A farmer on the Hopi Indian Reservation in Arizona inspects his corn crops amidst a summer drought. The tribal lore that sustained Hopi farming practices isn't working anymore, as climate change shifts seasons. Photograph by George H.H. Huey, Alamy

Indigenous farming practices failing as climate change disrupts seasons

Farmers around the world rely on millennia-old wisdom to guide their planting. Scrambled weather and seasons are forcing them into uncharted territory.

By **Peter Schwartzstein**

PUBLISHED October 14, 2019

The Hopi tribesmen of northern Arizona are born meteorologists.

When snake weed blooms in the spring, they know they're in for bumper summer rains. When the desert stays largely barren, they prepare for drought. As far back as tribal lore goes, Hopi farmers have sustained themselves and their crops by diligently reading their arid mesa surroundings.

This summer, however, their millennia-old forecasting techniques failed them, and not for the first time in recent years. The weeds sprouted in great numbers in April. The usual

rains in August did not come at all. Were it not for local grocery stores and the seed stockpiles they maintain in anticipation of the occasional bad year, many Hopi might well have gone hungry.

“These indicators have always been dang reliable. We have over 2000 years of replication. We know our fields, like many indigenous people,” says Michael Kotutwa Johnson, a Hopi farmer who grows corn, beans, squash, and melons on the tribal reservation several hundred miles north of Phoenix. “But when I talk to my people, they say our winters are getting longer, so people plant a little later, and that can wreak havoc. Now we’re kind of in a bad situation.”

They’re not alone. Climate change is upending millions of people’s lives, yet few communities are seeing their crops and worldviews crumble quite like those that rely on indigenous weather forecasting. Dependent in many cases on millennia-old trial and error, as well as analyses of the landscape to gauge planting cycles, their fields are withering as the conditions on which the calendars are predicated change. Without that accumulated wisdom to fall back on—bird migrations, wind direction, stars, and more—farmers are feeling particularly defenseless just as other consequences of climate change complicate their lives.

People used to forecast weather/climate just by observing natural phenomena.

Tsegaye Kedema, director of the National Meteorological Agency of Ethiopia

As a measure of climate change’s severity, it’s a sobering one. Many of these farming communities are unfamiliar with “climate change” as a concept, and yet they’re all acutely aware that something’s horribly awry. There’s no denial or skepticism here, only shock and dismay as practices and traditions that have withstood thousands of years of civilizational rise and fall are becoming obsolete. Wrapped up as these growing patterns often are with local religious and cultural rites, there can be a heavy psychological toll to this change as well.

But in practical terms, too, the implications of this failing indigenous wisdom are extra grim, travels through traditional farming areas reveal. Because many farmers have zero or limited access to modern weather forecasting, they have nothing else to turn to when the rains, temperatures, and wildlife behave in new and unexpected ways. And because many of these calendars predominate in the parts of the world that are bearing the brunt of climate change, notably tropical and dryland areas, the value of their knowledge is shriveling fast. Failing crops and hence hunger are increasing. Meteorologists fear that those losses and that suffering will only intensify unless help arrives in a hurry.

“People used to forecast weather/climate just by observing natural phenomena,” says Tsegaye Kedema, director of the National Meteorological Agency of Ethiopia, in an email. “However, due to climate change these phenomena also changed and the forecasters lost their credibility and status within the community. This creates a big problem for the communities to perform their informed farming activities.”

Crumbling calendars

The trauma spans almost every continent.

In southern Iraq, farmers work much the same land as the Sumerians, the civilization that pioneered irrigated agriculture in about 6000 BCE, and still abide by much of the ancient planting timetable. But as summers become longer and hotter and other seasons shift, many farmers have been left bewildered, angry, and scared.

“The old people have the same mindset as in the past. They feel there’s a continuity because there’s been no development and we have the same tools and same ways of agriculture,” said Jaafar Jotheri, a geoarchaeologist at Iraq’s Al-Qadisiyah University whose father and brother still farm to the south of Baghdad. “Now they’re seeing the climate change, though, and some of the older people don’t know what and when to grow.”

Southern Iraqi farming is rich with millennia-old idioms that no longer hold true. ‘August is for

reducing the grapes and producing the dates,' goes one, but the grapes and dates have started to come at irregular times in recent years. 'September is the month of moving the buffalo from the water,' goes another, but Septembers are so hot that water buffalo must be grazed in the marshlands of southern Iraq until later in the year for fear of overheating them.

Iraqi farmer Raed al-Jubayli checks dates at his palm tree nursery in the southern Iraqi city of Basra. Iraqi farmers are also facing challenges as their traditional farming wisdom no longer holds true. Photograph by Haidar Mohammed, ALI/AFP/Getty

In southern Egypt and northern Sudan, many farmers still depend on the Coptic calendar, a variation of the ancient pharaonic calendar. They, too, however, are finding that reality no longer conforms to thousands of years of Nile-side wisdom. These days, it's often too hot to plant wheat at the end of *Masry*, which roughly corresponds with August, and it can derail the rest of the winter planting cycle if the delay drags on long enough.

Until 20 years ago, this calendar was "almost perfect," says Ismail Elgizouli, a Sudanese scientist and former acting chair of the UN's Inter-governmental Panel on Climate Change (IPCC). But now "due to climate change there is variability from one year to another."

As in Iraq and other parts of the region, Sudan's farmers are fleeing the countryside en masse. It's a wretched end for a calendar that anchored ancient Egypt's vital agricultural sector and enabled its pharaohs to measure the length of their reigns and to time celebrations.

And in large swathes of sub-Saharan Africa, things are also going very wrong. The Nganyi people of Western Kenya have traditionally used everything from grasshopper swarms to the winds that whip in off Lake Victoria to predict rains, but deforestation and biodiversity loss have put paid to their longstanding success.

It's a similar situation in Eastern Kenya, where the Atharaka's usual forecasting measures—the flowering of various plants, the croaking of frogs—have crumbled amid drought. From insect-reading communities in northern Benin, to Nigeria, where some farmers read stars to predict crop yields, the utility of these traditional measures is evaporating fast.

> *We've seen our crops die before, so we're prepared for the psychological impact of climate change. We can handle it.*
>
> *Michael Kotutwa Johnson, Hopi farmer*

According to several studies, older farmers and geographically isolated farmers are particularly vulnerable to the changes because they're less likely to be offered help transitioning to other types of forecasting. So, in a cruel yet common twist, it's the poorest of the poor who are suffering most.

Rolling out modernity

But as desperate as the situation might look in places, this is at least one consequence of climate change that is, in theory, within our capacity to tackle. Farmers in richer parts of the world, like Australia, have overcome a number of climate challenges by tweaking their agricultural calendars and sowing earlier. By successfully rolling out modern forecasting to areas that have had none, developmental organizations have already enjoyed some success.

Farmers in West Africa saw a 20 percent rise in millet yields after they gained access to modern meteorological information, according to World Meteorological Organization (WMO) data.

"Farmers need to know: When do I plant? What do I plant? If a farmer usually has a mix of 60 percent corn and 40 percent millet, they've got to make a judgement," says Robert Stefanski,

Chief of the Agricultural Meteorology Division at WMO. “Corn might be more profitable, but it uses more water, so if there's a drier season, perhaps they'll make a decision based on that forecast.”

Even seven-day forecasts can allow farmers to assess whether they have long enough dry periods to weed their fields or spray their crops.

The challenges are still considerable, of course. Agricultural assistance is shrinking in many of the places it’s most needed as developing countries redirect resources toward more profitable industries. Given the religious and cultural components of indigenous knowledge, there will be insurmountable costs no matter what. It will require finesse, too.

“You can’t go into a place and say: your traditional knowledge is not valid. You can’t be adversarial since a lot of it is based on science,” Stefanski says.

But if we’re smart, we might even see this as something of an opportunity, farmers and meteorologists say. After all, indigenous forecasting relies on a careful reading of the natural landscape, something many societies appear to have lacked as environmental practices have deteriorated. If nothing else, we might learn something from many indigenous communities’ fortitude.

“We’ve seen our crops die before, so we’re prepared for the psychological impact of climate change,” said Michael Kotutwa Johnson, the Hopi farmer. “We can handle it.”