

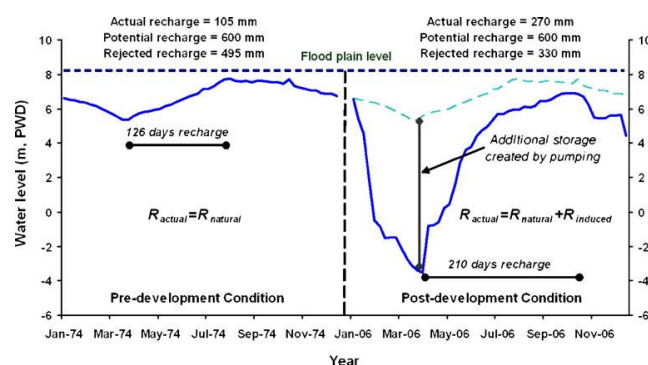
# Groundwater trends in the northwest region of Bangladesh

In a country dominated by large river systems, monsoon flooding and surface water, groundwater has come to play a central role in Bangladesh achieving food security. Groundwater is used to irrigate dry season crops, predominantly *Boro* rice, and as a supplementary source during other times of the year. This has led to declines in groundwater levels in parts of the northwest region. To assess whether this use is sustainable, we have developed a method, specifically for the northwest region, that analyses the change in groundwater levels over time. Understanding these trends can assist in targeting measures to address the sustainability of the groundwater resource.

## Background

A shallow groundwater aquifer underlies the northwest region of Bangladesh, the depth of which fluctuates seasonally in response to recharge events such as monsoon rainfall and associated flooding. Groundwater is typically close to the surface after the monsoon period (minimum depth to groundwater) and deeper in the pre-monsoon period (maximum depth to groundwater). Groundwater is an important resource for cropping and drinking water supply in this region, especially in areas where surface water resources are scarce. Development of the groundwater resource has been widespread since the mid-1980s and many tubewells have been installed to facilitate groundwater pumping for irrigation of crops, especially during the dry season. The seasonal pumping of groundwater creates space (storage) in the aquifer for more rainfall to infiltrate (Figure 1). This process is known as **induced recharge**.

However if the volume of water pumped exceeds the potential recharge of the system, declining groundwater levels may be observed. When the groundwater no longer returns to the previous post-monsoon level the system and be said to be in **deficit**. The observed reduction in rainfall over recent decades also plays a part.



**Figure 1 Induced recharge process caused by groundwater pumping in the pre-monsoon period**

In a previous study we developed a method to assess groundwater levels at monitoring wells to classify wells according to the trends in both the minimum and maximum depth to groundwater levels. We also created a database to store the data, for ease of analysis. The current study examines the changes since 2009.

## Groundwater trends

The trend analysis identifies regions where groundwater is declining, and to what degree. We use four classes to assess the behaviour of groundwater over long and short timeframes.

- **Type 1:** Strongly declining levels in both maximum and minimum depth to groundwater – little or no post monsoon season recovery observed
- **Type 2:** Locations where both the maximum and minimum depths to groundwater are declining, with

some recovery in the minimum depth post monsoon, albeit to a deeper level than previously observed

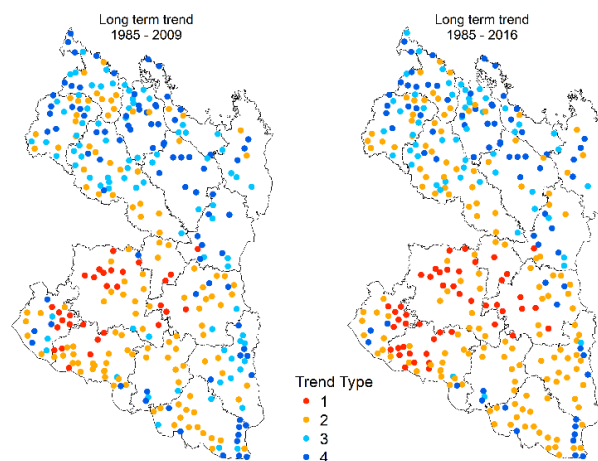
- **Type 3:** Locations where maximum depth to groundwater is declining but there is no decline in the minimum depth
- **Type 4:** Both maximum and minimum depths to groundwater are stable.

Since 2009 an additional 17 locations have been classified as Type 1 using the long term trend analysis.

## Water table difference

Groundwater levels extracted from the database were also used to develop groundwater depth surfaces for the northwest region to examine the spatial patterns of change over time (Figure 2).

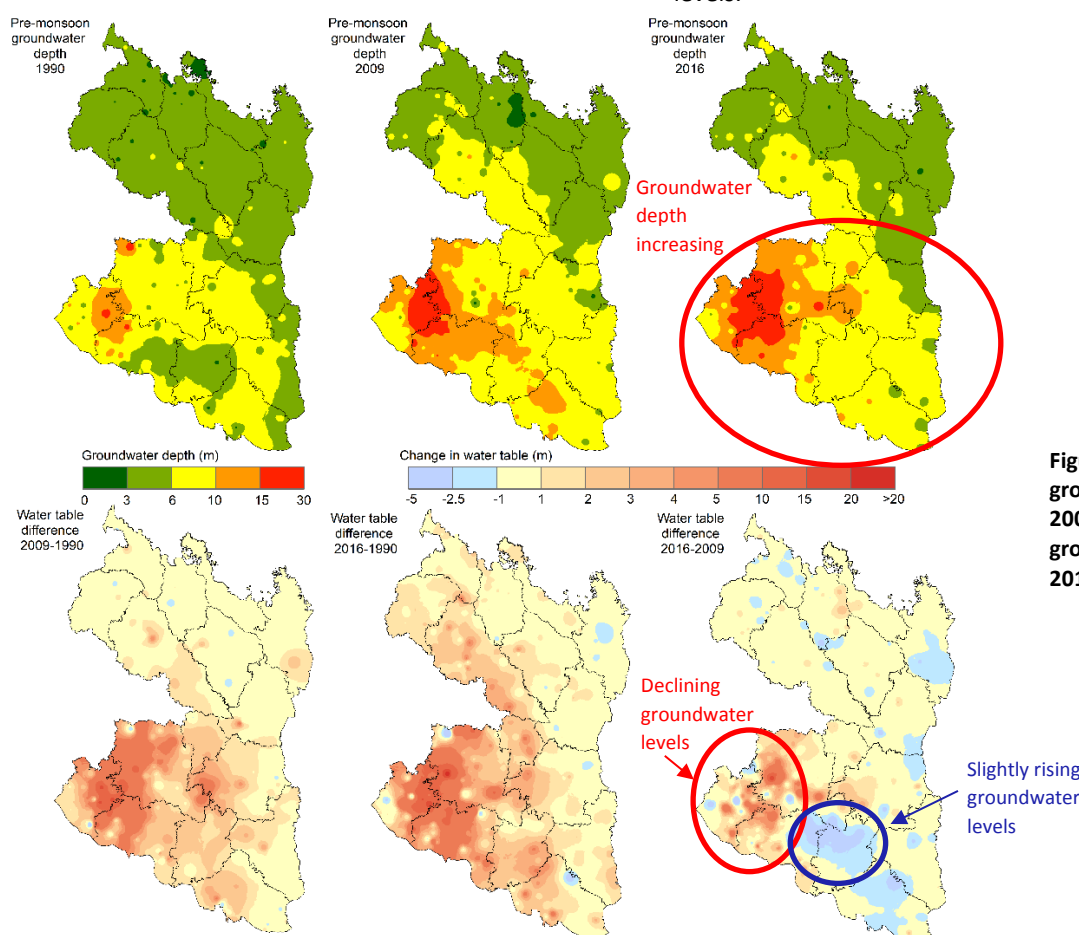
Since 1990 there have been significant reductions in pre-monsoon groundwater depth across most of the southern half of the region. The watertable differences between 2009 and 2016 show there have been further declines in the Barind Tract despite slightly wetter conditions.



**Figure 2 Long-term trends in groundwater levels for the northwest region**

Moderate rises are also apparent in some areas between 2009 and 2016 (Figure 3).

Continued monitoring and analysis can help determine the effectiveness of policy initiatives and cropping type/pattern changes in addressing falling groundwater levels.



**Figure 3 Pre-monsoon groundwater depth in 1990, 2009 and 2016 and the change in groundwater levels 2009-1990, 2016-1990 and 2016-2009**

### CONTACT US

t 1300 363 400  
+61 3 9545 2176  
e [csiropenquiries@csiro.au](mailto:csiropenquiries@csiro.au)  
w [www.csiro.au](http://www.csiro.au)

The CSIRO SDIP project team maintains an up-to-date website for sharing material and news on project activities  
<https://research.csiro.au/sdip>

### FOR FURTHER INFORMATION

**Land and Water**  
Mohammed Mainuddin  
t +61 2 6246 5929  
e [mohammed.mainuddin@csiro.au](mailto:mohammed.mainuddin@csiro.au)  
w <https://research.csiro.au/sdip>