Online Supplementary Document

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Lam et al. Freshwater access in high salinity regions: impacts and adaptation insights from the Ganges River Delta

Appendix S1 – Salinity Testing Protocol

Overview

We measured electroconductivity (EC), as an indicator of salinity, in water samples drawn from tubewells, surface water sources such as ponds and canals, and taps that came from a pond filter system or piped water supply. We photographed and took the GPS coordinates of all sources of water sampled. We also recorded weather conditions. During site selection, we measured EC using the Extech EC500 pH/conductivity meter, calibrated to standards of 84 microSiemens/cm (μ S/cm), 1,413 μ S/cm, and 12,880 μ S/cm. In the first round of data collection, the same meter was re-calibrated and used to measure water samples. However, due to a technical problem with the meter thereafter, for the second round of testing, we used Hanna Instruments' HI 86304N meter, calibrated to 5,000 μ S/cm.

All water testing happened on site. For tubewells, EC of water pumped from the tubewell at three specific intervals was measured and the average was reported. Information was recorded about the reported depth of the tubewell, the uses of the tubewell, the salinity of the tubewell's water as perceived by its users, and the tubewell's history. For ponds and other surface water sources, the EC of water taken from two different depths was measured and the average was reported. Information about the pond's uses and user perception of the pond's salinity was noted. For water taps, the tap was allowed to run for a minute and then EC was measured. The history of the tap system and the perceived quality of water was recorded.

Tools

- Notebook/clipboard
- Three smaller buckets for collecting water [SEP]
- Rags (to wipe off soil shovel and to dry salinity probes)
- Pen or marker with waterproof ink
- 2 liters of de-ionized water (to wash off salinity probes)
- Water sampling containers [1]
- Nalgene bottle to carry clean water [stp]
- Screw top bottles (like Nalgene bottles) for soil suspension testing later
- GPS device [SEP]
- Extra batteries for GPS device SEP

- Extra batteries for E/C meter [1]
- Ruler
- Extra pH 4.0 solution (to clean off salinity probe and for storage)
- Extra calibration solutions for the three E/C measurements (packets)
- Whiteboard and dry erase marker.
- Measurement log book [1]

Common information to record for each site [L]

- Current weather
- Last time it rained
- Date and time

Naming convention for sample points

- District Code (B for Bagerhat, S for Satkhira, and K for Khulna)
- Village/Site Code (1, 2, 3, etc.)
- W or S for type of sample collected + sample point (1, 2, 3, etc.)
- Example: B1-s1 (first site/village visited in Bagerhat, first soil sample point)
- Use this format for mapping points.
- When denominating samples, mark a letter -a/b/c, etc.- corresponding to batch. Each source will have either 2 (surface water sources will have the first batch from the top, and the second batch from deeper) or 3 (groundwater will have 3 corresponding to the 5th, 20th, and 5-minute pumps) batches. E.g., 1st site in Bagerhat, 1st location sampled, and 2nd soil packet collected from the bucket would be labeled B1-s1-b.
- And when denominating measurements, mark an extra number corresponding to the measurement. (Since everything will have 2 measurements.) E.g., the 2nd site in Bagerhat, 1st water location sampled, 5-minute pump of water, 2nd reading would be labeled: B2-w1-c-2.

Type of source	Number of Batches	Code for Batch
Pond, <i>gher</i> (aquaculture pond), other surface water	2	a = water skimmed off the top b = water taken from below surface, at bottommost depth
Tubewells	3	a = 5th pump b = 20th pump c = after 5 continuous minutes of pumping

Naming template

[First letter of district][# of site visited in that district, so 1 or 2]-[w for salinity/s for soil][that # sample of either soil or water]-[batch letter]-[measurement number, so either 1 for first reading, 2 for second reading]

Procedure

- Note description of where it is taken from (type of source, etc.)
- Make sure salinity meter reads zero when held in the air.
- Dip water sampling bucket into water to be tested and rinse thoroughly.
- Take the appropriate number of batches (3 for groundwater or 2 for surface water sources), as sper the chart above each batch should go into a different container.
- For each batch, take a testing container, rinse it in that water, and then do one reading. Immerse scalinity meter into the testing container up to the raised mark (about 25 mm) and move the probe up and down to remove bubbles from around the electrodes (do not swirl it around as this may actually drive water out of the probe). Make sure the electrodes are covered.
- Allow probe to reach the temperature of the water. The meter has automatic temperature compensation, so wait 30 seconds before taking the reading if the water and probe are about the same temperature and 2 minutes if the water is much colder than the probe. Allow measurement of E/C to stabilize.
- Read number and record reading along with the temperature.
- Rinse the testing container, refill it, and do a second reading. Record with temperature.
- Label measurement in the log book according to scheme set out above.
- Drop GPS point on GPS device and ODK collect according to the scheme set out above.
- Take picture of surroundings. The picture should show someone holding the whiteboard that the name of the location code used to label the GPS point.
- Wash off lower part of the meter with bottled water (especially electrodes). If storing overnight, with hen wash off with de-ionized water. If storing for several days or more, make sure cap is moist with pH 4 solution.

Appendix S2. Maps of salinity localization.

Bagerhat Site, Surface Water Salinity (October 2015)

Legend

Salinity (in microS/cm)

- ♦ 825 1,000
- ♦ 1,001 2,250
- ♦ 2,251 3,500
- 3,501 4,750
- 4,751 6,000







Satkhira Site, Surface Water Salinity (June 2015)

Legend

Salinity (in microS/cm)

- ♦ 1,347 5,000
- ♦ 5,001 9,000
- 9,001 13,000
- 13,001 17,000
- 17,001 20,000+

Ν





Satkhira Site, Surface Water Salinity (October 2015)

Legend

Salinity (in microS/cm)

- ♦ 715 1,000
- ♦ 1,001 2,250
- 2,251 3,500
- 3,501 4,750
- ♦ 4,751 6,000

Ν





Khulna Site, Surface Water Salinity (June 2015)



Salinity (in microS/cm)

- ♦ 1,049 5,000
- ♦ 5,001 9,000
- 9,001 13,000
- 13,001 17,000
- 17,001 20,000+







Khulna Site, Surface Water Salinity (October 2015)

Legend

Salinity (in microS/cm)

- ♦ 650 1,000
- ♦ 1,001 2,250
- 2,251 3,500
- 3,501 4,750
- ♦ 4,751 6,000





