary of the area, across land now flooded by Lefthand Valley Reservoir.

In 1938, about 14 per cent of the area was used for growing crops, probably hay, and the rest was grazing land. (See Table I) Between 1938 and 1956, agricultural land use "degenerated" in the sense that cropland acreage was reduced by one-half. Acreage used for grazing increased only slightly, however, because the parts of the area came under some new uses: a poultry farm was established northeast of Six-Mile Fold, Lefthand Valley Reservoir was constructed, and Beech Aircraft, Inc. began to occupy its present location south of Six-Mile Fold.

In summary, during the 1938 to 1956 period, about four per cent of the land in the area was converted to uses other than for crop growing and grazing. In addition, during this period there was a notable increase in the variety of uses of the land which contributed to the overall degredation of the original rural patterns of use. Thus, this period saw the beginning of change in land utilization from a predominantly agricultural area to one of varied land uses.

1956 - 1963 (See Figure 11)

Crop land declined slightly in acreage, and some of the land was put to other uses. Livestock raising (poultry and horses) was undertaken or expanded, about 30 acres were flooded by reservoirs, and Beech Aircraft, Inc. expanded its facilities. Some land was left idle.

Although 80 per cent of the area was still used for grazing, increasing diversification of land use meant that by 1963 grazing was reduced by about 150 acres. By the end of 1963 about 8 per cent of the area was being used for purposes other than grazing and crop growing. (Note: Six-Mile Fold and vacant land was not counted in estimating percentage.)

1963 - 1969 (See Figure 12)

Two important events occurred: Beech Aircraft, Inc. continued to expand, and single-family residences were built northeast of Six-Mile Fold. During this brief period, grazing land continued to decline in acreage, but crop land increased slightly. More important, however, is that resident population in the area increased from about 21 in 1963 to over 100 in 1969. (Note: Estimation based on assuming three persons per house). In addition, 14 per cent of the land was used other than to grow crops or to graze animals. Thus, there were more changes in the area between 1963 and 1969 than in the entire previous 25 years.

Summary and Predictions

East of Colorado Highway 7 the land is naturally terraced, and only moderately suitable for agricultural use. In general, and typical of this region, the upper parts of the terraces are difficult to irrigate and are best suited for grazing, whereas lower ground can be irrigated and used for crop growing.

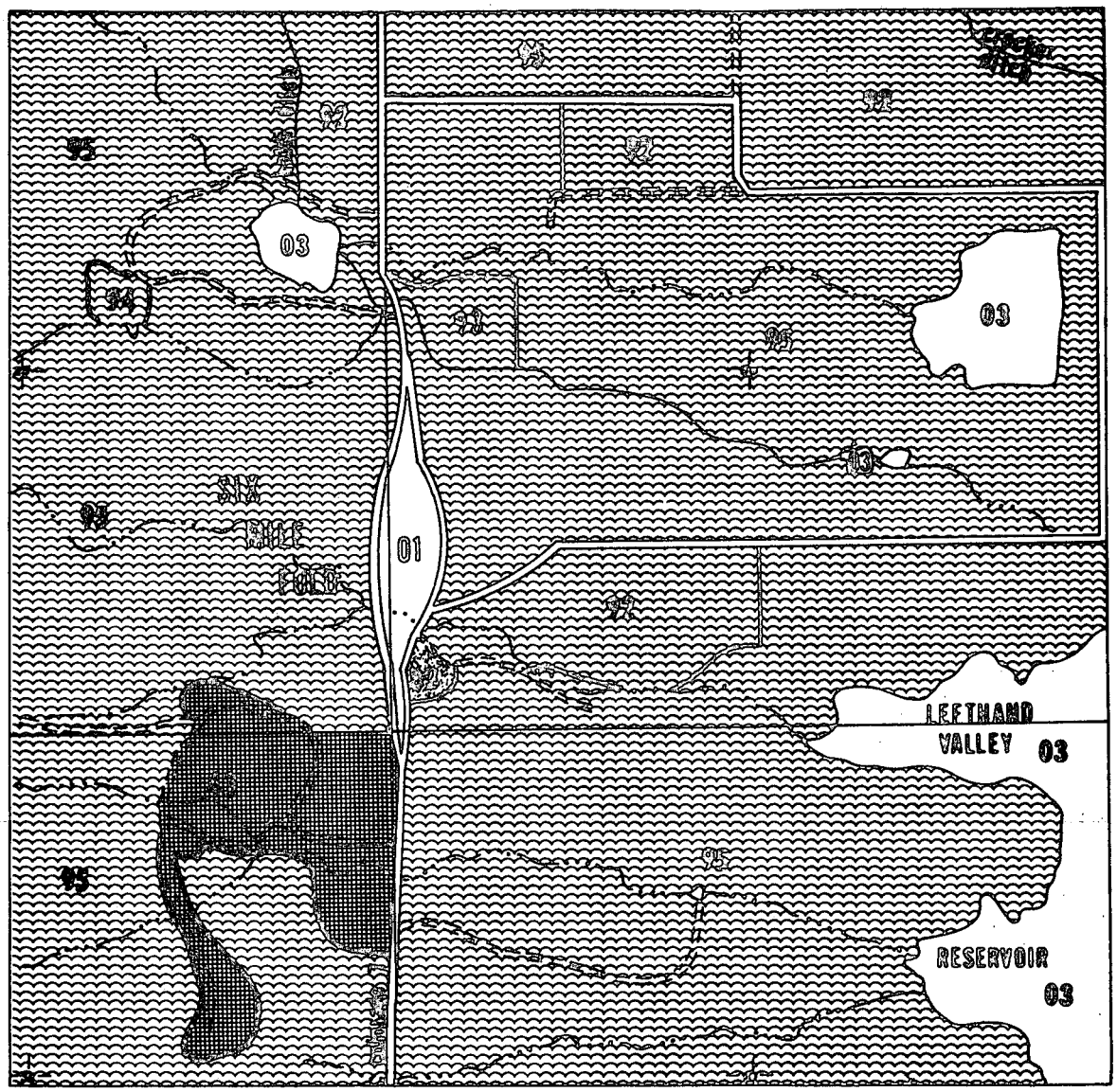
TABLE 1. ESTIMATED ACREAGE OF LAND USE[1]

Category[2]	1938	1956	1963	1969
Crop Production	330	164	140	160
Pasture, Grazing	1,910	1,973	1,821	1,767
Reservoirs	-	60	90	90
Secondary Metal Products Manufacturing (Including parking lots)	-	20	52+	60
Vacant Land	-	11	56	46
Animal Production	?	12	12	12
Six-Mile Fold (Scientifically used)	-	-	65	65
Animal Husbandry	-	-	4	4
Single-Family Residence	-	-	-	35
Recreation (Outdoor facilities)	-	-	-	1

[1]Estimated acreage was based on a total 2,240 acres within the study area.

[2]Categories are based on those used by the Denver Regional Council of Government.

Figure 11



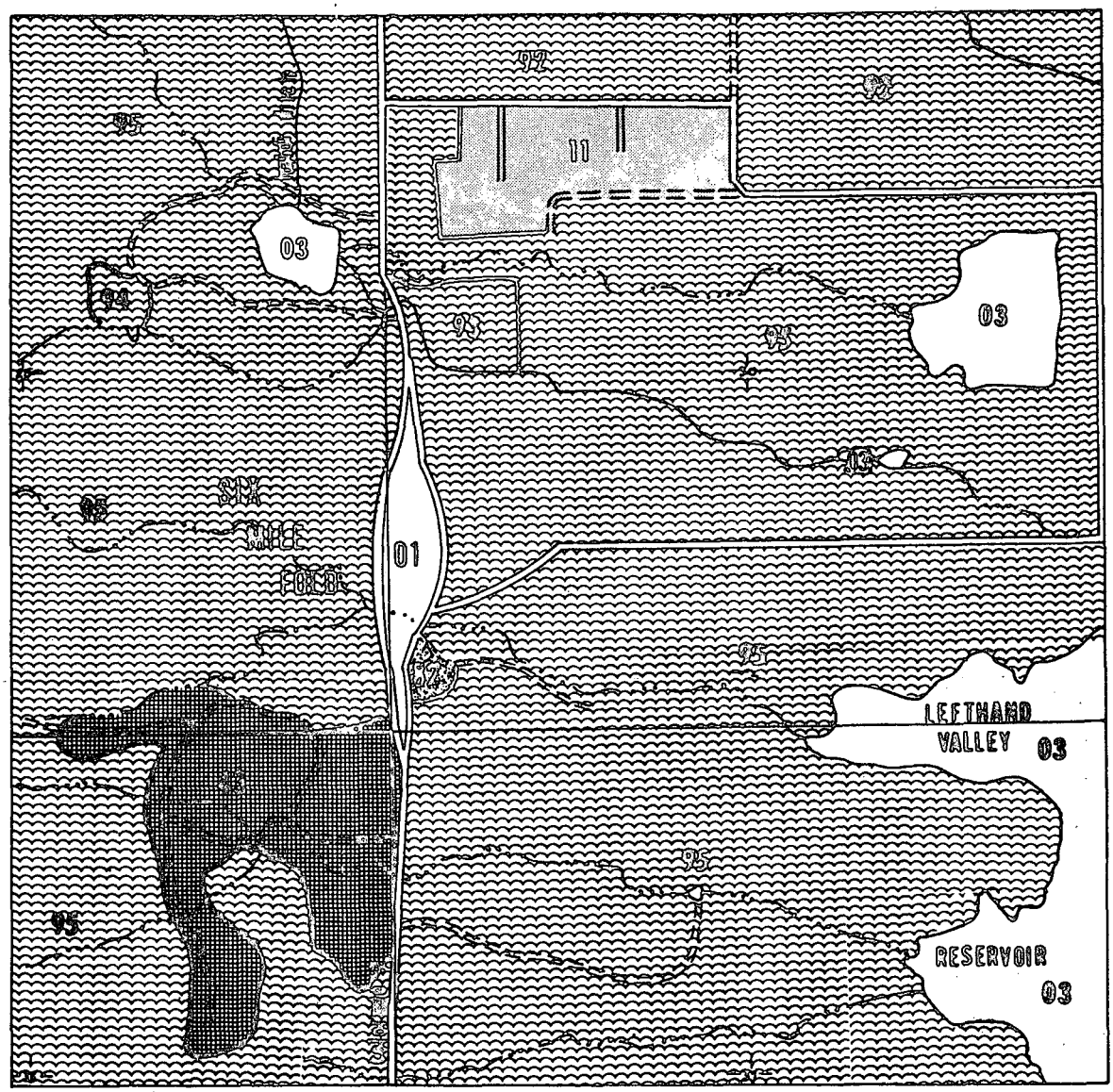
LAND USE: SIX-MILE FOLD & AREA
1963

N

0 1000 2000
FEET

Location: Town 2 North, Ranges 70 & 71 West

Figure 12



LAND USE: SIX-MILE FOLD & AREA
1969

N

0 1000 2000
FEET

Location: Town 2 North, Ranges 70 & 71 West

West of the highway the land varies from gently rolling to moderately rough, and would probably be judged as Class IV to Class VI land in the land capability scheme used by the Soil Conservation Service (Soil, 1957). Class IV to Class VI land ranges from land with severe limitations in choices of crop to severe limitations on use as pasture land. Some of the land in the Six-Mile Fold site is deeply gullied so that use even for industrial sites might be impractical.

Agricultural land use declined from 100 per cent of the area in 1938 to 86 per cent in 1969. It seems unlikely that more irrigation water can be obtained, and without irrigation, agriculture in the area will probably continue to decline. The tendency towards other land use points to a further decline in agriculture, and an increase in residential use. From the estimates of population in 1963 and 1969, it is possible to predict 144 residents by 1972 and 240 by 1980. These estimates are conservative. With decreasing distance to Boulder and Longmont as the cities expand, the Six-Mile Fold area should become even more populated than previously indicated.

It should be pointed out that the land east of Colorado Highway 7 is, in many respects, on the verge of development for residential subdivisions, assuming adequate sewage and water facilities can be provided. It is essentially level, geologically stable, and close to shopping facilities and employment centers via an all-weather highway.

References

Soil, Yearbook of Agriculture, 1963. 1963. U.S. Government Printing Office, Washington, D. C.

CHAPTER IV. LAND ECONOMICS

William Callahan and John Harper

Introduction

The figures indicated on the 1970 land economics map (Figure 13) are the fair market values of the land (in terms of dollars per acre) as classified by the county tax assessor. These figures were derived by multiplying the assessed value (defined as 30 per cent of the fair market value) of each parcel of land by 3.3, and then dividing the resultant figure by the number of acres included within that parcel. The figures on the 1950 map (Figure 14) are also fair market values, but, in 1950 the assessed value was defined as 18 to 20 per cent of the fair market value. Therefore, these figures were derived by multiplying the assessed value by 5.0, and again dividing by the number of acres involved. The values should be used primarily for comparison between the two maps and within each individually. In this way, changes in land value through time and space can be visualized.

Land Valuation

Most of the area under study is classified as agricultural (especially grazing) land, but purchases in the area, especially along the major arteries, reflect a transition from agricultural usages to industrial and residential developments. Actual land values, therefore, must be derived by other means. An excellent representative sample is the "Saddle Club Acres" subdivision (T 2 N R 70 W, Section 30). Table II shows the fair market values and sale prices of 12 lots in this subdivision. The average dollar-per-acre figures are an indication of the wide differentiation between assessed and actual land values in the area.

Mineral Rights

Mineral rights are also assessed by the county tax office. In Section 25 (T 2 N R 71 W) minerals are assessed at $2.00 per acre. This value is not included in the figures included on the land economics maps. Coal rights under the Beech Aircraft Corporation's holdings belong to the State of Colorado. They are, therefore, not taxed (or assessed). When mineral rights are severed from the surface rights as they are in portions of Section 30 (T 2 N R 70 W) they are assessed at a maximum of $1.00 per acre to a minimun of $10.00 for an entire holding.

Mill Levy

The tax rate for any parcel of land can be determined by using the mill levy (1 mill = .1 cent). For example, in Section 36 (T 2 N R 71 W) the mill levy is 78,334 mills or $78.334 per $1,000 of assessed value. In

Figure 13

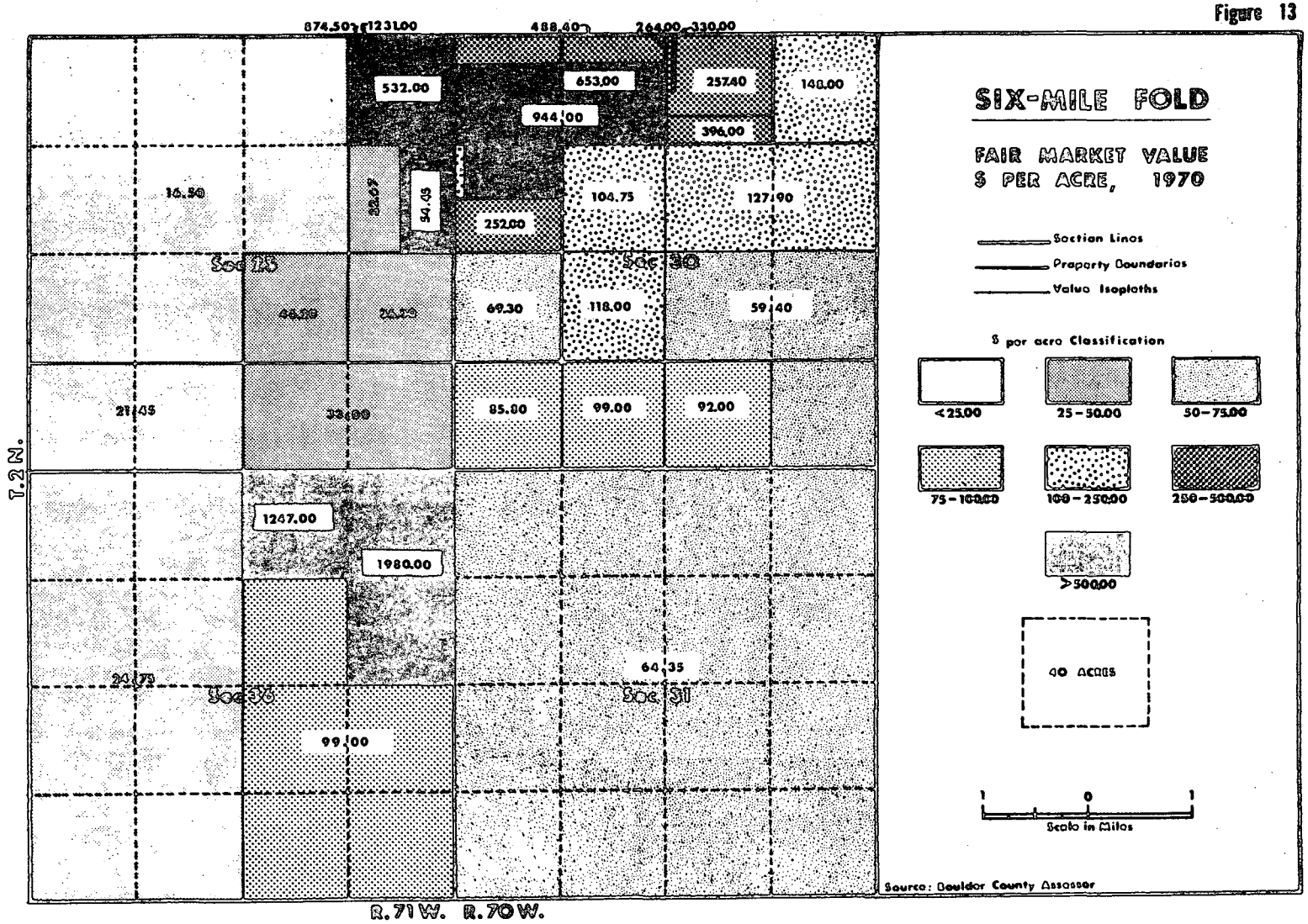

874.50
1231.00
488.40
264.00
330.00
532.00
653.00
257.40
148.00
944.00
396.00
16.50
33.07
34.43
104.75
127.90
252.00
Sec 25
Sec 30
48.50
24.25
69.30
118.00
59.40
21.45
33.00
85.00
99.00
92.00
1247.00
1980.00
24.75
Sec 36
Sec 31
64.35
99.00
T.2 N.
R.71 W.
R.70 W.
SIX-MILE FOLD
FAIR MARKET VALUE
$ PER ACRE, 1970
Section Lines
Property Boundaries
Value Isopleths
$ per acre Classification
<25.00
25-50.00
50-75.00
75-100.00
100-250.00
250-500.00
>500.00
40 ACRES
1 0 1
Scale in Miles
Source: Boulder County Assessor

Figure 14

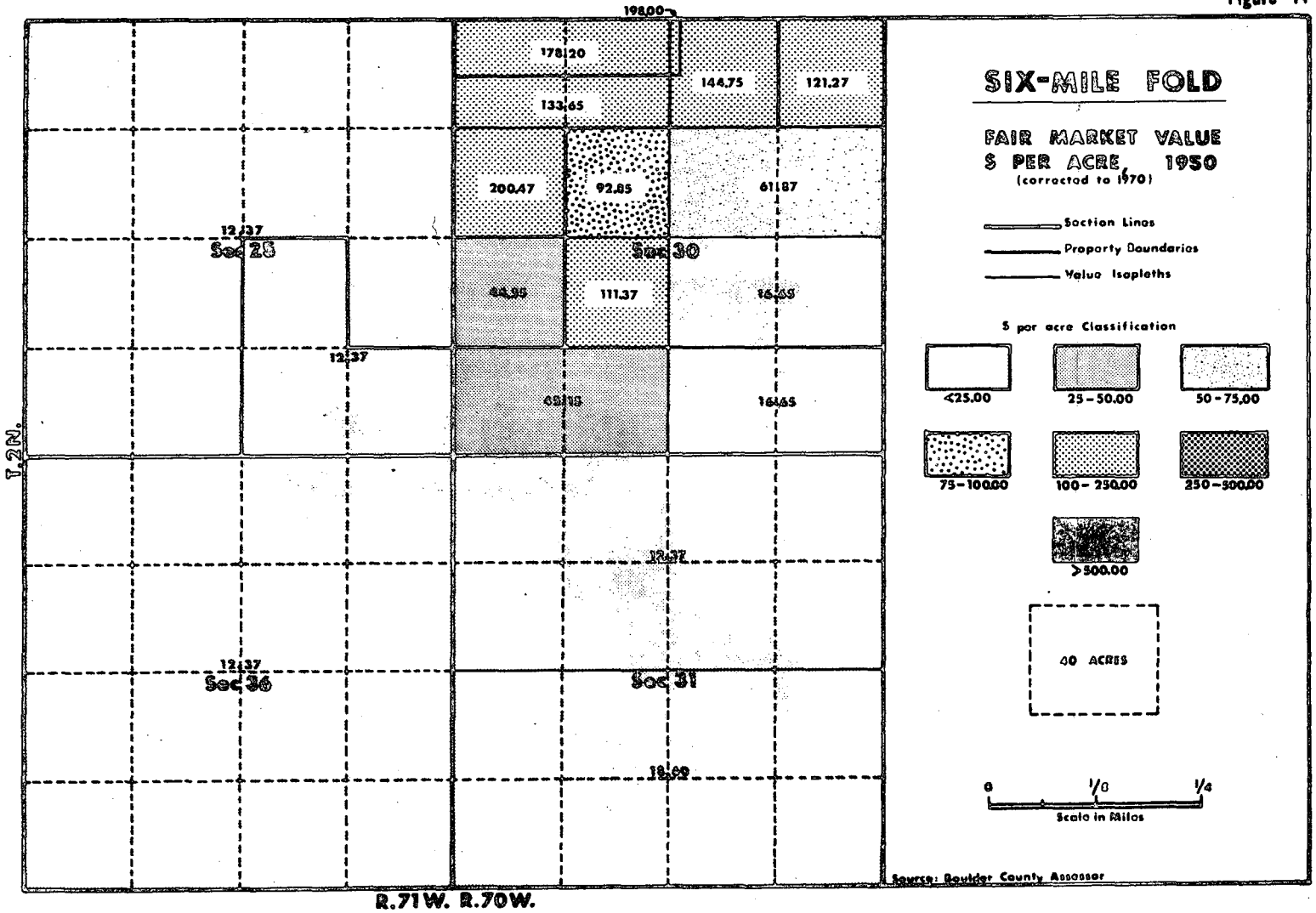

198.00
178.20
144.75
121.27
133.65
200.47
92.85
61.87
12.37
Sec 25
Sec 30
111.37
12.37
12.37
Sec 36
Sec 31
T.2N.
R.71W.
R.70W.
SIX-MILE FOLD
FAIR MARKET VALUE
$ PER ACRE, 1950
(corrected to 1970)
Section Lines
Property Boundaries
Value Isopleths
$ per acre Classification
<25.00
25-50.00
50-75.00
75-100.00
100-250.00
250-500.00
>500.00
40 ACRES
0
1/8
1/4
Scale in Miles
Source: Boulder County Assessor

TABLE II. SADDLE CLUB ACRES - FAIR MARKET VALUE BY LOT

Lot Number	Acreage	Fair Market Value (3.3 times the assessed value)	Sale Price
1	4.5	$ 3,630	$ 3,000
2	4.5	3,630	3,700
3	3.3	3,630	6,640
4	3.3	3,630	3,000
5	3.3	3,630	6,500
6	3.3	3,630	3,000
7	3.4	3,630	6,000
8	3.4	3,630	7,750
9	3.0	3,630	6,500
10	3.0	3,630	10,300
11	7.0	3,630	7,810
12	7.0	3,993	9,530
	Total:	$43,923	$73,730
		($896.4/acre)	($1,504.7/acre)

Extremes

Lot 10 = $3,433 per acre

Lot 4 = $ 909 per acre

Section 25 (T 2 N R 71 W) and Sections 30 and 31 (T 2 N R 70 W) the levy is 67,360 mills per thousand.

Improvements

The value of improvements placed on the land (buildings, etc.) has not been included in the value of the land itself. The value of improvements, however, can be an indication of land use and land values. A grouping of $10,000 homes does not carry the same implications as does a grouping of $50,000 homes. For this reason a listing of the major improvements in the area is offered in Table III.

Summary

The two maps (Figure 13 and 14) and Table II indicate the major economic trend of the area, namely rising land values. In 1950, (Figure 14) the Beech Aircraft Corporation was not located in the area, and the entire

TABLE III. ASSESSED VALUE OF IMPROVEMENTS OF SELECTED LOCATIONS

Name of Owner	Assessed Value of Improvements*	Section Location
R. J. Wright	6,580	25 NE¼ of NE¼
Anna B. Joder	9,020	25 NE¼ of NE¼
Frank Campbell	5,050	30 NE¼ of NE¼
Edythe M. Snyder	2,400	30 NE¼ of NW¼
Robert G. Schooley	14,510	30 SW¼ of NW¼
Beech Aircraft Corporation	233,890	36 NW¼ of NE¼
Left Hand Water Supply Company	5,620	30 NE¼ of SW¼
Left Hand Water Supply Company	1,260	30 NW¼ of SE¼
Saddle Club Acres		
Lot No. 1	7,160	30 NW¼
2	7,740	
3	6,730	
4	6,380	
5	9,370	
6	6,470	
7	6,960	
8	6,870	
9	5,900	
10	7,040	
11	6,300	
12	6,340	

* To obtain the fair market value, multiply by 3.3

area of Sections 25, 31, and 36 were valued at less than $15.00 per acre (fair market value). Only portions of Section 30 displayed some degree of correspondance to contemporary prices. Most land was agricultural, and was, therefore, assessed under that classification. The lowest value per acre was $12.37 while the highest value was a modest $200.47.

The past 20 years have seen value increases of at least 100 per cent in all but the northwest portion of Section 25. The Beech Aircraft holdings have displayed the most drastic rise. (The NE¼ and the SE¼ of Section 36 have increased a phenomenal 15,000 per cent). This inflation has affected surrounding land values as well. Furthermore, increased amounts of marginal farmland have been residentially developed, explaining the sharp increase in land values in the north central portion of Figure 13. This is the Saddle Club Acres Subdivision mentioned earlier.

An analysis of the above shows clearly that increased land values in the area have been accompanied by an intensification of land uses which will in turn command higher land prices in the future.

CHAPTER V. CADASTRAL AND LAND TENURE

Scott Mernitz, Max Dodson, and Michael Tripp

Introduction

The study area for the cadastral and land tenure segments of the survey on the Six-Mile Fold Site was enlarged to include all of Sections 25 and 36, T 2 N R 71 W, and Sections 30 and 31, T 2 N R 70 W. This chapter briefly traces changing ownership patterns and present land tenure in the designated area during the period 1880 to 1970.

Past Cadastral Patterns

Fully one-half of the study area (Sections 25 and 36) remained vacant in 1880. According to the Boulder County Assessor, this portion was most probably owned by the U.S. Government rather than the State of Colorado. Seven individuals owned the land comprising Sections 30 and 31 with one owner holding 800 acres. Each of the other six holdings were much smaller, the next largest being 160 acres (Figure 15).

By 1910 both Sections 25 and 36 were in private ownership. Six new owners are indicated in Sections 30 and 31, but only two boundary changes occurred (Figure 16).

The changes between 1910 and 1930 echo those of the earlier period. Ownership changed on all parcels, but only two small boundary line changes took place. Parcel size remained essentially as before (Figure 17).

Basically the same pattern is revealed on the 1950 map. With one exception, a complete change of ownership occurred. Boundary lines remained static except for consolidation of all acreage in Section 31 into a single holding (Figure 19).

Present Cadastral Pattern

The 1970 map reveals an interesting combination of consolidation and fragmentation of property holdings. The light industrial concern of Beech Aircraft Corporation acquired possession of Sections 36 and 31 as well as the south one-half of the south one-half of Sections 25 and 30, a total of 1,600 acres. Most recently, the development of Saddle Club Acres has involved the creation of numerous 2 to 5 acre lots and subsequent home-building. There are presently 15 relatively new homes in this development, all owner-occupied with the exception of one vacant home being offered for rent.

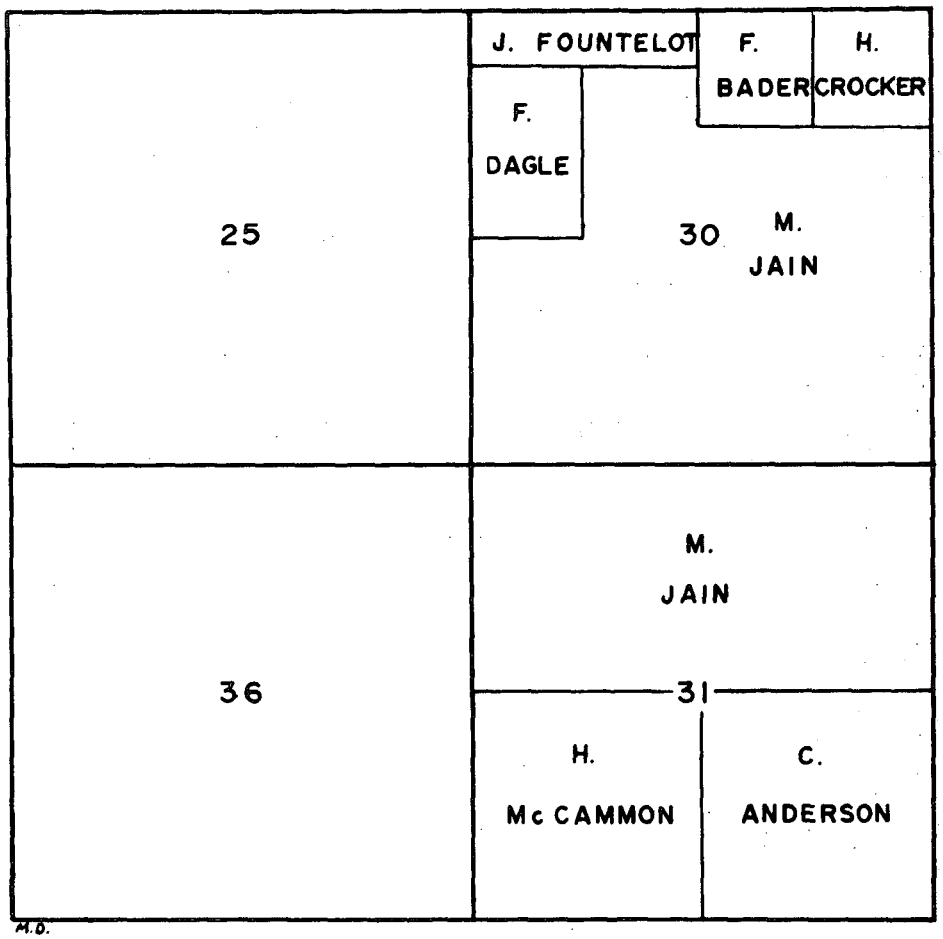

1880
J. FOUNTELOT
F. BADER
H. CROCKER
F. DAGLE
25
30
M. JAIN
M. JAIN
36
31
H. Mc CAMMON
C. ANDERSON
M.D.

Figure 15

1910

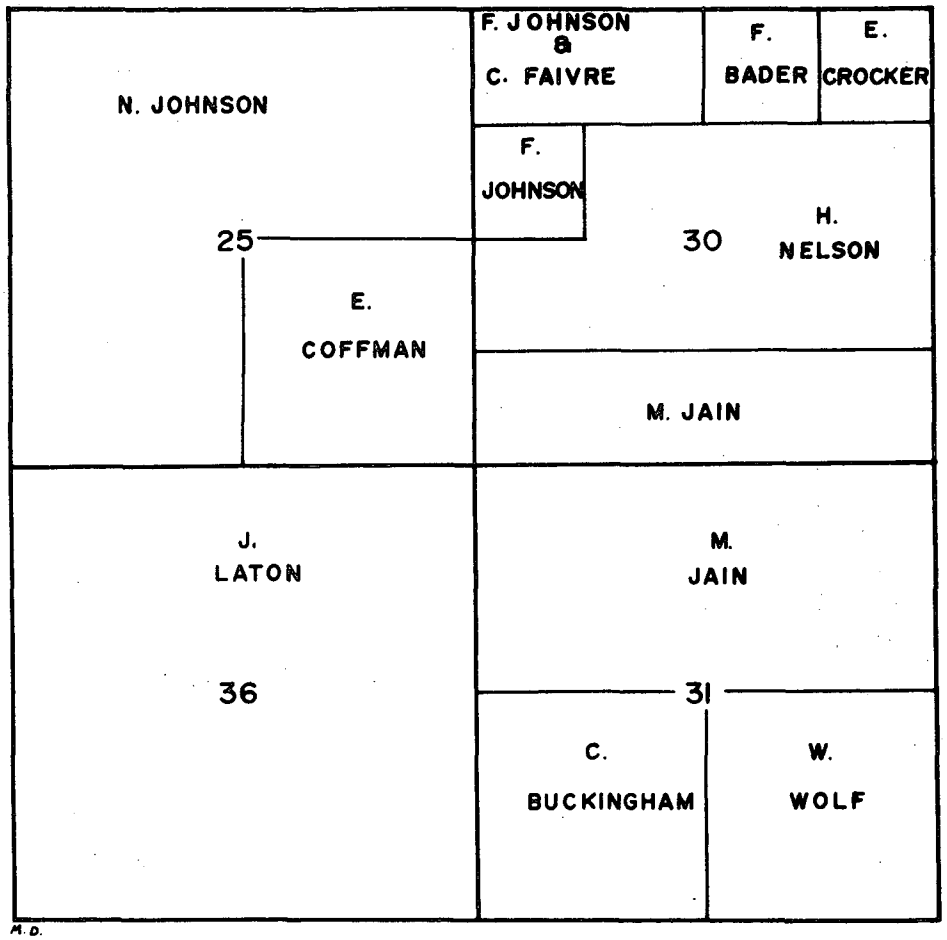
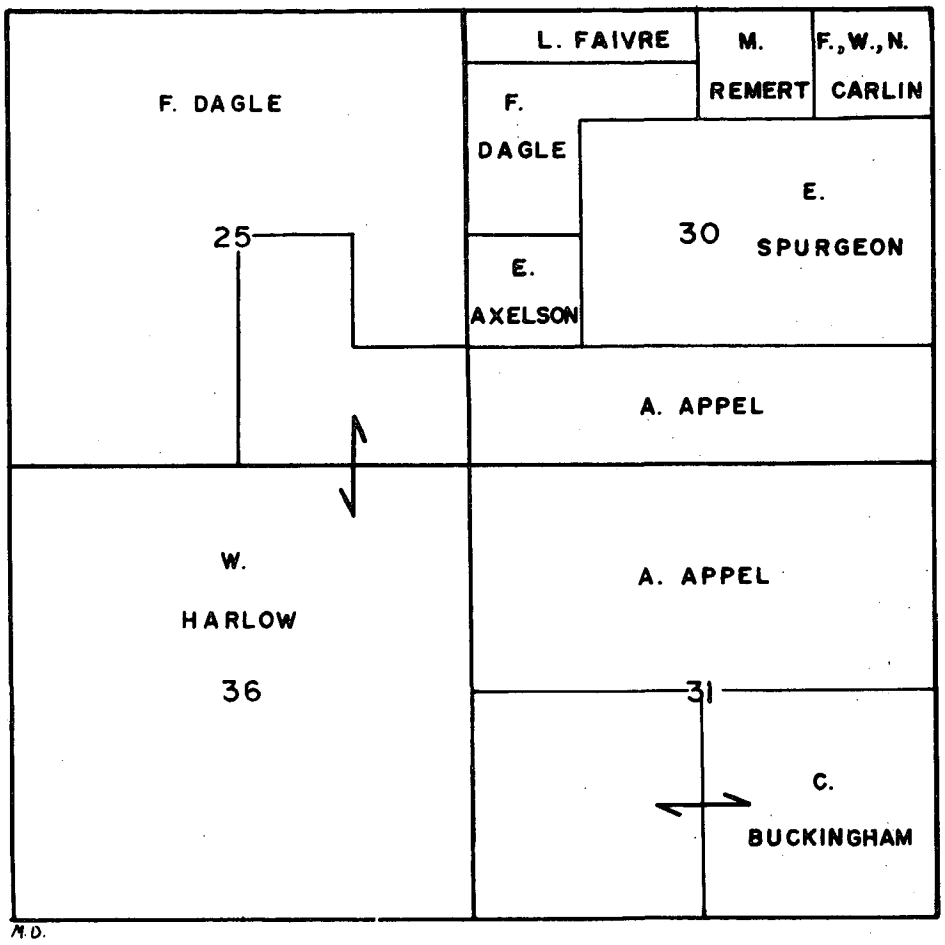


Figure 16

1930


L. FAIVRE
M.
REMERT
F., W., N.
CARLIN
F. DAGLE
F.
DAGLE
E.
30
SPURGEON
25
E.
AXELSON
A. APPEL
W.
HARLOW
36
A. APPEL
31
C.
BUCKINGHAM
M.D.

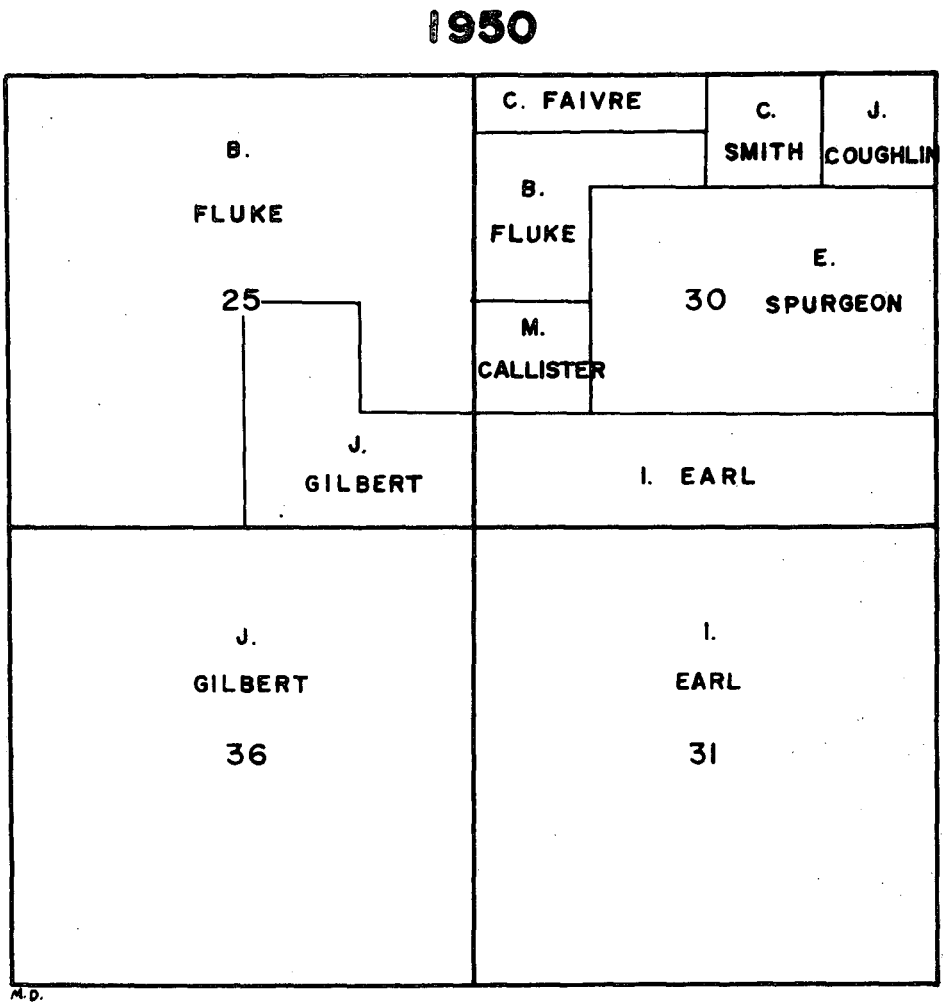

1950
C. FAIVRE
C. SMITH
J. COUGHLIN
B. FLUKE
B. FLUKE
25
E. SPURGEON
30
M. CALLISTER
J. GILBERT
I. EARL
J. GILBERT
36
I. EARL
31
M.D.

Figure 18

1970

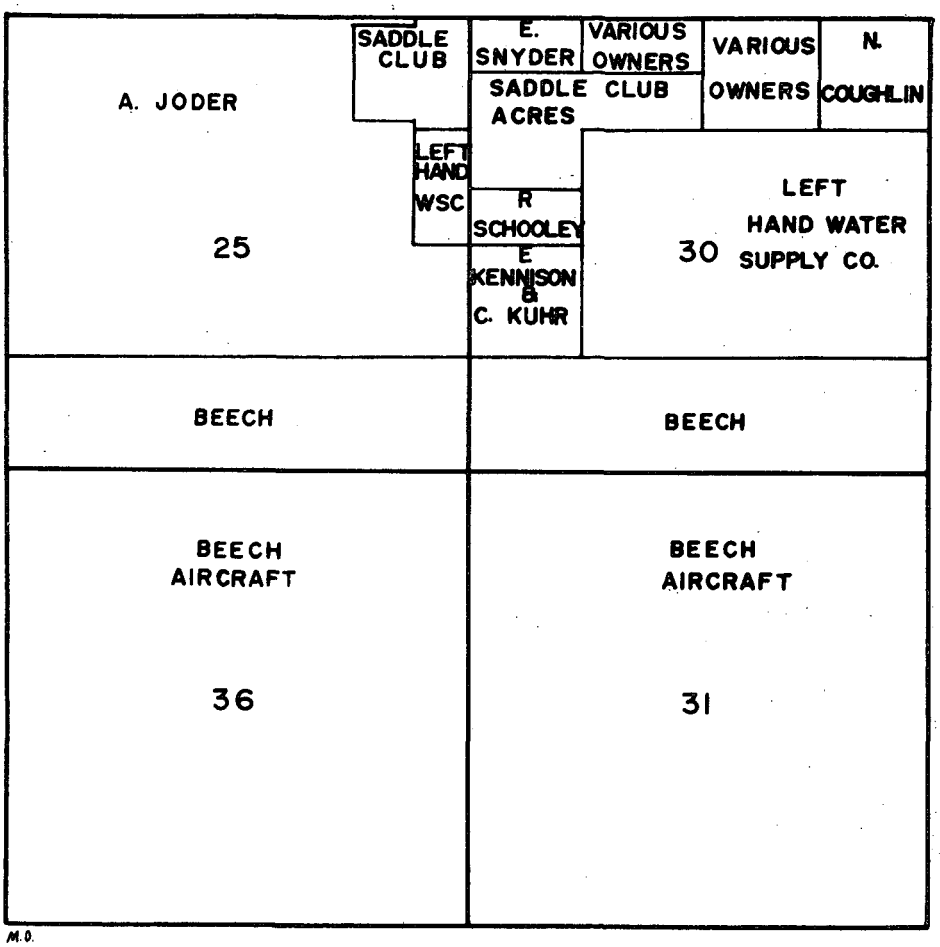


Figure 19

Land Tenure

Residential and industrial expansion adjacent to the study area is evident. Land tenure data indicates most of the acreage in the four sections is owner-occupied, with a few plots in Section 30 being offered for sale by the owners. The Beech Aircraft Corporation allows some grazing on their peripheral land in Sections 26 and 31 for use by some of their employees, but does not actually lease or rent any of their land.

CHAPTER VI. SUMMARY

Dean G. Wilder and Gary Heaslet

In 1968, the population for the City of Boulder was approximately 57,000. According to projections made by the Denver Regional Council of Governments, the population will increase to 171,000 by the year 2000. Such growth is sure to mean increased urban encroachment on peripheral rural land surrounding the city.

If the above predictions are realized, the results would have a detrimental effect on the preservation of the Six-Mile Fold site as a natural area. Changes in land use and land values in the past indicate that the area surrounding Six-Mile Fold will probably change to a suburban residential area. Saddle Club Acres is an example of this type of change. This will result in more people using the area and thereby modifying its natural ecosystems.

It is unlikely that the Six-Mile Fold site itself will become subdivided for residential development. This is due primarily to the uneven terrain within the area. Other reasons include the problem of drainage and access to power and water. It is also unlikely that Beech Aircraft Corporation will develop its peripheral land in the near future. However, the areas to the north and east have a high probability of becoming residential suburbs of a growing Boulder. Therefore it is important that due consideration be given to Six-Mile Fold as soon as possible to ascertain its value as a natural area site.

Six-Mile Fold is limited in its potential use as a park or recreation area. However the site does have a number of unique aspects which make it of considerable value for research and educational purposes. The intense folding of the substrata resulting in the plunging synclinal-anticlinal structure, the evidence of faulting in the vertical sides of the Niobrara Formation, the occurrence of fossils in the limestone, and the distribution of vegetation along the eastern edge of the Front Range provide a valuable Laboratory for study in the fields of geography, geology and biology. In addition, the site could also be used as a part of a county-wide open space or greenbelt system that would attempt to protect the foothills from exploitation by private interests.

If designated as an area of interest for natural studies or as part of a greenbelt, steps should be taken to protect the environmental quality of the site. For example, consideration should be given to the problem of accidental, unintentional damage to the area. Extensive grazing, fossil collectors, litterers and motorcycle riders could seriously reduce the value of the site for research and instructional purposes. Fire is another serious hazard during the dry months. One solution might be to control access to the area by means of a designated access road and ac-

companying parking lot. Visitors could be required to walk from this point, thereby preserving the natural character of the area and allowing eventual restoration of the natural vegetation patterns.

In summary, this study would seem to indicate that Six-Mile Fold is a unique natural area site in Boulder County. It has a considerable potential for use as either a natural study area or as a part of a greenbelt. Therefore, it is suggested that further consideration be given to this area for the purpose of determining if acquisition of this site for the purpose of preserving it in its natural state is feasible.