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Know Your Desert

Phreatophytes – Plants on the Run for water – Ancient Ideas to Modern Approaches

Adaptation of plants to natural conditions permit them to grow on their specific habitats throughout the world. These may be classified as: (a) Xerophytes (b) Mesophytes (c) Hydrophytes. There is another category of plants called Phreatophytes. The term "phreatophyte" was first used by Meinzer. The word is derived from two Greek words meaning "well plant". He defined it as a plant that habitually obtains water from the zone of saturation, either directly or through the capillary fringe. In the first half of the 20th century plant-hydrologists regularly used such plants as indicators in groundwater prospecting. Phreatophyte grows where precipitation is insufficient for long-term survival and, consequently, it requires groundwater in that specific environment such as arid regions. The spatial and temporal variation in water availability is the main driver of plant development in arid environments. In deserts where water is available in form of short pulses of monsoon the perennial plant species rely on access to water in deep soil layers. To tap this soil water at great depths, desert plants have deep-reaching roots. Nevertheless, the deep root system can only sustain limited above ground biomass. Thus, these plant species are also characterized by a high root: shoot ratio and a high specific root length (SRL), defined as the unit root length per unit mass (mg^{-1}). A high root: shoot ratio and high SRL are particularly important during establishment of desert phreatophytes. As the different phreatophytic species exhibit different realized niches according to different depths to the groundwater table, they might differ in their root growth and their ability to deal with receding water tables in the period of establishment. Plant cover as a geologic and hydro-geologic indicator is also well known since ancient times and in Vedic age several authoritative works were conducted by Hindu Rishis like Saraswat, Manu, Garga and Varahamihira during Gupta period and many ground water indicators were indicated (Table 1). However, present scenario analysis need to be carried out.

Table1. Phreatophytes as confirmed in ancient literature (Source: Gupta, 1965*)

Phreatophytes species	Ground Water Depth (in ft.) as mentioned		
	Saraswat	Manu	Varahamihira
Capparis decidua	60	+	96
Calotropis procera	+	++	+
Datura fastuosa	+	-	90
Prosopis cineraria	+	+	300
Pongamia pinnata	+	18	+
Saccharum munja	+	18	+
Saccharum spontaneum	+	18	+
Salvadora persica	32	+	32-49
Solanum surattense	+	+	21
Vitex negundo	+	++	+
Ziziphus mauritiana	+	+	96

+ Depth not mentioned

++ Mentioned as indicator, but no references to depth indicated

*Source: Gupta, S.C. 1965. Hindus on Ground Water Hydrology. The Nat. Geogr. Journ. 2 (3&4): 174-184

The phreatophytes serve as good indicators of the presence of water. A contact of phreatophytes root system with water, even with the margin of capillary ground water, is an essential condition for their existence in desert. Consequently, independent of the atmospheric precipitation, plants of this group grow and develop very well during the entire year. Throughout their life time, these groups of plants are so dependent on ground water that when its root system

becomes isolated from it, the plants die. Because of the close relationship which exist between the vegetation and the depth at which the ground water is situated (specifically under arid conditions) plant cover and the plant association may be used as an indicator for ground water. Some examples of phreatophytes in the Indian desert are *Salvadora oleoides* (Fig. 1), *Acacia nilotica* (Fig. 2), *Prosopis cineraria* etc. (Fig. 3).

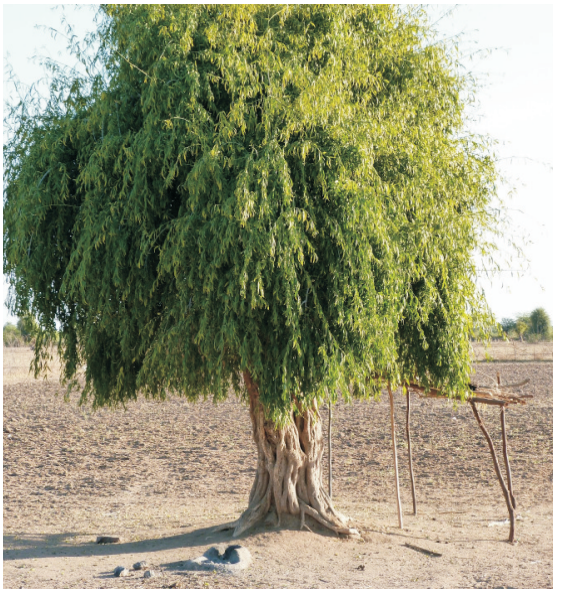

Fig. 1 *Salvadora oleoides* (Mitha Jal)

Our current knowledge suggests that three factors drive above ground vegetation responses to changes in groundwater levels: 1) drought and anoxic stress tolerance.2) changes in the size and distribution of the active root system: and 3) associated changes in the water uptake capacity. In addition, a number of confounding factors may modify vegetation response. These include soil texture, timing and rate of change in groundwater, herbivory, and disease. Finally, climate change may affect precipitation amount and temporal distribution and thus groundwater recharge in these ecosystems. This could further increase conflicts between human consumption and ecosystem requirements. Consequently in depth studies on ecology and hydrology of phreatophytes obviously deserve more attention in desert ecosystems of India.

Fig. 2 *Acacia nilotica* (Desi Babool)

Fig. 3 *Prosopis cineraria* (Khejri)

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New Databases of Rajasthan at CAZRI-ENVIS Website

- Trends of rural and urban population in various districts of Rajasthan.
- Trends of livestock population in various districts of Rajasthan.

Compiled & Uploaded by : **Taru Mathur,** IT Assistant, ENVIS, ICAR-CAZRI, Jodhpur

Conferences

Date	Topic	Place
International		
25-27th July, 2016	5th Earth Science and Climate Change Conference,	Bangkok, Thailand
1-10th September, 2016	IUCN World Congress: Planet at the crossroads	Hawaii, USA
19-23rd September, 2016	European Ecosystem Services Conference	University of Antwerp, Belgium
National		
22-24th September, 2016	Impact of Climate Change on Biodiversity: Applications of Recent Technologies for Conservation of Threatened Species	Mizoram University, Aizwal
23-25th September, 2016	International Conference on Occupational and Environmental Health (ICOEH-2016)	New, Delhi