# The secret lives of the wild asses of the Negev

As a critically endangered population makes a comeback, scientists are keeping a discreet eye on it with the help of GPS and dung

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By Diana Lutz



Alan Templeton

The wild asses of the Negev are extremely wary of people, but Brian Hampton, who studies Australia's wild horses (in t-shirt) was able to get close enough to dart this male, called Tail-less because of a missing appendage. See the video below for the record of Tail-less' movements generated by the GPS device with which he was fitted. The man on the left with the black hair is Amos Bouskila, another of Templeton's collaborataors.

The story is too familiar. The Asiatic wild ass (*Equus hemionus*) which once ranged widely over the desert steppes Mongolia, Russia and the Arabian Peninsula now survives only in small, isolated populations.

It disappeared from the Negev, the desert region in southern Israel, in the 1920s. But a remnant herd survived in the Shah of Iran's zoo, and some of these animals were brought back to Israel before the Iranian revolution in 1979, where they were bred in captivity. Of this captive herd 28 animals were reintroduced to the desert beginning in 1982 with an additional 10 released in 1992.

But the Asiatic wild ass is truly feral and doesn't tolerate the presence of people. So once released, the animals were difficult to find, much less to monitor.

By 2005 nobody really knew how the population were doing. Had their numbers increased? And what was their genetic status? Were they suffering from the founder effect, the loss of genetic variation that occurs when a population is established from a small number of individuals? Did the population have enough genetic diversity to adapt to new challenges in the future.

Together Shirli Bar-David and Amos Bousikila of Ben-Gurion University in Israel and Alan Templeton of Washington University in St. Louis set out to find out. Given the skittishness of their quarry, they used methods that would disturb it as little as possible, such as collecting DNA from dung and tracking animals with GPS.

The asses are like Heisenberg's atoms says Templeton; "by observing them you can alter what they're doing."

Alan Templeton

A male wild ass in the Negev. Like all prey animals it prefers to stand in profile to keep an eye on the potential predator with the camera.

**A tale of an ass and a lizard**

The collaboration began by chance. Templeton, in Israel in 2007 as a Fulbright scholar, gave a talk to the Israeli Society of Ecology and Evolution about reintroducing collared lizards to glades in the Missouri Ozarks. (For more about this project see: "Restoration as science: case of the collared lizard." )

Bar-David came to his office after the talk and said "you know there's something very similar to the collared lizard here in Israel."

And, in fact, the stories of the collared lizard and the Asiatic wild ass are uncannily similar. Both the collared lizard and the wild ass had gone extinct locally and both had been reintroduced from surviving populations at the beginning of the 1980s. In both cases the initial population was small: 29 collared lizards and, eventually, 38 wild asses.

Templeton had followed the collared lizards for 20 years and knew they were thriving. Had the Asiatic wild ass fared as well?

**How the Asiatic wild ass was driven out of Israel**

The Asiatic wild ass belongs to the same genus as the domestic horse, is about the same size and looks much like a horse. But one reason it is endangered is it doesn't behave like a horse.

"When people hear 'wild ass,' they think 'donkey,'" says Templeton," but this species is not the progenitor of the donkey. The ass family has two major branches: the African lineage and the Eurasian lineage.

The African lineage, such as the Somalia wild ass, is the lineage that was domesticated. The Eurasian lineage, however, has never been domesticated, and is notoriously untameable. In fact, the Asiatic wild ass's Hebrew name is *pere*, which means wild.

Because the Asiatic wild ass couldn't be tamed, the Negev Bedouin hunted it for meat. But the ass's ultimate undoing, says Templeton, was water and the First World War. When Britain defeated the Ottoman forces and occupied Palestine, displaced people moved into the Negev, where they settled near the few permanent water sources.

Most of the year, the ass doesn't need to drink very often, but when the mares are nursing, which is usually through the summer months, they must drink water every day. Inadvertently people who took refuge in the Negev excluded the asses from the water sources, so that they couldn't rear their foals.

Animals from zoo population in Iran were imported to the Hai-Bar Yotvata Reserve in Israel in 1968, where a captive breeding population was established. The Hai-Bar herd had prospered and 28 animals were released into the Negev between 1982 and 1987. In 1992-1993 an additional 10 animals were released.

**The science of dung**

By counting animals that came into water holes in the summer, many of them individually recognizable by coat variations and battle scars, the scientists estimated that the population had increased from 38 to about 250. And blood work done on the captive population at Hai-Bar showed this population had very high levels of genetic diversity.

Both of these were good omens for the reintroduced animals in the Negev, but the scientists wanted to study their population directions directly but taking blood samples from the widely scattered and elusive animals was not practical.

Alan Templeton

Shirli Bar-David and Gili Greenbaum collecting DNA evidence.

So the scientists got their DNA by swabbing dung. They would wait in a blind near a watering hole until an animal defecated and then pop out after the animal had moved away and swab the feces.

Sloughed-off cells from the gut on the surface of the feces sometimes allowed the scientists to find enough mitochondrial and nuclear DNA to analyze it, but not always. Not only is most of the DNA in the feces from gut bacteria and other sources rather than from the host animal, but the DNA also degrades rapidly in the heat of the desert.

Because the asses are herbivores, the dung is also chockfull of secondary compounds, bitter compounds plants produce to discourage herbivory, that also do nasty things to DNA.

To learn how to get usable amounts of DNA from dung, two of Bar-David's graduate students took a course in noninvasive genetic techniques from the Smithsonian Conservation Biology Institute in Front Royal, Virginia.

After the Front Royal course, they continued to experiment with different combinations of techniques for collecting, preserving and extracting DNA. In 2012 they published an article in Molecular Ecology Resources recommending that scientists conduct a pilot study before starting full-scale research in order to determine the optimal combination of techniques for the situation they confront.

Not only did the scientists collect dung near blinds, they set up a grid over the Negev, so they could use dung piles to track the asses.

"Being a good herbivore eating a low-calorie food they defecate a lot," Templeton says. "It's really amazing what you can learn from piles of dung scattered in the desert."

Analysis of the DNA from 400 dung samples showed that the Negev population had already split genetically. "The movement of genes hadn't been completely unimpeded," Templeton says. "An eastern subpopulation had become genetically different."

What was the barrier to gene flow? The Negev has enormous, craterlike cirques, called *machteshim*, that were created by erosion. "We learned from the dung trails that the asses don't like to traverse steep slopes, so they'd go way out of their way to avoid the cirques," Templeton says.

Wikimedia Commons

An erosion cirque in the Negev called a *machtesh*. These cirques proved enough of a barrier that ass populations on either side of them became genetically distinguishable from one another.

The eastern subpopulation had become geographically isolated in this way.

**When is a horse not a horse**

"The dung told us a lot about the behavior and ecology of the wild asses," Templeton says. And we learned more about their social behavior by videotaping from blinds near water holes."

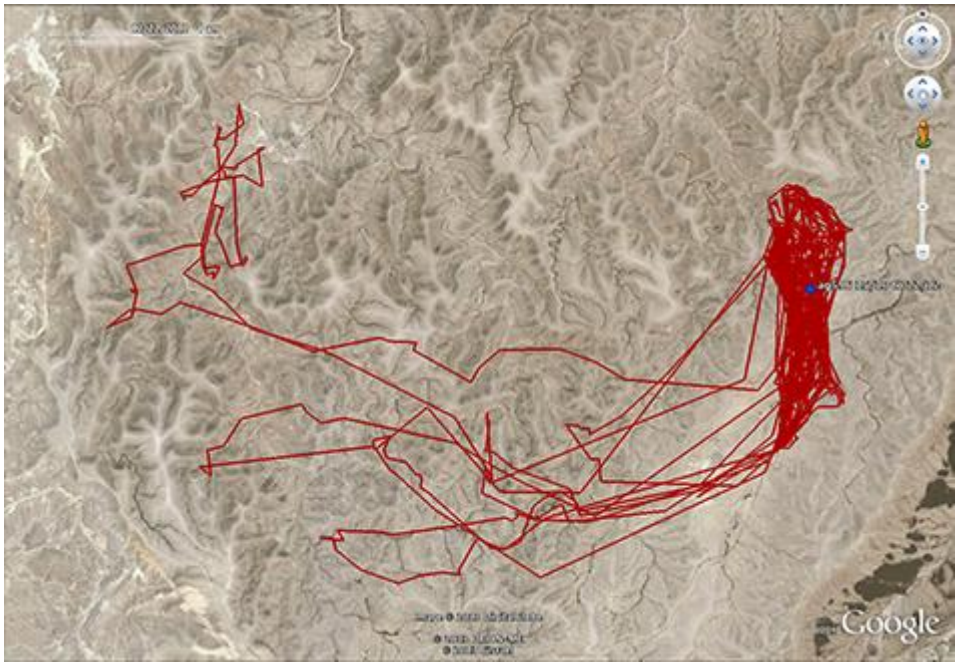
But then they had a stroke of luck. Amos Bouskila, another of Templeton's Israeli collaborators on this project, traveled to the International Wild Equid Conference in Vienna in 2012, where he met Brian Hampson, who was studying the wild horses of Australia, called brumpies.

When they discussed the Negev project, Hampson said he could dart animals 40 meters away. That might not sound like much but it a long shot for a tranquillizing-dart gun, says Templeton.

"A flying syringe doesn't have the same aerodynamic properties as a bullet," he says.

Hampson volunteered to stop by in Israel to dart an ass gratis. "He shot a male we all knew very well," says Templeton. "A very aggressive male, very dominant, that we called Tail-less, because his tail had been bitten off in a fight."

“Even from this animal we’ve learned so much,” Templeton says. They captured Tail-less’s movements on Google Earth and walked in to the desert to examine his home ground more closely when he left for exploratory trips.




Bar-David, Templeton et al.

Tail-less spent almost all of his time in a very narrow area, about two kilometers wide, where he ate and slept. But every other week, he’d race off on an exploratory trip and then race back. While he was gone, the scientists took a closer look at his ‘bachelor pad.’ It turned out to have three distinct areas, shown in the photos below.

Alan Templeton

Tail-less’ bathroom.

Alan Templeton

Tail-less’ larder, with Amos Bouskila looking on.

Alan Templeton

Tail-less' bedroom (rolling room).

Dominant males, like Tail-less, are solitary most of the year, and although females and subdominant males will form herds membership in these groups is very fluid; animals come and go.

This lack of a rigid dominance hierarchy and of the receptivity to the elaborate system of social cues needed to enforce it may explain why the Asiatic wild ass cannot be domesticated: it doesn't possess the social behavior people shape to tame an animal.

The Asiatic wild asses' social structure is more like that of Grevy's zebra, which also cannot be domesticated, than like that of the Somalia wild ass, which have been domesticated.

Bar-David, Bouskila, and Templeton, who recently received a new grant from the U.S.-Israel Binational Science Foundation, which has been funding their work, plan to collar seven or eight more asses when they begin to congregate around the waterholes this summer.

**A saving remnant**

"One of the unique aspects of both the wild ass and the collared lizard projects," says Templeton, "is that instead of avoiding hybridization, which is anathema to some conservation biologists, we said, 'No, we'll embrace it.'"

“In the wild asses’ case,” he says, “we really didn’t have any choice. The population of animals in the Shah’s zoo weren’t “pure” but rather hybrids of two of the five recognized subspecies of Asiatic wild ass. There isn’t any Negev subspecies anymore.

“As an evolutionary biologist,” Templeton says, “I err on the side of genetic variation. A species is not a static entity, it is an evolving population and that’s the common theme between the collared lizard restoration and this project. We’re looking not just to restore a population but rather to restore a population with evolutionary potential.”