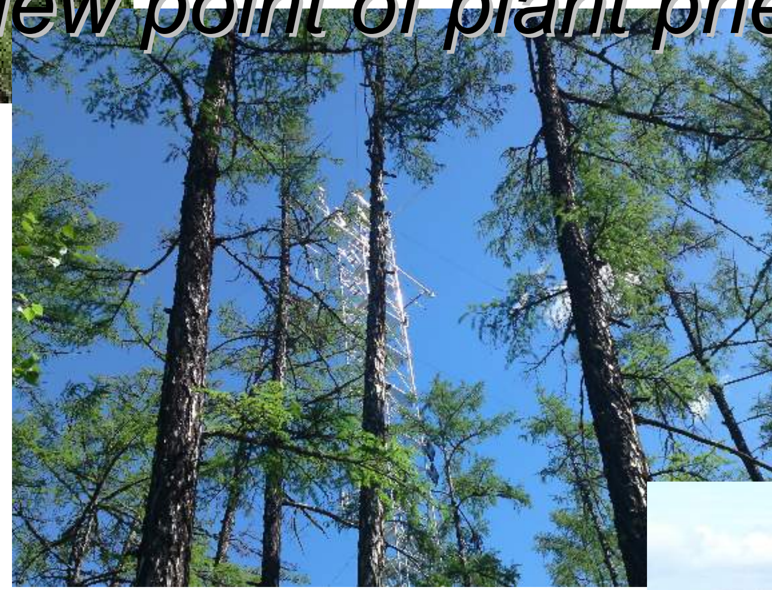
GEO APBON (19th Sep. 2017@Hanoi)

How to link multiple super sites for integration of satellite and ground observations -from the view point of plant phenology-



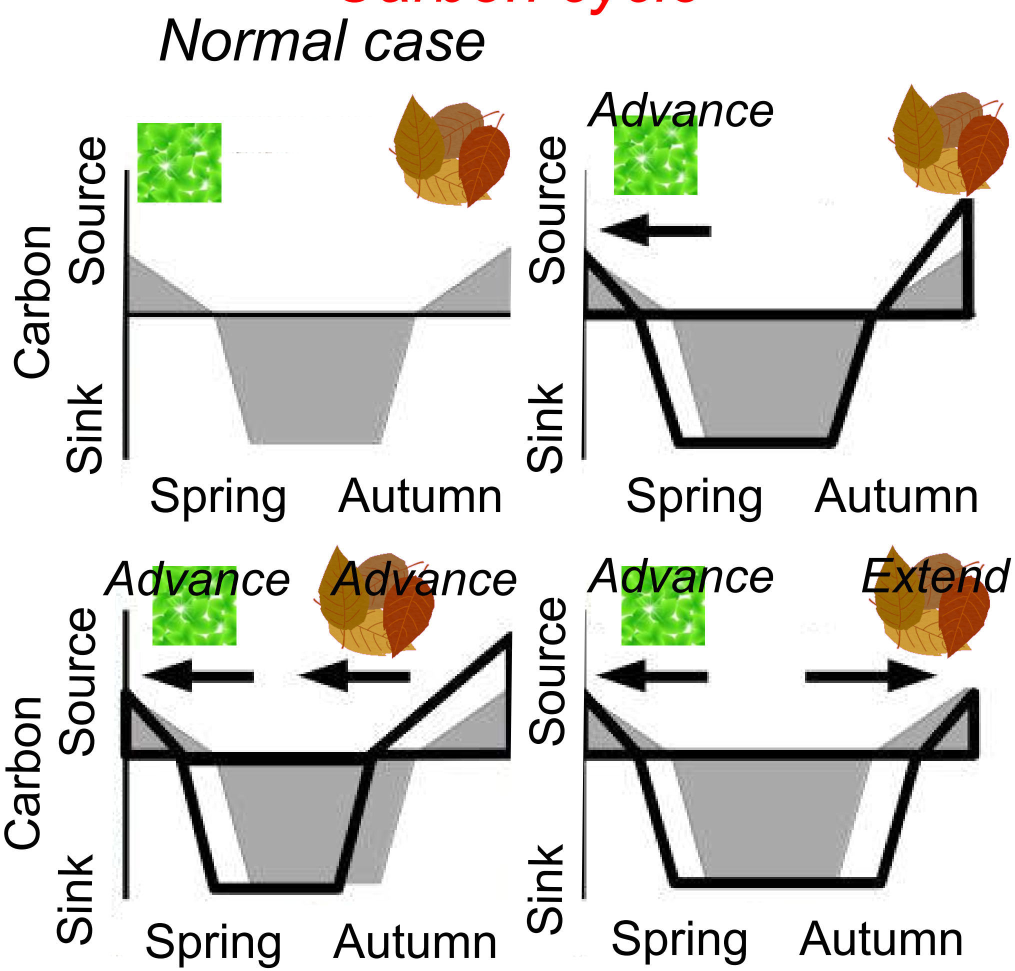
Shin Nagai

JAMSTEC 国立研究開発法人 海洋研究開発機構
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

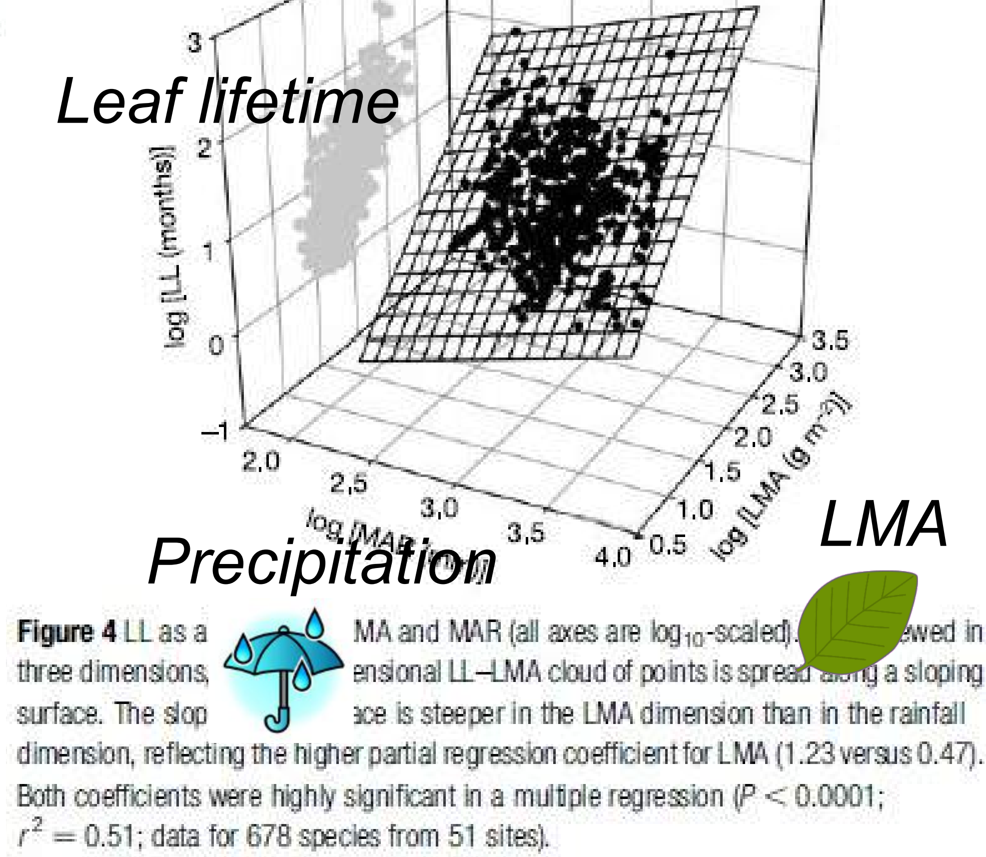
Plant phenology (e.g. timing of flowering, leaf-flush, and leaf-fall) is important to evaluate spatio-temporal variability of ecosystem functions and service under climate change.

Function of photosynthesis & Regulating services

Carbon cycle

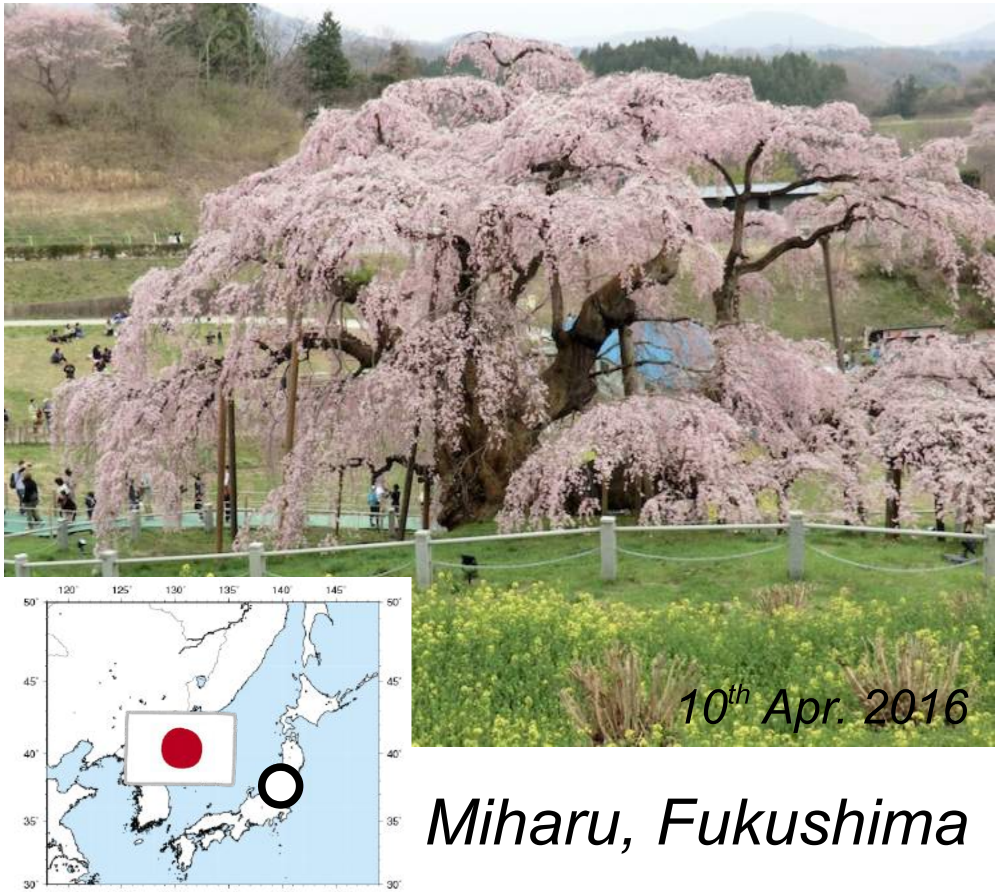


Photosynthetic capacity−leaf trait −plant phenology (leaf longevity) −climate

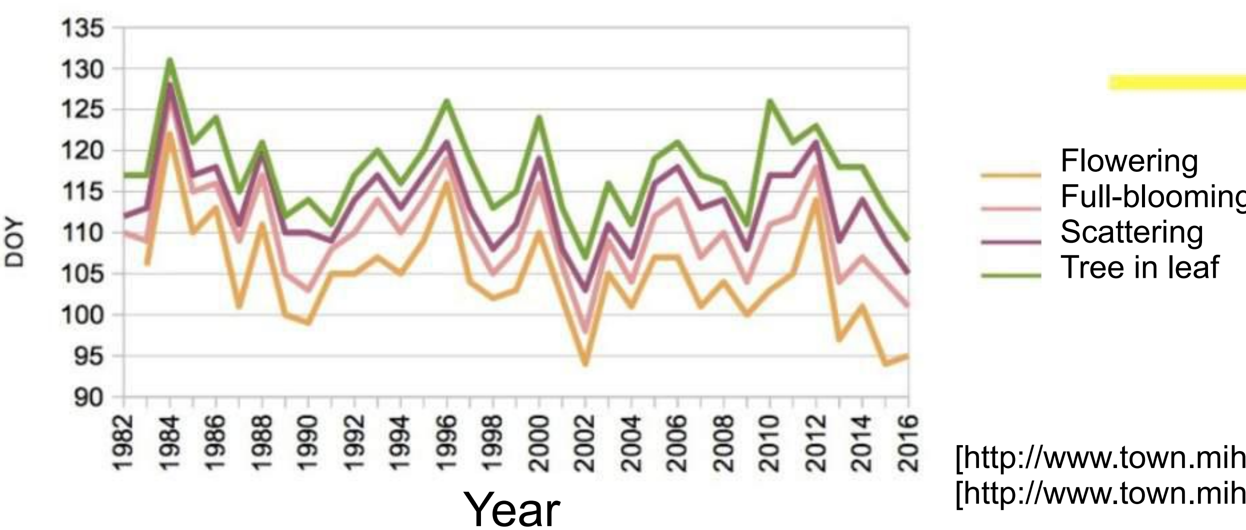


[Wright et al. 2004 Nature]

Cultural services

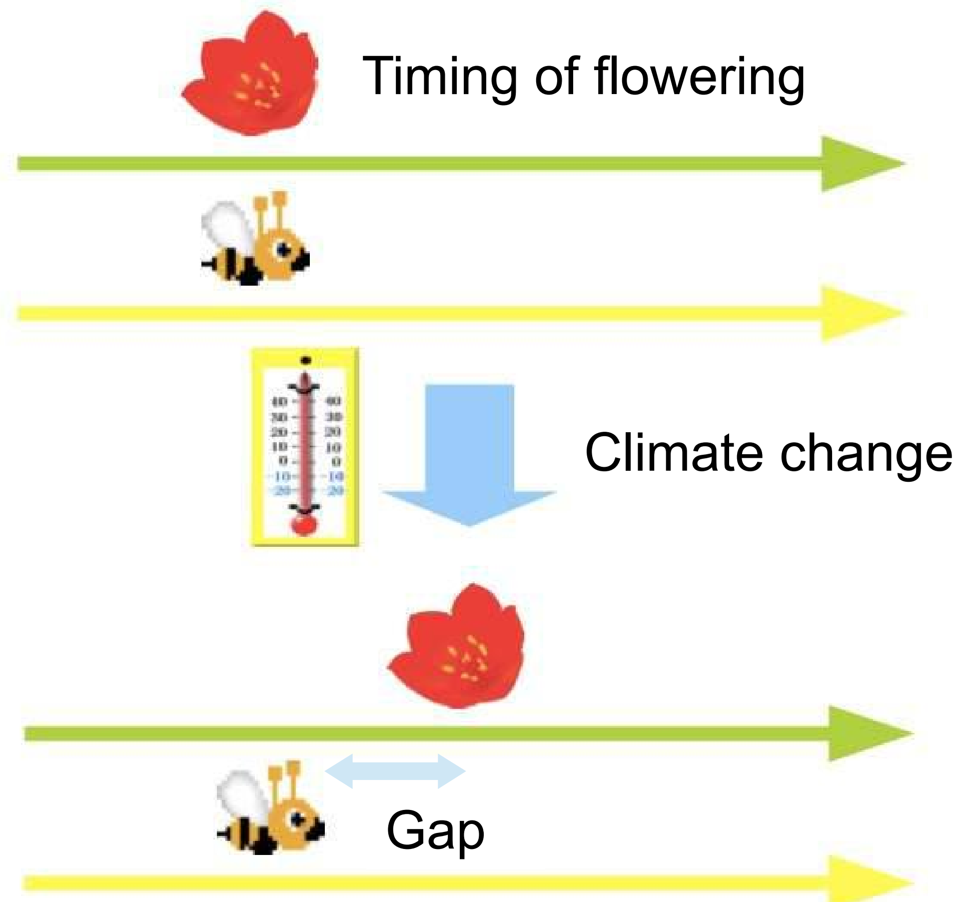


Miharu, Fukushima



Risk of lossing biodiversity

Phenological missmatch

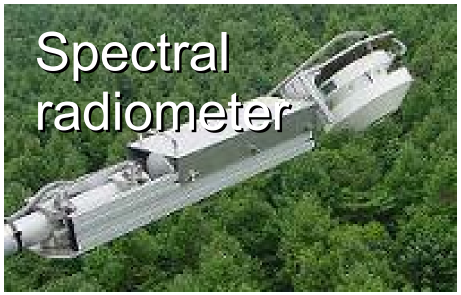


[http://www.town.miharu.fukushima.jp/soshiki/7/01takizakura-01-0201kako.html]
[http://www.town.miharu.fukushima.jp/soshiki/7/takizakura0417.html]

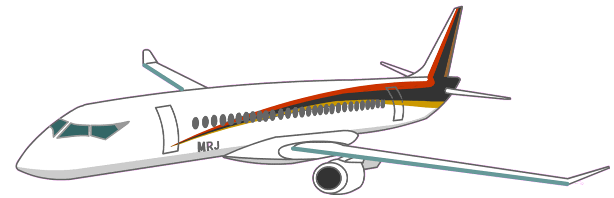
To observe spatio-temporal variability of plant phenology, remote and non-destructive sensing is very useful!!

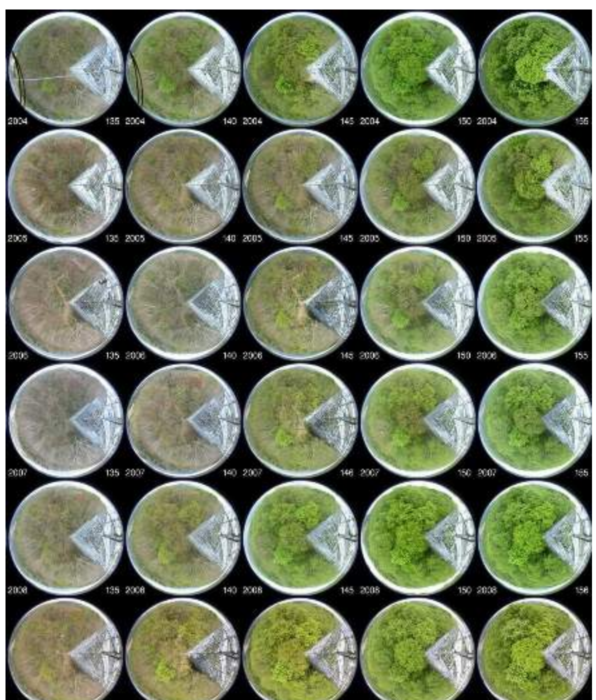
←Plot **Spatial scale** Wide area→

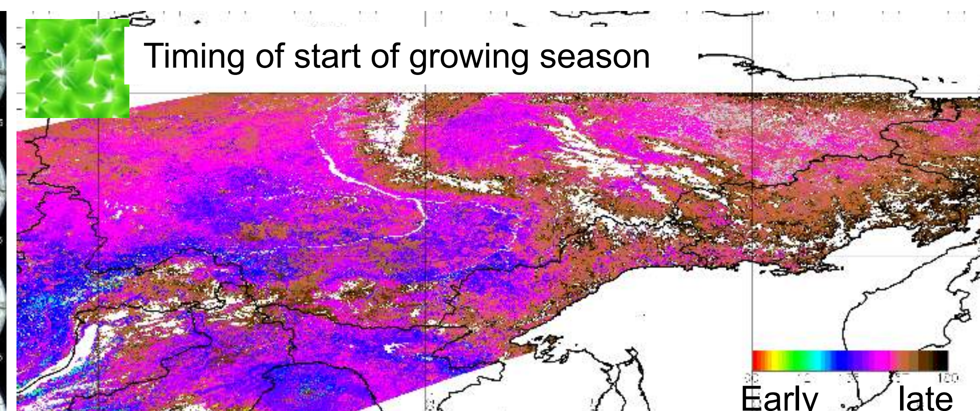
1-10m 100-1000m 1-100km global



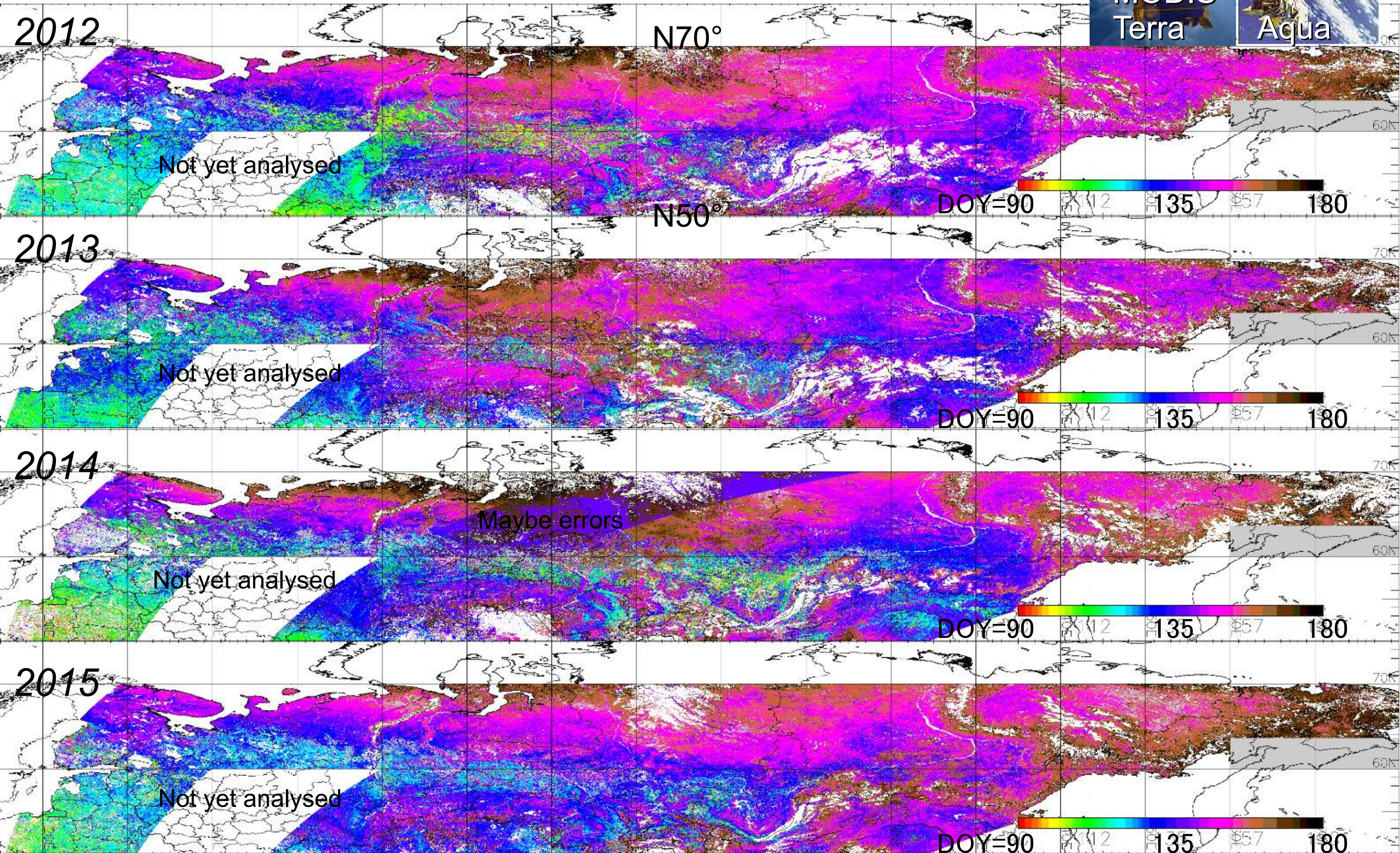
Aircraft



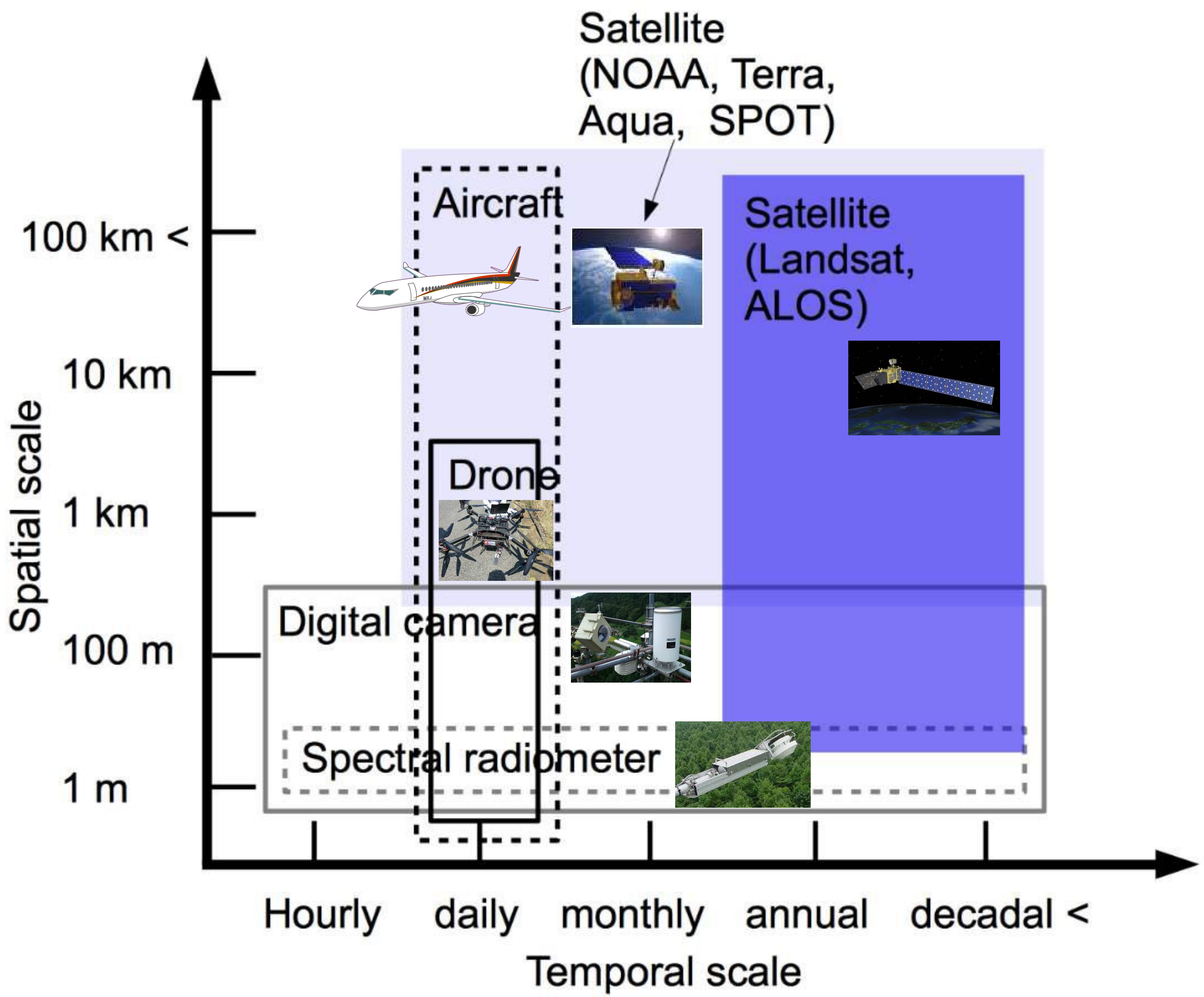




Spatio-temporal variability of the timing of start of growing season by analysing MODIS/Terra&Aqua-observed daily GRVI (500m res.)



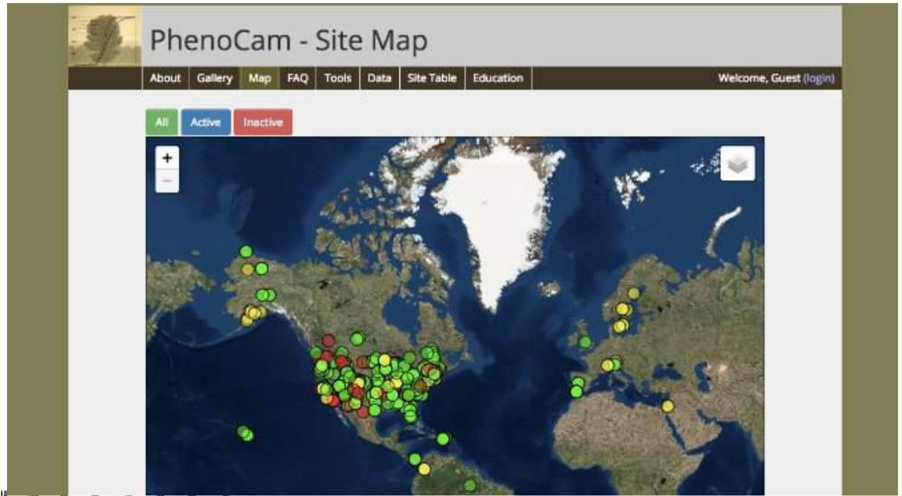
Unavoidable important issue: spatial and temporal gaps among multiple sensonrs mounted on multiple platforms.



[Nagai et al., submitted]

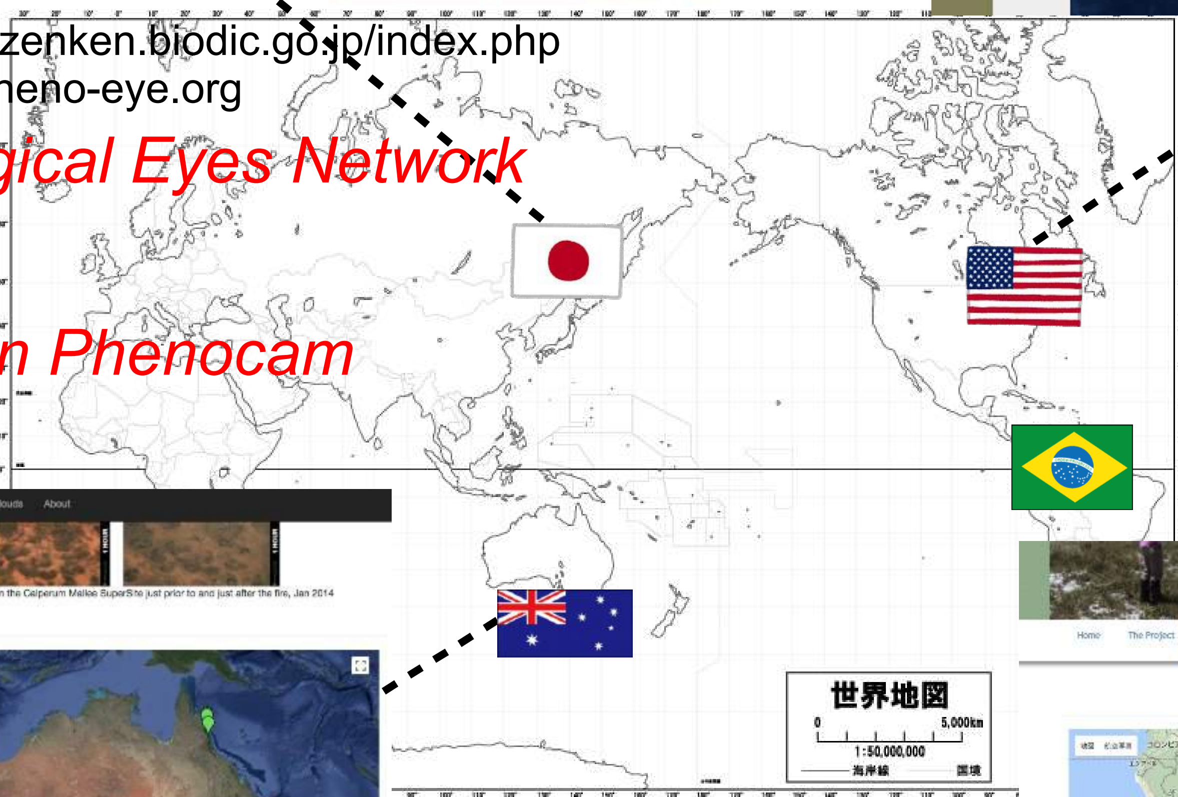
Global phenology observation networks by using time-lapse cameras

Web Camera Images of National Parks and Wildlife in Japan



http://www.sizenken.biodic.go.jp/index.php
http://www.pheno-eye.org

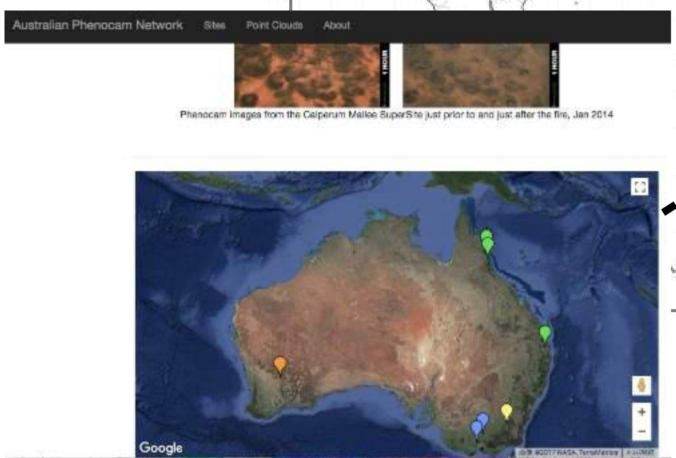
Phenological Eyes Network



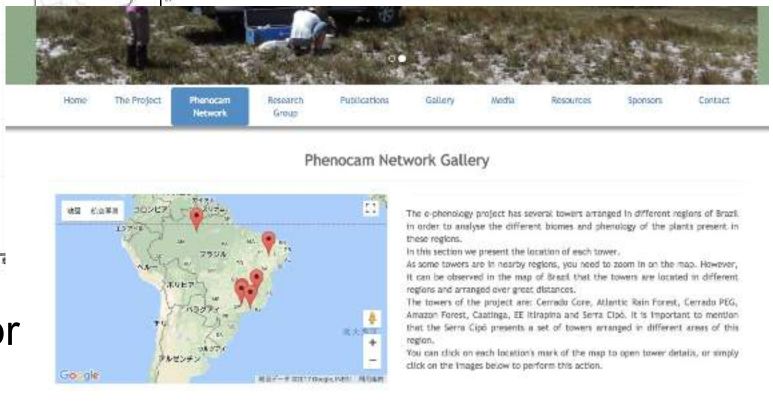
https://phenocam.sr.unh.edu/webcam/

PhenoCam

Australian Phenocam Network

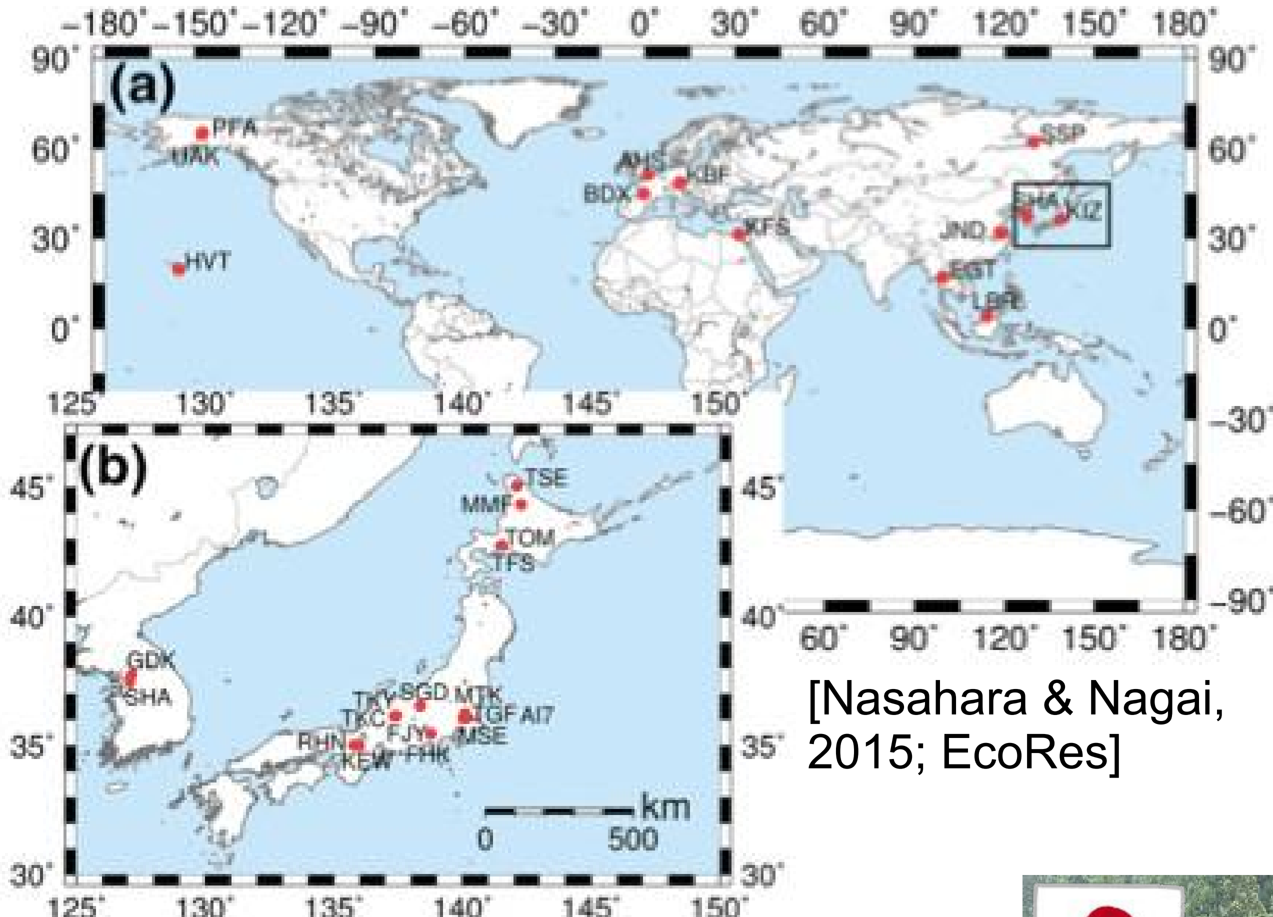


e-phenology

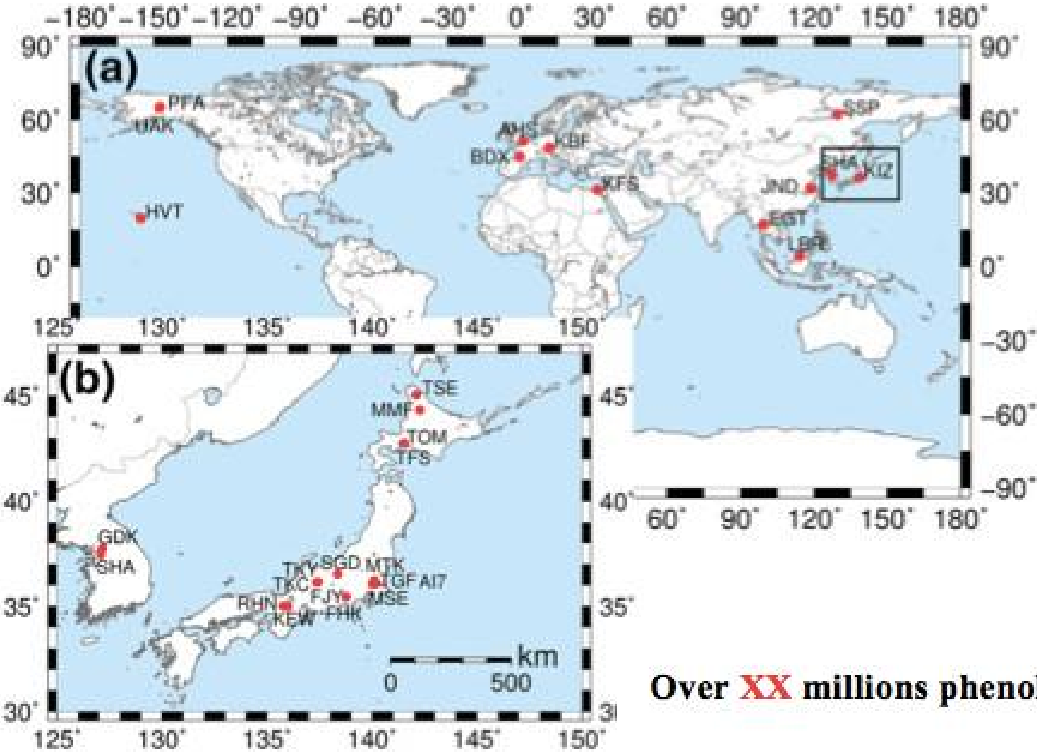


←https://phenocam.org.au/
→http://www.recod.ic.unicamp.br/ephenology/client/index.html#/

PEN (Phenological Eyes Network) (http://www.pheno-eye.org)



[Nasahara & Nagai, 2015; EcoRes]



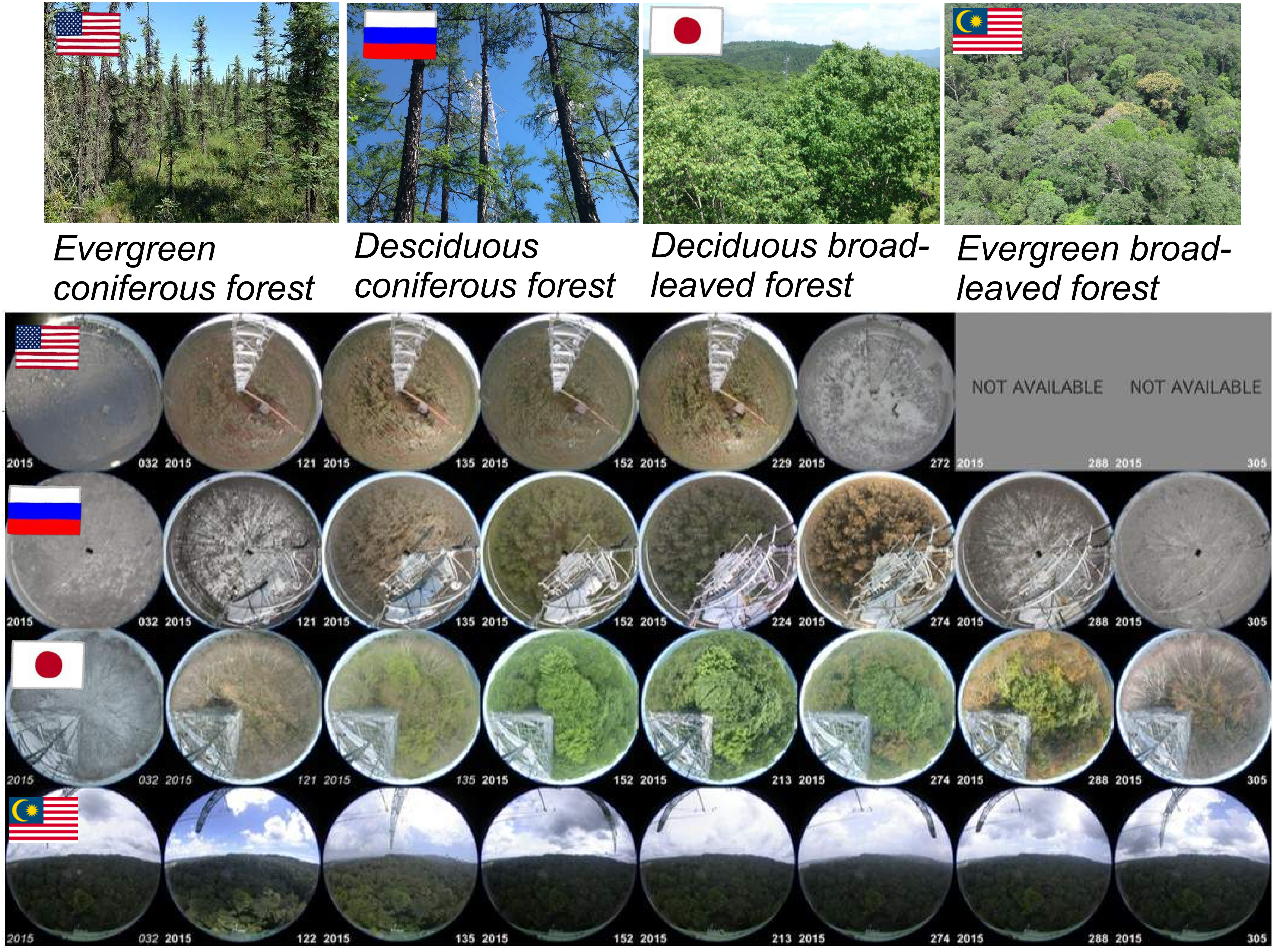
Now, we are preparing data paper of phenology and sky images in 28 sites.

Will be submitted to Ecorogical Research

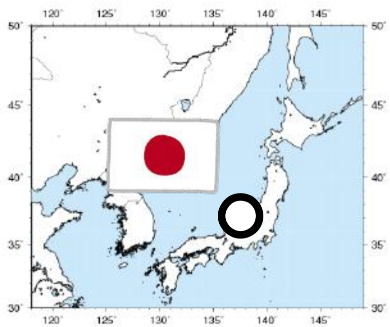
Over XX millions phenology and sky images in 28 various ecosystem sites ranging from

Arctic to tropic regions: the Phenological Eyes Network

Shin Nagai[1], Tomoko Akitsu[2], Taku M Saitoh[3], Robert C Busey[4], Karibu Fukuzawa[5], Yoshiaki Honda[6], Tomoaki Ichie[7], Reiko Ide[8], Hiroki Ikawa[9], Akira Iwasaki[10], Koki Iwao[11], Koji Kajiwara[6], Sinkyu Kang[12], Yongwon Kim[4], Kho Lip Khoon[13], Alexander V Kononov[14], Yoshiko Kosugi[15], Takahisa Maeda[16], Masayuki Matsuoka[7], Trofim C Maximov[14], Annette Menzel[17&18], Tomoaki Miura[19], Toshie Mizunuma[20], Tomoki Morozumi[21], Takeshi Motohka[22], Hiroyuki Muraoka[3], Hirohiko Nagano[4], Taro Nakai[23], Tasuro Nakaji[24], Hiroyuki Oguma[8], Takeshi Ohta[25], Keisuke Ono[9], Petrov E Roman[14], Runi Anak Sylvester Pungga[26], Christian Schunk[17], Seikoh Sekikawa[27], Yowhan Son[28], Atsuko Sugimoto[29], Rikie Suzuki[1], Kentaro Takagi[30], Satoru Takanashi[31], Shunsuke Tei[29], Satoshi Tsuchida[11], Hirokazu Yamamoto[11], Eri Yamasaki[32], Megumi Yamashita[33], Tae Kyung Yoon[34], Mitsunori Yoshimura[35], Shinpei Yoshitake[3], Matthew Wilkinson[36], Lisa Wingate[37], Kenlo Nishida Nasahara[2]


Evergreen coniferous forest
Desciduous coniferous forest
Deciduous broad-leaved forest
Evergreen broad-leaved forest
NOT AVAILABLE
NOT AVAILABLE

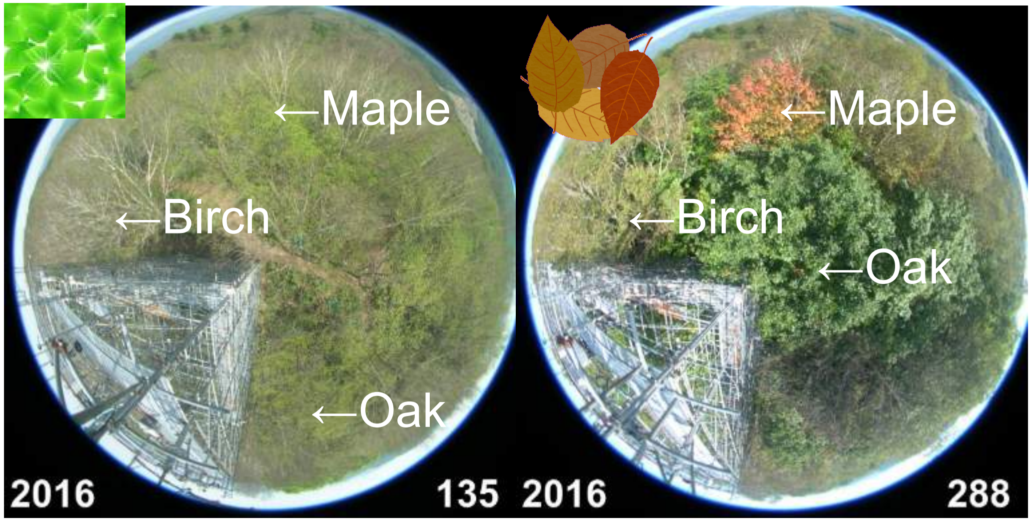
Year-to-year variability of the timing of leaf-flush and leaf-fall for various tree species

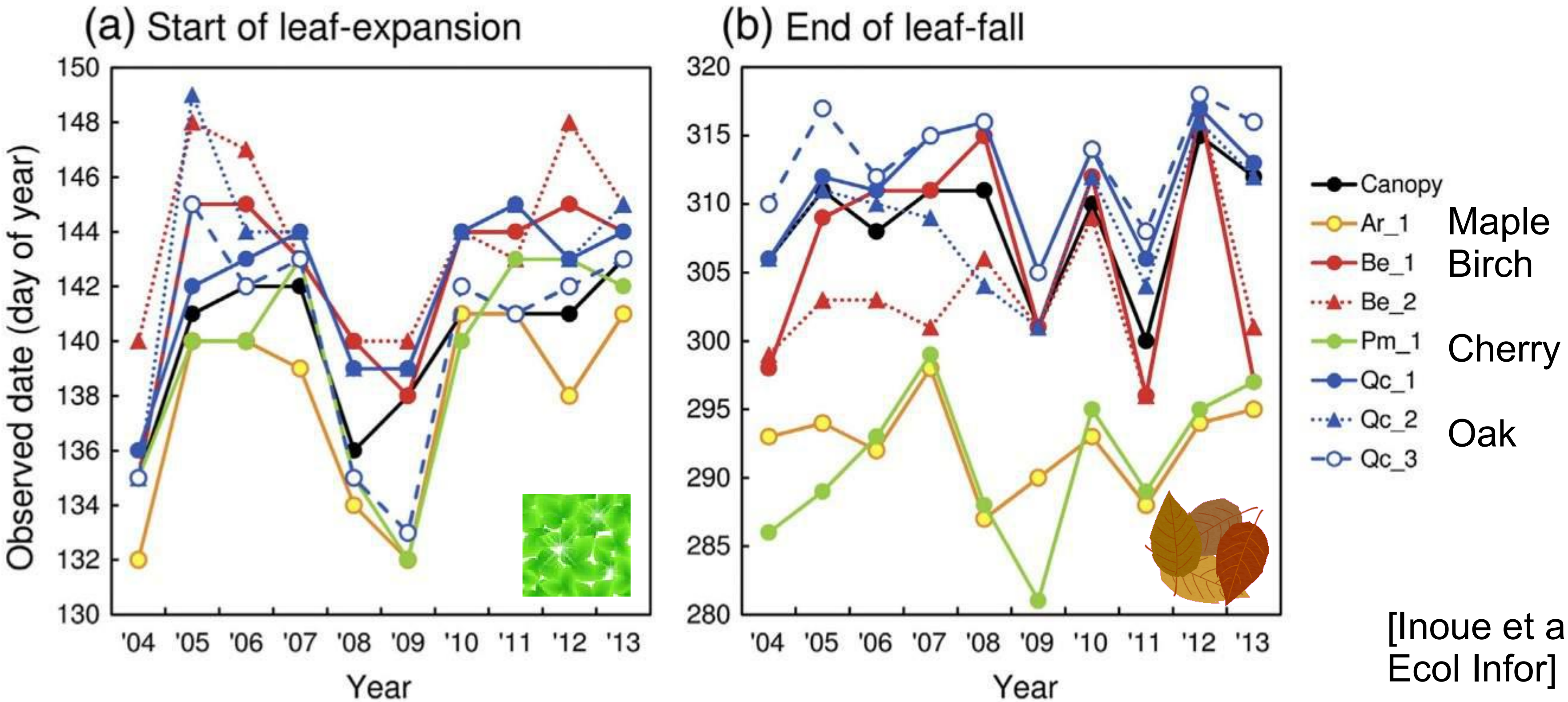


Takayama site

Dominant species
  Overstorey: birch, oak
  Understorey: maple

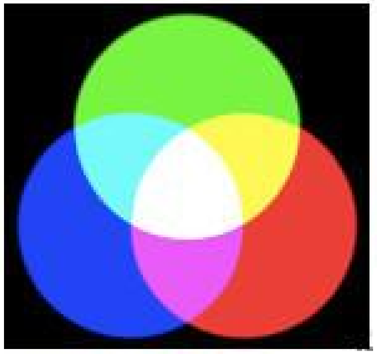
Leaf longevity (leafy period) is important!!





[Inoue et al. 2014, Ecol Infor]

Detection of characteristics of tree phenology in a tropical rain forest, Borneo by using the red, green, and blue digital numbers



By Wikipedia

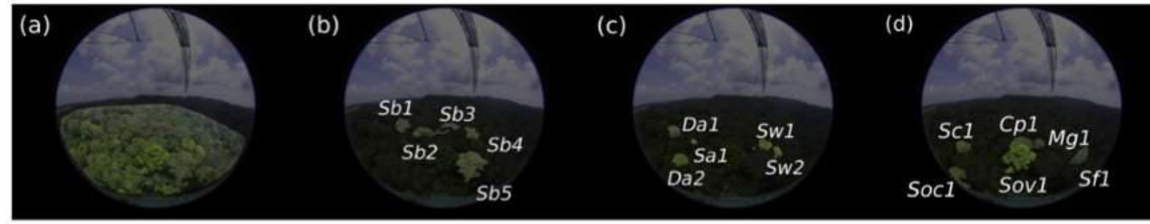
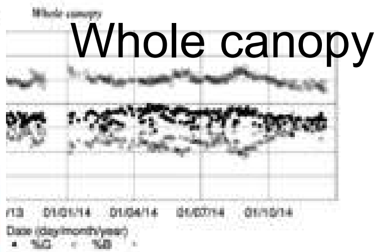


Fig. 1. Photographs of the canopy areas (highlighted) that were analyzed for the %RGB, HSL (hue, saturation, and lightness), and GEI values (see text for explanations). (a) Whole canopy; (b) five *Shorea beccariana* trees (*Sb1–Sb5*); (c) two *Dryobalanops aromatica* (*Da1* and *Da2*), one *Swintonia acuta* (*Sa1*), and two *Swintonia* sp. (*Sw1* and *Sw2*); (d) one *Shorea* sp. cf. *ovata* (*Sov1*), one *Shorea ochracea* (*Soc1*), one *Swintonia foxworthyi* (*Sf1*), one *Shorea curtisii* (*Sc1*), one *Ctenolophon parvifolius* (*Cp1*), and one *Myristica gigantea* (*Mg1*).



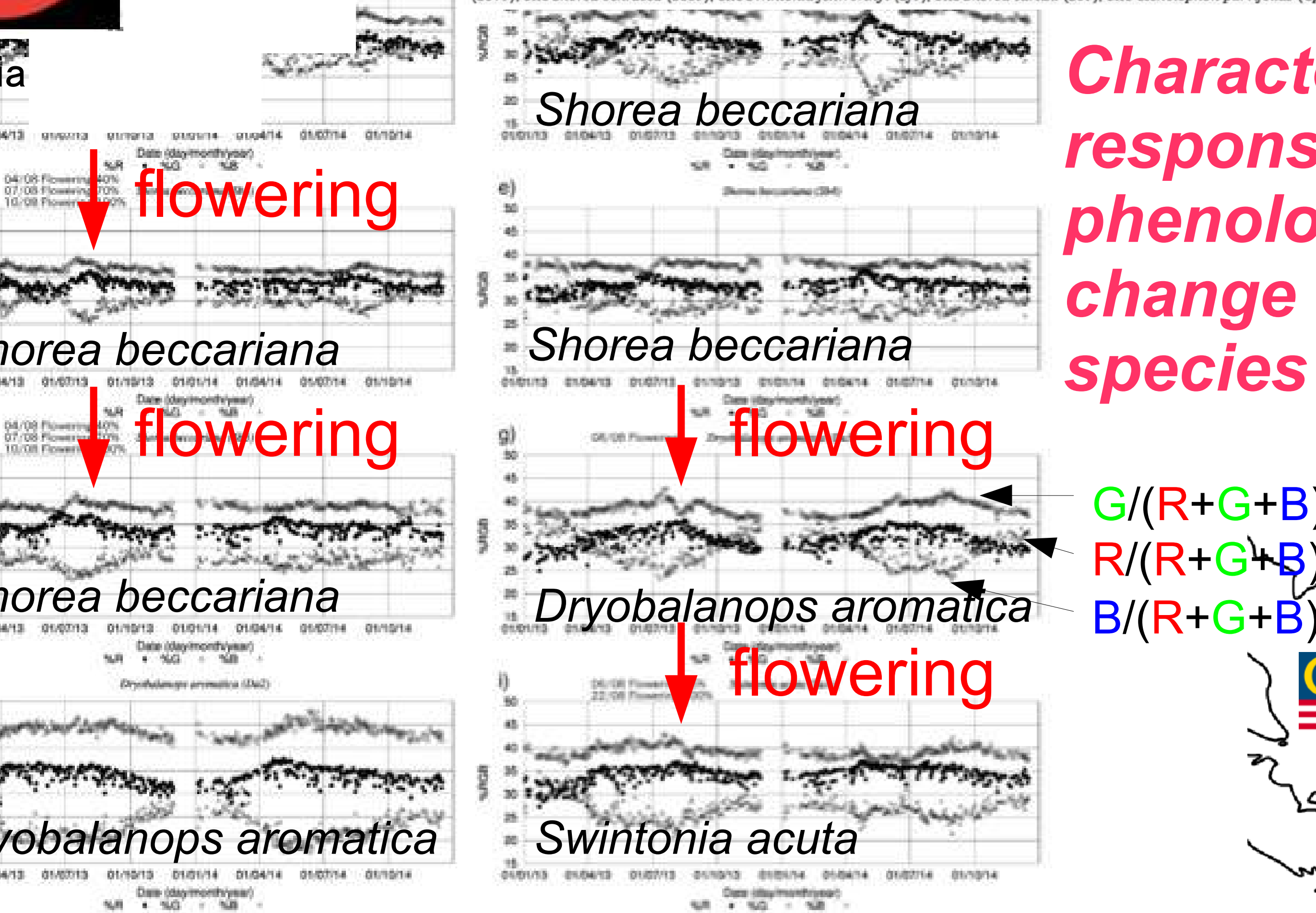
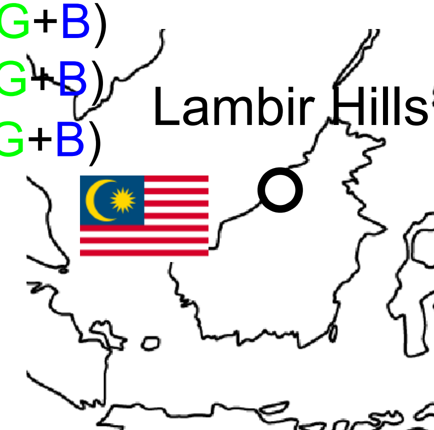


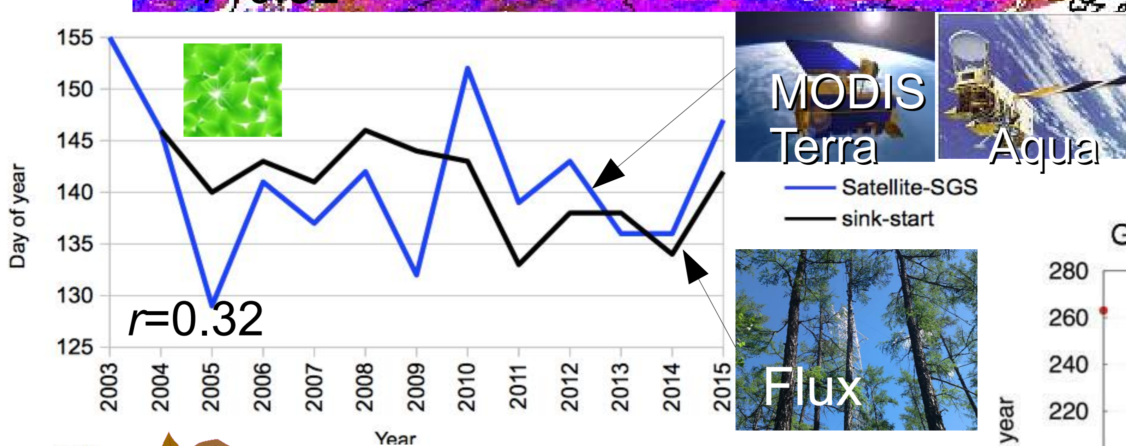
Fig. 4. Temporal patterns in %R, %G, and %B based on DN_{RGB} values extracted from phenological images (after exclusion of low-visibility images) of (a) the whole canopy and (b–q) individual trees of each species. During late July 2013 and late August 2013, trees *Sb3*, *Sb5*, *Da1*, *Sa1*, *Sw1*, and *Sw2* flowered. Dates of the flowering phenology of these individuals are shown at the top of the graphs (T. Itioka et al., unpublished data). The flowering of *Da1* was confirmed from a photograph taken on 8 August 2013 (Yayoi Takeuchi, NIES, unpublished data).

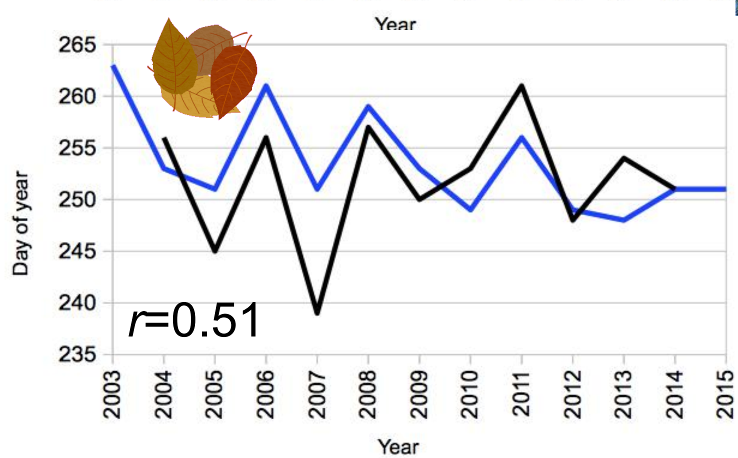
Characteristic of responsiveness of phenology to climate change among species is important!!



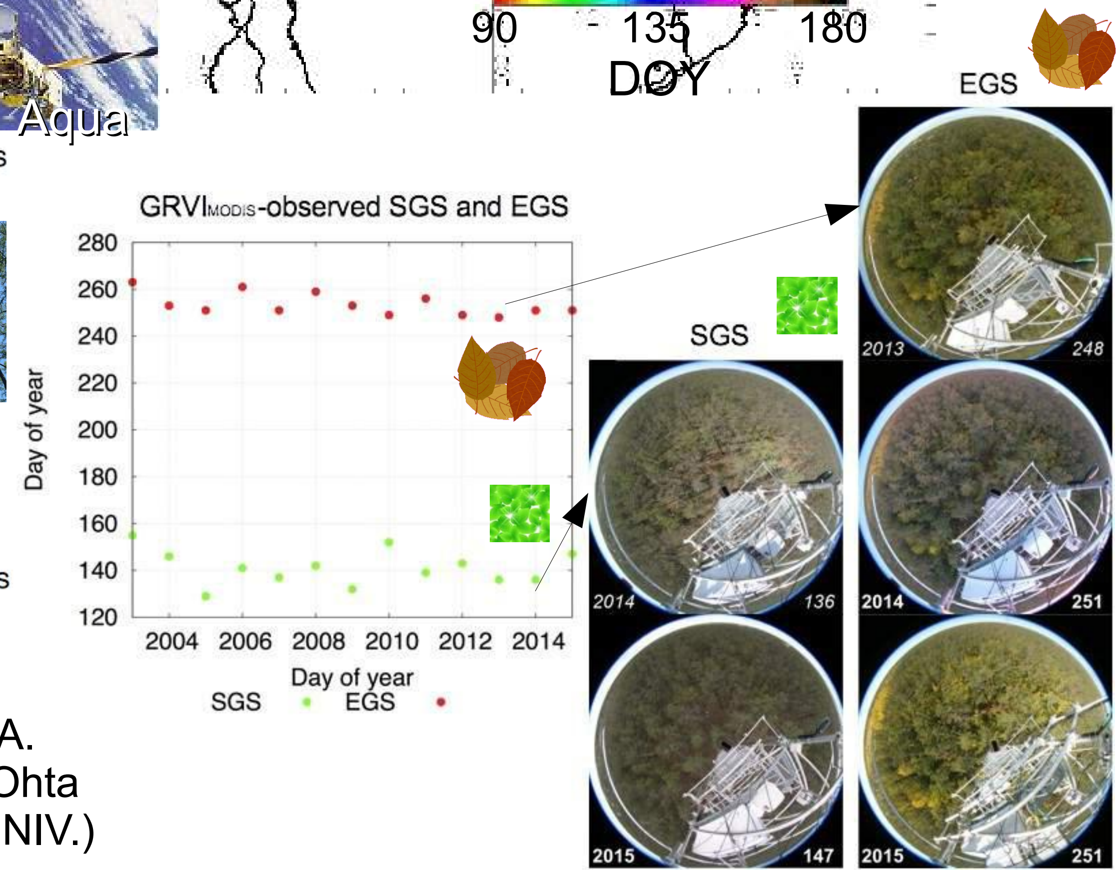
[Nagai et al. 2016 Ecol Infor]

Validation of satellite-based timing of start (SGS) and end of growing season (EGS) (res.: 500 m) in Eastern Siberia

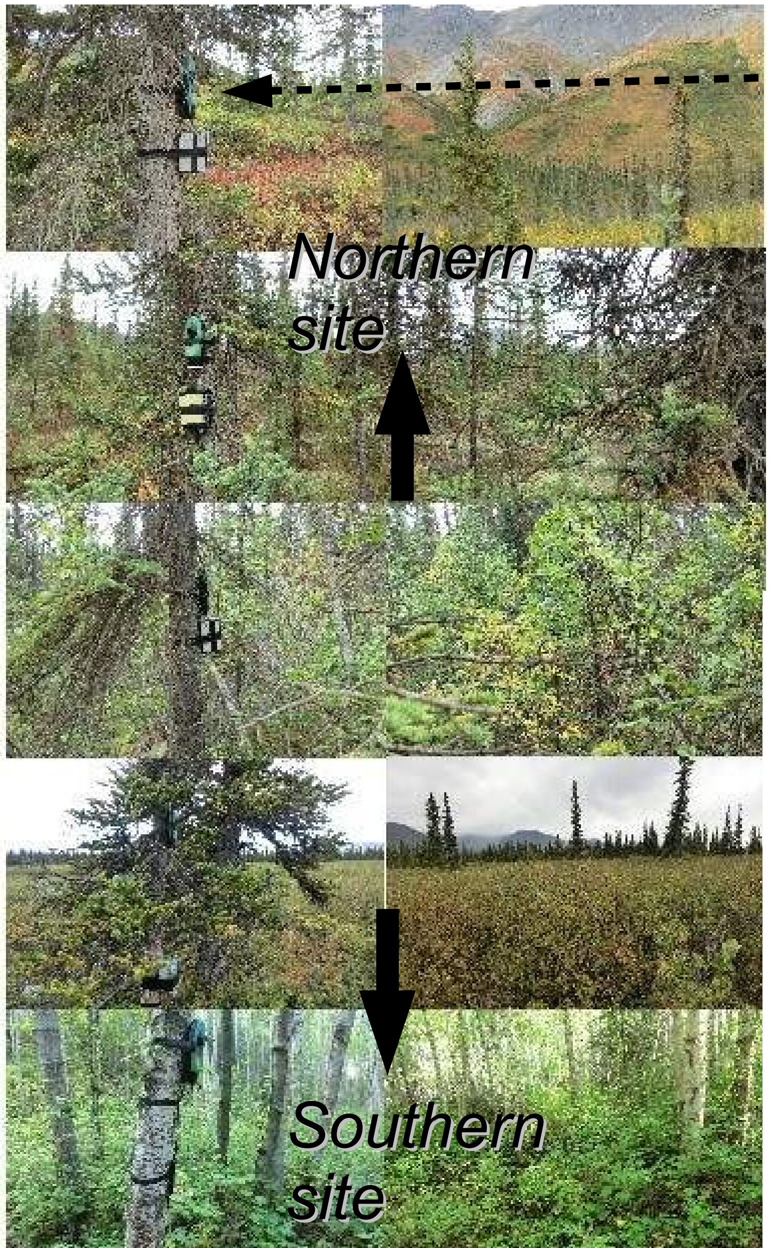




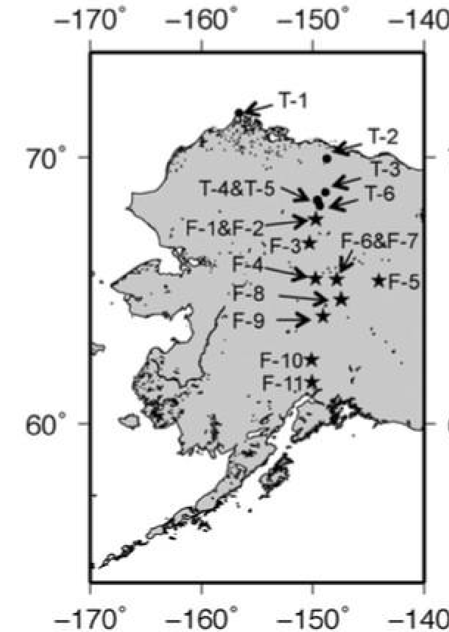
Flux data: A. Kotani, T. Ohta (Nagoya UNIV.)



Multiple time-lapse digital camera sites along latitudinal gradient for validation of satellite-based growing season



GardenWatchCam (Brinno)



Geographical distribution of the time-lapse camera locations. Black circles are … sites and the stars are forest sites. Full site names are provided in Table 1. Some … images for individual sites are provided in the supplemental figure.

Satellite: Terra MODIS 8-day & SPOT-VEGETATION 10-day NDVI

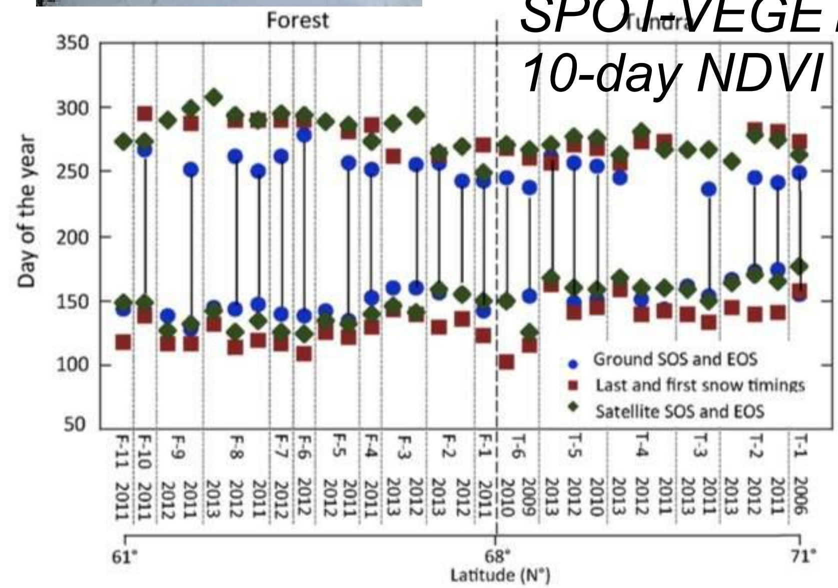
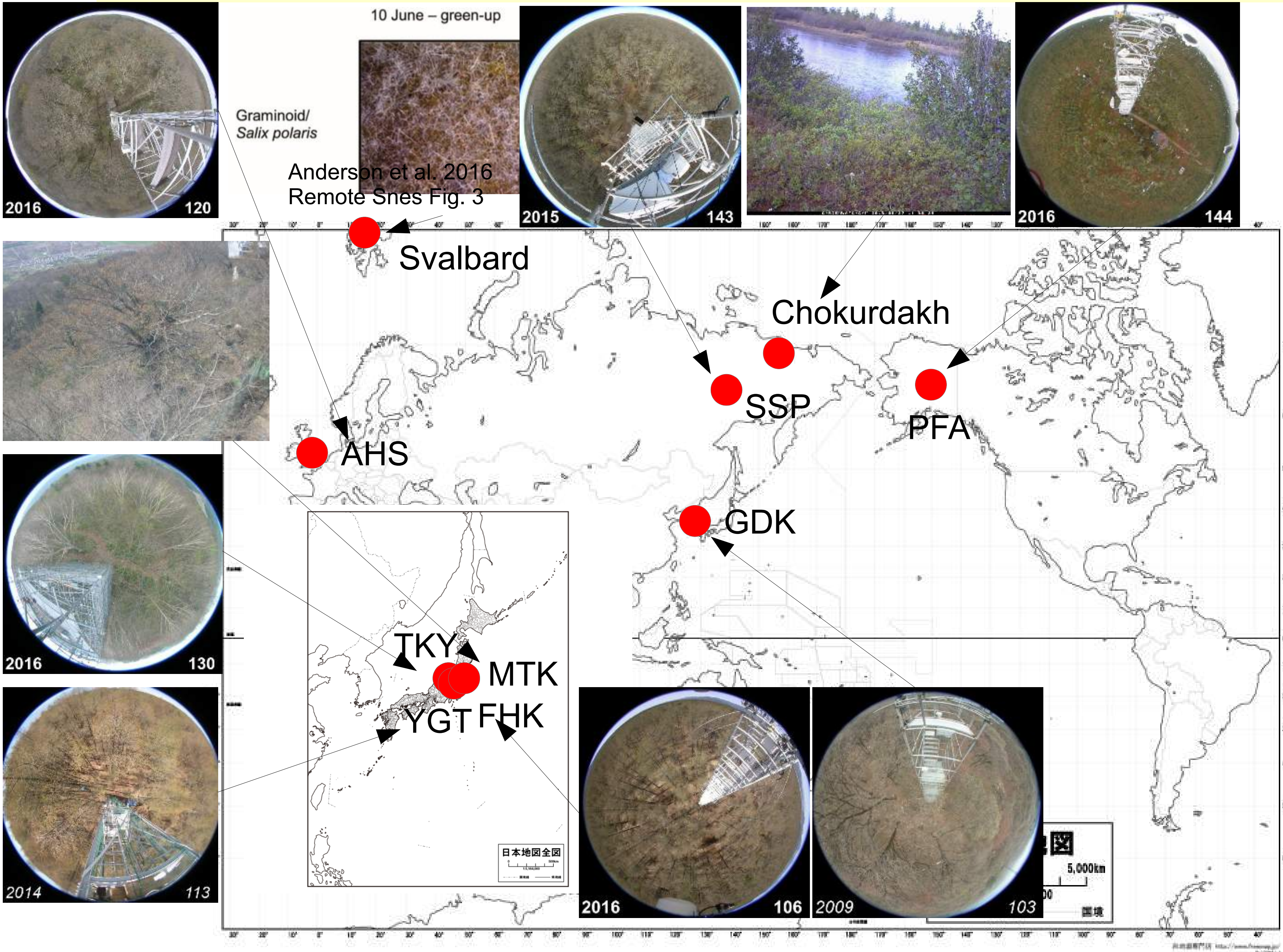


Fig. 4. Summary of the satellite-derived SOS and EOS (green diamond), the last (spring) and first (autumn) snow timings (red rectangle), and the ground-based SOS and EOS (blue circle). The black bars indicate the growing season determined by the ground-based time-lapse cameras. The satellite-derived SOSs and EOSs were the average of all methods derived from two satellite datasets (SPOT-VEGETATION and Terra-MODIS).

[Kobayashi et al. 2016, RSE]

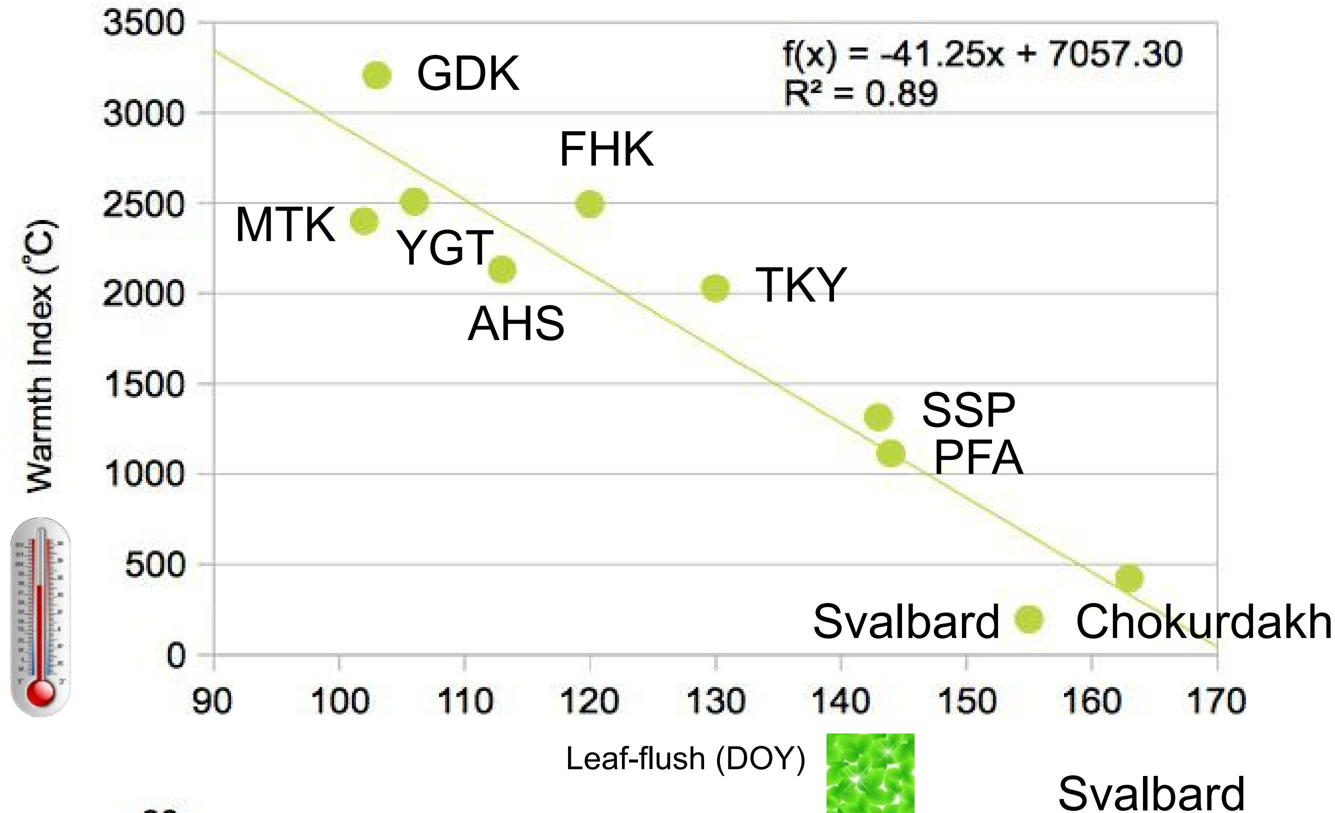
Examination of spatial characterisitc of the timing of leaf-flush along latitudinal gradient by using phenology images



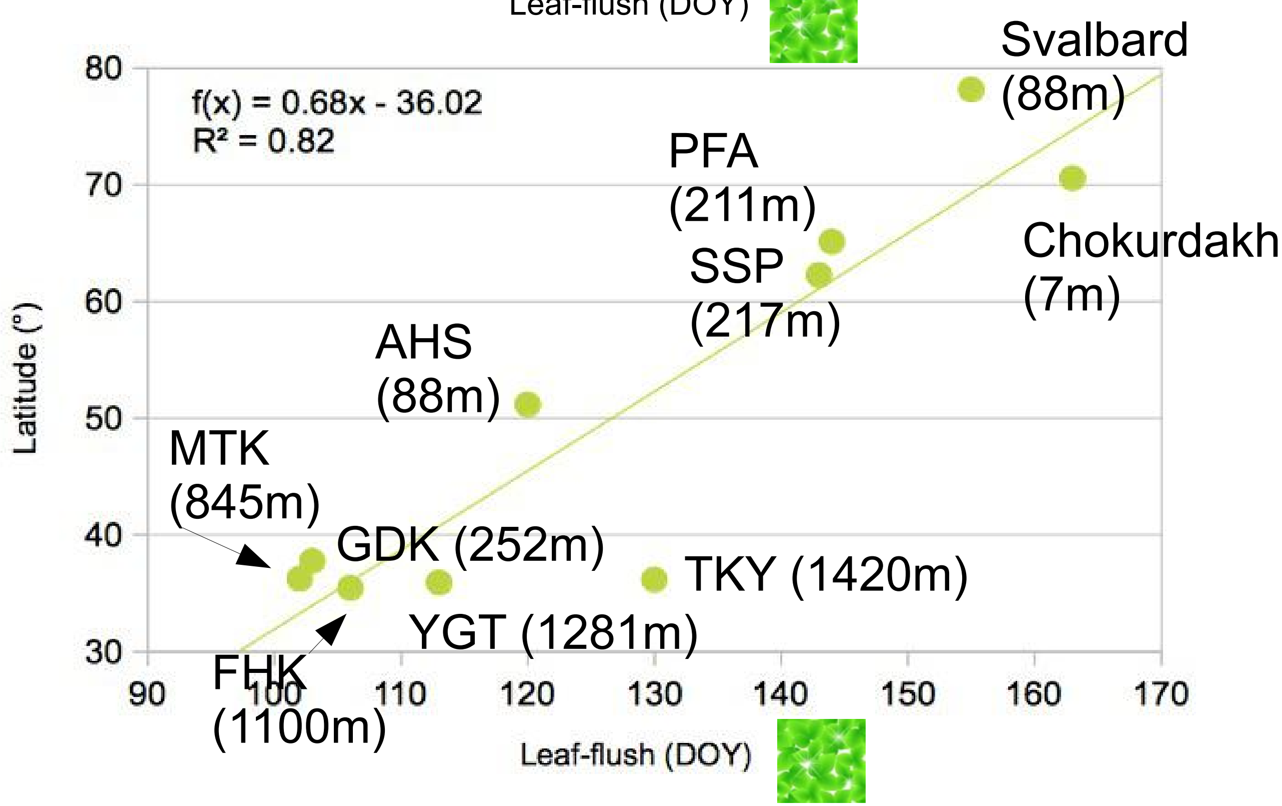
Warmth index−leaf-flush relationship*

*Sum of over 5℃ in daily mean air temperature until leaf-flush

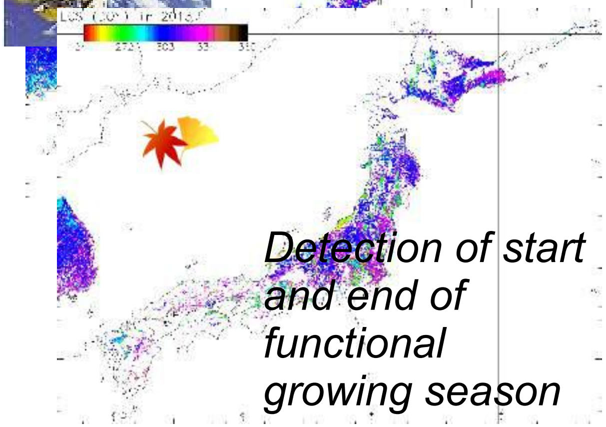
$$WI = \sum_{t=1}^{D_{SGS}} \max(Temp_t - 5, 0)$$



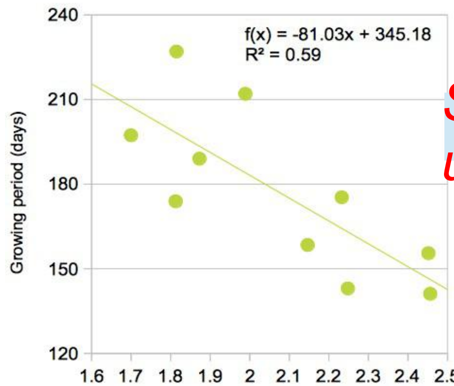
Latitude−altitude−leaf-flush relationship



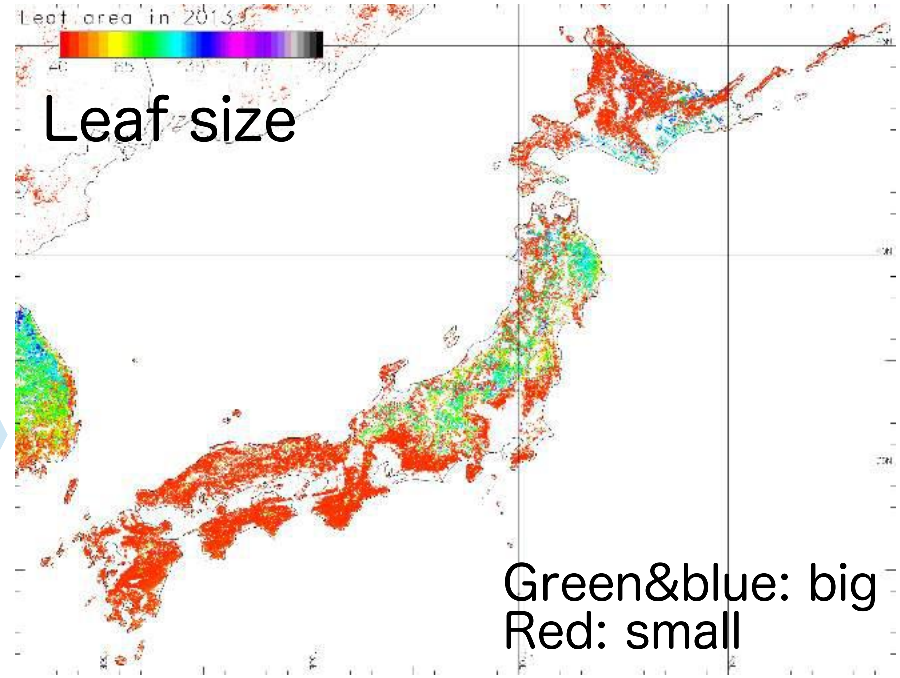
Evaluation of spatial distribution of leaf traits by analysing satellite-observed functional growing period

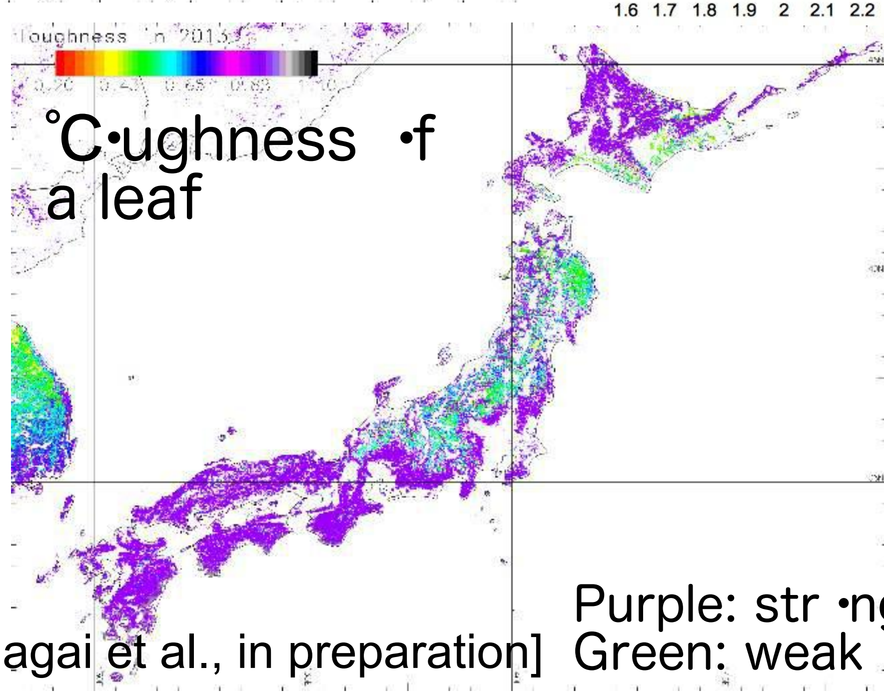


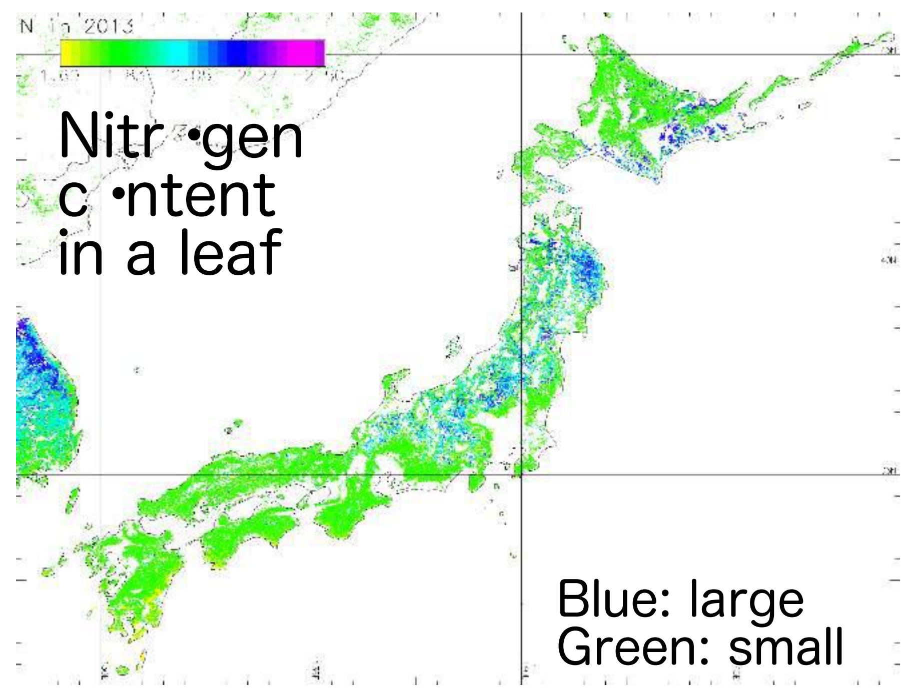
Examination of the relationship between in situ-observed leaf trait and satellite-based functional growing period



Scale up!

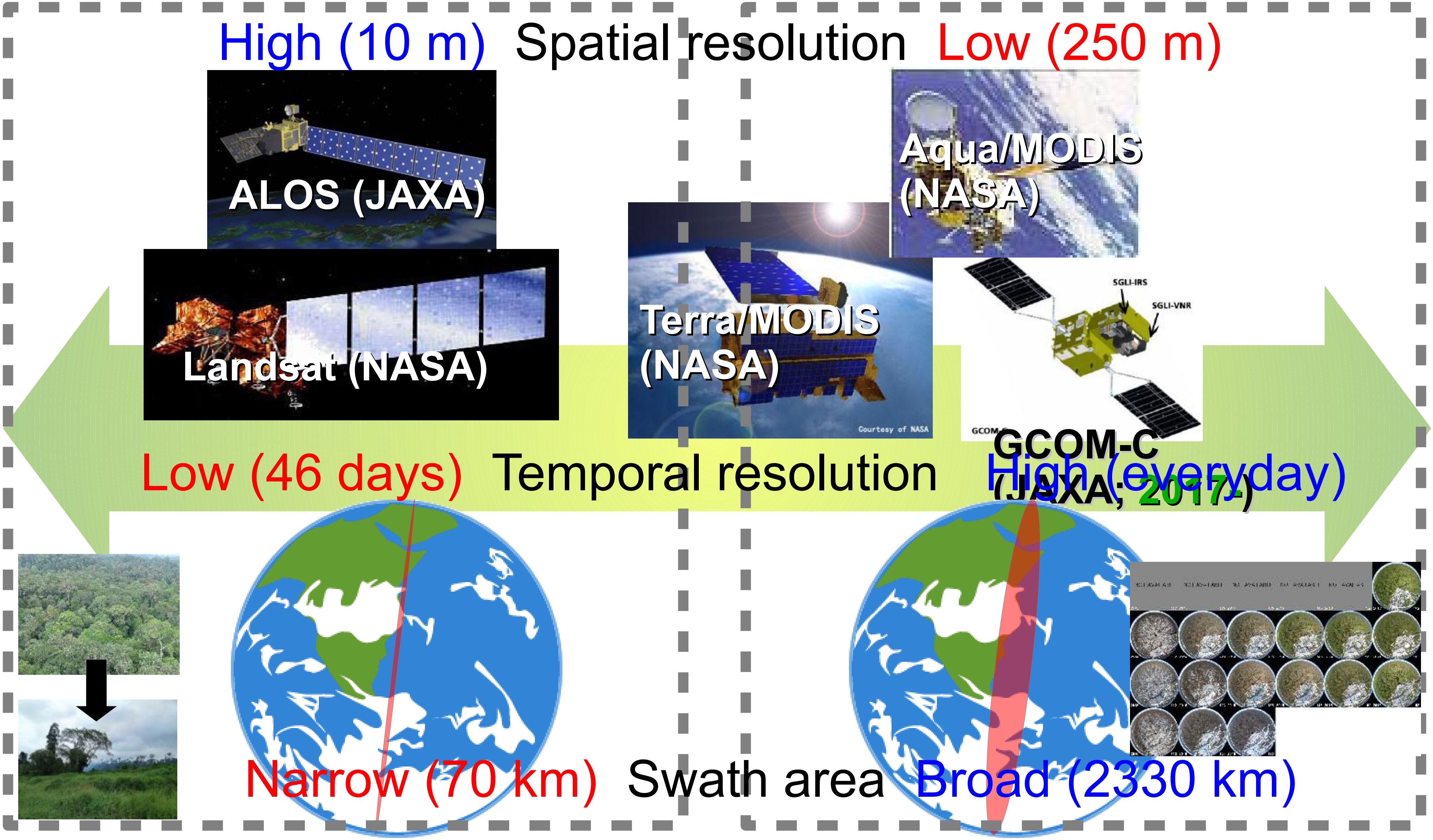






[Nagai et al., in preparation]

We never simaltaneously observe high spatial, high temporal, and multi spectral data.



Aboveground biomass
Plant functional type (land cover change)

Growing season duration

PLOS | BIOLOGY

Languages Are Still a Major Barrier to Global Science

Tatsuya Amano , Juan P. González-Varo, William J. Sutherland

Published: December 29, 2016 • https://doi.org/10.1371/journal.pbio.2000933

Abstract

While it is recognized that language can pose a barrier to the transfer of scientific knowledge, the convergence on English as the global language of science may suggest that this problem has been resolved. However, our survey searching Google Scholar in 16 languages revealed that 35.6% of 75,513 scientific documents on biodiversity conservation published in 2014 were not in English. Ignoring such non-English knowledge can cause biases in our understanding of study systems. Furthermore, as publication in English has become prevalent, scientific knowledge is often unavailable in local languages. This hinders its use by field practitioners and policy makers for local environmental issues; 54% of protected area directors in Spain identified languages as a barrier. We urge scientific communities to make a more concerted effort to tackle this problem and propose potential approaches both for compiling non-English scientific knowledge effectively and for enhancing the multilingualization of new and existing knowledge available only in English for the users of such knowledge.

Citation: Amano T, González-Varo JP, Sutherland WJ (2016) Languages Are Still a Major Barrier to Global Science. PLoS Biol 14(12): e2000933. https://doi.org/10.1371/journal.pbio.2000933

Published: December 29, 2016

[Amano et al. 2016]

"We should publicize Japanese language phenological data in the international research literature so that the data will be more accessible to the international research community."

[Nagai et al. 2016; Int J Biometeorol]

Thank you for your attention and supports!

- Global Change Observation Mission (GCOM; PI#117) of the JAXA
- Belmont Forum (COPERA)
- ArCS (MEXT)
- RBRC, Gifu University