

# Life Form Spectrum and Phytoclimatic Analysis of Bassi Wildlife Sanctuary, Rajasthan, India

## Abstract

Bassi Wildlife Sanctuary (BWS) is located in the South-Eastern part of Rajasthan, India. This study resulted in plant life form diversity and distribution using Raunkiaer's classification system. A total of 468 plant species belonging to 322 genera and 85 families were recorded. The results indicate that therophytes (55.8%) are the dominant life form, followed by phanerophytes (23.5%), hemicryptophytes (7.3%), cryptophytes (6.8 %) and chamaephytes (6.6%). On comparison with Raunkiaer's normal spectrum, the present study area depicts Thero-phanerophytic type of phytoclimate. This study also provides valuable insights into the plant ecology of BWS and contributes to the understanding of the region's biodiversity.

**Keywords:** Bassi Wildlife Sanctuary, Biological spectrum, Plant life forms, Raunkiaer classification, Thero-phanerophytic phytoclimate

## Introduction

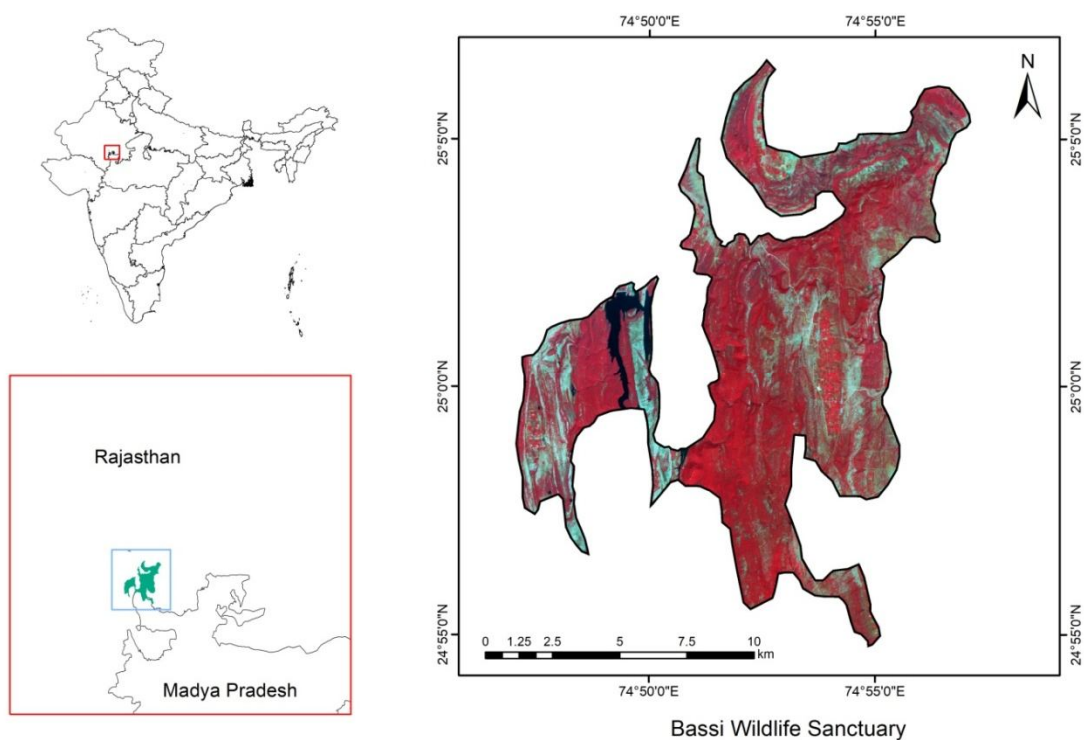
Plant life forms, reflecting plant adaptations to their environment, are crucial in plant ecology (Grime, 2001). Life forms are classified based on the adaptations of their perennating organs to survive unfavorable conditions. A plant's life form represents the sum of all its life processes and evolves directly in response to the environment (Cain, 1950). Humboldt (1886) first formulated the concept of life forms, considering the location of perennating buds or organs. Raunkiaer (1934) used it as a descriptive tool to classify plant life forms based on the position and protection of renewing buds, that allow plants to regenerate during favorable seasons. According to this system, plant species can be grouped into five main classes: such as phanerophytes, chamaephytes, hemicryptophytes, cryptophytes, and therophytes. The combined percentage of these life form classes is known as the biological spectrum.

In India, several researchers have studied the biological spectrum of different regions (Meher Homji, 1964; Sinha, 1990; Singh and Arora, 1994; Rana *et al.*, 2002; Jamir *et al.*, 2006; Reddy *et al.*, 1999; Pattanaik *et al.*, 2007; Maitreya, 2015). In Rajasthan, a few attempts have been made in this direction, with notable contributions of Pandey and Parmar (1993), Sarup

(1952) and Reddy *et al.*, (2011). Realizing this study aims to investigate the diversity and distribution of plant life forms within Bassi Wildlife Sanctuary (BWS), India.

## Study Area

Bassi Wildlife Sanctuary (BWS) is situated in Rajasthan's southeastern Chittorgarh District, covering an area of 138.69 km<sup>2</sup> (Figure 1). Its geographical coordinates are 74° 47' to 74° 57' E longitude and 24° 55' to 25° 07' N latitude (Figure 1). The study area encompasses Begu and Chittorgarh tehsils. The temperature varies from 23.8°C to 43.8°C in summer, while from 11.6°C to 28.4°C in winter. Annual precipitation varies between 600-850 mm. BWS comprises tropical dry deciduous forests interspersed with grasslands.



**Figure 1. Bassi Wildlife Sanctuary map**

## Materials and Methods

Extensive field surveys were conducted in BWS between April 2017 and March 2019 to identify and record plant species. The collected specimens were identified by using state and regional floras (Shetty & Singh, 1987, 1991, 1993) and processed, deposited at BSJO, Jodhpur (Botanical Survey of India, Arid Zone Regional Centre Herbarium). Raunkiaer's classification system was used to categorize the recorded species into different life forms. The relative abundance of each life form was calculated as a percentage of total species richness.

## Results

A total of 468 plant species belonging to 322 genera and 85 families were recorded in BWS. Therophytes (annuals) were the dominant life form, accounting for 55.8% of the total species richness, followed by phanerophytes (23.5%), hemicryptophytes (7.2%), cryptophytes (6.8%), and chamaephytes (6.6%) (Table 1).

Table 1. Biological spectrum of Bassi Wildlife Sanctuary

Sl.No.	Life Form	Number of species	Percentage of life-form in Present study	Percentage of life-form in Raunkiaer's normal spectrum
1	Therophytes	261	55.8	13.0
2	Phanerophytes	110	23.5	46.0
3	Hemicryptophytes	34	7.2	26.0
4	Cryptophytes	32	6.8	6.0
5	Chamaephytes	31	6.6	9.0
	<b>Total species</b>	<b>468</b>	<b>100.0</b>	<b>100</b>

A comparison of the observed biological spectrum with Raunkiaer's normal spectrum revealed a Thero-phanerophyticphytoclimate for BWS. This indicates a dominance of annuals and perennials, characteristic of a relatively dry climate.

Table 2. Comparison of life forms of study area with other areas having similar climatic conditions in Rajasthan

Sl. No.	Life Form	Ajmer (Reddy <i>et al.</i> , 2011)	Sariska Tiger Reserve (Pandey & Parmar,	Mount Abu (Sarup, 1952)	Bassi WLS (Present Study)

			1993)		
1	Therophyte	50.5	48.1	46.3	55.8
2	Phanerophyte	23.2	26.1	30.2	23.5
3	Hemicryptophyte	14.5	13.4	11.7	7.3
4	Cryptophytes	10	11.2	8.4	6.8
5	Chamaephyte	1.8	1.2	3.4	6.6
	<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

A comparison of the observed biological spectrum with Raunkiaer's normal spectrum and the spectra of adjoining areas were carried out to assess the phytoclimate of BWS. The comparison of life forms of the study area with other areas having similar climatic conditions in Rajasthan is represented in Table 2. Among these areas, the phytoclimate of the study area resembles to that of Ajmer and Sariska Tiger Reserve (Reddy *et al.*, 2011).

## Discussion

The dominance of therophytes in BWS indicates a dry season during which numerous plants complete their life cycles within a short period (Walter & Ellenberg, 1974). The presence of a significant number of phanerophytes suggests that the area also receives adequate rainfall to support the growth of woody plants (Whittaker & Niering, 1975). The observed Thero-phanerophytic phytoclimate aligns with the region's overall climatic conditions (Mishra & Singh, 2008).

The dominance of therophytes in BWS is a common adaptation to arid and semi-arid environments. Therophytes have adapted strategies to complete their life cycles rapidly during favorable periods, often germinating from seeds during the rainy season and producing seeds before the dry season sets in. This adaptation allows them to maximize their reproductive success in environments with limited water availability.

The presence of phanerophytes, while less dominant than therophytes, is indicative of the sanctuary's ability to support woody vegetation. These plants have developed adaptations to withstand dry periods, such as deep roots to access groundwater or drought-tolerant leaves. The

balance between therophytes and phanerophytes in BWS suggests a dynamic ecosystem that is resilient to seasonal variations in precipitation. The Thero-phanerophyticphytoclimate observed in BWS is a characteristic feature of many arid and semi-arid regions in India. This phytoclimate reflects the delicate balance between plant adaptations and environmental conditions, and it is crucial for understanding the ecological dynamics of these ecosystems.

This study contributes to understanding BWS's plant ecology and provides valuable information for conservation and management efforts. Further research is needed to investigate factors driving the distribution of plant life forms in BWS and to assess the impact of climate change on the plant community.

## Conclusion

Bassi Wildlife Sanctuary is characterized by a diverse plant community, with therophytes and phanerophytes dominating. The observed biological spectrum indicates a Thero-phanerophyticphytoclimate. This study highlights the importance of considering plant life forms in ecological assessments and conservation planning.

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