

## Supplementary Materials:

**Table S1: PhenoCam networks world-wide**

**Vegetation Type:** DF- Deciduous forest, MF: Mixed forests, CR: Croplands, SA: Savannas, TN: Tundra, EF: Evergreen forests, GR: grasslands, SH: shrublands, MG: Mangrove, WL: Wetlands

**Parameters monitored :** SM: snowmelt, SOG: start of the growing season, MOG: max of the growing season, EOG: end of the growing season, FSF: first autumn snow fall SOS: Start of Spring, EOS: End of Spring, SOF: Start of Fall, End of Fall , MOF: middle of fall, MOS: middle of spring, LOS: Length of Season, POF: peak of flowering, GU: green-up, Mat: maturity, Sen: senescence, Dorm: Dormancy, SLE: the start of leaf-expansion, ELF: end of leaf-fall, Flw: Flowering, POR: peak of redness, EOR: end of redness, POS Peak of season, SEN: start of leaf senescence

| Sl. No | Location      | Lat-long          | Year      | Vegetation Type    | PhenoCam Index      | Parameters monitored   | Satellite Data / Other | Result   | Reference |
|--------|---------------|-------------------|-----------|--------------------|---------------------|------------------------|------------------------|--|-----------|
| 1      | Svalbard      | 78° 9'N, 16° 1'E  | 2015      | GR                 | 2G_RBi, GCC, GRVI   | SM, SOG, MOG, EOG, FSF | -                      | GRVI and NDVI measured obtained through both active and passive sensors exhibited similar vegetation attributes.                                     | [50]      |
| 2      | USA           | 31°44'N,109°55'W  | 2014 - 15 | GR                 | GCC                 | SOG, EOG, & LOG        | MODIS                  | GCC may be more suitable for estimating changes in grassland greenness during the senescence.  | [51]      |
| 3      | USA           | 31°49'N, 110°51'W | 2008      | SH                 | 2G_Rbi              | SOS                    | EC                     | The net ecosystem exchange of CO <sub>2</sub> shows a nearly inverse pattern to the overall greenness of the ecosystem (GCC).                        | [45]      |
| 4      | Japan         | 36° 8'N, 137°25'E | 2005 - 07 | DF                 | 2G_RBi & Hue values | SOG, EOG               | LAI, SPAD (Ground)     | Variations in autumn phenology among tree species can be better monitored using employing the normalized RGB_DN method.                              | [92]      |
| 5      | USA           | -                 | 2013 - 15 | MF, DF, GR, CR, SV | GCC, VCI            | SOS, EOS, SOF & SOF    | MODIS, VIIRS,          | PhenoCam GCC and VCI were exhibited stronger correlation with phenological dates derived from VIIRS EVI2 compared to those obtained from VIIRS NDVI. | [93]      |
| 6      | North America | -                 | 2013 - 15 | EF, DF, SH, GR, CR | NDVI, GCC           | SOG, EOG               | MODIS                  | NDVI values derived from PhenoCam data demonstrate good correlation with NDVI obtained through spectral measurements.                                | [54]      |

|    |          |                   |              |                                |   |                              |                   |   |      |
|----|----------|-------------------|--------------|--------------------------------|---|------------------------------|-------------------|---|------|
| 7  | USA      | -                 | 2014<br>- 15 | EF, DF                         | GCC, RCC  | SOG, EOG                     | EC, MODIS-LAI     | RCC was shown better accuracy on both GPP-based SOG and EOG in EF sites   | [46] |
| 8  | France   | 48.48°N, 2.78°E   | 2012<br>- 18 | DF                             | GCC   | SOG, EOG                     | -                 | A strong correlation between the WPVbb by camera and the data from ground observation   | [44] |
| 9  | Japan    | 36°08'N, 137°25'E | 2007<br>- 09 | DF, EF                         | % of total DN and 2G_ Rbi                           | SOS, EOS, SOF & EOF          | EC                | The DNRGB values in the upward-facing images within DBF were capable of discerning canopy phenology, whereas the same was not observed in ECF.  | [94] |
| 10 | Arctic   | 67°30'N, 15°55'E  | 2019<br>- 20 | TN                             | GCC   | SOG, EOG, LOG                | Sentinel 2, MODIS | High level of correlation between Sentinel-2 and PhenoCam indices; the best correlation is with Sentinel-2 EVI  | [95] |
| 11 | Malaysia | 4°11'N; 114°2'E   | 2013<br>- 14 | EF                             | % of total DN, 2G_ RBi, Hue values, NDVI, EVI, GRVI | Flw                          | -                 | The temporal trends in %RGB and saturation exhibited by individual trees unveiled distinctive traits of tree phenology attributed to flowering, color transformation, and leaf emergence. | [55] |
| 12 | USA      | 39°27'N, 117°36'W | 2015<br>- 17 | SH                             | NDVI, GCC   | SOG, EOG, LOG                | Landsat           | Strong concurrence observed between PhenoCam and Landsat NDVI.  | [96] |
| 13 | Alaska   | 71°17'N, 156°42'W | 2010<br>- 13 | WL                             | 2G_ RBi   | SOG, EOG                     | -                 | A strong difference in timing of greenness and its intensity among species  | [97] |
| 14 | USA      | -                 | 2002<br>- 15 | DF, EF, GR, MF, SH, TN, WL, CR | GCC   | SOG, EOG                     | MODIS             | High correlation between PhenoCam and MODIS transition dates for CRO, DBF, DNF and GRA and poor for EBF & ENF.  | [41] |
| 15 | Brazil   | 22°10'S, 47°52'W  | 2011         | SV                             | GCC   | SOG, EOG                     | -                 | Individual plant species ROIs displayed a higher degree of sensitivity to changes in relative green values compared to the collective community ROIs.                                     | [52] |
| 16 | USA      | 43°58'N, 74°13'W  | 2002<br>- 12 | DF                             | 2G_ Rbi   | GU, SOS, Mat, Sen, EOS, Dorm | MODIS, Landsat    | Landsat and MODIS comparison showed strong agreement  | [98] |
| 17 | Canada   | 48°22'N, 71°25'W  | 2015<br>- 18 | MF, EF                         | GCC   | SOG, EOG                     | -                 | The initiation and completion of budburst, along with bud setting, were recorded at the points when GCC achieved 72%, 92%, and 94% of its peak magnitude, correspondingly.                | [99] |
| 18 | Italy    | 45°50'N, 7°34'E   | 2013<br>- 15 | GR                             | GCC   | Conopy greenness             | EC                | Due to heat waves, 39% of drop in maximum canopy greenness value and a senescence reported 32 days earlier when compared to mean values.  | [7]  |

|    |             |                   |           |        |                        |  |                             |   |       |
|----|-------------|-------------------|-----------|--------|------------------------|--|-----------------------------|---|-------|
| 19 | Greenland   | 64° 7'N, 51°21'W  | 2010      | WL     | 2G_ Rbi, GCC           | GPP  | EC, WorldView-2             | GPP (EC) were found good correlation with greenness for all plant communities, and the highest correlation - fen.   | [36]  |
| 20 | Japan       | 36° 8'N, 137°26'E | 2010 - 11 | GR     | GCC, RCC, BCC, 2G_ Rbi | SOS, EOS, SOF & EOF  | Portable spectroradiometer  | Seasonal trend of the GCC was shown high correlation to the aboveground green biomass throughout the year   | [53]  |
| 21 | Australia   | 36°12'S, 148°33'E | 2001 - 16 | GR     | GCC                    | SOS, EOS, SOF, EOF, LOG  | MODIS, EC                   | There exists a critical threshold at which excessive summer VPD hinders the ability of Australian mountain grasslands to recover during the latter part of the season.  | [100] |
| 22 | Japan       | 36° 8'N, 137°25'E | 2004 - 13 | DF     | % of total DN, 2G_ Rbi | SLE, ELF   | -                           | The timing of early ELF was found to be less responsive to changes in air temperature compared to the timing of SLE.  | [101] |
| 23 |             |                   |           |        |                        |  |                             |   |       |
| 24 | Switzerland | 47° 28'N, 8° 21'E | 2005 - 07 | MF, DF | GCC                    | SOS, EOS, Sen  | EC                          | The new leaf appearance dates of the dominant species played a role in shaping the seasonal patterns of spring gross primary productivity (GPP), although their influence was also influenced by the specific local weather conditions. | [102] |
| 25 | USA         | 32°13'N, 110°48'W | 2007      | SH     | 2G_ Rbi                | Flower count   | -                           | The comparison between manually and automatically counted cinchweed blooms resulted in a strong correlation, with an $R^2$ value of 0.97 ( $p < .0001$ ).   | [103] |
| 26 | USA         | 41°21'N, 70°34'W  | 2013      | DF     | GCC                    | Ecophysiological traits, Sen                                   | -                           | Utilizing camera-based phenology observations proves to be an effective method for accurately quantifying the trends in the START and END of senescence.  | [81]  |
| 27 | Canada      | 53°43'N, 127°38'W | 2013 - 14 | DF     | 2G_ Rbi, GCC           | Stand-health metrics, vigour, mortality and disease occurrence | Visual forest-health survey | GCC represented differences in healthy <i>vigour</i> and mortality, whereas, EG best representative of occurrences of foliar diseases.  | [85]  |
| 28 | USA         | 44°03' N, 71°17'W | 2013 - 16 | DF     | GCC, RCC               | SOS, EOS, PAI, LAI   | PAR                         | The reported transition dates and length in shows large variation among the VIs of $PAI_{CANOPY}$ , GCC, RCC and $PAI_{PARL}$ .   | [86]  |
| 29 | Finland     | 67°21'N, 26°38'E  | 2014 - 15 | EF, WL | GCC                    | SOS, EOS, SOF, EOF   | EC                          | The correlation between GCC and CO2 exchange was highest during the spring.   | [104] |

|    |                |                      |              |                         |                                      |   |                                   |   |       |
|----|----------------|----------------------|--------------|-------------------------|--------------------------------------|---|-----------------------------------|---|-------|
| 30 | Portugal       | 39° 08'N, 8°19'W     | 2011<br>- 18 | EF, SH, GR              | GCC, NDVI,<br>NDWI                   | Greenness<br>variation                                | -                                 | The GRA shows a very good correlation between GCC and NDVI while the GCC of SHB showed a better fit with NDWI than with NDVI. | [105] |
| 31 | USA,<br>Canada | -                    | 2014         | DF, EF, GR              | 2G_ Rbi, GCC                         | GPP   | EC                                | GPP shows better correlation with greenness derived from camera imagery in all 3 PFT  | [39]  |
| 32 | Canada         | 52° 2'N, 117° 0'W    | 2010         | SH                      | 2G_ Rbi                              | GU, Sen, Flw, root<br>nutrition                       | -                                 | Protein content of <i>H. alpinum</i> is shows that, a depletion in protein level while plants are growing actively.           | [106] |
| 33 | Brazil         | 7°58'S, 38°23'W      | 2018<br>- 19 | Caatinga<br>woody plant | GCC                                  | EOS, SOS  | MODIS, Sentinel 2                 | Seasonal GCC and NDVI derived from optical RS were indeed strongly related to water use.                                      | [107] |
| 34 | Japan          | -                    | 2012         | DF                      | GRVI, RCC,<br>ExR, RGR,<br>VARI, Hue | Leaf color<br>duration, Autumn<br>leaf phenology      | -                                 | For max leaf-color brightness - target autumn leaf color  | [108] |
| 35 | Brazil         | 2°51'S, 54°58'W      | 2000<br>- 19 | EF                      | leafless tree-<br>crowns<br>fraction | leafless or leafy                                     | MODIS, Planet<br>Scope            | At ecosystem-level, the observed pattern in NPV fraction correlate well to PhenoCam based leafless tree-crown fraction.       | [109] |
| 36 | China          | 44.42°N, 122.87°E    | 2012<br>- 14 | GR                      | 2G_ Rbi                              | GPP   | EC                                | For the 3 continuous years, the daily fAPAR from PhenoCam shows similar temporal pattern with the EC-GPP.                     | [25]  |
| 37 | Brazil         | 2° 8' S, 59° 0'W     | 2015<br>- 16 | EF                      | GCC                                  | GU, Mat, Sen,<br>Dorm                                 | MODIS                             | Observed post-drought changes in the timing in leaf demography  | [88]  |
| 38 | USA            | 37°55'N, 78°16'W     | 2018         | DF                      | GCC, NDVI                            | Canopy Closure,<br>LAI                                | UAV, MODIS and<br>Landsat 8       | Shift from spring phenophases to canopy-closure largely agrees among sensors other than Landsat 8 or MODIS.                   | [110] |
| 39 | USA            | 38°16'N,<br>119°34'W | 2012<br>- 15 | SV, GR                  | NDVI                                 | GU, Mat, Sen,<br>Dorm                                 | MODIS, VIIRS,<br>Landsat 8        | Results show that NDVI - satellite are strongly correlated with PhenoCam NDVI time series.                                    | [111] |
| 40 | Italy          | 45°50'N, 7°34'E      | 2009<br>- 11 | GR                      | GCC, BCC                             | SOS   | -                                 | Regions where snow melts at a later time reported to early BOS.   | [112] |
| 41 | Italy          | 45°50'N, 7°34'E      | 2009<br>- 10 | GR                      | 2G_ Rbi, GCC,<br>BCC, RCC            | Canopy<br>greenness, LAI,<br>canopy<br>photosynthesis | EC, Hyperspectral<br>Irradiometer | Strong correlation between canopy greenness with LAI and canopy photosynthesis.   | [87]  |

|    |             |                  |              |                       |                        |  |  |   |       |
|----|-------------|------------------|--------------|-----------------------|------------------------|--|--|---|-------|
| 42 | USA         | 41°49'N, 72°14'W | 2012<br>- 14 | DF                    | GCC, RCC,<br>BCC, VARI | SOS, EOS, POR,<br>EOR                            | -  | Spring: SOS from a GCC correlated well with visually observed timing between onset and max leaf unfolding. Autumn: POR & EOR from RCC correlated well with the visual end of leaf drop and color change.      | [113] |
| 43 | Netherlands | 53°29'N, 6°13'E  | 2016<br>- 17 | GR                    | GCC                    | SOS, POS, EOS                                    | Sentinel 2                                 | The SOS derived from NDVI Sentinel-2 closely corresponded to the SOS camera-based GCC. The estimates for EOS-camera-based GCC series were two months earlier on average compared to the NDVI-based estimates. | [114] |
| 44 | Europe      | -                | 2008<br>- 14 | DF, EF, GR,<br>WL, CR | GCC                    | SOS, EOS, GU, Sen                                | EC   | Differences in color fractions and pigment concentrations in deciduous forests.   | [59]  |
| 45 | USA         | -                | 2000<br>- 13 | DF                    | GCC                    | Spring leaf emergence                            | MODIS                                      | community composition impacts on phenological dynamics over large areas.  | [115] |
| 46 | USA         | -                | 2008<br>- 12 | DF                    | GCC, RCC               | SOS, MOS, EOS,<br>SOF, MOF, EOF                  | MEASURES,<br>MODIS                         | PhenoCam images exhibit lower levels of uncertainty compared to satellite imagery.  | [37]  |
| 47 | Czechia     | 48°40'N, 16°56'E | 2014<br>- 17 | DF                    | GCC                    | GU, Mat, Sen,<br>Dorm                            | Ground<br>Observation                      | Correlation between ground and PhenoCam derived phenological periods.   | [116] |
| 48 | Sweden      | 57° 8'N, 14°44'E | 2018         | DF                    | VARI, GCC              | SOS, EOS   | MODIS, Sentinel-2,<br>UAV                  | PhenoCamGCC proved to be more effective in accurately monitoring the canopy's green-up compared to other indices.   | [117] |
| 49 | Global      | -                | 1999<br>- 17 | DF                    | GCC                    | SOS, EOS   | Copernicus land<br>surface products,<br>EC | A substantial correlation for the SOS and a coefficient of determination ( $R^2$ ) exceeding 0.5 for the EOS.   | [23]  |
| 50 | USA         | -                | 2002<br>- 12 | DF, EF, GR            | GCC                    | Canopy<br>greenness,<br>Pigment<br>concentration | MERIS                                      | Significant correlations ranging from moderate to strong were identified between GCC and vegetation metrics derived from MERIS data at DF sites. However, weaker associations were noted over EF sites.       | [118] |

|    |         |                   |           |            |               |   |                               |  |       |
|----|---------|-------------------|-----------|------------|---------------|---|-------------------------------|--|-------|
| 51 | USA     | 42°32'N, 72°10'W  | 2008-12   | DF         | GCC           | Spring bud burst, POS, Sen, LAI           | MODIS, Ground Observation     | The emergence of spring-related changes in both Leaf Area Index (LAI) and the measured physiological and morphological characteristics is demonstrated to occur later than the initial rise in canopy greenness. | [40]  |
| 52 | Germany | 48°57'N, 13°25'E  | 2011      | DF         | GCC           | SOS, EOS, frost damage, re-sprouting, Mat | -                             | Individuals that exhibited an early onset of greening during the initial flushing phase experienced a briefer recovery period and commenced the second greening phase earlier.                                   | [49]  |
| 53 | USA     | -                 | 2002 - 10 | DF         | 2G_ RBi       | Gin, Gmax, Gdec, Gmin,                    | MODIS                         | Best correlation between PhenoCam and Modis  | [35]  |
| 54 | Germany | 49° 5'N, 13°16'E  | 2006 - 07 | DF         | GCC, RCC      | SOS, SEN, EOS, SOF                        | -                             | An approximate delay in the initiation of green-up of 2.5 days per 100 meters of altitude was calculated for <i>Fagus sylvatica</i> .  | [119] |
| 55 | UK      | -                 | 2011 - 12 | DF, EF, MF | GCC           | SOS, EOS, SOF, EOF                        | -                             | A strong correlation was found between automated method and visual inspection.   | [120] |
| 56 | Europe  | -                 | 2018 - 19 | DF, EF, GR | GCC           | SOS, EOS                                  | Sentinel-2, PEP725, EC        | For GPP phenology, PPI emerges as the most effective approach, especially for ECF.   | [90]  |
| 57 | USA     | -                 | 1982 - 13 | DF         | GCC, RCC      | SOS, EOS                                  | Landsat, MODIS, EC            | Ground observations exhibit a stronger alignment with LPA derived estimates for SOS dates compared EOS dates.  | [121] |
| 58 | Sweden  | 64°11'N, 19°33'E  | 2011 - 12 | WL         | GCC, RCC, BCC | LAI, GEP                                  | EC                            | Strong correlations and seasonal hysteresis effects were observed between the GCC and LAI, day length, and GDDS.   | [122] |
| 59 | Kenya   | 1°38'S, 37° 8'E   | 2017 - 19 | GR         | GCC           | SOS, EOS                                  | Sentinel, MODIS, Planet Scope | Both Planet Scope and Sentinel-2 data sets resulted in acceptable extraction of phenological dates.  | [123] |
| 60 | Germany | 49° 6'N, 13°18'E  | 2001 - 16 | MF         | GCC           | SOS, EOS, POS                             | MODIS, EC                     | Increasing trend in GCC, was paralleled by increasing trends of GPP and satellite-based indices  | [124] |
| 61 | China   | 24°32'N, 101° 1'E | 2010      | EF         | GCC, RCC      | SOG, EOG, Sen                             | -                             | The RCC was more accurate for estimating leaf senescence, while the GCC is accurate for estimating leaf development events.  | [125] |

|    |               |                      |              |                       |                        |                        |  |  |       |
|----|---------------|----------------------|--------------|-----------------------|------------------------|------------------------|--|--|-------|
| 62 | USA           | 31°49'N,<br>110°52'W | 2013<br>- 16 | SV, GR, SH            | NDVI, GCC              | GPP                    | Landsat8, MODIS,<br>EC                 | The relationships between Greenness - GPP were not influenced by changes in spatial scales.  | [126] |
| 63 | Australia     | -                    | 2014<br>- 15 | GR                    | GCC                    | Biomass                | Landsat8,7,<br>MODIS                   | The primary factor driving variations in phenology among different grassland types is the dominance of C3/C4 species.  | [33]  |
| 64 | Thailand      | 8° 3'N, 98°24'E      | 2015<br>- 16 | MG                    | GCC, BCC,<br>RCC, VARI | SOG, EOG               | -                                      | Signals derived from the GCC exhibited a positive correlation with diurnal water levels in the background, whereas signals from the RCC displayed a negative relationship with tidal water levels. | [127] |
| 65 | North America | -                    | 2012<br>- 17 | EF                    | GCC, GRVI              | SOG, EOG, GPP          | EC, Field spec,<br>fluorometer         | Changes in canopy level color intensity can be used to project canopy-level photosynthesis   | [128] |
| 66 | USA           | -                    | 2018<br>- 19 | DF                    | GCC                    | SOS, EOS, SOF,<br>EOF  | MODIS, GOES                            | GOES displayed a higher degree of correlation with PhenoCam data.  | [129] |
| 67 | North America | -                    | 2016         | DF                    | GCC                    | SOG, EOG               | -                                      | The accuracy of the model improved when deep networks utilized region of interest images instead of using the entire images as inputs.   | [130] |
| 68 | USA           | -                    | 2017<br>- 20 | EF, DF, CR,<br>GR, SH | GCC                    | SOS, EOS, SOF,<br>EOF  | Landsat, Sentinel<br>2, Planet scope   | Vegetation index - high temporal correlation for all the data sources.   | [131] |
| 69 | Canada        | -                    | 2016<br>- 19 | EF                    | GCC                    | SOG, EOG, LOS          | MODIS                                  | EVI provided more accurate estimations of phenological dates compared to the NDVI.   | [132] |
| 70 | India         | 32°35'N, 76°16'E     | 2017<br>- 18 | DF                    | RCC, GCC, BCC          | GU, Mat, Sen,<br>Dorm  | -                                      | GU occurred four days earlier in 2018 than in 2017, whereas Dorm occurred one day later  | [79]  |
| 71 | Japan         | 35-45N, 136-140E     | 2015<br>- 16 | CR                    | GCC                    | SOS, EOS, SOF &<br>EOF | Advanced<br>Himawari Imager<br>& MODIS | Difference in timing of SOS and EOF in the areas with natural vegetation, urban zones, and croplands highlights the influence of human activities LSP.   | [133] |
| 72 | USA           | 41°10'N, 96°26'W     | 2009<br>- 10 | CR                    | VARI, SR,<br>Cgreen    | Crop stages            | MODIS                                  | Camera-derived CLgreen, SR and NDVI demonstrated a high level of accuracy in estimating the overall LAI of maize and soybean crops.  | [56]  |

**Table S2: PhenoCam networks worldwide.**

| Name   | Country                | Date of establishment  | Biome/ forest type covered  | Number of Cameras | References  |
|--|------------------------|------------------------|---|-------------------|---|
| PhenoCam Network   | USA                    | 2008 and it is ongoing | Agriculture land, Deciduous (broad and needle), Evergreen (broad and needle), Grassland, Mixed vegetation, Shrubs, Tundra, Understory, Wetland                        | 528               | [41]  |
| The Phenological Eyes Network (PEN)                          | Japan                  | 2003 and it is ongoing | Deciduous (broad and needle ), , Evergreen Forest, Urban, Agricultural land, Rice paddy, Mixed Vegetation, Evergreen plantation forest, Dry grassland, Grassland, Sky | 38                | [57]  |
| Australian PhenoCam Network                                  | Australia              | 2014 and it is ongoing | Evergreen forests, Deciduous forest, Savana, Grasslands   | 15                | [60]  |
| European Phenology Camera Network (EuroPhen)                 | Europe (17 countries ) | 2008                   | Agriculture land, Deciduous forest, Evergreen forest, Peat land, Grassland  | 65                | [59]  |
| European Integrated Carbon Observation System (ICOS) Network | Europe                 |                        | Forest, Grasslands, Cropland, and Wetlands  | 42                | [59]  |
| National Ecological Observatory Network                      | USA                    | 2019                   | One is for vegetation monitoring and the other on the shore facing the aquatic body to capture land-water interface images  | 2                 | [58]  |
| Brazil PhenoCam Network                                      | Brazil                 |                        | The towers of the project are: Cerrado Core, Atlantic Rain Forest, Cerrado PEG, Amazon Forest, Caatinga, EE Itirapina and Serra Cipó.                                 | 7                 | <a href="http://intranet.recod.ic.unicamp.br/ephenology/client/index.html#/phenocamNetwork">http://intranet.recod.ic.unicamp.br/ephenology/client/index.html#/phenocamNetwork</a> |

**Table S3: Indian Ground based forest phenology monitoring sites**

**Phenological Properties:** PL: Production of young leaves, ML: maturation of leaves, AL: abscission of leaves, PF: production of young flowers, MF: maturation of flowers, AF: abscission of flowers, Pfu: production of young fruits, Mfu: maturation of fruits, Rfu: ripening of fruits, SG: Seed Germination, SD: Seed Dispersal, SP: Seed Production, FT: Floral Transformations, and LA: Leaf area

**Forest Types:** TMDF: Tropical Moist Deciduous Forest, TDFF: Tropical Dry Deciduous Forests, StPF: Subtropical Pine Forests, HMTF: Himalayan Moist Temperate Forests, TWEF: Tropical Wet Evergreen Forests, TSEF: Tropical Semi-evergreen Forests, TDEF: Tropical Dry Evergreen Forests, MWTF: Montane Wet Temperate Forests, LSF: Littoral & Swamp Forests, TTP: Tropical Thorn Forests, StBHF: Subtropical Broadleaved Hill Forests, TOF: Plantation/TOF



| Sl. No | Location   | Year              | Method (Duration) | Forest Type      | Phenological Properties               | Reference |
|--------|--|-------------------|-------------------|------------------|---------------------------------------|-----------|
| 1      | Khasi Hills<br>(25°45"N; 91°45"E)                                | 1979-80           | 2 weeks           | TMDF             | PL, ML, AL, PF, MF, AF, Pfu, Mfu, Rfu | [71]      |
| 2      | Khasi Hills<br>(25°45"N; 91°45"E)                                | 1976-79           | Weekly            | TMDF             | PL, AL, LL                            | [134]     |
| 3      | Bandipur<br>(11°39' N; 76°37' E)                                 | 1975-76 & 1978-79 | 2 weeks           | TDDF             | PL, ML, AL, PF, MF, AF, Pfu, Mfu, Rfu | [66]      |
| 4      | Kumaun Himalayan<br>(29 ° 8' -29 ° 38'N; 79 ° 27' - 79 ° 43' E)  | 1981-83           | 4-5 days          | StPF, HMTF, TDDF | AL, PL, PF, Pfu                       | [67]      |
| 5      | Uttara Kannada<br>(13° 55' - 15° 31' N; 74° 9' - 75°10' E)       | 1983-85           | 2 weeks           | TWEF, TSEF, TMDF | PL, ML, AL, PF, MF, AF, Pfu, Mfu, Rfu | [135]     |
| 6      | Mudumalai Sanctuary<br>(11° 30' N -11° 39' N; 77°27' - 77°43' E) | 1988-90           | 2 weeks           | TDDF             | PL                                    | [68]      |
| 7      | Mudumalai Sanctuary  | 2000-08           | Monthly           | TDDF             | PL, ML, AL, PF, MF, AF, Pfu, Mfu, Rfu | [74]      |
| 8      | Mudumalai Sanctuary  | 1988-90           | 2 weeks           | TDDF             | PF, MF, AF, Pfu, Mfu, Rfu             | [136]     |
| 9      | Mundanthurai Tiger Reserve<br>(8°50'N ;77°00' E)                 | 1991-93           | Weekly            | TSEF             | PF, MF, AF, Pfu, Mfu, Rfu             | [69]      |
| 10     | Mundanthurai Tiger Reserve<br>(8° 33' N;77° 23'E)                | 1991-94           | 2 Week            | TWEF             | Mfu, Rfu, Fruit Abundance             | [137]     |
| 11     | Mundanthurai Tiger Reserve                                       | 1991-92           | Monthly           | TWEF             | PF, MF, AF, Pfu, Mfu, Rfu             | [138]     |
| 12     | Kodayar<br>(8°29'N;77°15'E)                                      | 2002-03           | 2 weeks           | TMDF, TWEF       | PL, ML, AL, PF, MF, AF, Pfu, Mfu, Rfu | [139]     |
| 13     | Tamil Nadu<br>(12°03" N;79°52" E)                                | 2003              | 2 weeks           | TDEF             | PF, MF, Pfu, Mfu, Rfu                 | [140]     |

|    |  |                      |         |            |   |       |
|----|--|----------------------|---------|------------|---|-------|
| 14 | Palni hills<br>(10°01' -10°26'N; 77°14' -<br>77°52'E)                                | 2002-04              | 2 weeks | MWTF       | PF, MF, Pfu, Mfu, Rfu                         | [141] |
| 15 | Nilgiri hills<br>(11°43' N;76°87' E)   | 2000-03              | Monthly | MWTF       | PL, ML, AL                                    | [142] |
| 16 | Bhadra Wildlife Sanctuary<br>(13°46' -13°52' N, 75°36' -<br>75°42'E)                 | 2004-06              | Monthly | TDDE, TWEF | PL, ML, AL                                    | [143] |
| 17 | Bhadra Wildlife Sanctuary  | 2004-06              | Monthly | TDDE, TWEF | PL, ML, AL                                    | [144] |
| 18 | Hathinala Forest<br>(24°18' N,83°06' E)  | 2001-03              | Monthly | TDDE       | PL, AL  | [145] |
| 19 | Katerniaghat Wildlife<br>Sanctuary<br>( 28°20'N, 81° 7'E)                            | 2010-11              | Monthly | TMDF       | PL, ML, AL, PF, MF, Pfu,<br>Rfu, leaf area    | [72]  |
| 20 | Katerniaghat Wildlife<br>Sanctuary   | 2009-12              | Monthly | TMDF       | PL, AL, PF, Pfu, Rfu                          | [146] |
| 21 | Gorakhpur Forest Division<br>(27°17'N; 83°35'E)                                      | 2016                 | 2 weeks | TMDF       | PL, AL, PF, MF, Mfu, Rfu,<br>Seed Germination | [147] |
| 22 | Similipal<br>( 21°35'N; 86°17'E)   | 2003-04              | 2 weeks | TMDF       | PL, AL, PF, Pfu, Rfu                          | [148] |
| 23 | Bala-fort<br>(27°29'N; 76°30'E)  | 2001-03              | 15 days | TDDE       | PL, AL, PF, Pfu, Rfu                          | [149] |
| 24 | Pakke Wildlife Sanctuary<br>and Tiger Reserve<br>(26°54'-27°16'N;92°36'-<br>93°09'E) | 1997-99 &<br>2009-11 | 2 weeks | TSEF       | PF, Pfu, Rfu, Seed Dispersal                  | [73]  |
| 25 | Tungnath<br>(30°14'N ;79°13'E)   | 1988-98              | -       | HMTF       | PL, ML, AL, PF, MF, AF, Pfu,<br>Mfu, Rfu      | [150] |

|    |  |           |         |                       |  |       |
|----|--|-----------|---------|-----------------------|--|-------|
| 26 | Goa<br>(15°48'-14°53' N;74°20'-73°40' E)                                 | 1997-2000 | 2 weeks | LSF, TSEF, TMDF, TWEF | PF, MF, AF                                 | [151] |
| 27 | Hollongapar Gibbon Wildlife Sanctuary<br>(26°40'-26°45'N;94°20'-94°25'E) | 2010-12   | Monthly | TSEF                  | PL, AL, PF, Pfu, Rfu, vegetative growth    | [152] |
| 28 | Chatla floodplain<br>(90.45 N, 24.45 E)                                  | 2012-14   | 15 days | TOF                   | PL, AL, PF, Pfu                            | [153] |
| 29 | Thiruporur<br>(11°00'-12°00';77°28' - 78°50'E)                           | 2009      | 2 weeks | TTF                   | Pfu, Mfu, Rfu                              | [154] |
| 30 | Pichavaram<br>(11°20'-11°30'N;79°45'-79°55'E)                            | 2 years   | 15 Days | LSF                   | PF, MF, AF, Pfu, Mfu, Rfu, Seed Production | [155] |
| 31 | Dargakona village<br>(24°41'N;92°41'E)                                   | 2004-05   | Weekly  | TSEF, TMDF            | PL, ML, AL, PF, AF, Pfu, Rfu               | [64]  |
| 32 | Amritsar<br>(31.28°N;74.29°E)  | 2009-11   | Daily   | TDDEF                 | PF, MF, Pfu, Mfu, Rfu, Seed Production     | [156] |
| 33 | Kangchup hills<br>(24.45°N;93.48°E)                                      | 1993-94   | Monthly | StBHF                 | PL, AL, PF, Pfu                            | [157] |
| 34 | Gujarat<br>(22°35' N;69°57' E, 22°31' N;69°56' E. 22°34' N;69°57' E.)    | 2007-09   | Daily   | LSF                   | Floral Transformations                     | [158] |
| 35 | Hathinala Forest<br>(24.18 N, 83.6 E)                                    | 2001-03   | Monthly | TDDEF                 | PL, ML, AL, PF, Pfu, Rfu                   | [159] |
| 36 | Kanha tiger reserve<br>(22.17°N;80.38°E)                                 | 14 months | Monthly | TMDF                  | PL, ML, AL, PF, MF, AF, Pfu, Mfu, Rfu      | [160] |
| 37 | Western Himalaya<br>(30°51'N;76.11 E)                                    | 1999-06   | 15 days | TOF                   | PL, ML, AL, PF, MF, AF                     | [161] |

|    |   |         |         |                 |  |       |
|----|---|---------|---------|-----------------|--|-------|
| 38 | Shervaroys<br>(11.45'-11.55'N;78.10'-<br>78.20'E) | 1986-88 | Monthly | TDDE, TDEF, TTF | PF, MF, AF                               | [162] |
| 39 | Garhwal Himalaya<br>(30.10'N,78.47'E)             | 1986-87 | 4 Week  | SPF, TMDF       | PL, ML, AL, PF, MF, AF, Pfu,<br>Mfu, Rfu | [163] |
| 40 | Tunganath, Himalaya<br>(30.14'N,79.15'E)          | 1984    | Weekly  | HMTF            | PL, ML, AL, PF, MF, AF, Pfu,<br>Mfu, Rfu | [164] |
| 41 | Upper Shillong<br>(25.34'N;91.56'E)               | 1977-99 | Monthly | StPF, StBHF     | PL, ML, AL, Leaf area                    | [70]  |

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