Sampling

In order to construct a population to draw our sample villages from, we used data from India's Ministry of Drinking Water and Sanitation (MDWS). The ministry collected half million water samples from water sources in habitations (nested within villages) spanning over 35,700 of 45,000 villages in Rajasthan between 2009 and 2015. We aggregated the measures of fluoride, total dissolved solid, and nitrates from habitation to village averages.

We then constructed a heat map of fluoride for Rajasthan (See Figure 1 and Figure 2). Two belts with hot-spots of naturally occurring fluoride were emergent in Western and Central Rajasthan. We focused on the central belt because western districts are mostly desert. We then obtained a map of the rock formations for the central belt along with the data on the soil groups (See Figure 3). Based on the rock composition and their inherent fluoride content, we categorized the central belt into three categories of high fluoride concentration rocks (majority rocks are fluoride rick rocks), low fluoride concentration (very small share of fluoride containing rocks), and medium fluoride concentration (soil with weathered particles of fluoride rocks) (See Figure 4). This information was coded into a map. If we did not have the geological information for a district, we did not consider it. We stratified the western belt based on the three rock groups bearing different concentration of fluoride and then chose 8 districts from these three strata based on costs of conducing the field work. The sample districts are: Nagaur, Jodhpur, Bhilwara, Pali, Tonk, Ajmer, Bundi, and Sirohi (See Figure 5).

After choosing the districts, we used village averages of water parameters for village selection. Any village which exceeded the permissible limits for drinking water for TDS and nitrates was excluded. We then stratified villages into high, medium, and low fluoride concentration based on MDWS drinking water parameters: Less than 1.5, between 1.5 and 4, and greater than 4. Then we randomly sampled total of 300 villages from this universe of villages. This sample forms the baseline for further investigation of efficacy of remedial technologies and the sample size was arrived at by conduction power calculations for a randomized control trial that would evaluate the effectiveness of a point-of –use technology to address fluoride in drinking water. With significance set to 5 percent, the desired power to 80 percent for a two-sided test, 50 percent of villages treated with an intra-cluster correlation of 0.04 for behavioral outcomes (and 0.11 for cognition based on pilots and other studies in this region) and expected attrition of 10 percent, the minimum detectable treatment effect using 300 villages was computed to be 0.25 of a standard deviation.

Within each village, we chose a habitation randomly and constructed a roster of all households with children between the ages of 5-11. We then randomly chose 3 households from this roster for the study. If the chosen household did not provide voluntary consent, we replaced that household with a substitute from our list. A team of psychologists with either MPhil or Master's degrees were trained for administration of cognitive tests. Sample children in the study were visited by this team in order to collect data from a battery of cognitive tests.

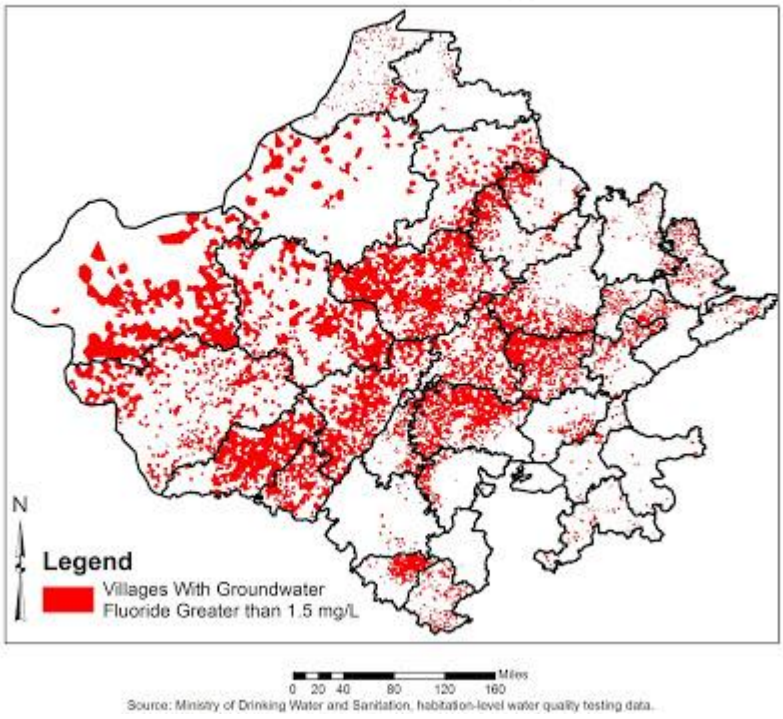

Figure 1: Areas of Rajasthan with High Fluoride

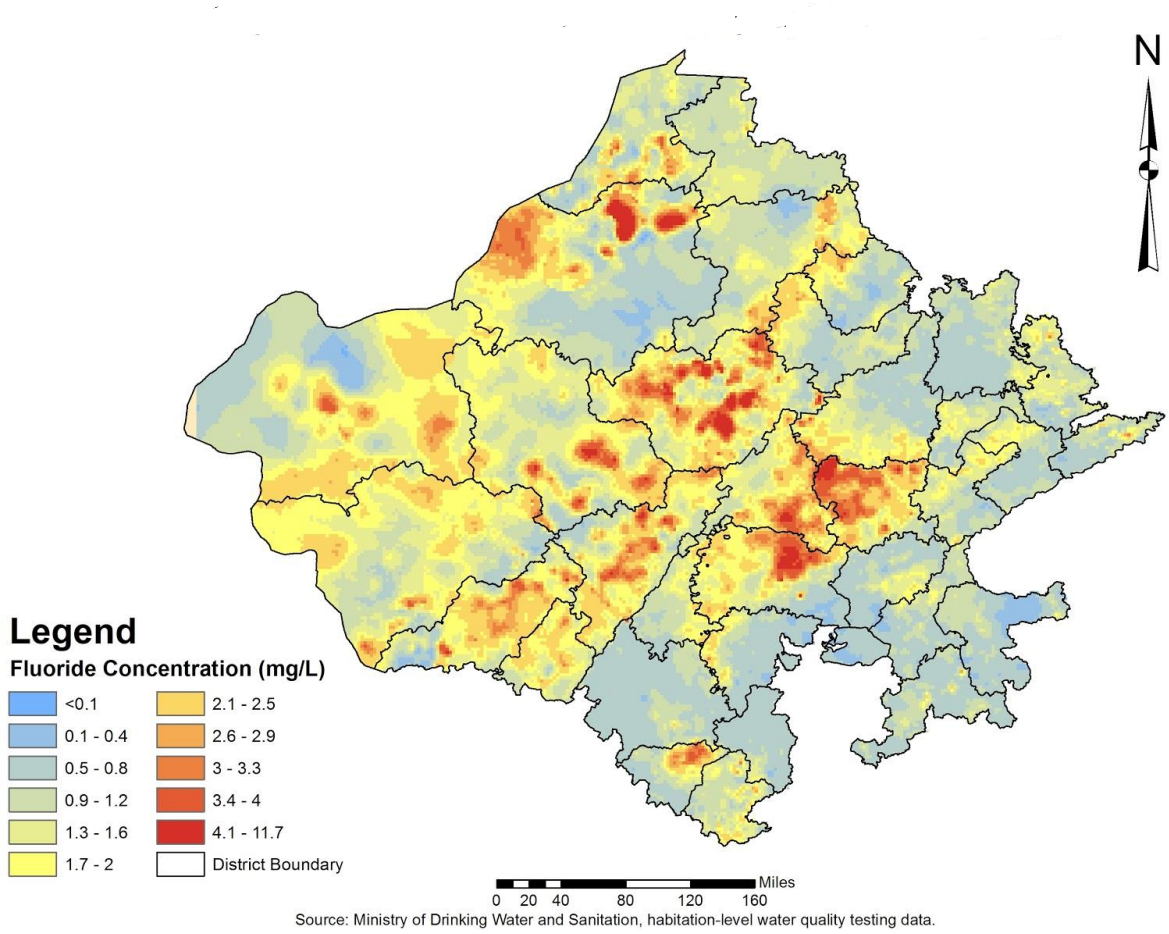

Figure 2: Rajasthan Fluoride Heatmap

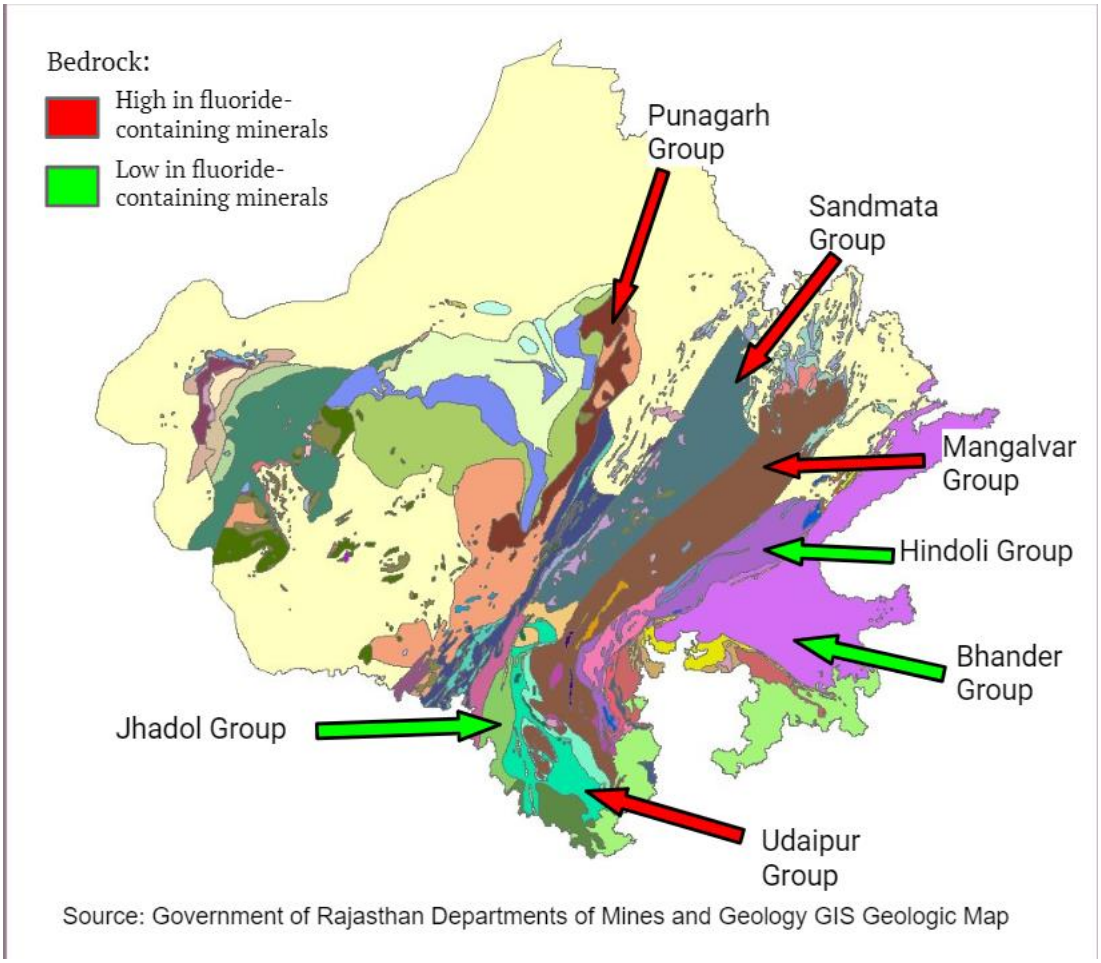

Figure 3: Map of the Rock Formations Along With Soil Groups

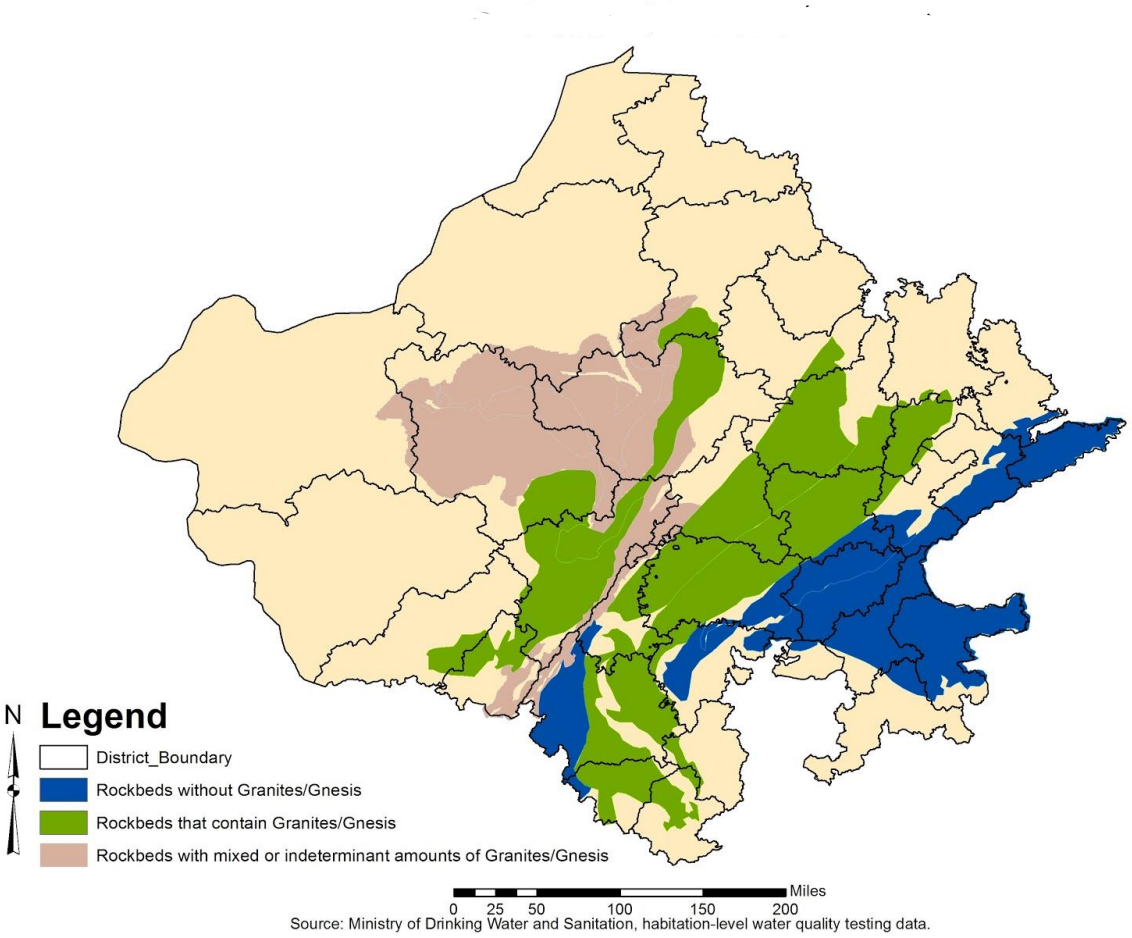

Figure 4: Geology and Fluoride in Rajasthan

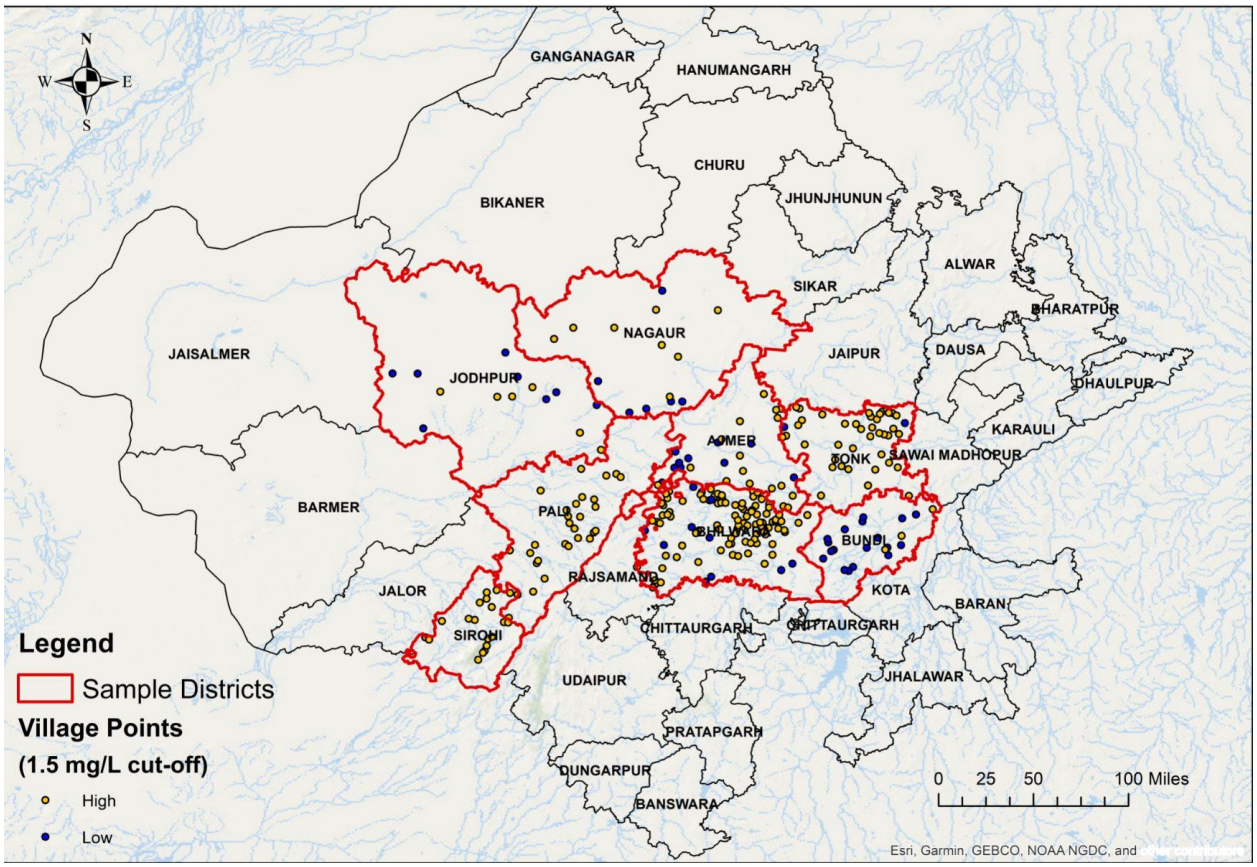

Figure 5: Sample Districts and Villages