AN ABSTRACT OF THE THESIS OF

Rebecca S. Roberts for the degree of Master of Science

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Title: AN EVALUATION OF AGRICULTURAL LANDS FOR ACQUISITION AND CONSOLIDATION: THE UMATILLA INDIAN RESERVATION

Abstract approved: Redacted for Privacy

Thomas J. Maresh

The Farm Enterprise Committee of the Confederated Tribes of the Umatilla Indian Reservation requested that an evaluation be made of the Reservation land resource for the purpose of acquisition by the Tribe as a part of a study of the feasibility of an expanded farm enterprise. The Committee's primary goal is to regain control of Reservation lands for Indians, but they realize that the economic success of the farm enterprise will determine the ability of the Tribe to buy more land.

The first step in satisfying the Committee's request was to determine the kinds of information necessary to an evaluation of the land resource and the availability of information compiled by public and private agencies to satisfy these information needs. Specific information needs included owner and operator data, land and improvements costs, and agricultural characteristics such as soil,

slope, precipitation, productivity, potential crops, and irrigated agriculture potential. Where possible, information was collected on a parcel by parcel basis. Where parcel by parcel data were not available, information was developed for each of 11 regions into which the Reservation was divided.

The data were analyzed and organized into forms that would convey to the Committee the information collected and the understandings formed. Two forms of descriptive analysis of the variation in land quality were produced to form a backdrop for evaluating individual parcels. In one analysis, the spatial variation of each variable was described verbally and cartographically. The second analysis describes the agricultural characteristics and potential of each of the 11 relatively homogenous regions. The economic analysis of the larger study characterizes the economic potential of the typical parcel in each region. The information collected on individual parcels is organized into a set of index files of owners and parcel codes, a map which locates parcels by their codes, and a set of parcel data cards on which all the information on each parcel is recorded. Finally, each parcel is ranked on a scale of 1-100 by means of a parcel rating scale which integrates the parcel characteristics of nine different variable categories into one ranking. This ranking is then used to differentiate between poorer than average, average, and better than average parcels within each region. The information collected in the land resource analysis can thus be integrated with the economic analysis of each region.

An Evaluation of Agricultural Lands for Acquisition
and Consolidation: The Umatilla
Indian Reservation

by

Rebecca S. Roberts

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AN EVALUATION OF AGRICULTURAL LANDS FOR ACQUISITION AND CONSOLIDATION: THE UMATILLA INDIAN RESERVATION

I. INTRODUCTION

A continuing loss of Indian control over the land base has characterized the history of whites and Indians in America. The Indian treaties gave the Indian reservations in perpetuity to tribes in exchange for the cession to the United States of all rights to lands outside the reservations. Reservation lands were originally held by the United States in trust for a tribe as a whole. The United States hoped Indians would till the land and become "civilized" farmers. To further these goals the Slater Act of 1885 and the Dawes Act of 1887 provided for the allotment of distinct parcels to individual Indians. The head of family was given 160 acres and children were given 40 or 80 acres, depending on their ages. Lands remaining after allotment were frequently opened to homesteading.

The concept of private property attributed to land by allotment opened the way to leasing of lands to non-Indians and to the sale of parcels to non-Indians. By the late 1800's and the early 1900's much trust agricultural land was leased to non-Indians. Regulations were gradually relaxed to permit the patenting of land and its sale to non-Indians. This did make credit available to Indians through land mortgage, but it also increased the flow of land from Indian to non-Indian hands through loan defaults by agriculturally inexperienced Indians.

These trends have continued to the present day. Trust lands held by the government in reservations for Indians in the 48 contiguous states have decreased from 73,372,000 acres in 1900 to 50,919,194 acres in 1975.[1] The situation is no different on the Umatilla Indian Reservation (Table 1). Indian controlled land represents only 50 percent of all land within the Reservation. Ninety-five percent of Indian controlled cropland is leased to non-Indians.

Table 1. Land controlled by Indians on the Umatilla Indian Reservation.

Land within Reservation boundaries	158,000 acres
Trust land in Reservation	72,333 acres
Percentage of trust cropland operated by Indians	5 percent

Source: U.S., Department of the Interior, Bureau of Indian Affairs, Division of Economic Development, Umatilla Agency, Land Use Inventory and Production Record, Report 50-1 for the Umatilla Indian Reservation, 1975.

The causes behind the high percentage of cropland leased to non-Indians are complex.[2] Allotments are no longer of a sufficient

[1] Henry W. Hough, Development of Indian Resources, (Denver: World Press Inc., 1967) p. 9. And telephone communication with Lucille Niushan, Realty Office, BIA, Portland, July 20, 1976.

[2] Theodore Stern and James P. Boggs, "White and Indian Farmers on the Umatilla Indian Reservation," Northwest Anthropological News Notes 5 (Spring, 1971):39.

size for economic farming. Indians have not had access to capital to enlarge their holdings, buy equipment, or finance farm operation. Most Indians have not learned, through either experience or education, the farming and management skills necessary to successful farm operation. White farmers held an early advantage in skills and access to economic and political resources which has been self-perpetuating over the years. Further, the advantages of farming were frequently not so evident to Indians, who came from a non-agricultural tradition, as they were to white settlers.

The loss of control by Indians over Reservation lands disturbs many tribal members. They see that trust parcels continue to be patented and sold to non-Indians, diminishing their cultural patrimony. They believe Reservation resources are not being fully used to promote the economic well being of Tribal members. They fear that Reservation land, a cultural heritage, may be abused and mismanaged. They see unwanted urban and suburban land uses encroaching on agricultural open spaces of the Reservation. These Tribal members would like to see Indians re-establish control over Reservation lands and resources. To check these trends, the Confederated Tribes of the Umatilla Indian Reservation established a goal of increasing tribally owned and operated cropland from 1360 acres to

6000 acres by 1985.[3] The Tribe formed the Farm Enterprise Committee to carry out this goal.

The Feasibility Study

The Farm Enterprise Committee and Tribal Development Office were awarded a technical assistance grant from the Economic Development Administration to support a feasibility study of the Tribal agricultural expansion program. The Tribe then contracted with the Department of Agricultural and Resource Economics of Oregon State University to perform the feasibility study. As outlined in the research proposal accepted by the Tribe, the study was divided into three parts:

1) Evaluation of the agricultural land resource of the Reservation for acquisition and consolidation by the Tribe.
2) Analysis of the economic feasibility of land acquisition and various cropping alternatives.
3) Development of procedures for carrying out feasible expansion including management structure analysis.[4]

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[3] Confederated Tribes of the Umatilla Indian Reservation, Program Planning Committee, " Plan for Growth: Overall Economic Development Plan, Development Strategies, Long Range Plan" (July 1974), p. 2.

[4] Oregon State University, Department of Resource and Agricultural Economics, "Feasibility of a Tribal Agricultural Enterprise: A Proposal Submitted to the Board of Trustees, Confederated Tribes of the Umatilla Indian Reservation of Oregon, " by James B. Fitch, p. 2.

Purpose of the Thesis

This thesis is an outgrowth of the land resource evaluation of the feasibility study. According to the proposal, the land evaluation was to include four processes:

1. Establish priorities and goals of the Tribe.
2. Collect data suitable for evaluation of all parcels lying within Reservation boundaries.
3. Establish a data management system for the collected data.
4. Establish a land acquisition and consolidation plan in conjunction with the economic and management analyses of the study.[5]

This listing of tasks could not provide a blueprint for the study, and no similar studies were available to indicate the directions that should be taken.

The land resource evaluation desired by the Tribe was distinguishable from other land resource analyses in a number of ways. The desired scale was much larger than other studies; the Tribe wished an evaluation of individual parcels. The purpose of the study was to evaluate parcels for acquisition rather than primarily for capability, management needs, or desirable future uses. The evaluation was to be made in the context of the goals and priorities of the Tribe, an organization with major cultural, organizational, and political differences from other agricultural operators. And finally,

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[5] Ibid., p. 3.

the study had to work with two different sets of information gathering agencies, those of the Bureau of Indian Affairs and those of the usual public and private organizations, with different jurisdictions and different classifications of information.

All these conditions required development of information categories and a methodology different from other resource evaluation studies. This thesis describes the form of information generated and the methodology used to develop that information. In overview, this thesis will discuss the nature of the land resource of the Reservation, the priorities and goals of the Tribe, the data needed for the required evaluation, and the availability of data to serve these needs. Finally, this thesis will describe the organization and synthesis of collected information into forms that allow easy evaluation of the variability of the quality of the land resource for acquisition, the comparison of individual parcels, and the use of reliable data in the economic analysis.

II. BACKGROUND TO THE RESERVATION AND THE FARM ENTERPRISE COMMITTEE

The framework of this study is determined by the characteristics of the Umatilla Indian Reservation and the goals of the Farm Enterprise Committee. The Reservation is a region of contrasts in physical characteristics and in the uses man has made of the physical environment. The Farm Enterprise Committee has goals, needs, and organizational structures in some ways similar, and in other ways different, from non-Indian groups or individuals directing similar agricultural operations. This chapter will discuss the characteristics of the Reservation important to agriculture and the history, structure, and goals of the Farm Enterprise Committee.

The Umatilla Indian Reservation

The Umatilla Indian Reservation was established in 1855 by a treaty between the United States and the Umatilla, Walla Walla, and Cayuse tribes. It is located in northeastern Oregon on the western edge of the Blue Mountains (Fig. 1). The city of Pendleton is located on the western edge of the Reservation; its suburbs are expanding onto the Reservation.

The Reservation originally contained 295, 900 acres; it has subsequently been diminished to 157, 982 acres. There are an additional 14, 140 acres outside the diminished boundary but inside the original boundary that were restored to the Tribe in 1939.

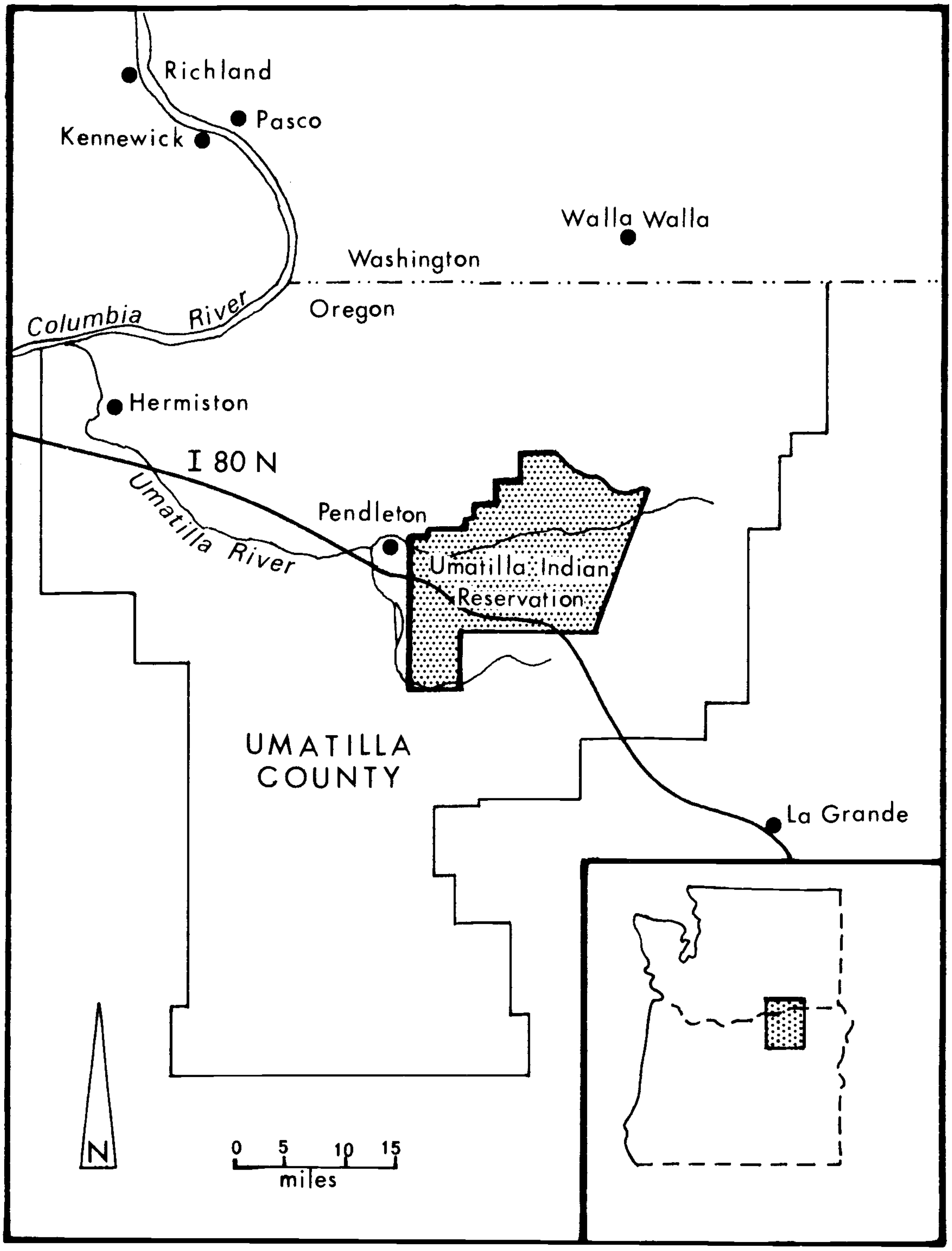

Figure 1. Location of the Umatilla Indian Reservation.
Source: Official Oregon Highway Map.

Boundaries of the Study Area

The mountainous eastern one-third of the Reservation has no agricultural potential. Since the project was to be an evaluation of agricultural lands for acquisition as a part of the farm enterprise, it was desirable to restrict the data collection and evaluation processes to only those lands of the Reservation with agricultural potential. The study area was therefore defined as those sections that included soils capable of producing crops. The Soil Conservation Service soils map and soils interpretations were used in this determination.[6] All further maps and discussions in this thesis eliminate non-arable portions of the Reservation.

Land Ownership and Operatorship

The Reservation presents a checkerboard of parcels in tribal, allotted, deeded, and undivided interest ownership status. Tribal land is land in which the legal title is in the United States and the beneficial or equitable title is in the Tribe as a unit. Allotted land is land allotted to an Indian with the legal title in the United States and the beneficial or equitable title in the Indian allottee or his heirs. Because of the large number of heirs, many allotted parcels have

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[6] U.S. Department of Agriculture, Agricultural Research Administration, Bureau of Plant Industry, Soils, and Agricultural Engineering, Soil Survey: The Umatilla Area, Oregon, Series 1937, no. 21 (1948), attached map.

from 5 to 20 or more allottees. Tribal and allotted lands are trust lands controlled by Indians. Deeded land is patented land in fee simple estate, usually held by non-Indians. Undivided interest lands are parcels with both trust and deeded interests where the property has not been divided between the interests. The acreage for each of the ownership status classes is given in Table 2.

Table 2. Acreage by ownership class.

Status class	Acreage
Land within Reservation boundaries	157, 982
Tribal land	2, 069
Allotted land	68, 312
Undivided interest	830
Deeded	86, 771
Land outside Reservation boundaries	14, 140
Tribal	14, 140
Total land area	172, 172

Source: CH_2M-Hill, "Planning for the Umatilla Indian Reservation: Initial Comprehensive Planning Investigation," (December 1973), p. 74 and Bureau of Indian Affairs, Report 50-1.

Agricultural land on the Reservation is used predominantly by a few large farm operators on owned and leased land. A larger number of smaller operators use a smaller percentage of the crop-land. Only a small amount of the trust land is operated by Indians; most trust land is leased to non-Indian farmers (Table 3). Most of the trust cropland operated by Indians is tribal land operated by the Farm Enterprise Committee.

Table 3. Cropland and cropland operated by Indians by ownership class.

Ownership class	Cropland (acres)	Cropland operated by Indians (acres)
Tribal	1,253	1,360[a]
Allotted + undivided interest	27,769	147
Deeded	46,979	0
Total	76,000	1,507

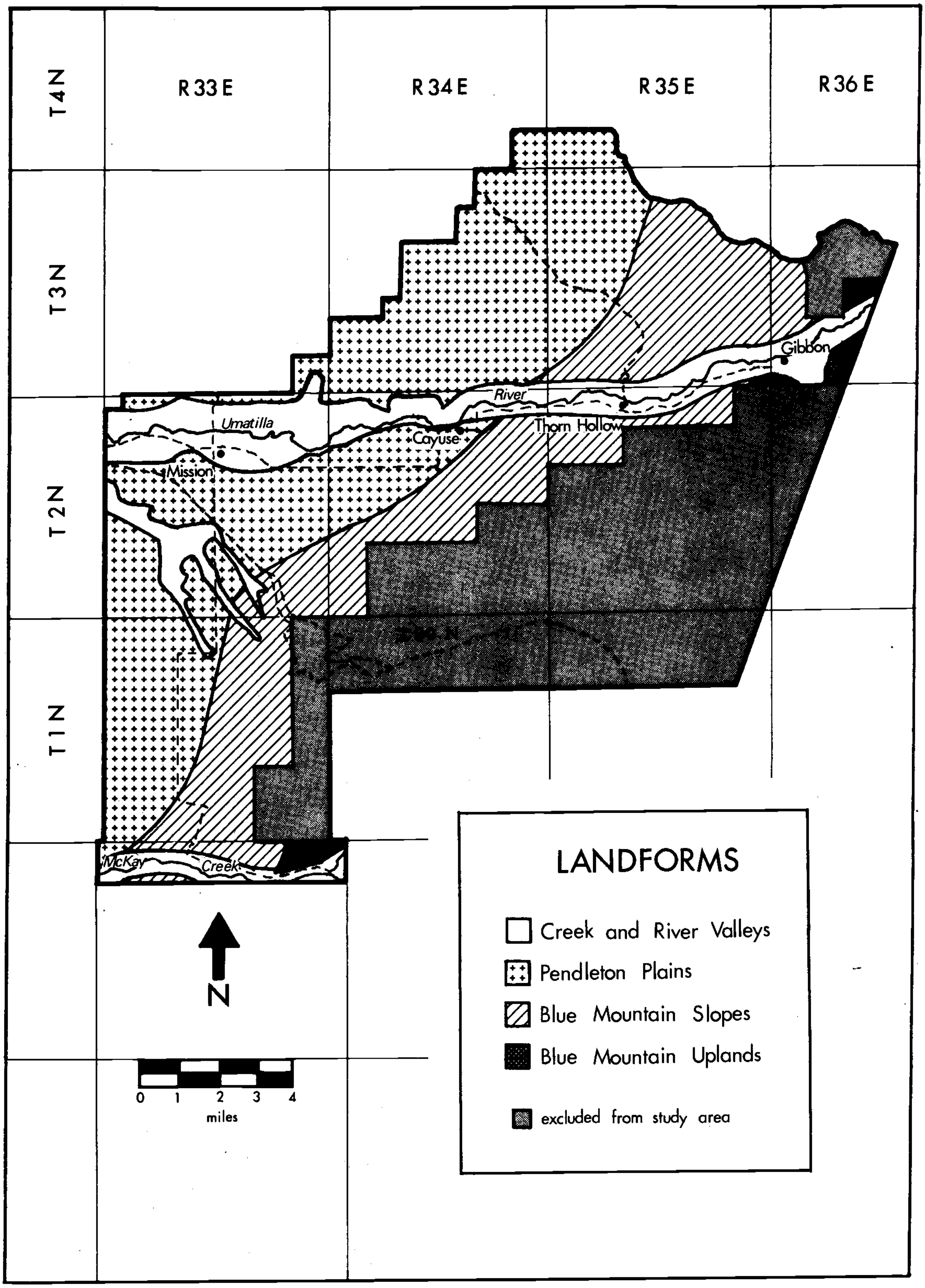
[a]Includes some non-cropland in parcels operated by the Tribe.

Source: Bureau of Indian Affairs, Report 50-1, p. 1.

Landforms

The landforms of the Reservation can be divided into four groups: (1) the Pendleton Plains, (2) the Blue Mountain Slope, (3) the Blue Mountain Uplands, and (4) the creek and river valleys with associated slopes (Fig. 2). The Pendleton Plains are a slightly dissected plateau characterized by gently rolling slopes favorable to farming. The Blue Mountain Slope can be described as a series of steep walled canyons ascending to the more plateau-like Blue Mountain Uplands. The creek and river valleys, principally those of the Umatilla River, McKay Creek, and Patawa Creek, dissect the

Figure 2. Landforms of the Umatilla Indian Reservation.
Source: Modified from U.S., Department of the Interior, Geological Survey, Geology and Groundwater Resources of the Umatilla River Basin, by G.M. Hogenson, Water Supply Paper no. 1620 (Washington, D.C.: U.S. Government Printing Office, 1964) attached map.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R35E
R36E
Umatilla
River
Gibbon
Thorn Hollow
Cayuse
Mission
McKay
Creek
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0 1 2 3 4
miles
LANDFORMS
Creek and River Valleys
Pendleton Plains
Blue Mountain Slopes
Blue Mountain Uplands
excluded from study area

topographic units. They are characterized by very flat floodplains edged by moderate to steep slopes up to the surrounding land.

By comparing Figure 2 and Figure 3 it can be seen that landforms and slope are highly correlated (Fig. 3). Slope is a major limiting factor to many agricultural processes in the area.

Climate

The climate of the Reservation is semi-arid to subhumid. Summers are hot and winters are cold. The frost-free season varies from 185 days at the western edge to less than 120 days in the northeast corner. Precipitation is a major limiting factor to agriculture. Although some precipitation occurs as brief, violent, erosive, convectional summer downpours, most of the precipitation occurs as orographic precipitation from winter cyclonic systems. The rapid increase in altitude from west to east across the Reservation therefore results in a rapid rise in precipitation over the same area (Fig. 4). This variation in rainfall is one of the major causes of variation in soils and cropping patterns within the Reservation. Because most of this precipitation occurs outside of the growing season, it must be stored as soil moisture to be of use to a crop. Where soils are shallow, as in the south Reservation, crop yields are low because of the low amount of moisture that can be stored in the soil.

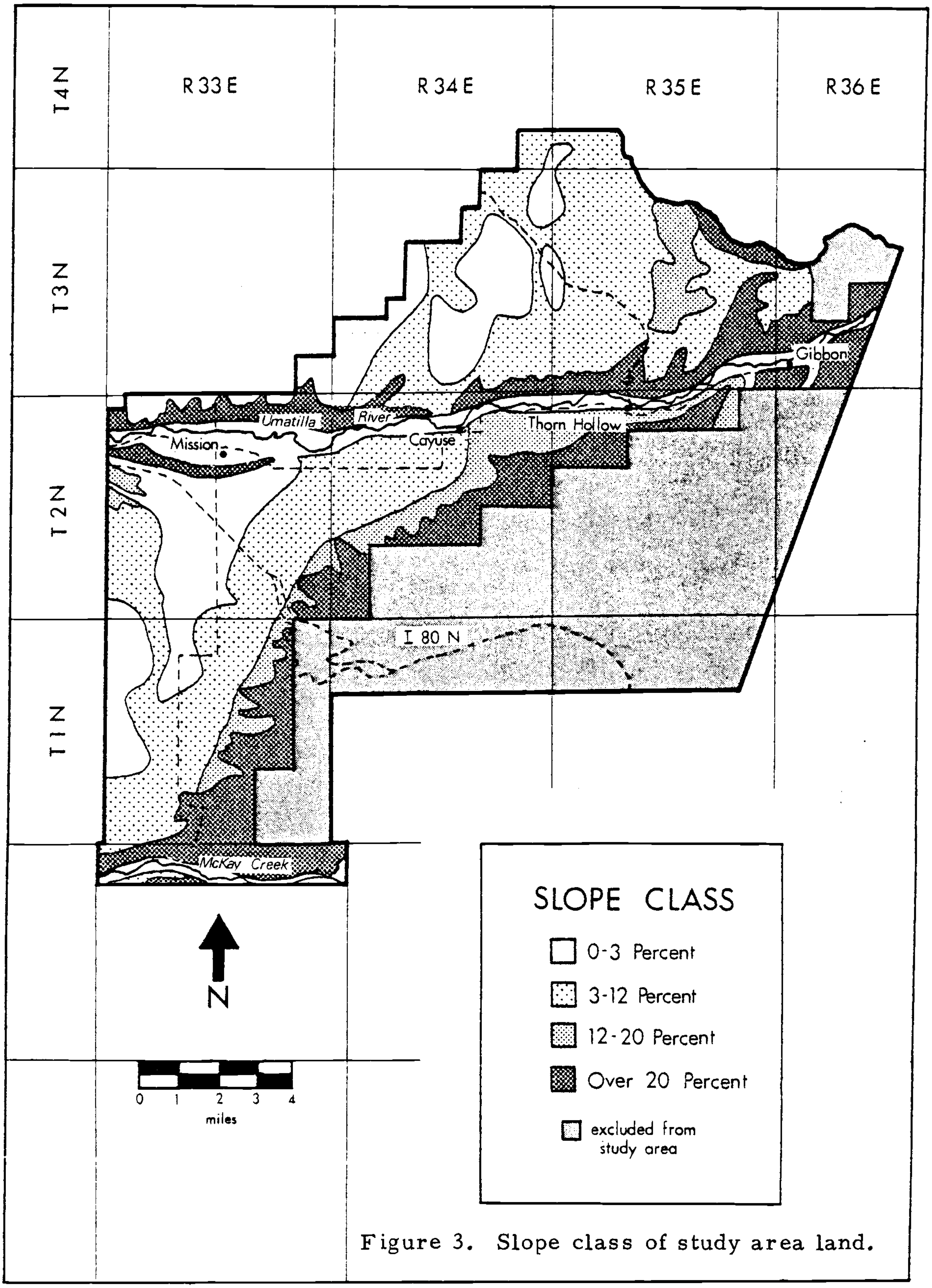
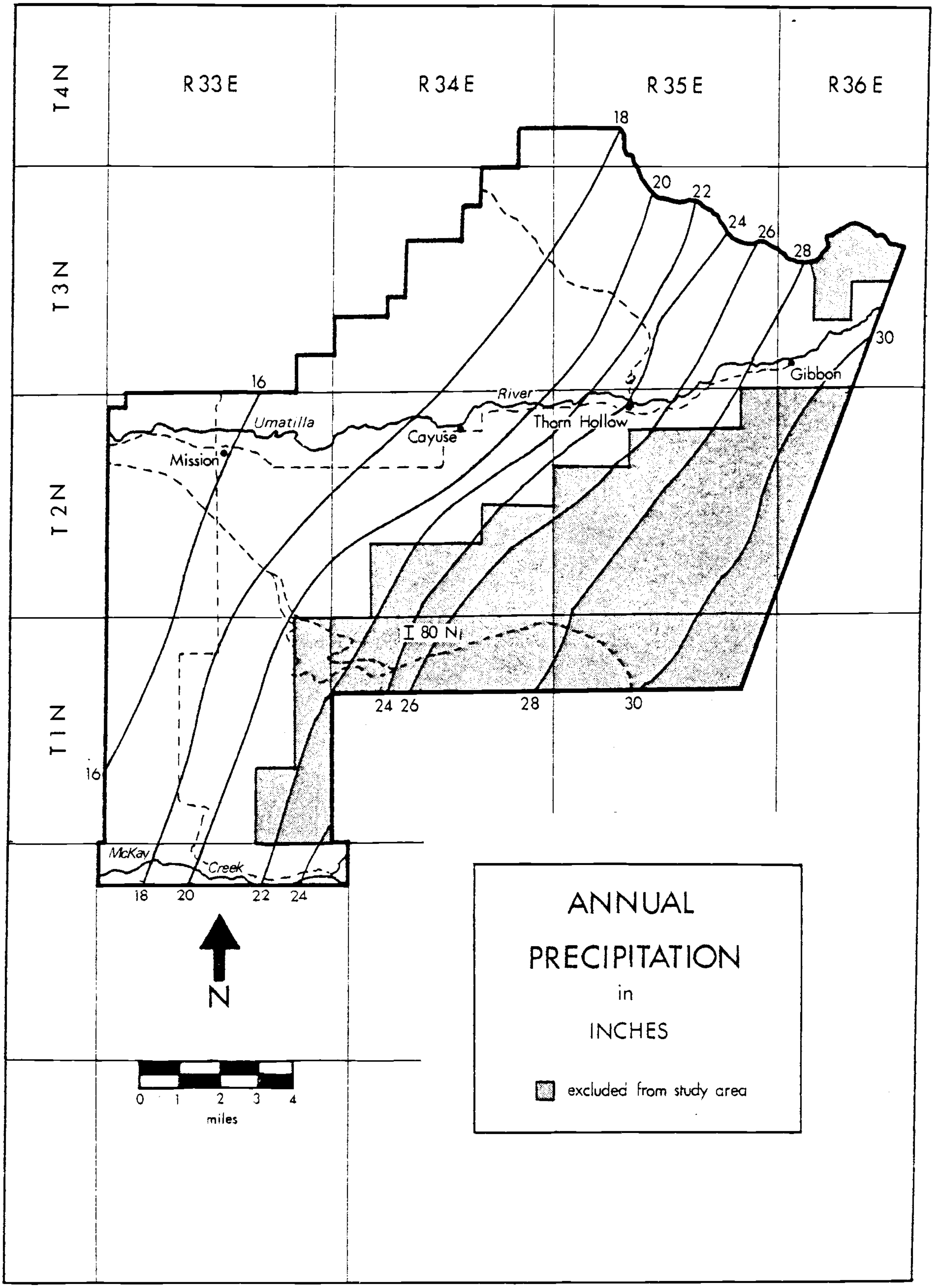


Figure 3. Slope class of study area land.

Figure 4. Annual precipitation. Source: U.S., Department of Agriculture, Soil Conservation Service, Isohyetal Map; Average Annual Precipitation, Umatilla Survey Area, by W.R. Patching (Pendleton, Oregon: SCS, 1963).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ANNUAL
PRECIPITATION
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INCHES
excluded from study area

Soils

The soils of the Umatilla Reservation can be grouped into four categories which correspond to the four landform regions (Fig. 5, Table 4). The characteristics of the soils vary with the climatic, topographic, and geologic features of these regions.

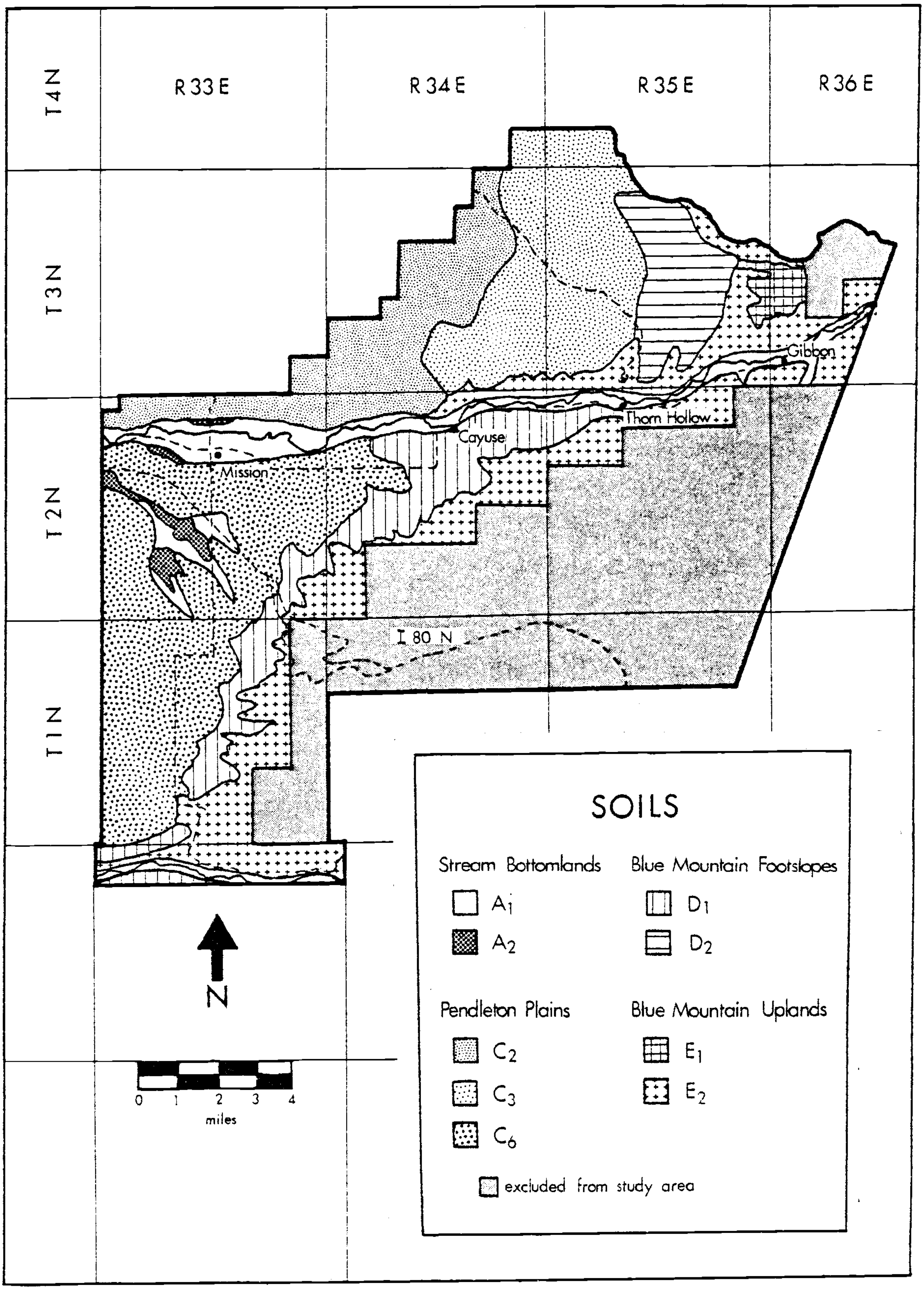
Stream Bottomlands. Most of the bottomland soils are well drained, medium-textured soils of the Hermiston, Onyx, Snow, and Yakima series. The Hermiston, Onyx, and Snow series are excellent, deep agricultural soils. Most of the Yakima soils have shallow, gravelly topsoils over gravel. They are too excessively drained and too gravelly to cultivate and are best suited to irrigated pasture or alfalfa. About one-half of the bottomlands on the Reservation have Yakima soils. On the wider bottomlands there are some wet and poorly drained soils of the Pedigo and Stanfield series. The Stanfield soils are severely salt affected and have a hardpan.

Pendleton Plains. The soils of this landform have been formed from windborne loess deposited on top of the Columbia River basalt. This mantle is thicker north of the Umatilla River than south of the river. Soil depths are typically at least five or six feet on the north side and four feet or less on the south side. All these soils are fine-textured silt loams, but they become darker and more fertile from west to east as the precipitation increases. Thus, on the thick loess of the north Reservation, the Walla Walla (high rainfall phase),

Table 4. Description of soils. Source: Modified from State Water Resources Board, Oregon's Water Requirements, pp. 6-8.

Map area	Description	Soil series
Stream bottomlands:		
A_1	Well-drained, medium-textured, deep soils	
	Moderately dark, silt loam........................	Hermiston
	Dark, silt loam................................	Onyx
	Dark, silt loam................................	Snow
	Moderately dark, gravelly, loam over gravel.....	Yakima
A_2	Somewhat poorly drained, medium-textured, deep soils	
	Silty-clay loam................................	Pedigo
	Alkali, silt loam, moderately deep over hard pan...................................	Stanfield
Loess-mantled Pendleton Plains (semi-arid to sub-humid grassland):		
Thick loess region:		
C_2	Moderately dark soils under 18" precipitation	
	Deep, silt loam................................	Walla Walla
C_3	Dark soils under 18" to 22" precipitation	
	Deep, fine silt loam...........................	Athena
	Deep, fine silt loam...........................	Palouse
Thinner loess region:		
C_6	Gravel outwash plain	
	Moderately deep over hardpan, silt loam.........	Pilot Rock
	Somewhat poorly drained, clay loam (alkali).....	McKay
Blue Mountain Footslopes (grasslands, 15" to 25" precipitation):		
D_1	Thinner loess region (dark colored soils)	
	Moderately deep, silty clay loam................	Waha
	Rough, broken, and stony ground (non-arable)....	NA
D_2	Thicker loess region (dark colored soils)	
	Deep, fine silt loam...........................	Palouse
	Moderately deep, silty clay, and silt loam......	Waha
	Rough, broken, and stony ground (non-arable)....	NA
Blue Mountains Uplands (sub-humid forest land):		
E_1	Crop land	
	Deep, silt loam over silty clay loam............	Couse
	Somewhat poorly drained, silt loam over silty clay loam...................................	Thatuna
E_2	Non-cropland, steep slopes	
	Rough, broken, and stony ground.................	NA

Figure 5. Soils. Source: Modified from Oregon, State Water Resources Board, Oregon's Long Range Requirements for Water, Appendix I-7, General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin (1969), p. 5.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R 35 E
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Gibbon
Thorn Hollow
Cayuse
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SOILS
Stream Bottomlands
A1
A2
Blue Mountain Footslopes
D1
D2
Pendleton Plains
C2
C3
C6
Blue Mountain Uplands
E1
E2
excluded from study area

Athena, and Palouse soils form bands of increasing darkness paralleling the Blue Mountains. These are the best agricultural soils on the Reservation. The Pilot Rock and McKay series on the thinner loess of the south Reservation are formed on top of a cemented gravel outwash fan sloping gently from the Blue Mountains. Both of these soils are limited by shallow depth, and the McKay soils are also limited by poor drainage.

Blue Mountain Footslopes. The footslopes are a higher portion of the plateau consisting of increasingly steep canyons. Soils are the very dark, fine textured Waha and Palouse soils formed from loess under high precipitation and a number of non-arable soils. These soils are typically deeper when they occur on the north Reservation than when they occur on the south Reservation. Farming occurs on the Waha and Palouse soils where depth and slope are not too limiting. Non-arable soils are very steep, very shallow, or very stony.

Blue Mountain Uplands. Most of the soils of the Blue Mountain Uplands are non-arable. Many of them are forested. The arable soils are the Thatuna and Couse series, although most of the Couse soils are currently under forest or range. Both soils are deep and fine textured and are formed from loess under high rainfall. Drainage is moderately restricted in both soils. The growing season is short enough to begin to be restrictive.

Wheat Yields

Wheat is used to indicate the pattern of variation in yields of most dry crops on the Reservation. In general, average wheat yields per acre increase from west to east and from south to north (Fig. 6). The west to east increase is caused by increasing precipitation. The south to north increase is caused by the increasing depth of the wind-laid loess and increasing precipitation.

The alluvial soils of the creek and river valleys produce yields not strictly in accord with the above pattern. The wet soils with drainage and alkali problems have poorer yields whereas some of the deep, well-drained alluvial soils have better yields than those of adjacent areas. Both the Umatilla and McKay valleys have extensive areas of gravelly soils not capable of producing any wheat crop.

Suitability for Irrigation

One of the objectives of the Farm Enterprise Committee is to increase agricultural diversification.[7] In this semi-arid region, irrigation holds the key to most diversification.

Large areas of the cropland of the Reservation are suitable for irrigation (Fig. 7). Excellent, good, and fair suitabilities are considered irrigable. Thus, most of the Pendleton Plains and the

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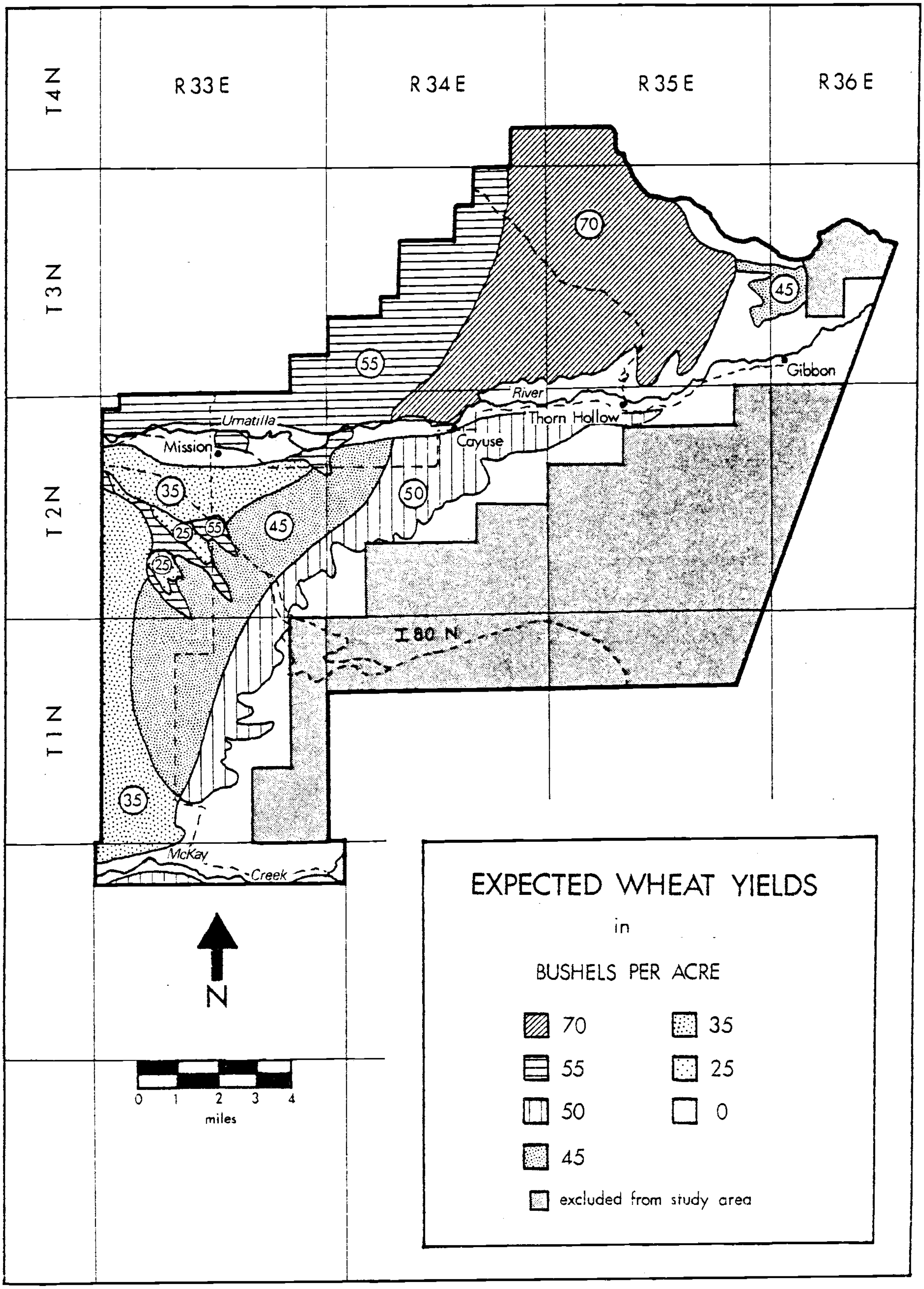
[7] Confederated Tribes of the Umatilla Indian Reservation, "Plan for Growth," p. 2.

Figure 6. Expected wheat yields. Source: Adapted from U.S., Department of Agriculture, Soil Survey, attached map and U.S., Department of Agriculture, Soil Conservation Service, OR-Soils-1, 12/72, File Code Soils 12, Soil Interpretations for Oregon.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EXPECTED WHEAT YIELDS
in
BUSHELS PER ACRE
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45
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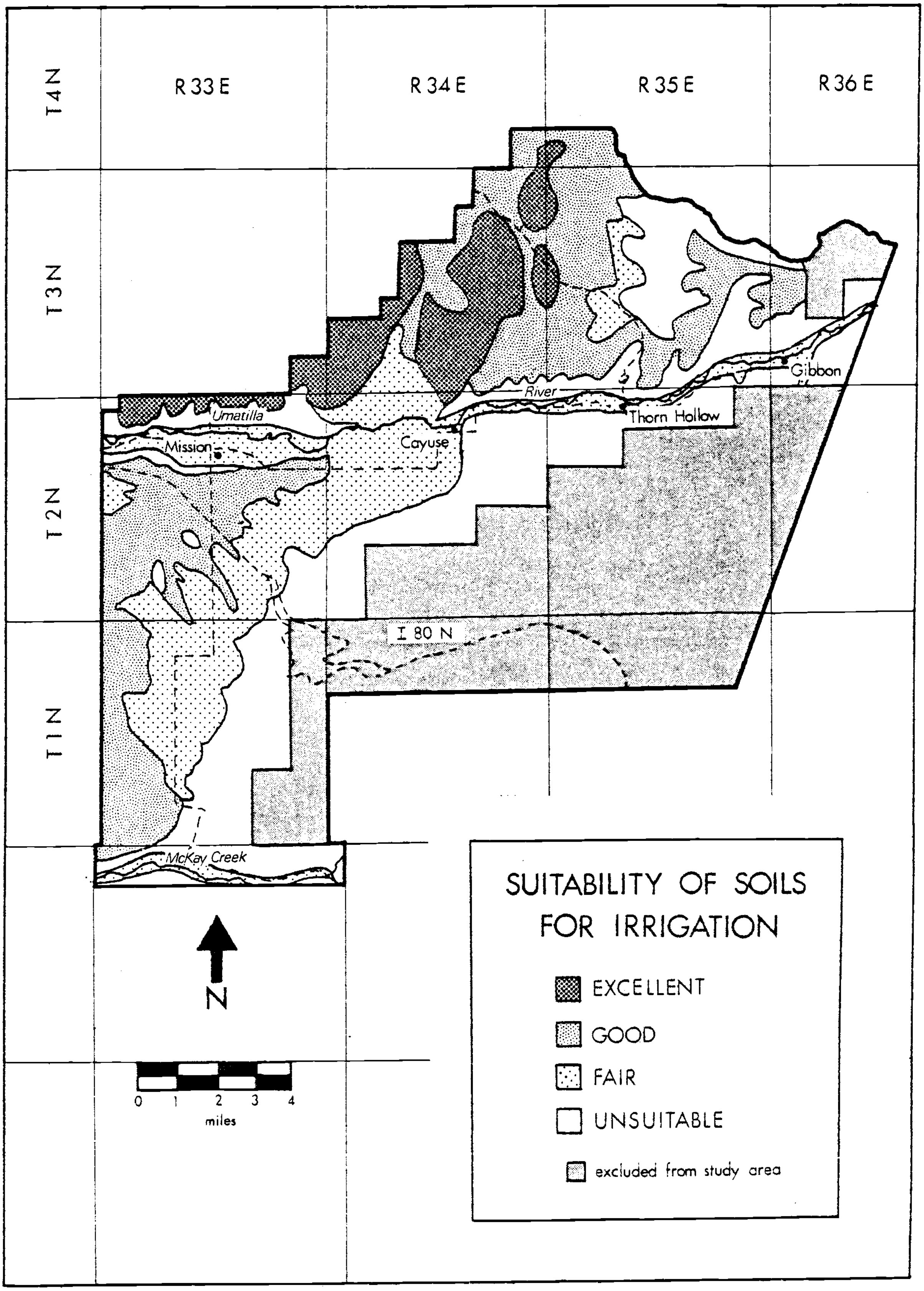
Figure 7. Suitability of soils for irrigation. Source: Modified from U.S., Department of Agriculture, Soil Survey, attached map, and Oregon, State Water Resources Board, Oregon's Water Requirements, pp. 36-39.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McKay Creek
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0 1 2 3 4
miles
SUITABILITY OF SOILS FOR IRRIGATION
EXCELLENT
GOOD
FAIR
UNSUITABLE
excluded from study area

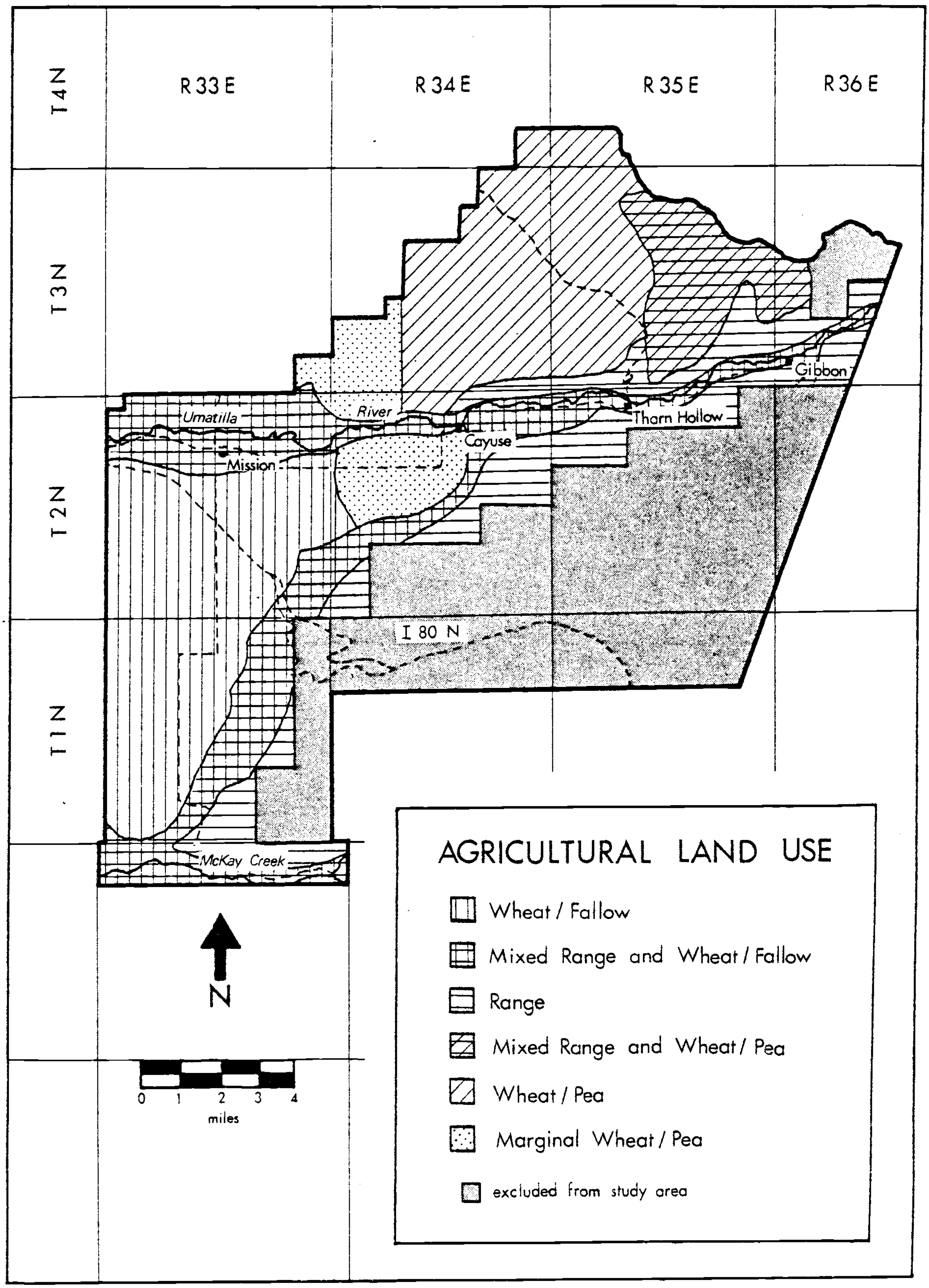
creek and river valleys are irrigable. The suitability of the soils within this area varies. Shallow soil depths, slopes, flood hazards, and drainage problems may cause a soil to receive a good or fair rating instead of excellent. Most cropland soils on the Blue Mountain Slope and the Umatilla valley slope receive a non-irrigable rating because of steep slopes or shallow soil depths.

Water Availability

Both McKay Creek and the Umatilla River flow throughout the summer. Irrigation water is therefore potentially available from both these sources. The Reservation also lies over the Columbia River basalt aquifer. Deep wells could tap this aquifer as another source of irrigation water.

Land Use

Agricultural Land Use. Current agricultural land uses are shown in Figure 8. The dominant crop rotation in the south Reservation is wheat/fallow; in the north Reservation it is wheat/pea. The shallower soils of the south Reservation cannot store enough rainfall to allow annual cropping. On the Blue Mountain Slope both these cropping patterns become mixed with pasture and range on the steeper slopes and shallower soils. To the west of the wheat/pea area are two areas marginally suited for yearly cropping. Peas are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AGRICULTURAL LAND USE
Wheat / Fallow
Mixed Range and Wheat / Fallow
Range
Mixed Range and Wheat / Pea
Wheat / Pea
Marginal Wheat / Pea
excluded from study area

frequently grown in the marginal area of the north Reservation but rarely in the south Reservation. Precipitation is most likely to be the limiting factor in cropping decisions on the north Reservation with soil depth or other factors playing a limiting role on the south Reservation. The valleys and surrounding bluffs of the Umatilla River and McKay Creek are predominantly range on steep slopes or on droughty, gravelly soils. There are areas near Mission, however, where wheat/fallow is a major land use on excellent soils in the river valley.

Urban Land Use. The Reservation has been increasingly subjected to urbanizing pressures by the growth of the town of Pendleton, which lies immediately to the west of the Reservation boundary (Fig. 9). The Umatilla River valley is the primary center of this urban development. The valley west of Mission has seen so much development and subdivision that land prices effectively exclude land purchase for other than urban uses. Other sites of development and subdivision are found throughout the Umatilla valley at Cayuse, Thorn Hollow, and Gibbon.

A secondary center of urbanizing pressure is found in the central part of T2N R33E. Access into this area from Pendleton is excellent because of the presence here of an offramp to the interstate highway I80N. A number of parcels of agricultural land have been subdivided and developed for residential or commercial use. Demand

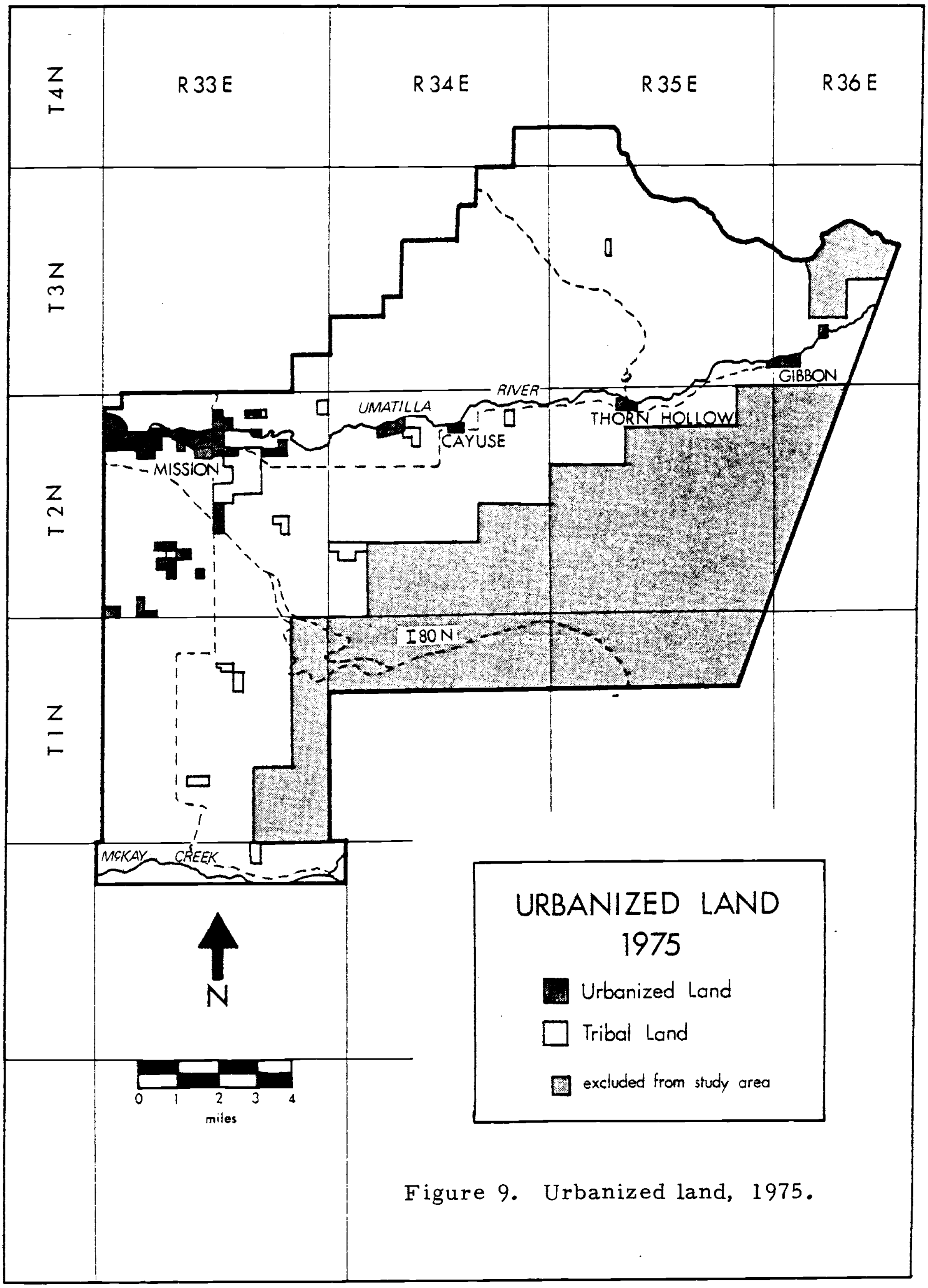

Figure 9. Urbanized land, 1975.

for further subdivision exists and might raise land costs on any particular parcel to values similar to those in the Mission area.

Land Cost

The cost of land varies greatly over the Reservation. There is a pattern to this variation, but individual prices can vary greatly from this pattern (Fig. 10). Large parcels in most of the Reservation sell at a price reflecting primarily the agricultural or range value of the land. Range land is the cheapest, varying between $25 and $100 per acre. Cropland in the south Reservation sells for $350 to $500 per acre and in the north Reservation for $500 to $750 per acre. The difference between the north and south Reservation reflects the productivity of the land and its ability to sustain annual cropping.

There are significant portions of the Reservation, however, where land prices of large parcels reflect the urban use value of the parcel or where land prices are inflated above their farm use value by speculation on future urban use. The Umatilla valley near Mission is essentially completely urbanized, with selling prices of large parcels varying between $800 and $1500 per acre. The probability of selling prices below these figures appears to be slight. Surrounding the Mission area are three areas where land prices could range from the farm use value to the urban use value, depending on the identities and motives of the buyer and seller. Thus, prices for large parcels

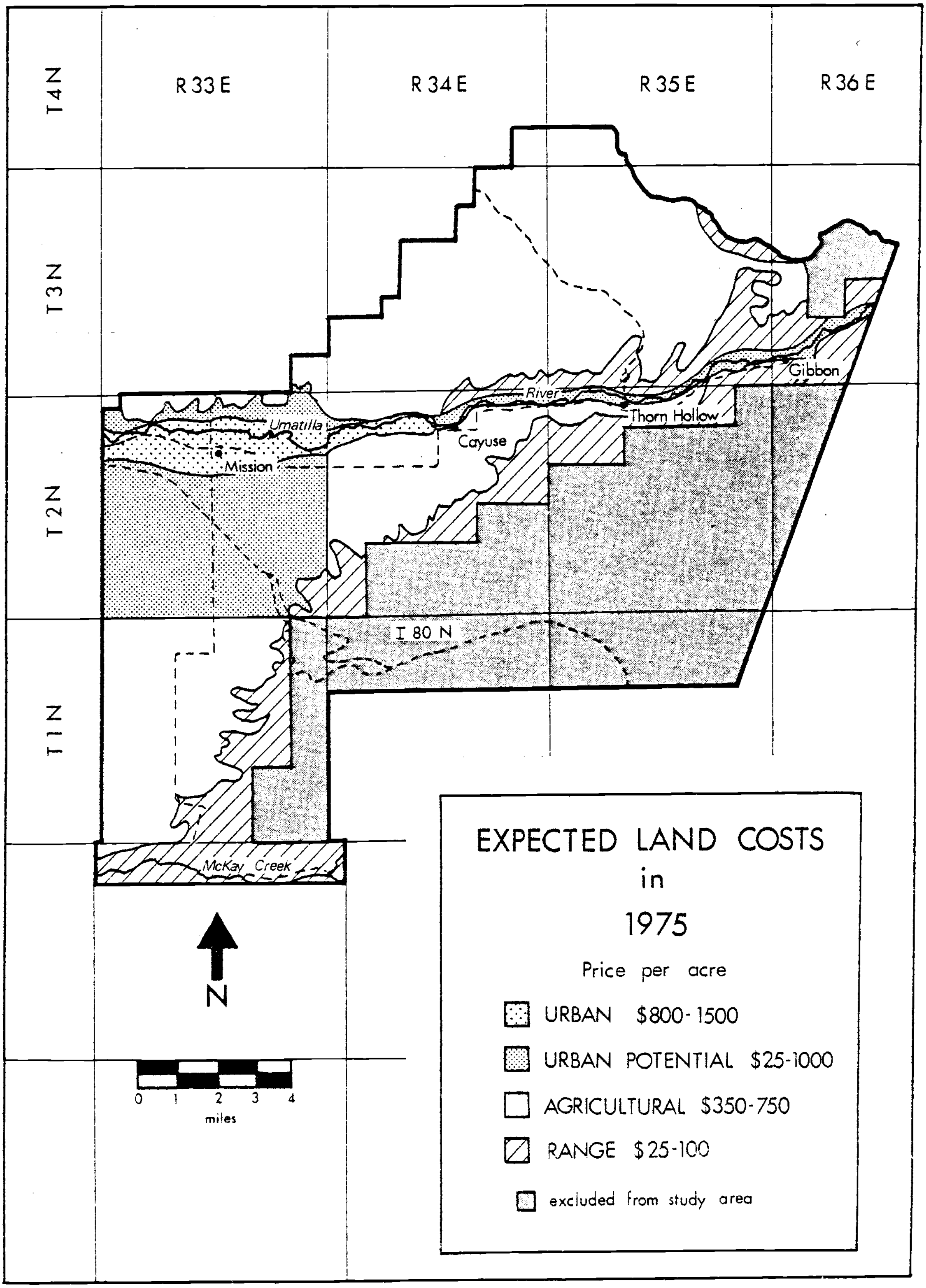

Figure 10. Expected land costs in 1975 for parcels larger than 19 acres.

could range from $25 to $1000 per acre. These three areas are the slope on the north side of the Umatilla valley, the Umatilla valley east of Cayuse, and T2N R33E south of the Umatilla valley.

Small parcels anywhere on the Reservation, but especially in those areas subject to urbanizing pressures, will, of course, sell for much more than indicated above. Access to Pendleton is sufficiently good throughout the Reservation to make any small parcel attractive as a homesite or as recreation land.

The Farm Enterprise Committee

History

Official interest in land consolidation and acquisition by the Tribe began in 1959 when the Board of Trustees of the Confederated Tribes of the Umatilla Indian Reservation established a land purchase program. Their concern was the fact that allotments continued to be sold out of trust status. At that time, 41 percent of the Reservation had been converted to deeded land. The principal purpose of the program was "to retain and consolidate all available farm lands, whether they be trust or deeded, for Indian use and benefit."[8] They planned to purchase land and rent it to Indian operators. The ultimate goal was to sell the land to Tribal members.

[8] Confederated Tribes of Umatilla Indian Reservation, Board of Trustees, "Land Purchase Program," quoted in CH_2M-Hill, "Planning for Umatilla Indian Reservation," p. 313.

In the early 1960's some Tribal members felt that non-Indian operators of Tribal lands were not adequately managing the land and living up to lease agreements. When the Bureau of Indian Affairs (BIA) failed to respond to complaints, the Tribe established the Farm Enterprise Committee in 1965 to directly manage Tribal lands. The Farm Enterprise Committee then became the Tribal body responsible for coordinating the farmland acquisition and consolidation program. The Committee has expanded the Tribal land base from 495 acres to approximately 1800 acres of cropland. About 1400 acres are currently managed directly by the Committee through a contract farming relationship with a local retired farmer having unused equipment.

Authority and Composition

The Farm Enterprise Committee is a three member committee appointed by the Tribal Board of Trustees. The nine member Board of Trustees is elected by the General Council, which is composed of all Tribal members over the age of 18. Almost all of the powers of the General Council are delegated to the Board of Trustees. The Farm Enterprise Committee has the authority to manage Tribal farmlands and to buy and sell land. All of their decisions are subject to approval by the Board of Trustees and ultimately by the General Council.

Goals

The underlying goal of the Committee is to help preserve the Tribe's cultural identity and heritage.[9] Subgoals important to achieving this underlying goal are maintaining the Reservation land base in Indian ownership and control, limiting the non-Indian population on the Reservation, and keeping the Reservation in non-urban land uses such as agriculture, range, or forestry which preserve the face of the land. The Committee wants to help the Tribe regain treaty rights which the Committee feels the Tribe has lost over the years.

The Tribe's own statement of its agricultural development goals and purpose is[10]:

> To place as much of the available 28,000 acres of Tribal and allotted land under tillage by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) agriculture program and thereby:
>
> 1. Generate income from Indian lands for Indian people through the CTUIR.
> 2. Increase the income of allottees through their participation in the Tribal Agriculture program.
> 3. Protect the quality and productivity of Indian lands through concerned management by Indian farmers.

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[9] This discussion of the Tribe's goals owes much to material developed in Oregon State University, Department of Agricultural and Resource Economics, "Feasibility of an Expanded Tribal Agricultural Enterprise for the Umatilla Indian Reservation: A Report Submitted to the Farm Enterprise Committee of the Confederated Tribes of the Umatilla Indian Reservation" (draft), (July 1976), pp. 1-7.

[10] Confederated Tribes of the Umatilla Indian Reservation, "Plan for Growth," p. 2.

4. To provide employment agriculture for Indian people in their own agriculture enterprises.
5. To insure the preservation of Indian lands now in agriculture status as agriculture land.
6. To diversify the agriculture enterprises into various types of agriculture and associated agribusiness enterprises and thereby increase income to Tribal members and employment for Indian people.

To acquire up to 6,000 acres of farm land into Trust Status for the direct control and tillage of the CTUIR agriculture program.

The most important of these purposes to the Committee is the generation of income or profit. Profitable operation of Tribal lands is one of the few means the Committee has for acquiring more land. The Committee wishes to acquire lands in such a manner as to maximize the amount of land under Indian control and to minimize urban development. Acquisition and consolidation are also means to halt the leapfrogging urban development which encourages further urbanization and interferes with agricultural use. The Committee also wishes to encourage employment and training opportunities for Indians, but it does not wish to favor these goals to the point where profitability and the land acquisition program are endangered. The desire for good resource utilization reflects the fact that Reservation resources are not managed so as to contribute as much as possible to the well-being of Tribal members. It also reflects the strong Indian concern for good stewardship of the land.

Summary

The Umatilla Indian Reservation is an area of contrasts in landscape, land quality, and land use. Up until the recent past most land uses have been agriculture, range, and forestry--uses which preserve the landscape. Recently, urbanization from adjacent Pendleton has begun to creep over the Reservation. In spite of the fact that the Reservation was given to the Tribe in perpetuity, more than half of the Reservation is now owned by non-Indians. The Tribe, through the Farm Enterprise Committee, has expressed concern that urbanization will destroy the landscape and that land will continue to move from Indian to non-Indian control. The Tribe desires to establish a land acquisition and consolidation program that will reverse these trends. Although the Committee's goals are not primarily economic goals, the Committee realizes that the Farm Enterprise must succeed economically if it is to achieve the goals of acquisition and consolidation.

III. EVALUATION OF DATA NEEDED

In its land acquisition and management functions, the Farm Enterprise Committee felt a need for data on the land resource and for an evaluation of that data. One of the Committee members has experience as a farm equipment operator. Another has a college education but no formal training in agriculture or farm management. All three members have very limited practical experience in land evaluation and farm management. They realized that a greal deal of information on the land resource is available at the BIA and other federal, state, and local agencies, but it was not immediately available to them in a form that would allow them to evaluate their land acquisition and consolidation options. This chapter will analyze the land resource data needs of the Farm Enterprise Committee.

Types of Data Needed

The Committee has three basic information needs. They need generalized small scale data on the range of variation of land resources over the entire Reservation to allow evaluation of the suitability of a parcel in the context of the Reservation. They also need large scale data sufficient to fully evaluate the suitability of a parcel for acquisition as a part of the agricultural enterprise. Finally, to assist comparison of parcels, they need a classification system for land parcels which reduces the complexity of variation in many factors to one generalized rating for each parcel. The rest of this chapter will discuss the second of these needs, the need for large scale data to fully evaluate land on a parcel by parcel basis.

Large Scale Data Needed

Identification System

Some uniform means is needed to identify data about a parcel with the parcel, whether it be in deeded, trust, or undivided interest status. Identification systems commonly in use are different for trust and deeded land. Access to the data file is needed both by map location of the parcel and by the owner's name. The size of the parcel should be included with identification information.

Identification of Owner and Operator

The owner's name is one of the key access routes to location of information about a parcel. The identity of the owner and operator indicates who should be contacted about a parcel. The identity of owner and operator also gives information, to those who are familiar with agriculture in the area, about the quality of management a parcel has seen or its possible future availability.

Land Use

Current Use. Current use gives some information on the potential uses of a parcel. It indicates current uses, such as residential, part-time farming, and industrial or commercial, that would reduce the probability that a parcel could physically or economically be converted to agricultural use.

Zoning. A comprehensive land use plan and zoning to implement the plan have become powerful land use controls in Oregon since the Fasano and Baker decisions by the Oregon Supreme Court and the passage of SB 100, the Oregon Land Use Planning Act. Counties are required to adopt a comprehensive plan after extensive community involvement in the planning process. The comprehensive plan becomes the major land use document; zoning must be in accord with the comprehensive plan. Planning commissions can grant zoning changes or variances only after a semi-judicial process and only if the proposed change is in accord with the comprehensive plan. The comprehensive plan can also not be easily changed by a planning commission without extensive community involvement. It would therefore appear to be possible to preserve the Reservation in agricultural use by adopting a comprehensive plan which reserves the Reservation for agricultural use and by developing a zoning ordinance which would implement this plan.

Minimum lot sizes could be very large, 40 acres for example, or new residences could be prohibited except under very limited conditions.

The Tribe and the County Planning Commission are both under political pressures from Indians and non-Indians alike to allow increased urban development on the Reservation. Under conditions before SB 100 and the court cases it would have been very difficult for these bodies not to submit to these pressures. If a comprehensive plan could be developed with broad community support for keeping the Reservation in agricultural use, the new law in Oregon could greatly help the Tribe and the County resist these pressures.

Cost Factors

Cost of Land. The cost of land is a major determinant of a parcel's potential profitability. Cost varies greatly over the Reservation and frequently is not correlated with potential productivity but rather with other factors such as distance to Pendleton or size of parcel.

Improvements. Improvements increase the cost of land. If improvements are agriculturally related, purchase of improvements along with land may be justified. Improvements not related to agricultural use, such as houses, serve only to increase the cost of obtaining land. For example, a $20,000 house on an 80 acre parcel would increase the cost of the land by $250 an acre, a substantial amount where land costs average $500 an acre. Therefore, the identity and cost of improvements are necessary to evaluate a parcel.

Operating Costs. Operating costs, together with land cost, productivity, and price of product, is a major determinant of parcel profitability. It is difficult to assign a dollar value to operating costs by parcel characteristics since the level of operating costs depends on so many factors, many of which are not a function of parcel characteristics but of other management decisions. There are, however, some parcel characteristics which are likely to increase operating costs above the average. Such characteristics are steep slopes, poor drainage, rocky soils, and high erosion hazards. Parcels with these characteristics need to be identified.

Agricultural Characteristics

Cultivable Acres. The Committee is primarily interested in buying only cultivable land which can be profitably operated. Small amounts, less than 10 percent, of non-cultivable land usually add little to the per acre cost of the cultivable acreage in the parcel.[11] Larger amounts of non-cultivable land do begin to add to the cost of the cropland. Most such non-cultivable land in parcels with

[11] Interview with John Hardin, Bureau of Indian Affairs Appraisal Office, Yakima, Washington, December 10, 1975.

cultivable land on the Reservation is poor quality rangeland with costs ranging from $25 to $100 per acre. Parcels with significant amounts of rangeland or other kinds of non-cropland need to be identified.

Precipitation. The amount of expected precipitation is an important statistic since it determines to a large extent the productivity of a parcel in this semi-arid region. Annual precipitation varies from 14 inches on the western edge to 31 inches on the eastern edge, a distance of only 20 miles. Areas with good soil depth receiving more than 16 inches a year can be cropped annually in a grain/pea rotation.[12] These areas are the most profitable on the Reservation. Areas receiving 14 inches or less or with shallow soils can be cropped only every other year. Areas receiving between 14 and 16 inches can sometimes support annual cropping.

Soils. Soils on the Reservation vary in their structure, texture, depth, fertility, water holding capacity, erodability, permeability, drainage, and pH, all of which contribute to their agricultural potential. Much of the small scale information available on agricultural potential is accessed by the identification of the soil and the slope. Such information includes soil capability class, adaptable crops, expected crop yields, and irrigability. There is also much

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[12] Interview with John Hesketh, Oregon State University Extension, Pendleton, Oregon, August 7, 1975.

valuable non-agricultural information accessed by the soil such as adaptability to sanitary facilities, community development, recreation, and wildlife habitat suitability.

Productivity. Productivity and land cost are the prime determinants of profitability which vary in space and therefore from parcel to parcel. Operating costs and price of product vary much less in space. There are two kinds of productivity possible, historic and potential. The potential yield is of the highest value to the Committee, since the Committee is interested in applying the best economic management to the land. However, the potential yield is an estimate and cannot be determined with the same accuracy as the historic yield. Both types of productivity would be useful as checks on each other.

Slope. Slope data are needed to help access information classified by soil and slope. Slope indicates the severity of management problems in an area where control of water erosion is the chief management problem. Steeper slopes also contribute to high operating costs and reduced productivities. Slopes of 0-3 percent are usually very favorable to farming except where drainage is a problem. They can be easily irrigated using sprinklers, borders, or corrugations and are seldom subject to erosion. Machines work efficiently with few problems. Slopes of 3-12 percent are also very suitable for farming but require more erosion control management. The time required for machine operations would be greater for the steeper clopes of this range, with about a 15 percent loss of efficiency compared to flat land.[13] They can be irrigated using sprinklers if the system is well engineered. Slopes of 12-20 percent can be farmed successfully if great precautions are taken to prevent erosion. These slopes are unsuitable for irrigation. The field efficiency of machines is reduced about 30 percent compared with flat land. A good operator is needed to prevent damage to vehicles and to minimize side slippage of equipment. Seeding depth is hard to control, resulting in a lower germination percentage which reduces the yield. Farming is possible on the gentler slopes within the 20-60 percent class, but all problems become more severe. The conservation difficulties are so severe that most such land would be better managed as range or forest.

Diversification Potential. One of the Farm Enterprise Committee's goals is to increase agricultural diversification on Tribal lands at some time in the future. Diversification could be valuable to them since it hedges against changes in the market for wheat and would allow intensification to more profitable crops.

Water is the key to most diversification on the Reservation. Therefore, the following kinds of information are necessary to

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[13] All the material in this paragraph is based on an interview with Clint Reeder, Oregon State University Department of Agricultural and Resource Economics, Corvallis, Oregon, March 31, 1976.

evaluate the diversification potential of parcels:

1. Suitability of soils to irrigation.
2. Irrigated crops that could be grown and their yields under irrigation.
3. Potential sources of water.
4. Amount of water available in the irrigation season, by source.
5. Economic feasibility of supplying water, by source.
6. Existing irrigation improvements or rights.

Overall Agricultural Recommendations. Besides all the data on crop yields, soils, precipitation, and diversification potential, the Committee needs some overall conclusions on what crops and farming practices are physically and economically suited to various parts of the Reservation. A simple checkoff list would be adequate as long as it summarizes all available information.

Location

Some parcels are more suitable than others because of their location. Factors contributing to this are the costs of moving equipment between parcels, management difficulties when parcels are small and scattered, blocking requirements for irrigation, and the locational preferences of the Committee. The Committee would like to acquire land in such a way as to help stem urbanization in the western part of the Reservation. The Committee would also most like to expand their agricultural operation in the south Reservation where most of the Tribal land is currently located and where they are most familiar with farming practices. Some way needs to be found to measure the effect of all these factors on the locational advantage of a parcel.

Summary

The Committee has needs for three basic kinds of information on the land resource--large scale parcel by parcel data, smaller scale regional generalizations based on large scale data, and a classification of all large scale data into one generalized rating for each parcel. All three types of information, together with the results of the economic analysis. will allow evaluation of the relative merits of parcels for acquisition. All three are based on the same large scale data. The basic types of large scale information needed are discussed in this chapter and include parcel and owner identification, land use, cost factors, agricultural characteristics, and locational advantage.

IV. COMPILATION OF LAND DATA

Once the information needs were determined, attention could be turned to finding the data to satisfy those needs. The needs for generalized and large scale parcel by parcel information involved the gathering of data. Time and financial constraints indicated that most of the data needed to be found in previously compiled sources. A search was therefore made for all relevant data available from federal, state, and local governmental agencies and from private organizations and individuals. If available information did not satisfy a need, alternative ways to satisfy that need had to be determined. In some cases, such as slope, land cost, and irrigation cost, data had to be generated. In other cases, where time precluded laborious field surveys, the data were not collected. However, instructions were left giving the procedures for collecting such data. This analysis of available data and generation of unavailable data is described in this chapter.

In evaluating available data and in generating new data, it was often necessary to make choices between conflicting estimates or between alternate ways of approaching the problem. Whenever such decisions had to be made, an effort was made to make the decision in the light of Tribal values and the Tribal economic situation. The attitude adopted can be best called conservative, conservative of the natural resources of the Reservation and conservative with respect to the financial return that can be expected from these resources.

Compilation of Generalized Information

A number of reports exist on Umatilla County or the Umatilla drainage basin land and water resources. These give a general orientation to the resources but are sometimes inaccurate or incomplete in detail. They point to the pattern of variation in land and water resources but cannot be used to characterize individual parcels. The USDA Report on Water and Related Land Resources: Umatilla Drainage Basin is one of the best of these sources.[14] It includes an excellent generalized treatment of the characteristics of agricultural resources and current patterns in man's use of these resources with good, small scale maps. The publication entitled Columbia-Blue Mountain Resource Conservation and Development Projects has similar information.[15] A publication of the Oregon State Water Resources Board, Umatilla Drainage Basin, concentrates on water supply, water use, and water control.[16]

[14] U.S., Department of Agriculture, Economic Research Service, Forest Service, and Soil Conservation Service, USDA Report on Water and Related Land Resources, Umatilla Drainage Basin, Oregon (1972).

[15] U.S., Department of Agriculture, Soil Conservation Service, Columbia-Blue Mountain Resource Conservation and Development Project (June 1974).

[16] Oregon, State Water Resources Board, Umatilla River Basin (June 1963).

Two medium scale general sources also exist on the Umatilla Indian Reservation itself. Again, these sources cannot be used for parcel by parcel analysis, but they do give the patterns of variation. A study prepared for the Tribe, "Planning for the Umatilla Indian Reservation: Initial Comprehensive Planning Information," has excellent information on Reservation history, physical setting, development patterns, housing, resource conservation and development, population and economy, and other topics.[17] A paper by Stern and Boggs, "White and Indian Farmers on the Umatilla Indian Reservation," analyzes the historical and cultural factors behind farming practices and lessee-lessor relationships on the Reservation.[18]

Other sources of generalized information included extensive observation of Reservation topography, urbanization, and farming practices. Agricultural extension experts provided useful information on soils and soil problems, crop yields, and agricultural land use patterns. A final source was information generalized from the large scale parcel by parcel data.

These generalized data were used to produce two different descriptions of the Reservation. In the first, the variation of each factor important to agriculture was given in both written and

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[17] CH_2M-Hill, Planning for Umatilla Indian Reservation.

[18] Stern and Boggs, "White and Indian Farmers."

cartographic form. In the second, more useful description, the Reservation was divided into 11 regions, each with a high degree of uniformity in the factors most important to Tribal agricultural expansion (Fig. 11). The regions were delineated using four criteria in the following order of importance: (1) soils and soil depth, (2) land prices and urban pressure, (3) land use, and (4) topography and slope. Precipitation and crop yields are so closely correlated with soils that they were not used as separate criteria. Regional boundaries were drawn so that they did not cross property boundaries.

The regional approach was used both as a way to explain variation in the quality of land for agricultural use and as a framework for developing some of the data needed that were otherwise unavailable. Data generated for each of the regions included land costs, crop recommendations, water sources, and irrigation costs. It would have been impractical, and would probably have implied greater precision than was possible, to develop these data on a parcel by parcel basis.

Compilation of Parcel by Parcel Data

Parcel Identification

Parcel identification systems are different for deeded and trust land, even though the ownership unit is the basic unit defining a parcel in both systems. For deeded land, the Umatilla County

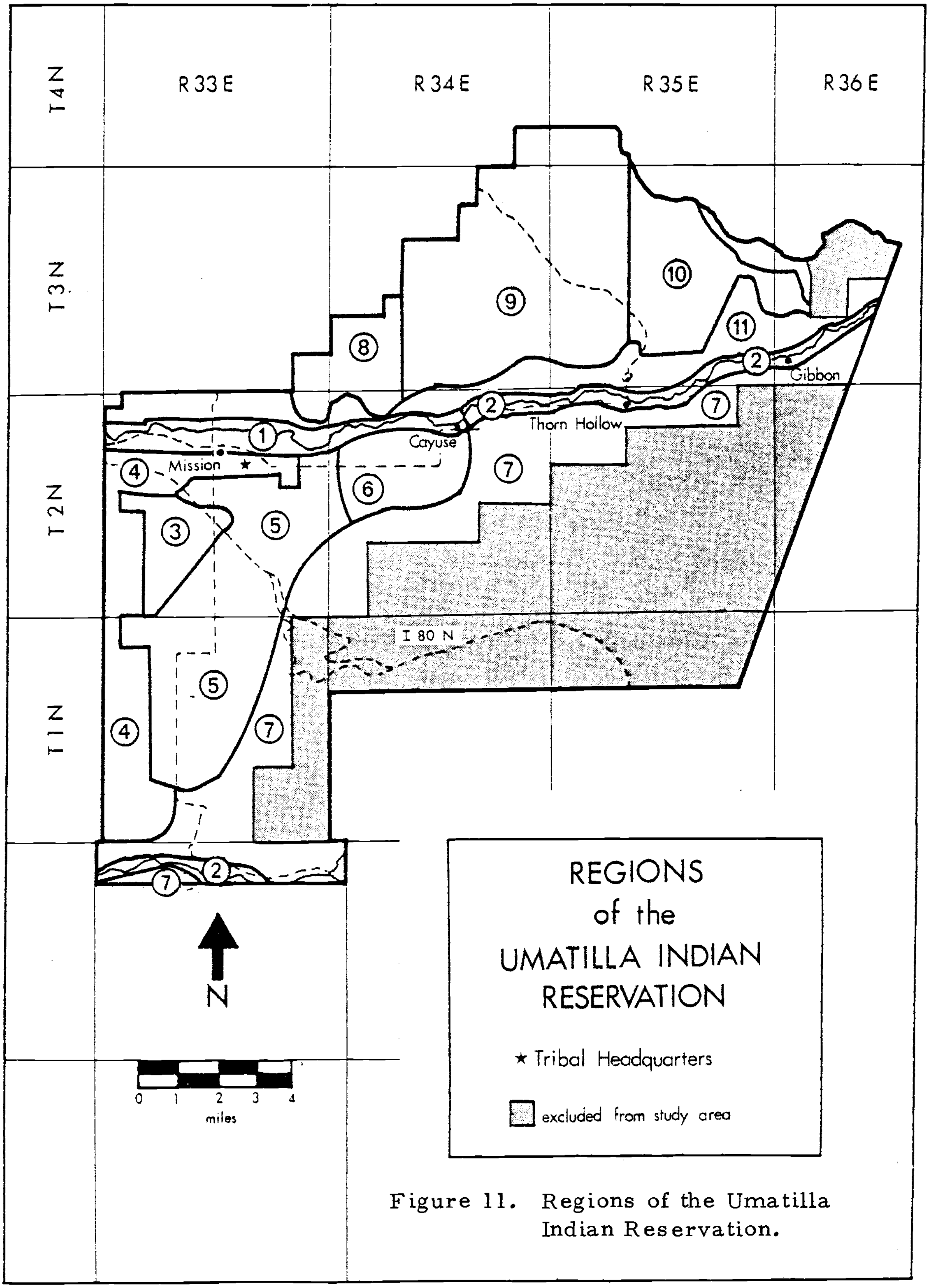

Figure 11. Regions of the Umatilla Indian Reservation.

Assessor's Office uniquely identifies a parcel by the township, range, and tax lot number of the parcel. On the Assessor's maps, trust land is divided into parcels which have no relationship to actual allotted ownership units.

Trust ownership units are identified by the allotment number given to the parcel when it was originally allotted. Only a few hundred acres of trust land were retained in tribal collective ownership without allotment numbers at the time of allotment. In most cases the allotment number is preceded by a "WW," "C," or "U" which represents the initials of the tribe to which the original allottee belonged. An "A" signifying "Allotment" was added to those allotment numbers lacking a preceding letter in order to distinguish them from tax lot numbers. Sample allotment numbers are WW160 and A367. Deeded ownership units are not identified on Tribal or BIA maps. In summary, the final identification code used consisted of the township, range, section number, and tax lot number or allotment number.

Land Use

Ownership. The most accurate compiled information on the identity of the owners of deeded land is the ownership file in the County Assessor's Office accessed through the tax lot number. Ownership information for trust land is confidential information held by the BIA. The Tribe already has this information on file so it was not pursued.

The size of the parcel was determined at the same time as the ownership. The number of acres was found on the Assessor's plat maps for deeded parcels and on the BIA Natural Resources Office index files for trust parcels.

Operator. The identity of the operator is available from a number of sources. Information from some of these sources, such as the Soil Conservation Service (SCS), is seriously out of date and hard to compile. Other sources, such as grain elevator companies and food processors, hold their information in confidentiality. The source finally used for deeded land was Agricultural Stabilization and Conservation Service (ASCS) files. Operator data are available for all parcels, both trust and deeded, that have participated in the wheat allotment program. Therefore, most agricultural parcels on the Reservation are included. These data were last updated in 1973 when the wheat allotment program was discontinued. The information is therefore out of date for some parcels. ASCS data were not used for trust land because current operator information was available from the BIA Leasing Office. This information is confidential, but it was given to us on condition that it not be released.

Current Use. Current land use was divided into the non-exclusive categories of residential, small part-time farm, agricultural, range/forest, and other. The presence of a habitable residence was determined from the appraisal card in the County Appraiser's Office for deeded land or from the BIA Housing Office for trust land. Small part-time farm was hard to define since farmers often lease or buy very small acreages down to an acre in size to expand their wheat production. It was finally decided to arbitrarily define a small part-time farm as a parcel larger than one acre but less than 20 acres with a habitable residence. Agricultural and range/forest uses were easily distinguished on large scale 1974 aerial photographs available in the BIA Natural Resources Office. Other uses, such as commercial and idle uses, are very few and had to be determined by ground survey.

Zoning. Authority to zone Reservation land is currently unclear. The Tribe and the County Planning Commission, acting jointly, have created an interim zoning ordinance with the Tribe having authority over trust land and the county over deeded land. The Tribe would like to obtain exclusive planning authority over Reservation lands and is in the process of preparing a comprehensive plan and final zoning ordinance. The Tribe is waiting for the results of this study before completing its plan and ordinance. Because of the tentative situation, interim zoning data were not collected for Reservation parcels.

Cost Factors

Land Cost. No compiled market land value data exist for all Reservation lands. There are a number of problems in compiling such data. The county appraisal values of most Reservation deeded land parcels are farm use values figured by capitalizing expected income. These values are carefully prepared and give a good comparative value of land parcels, but they do not give a good approximation of market value. Only about 25 sales of unimproved land parcels greater than a few acres have taken place in the last few years to allow appraisal by comparable sales. The grain sales to the USSR in 1973, machinery innovations introduced in the early 1970's, and the removal of ASCS allotments in 1973 have created an upheaval in land prices.[19] Prices have not stabilized at new levels. As a result of all these factors, most appraisers in the area do not feel confident about their estimates.

The resources that were available for estimating land values are listed below:

1. The actual sales prices of 21 deeded parcels of unimproved land larger than 19 acres and sold since 1970, available from the Umatilla County Appraiser.

[19] Interview with John Hardin, Bureau of Indian Affairs Appraisal Office, Yakima, Washington, December 10, 1975.

2. The actual sales prices of 32 deeded parcels of unimproved land smaller than 19 acres and sold since 1970, available from the Umatilla County Appraiser.

3. The actual sales prices of four trust parcels of unimproved land larger than 19 acres and sold since 1970, available from the BIA.

4. The estimates of accredited rural appraiser John Hardin, the BIA appraiser having responsibility for the Umatilla Indian Reservation.

5. The estimates of accredited rural appraiser William Scharn, a respected Pendleton rural appraiser.[20]

Given these resources, some means had to be found to estimate the spatial variation in land costs. One possible means would be to use multiple regression to estimate market land values from a number of independent variables such as size, year of sale, wheat yield, distance from Pendleton, and appraisal value. A 1974 study was able to explain 50 to 80 percent of the variation in market land prices in three other Oregon counties using such a technique.[21] The

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[20] Interview with John Hardin, Bureau of Indian Affairs Appraisal Office, Yakima, Washington, December 10, 1975 and interview with William Scharn, Oscar Schultz Agency, Pendleton, Oregon, September 24, 1975.

[21] U.S., Department of Agriculture, Farmland Use Values Versus Market Prices in Three Oregon Land Markets, by William D. Crowley, Jr., ERS-550 (Washington, D.C.: 1974), p. 18.

BIA Appraisal Office for the northwest has used this technique with good success for several northwest reservations. It was believed, however, that 25 observations for large parcels were not enough to develop an accurate multiple regression model for an area with as much variation as the Reservation. This belief was reinforced by the opinion of the BIA Appraisal Office that they did not have enough data on the Umatilla Reservation to use multiple regression.

The technique chosen was to make educated estimates of market values based on all available information. An estimate was made of the land value of parcels larger than 19 acres in each of the 11 regions and a separate estimate was made for parcels smaller than 19 acres in the Mission area. Sales observations and the estimates of the appraisers were divided to correspond to each of these regions.[22] An estimate was then made of the expected land prices in each region for the year 1975. An example of this process of estimation is given in Table 9. Mr. Scharn's estimates seemed low in many cases, Mr. Hardin's estimates seemed high in a few cases, and prices have risen rapidly in the past five years.

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[22] It should be noted that Mr. Hardin's estimates carry extra weight since he will be the person who will do the appraising that will determine what the Tribe can pay for a land parcel. The BIA appraiser determines the maximum value that the Tribe can pay for a parcel and the minimum price that trust land can be sold for.

Table 5. Estimate of per acre land value for Region 9.

Source of appraisal	Value per acre ($)	Year sold	Size (acres)
By appraiser:			
Scharn	400-600	1975	≥ 19
Hardin	700-750	1975	≥ 19
Verified sales:			
1	435	1971	80
2	400	1971	40
3	436	1972	40
4	668	1975	277
5	700	1975	40
Final estimate	600-750	1975	≥ 19

Improvement Identities and Costs. The identity of all improvements and their appraised market value are available for deeded parcels on the parcel appraisal card in the County Appraiser's Office. The appraised market value is made every six years and is updated yearly by applying a percentage increase. Only the appraisal value was collected because of the large number of improvements; the appraisal value indicates the magnitude of the effect the cost of improvements may have on the cost of land. Except for houses, the identity of improvements on trust land is not available except by ground survey. The value of these residences is not available at all. However, there are few improvements on trust land except for residences and some sheds.

Operating Costs. Conversations with farmers and extension personnel indicated that the spatially varying significant factors that would increase operating costs are slope and poor drainage. Comparison of farmers' reports of the magnitude of machine operation problems on sample parcels with the slope of those parcels showed that increased costs begin at a slope of about 10 percent and become very significant at about 20 percent slope.[23] Parcels with slopes greater than 12 percent were therefore indicated to have increased operating costs caused by slope. From SCS soils information Pedigo and Stanfield soils were determined to have drainage problems severe enough to require ditch drainage.[24] Costs of water erosion prevention measures such as terracing, grassed waterways, or strip cropping do not vary significantly spatially.

Suitability for Agriculture

Cultivable Acres. The County Appraiser's Office has very good figures available on the parcel appraisal card for deeded parcels giving the amount of land in each of eight land classes. These classifications were obtained by a field survey using the SCS

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[23] Interview with Clint Reeder, Oregon State University Department of Agricultural and Resource Economics, Corvallis, Oregon, March 6, 1976 and interview with Jack Duff, Reservation farmer, Pendleton, Oregon, September 23, 1975.

[24] Interview with Rudolph Mayko, Soil Conservation Service, Portland, Oregon, April 12, 1976.

soil survey of the county. Land classes I through IV are cultivable; class V is marginally cultivable but is usually cultivated. For this project the sum of classes I through V was used as the number of cultivable acres. The index card for each trust parcel in the BIA Natural Resources Office gives a figure for the number of tillable acres in the parcel.

The two different systems of measuring the number of cultivable acres are not consistent. The trust definition of tillable excludes all land on the parcel that is not leased for cultivation; this includes homesites, garden areas, and portions of the parcel which are retained in conservation uses such as grassed waterways. The trust definition is therefore slightly narrower than the deeded definition.

Precipitation. Two contradictory precipitation maps exist for the Reservation. The first was made by the U.S. Weather Bureau for the SCS and covers the entire state of Oregon using a five inch isohyet interval.[25] The second map was produced by the SCS and covers Umatilla County with a two inch isohyet interval.[26] The map prepared by the U.S. Weather Bureau conforms more accurately to the topography of the Reservation. However, a comparison of the

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[25] U.S., Department of Agriculture, Soil Conservation Service, Normal Annual Precipitation, 1930-1957, State of Oregon (July 1964).

[26] U.S., Department of Agriculture, Soil Conservation Service, Isohyetal Map.

two maps with the 30 year precipitation averages of U.S. Weather Bureau recording stations showed that the SCS map provides better quantity estimates.[27]

Soils. The basic source for all available soils maps is the SCS soil survey of Umatilla County published in 1948.[28] This is the most recent soils map for agricultural portions of the Reservation. There do exist, however, recent OR-Soils-1 soil interpretation sheets for all the soils that will be mapped in Umatilla County when the next soil survey is begun in the late 1970's.[29] These OR-1 sheets provide much useful information for agricultural and other types of planning (Fig. 12). It was therefore decided to update the 1948 soil survey to conform to the OR-1 sheets.

The following steps were taken to update the old survey. The 1:63, 360 soil survey map was enlarged using a zoom transfer scope to fit the grid of the 1:24, 000 USGS topographic maps covering the Reservation. Soil boundaries were occasionally modified where necessary to fit the topography. The old survey did not show slopes;

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[27] Precipitation averages for each station were calculated by averaging all available annual precipitation totals for the 30 years from 1946 to 1975. For some stations the number of years available is less than 30. The source of annual precipitation totals was U.S., Department of Commerce, Weather Bureau, Climatological Data for the U.S. by Sections, Volumes 52-71, No. 13 (U.S. Weather Bureau: Asheville, N.C., 1946-76).

[28] U.S., Department of Agriculture, Soil Survey.

[29] U.S., Department of Agriculture, OR-Soils-1.

OR-SOILS-1 12/72 Wa
FILE CODE SOILS 12 SOIL INTERPRETATIONS FOR OREGON U.S.D.A. SOIL CONSERVATION SERVICE

DATE: 1/73 A-D-G Wa Walla Walla High Rainfall SERIES SOILS: Wa

1. *Walla Walla silt loam, high rainfall, 1 to 7 percent slopes*
2. *Walla Walla silt loam, high rainfall, 7 to 12 percent slopes*
3. *Walla Walla silt loam, high rainfall, 12 to 20 percent slopes*
4. *Walla Walla silt loam, high rainfall, 20 to 35 percent north slopes*
5. *Walla Walla silt loam, high rainfall, 20 to 35 percent south slopes*

*6. *Walla Walla-Spofford complex, 1 to 7 percent slopes*

The Walla Walla (high rainfall) series consists of well drained silt loam soils formed in wind-lain silts. These upland soils have 1 to 35 percent slopes. Elevations range from 1000 to 2400 feet. Vegetation includes bluebunch wheatgrass, giant wildrye, Sandberg bluegrass and related forbs and shrubs. Average annual precipitation is 14 to 16 inches; mean annual air temperature is 49° to 51° F. The average frost-free period (32° F.) is 160 to 185 days.

Typically, the surface layer is dark grayish-brown (moist) silt loam about 12 inches thick. The subsoil is dark brown (moist) silt loam about 48 inches thick. Depth to basalt bedrock or laminated sediments is 40 to more than 60 inches.

Permeability is moderate. Available water capacity is 7.5 to 12.5 inches. Water-supplying capacity is 9 to 13 inches. Effective rooting depth is 40 to 60 inches. Runoff is slow to rapid. The erosion hazard is slight to severe.

Walla Walla (high rainfall) soils are used for dryfarm small grains, peas and irrigated crops. These soils occur in north central Oregon (B8).

The Walla Walla (high rainfall) series is a member of the coarse-silty, mixed, mesic family of Typic Haploxerolls.

ESTIMATED SOIL PROPERTIES

DEPTH FROM SURFACE (in.)	CLASSIFICATION USDA TEXTURE	UNIFIED **	AASHO **	COARSE FRACT. OVER 3 IN.	% OF MATERIAL PASSING SIEVE ** #4	#10	#40	#200	** LIQUID LIMIT	** PLASTICITY INDEX	PERMEABILITY (in/hr)	AVAIL. WATER CAP. (in/in)	SOIL REACTION (pH)	SHRINK SWELL POTENTIAL
0-17	silt loam	ML	A-4	0	100	100	100	70-90	25-30	NP-5	.6-2.0	.19-.21	6.6-7.3	low
17-60	silt loam	ML,CL	A-4	0	100	100	100	75-95	25-30	3-8	.6-2.0	.19-.21	6.6-7.8	low

DEPTH (in.)	CONDUCTIVITY (mmhos/cm)	CORROSIVITY STEEL	CONCRETE	EROSION FACTORS K	T	WIND EROD. GROUPS
0-17	.2 - .3	mod.	low	.43	5	-
17-60	.2 - .3	mod.	low	.55	-	-

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (ft.)	KIND	MONTHS	HYDROLOGIC GROUP
none	-	-	>6	-	-	B

CEMENTED PAN DEPTH (in.)	HARDNESS	BEDROCK DEPTH (in.)	HARDNESS	FROST ACTION	REMARKS
-	-	40->60	hard	low	

SANITARY FACILITIES AND COMMUNITY DEVELOPMENT			
USE	SOIL	RATING	RESTRICTIVE FEATURES
SEPTIC TANK ABSORPTION FIELDS	1,6 2 3,4,5	Slight Moderate Severe	- Slope Slope
SEWAGE LAGOONS	1,6 2,3,4,5	Moderate Severe	Slope, percolates rapidly Slope
SANITARY LANDFILL (TRENCH)	1,2,6 3 4,5	Slight to moderate Moderate Severe	Depth to rock Slope, depth to rock Slope
SANITARY LANDFILL (AREA)	1,6 2 3,4,5	Slight Moderate Severe	- Slope Slope
DAILY COVER FOR LANDFILL	1,6 2 3,4,5	Good Fair Poor	- Slope Slope
SHALLOW EXCAVATIONS	1,6 2 3,4,5	Slight Moderate Severe	- Slope Slope
DWELLINGS WITHOUT BASEMENTS	1,6 2 3,4,5	Moderate Moderate Severe	Low strength Slope, low strength Slope
DWELLINGS WITH BASEMENTS	1,6 2 3,4,5	Moderate Moderate Severe	Low strength, depth Slope, low str.,depth Slope
SMALL COMMERCIAL BUILDINGS	1,6 2,3,4,5	Moderate Severe	Slope, low strength Slope
LOCAL ROADS AND STREETS	1,6 2 3,4,5	Slight Moderate Severe	- Slope Slope

SOURCE MATERIAL AND WATER MANAGEMENT			
USE	SOIL	RATING	RESTRICTIVE FEATURES
ROADFILL	1,2,6 3 4,5	Fair Fair Poor	Low strength Low strength, slope Slope
SAND	1,2,3,4,5,6	Unsuited	Excessive fines
GRAVEL	1,2,3,4,5,6	Unsuited	Excessive fines
TOPSOIL	1,6 2 3,4,5	Good Fair Poor	- Slope Slope
POND RESERVOIR AREA	1,6 2,3,4,5	Moderate Severe	Percolates rapidly Slope
EMBANKMENTS DIKES AND LEVEES	1,2,3,4,5,6	Moderate	Piping, hard to pack
DRAINAGE	1,2,3,4,5,6	-	Not needed
IRRIGATION	1,6 2,3,4,5	Good Poor	Favorable Slope
TERRACES AND DIVERSIONS	1,6 2,3 4,5	Slight Moderate Severe	Favorable Slope, erodes easily Slope, erodes easily
GRASSED WATERWAYS	1,6 2,3 4,5	Slight Moderate Severe	Favorable Slope, erodes easily Slope, erodes easily

Figure 12. A sample OR-Soils-1 sheet, front side.

Wa
CONTINUATION SHEET OR-SOILS-1 12/72 Walla Walla SERIES
High Rainfall

RECREATION

USE	SOIL	RATING	RESTRICTIVE FEATURES	USE	SOIL	RATING	RESTRICTIVE FEATURES
CAMP AREAS	1,6 2,3,4,5	Slight Severe	- Slope	PLAYGROUNDS	1,6 2,3,4,5	Moderate Severe	Slope Slope
PICNIC AREAS	1,6 2,3,4,5	Slight Severe	- Slope	PATHS AND TRAILS	1,6 2,3,4,5	Slight Moderate	- Slope

CAPABILITY AND PREDICTED YIELDS - CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

SOIL	CAPABILITY		WinterWheat (Bu)		Peas (Tons)		Pasture (AUM)		Hay (Tons)						REMARKS
	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	
1	IIe	I	60	125	2.5	4	8	14	3	6					
2	IIIe	IIe	60	125	2.5	4	8	14	3	6					
3	IIIe	IIIe	60	125	2.5	4	8	14	3	6					
4	IIIe	IIIe	60	125	2.5	4	8	14	3	6					
5	IVe	IVe	50	125	2	4	6	14	2	6					
6	IVe	IVe	60	125	2.5	4	8	14	3	6					

WOODLAND SUITABILITY

SOIL	POTENTIAL PRODUCTIVITY		WOOD SUIT. GROUP	MANAGEMENT PROBLEMS					NATIVE SPECIES
	SPECIES	SITE INDEX		EROSION HAZARD	EQUIPMENT LIMIT.	SEEDLING MORTALITY	WINDTHROW HAZARD	PLANT COMPET.	
1,2,3,4,5,6	None								

WINDBREAKS

SOILS	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE	SPECIES	HT. AGE 20	PERFOR-MANCE
1,2,3,4,5,6 (IRR)	hybrid poplar	40		black locust	30		Russian mulberry	30	

WILDLIFE HABITAT SUITABILITY

SOIL	POTENTIAL FOR HABITAT ELEMENTS								POTENTIAL AS HABITAT FOR:			
	GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLAND WILDLIFE	WOODLAND WILDLIFE	WETLAND WILDLIFE	RANGELAND WILDLIFE
1,2,3,4,5 6 (NIRR)	Good	Good	Poor	-	-	Poor	V.poor	V.poor	Fair	-	V.poor	Poor
1,2,3,4,5 6(IRR)	Good	Good	Poor	Good	Good	Good	V.poor	V.poor	Good	Good	V.poor	-

RANGELAND

RANGE SITE NAME	SOIL	KEY SPECIES AND % COVER	POTENTIAL YIELDS		NORMAL SEASON	
			TOTAL lb/Ac	USABLE Ac/AUM	GROWING	GRAZING

FOOTNOTES

* See individual OR-SOILS-1 form for interpretations of the Spofford portion of the mapping unit.
** Based on engineering test data reported in Sherman County Soil Survey issued November 1964.

Figure 12. (Continued) Back side.

the OR-1 sheets had interpretations based on soil and slope class. It was thus necessary to divide each of the soils into the slope classes 0-3 percent, 3-7 percent, 7-12 percent, 12-20 percent, and more than 20 percent using the topographic maps.

The old survey nomenclature also had to be updated. These changes were made with the help of Rudolf Mayko, SCS State Soil Scientist, who has many years of experience in the Umatilla area.[30] One type of nomenclatural change required that a soil series name be changed, as from Caldwell to Pedigo or Waha (deep phase) to Palouse. A second type of nomenclatural change involved the reclassification of the soil type; for example, Thatuna silty clay loam had been changed to Thatuna silt loam. A portion of the old 1948 soils map and the updated version of that same portion is given in Figure 13.

Slope and Soil Capability Class. Once the soils map was updated, the slope class and soil capability class were readily available from the OR-1 sheet corresponding to the soil. The soil capability class and the slope class recorded for each parcel were generalized from the soils present on the parcel.

Productivity. A number of sources for expected potential yields are available. The Federal Crop Insurance Acturial Map is

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[30] Interview with Rudolph Mayko, Soil Conservation Service, Portland, Oregon, April 12, 1976.

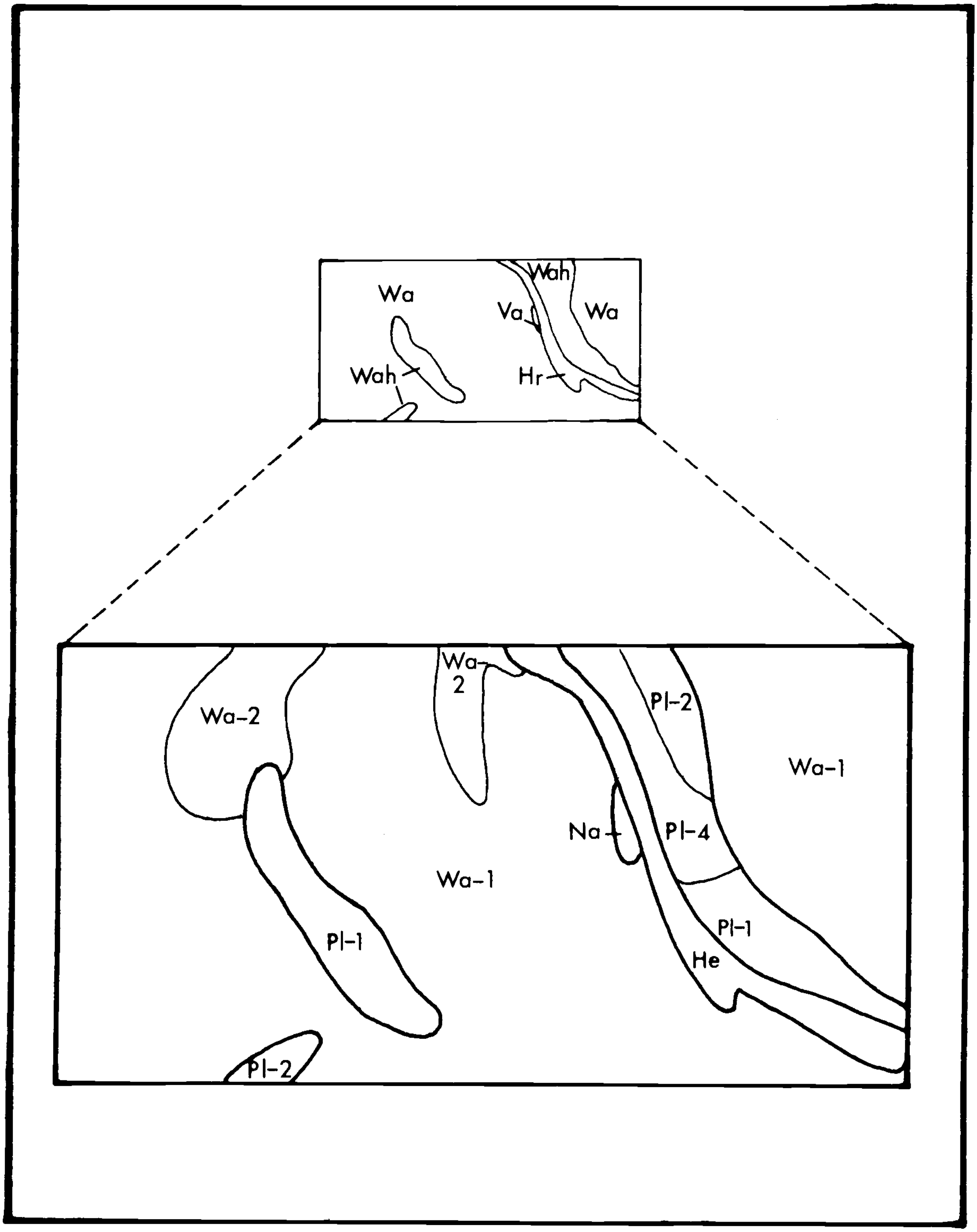

Figure 13. Portion of 1948 soil survey (upper) and the updated version of the same portion (lower). Source: U.S., Department of Agriculture, Soil Survey.

very generalized and tends to underestimate potential yields.[31] For example, it uses 50 bushels as a base for land that regularly averages at least 60 to 70 bushels of wheat per acre. Expected yields are available from the ASCS for wheat only. These values are generalized by operator; most operators farm so many acres of all kinds of productivities that these values are not accurate for individual parcels. The SCS predicts potential yields obtainable under a high level of management by soil and slope on the OR-1 sheets. These predictions are given for all crops that have been grown on each soil. They are based on the opinions and estimates of extension personnel, farmers, and SCS field agents. These are the most consistent data for the largest number of crops available for all Reservation lands.

There are two sources for historic crop yields. Historic yields of crops by owner and parcel are available on computer printouts from processors or elevator operators. The information is confidential so that processors will not release it unless it is to be averaged. However, the very point of this project was to obtain large scale, non-averaged data. The BIA Leasing Office supervises the leasing of trust lands. They therefore have records of historic yields on most trust lands for wheat, barley, peas, alfalfa, and pasture, the only crops that have been grown on trust land. These records are reported historic yields rather than potential yields; the

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[31] Federal Crop Insurance Acturial Map, April 18, 1974.

Tribe frequently has some concern that non-Indian operators do not manage for maximum productivity and in some cases dishonestly represent the yields obtained from parcels. Although a separate report of yield is to be made for each leased allotment according to BIA regulations, much of the data available are actually averaged by operator.[32]

The SCS yield predictions were used as the primary productivity data. These estimates were further subjected to critique by a USDA specialist in Pendleton.[33] The BIA data for trust land and the ASCS data for wheat lands were used as secondary sources to check SCS predictions.

Locational Advantage. The locational advantage of a parcel is hard to indicate quantitatively. A measure of the distance of a parcel from Tribal land would measure costs of moving equipment between parcels, but from which Tribal holding should the measurement be taken? A distance measure would not take into account management difficulties for small scattered parcels, blocking requirements for irrigation, the desire of the Tribe to stem urbanization in the western Reservation, or the locational preference of the Farm Enterprise Committee.

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[32] Interview with Dale Lingle, Bureau of Indian Affairs, Umatilla Agency, Mission, Oregon, September 24, 1975.

[33] Correspondence with Robert Raming, USDA Columbia Basin Agricultural Research Center, Pendleton, Oregon, March 24, 1976.

After consultation with Tribal planners and a Farm Enterprise Committee member, a decision was made to divide the Reservation along township lines and to assign a numerical ranking to each township which would indicate the locational advantage of parcels in that township (Fig. 14). Locational advantage values range from a high of one to a low of eight. T2N R33E, with most of the Tribal land, Tribal headquarters, and the center of the urbanization the Tribe is trying to stem, assumes a locational advantage of one. T1N R33E, with much of the rest of the Tribal agricultural land, has an advantage of two. These two townships are the heart of the South Reservation where the Committee would prefer to farm. T2N R34E takes precedence with a value of three over T1S R33E with a value of four because of its greater accessibility to the center of consolidation. T3N R34E and T3N R35E, with values of five and six, have the next greatest accessibility. The agricultural lands in T2N R35E and T3N R36E have very poor accessibilities from present Tribal lands and therefore have low values of seven and eight.

Agricultural Diversification Potential

Suitability of Soils for Irrigation. The Bureau of Reclamation surveyed and classified Reservation lands according to their suitability for irrigation.[34] The classification is based on the soil,

[34] U.S., Department of the Interior, Bureau of Reclamation, Region 1, Umatilla Basin Project, Oregon, Vol. 1 (April, 1970), p. 34.

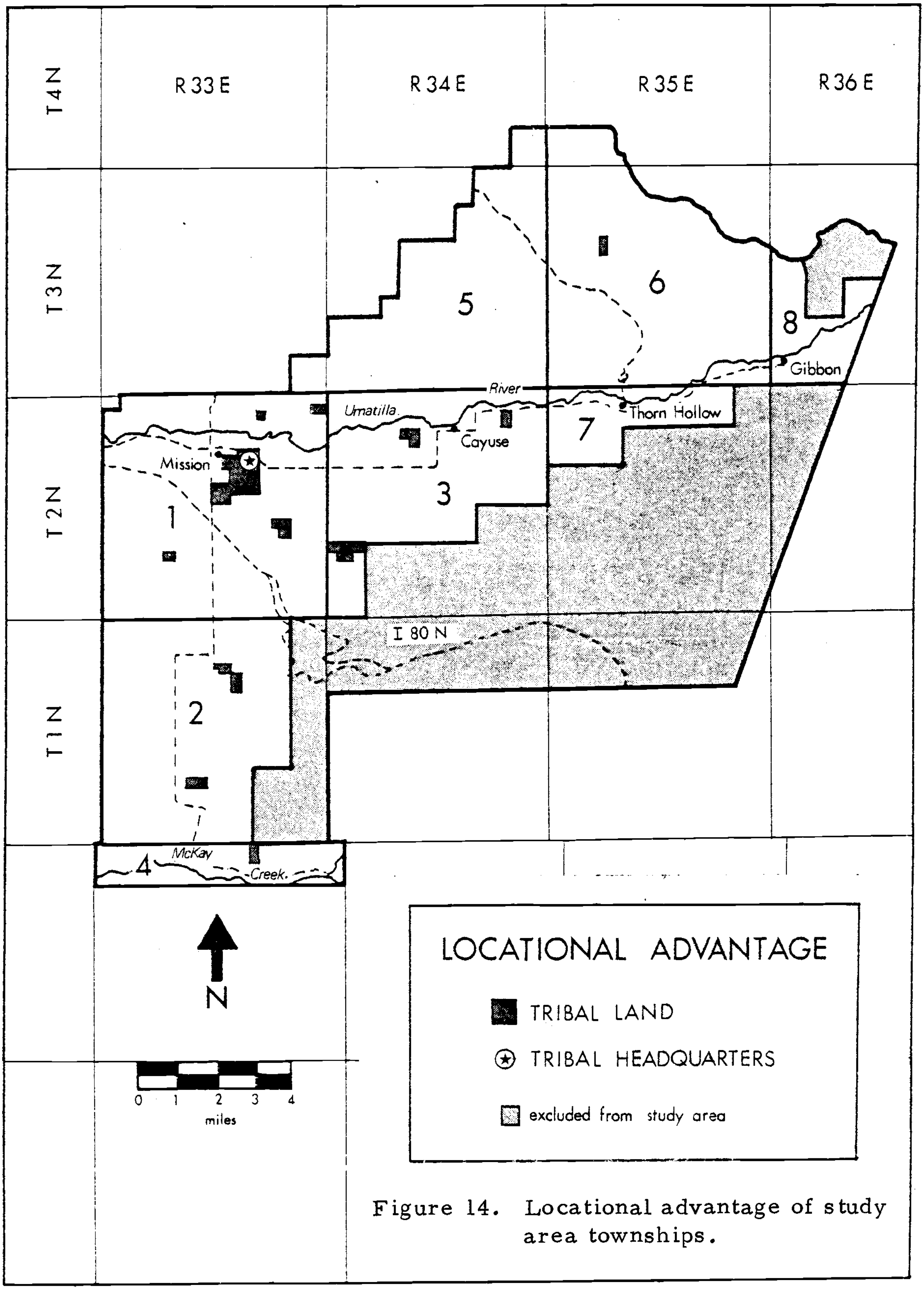

Figure 14. Locational advantage of study area townships.

the topography, and the economic potential of irrigated farming. This is the best survey available for irrigation suitability; however, it is complete for only the 20 percent of the agricultural lands of the Reservation that would be served by the Bureau Umatilla Basin Project.

The classification used to indicate soil suitability for irrigation in this project was the classification developed by the Oregon State Water Resources Board in their report Oregon's Long Range Requirements for Water, Appendix I-7.[35] This report classifies the suitability of soils for irrigation by soil series, soil type, and slope. It was therefore very easy to determine the irrigation suitability of each of the soils on the updated soils map. The "Excellent," "Good," and "Fair" suitability classes of the state report were used in this project. The "Poor," "Very Poor," and "Unirrigable" classes were combined here into a single "Non-irrigable" class.

Crops Possible under Irrigation. No irrigated crops except alfalfa and irrigated pasture are currently grown on the Reservation. The determination of what irrigated crops could potentially be grown therefore required expert extrapolation.[36] SCS personnel, agricultural

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[35] Oregon, State Water Resources Board, Oregon's Water Requirements, pp. 36-39.

[36] This determination was made with James Fitch and William McNamee of the Department of Agricultural and Resource Economics, Oregon State University.

specialists at the Pendleton Agricultural Experiment Station, and processor's representatives were surveyed for their estimates of potential irrigated crops. The list was then reduced in the light of soil, climate, marketing, and economic limitations. For example, irrigated pasture was eliminated because of a poor economic outlook; tree fruits were eliminated because of a lack of air drainage; and many processing vegetables were viewed with suspicion because of potential marketing problems.

Sources of Water. Three sources of water--surface waters with storage, surface waters without storage, and groundwater--are possible on the Reservation. Surface waters with storage were not even considered; the Tribe is unalterably opposed to dams on the Umatilla River because of the negative effect of dams on fish.

The Umatilla River and McKay Creek currently supply about four million gallons per day for small scale irrigation on the Reservation.[37] These streams could conceivably be used by the Tribe as a surface source of water to irrigate more acreage without building any storage capacity on the streams. There are two problems, however, to using surface water without storage for irrigation. First, the legal right to the water is under question. The State Engineer's office currently has control over the use of the the water through its prior appropriation system. Gaining the right

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[37] Interview with Joseph Gonthier, U.S. Geological Survey, Portland, Oregon, April 12, 1976.

to use stream flows under this system would be difficult for the Tribe, as there are so many other claims to the water. The Tribe is now preparing to challenge in court under the Winters Doctrine the current appropriation of water based on prior treaty rights of Indians to beneficial use of all streams running through the Reservation. There is an excellent chance that this suit will give the Tribe control over most, if not all, the water in the Umatilla River and McKay Creek.

The second problem is that the spring and summer fisheries and agriculture are competing uses of stream water. A major goal of the Tribe is to restore and conserve the fishery.[38] The Oregon State Game Commission has set recommended minimum and optimum flow levels in the Umatilla River within the Reservation for fish life.[39] A comparison of recommended minimum stream flows and actual Umatilla River flows indicates that there is no water available for uses other than fish habitat from June to November. All of these months except June show a deficit of water for recommended flow levels. During December to May, however, there is a large amount of water available above the recommended optimum stream flows. At

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[38] Interview with Michael Farrow, Umatilla Tribal Planning Office, Mission, Oregon, April 15, 1976.

[39] Oregon State Game Commission, Environmental Investigations: Umatilla Basin, Fish and Wildlife Resources and their Water Requirements, by Allan K. Smith (February, 1973), pp. 17, 50-53.

least 300 million gallons per day would be available in April and May for supplemental irrigation of up to 75,000 acres of wheat or other crops. This is enough water to supply the irrigation needs of all Reservation agricultural lands during the months of April and May.

Groundwater is available on the Reservation from the Columbia River basalt aquifer. The USGS recently completed an unpublished study of the aquifer on the Reservation; most groundwater information in the present study is based on estimates obtained from USGS.[40] An assumption on which the following analysis is based is that groundwater is an important resource which should not be mined. The aquifer is recharged by water percolating from the surface throughout the Reservation and particularly from exposed basalt in the canyons of the Blue Mountains.[41] The recharge rate is estimated to be between one inch and three inches of water over the 247 square miles of the Reservation. If this yearly recharge of water were used over a 210 day irrigation season, between 20 million gallons per day and 61 million gallons per day could be safely removed from the aquifer. Three million gallons per day are currently being removed, leaving 17-58 million gallons per day available. This is enough water to irrigate 1700 to 11,600 acres

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[40] Interview with Joseph Gonthier, U.S. Geological Survey, Portland Office, Portland, Oregon, April 12, 1976.

[41] U.S., Department of the Interior, Geological Survey, Geology of the Umatilla River Basin, p. 37.

during the peak irrigation season, much less than the 62,000 acres of irrigable land on the Reservation.

Costs of Supplying Water. All estimates of costs of supplying water depend on the specifications the delivery system must meet to satisfy the irrigation need. A side roll irrigation system was determined to deliver water at the best application rate for the heavy soils present on the Reservation.[42] Each irrigation system is also dependent on the crop to be grown and its water needs. Two crops, wheat and alfalfa, were chosen to represent the extremes of low and high water usage. The delivery rate, or gross system capacity per acre, that the system must be designed to meet for the two crops under the different conditions of the north and south Reservation were determined by techniques described in extension publications.[43]

A delivery system for surface water involves a system for delivering water to the edge of the parcel and a system for applying water to the land. Except for locations very near the river, a delivery system to get water to the edge of a parcel would likely require cooperative effort by many landowners. The cost of the

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[42] U.S., Department of Agriculture, Soil Conservation Service, Portland, Oregon, Oregon Irrigation Guide (July 1973), pp. 16-18.

[43] Oregon State University Extension Service, How to Estimate Capacity for Sprinkler Irrigation Systems, by Marvin N. Shearer, Extension Circular 813 (October 1972), and Oregon State University Agricultural Experiment Station, Consumptive Use and Net Irrigation Requirements for Oregon, by Darrell G. Watts et al., Circular of Information 628 (March 1968).

delivery system per parcel would be dependent on the number of parcels served by the system. Therefore, this surface delivery system is not purely a function of the parcel and is therefore not analyzed in this study. Ths cost of applying water to the land from the edge of the parcel to meet all specifications does not vary spatially. This cost was estimated by a farm management specialist to be $220 per acre for each 20 acre side roll field.[44] This system would supply enough water to irrigate alfalfa; the cost would be lower for wheat.

No good estimations of investment costs for ground water development were available to meet the conditions on the Reservation. It was therefore necessary to estimate well depth, projected well capacity, pumping lifts, and number of acres irrigated by each well before costs could be estimated. Depth to saturated groundwater varies over the Reservation. There is some shallow perched water but it is not considered since it would be easily depleted. The saturated groundwater level is just a few feet below the surface in the Umatilla Valley and less than 100 feet deep in the agricultural portion of the South Reservation.[45] The depth on the north

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[44] Interview with A. Gene Nelson, Oregon State University Extension Service, Corvallis, Oregon, April 1976.

[45] This information and following information on groundwater depths and well capacities is based on an interview with Joseph Gonthier, U.S. Geological Survey, Portland, Oregon, April 12, 1976 and U.S., Department of the Interior, Geological Survey, Portland Office, "Basic Water Data of the Umatilla Indian Reservation," prepared by Joseph Gonthier.

Reservation varies between 250 feet at the western edge to 700 feet or more north of Gibbon on the east. A survey of existing wells in the area indicated that a deep well could be expected to yield, on the average, one million gallons per day if it extended 1000 feet below the saturated water level. This projected capacity of the average well plus the required gross system capacity per acre then allowed the number of acres irrigable by a single well in different parts of the Reservation under different crops to be determined. The USGS also supplied estimates of the transmissivity and the distance/drawdown curves for the north Reservation, the south Reservation, and the Umatilla River Valley. These allowed the pumping lift to be determined. It also gave an estimate of the additional pumping lift that would be required if wells were placed close enough together to interfere with each other. In this study it was assumed that each well had eight neighbors, with all wells being two to three miles apart, to simulate full development of the aquifer.

Once specifications of well depth, well capacity, pumping lift, and number of acres irrigated per well were determined it was possible for an irrigation specialist to estimate the components and costs of components of the required system.[46] A sample of the

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[46] Interview with Marvin N. Shearer, Oregon State University Extension Service, Corvallis, Oregon, April 27, 1967.

specification and cost calculations for the south Reservation is given in Table 6.

Existing Irrigation Rights or Improvements. Surface water rights are filed with the State Engineer. There are hundreds of individual water rights recorded on the Umatilla River within the Reservation boundaries. It is impossible to determine from the State Engineer's records which rights are currently valid and how much water is actually diverted. Therefore, surface water rights were not obtained. There is very little irrigation from surface streams on the Reservation at the present time.

Groundwater wells are also filed with the State Engineer. The USGS has prepared a summary of wells in the Reservation area in a convenient format from the State Engineer's records.[47] From this summary the depth, location, and capacity of all Reservation wells can easily be determined. Wells with a capacity of 100 gallons per minute or more were recorded for this project as wells with agricultural potential. A 100 gallon per minute well could irrigate 10 to 20 acres.

Overall Agricultural Recommendations

As a summary to the project, a list of recommended crops was developed for each region. This determination was made in the

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[47] U.S., Department of the Interior, Geological Survey, "Basic Water Data."

Table 6. Specifications and costs of irrigation systems for wheat and alfalfa for the south Reservation.

	Wheat	Alfalfa
Well specifications		
Required gross system capacity (gpm)	6.15	8.52
Well capacity (million gallons per day)	1	1
Acres irrigated per well	120	80
Depth to saturated bedrock (feet)	100	100
Total depth of well (feet)	1100	1100
Transmissivity (ft^2 per day)	2940	2940
Lift without neighbors (feet)	190	190
Lift with eight neighbors (feet)	326	326
Costs ($)		
Well drilling, 12 inch diameter with casing @ $1.75 per inch diameter per foot depth	23,000	23,000
Turbine pump and accessories	25,000	25,000
8 inch PVC mainline @ $2 per foot	4,000	2,804
4 side roll systems	16,000	16,000
Total cost	68,000	66,804
Cost per acre	567	835

light of the economic, marketing, and management analyses performed by other members of the project team as well as the land evaluation analysis described in this thesis.[48] Each crop in each region was categorized as recommended, not recommended, or marginal.[49]

Summary

The information needs of the Farm Enterprise Committee required both generalized and parcel by parcel data. Land and water resources conservation or management agencies have published many generalized treatments of the Umatilla area, and the Tribe itself has contracted for similar information on the Reservation itself. It was possible to satisfy the need for generalized information from these sources plus information generalized from the parcel by parcel data. It was possible to satisfy almost all of the parcel by parcel data needs with previously compiled data in the hands of government agencies or by developing estimates for each of the regions.

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[48] Much of the credit for these conclusions goes to James Fitch and William NcNamee of the Department of Agricultural and Resource Economics, Oregon State University.

[49] Crops on which recommendations were made were dryland wheat, dryland peas, irrigated wheat, irrigated alfalfa, and irrigated small vegetables.

V. LAND DATA MANAGEMENT SYSTEM

Chapter III discussed the three types of information and the specific large scale data needed by the Committee. Chapter IV evaluated the ability of available data to serve the need for generalized and parcel by parcel information. This chapter will discuss the organization of these data into a land data management system which serves as a vehicle for conveying the large scale and generalized information to the Tribe.

Prerequisites

To be most useful to the Committee a data management system must meet several prerequisites. It must be easy to understand and use; it must use little sophisticated technology such as computers. The information must be accessible by the owner's name as well as by parcel location. Several land owners have approached the Tribe about selling their land but the Tribe has not been able to locate the parcels. There must be some kind of generalized information which will help in the interpretation of parcel characteristics. All the large scale data must be easily available on a parcel by parcel basis. A series of overlay maps could supply all the information on a parcel but would not organize it conveniently for the evaluation of a single parcel.

The Data Management System

Locator Map

A large locator map is the heart of the data management system (Fig. 15). From the location of a parcel, the identification code and the region number of the parcel can be determined. The identification code is given by the township, range and section in which the parcel is located followed by the number found on the map inside the parcel boundaries. The final part of the code is the tax lot number for deeded parcels, the allotment number for allotted parcels, or a "T" for Tribal parcels. Allotment numbers are preceded by a "U" (Umatilla), a "WW" (Walla Walla), a "C" (Cayuse), or an "A" (Allotment). The identification code can then be used to locate the small scale data on the parcel data cards; the region number can be used to locate generalized information in the regional analyses.

Index Files

The index files to owners and parcels cross reference owners with parcel identification codes. The Tribe already has index files for trust land very similar to the files described below for deeded land. Two files to the deeded parcels were produced by this project. One file has a card for each parcel and is organized by identification

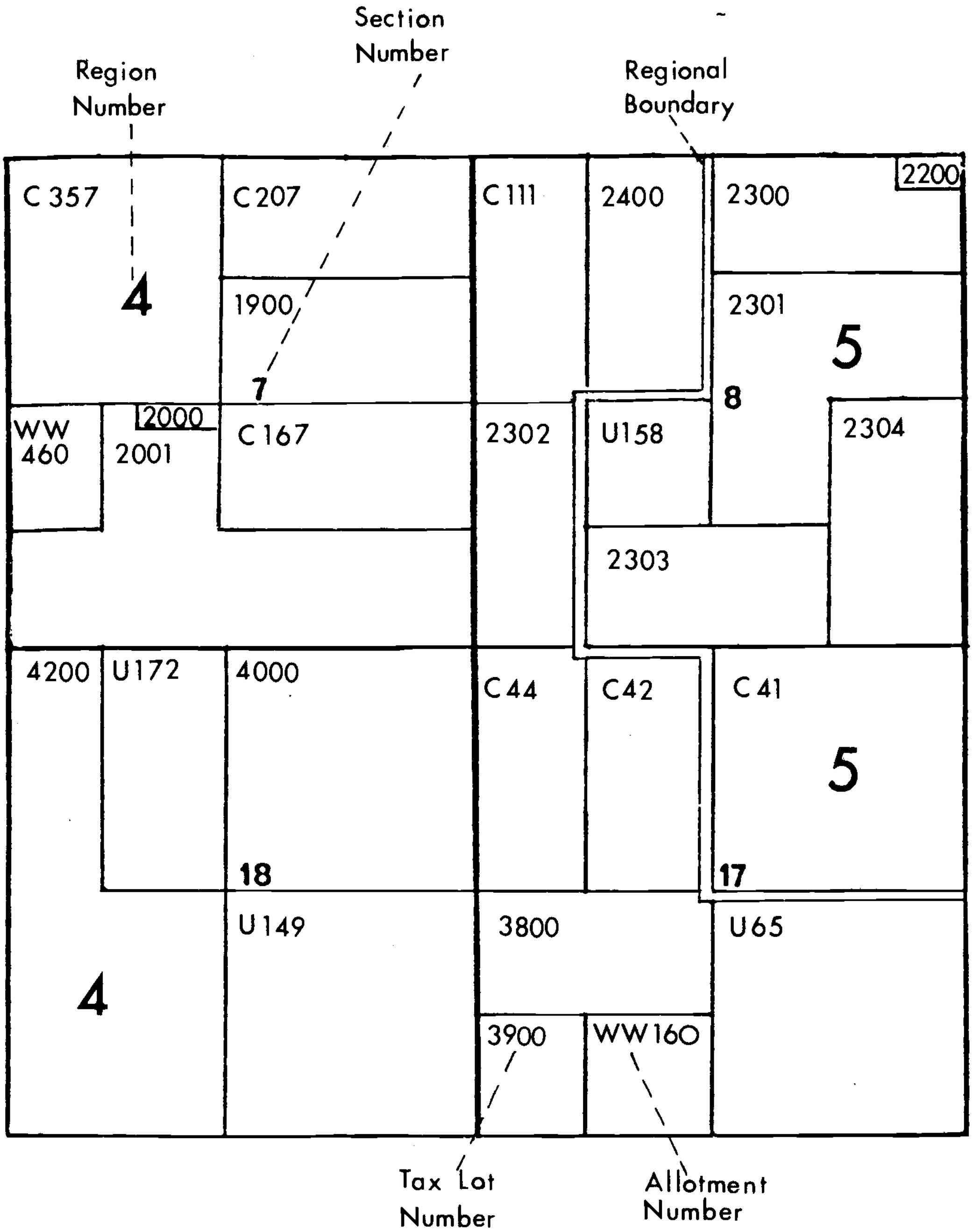

Figure 15. A portion of the locator map.

code (Fig. 16). The owner, the owner's address, and other information about the parcel is given. The second file has a card for each owner, is organized in alphabetical order, and gives the codes for all parcels owned by that owner (Fig. 17).

Generalized Information

Generalized information is provided in two forms. The first is a descriptive and cartographic survey of the variation over the Reservation of each spatially varying factor important to agriculture. This survey is very similar to the descriptive introduction to the Reservation given in Chapter II. An understanding of the variation of these factors is one of the best aids to understanding the variation in quality of agricultural land over the Reservation. The variation for many of these factors follows a common pattern, indicating a correlation between landforms, slope, rainfall, soils, yields, and cropping practices.

A second form of generalized information is a description of the location, size, agricultural characteristics, expected yields for adaptable crops, and market land values for each of the regions into which the Reservation was divided. A sample of these regional descriptions is given for Region 5 in Figure 18. The regional approach is one of the best ways to organize variation in many spatial factors so that it becomes comprehensible and orderly. The regional

Kirk, Harold E. 3N35E-26-10300
P.O. Box 213 80.00 Ac
Athena, OR 97813 N ½ SW ¼
334-215 deed no.

Figure 16. Sample card from index file 1, indexed by identification code.

KIRK, Harold E

1. 3N35E-26-10100		
2. 3N35E-26-10300		
3. 3N35E-27-10500		
4. 3N35E-27-10600		
5. 3N35E-27-10700		
6. 3N35E-34-10500		
7. 3N35E-34-10600		
8. 3N35E-34-13302		

Figure 17. Sample card from index file 2, indexed by owner.

Region 5

Location

Region 5 comprises the central part of the south Reservation just south of Tribal Headquarters. It is located on gently sloping alluvial fans between the slope of the Blue Mountains of Region 7 and the flatter terraces of Region 4. It contains most of the Tribal lands of the Study Area including most of the block of land adjacent to Tribal Headquarters. Urban pressure in the northern part of the region is similar to that in Mission but few parcels have yet been subdivided. Access to Mission and Pendleton is good. Urban pressure is very slight in the southern part of the region. Subregions can be identified as follows:

Subregion 5a - those parcels in T2N R33E and T2N R34E.

Subregion 5b - those parcels in T1N R33E.

Size

Subregion 5a - 7,200 acres.
Subregion 5b - 5,500 acres.

Total Region 5 - 12,700 acres of which 12,600, or 99%, are cropland. Forty acres are so urbanized as to be excluded from the study.

Region 5 contains about 12,600 acres of irrigable land. Region 5 contains 800 acres of Tribal land in four parcels.

Agricultural Characteristics

Soils are moderately dark McKay silt loams. Slopes are gentle to moderate (0-12%) and rainfall is moderate (16-19").

The area is currently used exclusively for grain/fallow. It has a fair agricultural suitability (SCS capability class IIIe). The moderate rainfall produces better grain yields than in Region 4. The

Figure 18. Sample regional description for Region 5.

soils are limited by a high erosion hazard and a restricted rooting depth because of the columnar subsoil at 20-40" depth. Excellent management, including timely operation, rotation, and fertilization could improve yields by 20-30% over 20 years.

The soil suitability for irrigated crops is only fair, limited by low surface infiltration and subsoil permeability and by alkali problems. Beans, milo, sorghum, onions, potatoes, and carrots should not be grown because of the alkalinity. Irrigating this area would increase the alkalinity of both this region and downslope areas; Region 3 already has a severe alkali problem. Increased alkalinity because of irrigation would decrease crop yields in the future. The topsoil tends to flow downhill when it is saturated with water. It would be necessary to install ditch drainage and to manage the water application very carefully to successfully irrigate McKay soils.

The economic analysis shows that the land in Subregion 5a is marginally suited to wheat/fallow farming because of the high land cost. Lower priced land in Subregion 5b is much more favorable.

Yields (per acre for cropland only)

fallow dry	annual dry	irrigated	
40-50		50-60	bushel wheat
30-40		50-60	bushel barley
	3-4	5-6	alfalfa hay
		6-10	AUM pasture

Irrigated peas and sugar beets could also be grown, but there are no data on yields.

Market Land Values (per acre)

Subregion 5a - $350-$500 ($1000) for 19 or more acres.
- $800-$2000 for less than 19 acres.
Subregion 5b - $350-$500

Note: Large parcels in Subregion 5a could sell for as much as $1000 per acre for subdivision.

Figure 18. (Continued)

level is appropriate for developing conclusions on the potential physical and economic value of certain types of parcels to the Farm Enterprise. The regional descriptions served as a base for the economic analysis. The description for each region becomes a standard by which to judge the specific characteristics of a particular parcel according to whether it is above or below the regional average.

Large Scale Information

The large scale information is primarily organized on a set of parcel data cards with a card for each parcel. A sample parcel data card is given in Figure 19. These cards are arranged by township, range, section, and tax lot number of allotment number. All the large scale information developed in Chapter IV is included on this card along with the region number and the classification rating of the parcel according to the classification system described in Chapter VI.

Included with the parcel data cards is a report describing in detail the value of each piece of information and the source from which it was obtained. This system permits easy revision as data need to be updated.

The large scale soils and slope map prepared in this study is also included as an overlay to the locator map. This is the most accurate and detailed soils map available at the present time for agricultural regions of the Reservation. Because of the importance

SUITABILITY FOR
ACQUISITION________________ T____ R____E, SEC____ ________

Deeded______ Tribal______ Allotted______

Total acres__________

1. LAND USE

Current use: Agricultural____ Small part-time farm____ Residential____ Forest/Range____ Other____

Zoning__________ If agricultural, operator's name__________

2. COST COMPONENTS:

1975 estimated market land value $__________per acre

1975 assessed land value $__________

1975 assessed market value of improvements $__________

Increased operating costs because of: _____slope _____other__________

3. AGRICULTURAL SUITABILITY

Cultivable acres__________

Locational advantage (1-8)__________

Dominant slope__________%

Average annual rainfall__________inches

Soil Series	% of Total Acreage	Soil Capability Class
	5	
	6-25	
	26-50	
	51-75	
	76-100	

Productivity (per acre yields of cultivable acreage):

Crop	SCS average under high level management DRY	SCS IRRIG.	BIA yearly under current management			AV	ASCS average by operator under current management
Wheat (bu)							
Barley (bu)							
Green peas (tons)							
Hay (tons)							
Pasture (AUM)							

Figure 19. Parcel data card, side one.

4. IRRIGATION POTENTIAL

Existing well?______ Depth________(ft.) Capacity________(gpm)

Soil suitability for irrigated crops______________________

Feasible water sources __________ ground

__________ surface

Probable per acre investment $______________ ground

$______________ surface

5. OVERALL AGRICULTURAL RECOMMENDATION

____________ wheat/barley-fallow

____________ wheat/pea

____________ irrigated crops __________

____

____

____________ range/forest

____________ not suitable for agriculture

____________ other________________

6. OTHER CONSIDERATIONS

Existing improvements____

Access: Public road_____________

Easement_____________

None_____________

Conservation Needs____

Figure 19. (Continued) Side two.

of soils and slopes to many kinds of planning besides agricultural planning, it was felt that this information would be of value to the Tribe in map form as well as in the form found on the parcel data cards.

Summary

The land data management system is designed to convey the information collected and the understandings formed during this project. The system is accessible either by the parcel owner's name or the location of the parcel. The user is then directed to either an index card giving the owner's name and a basic description of the parcel or to a parcel data card containing detailed information on the parcel. Included with these large scale parcel by parcel data are two forms of more generalized data to aid comprehension of the pattern of variation in land quality over the Reservation. The first form examines the variation of each factor important to agriculture. The second form divides the Reservation into homogeneous regions and examines the effect variation in all factors together has on the quality of land in each region.

VI. A CLASSIFICATION OF PARCELS FOR ACQUISITION

A large quantity of information is collected on the parcel data card for each parcel. It would be difficult for someone to come to a conclusion about the relative suitability of a parcel for acquisition from this plethora of data. The Tribe requested that the data management and analysis system "classify specific land areas in terms of their suitability for acquisition and consolidation in light of the established priorities."[50] This chapter will describe a land classification system developed for this purpose to be used in conjunction with the economic analysis prepared by other team members.

Purposes

The classification system for parcels described in this chapter would serve two purposes. First, it would summarize all the data available on a parcel into one value which is easy to compare with other parcels. Second, it would complement the economic analysis performed by other members of the study team. The complexity of the economic analysis made it impossible to perform an evaluation for individual parcels. Instead, an analysis was performed for the typical parcel in each region. The classification system described

[50] Confederated Tribes of the Umatilla Indian Reservation, Tribal Planning Office, "Request for Proposal on Umatilla Agriculture Development Program Technical Assistance Feasibility Study, Attachment II."

in this chapter classifies individual parcels and can differentiate between poorer than average, average, and better than average parcels in each region. Further, only three factors which vary in space were included as variables in the economic analysis. These three factors were land cost, predicted yield, and irrigation costs and yield benefits. The classification system of this chapter includes many other factors which vary in space, such as percent of the parcel which is arable, slope and associated management difficulties, soil suitability to irrigation, soil quality as apart from predicted yield, size of parcel, and locational advantages in light of the Tribe's priorities. These other factors are not perhaps the most important factors in an analysis of a parcel, but they do make differences in the suitability of parcels for acquisition by the Tribe. These other factors are responsible for much of the fine detail in the variation of Reservation land parcels.

Types of Land Classification Systems

Ranked Classes Based on an Evaluator's Judgment

A series of ranked classes could be established with placement in a class dependent primarily on the evaluator's judgment. Classes could range from excellent to poor with non quantitative verbal criteria distinguishing the classes. The land capability classification used by the Soil Conservation Service is an example of this kind of classification (Fig. 20). Soils are assigned to a particular class by a trained evalutor based on their characteristics but not on well defined class criteria.

An advantage of such classifications is the ease with which results are understood. Classes are clearly ranked with easily interpreted descriptions attached. Disadvantages center around the lack of precisely defined criteria. It would often be hard for the evaluator to be consistent. The acceptance of the results depends on the perceived authority of the evaluator. The criteria used in classification are not definitively stated so they can be evaluated by the person using the results of the classification. Lands can be classified only by personnel trained in the system; lands could not be classified by a person having data on lands to be classified and the description of the classes.

Ranked Classes Based on Quantitative Criteria

It would be possible to have a series of ranked classes with exclusive quantitative criteria defining the classes. This would remove the element of judgment from the application of the classification system without destroying ease of interpretation of results. It could be applied by anyone having data on the lands and a description of the classes.

Soil Capability Classes

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III coils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impracticable to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

Figure 20. Description of SCS Soil Capability Classes.
Source: Soil Conservation Service.

Making the criteria quantitative does have drawbacks unless there is very little variation between lands to be classified. Keeping the number of classes to a reasonable size means that only a very few distinctions can be made between classes. A sample classification using five classes shows that only four distinctions can be made (Table 7).

Table 7. A five-class classification with four distinctions.

Class	Wheat yield (bu/acre)
1	>70
	*
2	50-70
	*
3	30-49
	*
4	< 30
	*
5	non-cultivable

*A distinction

If another variable with five possible values were introduced, such as slope, the number of potential exclusive classes would increase to 25, an unwieldy number of classes. If the number of classes were kept low by grouping a number of possible combinations into one class, the number of distinctions made in each variable would have to be decreased, as in Table 8. The number of distinctions made both in wheat yield and in slope has been reduced from four to two each. The flexibility of classifications consisting of ranked

Table 8. A five-class classification with two variables.

Class	Wheat yield (bu acre)	Slope (%)
1	> 70	≤ 12
2	> 70	> 12
3	30-70	≤ 12
4	30-70	> 12
5	< 30	any slope

classes based on an evaluator's judgment can therefore be seen as a strength of such systems when applied by a trained evaluator. The number of classes can be kept small even while the number of variables considered is large.

Quality Scales

Land units can be assigned a certain value on a numerical scale based on their quality. There are at least two methods of assigning a value on the scale to a parcel. Both establish a number of categories corresponding to different categories of land characteristics, such as soil type, slope, and rainfall. It is possible in both systems to divide the range of characteristics in each category into groups with quantitative or otherwise well defined limits. The category of slope, for example, could be divided into four groups with the limits 0-6 percent, 7-12 percent, 13-20 percent, and more than 20 percent.

In the first method, points assigned in each category are used to evaluate the characteristics of the land unit.[51] Points in the rainfall category for example, could be assigned as follows: 0-12 inches, no points; 10-20 inches, five points; and more than 20 inches, ten points. The value on the scale assigned to the parcel is the sum of the points obtained in all categories.

In the second technique, known as a Storie Index, a percentage is assigned in each category with 100 percent being optimum in each category.[52] The value on the scale is obtained by multiplying the percentages obtained in all categories together.

These classification systems have several advantages. It is possible to be consistent in assigning rankings to land units. Because the characteristics possible in each category can be divided into well defined exclusive groups, the classification of units does not depend on the judgment of the classifier; anyone can classify land units if he has the classification system and data on the

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[51] Tudor Rickards, Problem-solving through Creative Analysis (New York: John Wiley and Sons, 1974), pp. 40-46.

[52] Cornell University Agricultural Experiment Station, Land Classifications, by Gerald W. Olson, Search, vol. 4, no. 7 (1974), pp. 13-14.

lands to be classified. The criteria used for classification are openly stated in the classification system so it is possible for the user to evaluate the system. The system can also be modified to suit changing conditions or values. Finally, both systems automatically allow quality in one characteristic to compensate for lack of quality in another.

A number of disadvantages also exist. The first is the difficulty of designing such a scale. It is difficult to assign numerical points or percentages to characteristics so that different values on the scale represent true differences in the value of the land. Thus, the design of the scale, rather than its application, depends heavily on the judgment of an authority. In designing a point system care must be taken that high values on certain characteristics do not give a high total value on the scale to a land unit which has one characteristic that makes it entirely unsuitable for the intended purpose. This is automatically taken care of in the Storie Index as a very low percentage in one category would insure that the land unit received a low overall rating. Finally, because these scales consist of a large number of different values, for example from 1-100, it appears from the results that more precision is given than is actually possible. It would be impossible to actually define 100 different qualities of land. These scales are therefore best used when comparing similar parcels.

The System Chosen

The classification system chosen for this project was a quality scale using points. The system of ranked classes based on quantitative criteria was eliminated because of the low number of exclusive distinctions possible in such a system. The ranked classes based on an evaluator's judgment was eliminated as too dependent on consistent, authoritative judgment in the application of the system. Another important factor was the lack in this system of openly stated, precisely defined criteria that would allow evaluation of the system by others. The quality scale using points was preferred over a Storie Index because it appeared less complex to design.

Design of the Classification System

Outline of the System

A parcel rating scale assigns points based on the characteristics of a parcel (Fig. 21). One hundred points are possible. Of these 100 points, a certain number are obtainable in each of eight categories. For example, 30 points can be obtained in the category of wheat productivity. A parcel gets a certain number of points in a category depending on how its characteristics rank on the category scale. For example, a parcel with a wheat productivity of more than

> greater than
< less than
≥ greater than or equal to
≤ less than or equal to

Total points possible in category	Category	Category Scales					
10	Percent arable for grain	90-100%	50-90%	10-50%	<10%		
		10	7	3	0		
10	Land cost	Non-urbanized, max. cost ≤ 500	Non-urbanized, max. cost 500-800	Non-arable or chance of urbanized value, max. cost ≥800	Residence present or certainty of urbanized value, max. cost >1000		
		10	5	0	-20		
30	Wheat productivity of arable land	>60 bushels	50-60	40-50	20-40	<20	non-arable
		30	25	20	10	5	0
10	Slope	0-7%	7-20%	non-arable or >20%			
		10	5	0			
20	Irrigation potential:						
10	a. Economic feasibility of irrigation	Feasible Soil excellent or good	Feasible Soil fair	Non-feasible, non-irrigable, or non-arable			
		10	5	0			
10	b. Soil suitability for irrigation	Excellent	Good	Fair	Non-arable or non-irrigable		
		10	7	4	0		
5	Locational advantage	1	2-4	5-6	7-8		
		5	4	1	0		
5	Contiguity to Tribal land	Combined area > 200 acres	Combined area 81-200 acres	Combined area ≤ 80 acres or non-contiguous			
		5	3	0			
10	Size	>19 acres	<19 acres				
100 points		10	0				

Figure 21. The parcel rating scale.

60 bushels an acre will get 30 points, but if its productivity is only 45 bushels, it will get 20 points.

Once a value on the scale is assigned to all parcels, these values can be graphed by region. In the graph for Region 3 shown in Figure 22, the frequency of occurrence of scale values is shown. Locating the scale value of a particular parcel on this graph allows a comparison of the quality of a parcel to the quality of land described for the region in the regional analyses and the economic evaluations. In this way, parcels are primarily compared to similar parcels in the same region. This also allows the results of the land evaluation to dovetail with the economic analysis. The economic analysis makes recommendations about the suitability of the typical parcel in a region for acquisition by the Tribe. This can be used as a recommendation on the suitability of a particular parcel in that region for acquisition, which is the question with which the Tribe will be faced, only to the extent that all parcels within the region are alike. The classification system of this chapter helps to answer the question of the suitability of an individual parcel by rating it compared to other parcels in the region.

Construction of the Parcel Rating Scale

The parcel rating scale was constructed according to the following procedures. Important land characteristics were identified and

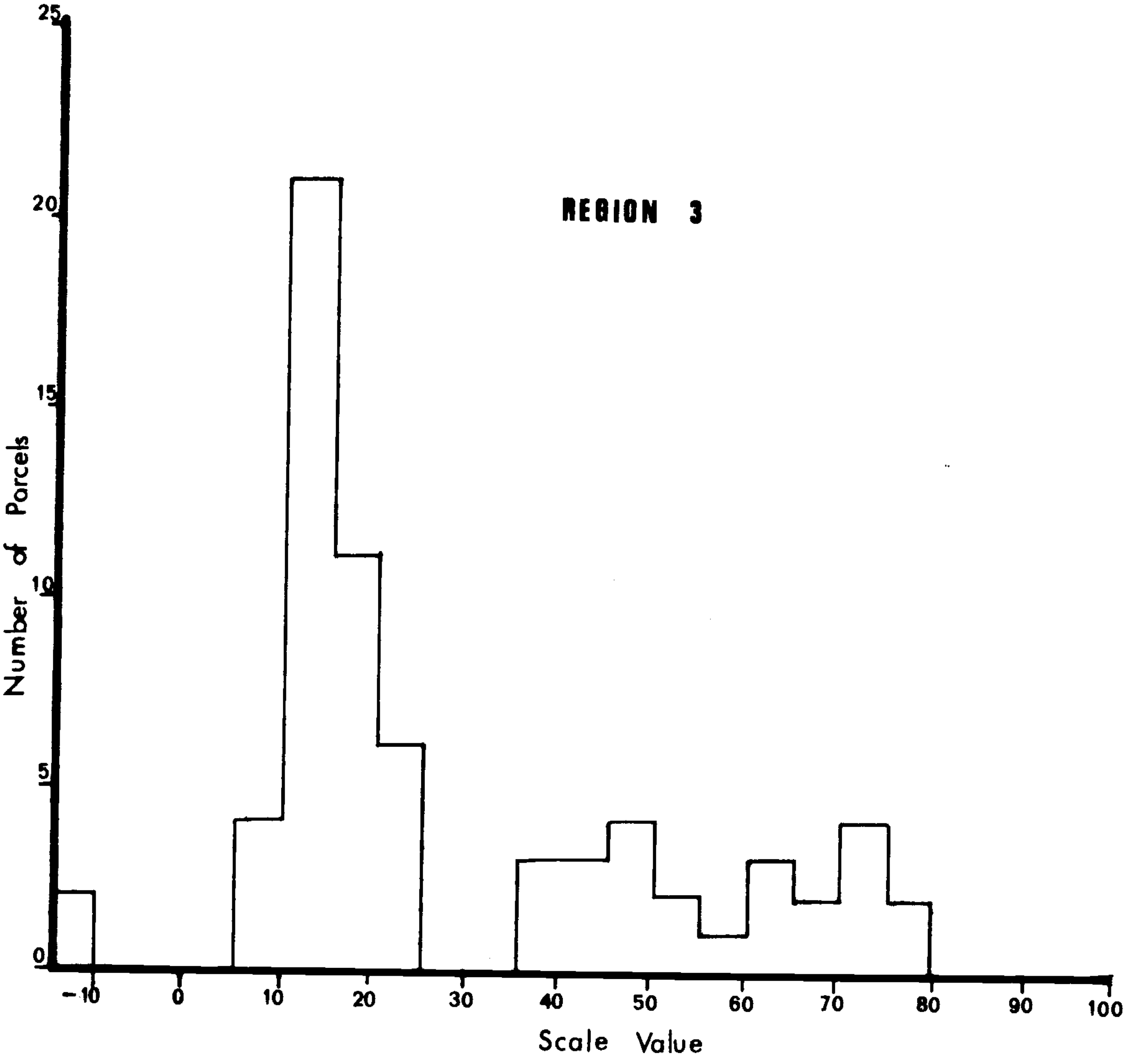

Figure 22. Frequency of occurrence of rating scale values for Region 3.

used to establish a number of categories. Preliminary groupings were made of the possible values a parcel could have in each category. The total of 100 points was then distributed evenly among the categories. The points for each category were then distributed evenly among the groupings in that category. A large number of parcels, representing all regions of the Reservation, were classified according to this preliminary rating scale. When the results of the rating scale did not correspond with the known relative quality of land in various parts of the Reservation, the rating scale was analyzed for the reason. The analysis of all parcels indicated changes should be made in the distribution of points between categories and among groupings within one category. A revised rating scale was constructed and the analysis procedure with a large number of parcels repeated. The third such revised rating scale was considered compatible with known relative land qualities and is the one presented here.

Distribution of Points

In the following analysis, it is assumed that: (1) the Farm Enterprise Committee wishes to acquire land and agriculturally valuable improvements only and is not interested in buying homes, (2) it would rather buy more land of moderate quality on the south Reservation than less land of higher quality on the north Reservation, and (3) its desire to stem urbanization in the Mission area is not so great that it would buy land so costly the land could not show a profit.

Wheat Productivity and Land Cost. Wheat productivity of arable land and land cost, each with a range of 30 points, are the two most important characteristics of a parcel under consideration for acquisition. Because operating costs are relatively constant from place to place on the Reservation, productivity and land cost are the major profit determinants which vary in space.

Wheat productivity is included as the Farm Enterprise Committee is initially interested in wheat/fallow farming and because wheat will probably continue to be the dominant crop in the area. Furthermore, wheat yield data for the area are readily available, while complete data on yields of most other crops are not. Wheat productivity takes into account the quality of the soil, the rainfall, the depth of the soil, and other factors affecting yields. The higher the expected wheat yields, the greater the number of points given to the parcel.

The 30 point range of land cost extends from -20 to +10. It was felt that a land cost representing the agricultural value of the land was not so much a positive factor in a parcel's desirability as an absence of the very negative factor of a speculative land value. Where the probability of land commanding a price reflecting urban use is certain, 20 points are subtracted. Where land prices could reflect either speculative pressures or the agricultural value, no points are given. Where land prices will most probably be agricultural use values, positive points are given. One of the aims of the Farm Enterprise Committee is to acquire the most land possible, hence more points are given to the cheaper south Reservation land, with a maximum cost of $500 per acre, than to the more expensive north Reservation land, with costs ranging from $500 to $800 per acre.

Irrigation Potential. Irrigation potential is ranked third in importance, with a range of 20 points, because of the Tribe's stated desire to increase agricultural diversification at some time in the future. If irrigation appears to be currently economically feasible, points are given only if the soils are also suitable to irrigation. Even if irrigation is not economically feasible, soil suitability for irrigation is given importance for two reasons. First, economic conditions may change whereas soils do not. Second, characteristics on which soil suitability for irrigation is based, such as texture, drainage, available water holding capacity, susceptibility to alkali, and profile characteristics, are not adequately measured by wheat productivity, which varies chiefly with rainfall.

Arability, size, and slope. Percentage of land arable for grain, size of parcel, and slope are given moderate importance. Low ratings in any of these categories do not preclude their agricultural value. Moderately steep slopes can be cultivated, albeit with greater trouble and expense. A small parcel, or a parcel with a small amount of arable land, can be profitably farmed if its location is excellently situated with respect to the Tribe's agricultural holdings.

However, low ratings in any of these categories do limit the value of the parcel. Significant quantities of non-arable land are of no value to the agricultural enterprise but increase the bost of buying the arable land. A high percentage of non-arable land frequently disrupts efficient agricultural management and sometimes indicates the arable land in the parcel is of marginal quality. Size recognizes that larger parcels are usually cheaper per acre and less subject to urban speculation. Nineteen acres was used as a convenient demarcation line between small and large, because parcels 19 acres or larger can be zoned for exclusive farm use in which residential development is prohibited. Parcels less than 19 acres can often be sold at inflated prices for residential or other development regardless of their location. Slope measures several factors not adequately accounted for by productivity. Greater slopes are more subject to erosion and therefore require expensive protective measures. Mechanical operations, particularly planting, require more time and expense and are less effective on slopes.

Locational Advantage and Contiguity. Locational advantage and contiguity to Tribal land have the least importance. They both measure the economic and management advantages of consolidating land. Other characteristics being equal, however, they assume a definite importance.

The locational advantage measure developed in Chapter IV is used to evaluate the advantages of various locations. The higher the locational advantage rating of the parcel, the higher the rating on the scale. The south Reservation receives the highest ratings and the north Reservation the lowest ratings. Accessibility to Tribal headquarters is used to make minor distinctions between areas in the north and south Reservation.

Contiguity to tribal land gives extra points to parcels contiguous to Tribal holdings. It is used in conjunction with locational advantage to recognize the economic and management advantages of land consolidation. Combined areas greater than 200 acres are large enough to allow excellent management and to justify irrigation of any crop. Combined areas between 81 and 200 acres are potentially more difficult to manage but still allow efficient management and irrigation of most crops.

Summary

A classification system was needed to simplify the wealth of information available on a parcel to one easily comparable value.

Instead of a series of unvalued statistics on a parcel, a single rank was assigned to the parcel to indicate its value to the Tribe for acquisition and its value compared to other parcels in the same region. Various types of land rating systems were examined to determine their usefulness for this purpose. A quality scale based on points given in a number of categories was chosen as the most suitable system. Points were assigned to categories and to characteristics within categories based on a judgment of the relative quality of sample parcels.

VII. SUMMARY AND CONCLUSIONS

The Need

The Farm Enterprise Committee of the Confederated Tribes of the Umatilla Indian Reservation wishes to expand their tribal farm enterprise from approximately 1500 acres to 6000 acres within ten years. As an aid to their goal, they contracted with Oregon State University to perform a feasibility study for this expansion program. One aspect of this study, the topic of this thesis, was an evaluation of the Reservation land resource for acquisition as a part of the farm enterprise.

The Committee and the Tribal Planning Office believed they lacked several important categories of information on the land resources. They had difficulty locating parcels, particularly patented deeded parcels. Although they knew a great deal of information was available from various public and private agencies, they had trouble both in evaluating the quality of the data from any source and in assembling all relevant data in a meaningful way on any particular parcel under consideration. Assuming all the data were available, they also did not have enough information to evaluate the suitability of a parcel to the farm enterprise. The Tribe thus had a need for very large scale parcel by parcel data as well as information on the suitability of various types of land found on the Reservation to the farm enterprise.

The Approach

Several steps were taken to evaluate the land resource. The goals and needs of the Farm Enterprise Committee were determined. This was followed by a field survey to establish familiarization with the physical characteristics of Reservation land and land uses. The data needs for the land resource evaluation were then determined. Concomitant with the determination of data needs, all data available from public and private agencies and individuals were evaluated for quality and relevance. Where possible, parcel by parcel data were collected. Where parcel by parcel data were not available, or were not reliable, new data had to be generated. To do this, the Reservation was divided into 11 regions based on a few critical variables for which information was already available. These variables included soils, extent of urbanization, and farming practices. Data were generated for a typical parcel in each region in each of those categories for which data were not already available. This value for the typical parcel was then used as the best available estimate for other individual parcels in the region. Data generated in this way included land cost, potential for irrigated agriculture, irrigation costs, and overall recommended crops.

After all the data were assembled, the data management system and the land evaluation were completed. The data management system included a locator map, index files of owners and parcel codes, and a parcel data card for each parcel containing all the information collected for that parcel. A generalized description of the variation in the quality of the land resource was also included to aid identification of the options open to the Tribe and to help in the evaluation of individual parcels against the background of the total land resource. This generalized description included both variable by variable and region by region analyses. The region by region analysis was used as basic land resource data by the economic evaluation of the larger study. The combination of the region by region land resource evaluation and the economic evaluation allowed a determination of the potential of land in the various regions for the land acquisition program of the Farm Enterprise Committee. The land classification system described in this thesis allowed the relative quality of the parcels in each region to be compared to each other and to the regional norm. Thus, the economic characterization of each region was complemented by the classification system, which added greater parcel by parcel detail.

Shortcomings and Benefits

There were several problems encountered in the land resource evaluation. The determination of goals and needs of the Committee was hampered by the problems of cross cultural communication. The Committee had difficulty articulating their goals to the study team, and, in return, the study team had difficulty appreciating the concerns of the Committee.

The land resource evaluation was not fully integrated with the economic analysis. Land cost and productivity data chosen for the economic analysis could have been better selected to represent both the norm and the range of variation in each region.

Several problems were introduced by the large scale of the evaluation. Presentation of the information on a parcel by parcel basis overstated the precision of some of the data. Unavailable data were generated only for the typical parcel in each region, not for the individual parcel. Even much of the soils data, which is one of the largest scale data categories used, are generalized. It assumes, for example, that soils of a given type and series are everywhere the same, produce the same yields, and change to a soil of different characteristics at the boundary indicated on the map. The parcel by parcel data collection was extremely time consuming. An approach perhaps more cost effective would have been to evaluate the land resource at the regional level with instructions to the Committee on how to assemble all the specific data available on a parcel when it becomes available for purchase.

Regardless of these difficulties and limitations, the study did succeed in many of its goals. A great deal of information was assembled in a logical, convenient format on the Reservation land resource and on individual parcels. The regional estimates of land cost and irrigation potential and costs are the most detailed information compiled on these factors.

By combining the land evaluation and the economic evaluation, definite conclusions could be made as to the suitability of various types of Reservation land for the expansion plans of the farm enterprise. Whereas the complexity of the economic analysis meant that only the three spatial variables of land cost, yield, and irrigation cost could be included, the more comprehensive land classification system described in this thesis was able to integrate many spatial variables into one rating which allowed the range of variation within each region to be expressed.

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