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Natural Elements of Northeastern New Mexico

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NATURAL ELEMENTS OF NORTHEASTERN NEW MEXICO

Northeastern New Mexico is one of the most diverse natural landscapes in the state. Large volcanic vents dot the massive basalt flows that cap the piedmont surface, providing a very rugged horizon rather than the flat monotonous topography usually associated with the Great Plains of the United States. The dissected and rolling plains are broken by severely eroded canyons that have cut through the sandstone layers capped with caliche. In some areas where the major drainages confluence (such as the intersection of the Ute and Canadian or the Conchas and the Canadian) the narrow canyons broaden into extensive valleys characterized by isolated piedmont remnants. The entire area drains to the east and onto the flatter plains of west Texas. The western edge of the northeast is well defined by the dramatic snow-capped and rugged front range of the Rocky Mountains...an edge that is visable from most high points throughout the area surveyed for this report.

Physiographic Areas

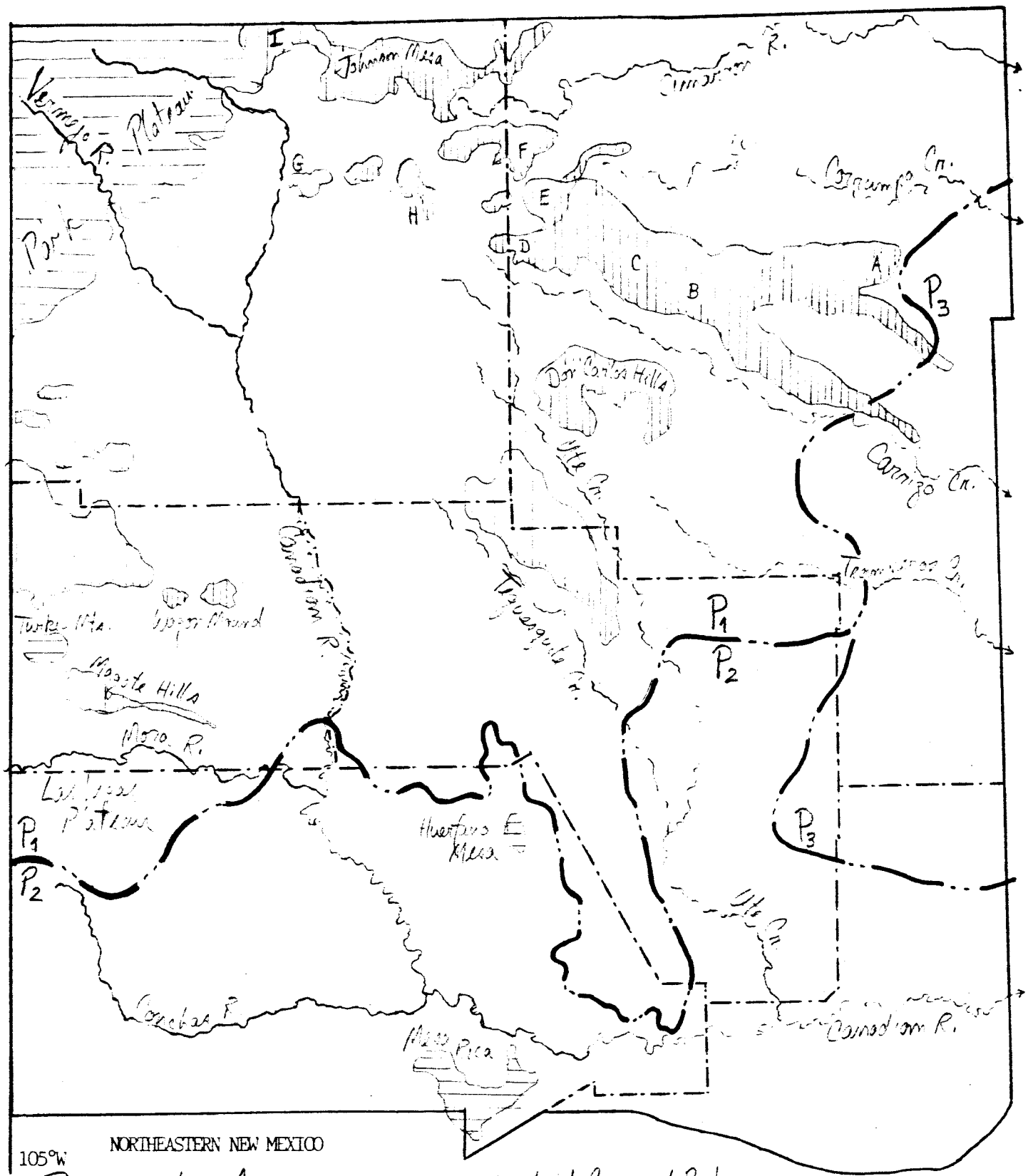
All of the northeast is located in the Great Plains Region of New Mexico and contains portions of three sections within that region. The largest section, covering nearly three-fourths of the study area, is the Raton Section (refer to the Map). The lower portion of the region is called the Pecos-Canadian Valley Section, which includes the Conchas and Ute tributaries. Along the eastern edge of the northeast is the Southern High Plains Section referred to as the Panhandle Subsection.

The Raton Section is characterized by high piedmont plains with high areas capped by extensive basalt flows. The piedmont is sliced by the perennial water channels of the Canadian and Cimarron rivers ~~that~~ which have cut deeply into the sandstone creating a remarkable canyon country out of portions of the northeast. The most impressive canyon barrier is the Canadian River as it cuts between Harding and Mora counties. The southern edge of the Raton Section is essentially defined by the Canadian Escappment, ~~that~~ which clearly marks the break of the broad Canadian Valley of eastern San Miguel County from the northern Piedmont surface. Some of the most striking features of the Raton Section are the more than eighty volcanic vents which are found in massive clusters in the basalt flows located north, south, and in the Don Carlos Hills area of Union County. An impressive feature of the northeast is the Sierra Grande stratovolcano (of pyroclastic formation) near Des Moines which stands as a giant isolated landmark of 8,720 feet high, nearly 3,000 feet above the surrounding piedmont. Laughlin Peak, a less impressive volcanic peak west of Sierra Grande, is of both stratovolcanic and cinder cone formation, and at 8,820 feet it is the highest point in the northeast.

The high, basalt-capped mesas near the Colorado border (Johnson and nearby Bartlett mesas) were formed by igneous flows which occurred when the High Plains surface was developed. Younger basalts cover the area with huge flows and remnant peaks (from Clayton to Raton). ~~There are additional large basalt flows with continued~~ west and south of Wagon Mound. The most recent basalt is characterized by the extensive malpais along

[add sentence from p. 3]

A-3


NORTHEASTERN NEW MEXICO
105°W
Physiographic Areas
(Great Plains Region)
P1 - Raton Section
P2 - Pecos-Canadian Valley Section
P3 - Southern High Plains (Panhandle Section)
Highland Caps and Peaks
Basalt Caps
Sedimentary Caps
A - Rabbit Ear Mtn.
B - Sierra Clayton
C - Little Grande
D - Malpais Mtn.
E. Sierra Grande
F. Capulin Peak
G. Eagle Tail Mtn.
H. Laughlin Peak
I Bartlett Mesa
Vermejo R.
Plateau
Johnson Mesa
Cimarron R.
Corrumpa Cr.
Dan Carlos Hills
Ute Cr.
Carrizo Cr.
Canadian R.
Turkey Mts.
Wagon Mound
Mesita Hills
Mora R.
Las Vegas Plateau
Huerfano Mesa
Conchas R.
Mesa Rica
Tramperos Cr.
Travesseros Cr.
P1
P2
P3

the border between Colfax and Union counties and by the cinder cones and flows near Capulin Peak. Many of the clustered volcanoes follow fissure alignments and provide excellent examples of fissure eruptions. A clear example of this are the sixteen extinct volcano vents which lie along a fourteen-mile fissure, forming the highlands called the Don Carlos Hills.[2] ~~The basalt near Wagon Mound~~ This basalt put back on page 2 forms a series of capped tables such as the Rayado and Charette mesas.

Broadly folding and dipping layered sedimentary rocks underlie the Raton Section. Erosional surfaces in the area include the highly dissected Park Plateau west of Raton and a ridge called the Trinidad escarpment, of which scattered remnants are found over the plains near Springer. Much of the southern part of the Raton Section is a series of broad tablelands capped by sandstone and mantled with alluvium deposits. One of the significant tableland summits is the rolling plains of the Las Vegas Plateau west of the Canadian River. There is also a large constructional High Plains outlier of the Raton Section between the Canadian River and the Ute Creek valleys that is covered with alluvial deposits and capped with a hardened layer of caliche.

The Pecos-Canadian Valley Section includes the terraced valleys of the Canadian and Conchas rivers, and the lowlands of ~~the~~ Ute Creek. The inner elements of the Valley Section varies from broad floors occupied by floodplains and extensive terraces to the canyons which vary from broad and shallow to narrow and deep. The flanks of the inner valleys and canyons are characterized by a stepped sequence of valley-border surfaces and remnant pieces which create a large amount of local relief within the Valley Section. There is also alternating

intervals of valley incision and broad mantles of wind-formed deposits. One of the large areas of aeolian valley border surfaces is north of the Canadian River in Quay County and East of the Ute Creek valley in Harding County. The outlet of the Canadian River at the Texas border, at around 4,000 feet, is the lowest elevation in the northeast.

The Canadian Valley Section is also characterized by huge erosional remnants of the extensive tablelands ~~capped by sandstone~~ which rim the valley. Mesa Rica and Huerfano Mesa are two of the landmark remnants ~~which occupy the eastern portion of the broad Canadian River valley.~~ that have become isolated from the headlands through erosion.

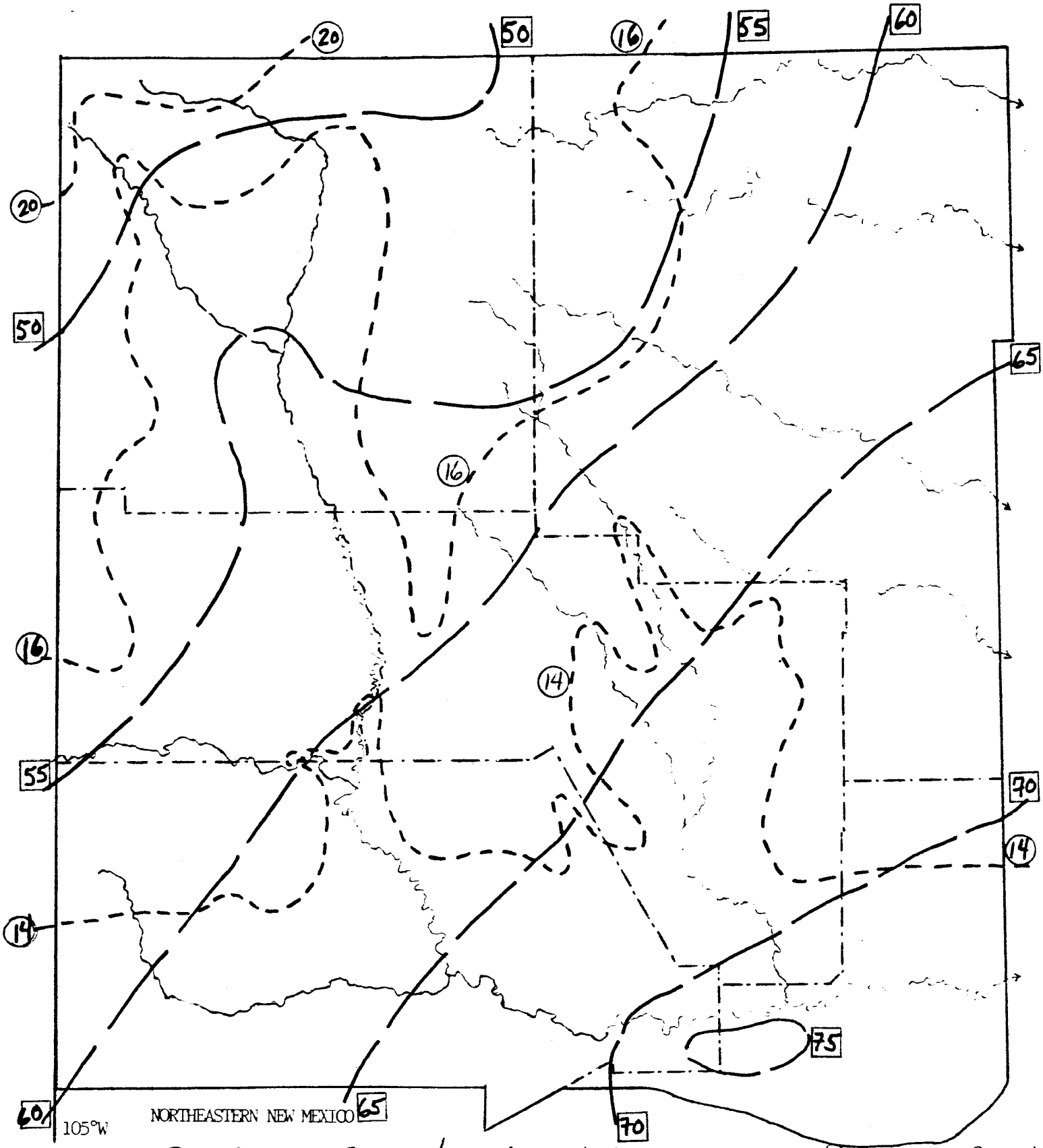
The Southern High Plains are characterized by the nearly flat to undulating surface of the Panhandle Subsection that extends into Oklahoma and Texas in a slight southeastward gradient. Much of the High Plains surface is formed by alluvial (water borne) and aeolian (wind borne) deposits ~~which~~ that have formed the Ogallala Formation ~~that~~ which is capped with a resistant caliche. Surface drainage throughout the area is poor, with shallow valleys of ephemeral streams (Tramperos, Carrizo, Perico, Corrumpa) cutting from northwest to southeast at parallel intervals. The uplands are covered with shallow depressions which are water-filled by seasonal rains. Otherwise the depressions become playas with active and stabilized dune systems. These depressions are formed by both wind deflation and by dissolution of the caliche deposits overlying the sandstone. The Panhandle Subsection represents ~~the~~ the area of lowest general relief in the northeast and is the portion that most resembles what people perceive of the flat, undulating Great Plains

Rainfall and Evaporation

Two very significant climatic variables that relate to the settlement character of the northeast are precipitation and evaporation. The entire state of New Mexico has very low rainfall amounts due to its' position relative to the source of moist winds. For moist air from the Pacific to reach this northeast area, the air is forced into cooler altitudes by the Rocky Mountains where it loses most of its' water vapor. Most of the winter air masses from the Pacific pass too far to the north to have a great impact on the northeast. There are periods when the warmer Pacific air mass does descend from the Rockies onto the cold plains and provides the northeast with some snow cover in winter.

More dependable moisture in the northeast arrives from the Gulf of Mexico in the summer. Once again the moist wind trajectory crosses over a large dry area of Texas and most of the moisture has been released prior to reaching New Mexico. The pattern of the rainfall follows a southeast to northwest direction with the lightest averages (less than 14 inches) generally in the lower Canadian River valley. The highest annual rainfall total (in excess of 20 inches) is along the higher portions of the Park Plateau and on the Raton Mesa in the northwest corner of the area covered by this survey.

A characteristic of a semi-arid environment is the variation in annual precipitation over a period of years. From 1951 to 1980 the rainfall varied in Clayton from 8.9 inches to 25.7 inches. For nineteen of the thirty years the rainfall was below the mean annual average of 14.1 inches. Sometimes two back-to-back years may repre-



Rainfall and Evaporation (in inches)

○ Average Annual Precipitation: 1957-1980

□ Average Annual Free Water Surface Evaporation: 1956-1970.

Source: Iven Bennett, Climatic Section of the Second Edition of New Mexico in Maps, 1986.

sent each extreme end of the scale. It was not unusual to follow a drought year with one of heavy and damaging downpours.

There is also a seasonal variation in rainfall on the plains, with summer representing the peak season throughout New Mexico. The moist unstable air form the Gulf of Mexico generates heavy thunderstorms through the northeastern area of the state. Most of the rainfall stations show a dominance of May to September as the "wet" months. Mosquero, for example, receives its' peak rains in July and August, and receives 81 per cent of its' 15.5 annual inches of rainfall from May through October. Most other stations show similar peaks and wet seasons, but they also point out a dangerous moisture gap during the month of June, which is a crucial month in a plants' growing cycle.

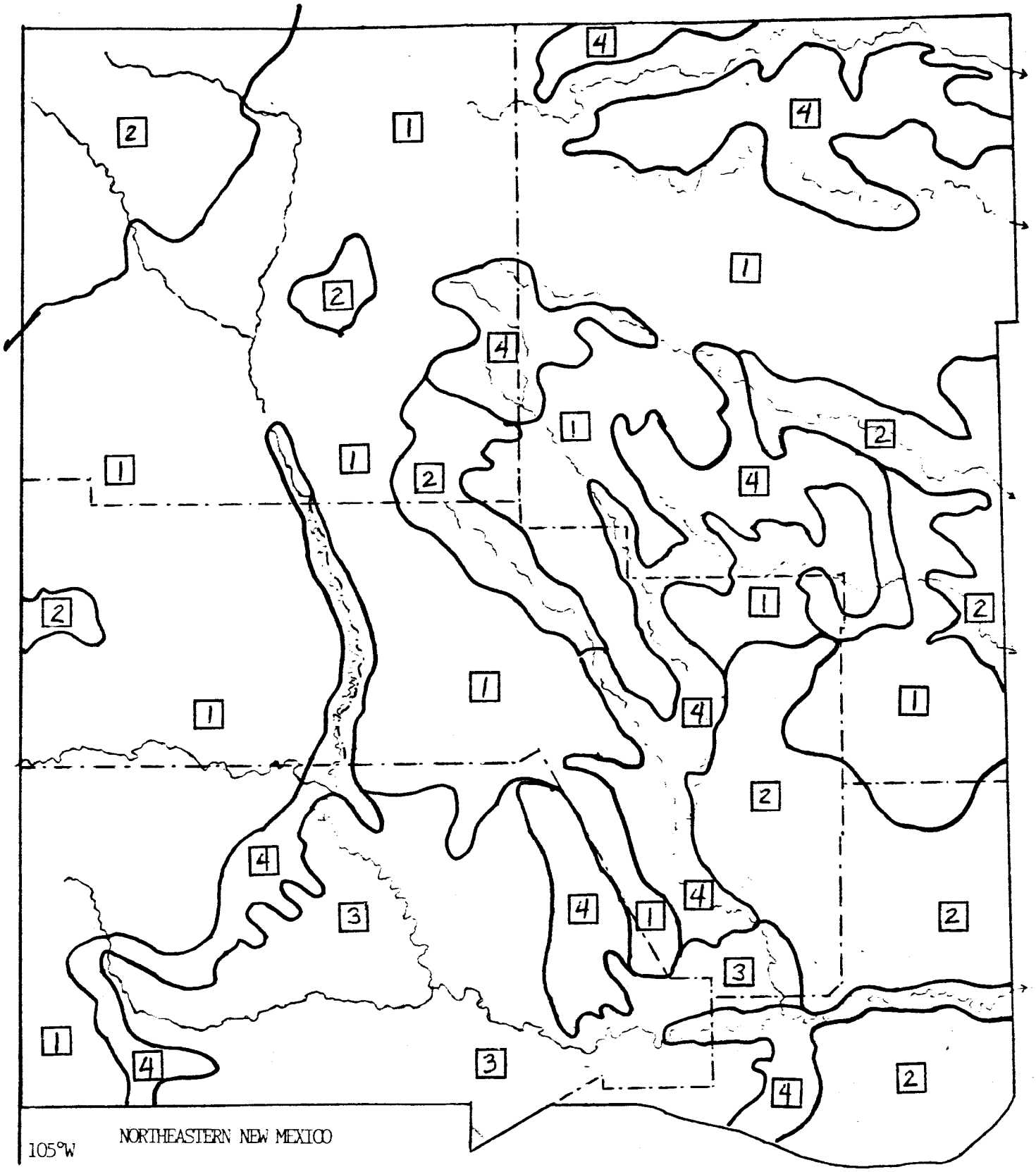
The northeast is severely short of water, receiving only a meager supply of rainfall and experiencing inordinate evaporation from land surfaces back into the atmosphere. The potential surface evaporation in New Mexico varies from forty to eighty inches and in the northeast the amount that could be evaporated (if it was available) is between two and a half to five times greater than the rainfall. Free water surface evaporation rates are estimated from pan evaporation data and is considered the potential evaporation through transpiration from the soil and plants of an area. Evaporation from the soil depends on the texture of the soil and the depth to groundwater and vegetation will provide the linkage between soil moisture and the atmospheric demand for moisture. Practically all of the area east of the Canadian River is in a severe moisture-deficit region and is a major factor in consideration for a location in dry-land farming.

Soils and Vegetation

The kind of soils that form in any area is the result of several soil-forming factors: climate, vegetation, parent material, topography, and time.[4] Climate and vegetation are the active factors and are considered together when discussing soil conditions. The leaching of the soil (removal of bacteria and nutrients by moisture transfer through the soil layers) and the organic composition (which determines the acidic nature of the soil) are both related to the climatic conditions and the vegetation that is associated with that climate zone.

There are four major soil groups in the northeast: Aridisols, Mollisols, Entisols, and Alfisols. Aridisols are located in the lower reaches of the Canadian River Valley where the temperatures are quite high in the summer. Mollisols cover most of the tableland and piedmont surfaces and is the most extensive soil type in the northeast. Entisols are mainly the floodplain soils of the northeast, but they are also found on steep slopes or on basalt flows where the bedrock is near the surface. Alfisols are found in the sandy areas where there is a low percentage of clay in the upper soil layers. The Park Plateau and the lower areas of eastern Harding and northern Guay counties are dominated by this soil type.

The only soil that is not suited for dryland farming is Aridisol. The surface layers are usually low in organic matter and as the bare surface is frequently exposed, it is characterized as a gravelly pavement. Although the soil has enough mineral bases to support plant life, most crops wilt in the summer as the soil has a poor capacity to retain moisture. Entisols are more recent alluvial and colluvial soils which have a high nutrient supply on a shallow profile. Erosion is a major



SOILS OF NORTHEASTERN NEW MEXICO

hazard, especially in the higher areas exposed to the winds. Valley entisols have been used in the northeast for dryland cropping, taking advantage of a very shallow water table for the root system. Entisols mainly occur along the Canadian and Ute drainages, but they also extensively cover portions of northern Union County.

Alfisols have a greater organic content than Aridisols. When exposed for long periods they may become leached by summer rainstorms. They have sufficient moisture retaining capacity and nutrient supply to support dryland farming. Mollisols are deep organic soils that are the dominant grassland and tableland soils on the high plains. Like Alfisols, Mollisols are found in areas of the plains which exceed twelve to fourteen inches of annual rainfall. However the soil profile easily deteriorates when it is abused (plowing during periods of low rainfall). The mollisol area of the northeast is the major location of the homestead settlers until 1940.

The vegetation of the northeast is complex, with many local variations related to soils, topography, and groundwater. In general the plains are dominated by extensive coverage of grasslands , usually with a mix of blue grama and sideoats grama with local concentrations of buffalo grass, galleta, and western wheatgrass. Scattered junipers also appear on hillsides and near drainages. The area surrounding the broad Canadian River Valley in eastern San Miguel County has an extensive surface coverage of junipers with local concentrations of scrub oak with pinon. The juniper-oak-pinon combinations also dominates the Canadian Canyon (between Mora and Harding counties) and in the area from the Corrumpa

Creek to the Colorado border in northern Union County. The only other major vegetation change in the northeast occurs on the Park Plateau where the higher elevation experiences an increase in rainfall and slight decrease in temperature. The Park Plateau vegetation complex is dominated by pinons and junipers in the lower elevations and by various pines on the highland portions.

References

1 The regions, sections, and general statewide geomorphology are described in a manuscript and on a map by John Hawley for the second edition of New Mexico in Maps, J L Williams (editor), UNM Press, 1986.

2 Refer to the volcanic sequence description in High Plains North-eastern New Mexico, Scenic Trips to the Geologic Past # 7, by Muehlberger, Baldwin, and Foster, New Mexico Bureau of Mines, 1967, pp. 8-12.

3 Much of the rainfall and evaporation in this section comes from a manuscript series on the climate of New Mexico by Iven Bennett, for the second edition of New Mexico in Maps, UNM Press, 1986.

4 From a manuscript by H J Maker and Leroy Daugherty for the second edition of New Mexico in Maps, 1986.