Regional potential of Managed Aquifer Recharge (MAR) systems in Southwest Bangladesh

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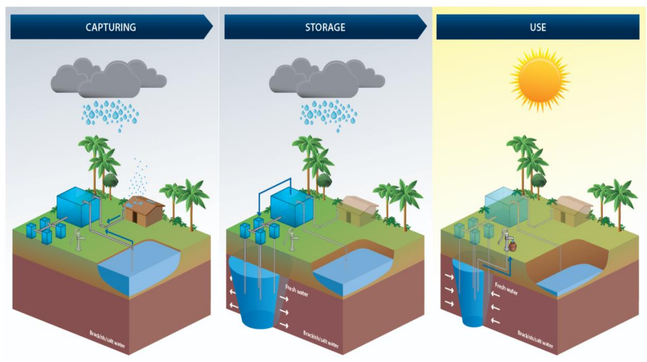
1. Managed Aquifer Recharge (MAR)

In the south-west coastal region of Bangladesh, there is an availability problem of safe drinking water. During the monsoon, abundant fresh rainwater is available, while there are few options for drinking water during the dry season. Managed Aquifer Recharge (MAR) systems are proposed to overcome the water supply problems.

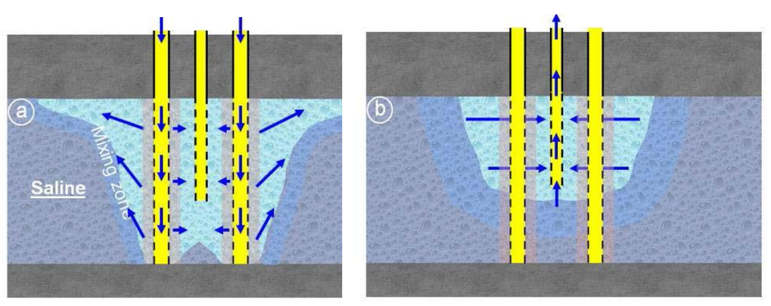
Principles of MAR

In a MAR system, water is collected in a pond during the wet season. This water is then filtered in a pond sand filter (PSF) and stored in a shallow aquifer. In the subsurface, the water is protected from contamination. During the dry season, the water is pumped up again to be used.

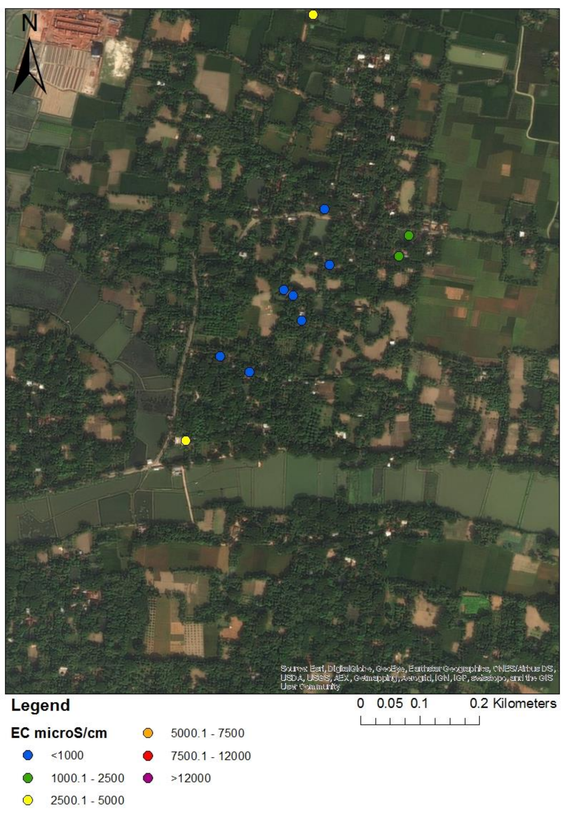


MAR performance

The performance of MAR-systems is commonly assessed by their recovery efficiency. The recovery efficiency is largely affected by both the salinity and the flow of the native groundwater. Native groundwater flow causes the fresh water to flow away laterally, making the water unavailable for recovery. Salinity causes density driven flow, due to buoyancy effects.



2. Hypothesis study area

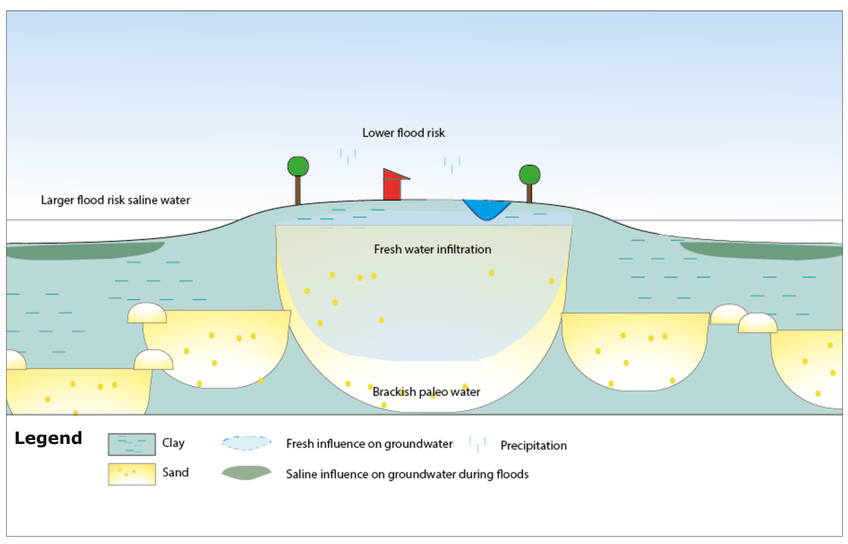


Elevated areas

Some parts of the study area are elevated. The elevated areas are present in the shape of fluvial patterns and they are thought to be formed by fluvial systems. Therefore, sandier material is expected.

Salinity distribution

At the elevated areas, fresher groundwater has been measured. An example is visible in the figure to the left, where EC measurements at an elevated areas near Assasuni are presented. The fresh groundwater is expected to be formed because of fresh water recharge from rain and ponds, enabled because of sandier conditions. Furthermore, there is a lower risk of saline water flooding in the elevated areas. In the figure below, these hypothetical processes are illustrated.



Polders

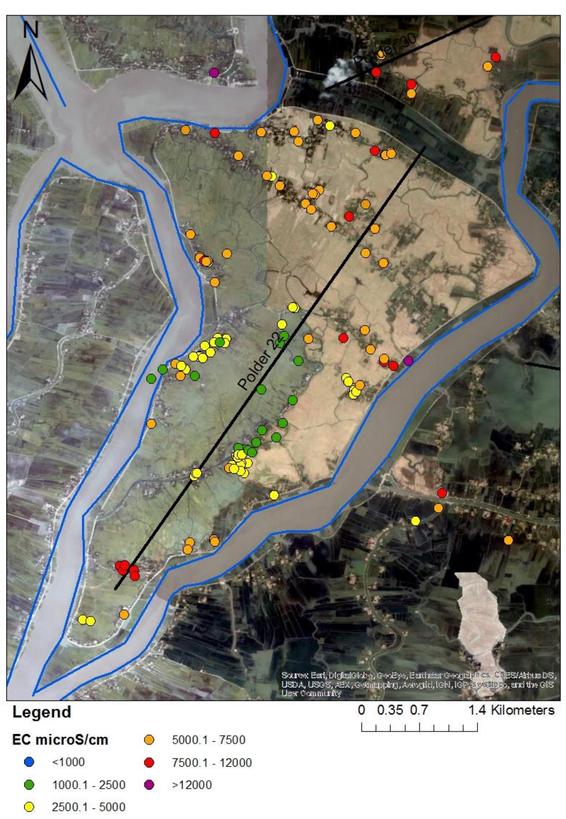
Most of the study area consist of polders. The polders are protected by dikes. The surface level of the polders is above the sea level, except during high tide. On average, no seepage is expected, and without flooding, the polders can freshen.

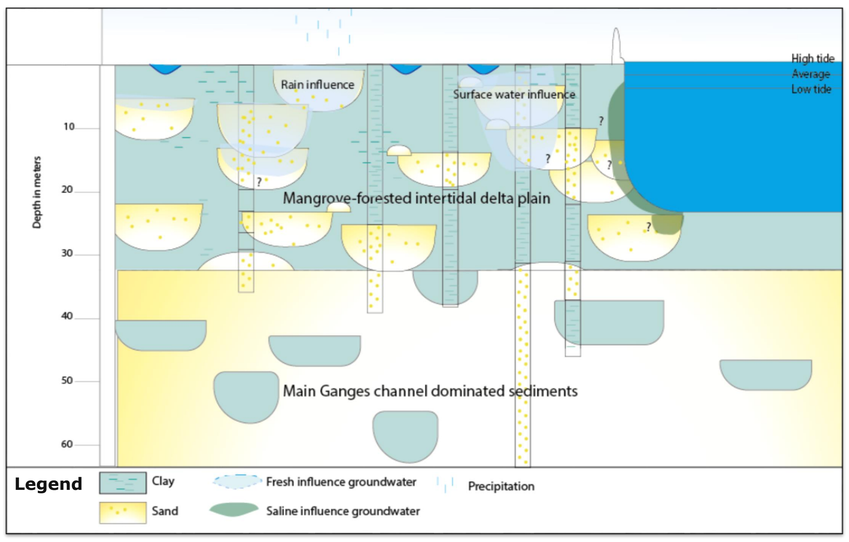
Salinity distribution

In the polders, large differences in groundwater salinity have been measured. An example is Polder 22 (see the figure to the right), where fresh groundwater was observed in the middle of the polder, compared to brackish in the north and south part of the polder.

There are a few hypothetical processes that influence the salinity distribution in the polders, which are illustrated in the figure below:

- Infiltration of meteorological water at areas with a thin clay cover
- Infiltration from surface water bodies containing fresh water
- Infiltration of saline water from tidal rivers.





3. Overview field methods

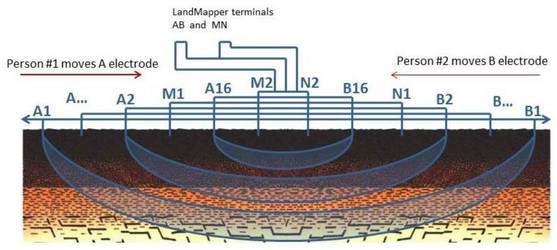
In the field, several different methods will be applied. Here, a short overview of the methods and their goals is given.

Water samples

- Groundwater salinity
- Horizontal hydrochemistry patterns
- Arsenic contamination

Geophysics

- Detecting fresh groundwater using the differences in electrical resistivity



Multi-level piezometers

- Vertical hydrochemistry patterns
- Monitoring tidal and seasonal variation in groundwater heads