Impact of Change in Depth to Groundwater on Vegetation Cover – A Case Study for Portion of Upper Thal Doab, Punjab-Pakistan

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Scheme of Presentation

• Research Introduction
• Project Area Description
• Research Methodology
• Research Outcomes
• Conclusions
Research Introduction

- To find out usefulness of Space Technology in investigating groundwater level
- To find a relationship between groundwater and vegetation cover
- To see whether NDVI and NDMI could ascertain groundwater fluctuations
Groundwater emerged as an important natural resource in Indus basin, which is contributing about 40% in total water resources of Pakistan and play eminent role in sustainability of irrigated agriculture in the country.

Groundwater exploitation for irrigation purposes has been tremendously increased in recent years in the Thal Doab, part of Indus basin.
The Indus river basin represents an extensive groundwater aquifer, covering a gross command area of 16.2 million ha.
Wells Location
Research Methodology

Data

- Depth to groundwater levels – 1998 to 2016
- Landsat images – pre and post monsoon

NDVI:

- For Landsat – 7: \( \text{NDVI} = \frac{(\text{B4}-\text{B3})}{(\text{B4}+\text{B3})} \)
- For Landsat – 8: \( \text{NDVI} = \frac{(\text{B5}-\text{B4})}{(\text{B5}+\text{B4})} \)
Research Methodology

Data

**NDMI**: The Normalized Difference Moisture Index (NDMI) determines the different contents of humidity from landscape elements, specifically for soil and vegetation.

\[
\text{NDMI: } \frac{(\text{NIR-IR})}{(\text{NIR+IR})}
\]

**Landcover Classification**: Supervised classification techniques were used for landcover classification.
Research Outcomes

Pre Monsoon
Research Outcomes

Post Monsoon
Research Outcomes

Landcover Classification Statistics
Research Outcomes

Landcover Classification
Statistics
The landcover classification shows the increase trend in biomass from 1998 onward. There is an increase of about 22% in vegetation cover and 13% and 7% decrease in Barren and Water area respectively.

Positive relationship was observed between increase in vegetation cover (from 9000.48 – 10984.64 sq km) and decrease in depth to groundwater (35.44 – 34.83 m) from 1998 to 2016.
Results

- The analysis shows that the decrease in depth to groundwater results an increase in biomass in general.
- Both the NDVI and NDMI results support the landcover classification results.
- Since the NDVI area indicates the biomass area, thus there is a direct relationship between vegetation cover, NDVI and depth to groundwater.
The results concluded that change in vegetation is linked with the change in groundwater depth.
This study depicts that satellite remote sensing technology can be effectively utilized for investigating fluctuation in depth to groundwater and change in biomass covered area.

Future scenarios on vegetation cover can be derived based on hydrological model results.
Conclusions

- Hence, remote sensing technology in conjunction with groundwater level data provides a better tool for management of groundwater resources and prediction on cropland area.
- This type of studies may provide a base for identification of depletion of groundwater resources.
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