Fig. 1. It is dramatically clear from this photograph, taken in 1957, that the surface of the Midas Mound has been eroding for some time.
Courtesy of the Gordion Archives

Plants in the Service of Archaeological Preservation

by Naomi F. Miller

Several years ago Dr. Ilhan Temizsoy, director of the Museum of Anatolian Civilizations, expressed concern about erosion on the Midas Mound at Gordion (Fig. 1). It occurred to me that the most effective way to reduce soil loss would be to have an uninterrupted cover of plants grow on the mound surface. At that time, the vegetation looked much like the surrounding overgrazed pasture, which is characterized by bare ground, many spiny plants, and plants that defend themselves against grazing goats and sheep by producing bitter compounds in their leaves (Fig. 2). I also began to envision an even grander project—recovery or partial restoration of the vegetation native to this part of Turkey. The central Anatolian steppe grassland is highly diverse, and includes many perennial grasses, wildflowers, and small shrubs that stay green all or most of the year and that are palatable to grazers (Fig. 3). Restored vegetation would not only be beautiful, but would also improve the rangeland.

In the short term, maintaining and expanding the plant cover would be an effective way to reduce erosion. Plant cover would keep the strong Anatolian winds from blowing soil away, would diminish the force of water reaching the soil surface, and underground, the roots would reduce the total volume of water reaching the bottom of the mound by absorbing rainwater. This approach would not solve all the problems, because the steep slope of the mound naturally limits plant growth. Also, the mound is the high point of the village, which makes climbing it almost irresistible to local young people and tourists.

Following the concept, "first do no harm," it seemed best initially just to encourage the existing plant cover to spread; thus, in April 1996 the General Directorate of Monuments and Museums erected a fence to keep animals and people off the mound (Fig. 4). By the summer of 1997, a luxuriant cover of grasses and other plants on the lower slopes demonstrated that the fence had begun to work at the base of the mound. Further up the mound, however, deep channels were still bare of any fresh vegetation.

Fig. 2 (top). An overgrazed area at Gordion shows patches of *Peganum harmala* (wild rue). The flocks avoid Peganum, because the leaves contain a bitter alkaloid (harmaline), but have eaten almost everything growing between the plants.

Fig. 3 (right). The inspiration for the Midas Mound conservation and revegetation project came after a visit to this small patch of (then) relatively undisturbed grassy steppe. Surrounded by dry-farmed fields and lying about 5 kilometers from the nearest village, the naturally high diversity of plants was able to grow here.

Mudbrick for Erosion Control

In the summer of 1997, the project benefited greatly from a site visit by Kurt Bluemel, an expert in ornamental grasses and landscaping. As he and I walked all around the mound, it became clear to us that the most serious problem was now the erosion channels. The force of water flowing in the channels was strong enough to move even fairly large stones down the slopes, so plants could not gain a foothold. I asked Kurt what he thought about lining the channels with unbaked mudbricks, the traditional Near Eastern building material; by absorbing water and dissolving gradually into the channels as the winter rains progressed, they would effectively slow the rate of water flow and allow seedlings to become established. Kurt thought this idea was worth a try

Fig. 4. Protected by the fence, it has not taken long for plants to spread onto the base of the mound. Outside the fence, the flocks still pass by and plant cover is sparse.

and showed us how the mudbricks should be set.

The Gordion Project arranged to have 1000 mudbricks from a dismantled village structure placed in two of the erosion channels. The Gordion site caretaker, Remzi Yilmaz, was drafted to supervise the laying of bricks in the fall of 1997 (Figs. 5, 6). The work had to be done by hand because heavy equipment would destroy the soft surface of the mound. As I described the plan to Remzi, the watchman for the dig house listened in. I explained that it was just an "experiment"; if it did not work out, I didn't want Remzi to blame himself. But then I caught the eye of the watchman. "You think I'm crazy, don't you?" I asked him; he smiled and said, "Well, if it works, you're not crazy."

By the spring of 1998, plants were thriving in both channels where the bricks had been laid (Fig. 7), and I have counted and mapped over 125 different types of plants, distributed according to their own growth requirements (Fig. 8). The mapping demonstrates that there is no one plant or even group of plants that is best for the mound (Fig. 9). For example, one perennial grass, *Stipa arabica*, does very well in the southeast sector, while another one, *Bromus cappadocicus*, is most abundant in the north sector.

In the summer of 1999, we set mudbricks in two more erosion channels, and we continue monitoring the vegetation to assess our progress and fine-tune our methods for the long-term survival of plants on the Midas Mound surface. It is possible that in the total absence of grazing, accumulating dead plant material might catch fire. In addition, there is no longer a source of animal droppings to fertilize the mound, which might adversely affect the steppe vegetation. Within the next few years, it may be desirable to allow some animals in to graze under controlled conditions.

Clearly, however, encouraging native plants works. As it stands, the variety of plants on the Midas Mound can survive the fluctuations

Fig. 5 (top left). Remzi Yilmaz sprinkling seeds between the bricks in one of the erosion channels. The bricks are laid across the channel in rows about 5 cm apart. Although several types of seeds were planted, only annual grasses survived.

Fig. 6 (top right). Looking downhill after some of the mudbrick was laid in 1997.

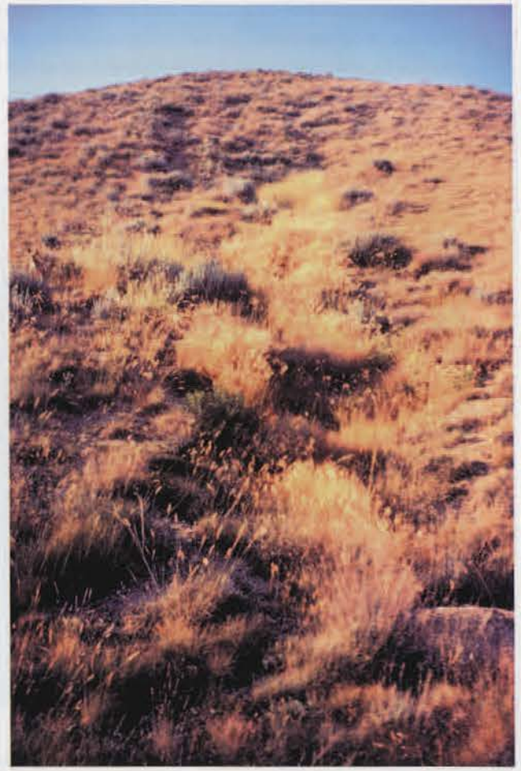

Fig. 7 (right). After two growing seasons, the annual grasses continue to thrive in the bed of the erosion channel. Even better, some of the perennial grasses and other plants that grow on the mound have been able to take advantage of the stabilized soil surface and have spread to the channel.

Gordion's Changing Landscape

Climatically, Gordion lies at the upper limit of the central Anatolian steppe, and this region might actually be capable of supporting a savannah-type vegetation (dominated by grasses but with widely scattered trees). In this part of Turkey, precipitation increases with elevation. Trees, largely absent near Gordion outside of gardens, do grow unwatered and untended as close as 10 kilometers from the site today.

As the archaeobotanist for the Gordion project, my research (which includes both archaeological and modern plant studies) informs the conservation work. Plant remains from excavations directed by Dr. Mary M. Voigt on the settlement site (approximately 1 kilometer from the mound) reflect how humans have changed the vegetation over a long period. The remains consist of wood charcoal and charred seeds. Many of the seeds come from plants consumed by animals and excreted in dung. (In wood-poor environments, dung is a common alternative fuel.) Therefore, both seeds and wood tell us first about fuel use, and secondarily allow us to infer the landscapes of the past.

At the beginning of the Gordion archaeological sequence (Late Bronze Age, about 3200 years ago), scrubby juniper was scattered amidst the grassland and cultivated fields. The flocks grazed on a steppe dominated by grasses, but which also produced many other nutritious plants. Over time, the nearby juniper was cut, and people went to more distant areas for firewood of oak (today about 10 km from the site) and pine (about 50 km). Indeed, by the time Midas's tomb was constructed of large pine and juniper logs, scrubby juniper was no longer available for fuel. Overall, the tree cover within easy collecting distance of the settlement was reduced. In addition, pasture quality seems to have declined, as some of the best forage plants (e.g., clover-like *Trigonella*) made up a smaller proportion of the seed assemblage.

At Gordion, we used a pump-driven flotation device to extract and concentrate the tiny bits of charred seeds and wood from samples of the archaeological deposits. Here I am pouring a bucket of dirt into the tank while my assistant adjusts the water level. As the water flows up and out of the tank, charred seeds and wood bits are caught in a cloth. After they dry, they are examined at low-magnification under a light microscope. Changes through time in the proportions of different types help us interpret corresponding changes in ancient vegetation and land use.

Fig. 8. Part of our conservation efforts involves gathering information as the project evolves. Here, I am in the midst of censusing plants on the Midas Tumulus; every 10 meters along a transect, I identify all the plant types growing in one square meter (the area encircled by the 3.54 m length of garden hose).

of wind and weather that occur from year to year. Even when the spring wildflowers are gone, many of the other plants survive well into the summer or year-round, so there should always be some color on the mound.

Future Plans for Vegetation Restoration

Successful as this first phase of the work appears to have been, it should be stressed that these plants do not constitute a "reconstruction" of the natural vegetation. The mound surface of ancient times, on which pollen or other evidence of growing plants might have been preserved, is long gone, so it is impossible to restore the vegetation cover to some hypothetical original state. In fact, from an archaeological perspective, we have no idea what, if any, plants grew on the tumulus in antiquity, although our research is continually providing new information on the ancient landscape (see box, "Gordion's Changing Landscape"). It is somewhat misleading even to use the word "natural" in the context of a landscape that people have inhabited fairly intensively for at least 5000 years.

The conservation work at the Midas Mound does, however, have significance well beyond Gordion itself. We have shown that erosion control can be inexpensive and can use locally available technologies, while maintaining the diverse flora of the region. Our methods may begin to demonstrate the value, and relative ease, of restoring rangeland by keeping animals off overgrazed pasture for just a few years. After all, the spiny and inedible plants are themselves components of the native steppe vegetation and only come to the fore because the flocks preferentially eat the rich pasture grasses and legumes.

It is clear that despite several thousand years of farming, herding, and wood-cutting, much of the vegetation can heal itself with limited human intervention. There is little doubt that the potential beauty of the landscape can be brought forth with a modest amount of thoughtful planning. Modern farming and herding can flourish even as tourists come to enjoy the open spaces, interesting plants, and of course, the archaeological ruins and museum that any visitor to Gordion should see and experience.

Fig. 9. Schematic watercolor of prominent vegetation on the mound as if seen from the air as we began the experiment with the bricks. Note that plant distribution varies according to slope and aspect. Thistles (probably *Onopordum* sp.; see 'a') thrive on the lower southwest slope and wild rue (*Peganum harmala*; 'b') continues to grow profusely on the southeast side of the mound along one of the main paths to the village from the surrounding pastureland. A small member of the daisy family (*Xeranthemum inapertum*; 'c') grows toward the base on the south side. Wormwood (*Artemisia* sp.), so common but nondescript that I did not think to paint it, is relatively sparse only in the northeast sector. The painting also illustrates trails beaten through the wild thyme by sheep in years past on the northeast side, and perennial grasses thriving on the north side. One of these grasses, *Stipa holosericea* ('d'), is an important part of the native steppe vegetation of central Anatolia and makes a fine fodder.

As a Senior Research Scientist in MASCA (Archaeobotany section), NAOMI F. MILLER studies ancient environment and land use in the Near East. She has been working at Gordion, Turkey, on plant remains from the archaeological site. Her appreciation of ancient and modern vegetation in the region has also inspired the steppe restoration project for the Midas Tumulus, reported here. Other current projects include archaeobotanical investigations along the Euphrates river in Syria and Turkey and at Anau, Turkmenistan. You can visit her website at www.sas.upenn.edu/~nmiller0.