One Through the Looking Glass

The Environment of the Ancient Mesa Verdeans

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For Alice in Wonderland, the task was easy. All she had to do was step through a magic looking glass into a wonderful new world that was not only clear but also in full color. Our archaeological looking glass, on the other hand, is fogged, and the images we peer at seem blurry at first. Plant remains and animal bones in archaeological sites usually are broken up, and plant fragments are often black from charring. Yet as we archaeologists continue to assemble evidence from many sources, the haze in our looking glass clears, and we see in increasing detail the environment of the ancient Puebloans of the Mesa Verde region. Little by little, we understand better how they went about growing crops, foraging for wild plants, and hunting animals.

We now know that for centuries farmers have considered the Mesa Verde country of southwestern Colorado and southeastern Utah to be a great place to settle down and raise a family. Well suited to agriculture, the region receives sediment carried by winds blowing regularly from the southwest, sediment that has formed thick layers of loose, nutrient-rich farmland. In addition, nature has obliged many a Mesa Verdean farmer's need for enough moisture and frost-free days to enable crops to mature. For much of the time between 500 and 1300 CE (the Basketmaker III through Pueblo III periods), farmers raised corn (maize), beans, and squash, and they grew or traded for gourds. More recently, farmers in southwestern Colorado have experienced a century of successful dryland farming (farming by natural precipitation alone), particularly of splotchy red-and-white common beans similar to those grown by ancient farmers.

Despite the region's suitability for farming, we know that ancestral Pueblo people also experienced times of hardship caused by agricultural failures. More than once they watched their crops wither from lack of rain or succumb to killing frosts. Sometimes hunger and malnutrition pitted groups against each other, resulting in warfare and emigration. The more we know about the environment of the past, the better we can understand population spikes and declines, the movements of people, and the ways they coped with food shortages.

The diverse biotic communities of the Mesa Verde region have long included many plants and animals that humans have found useful. Studies of preserved pack rat middens (nests) tell us that the present plant and animal communities of the American Southwest have been in place for the past 4,000 years. The archaeological record verifies that ancestral Pueblo landscapes hosted many of the same wild plants and animals we see today.

Still, our ability to envision earlier landscapes has been inhibited by the appearance over the last century of invasive species originating on other continents. Tumbleweeds, summer cypress, and clovers, for example, now crowd out native plants. In addition, commercial farming, logging, and livestock grazing have cleared vast areas that once supported piñon and juniper woodlands and parklands of sagebrush and native grasses. Along with deep plowing and fire suppression, these historic activities have altered the proportions and, in some instances, the natural groupings of plants and animals. The role that ancient people played in altering their environment must also be acknowledged.

Figure 1.2. Ancestral Pueblo farmers built agricultural terraces such as these in Mesa Verde National Park to contain runoff and stabilize soil.

The Modern Environment

Seven major biotic communities grace the Mesa Verde regional landscape. Each consists of a certain group of plants and animals that is affected by and adapted to local temperature, precipitation, and soil. From the valleys, at some 4,000 feet in elevation, to mountain peaks above 12,000 feet, these plant communities are characterized by, respectively, sagebrush and saltbush shrubs; grasses; piñon and juniper woodlands; Gamble oak scrubland; ponderosa pine and Douglas fir woodlands; spruce and true fir woodlands; and low-growing alpine tundra.

Piñon-juniper woodlands, expanses of sagebrush and saltbush, and grasslands abound in the southwestern corner of Colorado, where ancient human populations were once large. Although the region includes both major rivers (the San Juan, Animas, La Plata, and Dolores) and smaller rivers and creeks (the Mancos, McElmo, Piedra, and Yellow Jacket), the springs and ephemeral drainages have long been critical water sources for both animals and people. Over the centuries, Puebloans also constructed check dams, water diversion systems, and reservoirs to make water more accessible (fig 1.2).

All farmers know how critical moisture is to their crops. In the Mesa Verde region, mean annual precipitation ranges from 7.8 inches near Kayenta, Arizona, to more than 18.3 inches in and around Durango, Colorado. Moisture from snowmelt allows corn kernels to germinate and sustains tiny seedlings through the normally dry weeks of late spring and early summer. Later, sporadic summer rains spur rapid plant growth and ear development. On the Colorado Plateau, corn agriculture requires at least 12 to 14 inches of annual precipitation to be successful, and some developmental stages of corn growth, such as pollination and grain development, especially need water.

Pueblo farmers learned long ago that they could

direct runoff from intense summer showers to their fields by aligning stones, dirt, and brush debris. They also placed their fields in locations best suited to receiving storm runoff, such as at the bases of gentle slopes. Sometimes they also hand-carried water from reservoirs ("pot irrigation"), especially to drought-intolerant crops such as squash.

Temperatures, too, play an important role in growing crops successfully. Most varieties of corn need at least 120 frost-free days and a minimum amount of summertime heat in order to mature. The latter is measured in "corn-growing degree day" (CGDD) units; at least 2,500 units are required during a growing season.

CGDD units are calculated by summing the difference between each day's average temperature and a set base temperature (50 degrees Fahrenheit). One CGDD unit is accumulated for each degree by which the average exceeds the base temperature. A minimum of 50 degrees and a maximum of 86 degrees have been set as thresholds below and above which corn crops will not thrive.

My colleagues and I have examined modern temperature and precipitation records for the Mesa Verde region to assess the locations best (and worst) suited for farming. Our research shows that despite being above 7,000 feet in elevation, Mesa Verde proper currently has enough CGDD units, frost-free days, and precipitation to farm successfully in most years, enhanced by the fact that the broad, sediment-covered mesas tilt gently south, toward the warming sun. The Yellow Jacket, Cortez, and Blanding areas, too, receive enough moisture and summer heat to grow corn, so it is no surprise that they were all densely populated in prehistoric times.

Tree-ring samples obtained from ancient roof beams, stands of very old living trees, and even older wood lying on rocky landscapes provide data on precipitation in the past. Dendrochronologist Matthew Salzer, working in the San Francisco Peaks area, near Flagstaff, Arizona, used bristlecone pine records to reconstruct periods of relatively higher and lower temperatures for the ancestral Pueblo centuries. He then combined the annual temperature and precipitation data to construct a 2,000-year time line of conditions critical to agriculture. To add to this, Timothy A. Kohler (see chapter 8) and his associates from Washington State University recently assembled a broad range of environmental data, information about corn yields, and estimates of human population to form the basis of a sophisticated, multicentury model of periods of farming success and failure for the Mesa Verde region.

Agricultural Success and Failure, Population Spikes and Declines

Farmers in the Mesa Verde region began growing corn, a Mexican import, sometime in the first few centuries of the first millennium CE. Before long it became both a dietary staple and an integral component in ceremonies. Why did this happen? Corn is unique among grain crops in having both large kernels and high yields. By planting a single kernel, a farmer could grow a plant that produced 300 to 600 kernels. Studies have shown that Puebloans in the last century routinely set aside approximately 350 pounds of corn kernels for one person's annual consumption (fig. 1.3). Under favorable circumstances, three to four acres of land could yield enough corn to feed a family of three to four people for a year, assuming that wild plants and animals provided additional calories, critical vitamins and minerals, and protein missing from corn. Also, around 600 CE, Pueblo people began growing common beans. When added to corn in their diet, beans gave them all the amino acids of a complete protein.

After corn became a staple, the successes and failures of corn harvests paralleled the rises and declines of the native population. By the 600s, population was on the increase, but a drought in the late 800s made dryland farming too risky. Throughout the 900s, Pueblo farmers seem to have hung on by tending small fields along drainages or by clearing fields at the bases of slopes to benefit from storm runoff. By the middle and late 1000s, while living in dispersed farmsteads and walking daily to their nearby cornfields, they were again reaping successful harvests. Between 1130 and 1180, however, drought again placed its curse on agriculture. We see its reflection in tree rings, in a

Figure 1.3. Pueblo people stored large quantities of corn, their most important food staple. The kernels safeguarded in this jar, excavated in Mesa Verde National Park, may have been specially selected seed corn.

reduction in house construction and remodeling, and in a rise in intergroup violence and strife. When that long dry spell ended, prosperity returned. By the late 1100s, population was growing and construction booming.

As the thirteenth century drew to a close, ending the Pueblo III period, the inhabitants of the Mesa Verde region once more experienced scant and unpredictable summer rains. This severe drought, which lasted from 1276 to 1299, spelled the end of eight centuries of Pueblo presence in the Mesa Verde and Four Corners region. Some communities suffered violent ends, and some people must have perished from the effects of malnutrition. Others emigrated to more promising places to the south and east to join relatives or friends and acquaintances. Chapters 5 and 6 tell more about this warfare, abandonment, and migration.

Gathering and Hunting

Over years of working in the Mesa Verde region, I have accumulated a list of important native plant foods that are found in the archaeological record or have been recorded in historic ethnographic literature. Ancestral Pueblo people collected tasty, calorie-rich piñon nuts, harvests of which can be abundant but often are sporadic and undependable. They occasionally gathered the reliable juniper berries, whose tartness (one species is used to flavor gin) requires some getting used to. Other nourishing wild foods harvested in large quantities included the seeds or fruits of weedy goosefoot, pigweed, purslane, tomatillo, tansy mustard, yucca, globe mallow, grasses, and cacti (figs. 1.4, 1.5).

Ancient people knew when plant foods ripened and were ready to be collected. For example, starting in late spring or early summer, they gathered lemonade berries, rice grass grains, and tansy mustard seeds for immediate consumption and storage. Later in the summer, they likely gathered the tender and nutritious leafy greens of goosefoot, pigweed, and purslane. Although little evidence of the leaves and stems of these weedy plants has survived in the archaeological record, evidence for the use of their seeds is plentiful, and we assume that plants growing in farmers' fields and on midden piles produced copious seeds for harvesting.

As the growing season progressed, people ate a variety of grass grains, as well as serviceberries and sunflower seeds. By fall, everyone must have looked

Figure 1.4. The yucca plant provided large, sweet pods for food and fibrous leaves for making baskets, sandals, and mats.

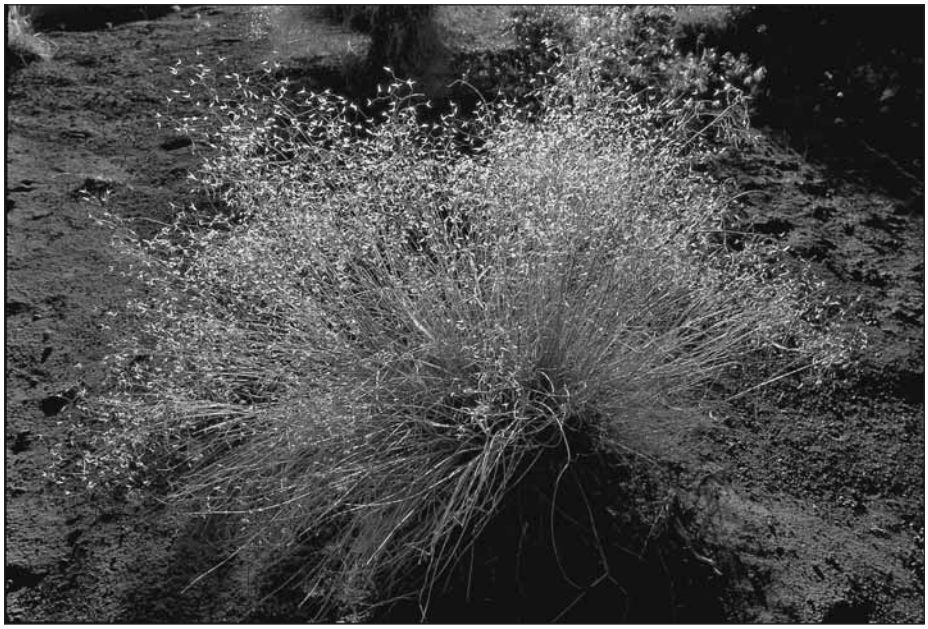

Figure 1.5. Rice grass produces abundant grains that ripen in late spring. Historically, Pueblo people cut the stems and held them over a fire, allowing the toasted grains to fall into a waiting container.

forward to gathering piñon nuts, if the harvest was good, and eating prickly pear fruit, one of the few sources of natural sugar. Because juniper berries remain attached to their tree branches for a long time, they could be gathered when needed. During the winter, women regularly prepared meals of stored corn and wild plants inside their dwellings, but during the warmer months they preferred cooking outdoors. They parched wild seeds over a fire or ground them up to be cooked in pottery vessels as porridge or gruel.

Ancestral Pueblo people found many other uses for plants besides food. On occasion they smoked wild tobacco, leaving burned tobacco seeds for archaeologists to find centuries later. Needing timbers for house construction, they chopped down juniper trees at lower elevations and Douglas firs and ponderosa pines on the higher mesas. They used piñon trees for building, too, but were aware that weaknesses in the wood reduced its value. Still, piñon and juniper, along with woody shrubs such as sagebrush, saltbush, bitterbrush, and mountain mahogany, provided fuel for cooking, heating, and light. And craftsmen no doubt tossed wood scraps left over from making household and agricultural tools into the fire.

In addition to knowing which wild plants to harvest, Mesa Verdean men and women also knew when and where to find each one. We infer from the investment they made in architecture, as well as from farmers' need to be near their crops during the growing season, that many lived in their dwellings and villages year-round. Because many of the wild plants they gathered thrive in disturbed habitats (we call such plants "weeds"),

Figure 1.6. Mule deer, which thrive in piñon-juniper woodlands, were an important source of animal protein for Pueblo people.

we assume that many harvests came from local agricultural fields and other places where daily living had disturbed the natural vegetation. Probably some members of each community occasionally traveled considerable distances from their pueblos to collect special plant resources.

Jonathan Driver, who has studied regional faunal records, believes that Mesa Verdeans hunted primarily local animals but occasionally sent small hunting parties farther afield. They obtained animal protein mainly from mule deer, jackrabbits, and cottontail rabbits, along with domesticated turkeys. Less often, hunters brought home bighorn sheep, pronghorn antelope, and elk. Although we find rodent bones in archaeological sites, they probably reflect natural deaths, as well as hunting and trapping.

As Driver has noted, the quantities of rabbit, deer, and turkey meat that Puebloan people consumed fluctuated over time. Basketmaker III and Pueblo I people, for example, relied on rabbits and large game and rarely ate turkeys, whereas later Pueblo II people regularly raised turkeys for their meat. After 1150, Puebloans of the Great Sage Plain (see map, p. 45) ate less big game and even more turkey meat. By then, they had overhunted deer near their settlements and diminished deer habitat through generations of tree cutting. Cottontails, however, continued to be hunted, for they apparently thrived in the brushy vegetation that grew on recovering fallow fields. The hunting pattern differed on Mesa Verde itself, where larger populations of big game continued to be available.

Like plants, animals provided useful products other than food. People wove blankets from tur-key feathers and rabbit fur and made awls, needles, spatulas, ornaments, and flutes from turkey and deer bones. "Man's best friend," the dog, shared their accommodations, and favorite dogs were buried with due regard. Although today fishermen flock to the region's rivers and man-made lakes, we have little evidence that ancestral Pueblo people caught or ate fish. This is puzzling. Part of the reason may be poor preservation of fish parts or the fact that fish caught and eaten on the spot leave no evidence back in villages or homes. But ancestral Pueblo people might simply not have eaten much fish.

Anthropogenic Ecology: Humans' Effects on Their Landscape

For eight centuries, inhabitants of the Mesa Verde region farmed, foraged, hunted, chopped down trees, and did much else that affected their landscape. From time to time, intentionally or not, they also set fire to portions of forests. We refer to such human influence on plant and animal communities as "anthropogenic (human-caused) ecology."

Archaeologists Tim Kohler and Meredith Mathews were among the first to report evidence of this process, from Pueblo I village sites around Dolores, Colorado. In the ancient plant remains, they observed a shift over time in fuelwood use, from piñon and juniper trees to shrubby plants and cottonwoods. That is, as preferred trees were used up, people sought alternative fuels still locally available.

Figure 1.7. Bean farming thrives today, as it did centuries ago, in the Montezuma Valley, north of Cortez, Colorado.

With Vandy Bowyer, I took a similar look at the Pueblo III plant record of the Sand Canyon locality near Cortez, Colorado, and concluded that although Puebloans had cut many trees and opened up land for agriculture, portions of piñon-juniper forests still remained within walking distance of their pueblos. That people consumed less corn in the late 1200s might reflect more than the onset of drought: the fertility of the land might have diminished, too, reducing its ability to produce enough food. It is clear that by this time, preferred foods, including wild game, had become scarce and people turned to foraging for wild plants. At Salmon Ruin, to the south, we know that hungry residents resorted to eating leftover corncobs, normally used only as tinder or fuel, as well as juniper bark, broad yucca leaves, animal bones, and insects.

Closing Thoughts

Reconstructing past environments can be a challenge. Many facets of life affected by the environment simply are invisible to the researcher's eye—a maverick late spring frost or an early fall frost, for example. Did eight centuries of intermittent farming diminish nutrients in corn fields? Can we even document such trends after modern farmers have cultivated the same land? To complicate matters, it is difficult to assess the effects of historically introduced weeds that have invaded modern landscapes.

Despite such difficulties, we archaeologists continue to fine-tune our knowledge of the Mesa Verde region's past environment. Our multiple lines of evidence include plant and animal data preserved in archaeological sites; reconstructions of ancient weather; knowledge of modern plants and animals and of the best places to farm; and the responses of living indigenous groups to their environmental problems. As our archaeological looking glass continues to clear, the ancient Mesa Verde landscape comes into sharper focus—not quite like Alice's experience, perhaps, but satisfying nevertheless.

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