

## **FLUXNET Phenological phase definitions**

*(proposed, on web at [http://www.uwm.edu/~mds/Pheno\\_phases\\_Fluxnet\\_proposed.pdf](http://www.uwm.edu/~mds/Pheno_phases_Fluxnet_proposed.pdf))*

Note: Photographs of the phases will be made available for as many species as possible.

### **CONIFEROUS SPECIES**

NA (Needle appearance)–Beginning of needle appearance (May shoot) is when first buds have burst open, but scales are still peeling off from the bud's exteriors. In this stage portions of the scales are still partially covering the not yet expanded needle bunches (DWD, translated).

CF (Flowering)–The flowers of male (staminate) inflorescence are open and begin to release yellow pollen (ICP).

### **DECIDUOUS SPECIES**

SL (Sprouting of leaves)–The buds begin to burst open in at least three places on the plant under observation. The first green is visible on the young spring shoots and the first scales fall off the buds (GPM).

UL (Beginning of the unfolding of leaves, first leaf surfaces visible)–In at least three places on the plant under observation first leaves have pushed themselves completely out of the bud or leaf sheath. The leaves have unfolded completely, so that the leaf stalk or leaf base is visible (sometimes only recognizable by bending back the young leaf). At this point, the individual leaf has taken its ultimate form, but has not yet reached its final size (GPM).

L95 (95% of the leaves are at 95% of their final size)–This is part of a continuous record at each observation of the percentage of leaves that have reached 95% or more of their final size, HF).

BF (Beginning of flowering, first flowers open)–In at least three places on the plant the first flowers have opened completely (GPM).

FR (Fruit ripe)–The fruit shows the coloring characteristics of the plant variety, and can be easily removed from the fruiting lateral (GPM).

CL (Coloring of leaves)–Approximately 50% of the leaves have taken on the colors of autumn (GPM).

### **GRASSLAND SPECIES** (GMH, *under development, events stratified as 5%, 5-20%, or >20%*)

IG (Initiation of growth, tiller emergence)

IF (Initiation of flowering, anthesis)

DF (Duration of flowering, anthesis)

PS (Peak number of seedheads)

LC (Leaves in canopy > 90% dry)

## **Additional FLUXNET Phenological Instructions**

*(adapted from ICP Forests, Europe Manual)*

1. **Location**
  - a. Selection of species—Priority should be given to the 2-3 most important (dominant) species at the site, which have the highest likelihood to be physically associated with the carbon and energy flux measurements. In forests, secondary and understory species should also be added as feasible.
  - b. (Forests only) Criteria for selection of sample trees—Trees on which a crown condition assessment and periodical measurement of DBH and height are preferred. Between 10 and 20 trees per species should be tagged with unique numbers and individually observed.
  - c. (Forests only) Crown to be assessed—Preferably the top of the crown (light crown) should be visible from one observation point. If this is not possible, the middle part of the crown is also acceptable. The same part of the crown should be considered for subsequent phenological observations throughout the whole year. The part of the crown observed should be reported at the time the trees are selected, or whenever it changes.
  - d. (Forests only) Direction of assessment—The direction from which the observations on individual trees are made should always be the same. It should be recorded using eight-point directions (N, NE, E, SE, S, SW, W, or NW) at the time the trees are selected. Any change in this position should also be reported.
2. **Frequency of Observations**—At least during the periods from the beginning to the end of the concerned phenological phases, daily observations are preferred. If daily observations are not possible, then they should be made at a minimum of three times per week, always on the same day of the week (i.e. Monday-Wednesday-Friday)

### Sources:

DWD=German Weather Service

GMH=Dr. Geoffrey M. Henebry

GPM=Global Phenological Monitoring protocol

HF=Harvard Forest Native Species protocol

ICP=ICP Forests, Europe