Combining Indigenous and scientific knowledge enhances fire management in the Sahel

March 22 2021, by Natalie Duncan

A shepherd and his herd in Senegal ©IFPRI/Milo Mitchell

The Sahel is an unforgivingly hot and arid belt stretching across the African continent, from Senegal to Chad. It marks the transitional zone

between the Sahara Desert to the north and the humid savannahs to the south. This zone is characterized by its unique rainfall patterns. A long dry season is followed by a short but intense rainy season; certain regions may experience up to 80% of their yearly rainfall between the months of August and September. Populations living in this challenging ecoclimate are particularly vulnerable to the effects of climate variability and change.

In the Sahel, pastoralism, or the raising of livestock and other ruminants, prevails as the dominant livelihood. Pastoralists rely on climate-related information like the amount and timing of rainfall in an area in order to make decisions that impact their herds. However, pastoralists report that increased climate variability is undermining their traditional decision-making. There may be an opportunity to overcome this by combining Indigenous knowledge with key scientific information.

In particular, scientific input could be helpful in pastoral communities that use prescribed burning as part of traditional land management practices, such as the Fulani in Senegal.

Prescribed burning is different from wildfires, which are uncontrolled and often have devastating impacts. Controlled fires are set early in the dry season to improve pastures by removing unpalatable stubble, encourage regrowth, and reduce the risk of more uncontrollable bushfires later in the season. Pastoralists rely on Indigenous ways of knowing to inform their burning strategies. These ways of knowing are centered around monitoring vegetation and predicting future weather conditions; for the most part, Indigenous knowledge relies on empirical evidence that can be verified by lived experience.

The pastoral use of fire for land management—including the timing, frequency, and intensity of fires—aligns well with scientific understanding of ecology preservation in the savannah biome. In

Senegal, the strategy typically involves setting fires early in the dry season. Fires are set more frequently in the south to encourage new growth, but rarely in the north, where the loss of fodder outweighs other advantages. The extent of burn is based on the desired outcome, where burning off specific areas of dry perennial grasses creates pasture, and burning large swaths of surrounding areas creates firebreaks which protect pasture.

In the face of increased climate uncertainty, there is an opportunity to integrate scientific data to enhance the resiliency of Indigenous climate monitoring and decision-making around if, when and how to conduct a controlled burn. There are three crucial parameters that should be considered to ensure prescribed burning regimes are optimally effective for the needs of pastoralists: ignition probability, rate of fire spread, and amount of fuel consumed. To quantify these parameters there are five variables that can be measured using scientific data collection: fuel moisture content, dead fuel load, grass cover, wind speed, and relative humidity. These variables are related to current and past climatic conditions and are useful for predicting the risks of starting a fire.

By including these variables in simulations of how fires will spread, there is an opportunity to develop a fire weather model for countries in the Sahel, such as Senegal. This would formalize fire behavior prediction, which has been historically under-studied in the savanna ecosystems of Africa. Pastoralists would benefit by gleaning a better understanding of when, how, and where to use fire to effectively groom pastures for their herds. It would allow for the avoidance of fires that spread in an intense and uncontrolled manner, damaging the limited natural resources. In fact, Senegalese pastoralists stated the need for more information on the conditions favorable for bushfires in a recent workshop funded by USAID.

However, the usefulness of scientific data and predictive models alone is

limited. The five variables that could be used as inputs in fire propagation simulations do not consider other disturbances unique to pastoral ways of life. For example, the patterns by which pastoralists migrate their herds to different pastures can greatly influence fire behavior, as the presence of cattle grazing and trampling naturally reduces the quantity of grass and thus the intensity of fire.

Given the uncertainty in developing fire prediction models for the savanna ecosystems of Africa, there will be a need for ground-truthing techniques. This will likely rely on the climate and environmental monitoring done by the herders themselves, underlining the need for both scientific and Indigenous knowledge systems.

Building partnerships between producers and the scientific community is a focus area of Columbia University's International Research Institute for Climate and Society, through the Adapting Agriculture to Climate Today, For Tomorrow (ACToday) Columbia World Project. With a recent focus on the Sahelian zone, ACToday is working in Senegal to forge connections and increase the use of climate data to enhance pastoralist resiliency and combat food insecurity.

Employing both scientific and Indigenous ways of knowing in parallel overcomes the shortcomings of each. This is supported by the literature, which has shown that the use of both has had a positive effect on pastoralists' climate adaptation. Fire prediction models that consider both ways of knowing will be critical for improving pastoral resilience to climate changeallowing for greater assurance that bushfires remain controlled and that prescribed burns are optimally effective.

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