

# Arsenic and Fluoride Contamination Analysis of Agricultural Topsoil in Guanajuato, Mexico

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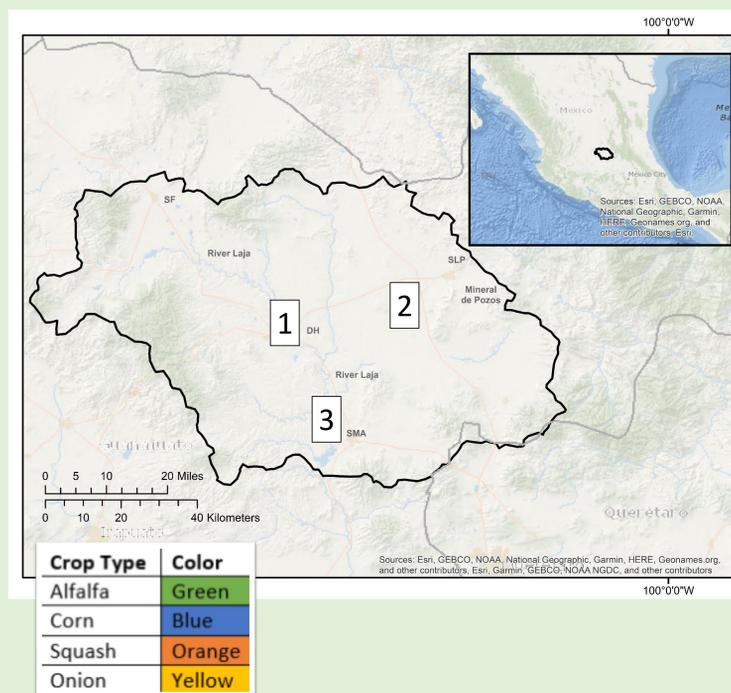
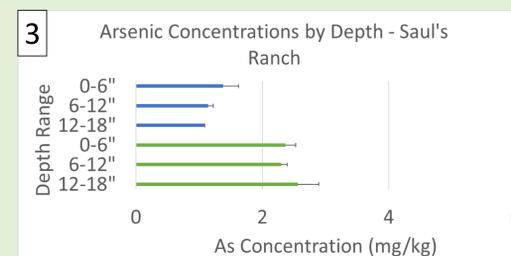
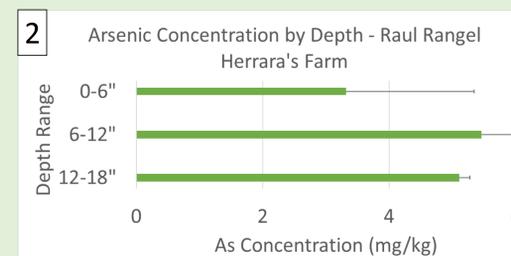
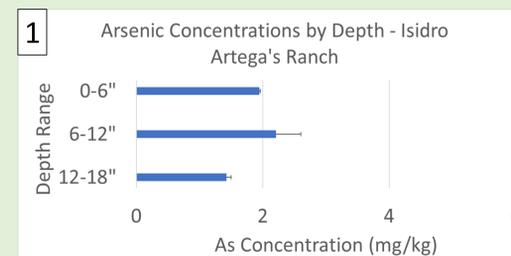
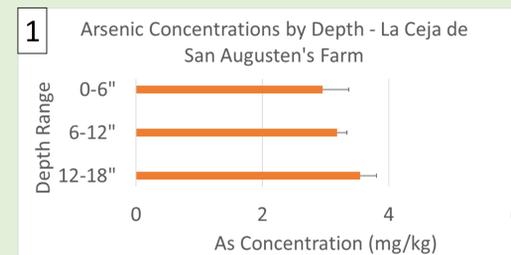
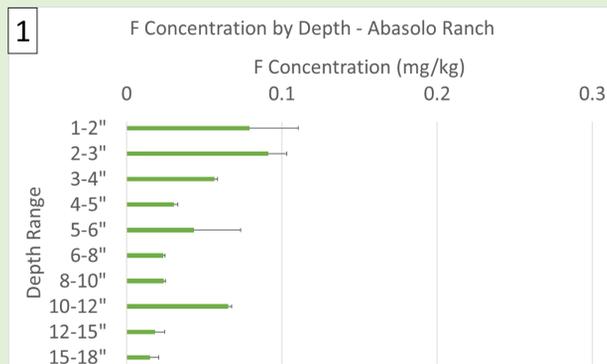
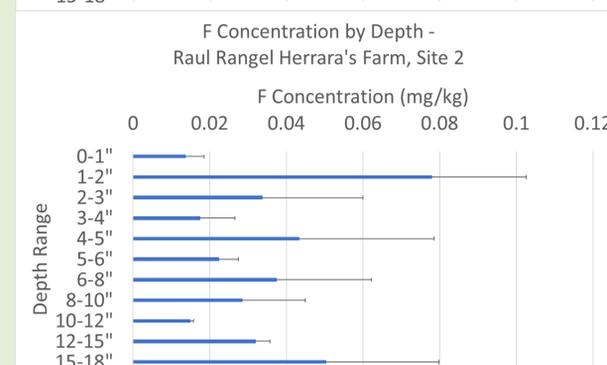
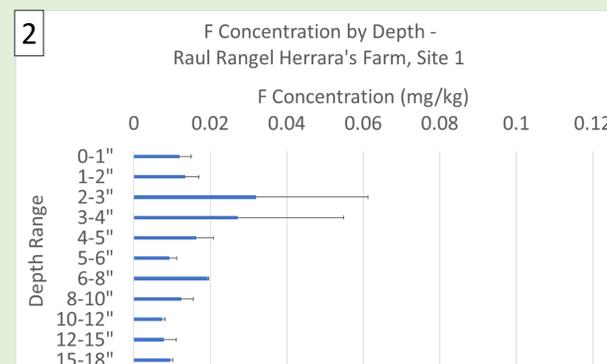
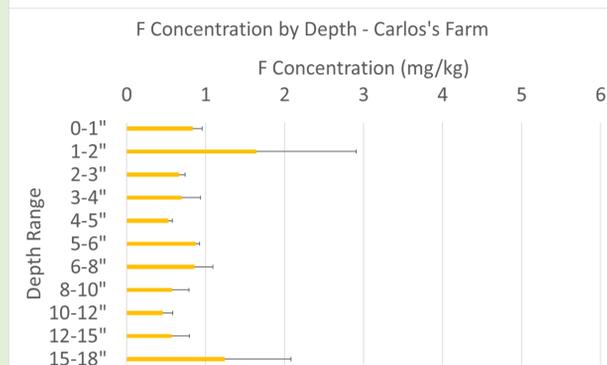
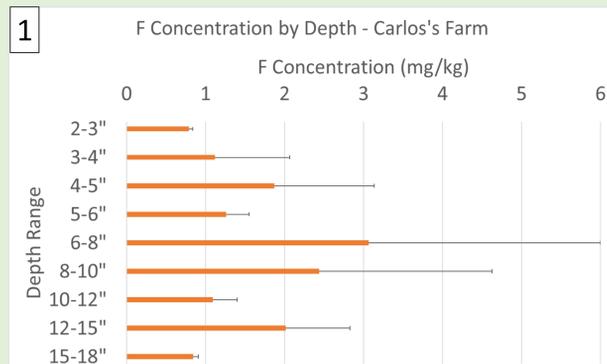
## Introduction

- Intensive agricultural productions rely on local groundwater in Guanajuato, Mexico
- Groundwater is often naturally contaminated with arsenic (As) and fluoride (F), leading to health hazards
- The effects are of irrigating with contaminated groundwater in the long term are unknown
- **Key question:** Are As and F accumulating in irrigated soil and potentially threatening the quality of crops?
- **Objective:** to understand the scale of contaminant accumulation within the region's topsoil
- **Hypothesis:** As and F will accumulate near the soil surface, where the soil comes in contact with the most irrigated water and As and F bind to soil particles

## Methods

- Sampled topsoil from 0-18" at six different farms in Guanajuato
  - Bulk soils - 0-6", 6-12", 12-18"
  - Cores – discrete depths
- Measured pH values for batch samples using pH probe
- Acid digested batch and core samples using modified EPA method 3050-B for heavy metals, used to find environmentally available concentrations in soils
- Analyses:
  - Arsenic: inductively coupled plasma optical emissions spectrometry (ICP-OES)
  - Fluoride: ion-selective electrode (ISE)

## Results



## Key Findings

- Soil As concentration averaged 2.66 mg/kg, and ranged from 1.08 to 5.46 mg/kg
- All soil F concentrations were below 3 mg/kg
- Apparent differences in concentrations based on crop require further investigation
- No dominant patterns in contaminant accumulation – not many sites exhibit the highest concentrations near the top, as hypothesized
- Inconsistencies possibly due to unknowns such as till/no till, intensity of irrigation, what fertilizers were used, and specific concentrations of As and F in local wells and groundwater, all of which would influence accumulation patterns
- Severity of contamination depends on standard used
  - Mexico does not have set standards for As or F concentrations in soil
  - Some soils have As concentrations that exceed some US standards, which range from 0.39 to 40 mg/kg

## Implications & Next Steps

- Ongoing work is seeking to define the loading limits of As and F onto soils via adsorption isotherm experiments
- Understanding how As and F accumulate within the soil will allow for better management plans that define how long local farmers can irrigate before As and F levels in topsoil become potentially hazardous

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