TITLE

Hubbard Brook Experimental Forest (US Forest Service): Routine Seasonal Phenology Measurements, 1989 - present

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PRINCIPAL INVESTIGATOR(s)

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ABSTRACT:
Spring and Fall leaf phenology observations have been made at 9 locations at the Hubbard Brook Experimental Forest since 1989. Timing and progression of spring leaf out and fall senescence are recorded for 3 dominant tree species, sugar maple, yellow birch, and beech, in treated and untreated watersheds and high and low elevations. Weekly measurements are taken during the active period of the fall or spring season.

KEYWORD SET: Hubbard Brook Ecosystem Study LTER
bud, canopies, flowers, foliage, forests, HBR, Hubbard Brook LTER, leaves, phenology, seasonality, trees, vegetation.

KEYWORD SET: LTER Core Research Areas
disturbance, primary production.

BEGIN DATE

1989

END DATE

2015

LOCATION

Phenology Collection Site - HQ, Headquarters Building

West bounding coordinate: -71.700975
East bounding coordinate: -71.700975
North bounding coordinate: 43.945733
South bounding coordinate: 43.945733

Elevation
Minimum: 750
Maximum: 750
(Unit: meter)

Phenology Collection Site - 1B.

West bounding coordinate: -71.725558
East bounding coordinate: -71.725558
North bounding coordinate: 43.952022
South bounding coordinate: 43.952022

Elevation
Minimum: 1549
Maximum: 1549
(Unit: meter)

Phenology Collection Site - 4B.

East bounding coordinate: -71.728739
North bounding coordinate: 43.950917
South bounding coordinate: 43.950917

Elevation
Minimum: 1733
Maximum: 1733
(Unit: meter)

Phenology Collection Site - 4T.

West bounding coordinate: -71.731661
East bounding coordinate: -71.731661
North bounding coordinate: 43.958947
South bounding coordinate: 43.958947

Elevation
Minimum: 1996
Maximum: 1996
(Unit: meter)

Phenology Collection Site - 5B.

West bounding coordinate: -71.731831
East bounding coordinate: -71.731831
North bounding coordinate: 43.949128
South bounding coordinate: 43.949128

Elevation
Minimum: 1656
Maximum: 1656
(Unit: meter)

Phenology Collection Site - 5T.

West bounding coordinate: -71.736869
East bounding coordinate: -71.736869
North bounding coordinate: 43.957400
South bounding coordinate: 43.957400

Elevation
Minimum: 2385
Maximum: 2385
(Unit: meter)

Phenology Collection Site - 6T.

West bounding coordinate: -71.742178
East bounding coordinate: -71.742178
North bounding coordinate: 43.955547
South bounding coordinate: 43.955547

Elevation
Minimum: 2518
Maximum: 2518
(Unit: meter)

Phenology Collection Site - 7B.

West bounding coordinate: -71.765647
East bounding coordinate: -71.765647
North bounding coordinate: 43.928928
South bounding coordinate: 43.928928

Elevation
Minimum: 1985
Maximum: 1985
(Unit: meter)

Phenology Collection Site - 7T.

West bounding coordinate: -71.769733
East bounding coordinate: -71.769733
North bounding coordinate: 43.918358
South bounding coordinate: 43.918358

Elevation
Minimum: 2700
Maximum: 2700
(Unit: meter)

SAMPLING DESIGN

Routine observations of phenology at HBEF began in the spring of 1989 at all watershed sites; observations at HQ began in 1993. The objective of the observations is to provide repeatable, quantified phenology data in a way that takes little time. Each location as described above (1B, 6T, etc) is a specific point along the weekly watershed rounds route which is permanently marked. Visible from each location are three dominant or codominant trees of each of the three species: sugar maple, yellow birch, and beech. These individual trees are permanently marked on

the side toward the "location" mark. When possible, their crowns are visible from the location itself to minimize the amount of moving around that is necessary.

DATA DESCRIPTION

For each tree at each location, one index value is recorded weekly during the seasonal transition periods in spring and autumn. The index value reflects the stage of leaf-out or scenescense as described in the data table below. The index is averaged for the three trees of one species at a location and this averaged value is recorded as the phenology index for a given date in the phenology database. Observations are not needed in winter or in summer unless insect attack causes premature senescence or leaffall.

REFERENCES

Hufkens, K., Richardson, A.D., Friedl, M.A., Keenan, T.F., Sonnentag, O., Bailey, A.S., and O'Keefe, J. 2012. Ecological impacts of a widespread frost event following early spring leaf out. *Global Change Biology 18:2365-2377.*

Richardson, A.D., Bailey, A.S., Denny, E.G., Martin, C.W., and O'Keefe, J. 2006. Phenology of a northern hardwood forest canopy. *Global Change Biology 12(7):1174-1188.*

DATA ACCESS GUIDELINES

Data Use Policy

The re-use of scientific data has the potential to greatly increase communication, collaboration and synthesis within and among disciplines, and thus is fostered, supported and encouraged. Permission to use this dataset is granted to the Data User free of charge subject to the following terms:

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Citation example: Holmes, R.T. 2012. Bird Abundances at Hubbard Brook (1969-2010) and on three replicate plots (1986-2000) in the White Mountain National Forest. Durham, NH. Hubbard Brook Data Archive [Database]. http://hubbardbrook.org/data/dataset.php?id=81 (23 July 2012)

4) Acknowledgment: The Data User should acknowledge any institutional support or specific funding awards referenced in the metadata accompanying this dataset in any publications where the Data Set contributed to its content. Acknowledgments should identify the supporting party, the party that received the support, and any identifying information such as grant numbers.

Acknowledgment example: Data on [topic] were provided by [name of PI] on [date]. These data were gathered as part of the Hubbard Brook Ecosystem Study (HBES). The HBES is a collaborative effort at the Hubbard Brook Experimental Forest, which is operated and maintained by the USDA Forest Service, Northern Research Station, Newtown Square, PA. Significant funding for collection of these data was provided by [agency]-[grant number], [agency]-[grant number], etc.

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CONTACT PERSON

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Data file: phn.txt
Description: Routine seasonal phenology measurement data at the Hubbard Brook LTER
Notes on Data: NOTES Index values are averaged for the three trees observed on a given day at each location. Therefore data reported here will contain values that are interpolated between the original index value recorded at time of observation. For example, if three sugar maple values are 3.0, 3.0 and 3.5, the reported value will be 3.2, even though that code is not listed below. The data is physically located at the USDA Forest Service, Durham, NH and was last updated in March 2013.

Column	Variable	Description	Units	Coded?	Missing value label
1	DATE	Sample date	YYYY-MM-DD	n	none
2	DAY	Sample day of year, Julian calendar	DDD	n	none
3	SEASON	Season when data were collected	none	y	none
4	SPECIES	Species type	none	y	none
5	1B	Trees located at the bottom of WS1	none	y	-9.0
6	6T	Trees located at the top of WS6	none	y	-9.0
7	4B	Tree located at the bottom of WS4, oldest strips	none	y	-9.0
8	4T	Trees located at the top of WS4, oldest strips	none	y	-9.0
9	5B	Trees located at the bottom of WS5	none	y	-9.0
10	5T	Trees located at the top of WS5	none	y	-9.0
11	7B	Trees located at the bottom of WS7 (or 8)	none	y	-9.0
12	7T	Trees located at the top of WS7 (or 8)	none	y	-9.0
13	HQ	Trees located near the Headquarters building	none	y	-9.0
14	CONE	Trees located at the Cone Pond site	none	y	-9.0

CODES

Variable: SEASON

Code	Description
SPRING	Spring observation
FALL	Fall observation

Variable: SPECIES

Description:	The species of tree observed

Variable: 1B - 7T, HQ and CONE (columns 5 - 14)

Code	Description
0	SEASON=FALL: All leaves have fallen except remnants on beech, winter condition
0	SEASON=SPRING: No change from winter conditions, unexpanded buds only
0.5	SEASON=FALL: Most leaves fallen
1	SEASON=FALL: No more green in canopy, half of leaves have fallen, leaves still obscure half of sky as seen through crown
1	SEASON=SPRING: Bud swelling noticeable
2	SEASON=FALL: Most leaves yellow, red or colored, few leaves have fallen, leaves still obscure most of the sky as seen through crown
2	SEASON=SPRING: Small leaves or flowers visible, initial stages of leaf expansion, leaves about 1 cm long
3	SEASON=FALL: Many leaves have noticeable reddening or yellowing, much green still present
3	SEASON=SPRING: Leaves 1/2 of final length, leaves obscure half of sky as seen through crowns
3.5	SEASON=SPRING: leaves 3/4 expanded, sky mostly obscured through crown, crowns not yet in summer condition
4	SEASON=FALL: Canopy appears in summer condition only scattered leaves or branches have any color change
4	SEASON=SPRING: Canopy appears in summer condition leaves fully expanded little sky visible through crowns

MISSING VALUE CODES

Variable	Missing Value Code	Code Explanation
1B	-9.0	Data missing
6T	-9.0	Data missing
4B	-9.0	Data missing
4T	-9.0	Data missing
5B	-9.0	Data missing
5T	-9.0	Data missing
7B	-9.0	Data missing
7T	-9.0	Data missing
HQ	-9.0	Data missing
CONE	-9.0	Data missing