India's First PhenoMet Tower Set up By BIT Mesra

Modelling Forest Phenological Parameters from Time Series Remote Sensing Data

C. Jeganathan, A. P. Krishna, Mili Ghosh Nee Lala, Nitish Kumar Sinha & Beependra Singh

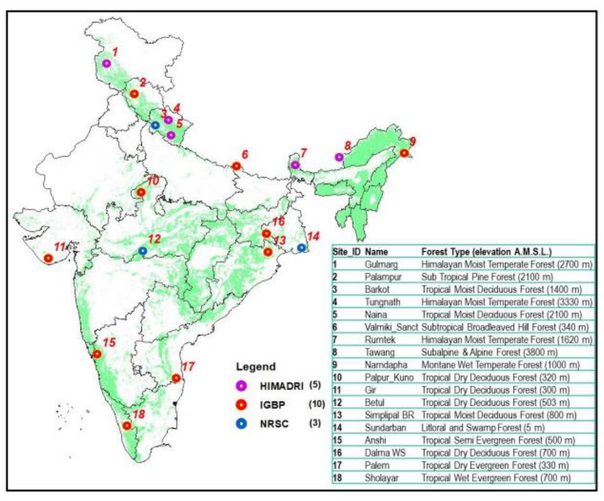
Department of Remote Sensing, Birla Institute of Technology, Mesra, Ranchi, India -835215

Background

- Forest **health and growth rhythm (phenology)** is one of the important indicators of climate change.
- **Vegetation phenology** is the timing of seasonal developmental stages in **plant life cycles** including **bud burst, canopy growth, flowering, and senescence**, which are closely coupled to seasonally varying weather patterns.
- Satellite Data availability over a longer period of time and over a larger spatial extent.
- This project attempts to understand and model phenological processes and its changes with respect to weather conditions.

Concept of the Study

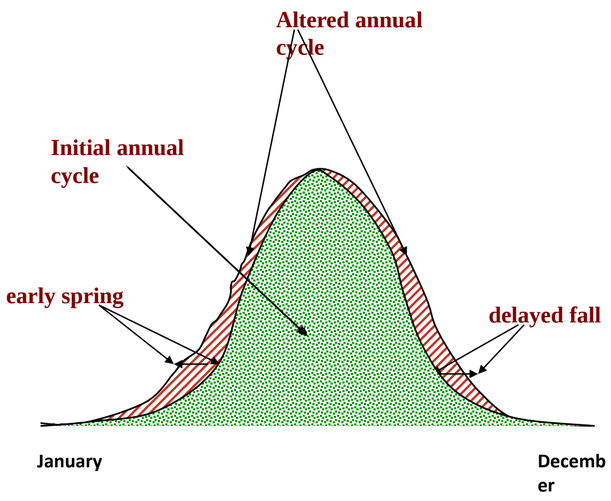
Modelling and Characterization of Vegetation Phenology using Satellite derived images and PhenoMet Data.



Site_ID	Name	Forest Type (elevation A.M.S.L.)
1	Gulmarg	Himalayan Moist Temperate Forest (2700 m)
2	Palampur	Sub Tropical Pine Forest (2100 m)
3	Barkot	Tropical Moist Deciduous Forest (1400 m)
4	Tungnath	Himalayan Moist Temperate Forest (3330 m)
5	Naina	Tropical Moist Deciduous Forest (2100 m)
6	Valmiki_Sanct	Subtropical Broadleaved Hill Forest (340 m)
7	Rumtek	Himalayan Moist Temperate Forest (1620 m)
8	Tawang	Subalpine & Alpine Forest (3800 m)
9	Namdapha	Montane Wet Temperate Forest (1000 m)
10	Palpur_Kuno	Tropical Dry Deciduous Forest (320 m)
11	Gir	Tropical Dry Deciduous Forest (300 m)
12	Betul	Tropical Dry Deciduous Forest (503 m)
13	Simplipal BR	Tropical Moist Deciduous Forest (800 m)
14	Sundarban	Littoral and Swamp Forest (5 m)
15	Anshi	Tropical Semi Evergreen Forest (500 m)
16	Dalma WS	Tropical Dry Deciduous Forest (700 m)
17	Palem	Tropical Dry Evergreen Forest (330 m)
18	Sholayar	Tropical Wet Evergreen Forest (700 m)

Proposed IGBP Phenology Network Sites

Pic Source: https://phys.org/news/2018-03-phenocam-network-harnesses-big-impact.html



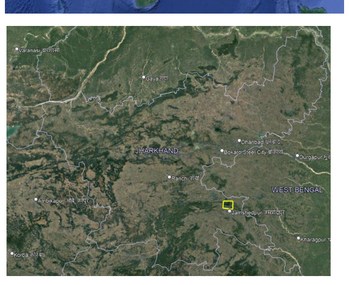
Data collected

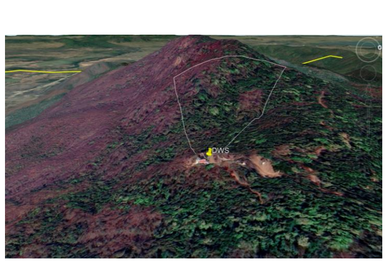
Measurements from PHENO-MET Observatory
(Pindrabera, Dalma Wildlife Sanctuary, Jamshedpur, Jharkhand, India)

1. Soil moisture (at 5cm and 20cm below ground surface)
2. Rain gauge
3. PAR sensor at Canopy Height
4. Air Temperature, Relative Humidity, electric conductivity sensors
5. Phenocam sensor (RGB & IR).
6. Data logger
7. Solar Panels (2 numbers)
8. Battery (15 Days backup without Sunlight, 2 days to full charge)
9. Accessories and components for connecting all the above sensors with data logger.

- These instruments are working fine. The data is continuously recorded at 30 minutes intervals (average of every second) in the data logger.
- These data will be transferred through SIM to the server located at the BIT Server

Study Site





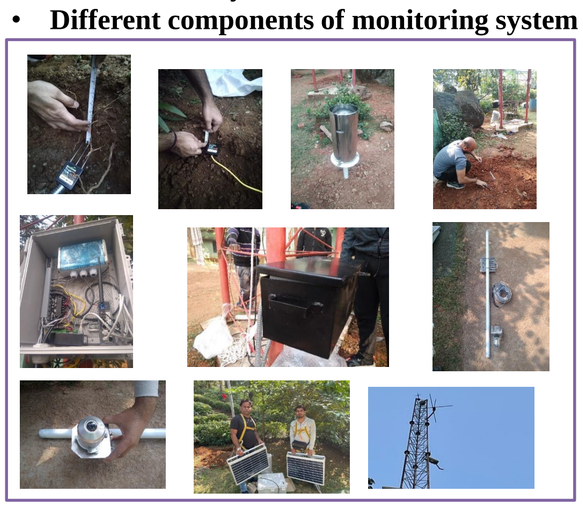
GoogleEarth View of PhenoMet tower Location (Dalma Wildlife Sanctuary, Pindrabeda)

Materials and Methods

- **Tower Specifications**

Height of Tower	**- 100 Feet**
Phenocam Sensor	**- 80 Feet**
Solar Panel	**- 65-70 Feet**
PAR Sensor	**- 60 Feet**
R. Humidity Sensor	**– 8 Feet**

- **Different components of monitoring system**

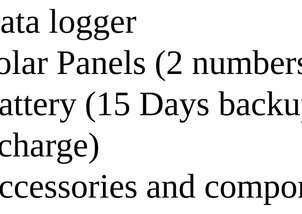


Objectives of the Study

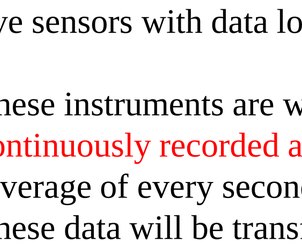
- To continuously monitor the phenological cycle of deciduous forest in Dalma Wildlife Sanctuary.
- To understand the role of environmental drivers and weather parameters in vegetation growth cycle.

Preliminary Results

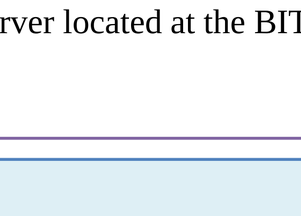
Zoomed In View of Dalma Wildlife Sanctuary, Pindrabeda Condition during Greening (SOS)



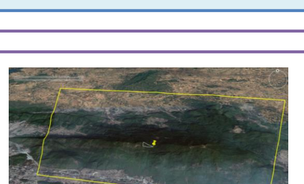
Ground Condition in January



Ground Condition in February

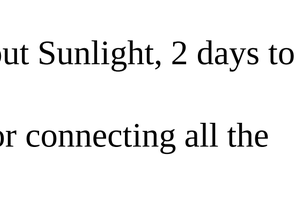


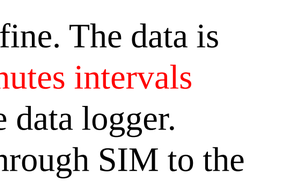
Ground Condition in April



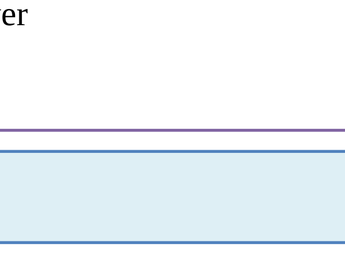
Ground Condition in May

Satellite View of PhenoMet tower Location (Dalma Wildlife Sanctuary, Pindrabeda)

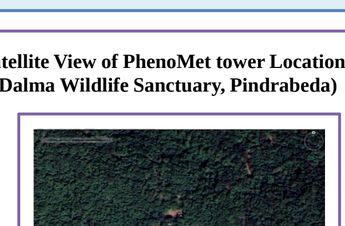




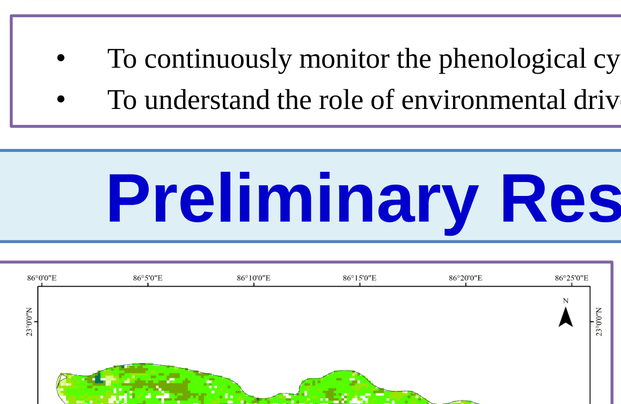
Zoomed In View of March Condition



Zoomed In View of May Condition

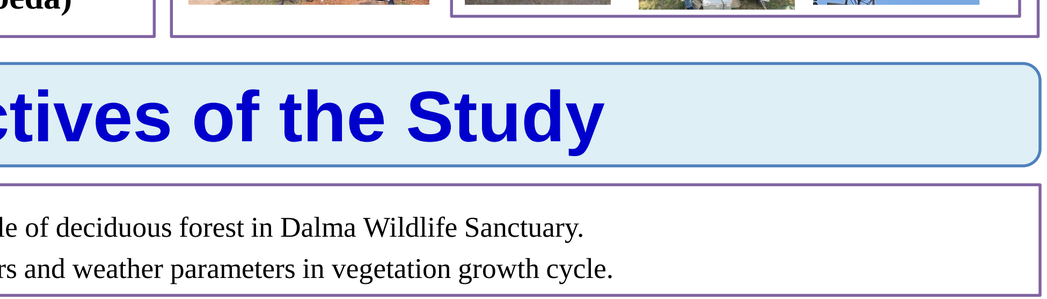


Spatial distribution of long-term Start of Greening (SOS)

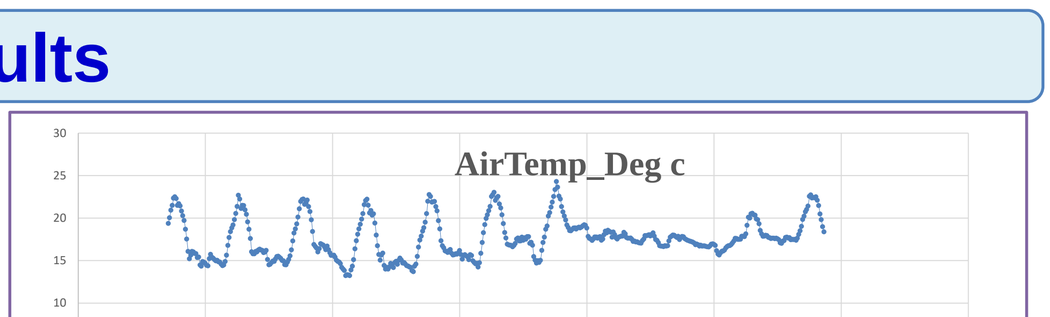


Spatial distribution of long-term deciduousness

Air Temperature from 26 Nov to 10 Dec, 2021



Relative Humidity% from 26 Nov to 10 Dec, 2021



PAR_Avg mmol/m^2 from 26 Nov to 10 Dec, 2021

Expected Outcome of the Project

- Vegetation calendar maps and annual phenology products
- Satellite phenological characteristics of Dalma forest
- Model the influence of climate on growth rhythms of vegetation
- Model for forest fire regimes
- To serve as input in vegetation modelling for understanding forest dynamics and predict growth at national level

Acknowledgement

- **Dr. C. P. Singh, Scientist/Engr. 'SG', National Coordinator, IGBP Phenology Network Project, SAC, Ahmedabad & SAC-ISRO TEAM.**
- **Honourable Vice Chancellor – Prof. Indranil Manna, BIT, Mesra.**

SPECIAL THANKS TO JHARKHAND FOREST OFFICIALS

- **Shri Rajiv Ranjan, and PCCF-Wildlife**
- **Mr. Viswanath Shah, CCF**
- **Mr. Maun Prakash (DM, FDC) and Dr. Abhishek (DFO, DWS)**