Government Regulation of Boreholes:

A Tool to Limiting Environmental Degradation in Eastern Senegal

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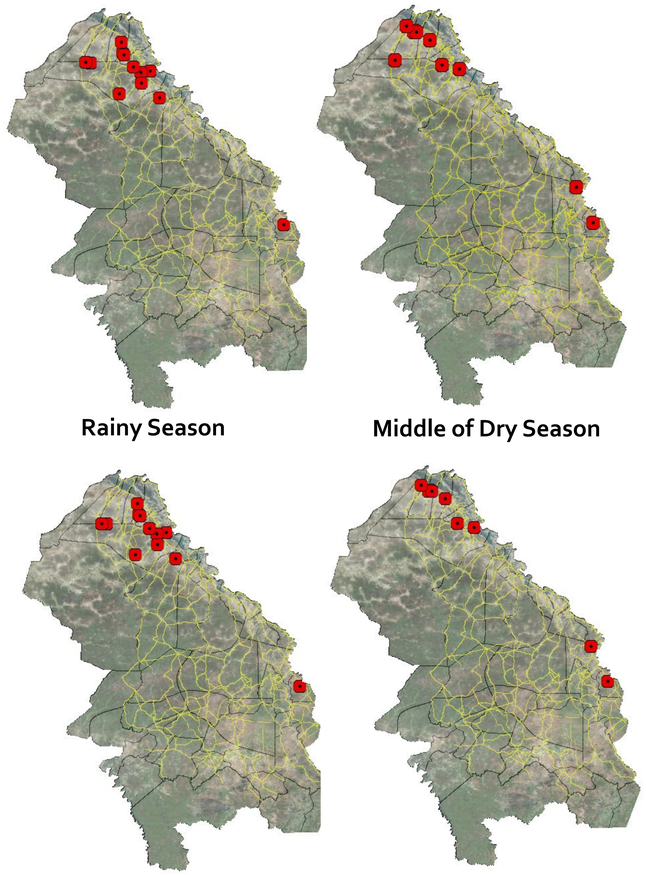
Overview

Herders in Eastern Senegal travel the country from north to south annually, following paths known as transhumance corridors. They travel to the north during the rainy season (June 1 to September 1) so as to not trample the crop fields in the south, and to the south during the dry season because the north becomes too dry for adequate vegetation to grow. Ponds, river points, and boreholes represent the three water sources that herders rely on during these trips in order to hydrate their cattle. One specific type of borehole, the machine-dug borehole, is the least labor intensive and most in demand borehole in eastern Senegal, because they are the only water source that contains a pump—a pump that makes collecting water for an average of 200 cattle a much simpler process. Although advantageous for the herders, these machine-dug boreholes pose a threat to the environment: when deciding their annual routes along the transhumance corridors, herders tend to prioritize routes that contain these boreholes, which in turn creates areas of environmental degradation around the boreholes due to overgrazing. An important facet of these boreholes is that they work with a gas-powered pump that can be turned on and off. This provides the premise for this research: how can the government regulate the use of these machine-dug boreholes to maximize the distribution of moderate- to high-quality water throughout the area covered by the transhumance network?

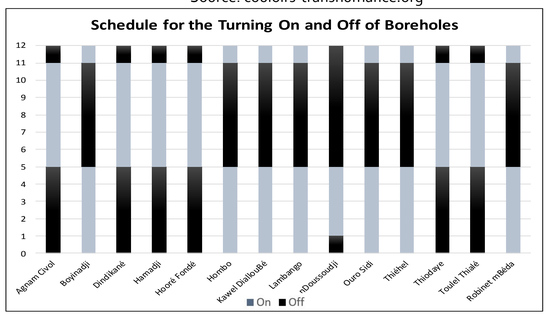


Results

The four maps to the left show the boreholes that are not necessary to herders as they travel across the country each year. These unnecessary boreholes were analyzed at four different times of the year to determine which sources still had good quality water available (i.e., hadn't dried up yet). They were selected based on their spatial proximity to the other available, good quality ponds and or river points. Although four of these boreholes are never needed, the rest are necessary for some but not all months of the year. Accounting for these requirements, the government should develop a system that follows the schedule put forth in the figure titled Schedule for the Turning On and Off of Boreholes. Each of the red points on the maps to the left represent a machine-dug borehole that can be turned off during the map's respective time of year and not cause any burden to herders—each of these points is represented in the figure to the right with the name by which they are known to the herders in Eastern Senegal. In this figure, the y-axis represents each month of the year in chronological order and shows which months each borehole should be turned on and turned off. Analysis of the data suggests that a schedule such as this would not demand too much procedurally for the government: just turning the boreholes on/off twice a year would create the ideal situation for eleven out of the twelve unnecessary boreholes.

Pond in Eastern Senegal

Source: couloirs-transhumance.org

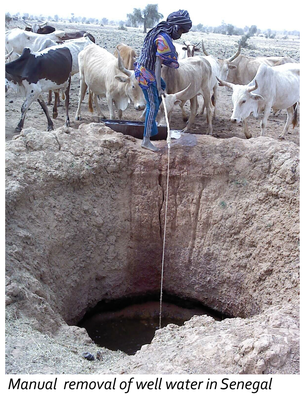


Conclusions

Machine-dug boreholes are in high demand for good reason: when using ordinary wells, herders are forced to carry the water up one bucket at a time, and do that enough times to hydrate an average herd size of 200 cattle—then repeat the process the next day. So, rather than expecting herders to recognize their impact on the environment and be responsible for putting in hours of extra labor each day, the government must take action. Overgrazing of territory surrounding boreholes in Eastern Senegal is a problem that will only increase in importance if not addressed soon, and by following the relatively simple and inexpensive guidelines outlined here, the government could save Senegal's transhumance corridors from becoming barren of vegetation—which would ultimately lead to a national crisis. Whether this action is to relocate four boreholes, turn existing ones off when they are not needed, or both, it would have an important impact on the environment of Eastern Senegal—the environment on which most Senegalese directly depend to make a living.

Machine-Dug Borehole in Eastern Senegal

Source: couloirs-transhumance.org

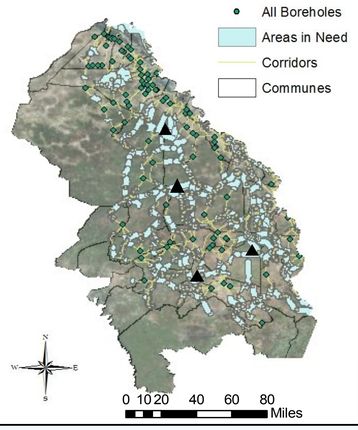


Manual removal of well water in Senegal

Source: couloirs-transhumance.org

Budget for New Boreholes:

Another way to increase the distribution of herds throughout the transhumance corridors—in addition to turning unnecessary ones off throughout the year—is to create new boreholes in areas that do not get a lot of herd traffic to incentivize more movement to these areas. Of the boreholes above that are shut off, four were able to be shut off all year: Dabia, Matam, Taiba, and Tamé. Speculating that these four completely unnecessary boreholes are taken out and placed in four new areas to optimize distribution, buffer and intersect tools can be used to find the new, optimal locations. Optimal locations were determined with the goal of finding areas in need of new boreholes that were within 3 km from the transhumance corridors, that were not within 10 km from another borehole, and that were not within a 3 km radius from villages (so as to ensure cattle don't trample crop fields). On the map to the right, the blue indicates these areas, while the green dots represent all boreholes, and the black triangles represent possible locations that look best for the placement of new boreholes.



Sources:

Beta website: http://couloirs-transhumance.org

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Kitchell, E., M.D. Turner and J. McPeak (2014). Mapping of pastoral corridors: Practices and politics in eastern Senegal. *Pastoralism: Research, Policy and Practice* 4: 17.

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Created By: Lucy Turner

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CEE187: Geographical Information System

Geographic Coordinate System: GCS WGS 1984

Datum: WGS 1984

Data Source: couloirs-transhumance.org

The Process

The data I have on these water sources contain information on the quality of water and months into the dry season that they typically last. These data were used in order to find the boreholes that are not necessary at each time in a year, using the process outlined by the series of maps to the right. This process was repeated four times, once for each of the four periods being examined.