

FORESTS, FOREST FIRES, & THEIR MAKERS

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The Story of Cliff Palace Pond

JACKSON COUNTY, KENTUCKY

IN OCTOBER 1996, the Daniel Boone National Forest brought a team of paleoecologists, Dr. Paul A. Delcourt and Dr. Hazel R. Delcourt of the Department of Ecology and Evolutionary Biology at the University of Tennessee, Knoxville, to Cliff Palace Pond to study the history of fire and its effects on the forest. Their goal was to determine the long-term changes the forest had undergone as a result of changes in climate, forest disturbance regimes, and prehistoric human activities. Cliff Palace Pond was chosen because (1) it was located on a ridge crest where it would reflect changes from only a small area; (2) it was situated adjacent to a variety of archaeological sites; and (3) it had good potential for containing a long and well-preserved pollen and charcoal record.

IT DID NOT DISAPPOINT. From a little over five feet of organic pond sediments, Cliff Palace Pond produced a nearly 10,000 year-long pollen record. This record clearly documents the influence prehistoric peoples had on the forest through their use of fire. The Cliff Palace Pond story challenges forever our view of the “virgin” forest primeval.

THE INFORMATION PRESENTED in this booklet draws on the results of forest fire ecology studies in general; research at Cliff Palace Pond and the archaeological sites at Keener Point Knob in particular; and the decades of archaeological research carried out and supported by the Daniel Boone National Forest.

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ILLUSTRATIONS: Tree and pollen illustrations were adapted from Donald C. Peattie, *A Natural History of Trees of Eastern and Central North America*, Houghton Mifflin, Boston, 1950 and Ronald O. Kapp, *How to Know Pollen and Spores*, Wm. C. Brown Co., Dubuque, IO. Prehistoric artifacts and lifeways scenes were taken from the Kentucky Heritage Council’s *Kentucky Before Boone* poster. The figure on page 15 was adapted from William H. Cottrell, Jr., *The Book of Fire*, Mountain Press, Missoula MT, 1989. Photographs on pages 1, 4 and 25 are used courtesy of Warren E. Brunner; other photographs are from the Daniel Boone National Forest collection.

COVER ILLUSTRATION: Photograph of Cliff Palace Pond by Warren E. Brunner, and petroglyph design pecked into a rock at Cliff Palace Cave by an unknown artist from Kentucky’s past.



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A Rare and Special Place

“Is *that* it? Is that all there is *to* it?” After you’ve traveled deep into the woods and hiked up the steep trail to Keener Point Knob, that’s likely to be your first thought as you stand at the edge of Cliff Palace Pond. And yet, contained within this small pond and the nearby sandstone rockshelters is the record of nearly 10,000 years of environmental and human history.

Keener Point Knob is an isolated, flat-lying plateau remnant located in northeastern Jackson County. This part of Eastern Kentucky is a region of narrow ridges and steep cliffs. The ridges and cliffs are made of sandstone, but their lower slopes are underlain by shales and limestones. Small tributaries of Station Camp Creek, itself a tributary to the Kentucky River, flank

the Knob. They flow in narrow valleys far below the ridge crest.

The tiny pond is nestled within a small depression near the Knob’s western edge. It sits in a young, mainly hardwood forest and is surrounded by a mat of sphagnum moss. A sparse thicket of buttonbush shrubs grows throughout its shallow basin. It looks unkempt and wild.

If you visit the pond in late winter or spring, its dark waters are no more than about two feet deep. They cover an area that measures only 50 by 100 feet. Should you return in the fall when the water level is lowest, Cliff Palace Pond will look like a small soggy depression, having shrunk to less than 20 by 50 feet in the intervening dry months.

Scientists discuss their research near the edge of Cliff Palace Pond.





The little pond is too small to fish in and often too shallow and muddy to drink from. So at first glance, it may appear to you to be good only as a home for frogs, marbled salamanders, crawdads, and water-loving bog plants. But to the trained eyes of *paleo-ecologists* (scientists who study past environments), Cliff Palace Pond is a tiny window through which they can peer back thousands of years into the past.

The pond muck is the key. Like many ponds, pieces of the plants and animals that live around Cliff Palace Pond fall into it or drift in and settle onto its watery surface. Over time, these bits of organic debris build up as layers of muck on the bottom of the pond. This muck is made up of decomposed leaves and branches from nearby trees blown in during a summer thunderstorm. It contains seeds and stems that fell gently into it from the plants growing along its edge, as well as the dead bodies of frogs and crawdads that lived within it. Tiny wind-blown

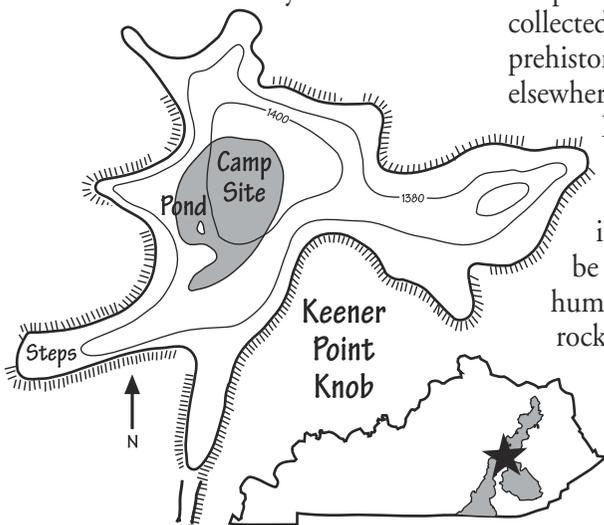
particles that land on the pond surface, such as dust, tree pollen, and charcoal ash from forest fires, also eventually settle into the pond's mucky bottom. Depending on how long ago it formed, undisturbed pond muck can record the events of hundreds or even thousands of years.

The muck on the bottom of Cliff Palace Pond records almost 10,000 years of environmental and fire history. But it does so on a local scale. This is because the pond receives organic debris from a very small area (around 1.2 acres) that is fed by rainfall runoff alone. Most of the air-borne pollen and charcoal particles that settle into it are carried by winds from the immediately surrounding trees and plants growing on Keener Point Knob and on the upper slopes of the adjacent steep-sided stream and creek valleys (a little over a half-mile radius).

Why, then, is this place so rare and special? It isn't just because of the environmental changes recorded in the pond sediments. Scientists have collected similar information from prehistoric soils in dry rockshelters elsewhere in Eastern Kentucky.

It is unique because local environmental changes and forest fire history recorded in the pond sediments can be linked to local changes in human culture recorded in nearby rockshelters.

Cliffs containing rockshelters surround Keener Point Knob. A prehistoric campsite and Cliff Palace Pond are located on its crest.



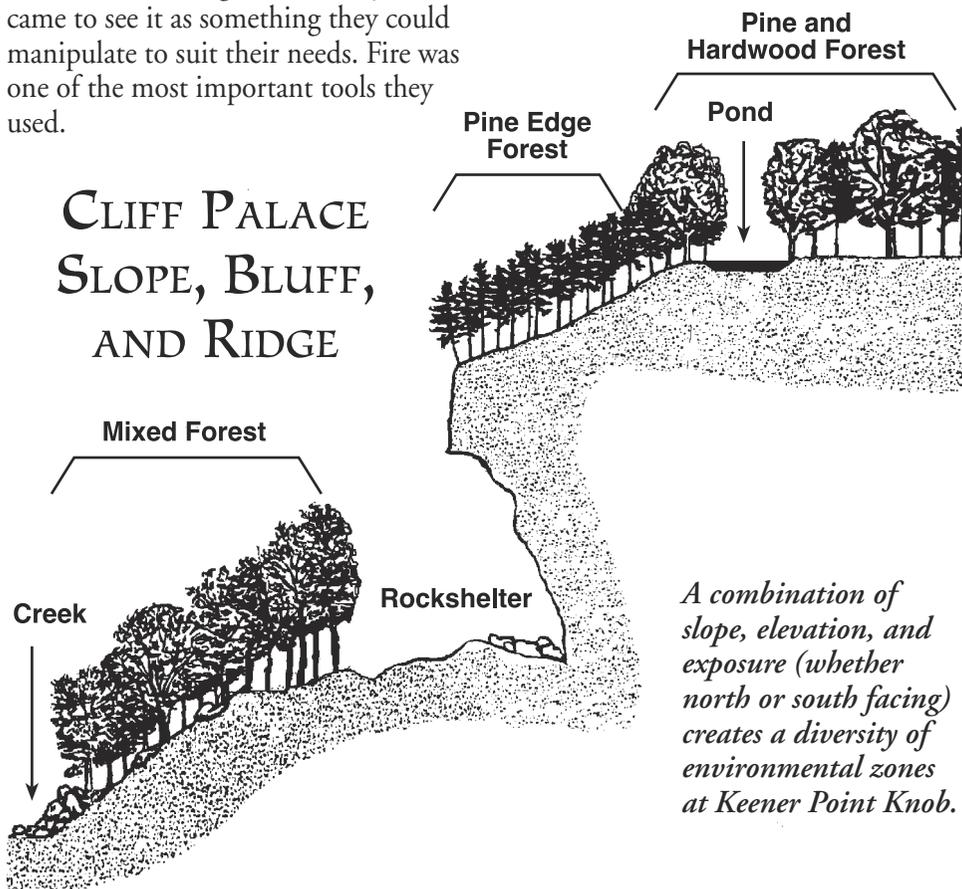


People lived near Cliff Palace Pond for thousands of years. They camped for short periods on the crest of the Knob next to the pond. At one time or another, they also lived in most of the rockshelters present in the steep sandstone clifflines that follow the edge of the Knob.

Over the centuries, human lifeways underwent many changes at Keener Point Knob. People turned from hunting and gathering to gardening, and then later to farming as a way of life. As their culture changed, the peoples' relationship with their environment changed, too. They came to see it as something they could manipulate to suit their needs. Fire was one of the most important tools they used.

Because the pond and the places where prehistoric peoples once lived are located so close to one another, Cliff Palace Pond's sediments can provide insights into the dynamic interaction between people, fire, and the environment. Most importantly, the scale at which prehistoric people used fire to manipulate their environment matches the scale at which Cliff Palace Pond has faithfully recorded that manipulation. It is reflected by dramatic changes in fossil pollen and charcoal over time.

CLIFF PALACE SLOPE, BLUFF, AND RIDGE



A combination of slope, elevation, and exposure (whether north or south facing) creates a diversity of environmental zones at Keener Point Knob.



The Cliff Palace Pond story begins almost 10,000 years ago. It starts with the pond's formation in a red spruce and northern white cedar forest, and the appearance of people, whom archaeologists call the Early Archaic peoples. Other peoples and other forests followed: the Middle and Late Archaic peoples and their oak, hemlock, and sugar maple forest; the Woodland and Fort Ancient peoples and their pine, oak, walnut, and chestnut forests; and the peoples of European and African descent and their oak, maple, black gum, and pine forests.

Despite such an early beginning, other forests and other people lived in the Eastern Kentucky mountains for at least 2,000 years before our story opens. These forests were made up of spruce and jack pine trees. And the people, ancestors of Early Archaic groups, were Ice Age hunters who were the first people to arrive in Jackson County.

Today, we are the people in the Cliff Palace Pond story, and the forests are the ones the U.S. Forest Service manages. The story is not complete, though. The next chapters have yet to be written.

The Cliff Palace Pond story is a fascinating one. It describes changes in the natural environment and changes in peoples' lifeways. It shows how people increasingly manipulated the environment to suit their needs through the use of fire. But most importantly, this story destroys forever our notion of a "virgin," pristine forest primeval, untouched by human hands.

Before we turn to the story itself, however, we need to understand how it came to be written. This means finding out how paleoecologists and archaeologists collected and studied the information on which the story is based.



Rockshelters, much like this one, served as homes for people throughout prehistory.



Pollen, Charcoal, and Points

The Cliff Palace Pond story is not a simple one, and telling it is not easy. Paleoecologists and archaeologists must weave together information from many different sources.

Other scientists collected some of this information. This includes facts like how forest fires behave under certain conditions; the kind of climate particular plants thrive in; and the activities of men and women in hunting and gathering societies. The paleoecologists and archaeologists collected the rest of the information from their own research and analysis.

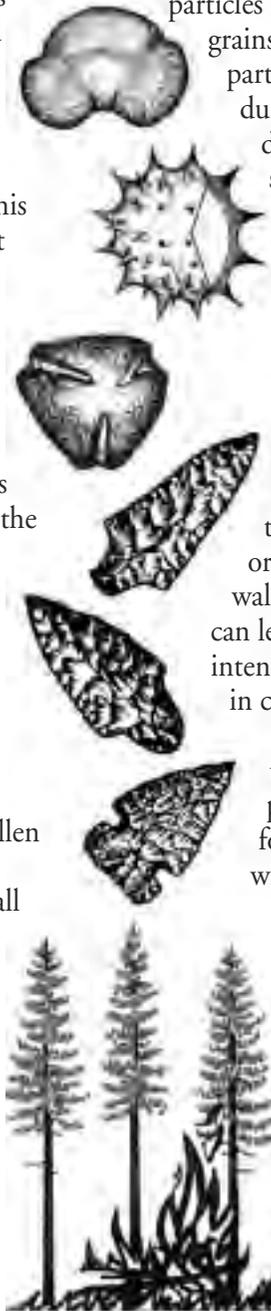
Paleoecologists study microscopic objects. To reconstruct the environmental and fire history of Cliff Palace Pond, they examined tiny fossil pollen grains, visible only with a microscope, and equally small particles of charcoal ash.

Trees and other plants produce pollen grains or “flower dust” in large quantities every growing season. The wind scatters the pollen over the forest, fertilizing flowers or cones. In this way, seed is set for the next generation of

plants. Forest fires produce charcoal ash particles of many different sizes. Pollen grains from the forest and charcoal particles produced in a forest fire during the same year will be deposited together in pond sediments. Thus, they record the environmental changes and fire events that take place throughout the lifetime of a forest.

Paleoecologists can identify the types of pollen shed by trees found in Jackson County forests based on differences in shape, size, and the number of circular *pores* or elongate *furrows* in the outer walls of each pollen grain. They can learn about the character and intensity of past fires from variation in charcoal particle size.

The paleoecologists’ job is to read and interpret the tree pollen record and the record of forest fire charcoal ash preserved within the pond sediments.



Scientists relied on information from tree pollen, spearpoints, and charcoal from fires to tell the Cliff Palace Pond story.



How do they begin? By taking small, pea-sized samples from the pond's sediments.

The samples must be collected carefully. At Cliff Palace Pond, a paleoecologist and several assistants waded out into the pond near its center, where the muck was thickest. They pushed a long metal coring tube, about a yard long and two inches in diameter, into the pond sediments. This removed a cylinder of mud, called a *mud core*, from the muck. The full coring tube was passed hand-over-hand to another paleoecologist, who laid it carefully on a plastic sheet spread out on the ground nearby. She pushed the mud core, which measured a little over three feet in length, out of the coring tube. Then she recorded the color and texture of the pond mud. Finally, she labeled and wrapped the mud core in aluminum foil to prevent it from drying-out and becoming contaminated.

The researchers repeated these steps, coring deeper each time in the same hole. They stopped when they struck the sandstone bottom of the pond. In all, they had cored about five feet below the surface.

The paleoecologists took the cores of ancient mud back to the laboratory for analysis. There, they processed 32 small samples of pond sediment

taken from the cores using a series of strong acids. In this way, most of the other materials were dissolved away. This left the acid-resistant fossil pollen grains and the charcoal particles for them to study.

The paleoecologists placed a drop of pollen-and-charcoal-rich liquid on a glass slide. They looked at it under a microscope that magnified the particles 480 times their normal size. This made it easier to identify and count the number of pollen grains for each tree species and the number of charcoal particles of various sizes. By plotting on diagrams the results from a series of samples taken from throughout the length of the mud core, the paleoecologists identified changes through time in the types and abundance of tree species and in the occurrence of forest fires around Cliff Palace Pond. From these diagrams, the paleoecologists interpreted the history of the forest and its forest fires. In addition, by finding out what kinds of trees grew around the pond, the paleoecologists could indirectly identify what past climates were like. This is because particular trees grow only in certain kinds of climates.



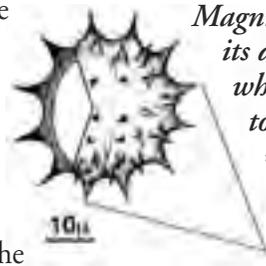
Paleoecologists recorded seven layers of pond sediment, based on differences in soil color and texture.



The final step was to fix the history of the forest and its fires in time and assign dates to the events. This was important, for this is how the pond's environmental history can be linked to the human history contained in the surrounding archaeological sites.

Assigning dates to the Cliff Palace Pond pollen sequence depended on comparing it with well-dated major forest changes recorded by pollen and by archaeological assemblages from nearby sites in Virginia and Kentucky. These changes themselves were based on radiocarbon dating of samples carefully selected from other pond sediments and archaeological sites. The changes in many of the types of pollen in the Cliff Palace Pond sediments occurred in the same sequence as those at other sites in the region.

The objects archaeologists study are much larger than tiny pollen grains



Magnifying a pollen grain reveals its distinctive exterior surface, which can range from smooth to bumpy to even spiny (10 μ = 10 microns or 10 one-thousandths of a millimeter).

and charcoal particles. To reconstruct the human history of the Cliff Palace Pond locale, the archaeologists analyzed *artifacts* (things that past people left behind) and interpreted their spatial (horizontal) and temporal (vertical) patterns in the soil layers of the places where people once lived. Artifacts and their patterns contain clues about how past peoples lived, what they ate, what they traded for, and what they believed.

Like the paleoecologists, the archaeologists visited Keener Point Knob to collect information about the past. They walked the cliffclines of the Knob's perimeter, recording the prehistoric and historic human use of rockshelters. The archaeologists examined the narrow ridgetop as well for prehistoric campsites.



Paleoecologists and archaeologists take a sample of the Cliff Palace Pond sediments.



Scattered on the rockshelter floors they found chipped stone tools and the debris from their manufacture. They also found prehistoric pottery; fragments of animal bone and wood charcoal; freshwater mussel shells; and sandstone rocks used for grinding. Metal cans and glass bottles, artifacts left behind by more recent visitors, were recovered, too.

Some shelters contained evidence for more permanent prehistoric occupation. Here the archaeologists recorded ancient trash deposits and the remains of prehistoric hearths. They found that looters had badly disturbed many of the shelters. The archaeologists also discovered a prehistoric stairway (a

series of footholds cut into the bare cliff face).

The archaeologists returned to a few of the rockshelter sites to collect more detailed information. They carefully excavated square or rectangular pits (called *units*) into the undisturbed prehistoric trash deposits, screening the soil to recover artifacts and taking care to keep the artifacts from each soil layer separate. They took photographs, drew maps, made notes, and collected soil samples to process in the laboratory. The soil samples could contain tiny animal bones as well as tiny charred seeds of plant foods, accidentally dropped into hearths by prehistoric peoples.

Archaeologists carefully excavate prehistoric trash deposits in rockshelters to recover information about the past.





Evidence for prehistoric campsites on the ridgetop was not as easy to find. Trees, shrubs, and leaf litter covered the ground. So, the archaeologists dug a series of **probes** (round holes) all across the ridgetop on a **grid** (a checker-board pattern). By screening the soil from each probe, they found stone tools and toolmaking debris. They mapped the location of the holes that produced the artifacts. In this way, they identified the boundaries of a prehistoric campsite that covered almost the whole ridge.

Back in the laboratory, the archaeologists described the artifacts they found: counting, measuring, and drawing them. They prepared diagrams and maps to show which soil layers the artifacts came from and where the artifacts had been found at the sites. Microscopes helped them identify the smallest artifacts, such as tiny fragments of burned wood, nuts, and seeds.

They determined when prehistoric peoples had lived at the sites in two ways. Burned wood fragments were radiocarbon dated, and the archaeologists studied characteristics of the artifacts themselves: the shapes of stone spearpoints and arrowheads; the style of designs on fragments of broken pots; and the manufacturing marks left on the sides of historic glass bottles.

The kinds of artifacts found also

helped the archaeologists figure out what cultural activities took place at the sites. These could include tool making, hunting, wild and domesticated plant food processing, gardening, farming, historic nitre mining (for making gunpowder), and modern looting.

For the final step in their research, the archaeologists compared their findings from the Keener Point Knob sites to others located in the Eastern Kentucky mountains and throughout the surrounding area. They studied regional history books to learn about landuse patterns, towns, and industries of the historic period. In this way, the archaeologists developed a general picture of human history at Keener Point Knob.

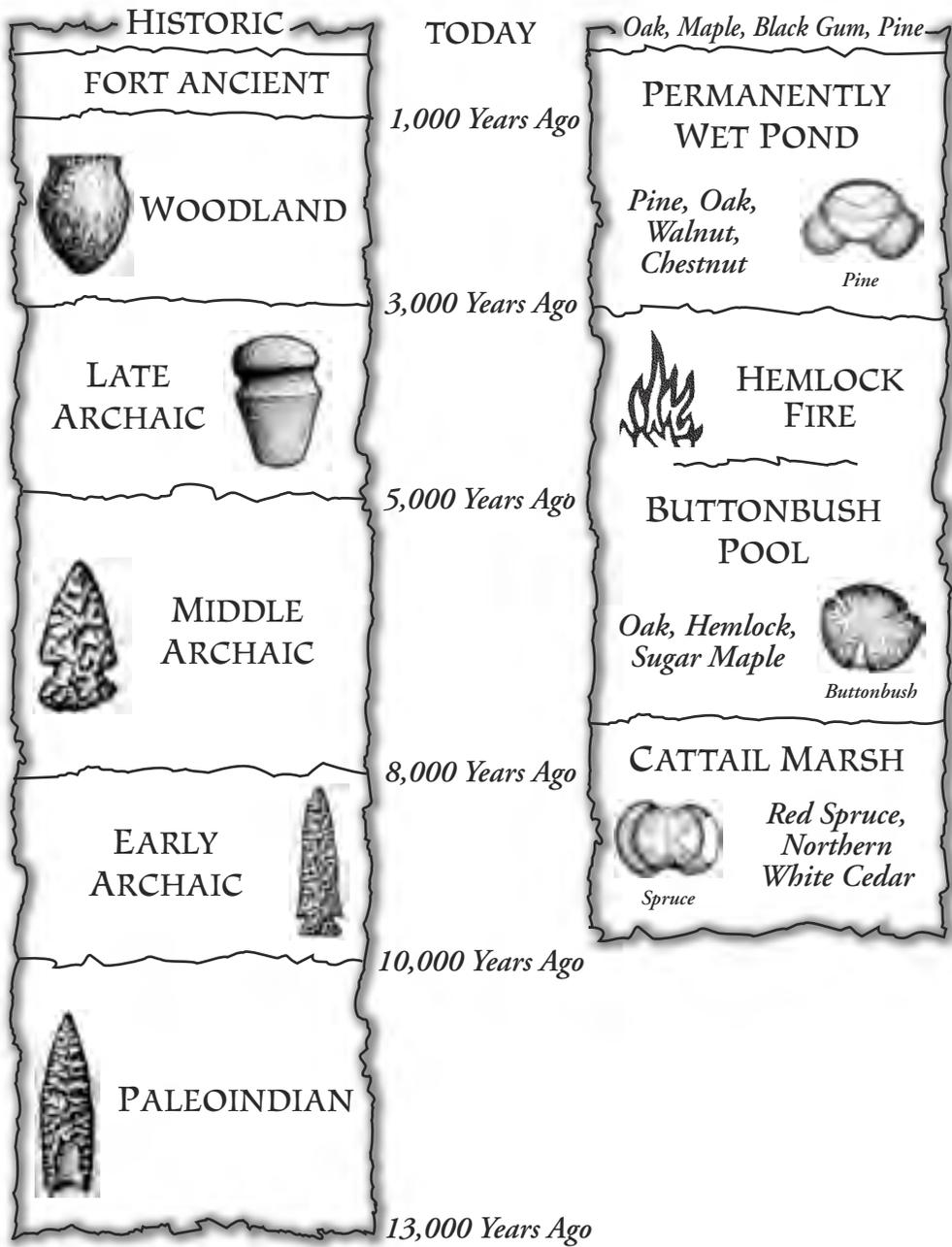


Archaeologists discovered this aboriginal petroglyph (a geometric design pecked or carved into a rock) in the large rockshelter below the pond.



REGIONAL CULTURAL HISTORY

CLIFF PALACE POND HISTORY





A Cattail Marsh in the Forest

The story of Cliff Palace Pond is a long one. It starts over 9,500 years ago with the formation of the little pond and the appearance of people in the Keener Point Knob locale.

The pond formed on gently rolling sandstone bedrock. A thin layer of silty particles, called *loess*, collected in a ridgetop depression in the sandstone. These particles had been blown southward by winds sweeping off the flanks of the retreating glaciers and from the sandy floodplains of the

Ohio River. The silty loess “sealed” the bottom of the sandstone depression, permitting water to collect in the little basin.

Cliff Palace Pond began as a cattail marsh within a forest made up of trees that grow in the cold climate of Canada today. They included cold-loving species such as red spruce and northern white cedar, as well as hornbeam, birch, alder, and aspen. Warmth-requiring oaks also grew in these forests. The climate was one of sharply distinct seasons: very cold winters and warm summers. Landslides and forest fires set by lightning occurred frequently in this type of climate. These disturbances would have created patchy, sunlit spots for the weedy growth of hornbeam and alder in shrubby thickets.

The first people to arrive at Keener Point Knob lived in a large rockshelter immediately west of the pond. These Early Archaic people lived in small bands, and moved with the seasons to hunt and gather over large territories. They hunted animals like white-tailed deer, bear, and turkey, using spears tipped with distinctively notched stone points. As Early Archaic peoples became more familiar with their surroundings, gathering plant foods, such as nuts, seeds, fruits, and roots, became increasingly important. Since their surroundings provided everything they needed, these people seldom used fire to manipulate the environment.

Cliff Palace Pond may have once looked like this drawing of a cattail marsh.





The Early Pond and Its People

Cliff Palace Pond existed as a cattail marsh for several thousand years. During that time, a little over a foot of dark grayish-brown sediment built-up in the shallow depression on the crest of Keener Point Knob. Sometime between 7,300 and 4,800 years ago, tiny Cliff Palace Pond became an open pool in which buttonbush grew. This is when precipitation in the central and southern Appalachians increased because of a southward shift in storm patterns.

The forest on Keener Point Knob gradually changed. As the Ice Age climate warmed up, the cold-loving trees, such as northern white cedar, died out. The spruce and alders disappeared. In their place, warmth-loving oak, hemlock, sugar maple, butternut, basswood, and hickories grew. Seasonal temperatures evened out: winters became warmer and summers became cooler. The climate in general grew warmer and more like that of today. Lightning-set fires occurred much less frequently than they had in the past.

Archaeologists call the hunting and gathering peoples who lived in this rich, temperate forest the Middle and Late Archaic peoples. Like their ancestors, they lived a mobile life, hunting and gathering in small bands. They moved seasonally within home territories, but these territories were

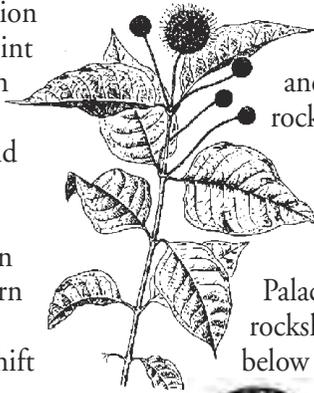
smaller than those of their ancestors. Throughout Eastern Kentucky, these Middle and Late Archaic peoples set up semi-permanent base camps and seasonal hunting and fishing camps along rivers and creeks, on ridgetops, and in rockshelters.

At Keener Point Knob, Middle and Late Archaic peoples camped on the ridgetop surrounding Cliff Palace Pond and in several rockshelters located in the cliffines below it. They likely camped around Cliff Palace Pond for short periods of time during a single year, but did so seasonally for thousands of years. Middle and Late Archaic peoples used the nearby rockshelters as base camps, living in them for several months a year.

Most activities of daily life took place outside their homes, which they used mainly for sleeping. These activities included cooking meals, making stone

Above: Buttonbush (Cephalanthus occidentalis) plant and pollen.

Below: Eastern Hemlock (Tsuga canadensis) branch and pollen.





tools, cracking nuts, weaving baskets, socializing, and holding rituals and ceremonies.

The men used spears tipped with notched and stemmed stone spearpoints to hunt white-tailed deer, elk, bear, turkey, and an assortment of small animals, birds, fish, and turtles. Unlike their ancestors, they used an *atlatl* or spearthrower when they hunted.

The women collected nuts and wild plants in the deep woods, along the forest margins, and in glade openings in the forest. They used these plants for food, medicine, and dyes, and as the raw material for baskets and net bags, sandals, and mats.

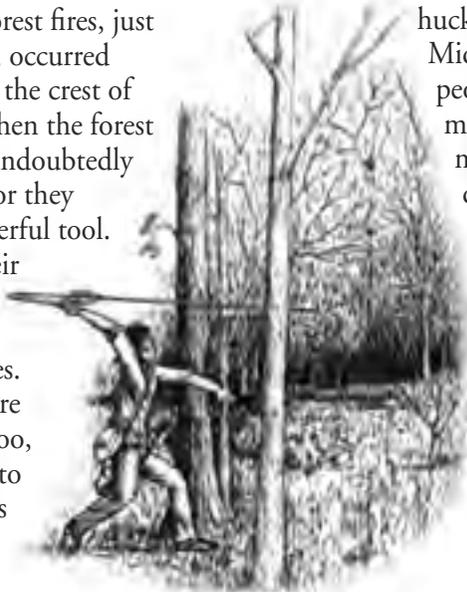
Nuts were an especially important source of food for these people. They stored well for use in the winter months, when other foods were scarce. These people preferred hickory nuts, but they also ate acorns, chestnuts, black walnuts, and butternut.

Lightning-set forest fires, just like those of today, occurred infrequently along the crest of the mountains. When the forest did burn, people undoubtedly had a hand in it, for they knew fire as a powerful tool. They used it at their camps for heat, cooking food, and preparing hides. They considered fire a powerful force, too, incorporating it into important religious ceremonies.



Using hand-sized stones, women cracked nuts on flat, pitted sandstone rocks.

It is likely that these peoples also set fire to the forest deliberately, but this probably did not happen often. Hunters may have set small, controlled fires to drive game animals into the waiting spears of their companions. Groups also may have set fire to the forest floor to clear it of unwanted vegetation and to enhance the growth of bushes like blueberry and huckleberry. Certainly Middle and Late Archaic peoples did not use fire to manipulate the forest as much as their gardening descendants would do later.



The atlatl improved a hunter's spear-throwing accuracy, power, distance, and speed.



A Major Forest Fire

The fossil pollen record at Cliff Palace Pond shows that, soon after 4,800 years ago, all the hemlock trees growing on and around Keener Point Knob began to die off. By 3,000 years ago, these trees had become locally extinct. No sharp change in climate was the cause. Instead, the hemlock looper moth probably was the culprit. In its larval stages, this insect eats the needle-like hemlock leaves.

Once the looper eats all the needles, the tree quickly dies.

This dieback did not take place only at Keener Point Knob. Throughout their range in eastern North America, hemlock trees succumbed to the looper at about the same time. Thus, the character of the forest changed as the once dominant hemlocks were lost - the dead and dying trees dropped branches, toppled over in summer storms, and opened up light gaps in the leafy forest canopy for other kinds of trees to grow and replace them.

Keener Point Knob and the region as a whole was now ripe for a catastrophic wildfire. For several thousand years, lightning-set forest fires had occurred infrequently. The standing or fallen dead hemlock trees scattered across Keener Point Knob and

along its slopes represented a large fuel load that would burn hot once started.

The size of the charcoal in the sediments of Cliff Palace Pond show that a major forest fire did indeed sweep across Keener Point Knob sometime between 4,800 and 3,000 years ago. This fire could have burned only a small area near the Knob. But given the widespread dieback of the hemlock



trees, it is also possible that the fire at Keener Point Knob was part of a much larger fire.

What might this fire have been like? Forest fire ecology can provide some insights. No doubt it would have started in the dead hemlock trees, for they were tinder dry. All it would have taken was one spark from a summer thunderstorm or an Archaic hunting party's loss of control over the fire they were using to drive game.

The hemlocks would have easily caught fire, burning quickly and intensely, and catching other trees on fire. The fire would have burned dead hemlock branches and fallen



*Above: The hemlock looper moth (*Lambdina fiscellaria*) probably caused the widespread dieoff of all the Knob's hemlock trees (left).*



hemlock trees on the ground and climbed quickly into the tree tops. Rising flames, using dead standing or leaning hemlock trees as ladders, could have vaulted up the sandstone cliffs to the ridgetcrests. Depending on wind and moisture conditions, the fire could have quickly

spread to the oak and hickory trees as well.

The fire could have started miles away from Keener Point Knob. Dead trees could have passed the fire along



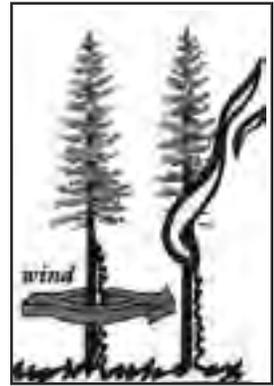
in the tree-tops ahead of the fire on the ground, especially if it was windy. Tree-top or ***crown fires*** can move several miles in a single day if conditions are right (very dry timber and strong,

persistent winds). Or, glowing embers could have carried the fire ahead of the main body by landing on ridgetops like Keener Point Knob.

After the smoke cleared and the firestorm had burned itself out, the scorched landscape would have looked like a patchwork quilt. In areas where only light ground fires had passed quickly through, the trees themselves would have been unburned. In other

places, partially burned trees would have had dead and scorched foliage and charred bark. In the completely burned areas, the intense heat would have reduced the trees to ash and penetrated deep into the soil, killing most living things. It would have been in these areas of scorched earth that the forest would have taken the longest time to grow back.

And what of the animals and people? Those caught in the path of the fire without any shelter surely died. Others, smelling the smoke, seeing the flames, and hearing the fire approach,



would have hurried to get out of its way. Some people may have headed for the rockshelters in the cliffs of Keener Point Knob or the nearby firebreaks of Station Camp Creek. Others may have traveled beyond the limits of their home territories in an attempt to escape it.

In the tinder-dry hemlock stands, fire could have quickly spread into the tree-tops in a number of different ways, as shown in these illustrations.





Once the fire had passed, what was left for these hunting and wild plant food gathering people to eat in its wake? It depended on how intense the fire had been and how large an area had been burned. Keener Point Knob and its rockshelters may have been abandoned for decades or even centuries. Home territories may have changed for a generation or more to avoid areas that had been burned the worst. Concerns about angry spirits may have kept some areas off-limits to people long after the forest had begun to grow back.

In time, the forest recovered, of course, but it was a different forest. Extensive stands of eastern red cedar sprang up on the slopes and fire-scorched ridgetop at Keener Point Knob. The great fire eliminated fire-sensitive tree species, like beech and butternut, from the forest for decades. It destroyed many nut-bearing trees, a critical source of food. This may have

meant a threat of wintertime hunger for some groups, unless they moved away from their home territories for a time.

The scars of the great hemlock fire eventually disappeared from the forest. Wind and rain deposited ash layers in Cliff Palace Pond. At Keener Point Knob, blue ash trees replaced the stands of eastern red cedar on the slopes. Then oaks, chestnut, and for the first time, pine, replaced the blue ash.

As the forest recovered, the native peoples returned. In time, they again gathered plants and nuts in the forest at Keener Point Knob and hunted the animals that lived within it. Once again they made their homes in the rockshelters below the Knob and on the ridgetop near the pond. But, like the forest, these Late Archaic people were different, too. They were experimenting with a new way of getting a more predictable supply of plant food, by growing it themselves. This simple act changed the face of the forest forever.



The forest around Keener Point Knob may have looked like this to the prehistoric survivors after the Great Hemlock Fire: leafless stands of scorched trees and the ground covered with ash.



Prehistoric Gardeners and Their Forest

After the Great Hemlock Fire, many changes took place at Keener Point Knob and throughout Eastern Kentucky. Between 3,000 and 200 (A.D. 1800) years ago, the climate got cooler. Precipitation increased and was more evenly distributed throughout the year.

Cliff Palace Pond became a permanently wet pond. The change in climate permitted a lush growth of buttonbush in the pond itself and the growth of sphagnum moss along its margin.

Despite the increased precipitation, local ground fires occurred frequently on the ridgetop surrounding the pond. These fires were not the result of a single fire event, like the Great Hemlock Fire. They were a constant feature of the environment.

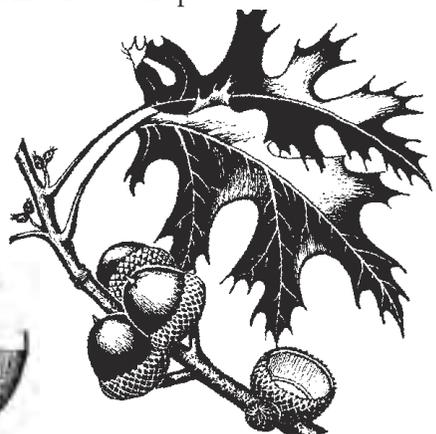
These recurring fires transformed the forest. Pine trees grew in profusion. Other fire-adapted and fire-tolerant species, such as oaks, black walnut, and chestnut, appeared with the pine and eventually dominated the forest around the pond. Why? What had changed? The lifeways of the prehistoric peoples living at Keener Point Knob.

Above: Pitch Pine (Pinus rigida) branch and pollen.

Right: Scarlet Oak (Quercus coccinea) branch and pollen.

These native peoples, whom archaeologists call the Woodland peoples, still hunted the same animals and collected the same wild plant foods as their ancestors. But increasingly, they turned to gardening as an important occupation.

How did Woodland people learn to grow their own food? Observant family members may have noticed that seeds sprouted and grew on the trash heaps, where they threw out the remains of weedy wild plants they collected. Under the right conditions (soil, light, moisture, and freedom from competing plants) and over a period of time, these *volunteers* (plants that come up without being planted on purpose) produced somewhat larger fruits and seeds than their wild counterparts. Eventually, these genetically selected seeds created new domesticated crops.





A gardener is really only a more organized, more intensive, plant food gatherer. And so Archaic gatherers became Woodland gardeners by tending volunteer plants that grew on their trash heaps. Once they had saved the seeds, then planted, weeded, and watered the plants, the Woodland peoples had turned into gardeners. Gardening led them to a more *sedentary* (living in places more intensively for longer periods of time) way of life. The domesticated seeds, in effect, domesticated the people by tying them to the land.

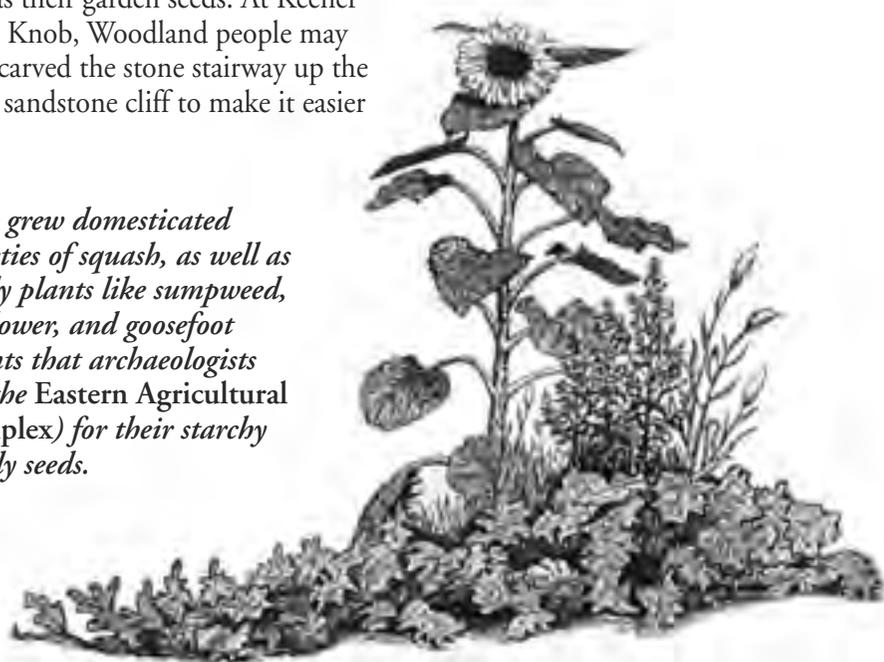
Life for these gardeners centered on rockshelters, where they lived for longer periods of time throughout the year than had their Archaic ancestors. Their home territories became smaller.

Women made pottery jars for cooking, and for storing water as well as their garden seeds. At Keener Point Knob, Woodland people may have carved the stone stairway up the sheer sandstone cliff to make it easier

They grew domesticated varieties of squash, as well as weedy plants like sumpweed, sunflower, and goosefoot (plants that archaeologists call the Eastern Agricultural Complex) for their starchy or oily seeds.

to get to their ridgetop gardens. A Woodland artist may have pecked out a spiral petroglyph design on a flat rock. Perhaps the artwork was tied to rituals associated with these new ways of getting food.

They probably located their gardens close to their rockshelter homes on sunlit hillslopes and on ridgetops like Keener Point Knob. In one of the several garden spots they kept in the forest, the women would have used digging sticks to prepare the soil. Then they would have dropped the seeds into a hole and covered them up with dirt. During the growing season, the women would have tended the plants periodically. At harvest time, they would have pulled squash from the vines and knocked ripe seeds off the weedy native plants into cane baskets.



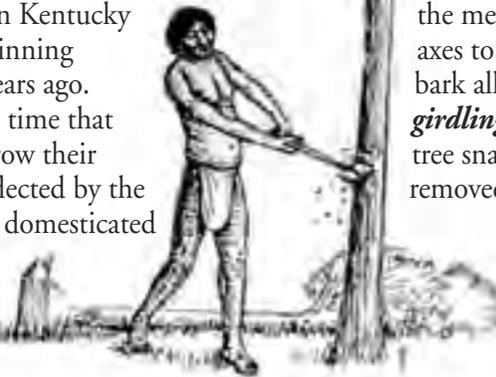


The success of the Woodland gardeners depended on their ability to open up spots in the forest for their gardens. Fire was the tool they used.

Paleoecologists and archaeologists think that the increase in the frequency of forest fires after around 3,000 years ago at Keener Point Knob was the result of people deliberately burning the forest for their garden patches. Woodland gardeners did not set fires only to remove the forest underbrush to enhance animal habitat. Archaic peoples had been doing that for thousands of years. No, Woodland people set fire to the forest more frequently and more deliberately than in the past because they now had gardens.

Information collected from archaeological sites at Keener Point Knob and from other Eastern Kentucky sites, like Cold Oak Shelter in Lee County and Cloudsplitter Rockshelter in Menifee County, supports this explanation. In fact, at sites all across Eastern Kentucky, an increase in fire and fire-tolerant tree species occurs at the same time native peoples turned to gardening as a way of life.

Native peoples most intensively occupied Eastern Kentucky rockshelters beginning around 3,000 years ago. This is the same time that they began to grow their own food, as reflected by the charred seeds of domesticated plants found in rockshelter trash deposits.



The fossil pollen record from Cliff Palace Pond also supports this interpretation. Pollen of plants native peoples first grew as they turned to gardening begins to occur consistently in pond sediments at the time when the transition from plant food gatherer to plant food gardener took place.

The fires these gardeners set to clear the land were not the intense fires of a major forest fire. Like those of their Archaic ancestors, the fires Woodland peoples deliberately set to burn off the surface materials and kill smaller trees and saplings were relatively cool and controlled. But the Woodland peoples took their burning one step further than their Archaic predecessors. Their

main purpose for using fire was to create light gaps in the forest canopy for their gardens.

To kill the larger standing trees, these prehistoric gardeners had two options. The women could set fire to wood piled around the base of the larger standing trees, or the men could use their stone axes to chop out a section of bark all around the tree (called *girdling*). Eventually, the dead tree snag would fall over, to be removed later by burning.

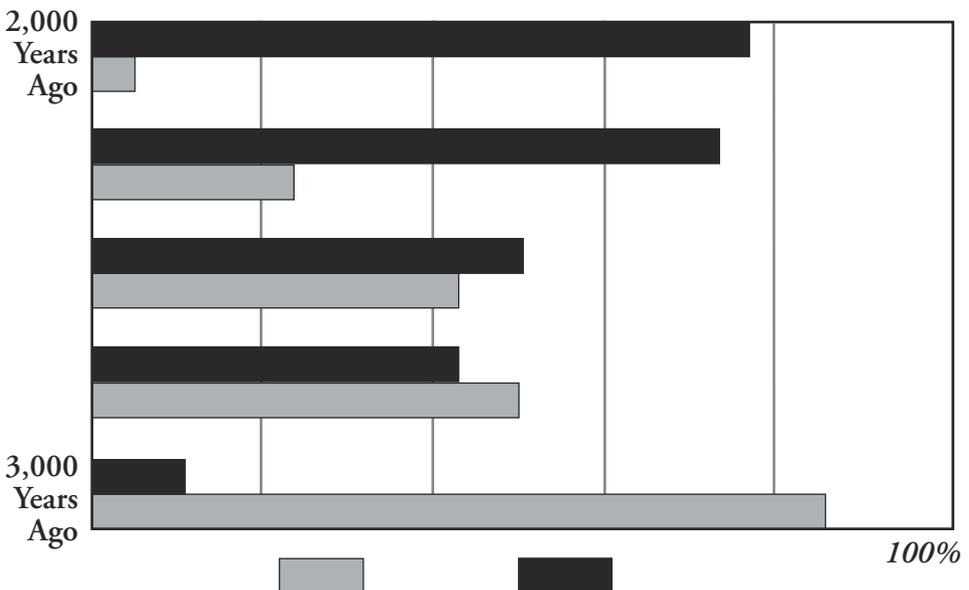
The men used stone axes to clear space in the forest for their family's gardens.



They located their gardens on hillslopes and on ridgetops like Keener Point Knob for several reasons. Fires burned more intensely in these places than on the wet floodplains, thus reducing the forest leaf litter and weedy plants to a nutrient-rich ash. This resulted in a soil that was loose and free of weeds; a soil that could be worked easily with a digging stick. Early frosts and shading also were not a problem for hillside gardens, as they would have been for gardens planted along creeks. South-facing hillslopes were warmer than the valley bottoms and received more sunlight for longer periods of time each day. Erosion of slopes was not a problem, because the forest soil was not intensively disturbed in these garden plots.

Fire in the hands of native peoples enhanced habitat diversity. It turned the forest into a fine-grained patchwork of vegetation. Garden patches were similar in size to forest openings created by windstorms that blew down one to several large old trees. Native people's clearing and abandonment of gardens also mimicked the natural pattern of forest regrowth in light gaps caused by tree falls. Burning patches of the understory opened up the forest and increased the rate at which forest nutrients were returned to the soil. Grasses, shrubs, and non-woody plants tended to grow more densely and vigorously in these places. This created ideal habitats for forest-edge wildlife, promoting an increase in game animals.

This chart shows how disturbed habitat plants, the ones Woodland peoples grew and domesticated, became the main ones used at Cold Oak Shelter as they turned to a gardening way of life.





What did the forest look like after these prehistoric gardeners had been at work for some time? A rich and diverse forest community grew in the sheltered ravines and lower slopes below the rockshelters. It included basswood, sugar maple, butternut, hickory, beech, and cucumber magnolia. The floodplain forest along Station Camp Creek, just east of Keener Point Knob, included canebrakes and the water-loving willow and sycamore. These locales, often in the noon-day shade, may have remained relatively protected from the spread of human-set fires.

Exposed ridgetops, upper slopes, and local hillslope patches near cliff overhangs experienced the most impact from human-set fires. This is because these were the preferred garden locations. A relatively open stand of yellow pine grew on the dry

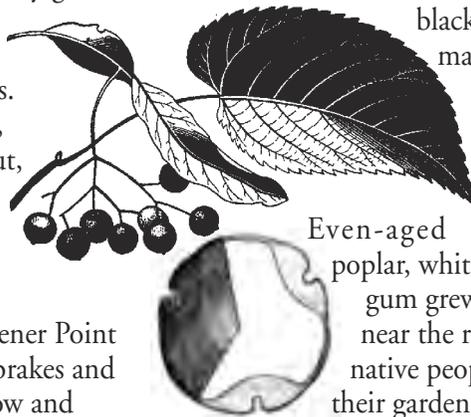
ridgetop, as did flowering dogwood, sassafras, and sourwood. Thickets of heaths (blueberry, huckleberry, laurel,

and rhododendron), wild grasses, and wild flowers grew in the open understory of the ridgetop pine stands. Oaks, chestnut, hickories, black walnut, black gum, and red maple grew in light gaps in the forests on the upper slopes near the rockshelters.

Even-aged stands of tulip poplar, white pine, and sweet gum grew in canopy gaps near the rockshelters where native peoples had planted their gardens in the past. Small open garden patches also occurred in these locales. Bracken fern and weedy species that invade openings in the forest, such as ragweed, grew in and around the gardens.

* * * * *

Around 1,000 years ago, seeds of corn and beans were brought to Eastern Kentucky from outside the region. The Woodland peoples gave up their small garden plots and most of their indigenous garden plants. Instead, they turned to farming extensive fields of corn. These fields required rich soils on moist, flat river terraces. The steep hillsides where once they grew their gardens would not do.



Above: Basswood (Tilia americana) branch and pollen.

Right: Sugar Maple (Acer saccharum) branch and pollen.

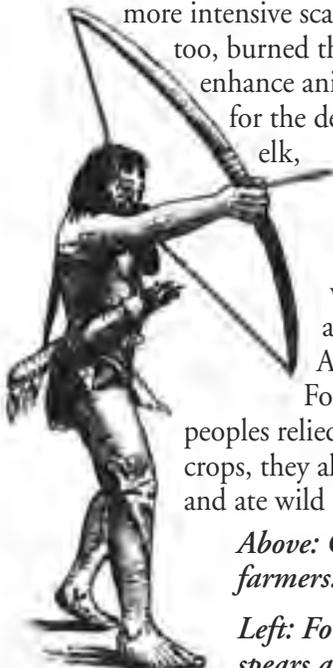


A farmer is really only a gardener who plants more intensively and extensively. So the change from gatherer to farmer is really just a progression of ever increasing time investment in the tending, nurturing, weeding, and harvesting of plants. This change carries a price: an ever increasing dependence on plants for food and a stronger bond with the land.

The Woodland peoples' descendants, called Fort Ancient by archaeologists, grew corn, beans, squash, and tobacco in large fields on the floodplains. These prehistoric farmers cleared and maintained their fields with fire in the same way their Woodland ancestors had cleared and maintained their gardens. But they did so on a much broader and

more intensive scale. They, too, burned the forest to enhance animal habitat for the deer, bear, elk, and turkey

they hunted with bows and arrows. Although the Fort Ancient peoples relied on their crops, they also collected and ate wild plants.



Above: Corn was an important crop for Fort Ancient farmers.

Left: Fort Ancient hunters used bows and arrows instead of spears and atlatls to hunt the forest animals.

Like their ancestors, they lived near their crops. But for the Fort Ancient peoples, this meant building large

villages some distance away from the Knob on the floodplains of larger streams and creeks.

Keener Point Knob was no longer the focus of base camps and year-round rockshelter use. Now, only small groups of adults and older children who left the villages in winter on hunting trips used the

rockshelters as occasional camps.

With the arrival of Europeans along the Atlantic coastline 450 years ago, native ways of life in North America, and eventually in Eastern Kentucky, changed. Smallpox and other European diseases preceded by decades the Europeans' physical entry into the region. Because native peoples had no natural immunity to these diseases, groups such as the Shawnee, Cherokee, and Tutelo, were decimated by them. The arrival of European explorers and traders in the Ohio Valley and Eastern Kentucky about 250 years ago completed the replacement of the region's native peoples or their absorption into European colonial populations.





New Settlers and the Forest

The last complete chapter in the story of Cliff Palace Pond is the shortest (A.D. 1800 to A.D. 1940, only 140 years long). It was a time of abrupt, widespread, and drastic changes in the forest and the people who lived within it. And unlike the preceding chapters in the Cliff Palace Pond story, paleoecologists and archaeologists can turn to the written history of the forest and the people to supplement information provided by fossil pollen, charcoal particles, and artifacts.

Cliff Palace Pond itself changed little during this period. It remained a small, permanent pond. The pond and the continued human use of fire to clear the forest, though on a much more extensive scale, represent the few links to the past during this period.

Fire-tolerant species still dominated the forest on Keener Point Knob. Oaks

remained, as did red maple, black gum, and Virginia pine. But the tall chestnut trees had disappeared. The Cliff Palace Pond sediments record the historically documented chestnut blight. It is represented by a major decrease in chestnut pollen. A fungus on chestnut nursery stock imported from Europe brought the blight to New York in 1904. It spread down the Appalachian Mountains, reaching Eastern Kentucky by 1930. It quickly killed all mature chestnut trees.

The amount of ragweed, a weedy plant that usually grows in plowed fields, increased sharply in this period. Dock, a perennial herb introduced from Europe that also invades cultivated land, also appeared.



Left: American Chestnut (Castanea dentata) branch and pollen.



Right: Dock (Rumex acetosella) plant and pollen.





Conversion of large sections of forest land to farming, industry, and human settlement took place for the first time. The result was widespread deforestation. Eastern Kentucky and its people had never before witnessed environmental change on such a vast scale. Fire was only one of many techniques used.

Although the ethnic makeup of the forest's people had changed since prehistoric times, the human relationship to the forest changed little at first. In the earliest years of white settlement, the lives Euro-American subsistence farmers led were comparable to those of the Indians. Some pioneers lived in rockshelters. Most lived in log cabins scattered along stream valleys in places similar to those where Fort Ancient farmers once had lived.

The Euro-Americans made their living by farming, by hunting, and by gathering wild plant foods. They grew the Indian crops of corn, beans, gourds, and tobacco. But they also grew Old World crops like oats, wheat,

Logging and clearing land for farms at the turn of the 19th century drastically altered Eastern Kentucky's forests.

and hemp, and they tended fruit trees in orchards. Unlike the Fort Ancient farmers, they kept domesticated livestock, such as cattle, sheep, mules, chickens, horses, and hogs. But they also hunted deer, raccoon, opossum, squirrel, and rabbit like the native peoples.

Guns replaced the bow and arrow and iron tools replaced those of stone. However, Euro-Americans cleared the land for farming and for settlement in essentially the same way the Indians had done it - with fire. Though they cut down trees with iron axes, they still piled up loose brush and logs by hand, and reduced the piles to ash by the fires they set. Unlike the native peoples, they removed stumps and worked the earth for planting with a team of mules or oxen.

In the spring, like the Indians, these Kentuckians of mainly Scottish and Irish descent burned the woods near their homes to clear the shrubby undergrowth. Folk wisdom said this would improve grass growth for their livestock, which they allowed to range





throughout the wooded slopes. People of Indian heritage knew that fire was a purification tool, used to rid the forest of anything unwanted. In the fall, the mountain people also set fires in the harvested fields and in the woods to drive out game animals during hunting.

Before the Civil War, a marked change in the regional human-forest relationship began with the appearance of the iron industry. Charcoal used to smelt iron was made from hardwood trees in the forests surrounding the furnaces. Thousands of acres of trees were needed to produce enough charcoal to keep these furnaces running.

After the Civil War, huge tracts of forest in Eastern Kentucky were sold and cut as a result of the logging boom (from 1870-1910). A regional population explosion followed the railroad and its attendant industries.

Unlike many places in Eastern Kentucky, few people visited the Keener Point Knob vicinity. People of European descent did not settle, farm, or burn the Knob. This was due to its remoteness and to the fact that the

surrounding landscape lacked large tracts of bottomland.

When people did return, it was around 1900. They came to take its natural resources. Someone mined a little *nitre* (an ingredient used to make gunpowder) at one rockshelter. For about 20 years, starting around 1900, the Turkeyfoot Lumber Company selectively harvested timber across northern Jackson County, including Keener Point Knob. The company brought the logs by standard gauge railroad to a sawmill in Lee County. Traces of this logging road are still visible in the woods east of the pond.



Above: Roadbeds like this one were cut through the area to transport logs by train.



Left: During the logging boom, the area's forests were cleared for lumber.



People, Today's Forest, and Fire

Today at Cliff Palace Pond, we do not need fossil pollen to tell us what the environment is like. We can see it with our own eyes. And we do not need artifacts of the past to tell us about the people, for now we are part of the story.

Cliff Palace Pond, as it has been for the last 7,300 years, is a small pond surrounded by forest. Tree pollen and charcoal ash windborn from forest fires, are still falling onto the pond's surface, then drifting and settling into its mucky sediments.

Today's young hardwood forest is dominated by red maple, black gum, oaks, and hickories. The understory supports a variety of trees and shrubs. They include beech, flowering dogwood, sassafras, big leaf magnolia, white pine, mountain laurel, and tulip poplar. On the sandstone ridge leading southward away from the pond, the



forest consists mainly of northern red oak, with mature trees of pitch pine, post oak, chestnut oak, white oak, and hickory. Bracken fern grows across this upland in the shallow, acidic soils underlain by sandstone. White oak, hickory, and northern red oak grow on the lower slopes in loamy soils derived from shales.

Today, Keener Point Knob is part of the Daniel Boone National Forest's London Ranger District. It has been part of a national forest since 1937, when the U.S. Department of Agriculture purchased the land from the Turkeyfoot Lumber Company. No one has lived at Keener Point Knob since Fort Ancient hunters camped in the rockshelters. No one has logged any trees since the mid-1920s. No one has deliberately set fires since the 1940s. Cliff Palace Pond has become a quiet place. The wild sounds of the forest are the only ones you hear, and the slices of sky visible through breaks in the forest canopy reveal millions of bright stars on a crisp autumn night.

The silence is broken occasionally. Recreation seekers have watched the sun set across the forested mountain ridges. People craving artifacts have destroyed our cultural heritage by looting all the rockshelters. Scientists have visited, interested in discovering the secrets of the past that lie preserved within the pond and in the rockshelters in the

Prehistoric human-set fires were instrumental in creating the "natural" beauty of Eastern Kentucky's forests.



steep sandstone cliffines below it.

Archaeologists first visited Keener Point Knob in the early 1980s. In 1996, the same year paleoecologists came to sample the pond sediments, archaeologists returned to Keener Point Knob. Though they documented additional prehistoric use of the Knob vicinity, they found no evidence of recent human occupation.

They did find, however, evidence of modern human *activity*. Some of it was hard to see: graffiti (“T F 59”) on a rock in a rockshelter and the scatter of trash from hikers or partygoers. Some of it was hard to miss. Backdirt piles and holes left by looters are present in every rockshelter that surrounds the Knob. These looters have destroyed forever the fragile record of the past. Their activities have made the story of the people who lived at Keener Point Knob much more difficult to piece together.

Until recently, the U.S. Forest Service has followed a policy set in the 1940s of actively preventing forest fires. The lichen mats growing on exposed sandstone flats near Cliff Palace Pond reflect this. So does the composition of the forest itself. Eastern red cedar, saplings of tulip poplar, white pine, and black gum are replacing fire-tolerant tree species. Fire-intolerant woody species that are prolific sprouters, such as red maple, sassafras, basswood, and beech, are increasing.

The unexpected increase of these trees in the Daniel Boone National Forest has led the U.S. Forest Service

Today, hikers enjoy visiting Keener Point Knob for its panoramic views.

to rethink the role fire plays in forest maintenance. This was why the paleoecologists came to study the history of fire at Cliff Palace Pond.

Fires have not disappeared from the forest completely, but they are different from the ones set regularly until 70 years ago. Lightning-set fires account for only one out of every 100 fires on the forest. Fires set by people are caused by arson or occur accidentally, set by smokers or people burning trash. Private, state, and federal land management agencies purposefully set fires under controlled conditions (called *prescribed* burns).

It is clear from the fossil pollen and charcoal particles preserved in the Cliff Palace Pond sediments that human-set fires were a very important part of the forest ecosystem. They were so much a part, in fact, that by suppressing fire, tree species in the forest have come to reflect its absence.

A visitor to today’s forest and the tiny pond within it might think of the Eastern Kentucky landscape as eternal, untouched by human hands. Indeed, the forest that surrounds Cliff Palace Pond has been shaped by natural forces.





But the Cliff Palace Pond story has shown us that people have been and continue to be an integral part of the forest. It has been shaped by the hands of fire-wielding peoples, who lit fires in the forest for thousands of years and then recently, purposefully, stopped lighting them. It is an artifact as surely as the stone tools prehistoric peoples made and the houses and villages they built.

Now that Cliff Palace Pond has revealed its pollen and charcoal history, and the rockshelters have revealed their cultural history, we know how the forest and its inhabitants have been inextricably intertwined throughout time. We have the obligation to act on that knowledge, to become stewards of the past.

To put what we have learned into action, we must reintroduce frequent and light intensity fire on Keener Point

Knob's upper slopes and ridgetop. At the same time, we must continue to suppress arson fires on the ecologically sensitive lower slopes. We must apply what we have learned about past peoples' use of fire to use it ourselves as a tool for managing the forest. Cliff Palace Pond has taught us that the limited, focused, and controlled use of fire actually enhances biological diversity and can help keep the forest ecosystem in natural balance.

We must protect the priceless sites that contain the information of the past: pond and petroglyph, rockshelter and ridge site. We must monitor the archaeological sites that still contain undisturbed information about the past and prosecute those who would destroy it. And above all, we must share with everyone the story of this rare and very special place.

These images illustrate the change in Forest Service fire policy: the 19th-century firefighters on the left are putting out a wildfire. Today's firefighters still fight wildfires, but they also use prescribed burning to enhance biological diversity and prevent fuel buildup, as shown in the image on the right.



KENTUCKY ARCHAEOLOGICAL SURVEY

The Kentucky Archaeological Survey is jointly administered by the Kentucky Heritage Council (State Historic Preservation Office) and the University of Kentucky Department of Anthropology. Its mission is to provide a service to other state agencies, to work with private landowners to protect archaeological sites, and to educate the public about Kentucky's rich archaeological heritage. For more information write/call: Kentucky Archaeological Survey, 1020-A Export Street, Lexington, Kentucky, 40506-9854, 606/257-5173.

KENTUCKY HERITAGE COUNCIL

The mandate of the Kentucky Heritage Council is to identify, preserve, and protect the cultural resources of Kentucky. The Council also maintains continually-updated inventories of historic structures and archaeological sites, and nominates properties to the National Register of Historic Places. By working with other state and federal agencies, local communities, and interested citizens, the Council seeks to build a greater awareness of Kentucky's past and to encourage the long-term preservation of Kentucky's significant cultural resources. Through its various programs (e.g., Main Street, Grants, Publications, Rural Preservation, Civil War Initiative, Conferences), the Council strives to show how historic resources contribute to the heritage, economy, and quality of life of all Kentuckians. For more information write/call: Kentucky Heritage Council, 300 Washington Street, Frankfort, Kentucky 40601, 502/564-6661.

UNIVERSITY OF KENTUCKY DEPARTMENT OF ANTHROPOLOGY

The University of Kentucky Department of Anthropology has a mission to educate students and promote scholarly research in the field of archaeology. The Department also is charged by state law with enforcing and administering the State Antiquities Act, which prohibits the destruction of archaeological sites on state and municipal lands. It maintains comprehensive inventory files and records on archaeological sites in the Commonwealth through the Office of State Archaeology, and supports the major state curation repository for archeological collections at the William S. Webb Museum of Anthropology. For more information write/call: Department of Anthropology, University of Kentucky, 211 Lafferty Hall, Lexington, Kentucky 40506-0024, 606/257-2710.

HERITAGE PROGRAM DANIEL BOONE NATIONAL FOREST

The 692,000 acres of land in Eastern Kentucky managed by the Daniel Boone National Forest have supported human populations throughout prehistoric, historic, and modern times. Since the historic record of these people and their activities is not quite 250 years old, the task of recording and interpreting the remaining 12,250 years of human activity on the forest falls to the archaeologist. Knowledge of the past is a part of everyone's basic heritage. The goals of the Daniel Boone National Forest's Heritage Program are to interpret the record left by those who preceded us and to pass on this legacy so that future generations can continue to experience their heritage. For more information about the history and prehistory of the Daniel Boone National Forest, contact Cecil Ison at Daniel Boone National Forest, 1700 Bypass Road, Winchester, Kentucky, 40391, 606/745-3100.

Other Booklets in this Series



Slack Farm and the Caborn-Welborn People

By David Pollack, Cheryl Ann Munson, and A. Gwynn Henderson (1996). This booklet summarizes what has been learned about this Mississippian society based on the research that followed the looting at the Slack Farm Site. The authors describe the lifeways of these farming people who lived in western Kentucky from A.D. 1,400-1,700. \$5.00.



Mute Stones Speak: Archaic Lifeways of the Escarpment Region in Jackson County, Kentucky

By William E. Sharp and A. Gwynn Henderson (1997). This booklet reviews the prehistory of the Escarpment Region of Eastern Kentucky, focusing on the lifeways of Archaic hunter-gatherers who lived in Jackson County in 6,000 B.C. and how they made stone tools. \$3.00.



Prehistoric Hunters and Gatherers: Kentucky's First Pioneers

Leon Lane, Eric J. Schlarb, and A. Gwynn Henderson (1998). This booklet describes how the very first people colonized and settled Kentucky at the end of the Ice Age, between 11,500 and 8,000 years ago. \$3.00.

To purchase a booklet, call or write the Kentucky Archaeological Survey. Discounts are available to teachers on orders of 20 or more.