地球観測連携拠点（温暖化分野）平成25年度ワークショップ
「陸域における炭素循環及び生態系・生物多様性観測の最近の動向」

生物多様性ー生態系機能観測ネットワークの現状

日浦勉（北大苫小牧研究林）

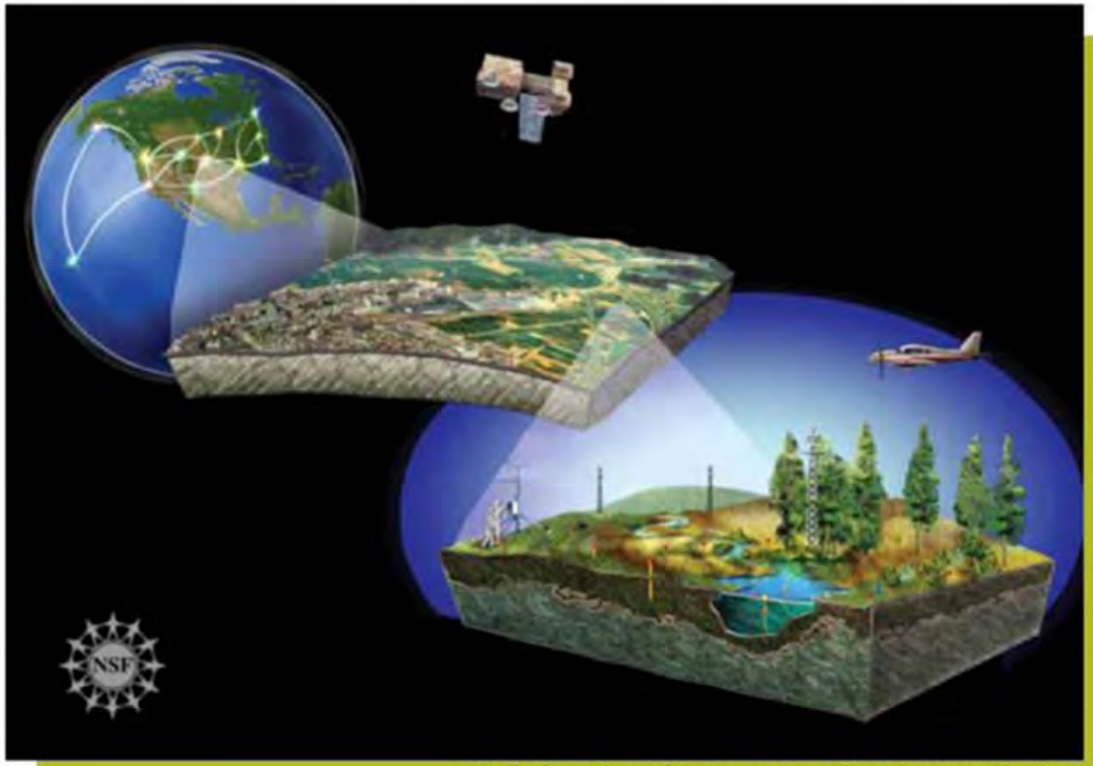

2008
JaLTERの可能性:
陸域炭素循環観測と生態系観測の連携
2010
長い目で見る、広い目で見る:
森林生態系モニタリングから分かること
環境省　技術開発推進費（H19-20, H21-23）
環境省　戦略推進費S-9-3（H23-27）
環境省　モニタリングサイト1000（H16-）
文科省　基盤研究(A)（H21-23）
文科省　基盤研究(B)（H19-20, H25-27）
文科省　挑戦的萌芽（H19-20, H25-26）
文科省　GRENE（H23-27）
文科省　GBIF（H20-22）
（H20以降の代表または機関代表のみ）

本日の話題

- 海外の生物多様性−生態系機能観測ネットワーク事例
- 最近5年間の日本のネットワークの進展
- ネットワークの5年間の成果
- 苫小牧における温暖化操作実験の5年間の成果

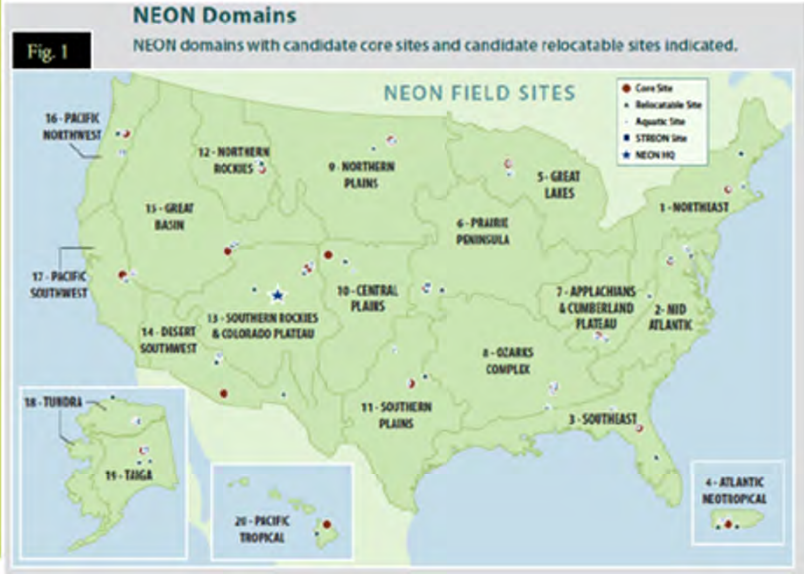
neon™ | THE NATIONAL ECOLOGICAL OBSERVATORY NETWORK

A Continental-Scale Observation System for Examining Critical Ecological Issues



* Modified from the image of Nicolle Rager Fuller, National Science Foundation, 2007.

年間1000億円で運営



DataONE

Data Observation Network for Earth

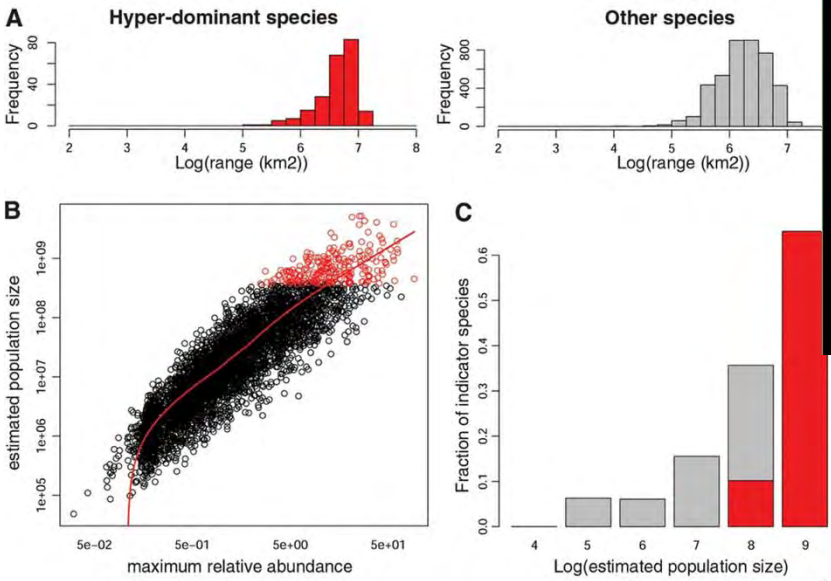
Search ONEMercury For

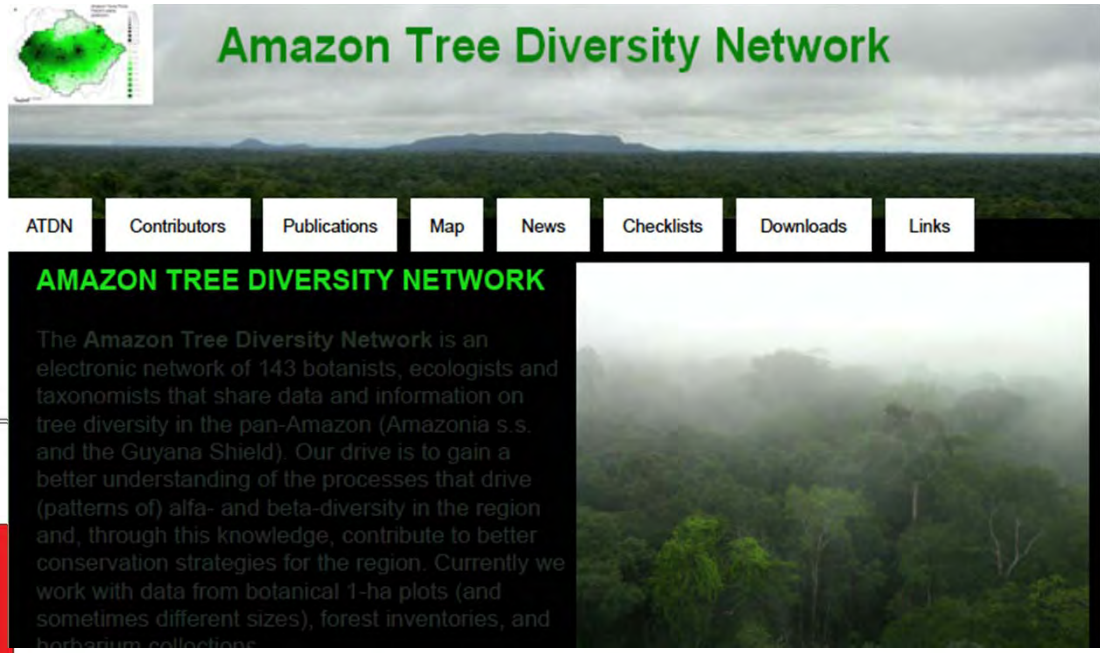
About Participate Resources Education Data

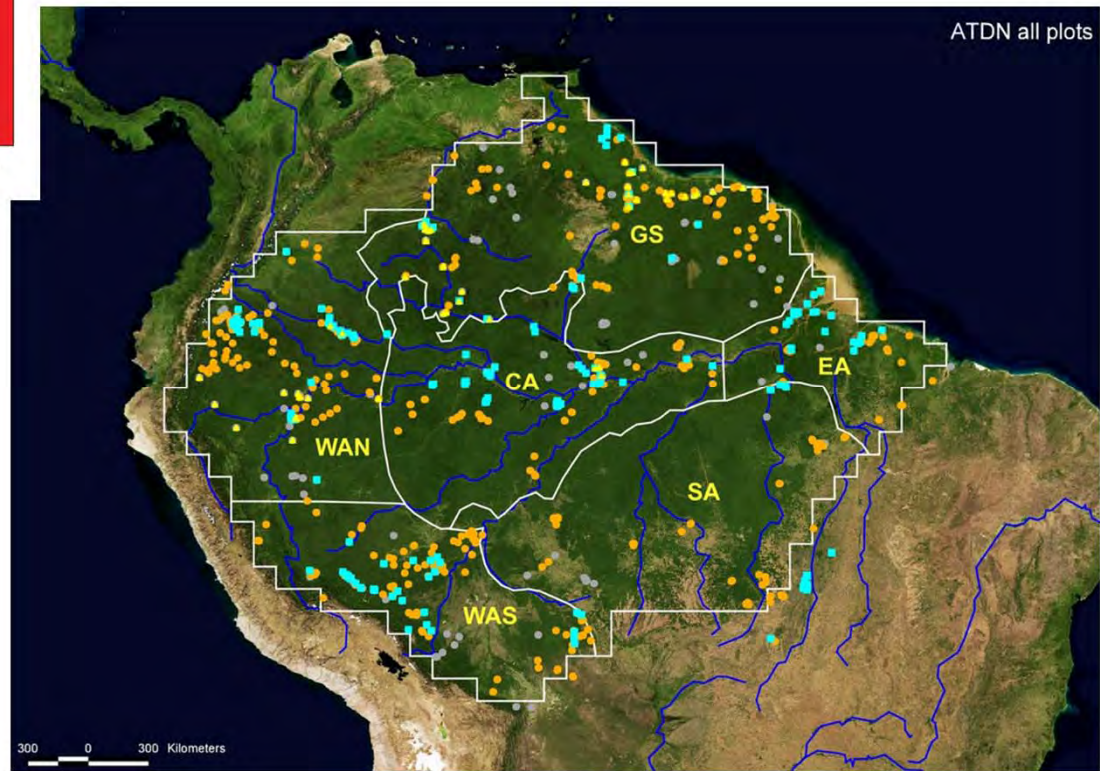
DataONE highlighted in International Innovation

NEONをはじめとする膨大な環境情報を格納

アマゾンの生物多様性観測ネットワーク



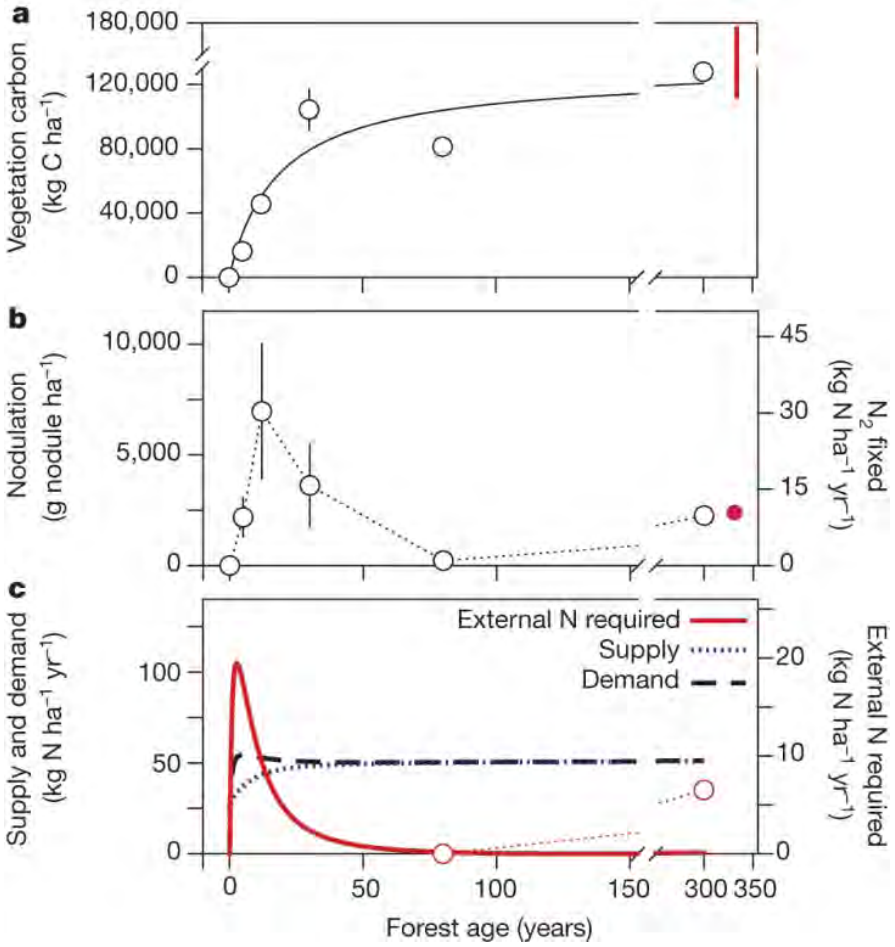


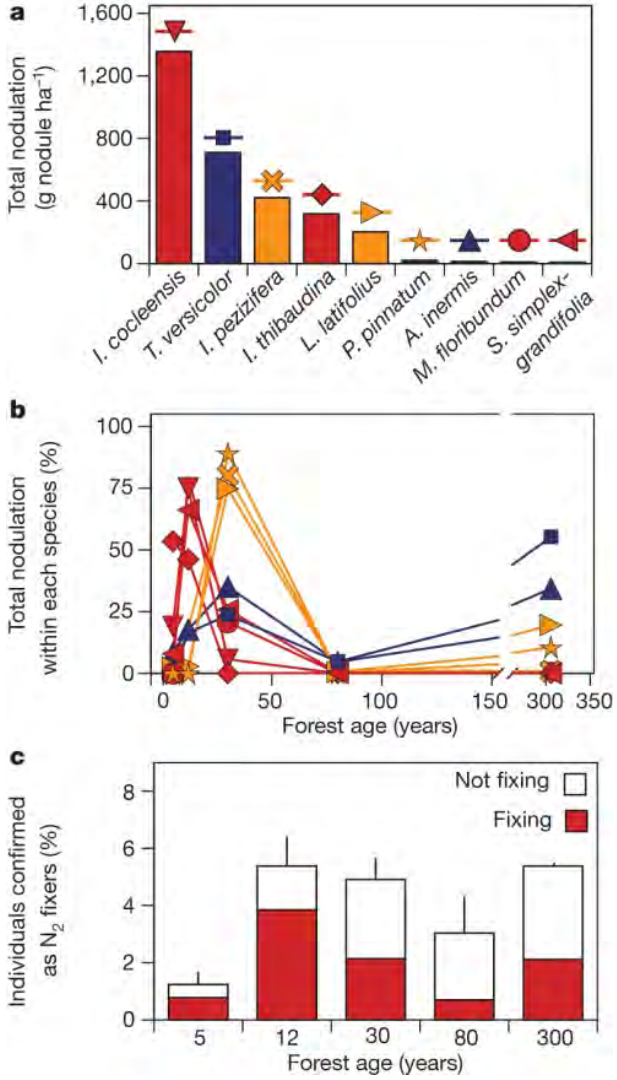


1,170 プロット
639,639個体　4,962種を調査
アマゾン全体で推定16,000種

Steege et al.2013 Science

アマゾンの熱帯雨林では炭素固定に必要な窒素の大半を林齢によって異なった窒素固定植物が取り込む

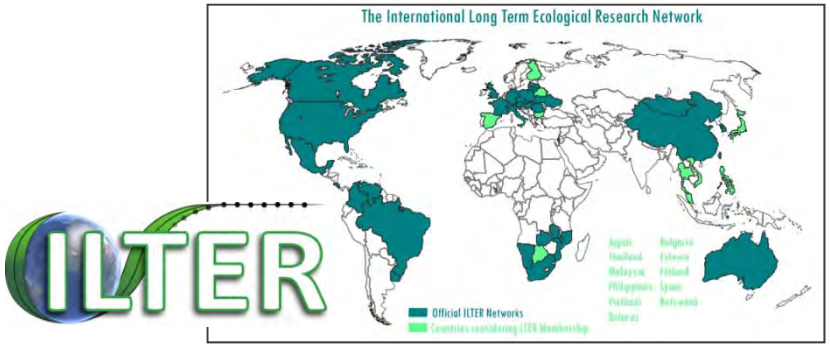




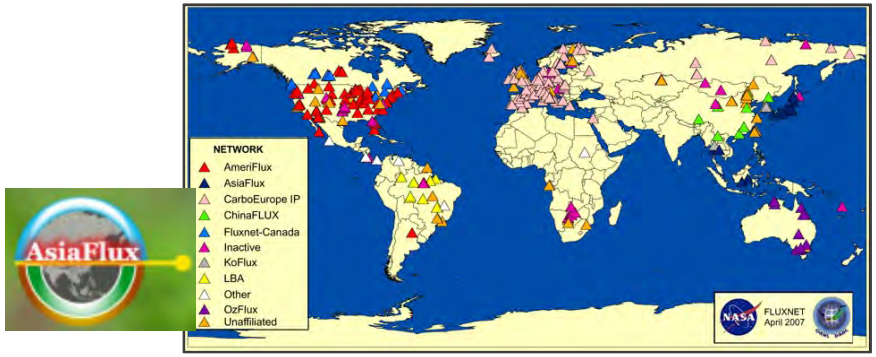
SA Batterman *et al. Nature* (2013) doi:10.1038/nature12525

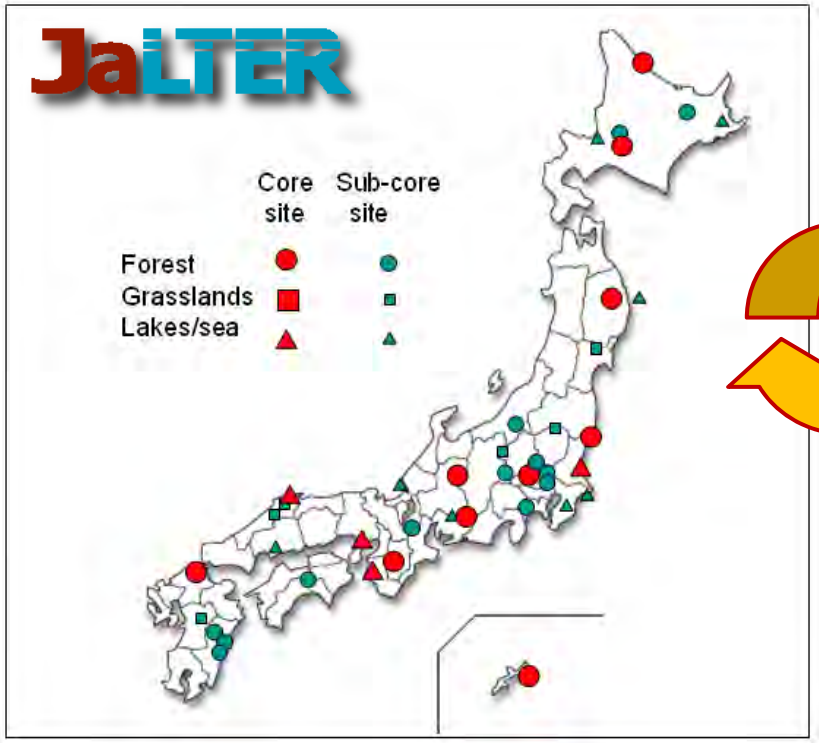
日本の生態系の研究ネットワーク

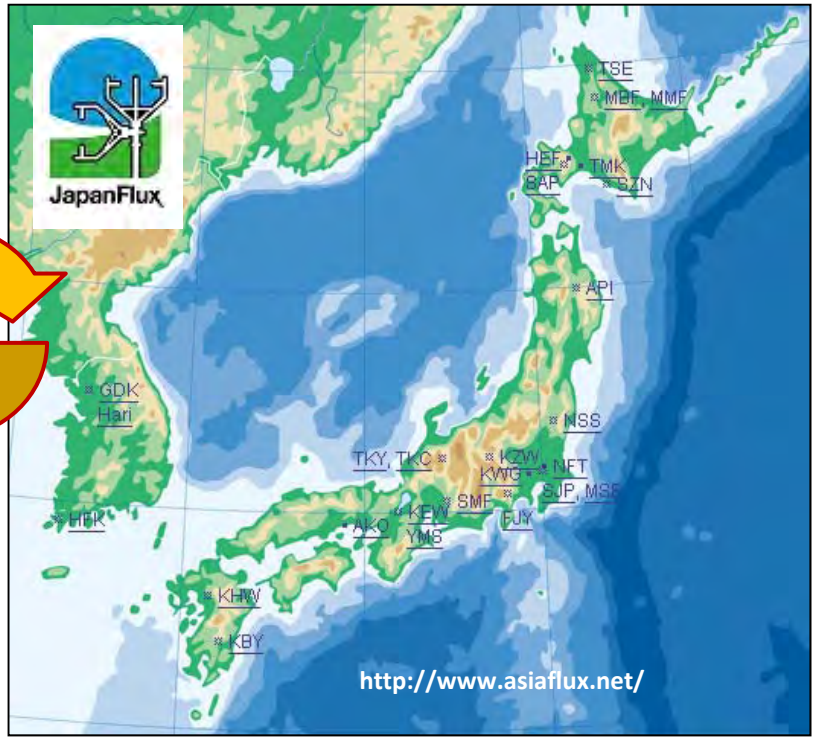
ILTER 国際長期生態学研究ネットワーク



FLUXNET CO_2観測国際ネットワーク







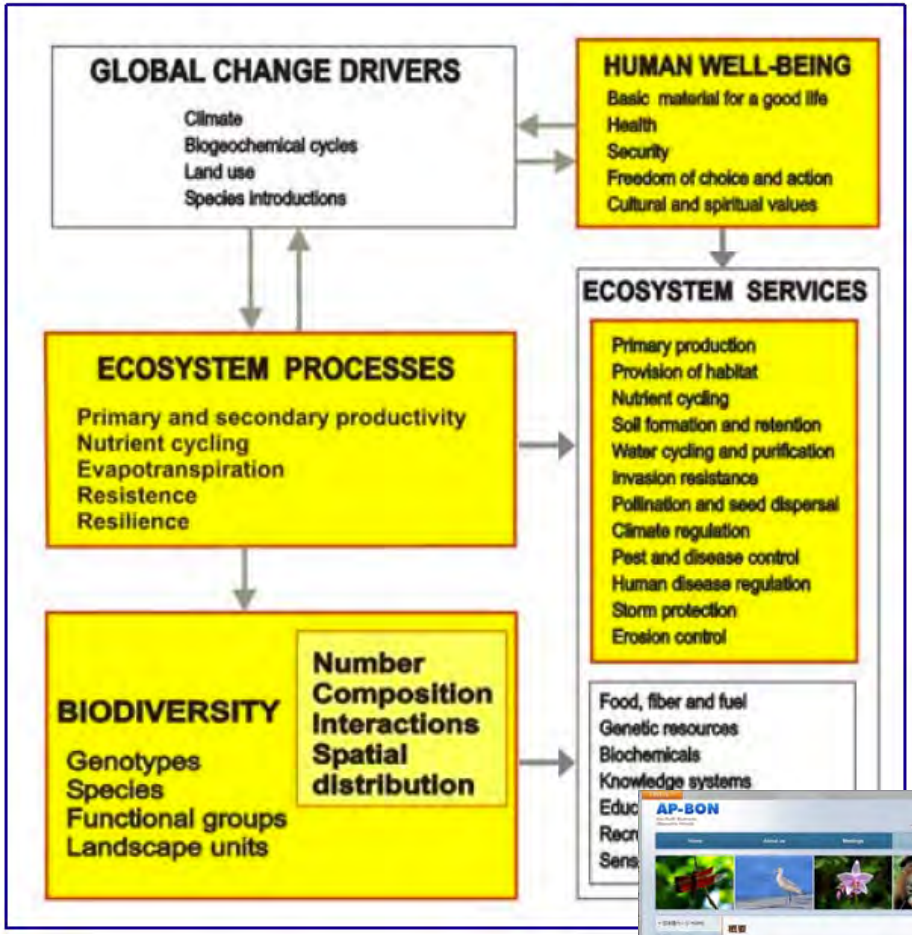
最近の新たな展開： 生物多様性観測ネットワーク

GEO
Biodiversity
Observation
Network (BON)

気候

生態系
（動態，炭素循環）

生物
（種分布，一次生産）



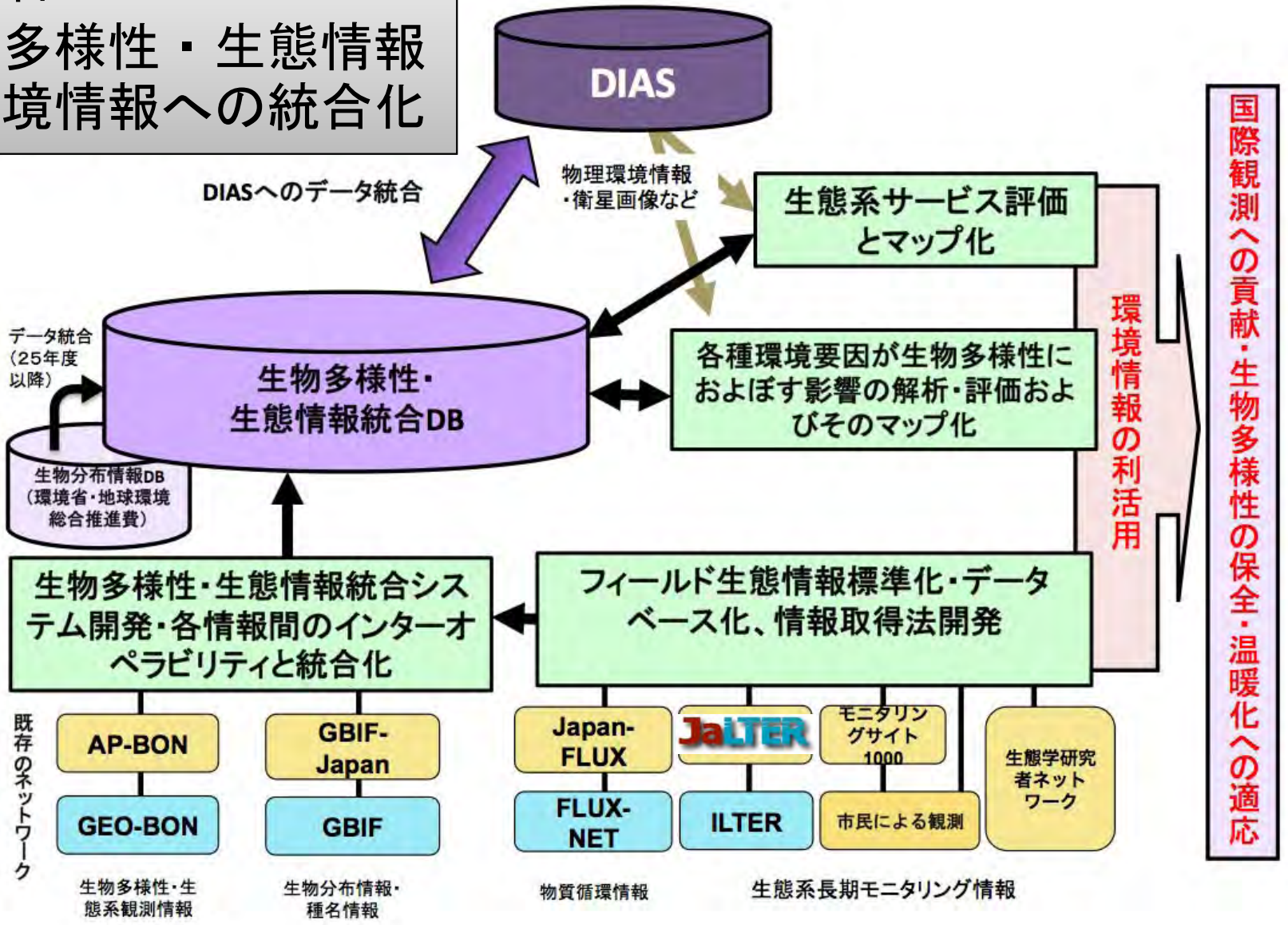
<u>国際的に推進すべき課題</u>：

一次生産（NPP）と生物多様性の関係解明とマッピング

（ILTERはGEO BONのパートナーとして協力）

生態学，フラックス観測，衛星観測データを共有するには，高度な情報基盤の整備が必要

文科省GRENE:
生物多様性・生態情報の環境情報への統合化



モニタリングサイト1000
Since 2003

Ecol Res (2011) 26: 1007–1008
DOI 10.1007/s11284-011-0847-y

DATA PAPER

Masae I. Ishihara · Satoshi N. Suzuki · Masahiro Nakamura · Tsutomu Enoki · Akio Fujiwara · Tsutom Hiura · Kosuke Homma · Daisuke Hoshino · Kazuhiko Hoshizaki · Hideyuki Ida · Ken Ishida · Akira Itoh · Takayuki Kaneko · Kaname Kubota · Koichiro Kuraji · Shigeo Kuramoto · Akifumi Makita · Takashi Masaki · Kanji Namikawa · Kaoru Niiyama · Mahoko Noguchi · Haruto Nomiya · Tatsuhiro Ohkubo · Satoshi Saito · Takeshi Sakai · Michinori Sakimoto · Hitoshi Sakio · Hirofumi Shibano · Hisashi Sugita · Mitsuo Suzuki · Atsushi Takashima · Nobuyuki Tanaka · Naoaki Tashiro · Naoko Tokuchi · Yakushima Forest Environment Conservation Center · Toshiya Yoshida · Yumiko Yoshida

Forest stand structure, composition, and dynamics in 34 sites over Japan

Received: 4 March 2011 / Accepted: 16 May 2011 / Published online: 30 August 2011

Abstract This data paper reports tree census data collected in a network of 34 forest sites in Japan. This is the largest forest data set freely available in Japan to date. The network is a part of the Monitoring Sites 1000 Project launched by the Ministry of the Environment, Japan. It covers subarctic to subtropical climate zones and the four major forest types in Japan. Forty-two permanent plots, usually 1 ha in size, were established in old-growth or secondary natural forests. Censuses of woody species ≥15 cm girth at breast height were conducted every year or once during 2004 to 2009. The data provide species abundance, survivorship and stem girth growth of 52,534 individuals of 334 tree and liana species. The censuses adopted common census protocol, which provide good opportunities for meta-analyses and comparative studies among forests. The data have been used for ecological studies as well as for the biodiversity reports published by the Ministry of the Environment.

Keywords Plot network · Forest · Tree species abundance · Stem diameter · Tree demography · Japan · The Monitoring Sites 1000 Project

The complete data set for this abstract published in the Data Paper section of the journal is available in electronic format in *Ecological Research Data Paper Archives* at http://db.cger.nies.go.jp/JaLTER/ER_DataPapers/archives/2011/ERDP-2011-01/.

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Japan Wildlife Research Center,
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Ecological ResearchにData Paper枠新設

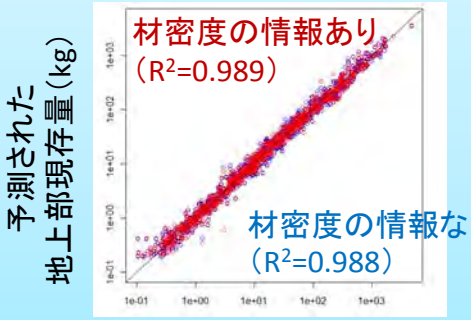
地上部現存量・純一次生産量の地図化

アロメトリーデータベース

2093 個体, 129 種

全国の天然林に適用可能な
地上部現存量の推定式

$\ln(AGB) = a+b_1\ln(D)+b_2(\ln(D))^2+b_3(\ln(D))^3$

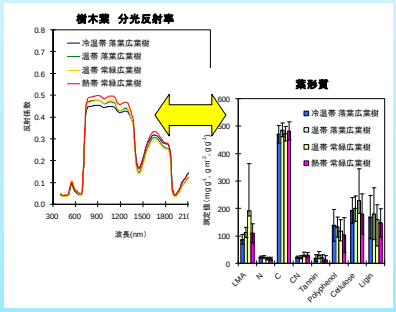


人工林はHosoda & Iehara (2010)

形質-分光データベース

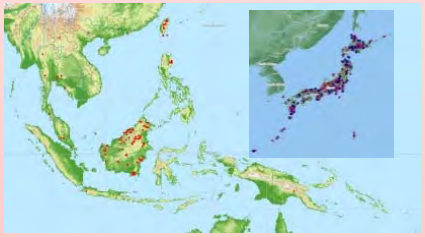
1131 個体, 192 種

冷温帯～熱帯アジアの樹木葉の分光
特性と形質のデータセット



森林プロット
データベース

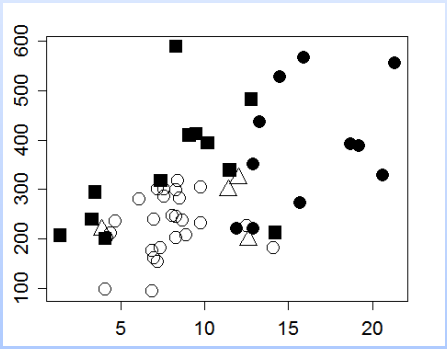
サイズ構造　約900プロット



森林資源
モニタリング調査
（林野庁）

全国4kmメッシュ

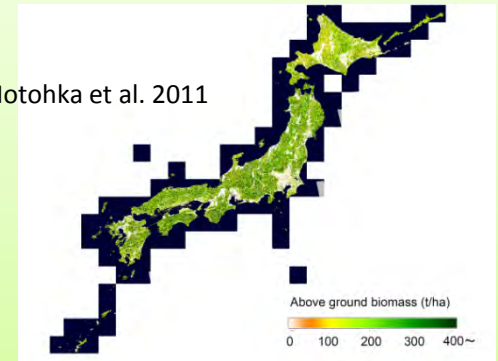
林分の地上部現存量・NPP



リモセンの
地上検証データ

広域マッピング

Motohka et al. 2011



アジア地域の森林プロットデータベース

現在約600プロットを整備

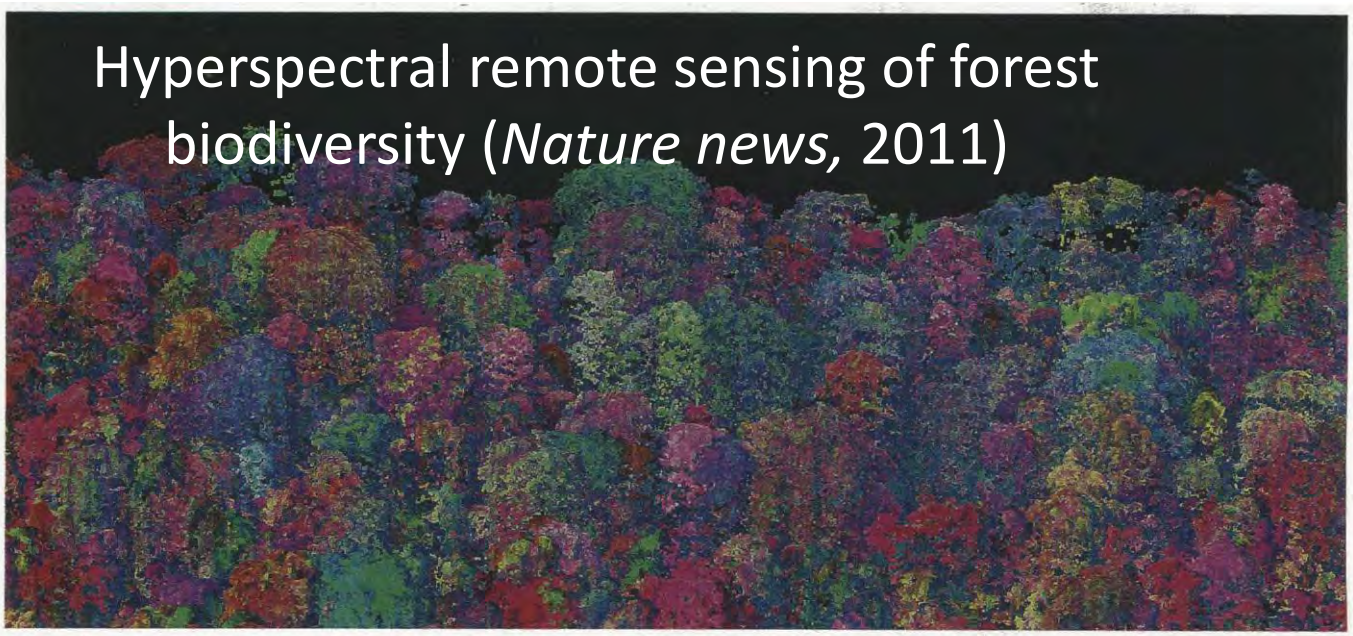
Center for Tropical Forest Science
(CTFS)　サイト

S9 森林プロットデータベース

日本は終了
台湾の研究者と共同研究体制を構築
今後CTFSサイト以外をリストアップ

分光データベースの構築

Hyperspectral remote sensing of forest biodiversity (*Nature news,* 2011)



A three-dimensional image of a forest in Panama, based on data from the Carnegie Airborne Observatory. The retooled observatory will be far more sensitive.

ECOLOGY

A new eye on biodiversity

Airborne observatory will use chemical clues to map and assess tropical ecosystems.

BY JEFF TOLLEFSON

For tropical ecologist Greg Asner, it's all about seeing the forest through its trees. Over the past two years, he and his team at the Carnegie Institution for Science in Stanford, California, have used world-class tree climbers, bows and arrows, and even shotguns to gather samples of vegetation from forest canopies around the globe. They have created a digital catalogue of the chemical and optical carbon stocks in support of efforts to reduce deforestation (see 'Taking stock of global carbon'), and will significantly advance the team's biodiversity research. With the digital catalogue as a reference, Asner hopes that the observatory will be able to perceive the species of many individual trees by their optical properties, while offering insights into forest health and diversity.

The team's work combines physics, biochemistry and ecology, beginning with measuring subtle differences in the way the forest canopy

wife, Robin Martin, identified 21 spectral traits that provided identifying signals for 90% of the species. "A lot of people look at trees and just see green," says Asner. "I see a kaleidoscope."

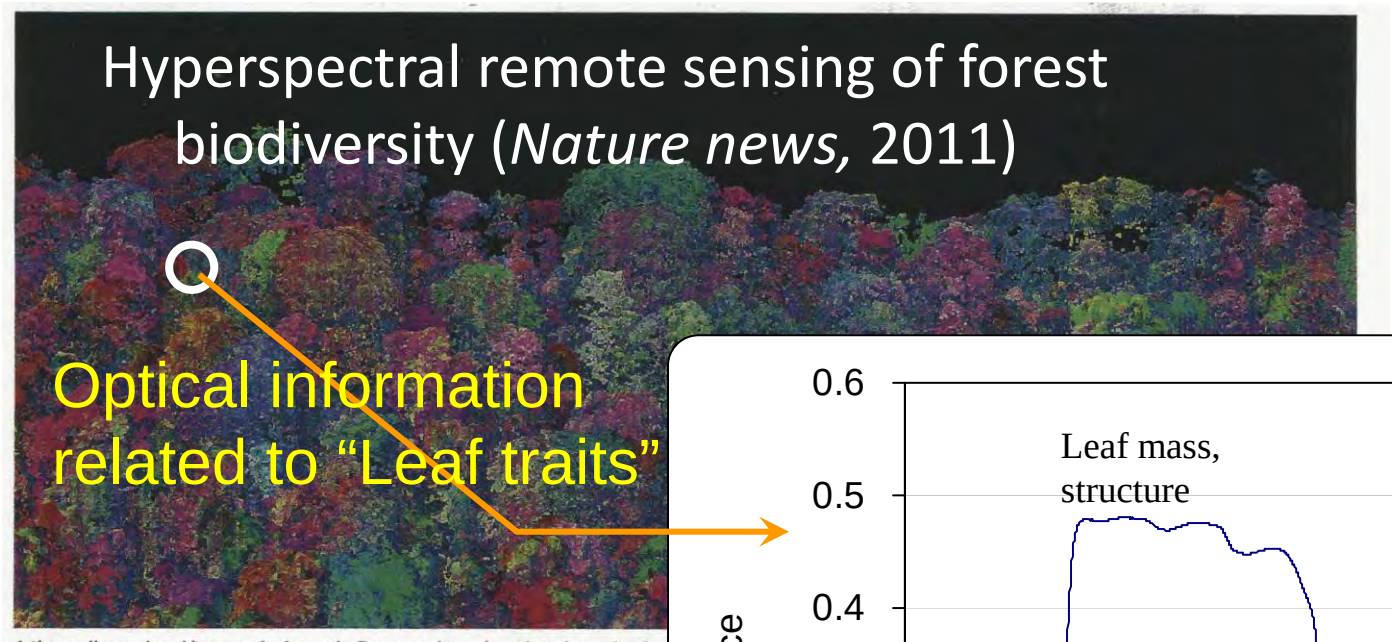
The heart of the CAO's US$8.3-million sensing system — dubbed the Airborne Taxonomic Mapping System (AToMS) — is a spectroscopic imager designed by engineers at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. Capable of registering more than 400 frequencies of light, from

CAO/CARNEGIE INST. FOR SCIENCE

分光データベースの構築

Hyperspectral remote sensing of forest biodiversity (*Nature news,* 2011)

Optical information related to “Leaf traits”



A three-dimensional image of a forest in Panama, based on data from the Car

ECOLOGY

A new eye on

Airborne observatory will use chemical clues

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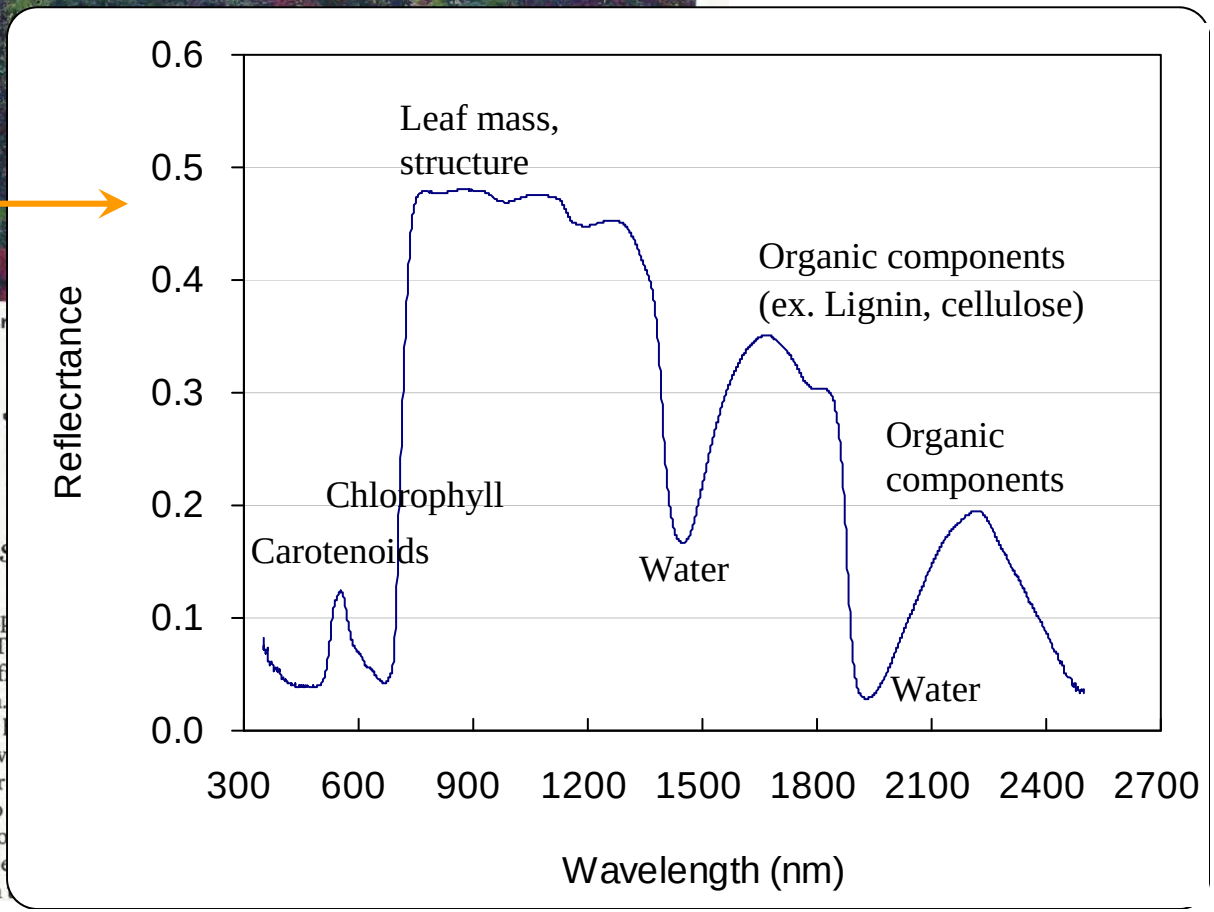
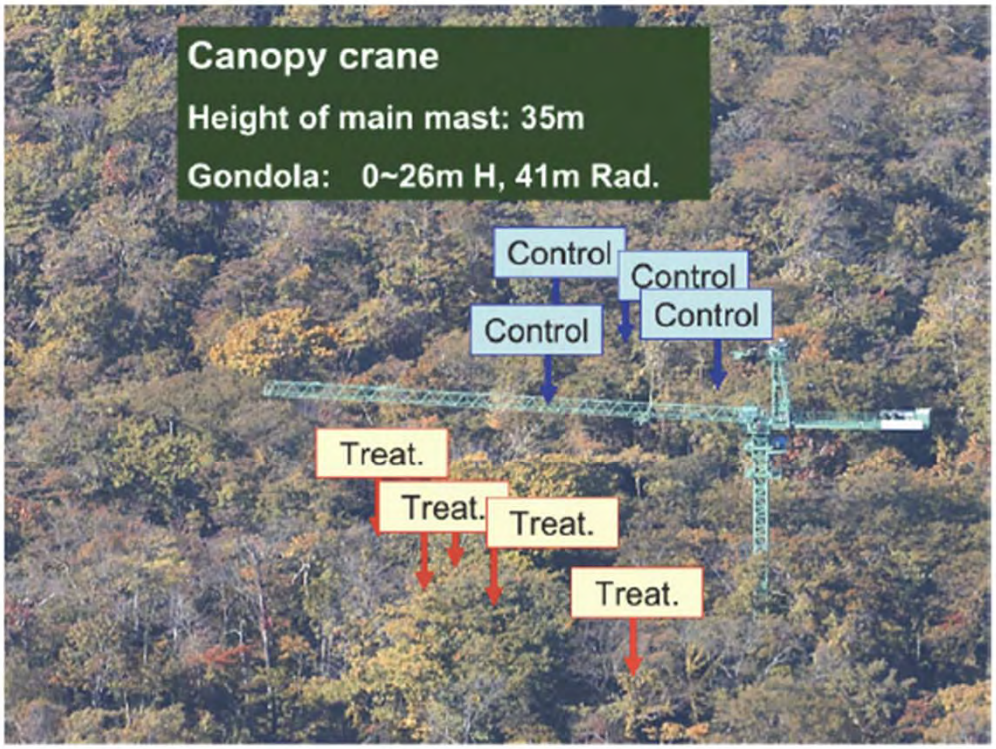


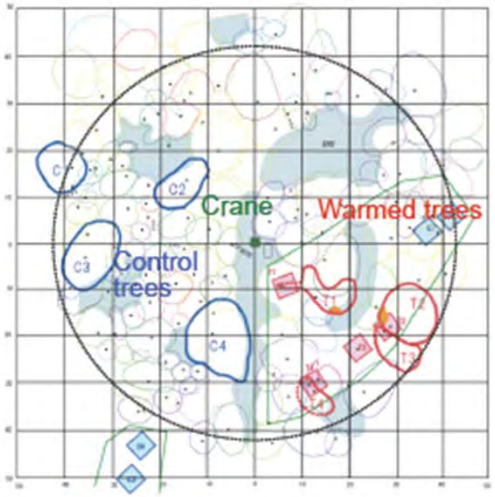
苫小牧研究林における温暖化操作実験（2007–）

Site / Canopy crane

- Deciduous broad-leaved forest
- Natural forest
- Crane: 25 m height & 41 m radius
- Build in 1997 (IGBP)
- Access to tree canopy

19 species & > 60 tall trees





Soil warming (underground heating cable)

Thinner snow cover & earlier snow melt

温暖化操作実験による融雪状況

Control　　Soil warming

Control

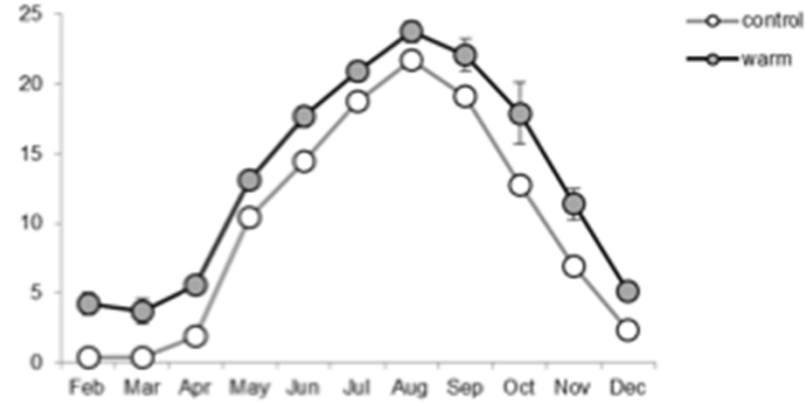
Soil warming

Control Soil warming

Control

Soil warming

土壌凍結する寡雪寒冷地では
春先の凍結融解が窒素動態に重要



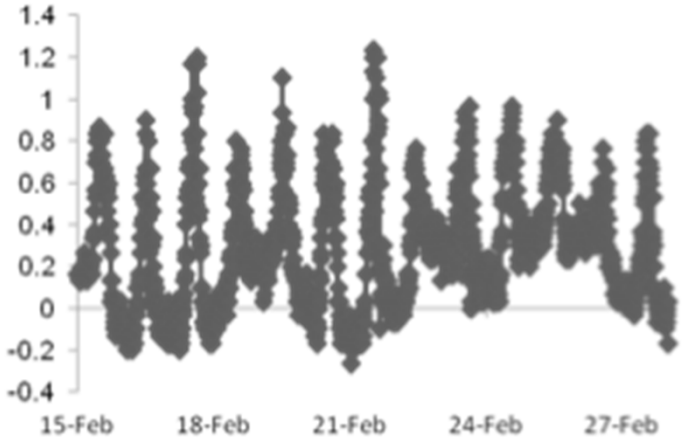
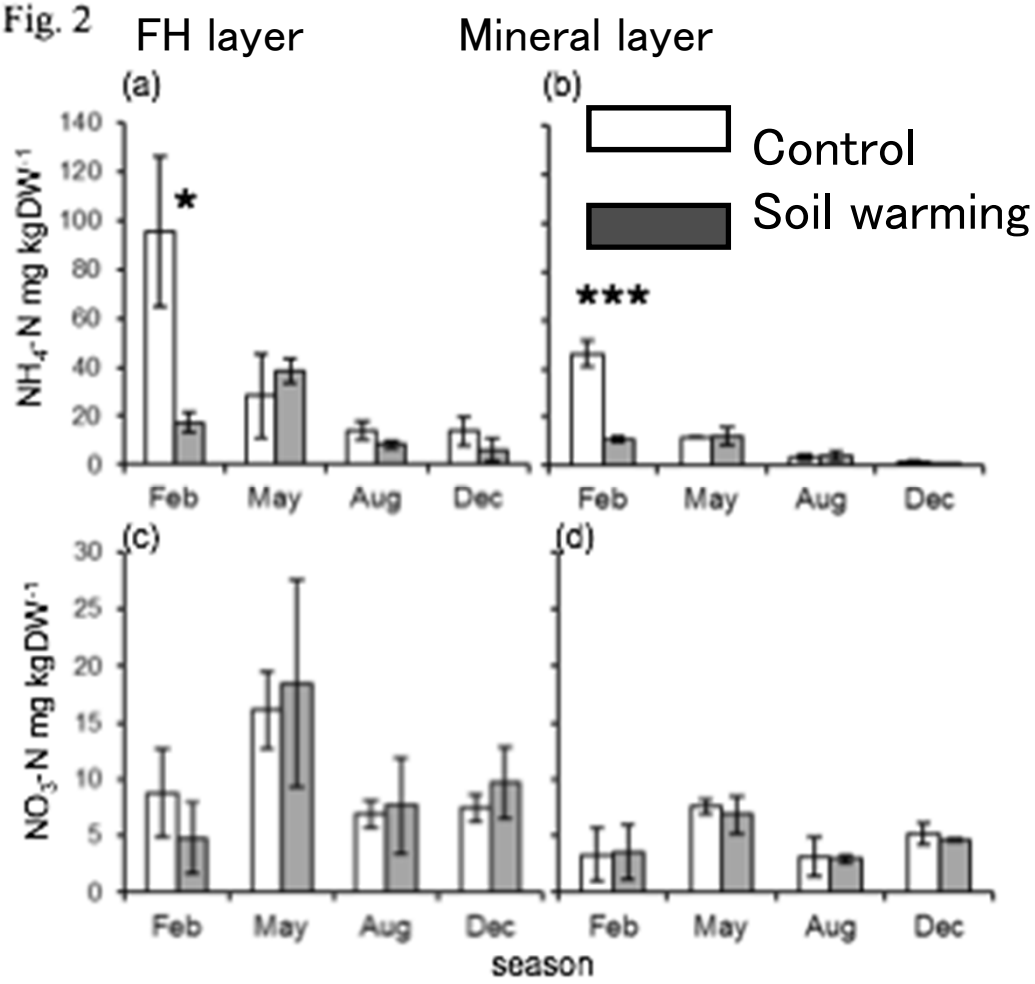


Fig. 2



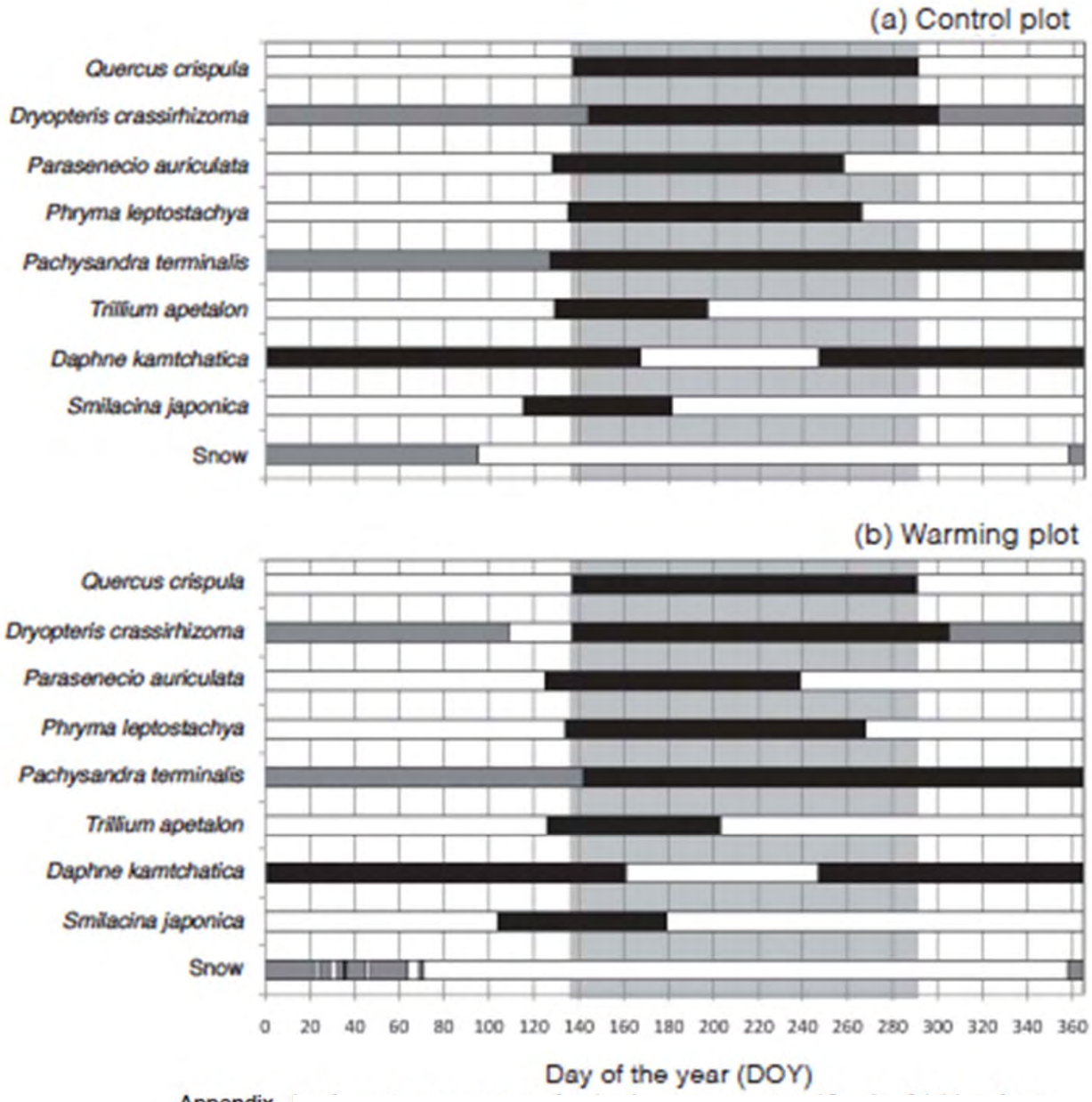
Ueda et al.(2013) Soil Biology and Biochemistry







林床植物の着葉様式は同じ場所でも大きく異なる：温暖化影響も異なる？



Control

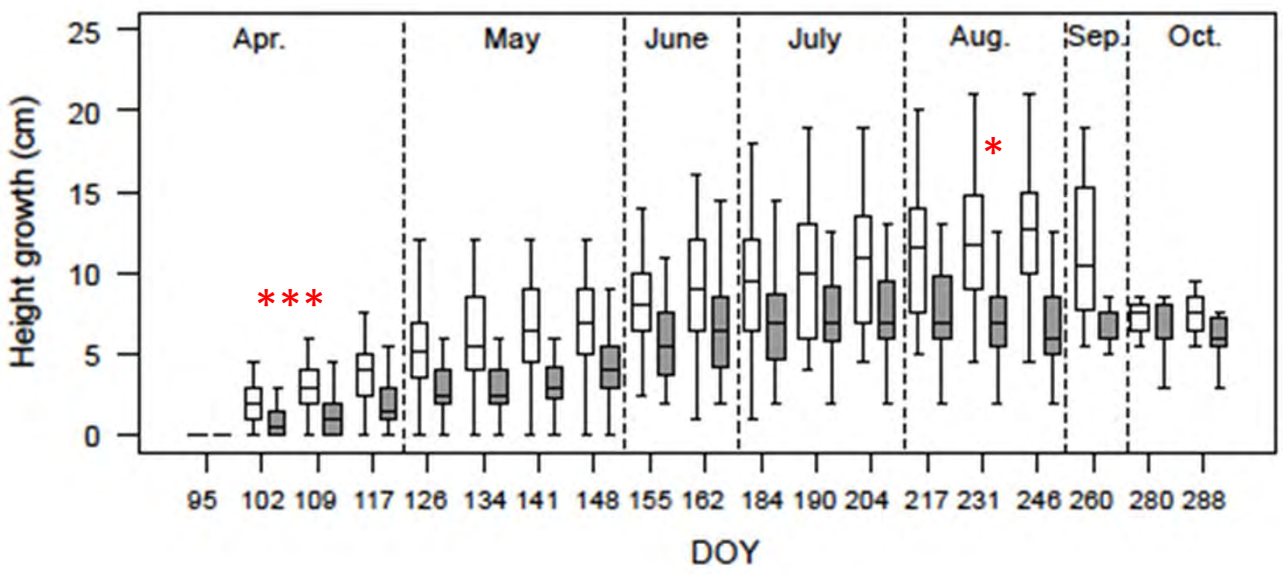
Warming

Appendix.
Nakaji et
the contr
by an aut
bars when leaves absent and grey bars either prostrating leaves (*D. crassirhizoma*)
overwintering leaves without new leaves (*P. terminalis*) or snow cover.

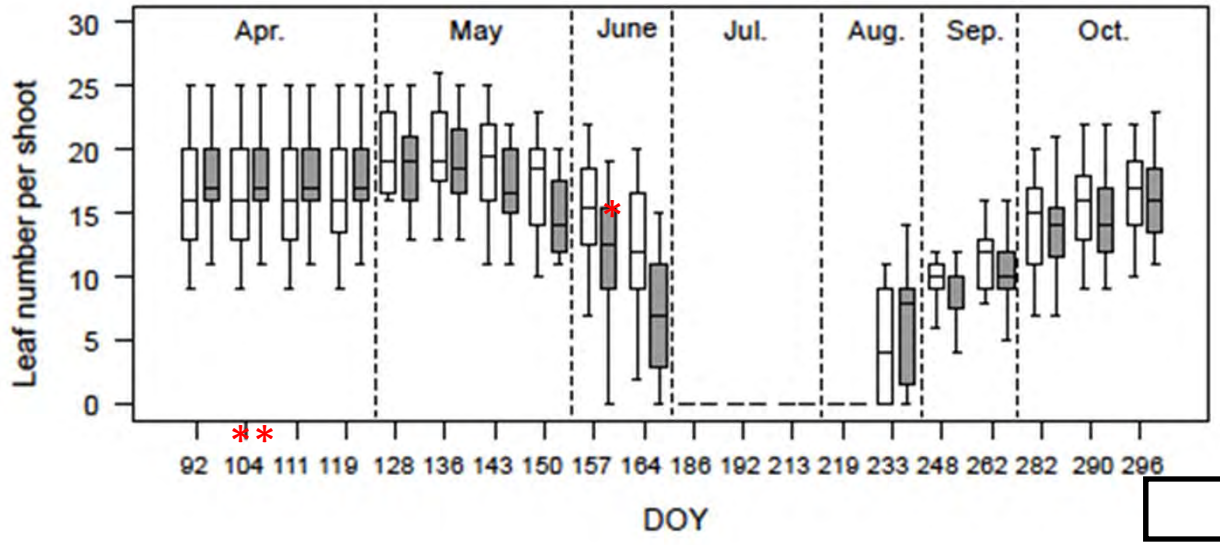
温暖化処理による林床植物のフェノロジー変化

Ishioka et al.(2013) Acta Oecologia

常緑性　フッキソウ



冬緑性　ナニワズ

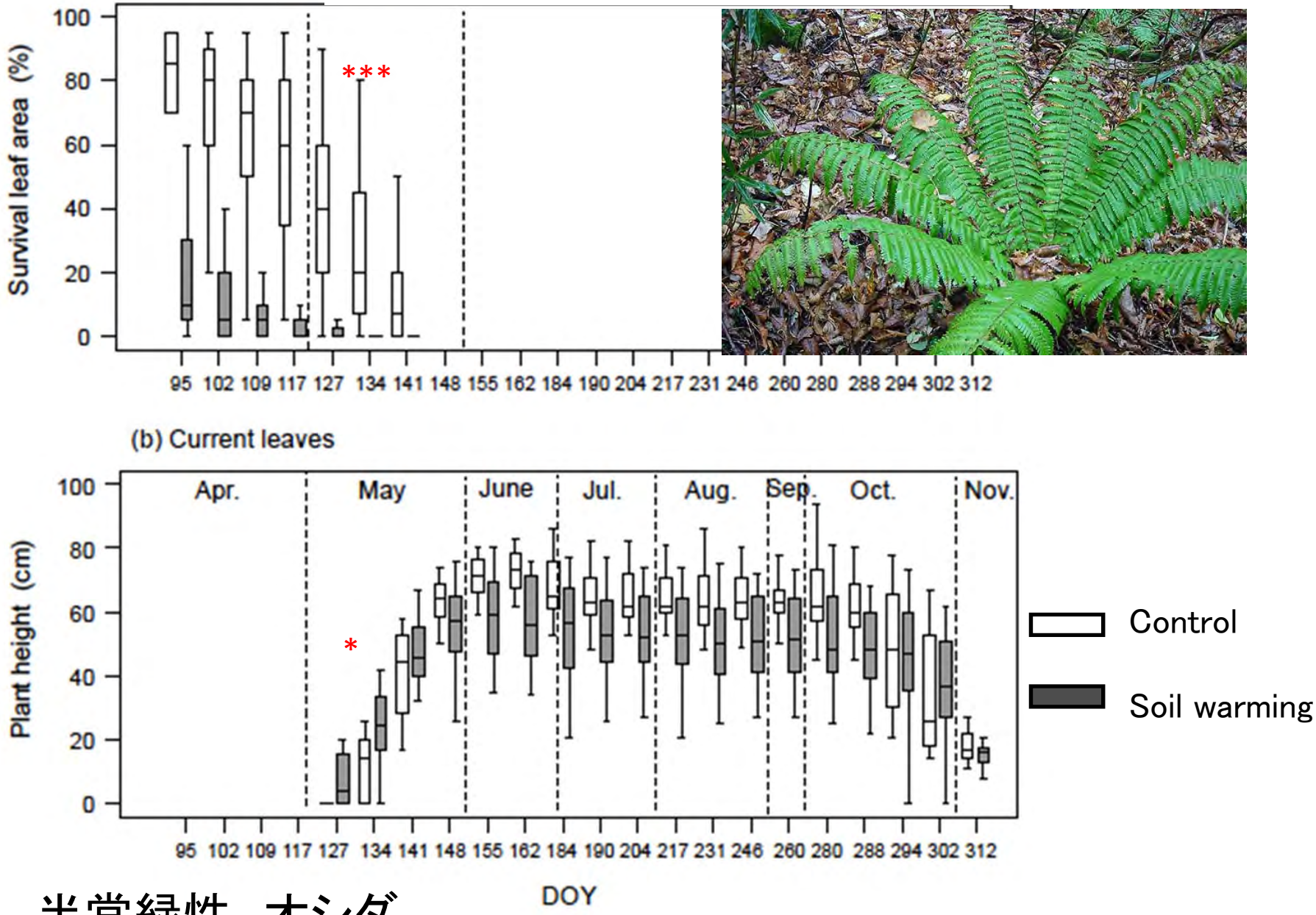


Control

Soil warming

Ishioka et al.(2013) Acta Oecologia

春先に越冬葉が大きなダメージを受ける

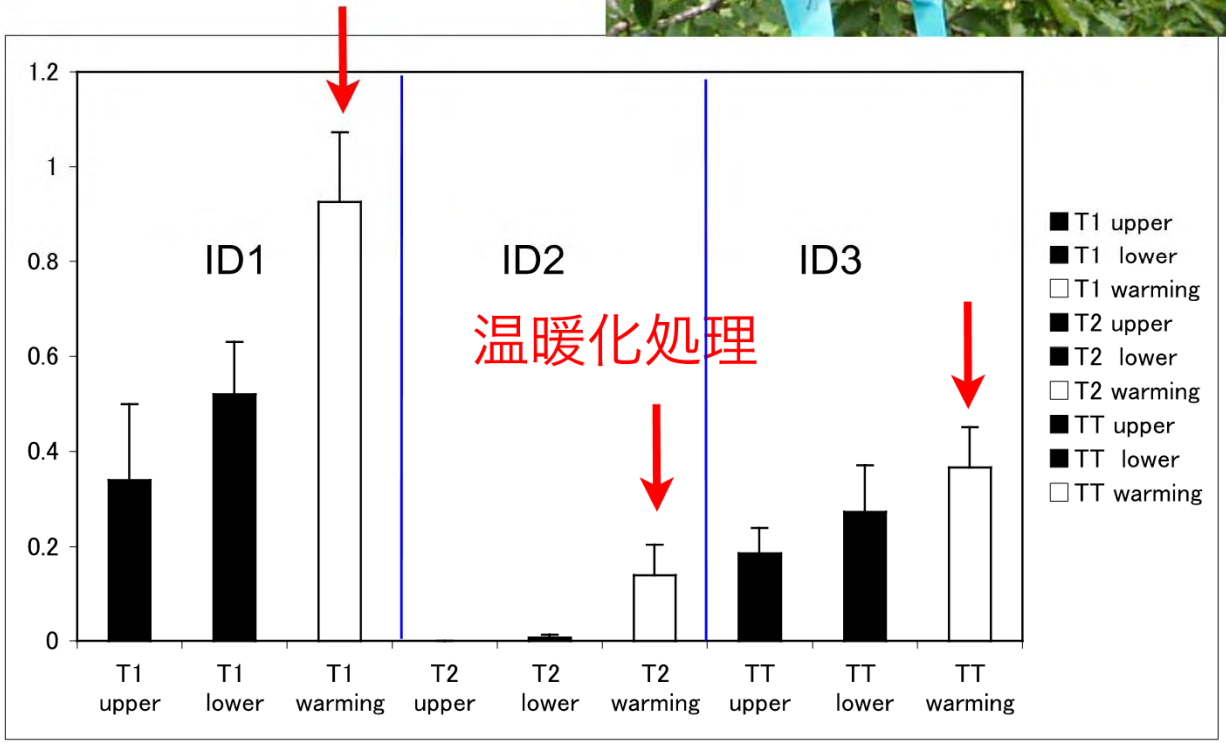


半常緑性　オシダ

Ishioka et al.(2013) Acta Oecologia

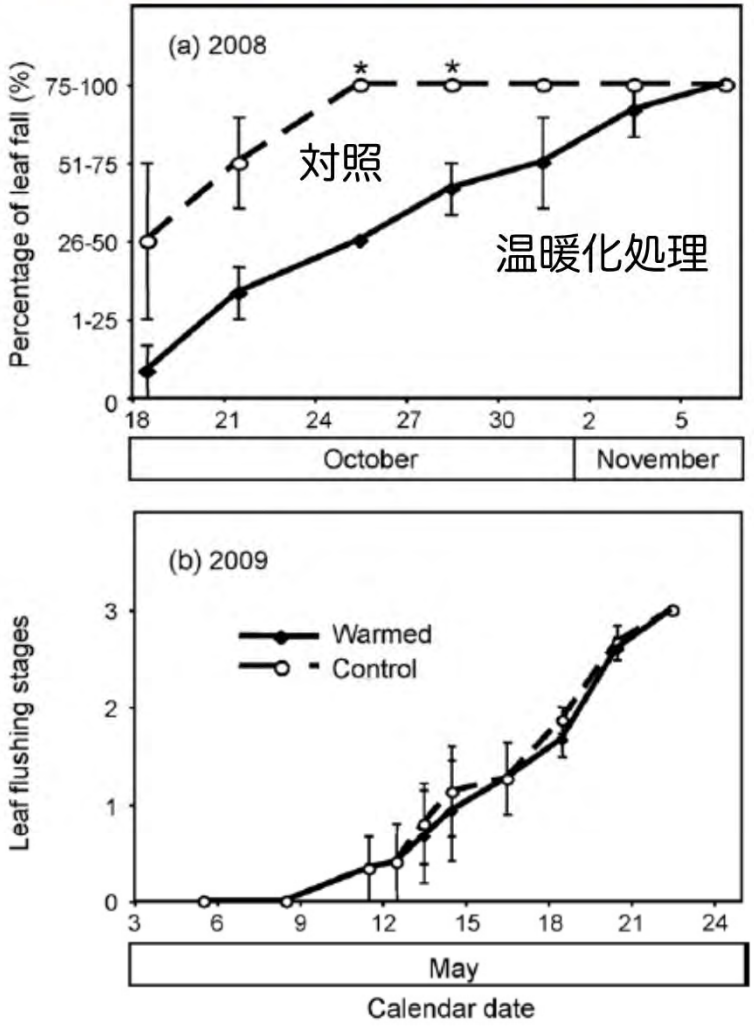
Nakamura et al.(2010)
Agr For Meteorl

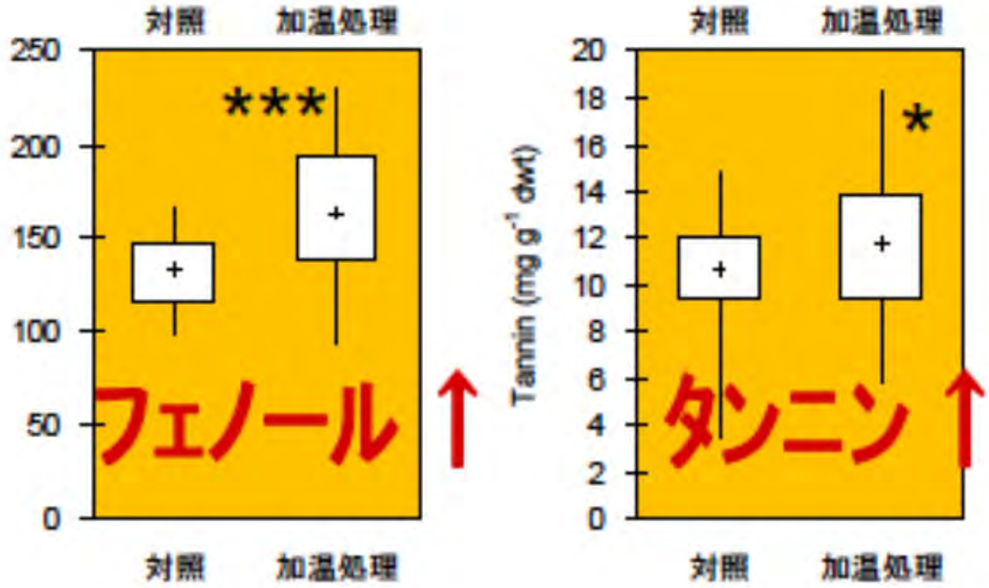
シュートあたりの
ドングリ数



苫小牧のミズナラで
温暖化処理すると結実数は増加した

苫小牧のミズナラで
温暖化処理で落葉は遅くなる（左）二次代謝物質が増える（右）





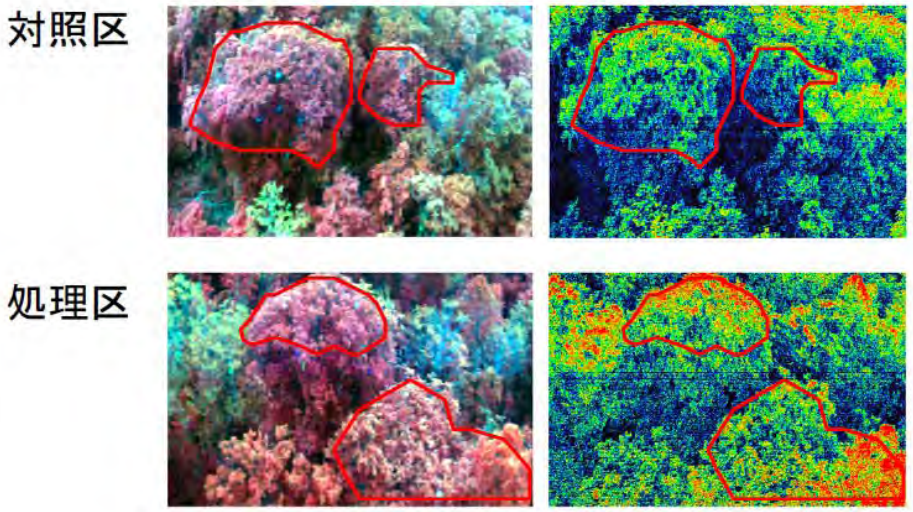
Nakamura et al.(2010)
Agr For Meteorl

Nakaji et al. in prep.

苫小牧のミズナラは温暖化処理で
主にフェノール増加により
食害度は相対的に年々低下

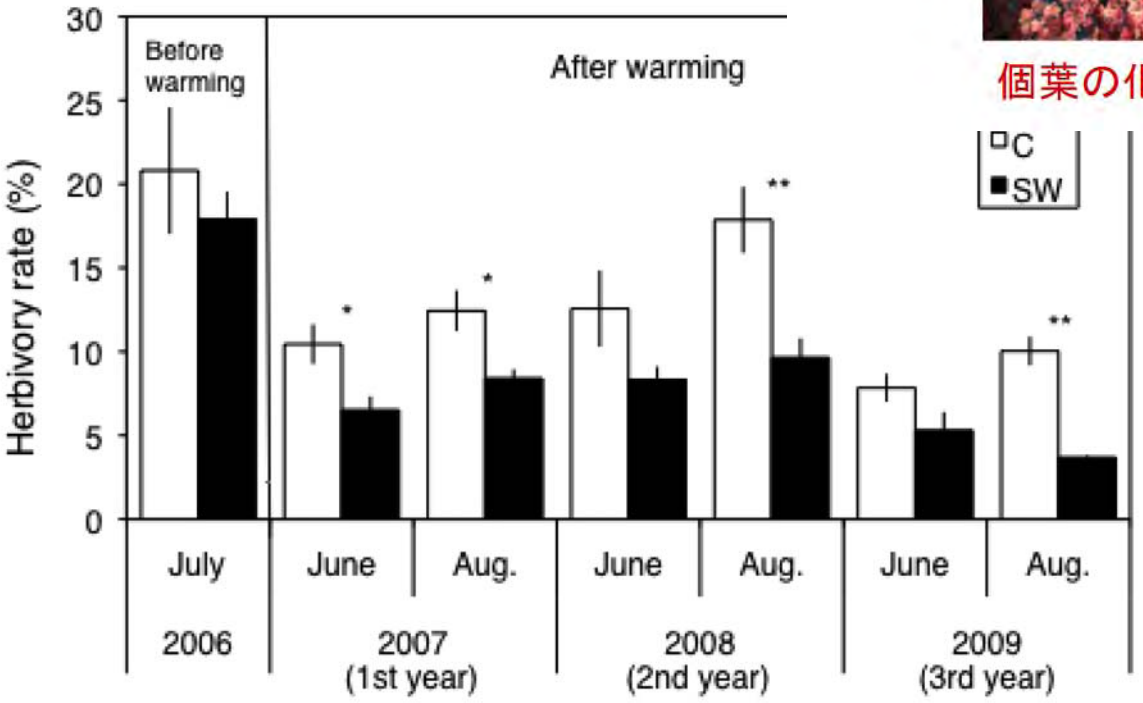
PLS回帰画像（フェノール含有量）

2008年秋（処理区で増加）



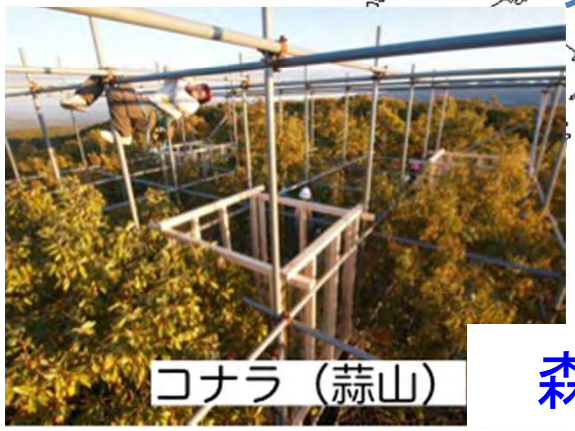
個葉の化学分析と同様の傾向を再現

Nakaji et al. in prep.



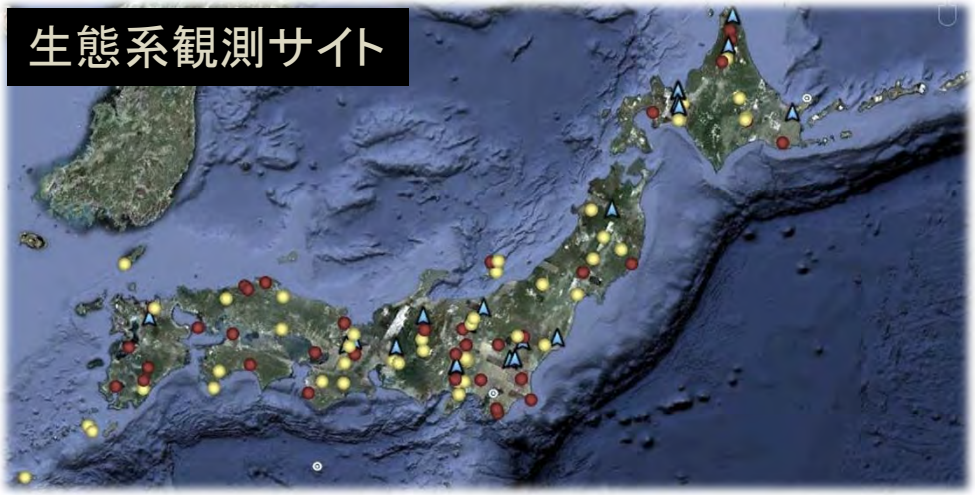
高山のミズナラでも
温暖化実験開始

Nakamura et al. submitted



森林生態系における温暖化操作実験ネットワーク

【展望】生態系−生物多様性関係の解明と長期・広域評価



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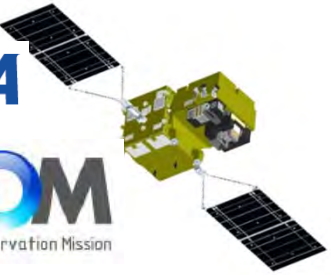
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

観測サイトでの生態系−生物多様性の機構解明

衛星観測（個葉分光，LAI）
モデル解析（NPP, NEP, …）

JAXA
GCOM
Global Change Observation Mission



生態系−生物多様性の総合的解明と広域モニタリングの実現へ
（気候変動影響，人間活動影響，自然撹乱影響）