Moderate Resolution Optical Satellite Data Applications for Forest Change Assessment

Peter Potapov, UMD GLAD

UNIVERSITY OF MARYLAND
DEPARTMENT OF GEOGRAPHICAL SCIENCES

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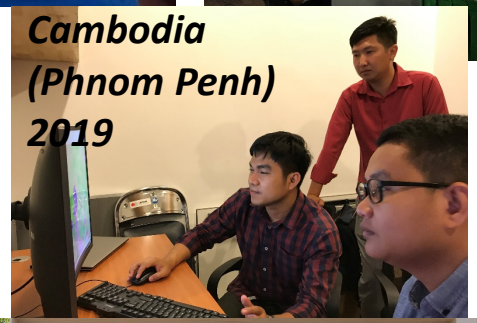
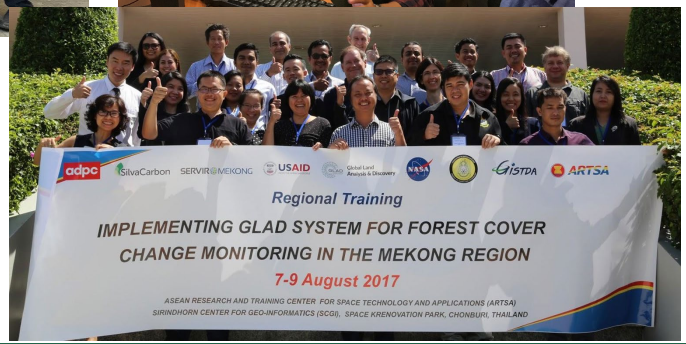
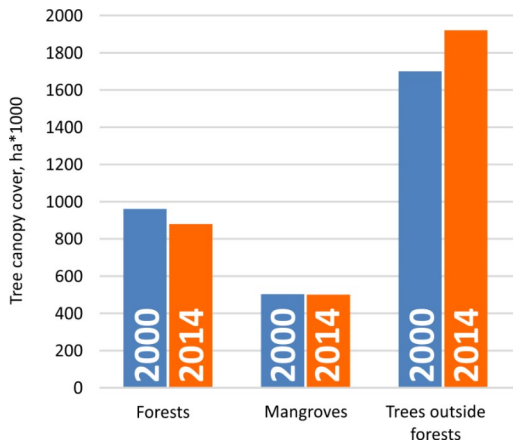
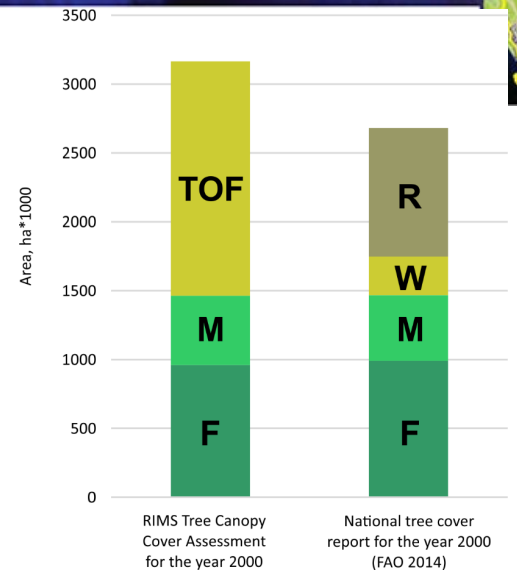
Satellite Data Application for National Forest Assessment





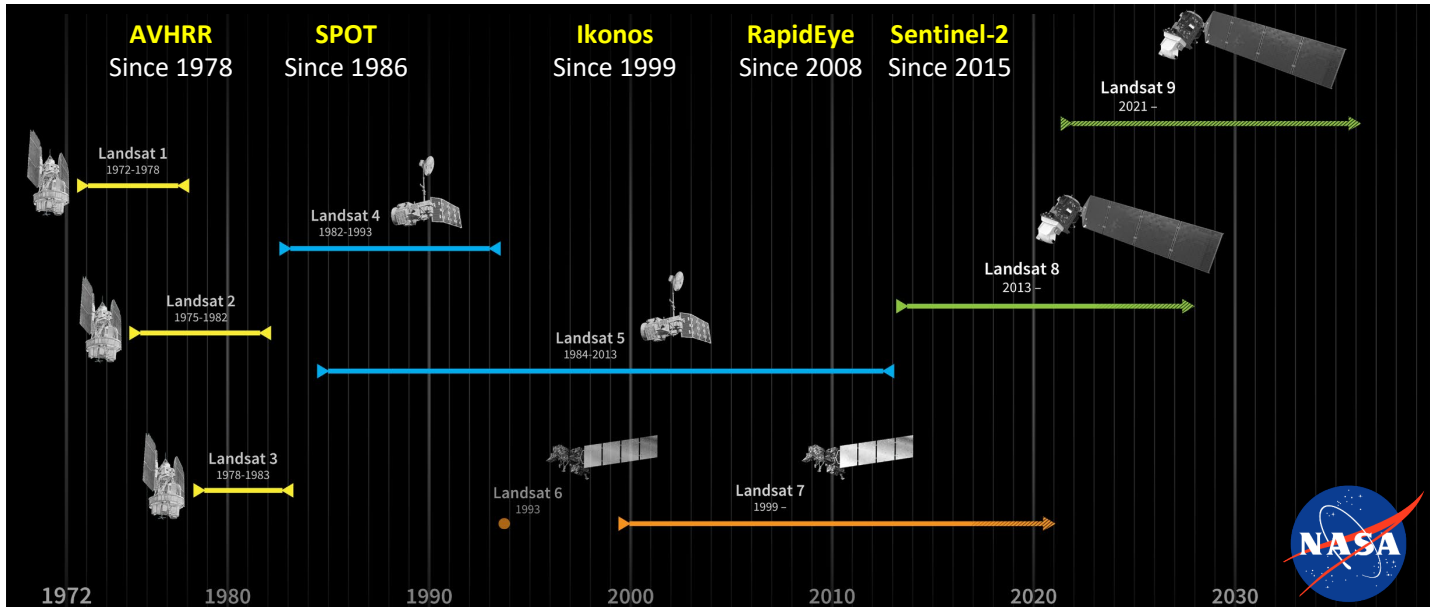
Regional workshop in Thailand 2017

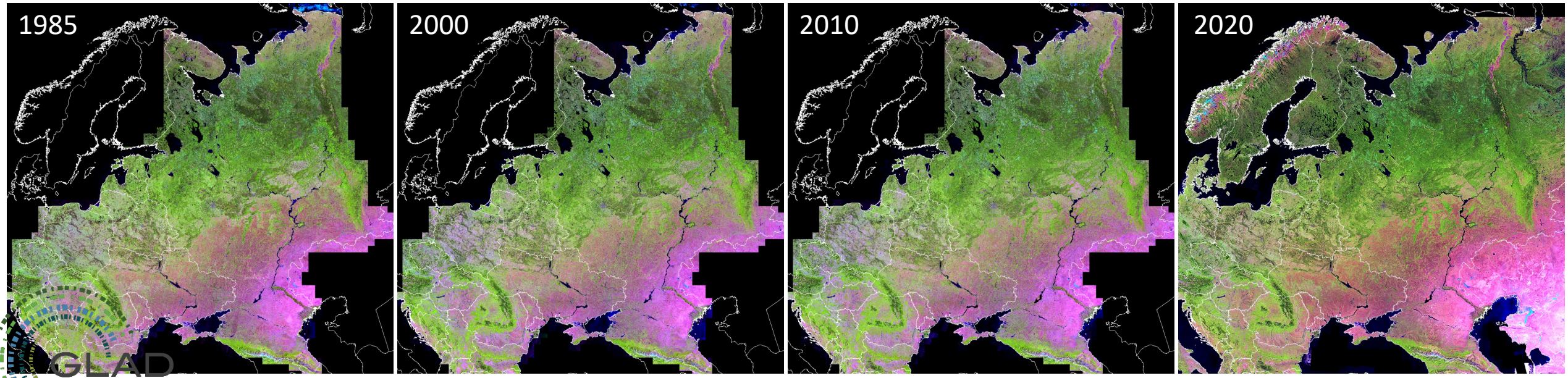




GLAD GLOBAL LAND ANALYSIS & DISCOVERY

Harmonization of National Forest Assessment Reports





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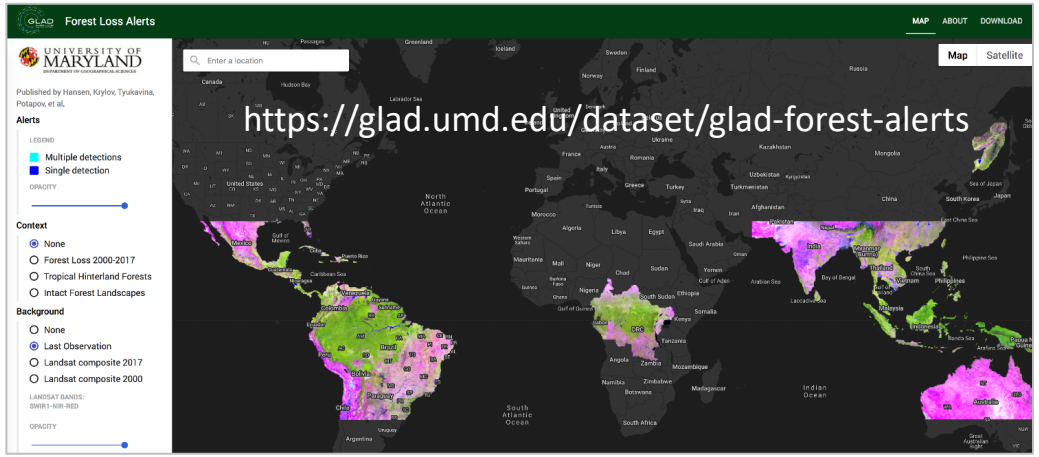
Near-Real-Time Forest Monitoring

GLAD Forest Loss Alerts



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Analysis | Published: 04 January 2021

The impact of near-real-time deforestation alerts across the tropics

Fanny Moffette, Jennifer Alix-Garcia, Katherine Shea & Amy H. Pickens

Nature Climate Change **11**, 172–178 (2021) | Cite this article

1889 Accesses | **1** Citations | **498** Altmetric | Metrics

Subscriptions to alerts in 22 tropical countries decrease the probability of deforestation in Africa by 18%.

The alert system's value is between US$149 million and US$696 million in social cost of carbon for avoided deforestation in Africa.

GLOBAL FOREST WATCH

WORLD RESOURCES INSTITUTE

www.globalforestwatch.org

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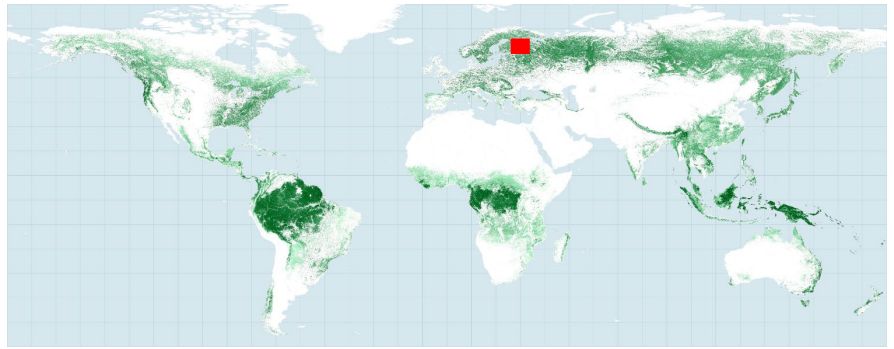
Continuous Mapping of Forest Stand Variables



Forest height 2020

30 m

0 m

Forest height loss 2000-2020

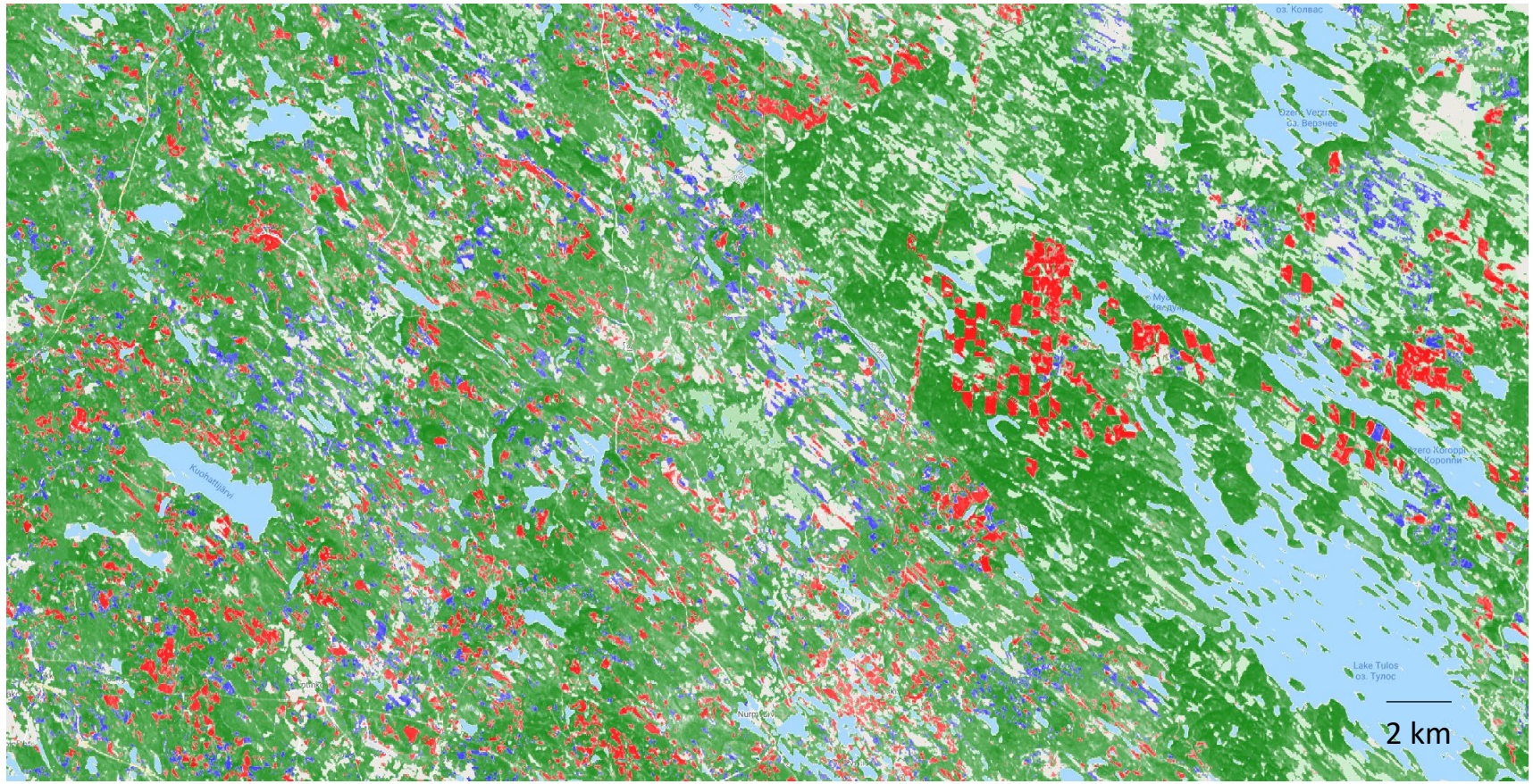
30 m

0 m

Forest height gain 2000-2020

30 m

0 m



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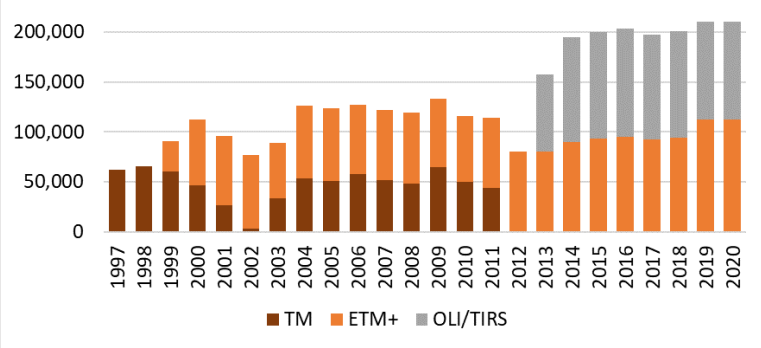
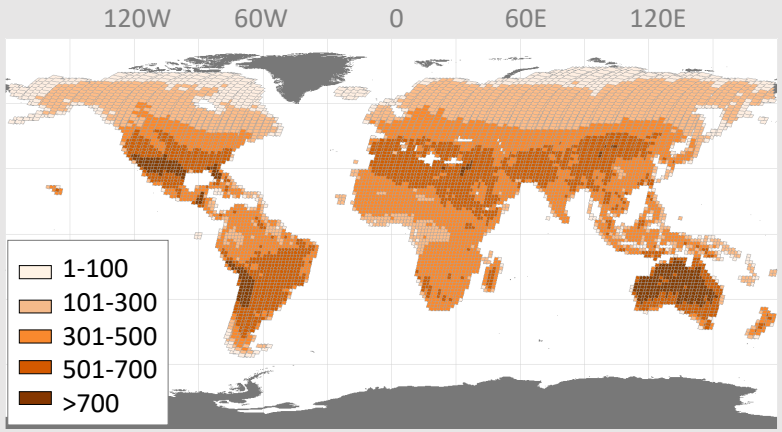
GLAD Landsat Analysis Ready Data

Landsat T1 Data (TOA)



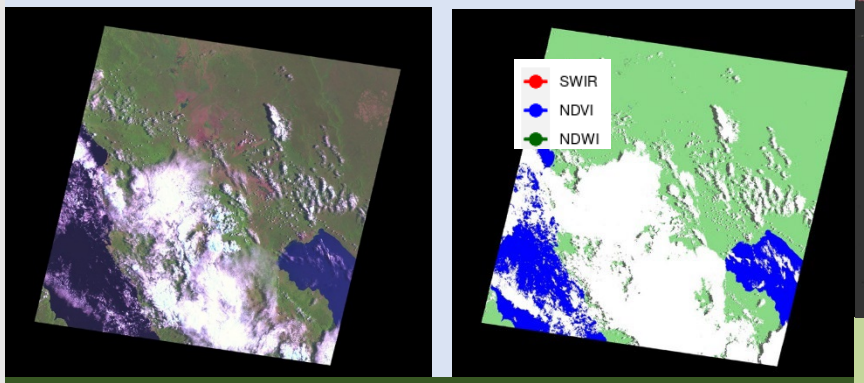
Archive @GLAD ~ 4 million scenes



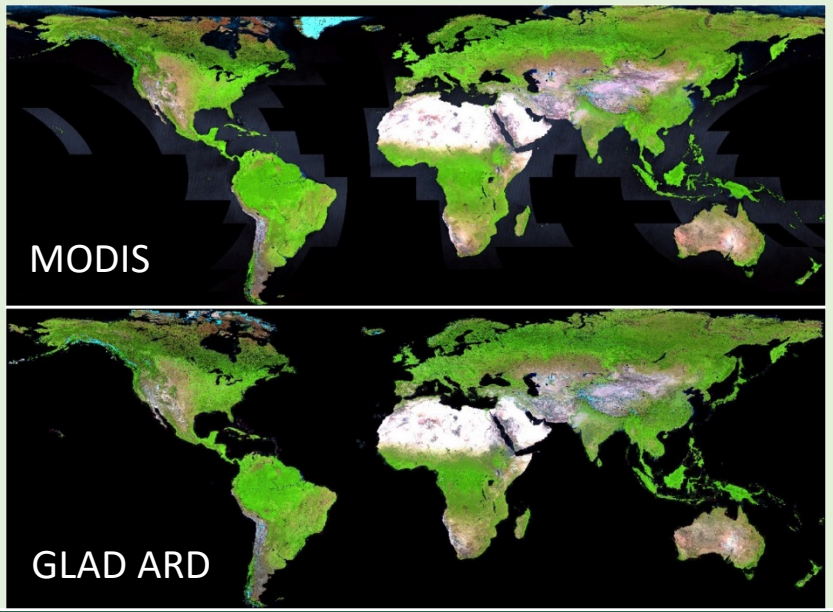
Number of processed images 1997–2019 by WRS path/row

Per-pixel QA

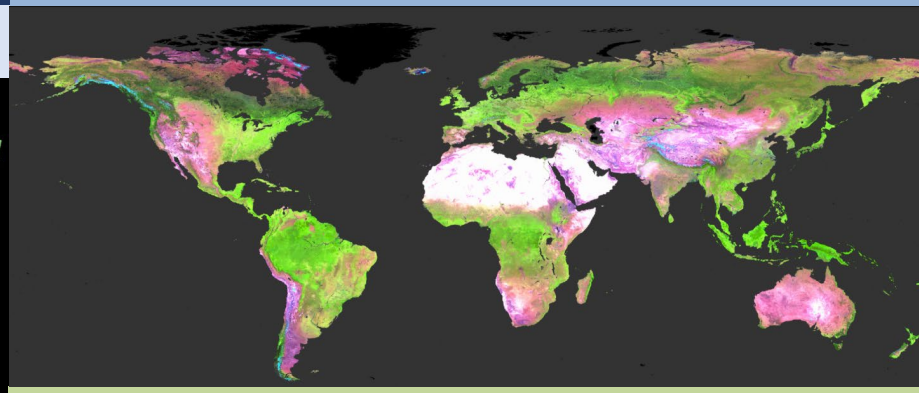
Integration of cfmask and GLAD QA models



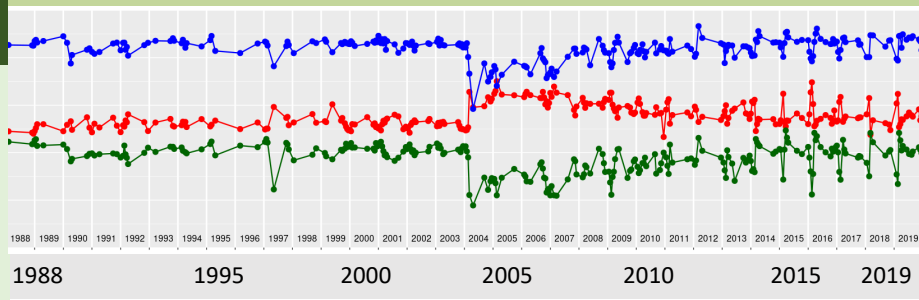
Reflectance Normalization



Spatial Consistency



Temporal Consistency



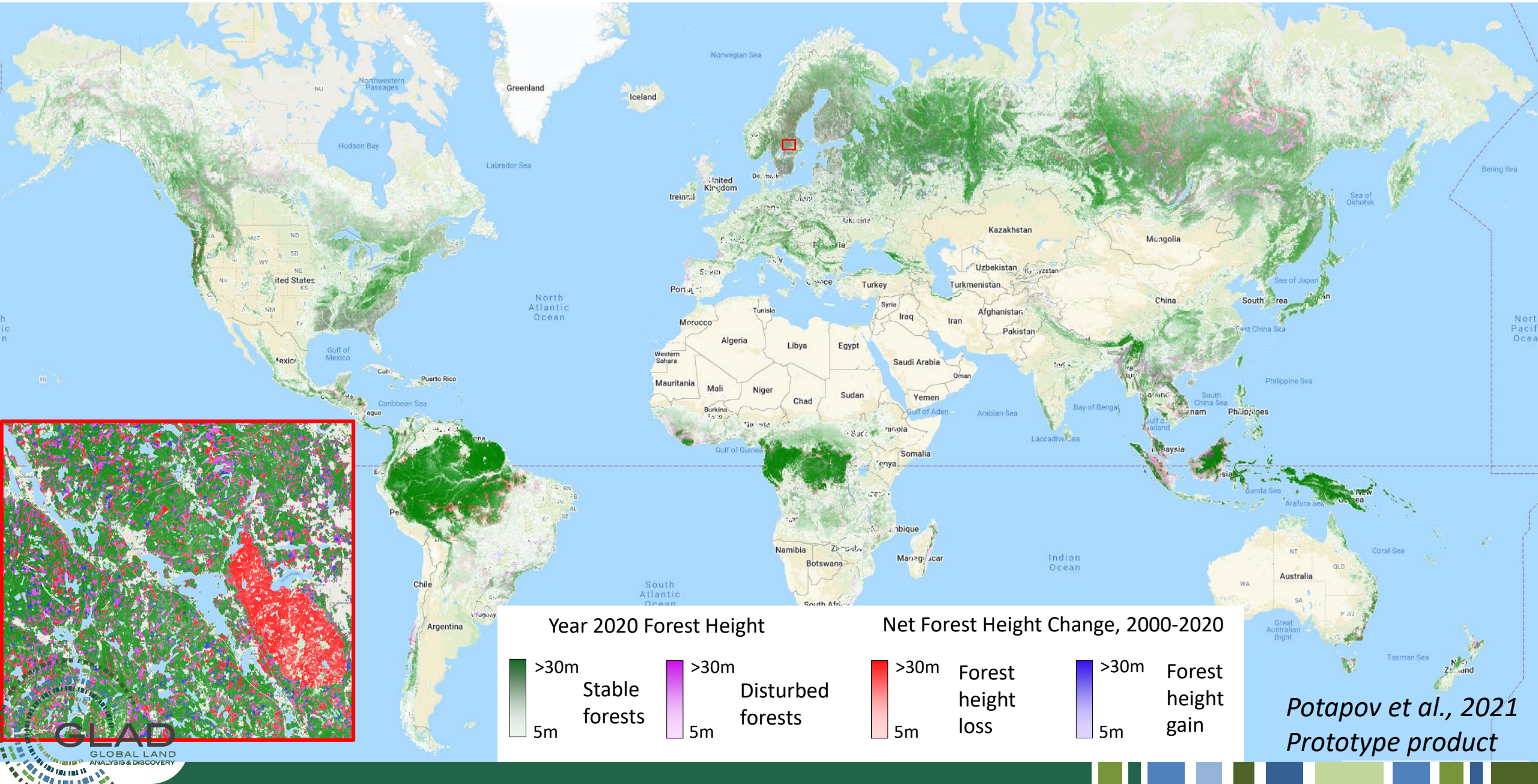
GLAD ARD Data is Publicly Accessible

The GLAD ARD API provides access to ~1.5PB of global data and tools for data processing, machine learning classification, and statistical sampling

https://glad.umd.edu/ard/home/

GLAD GLOBAL LAND ANALYSIS & DISCOVERY

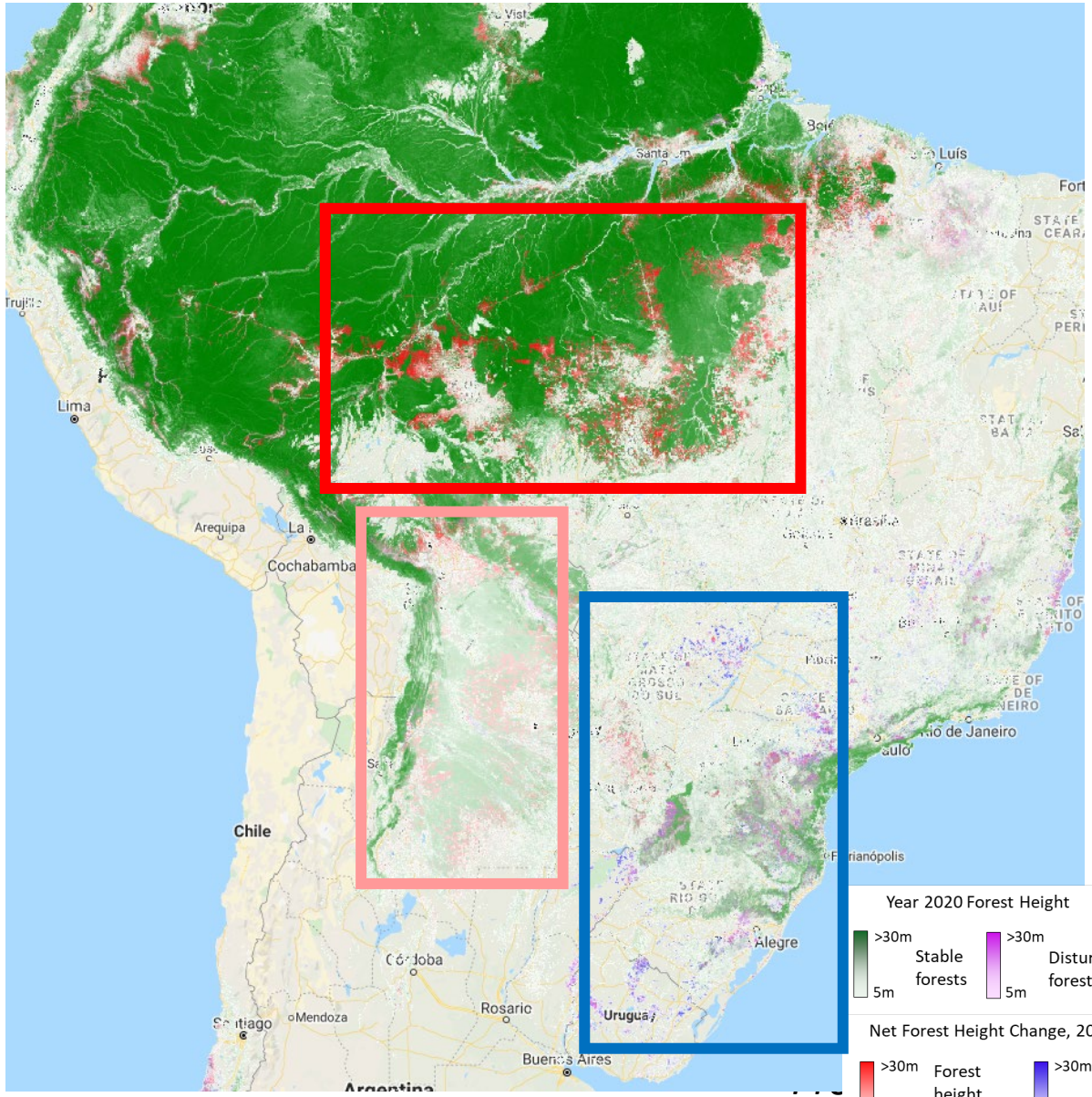
Global Forest Change Analysis, 2000-2020



Global Forest Change Analysis, 2000-2020

Global Forest Loss (www.globalforestwatch.org)

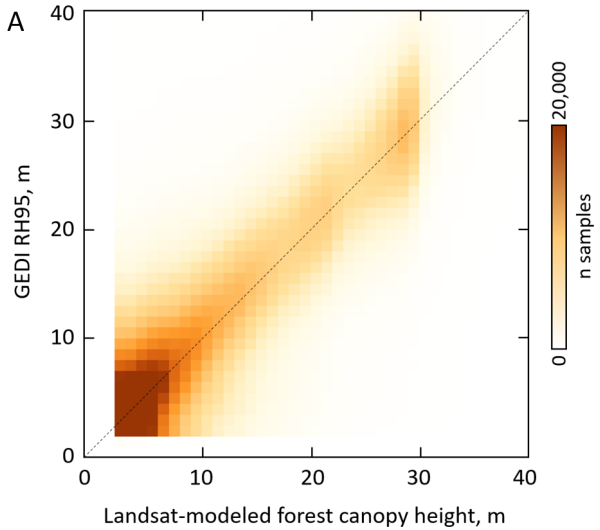
Global Forest Height Time-series Prototype



GLAD GLOBAL LAND ANALYSIS & DISCOVERY

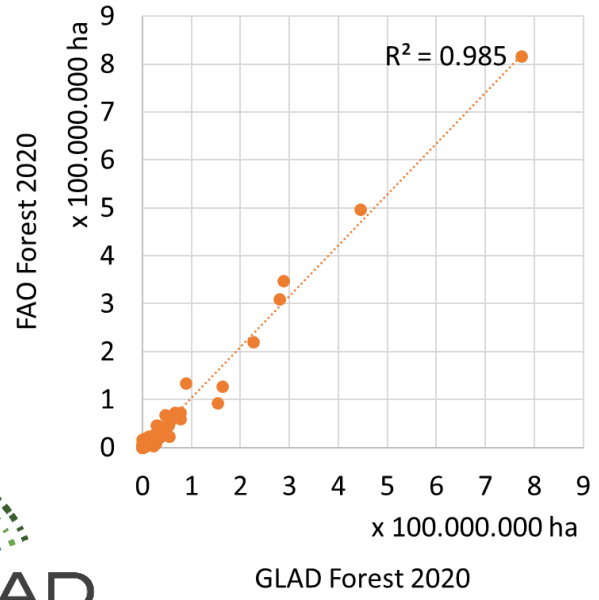
Global Forest Change Analysis, 2000-2020

GEDI validation data



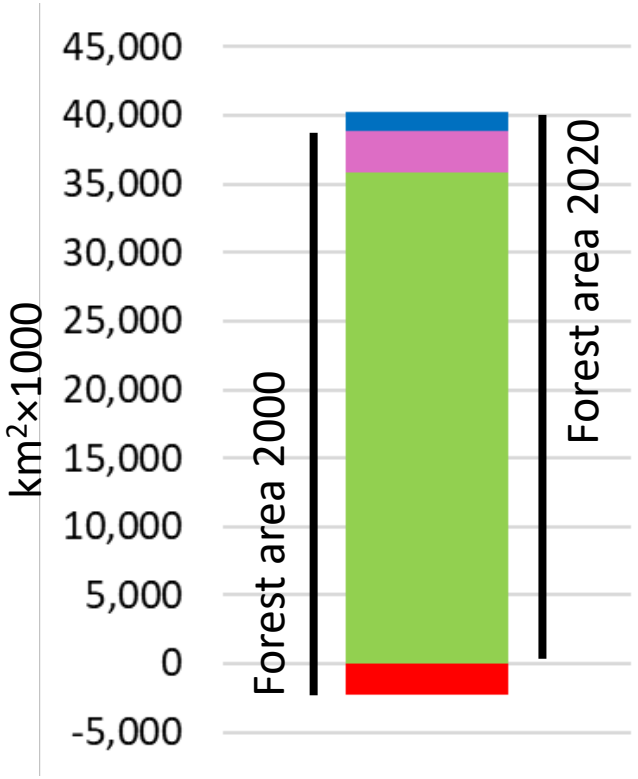
RMSE = 6.6 m; MAE = 4.45 m

FAO FRA 2021



Net global forest dynamics

	Forest, 5m	Forest, 20m	FAO forest
2000 (ha×1,000)	4,122,608	1,595,108	4,158,050
2020 (ha×1,000)	4,022,103	1,529,824	4,058,933
Change, % 2000	-2.4	-4.1	-2.4



3.3% of the year 2020 forest are new forest stands

7.5% of the year 2000 forest area affected by stand-level disturbances

Stable forest 2000-2020

5.6% of the year 2000 forest was lost by the year 2020

GLAD GLOBAL LAND ANALYSIS & DISCOVERY

The NFI Data and RS-based Products

https://doi.org/10.1038/s41598-021-92152-9

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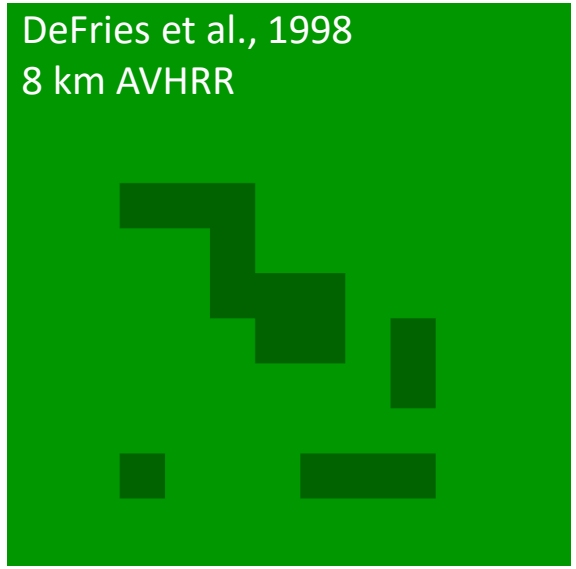
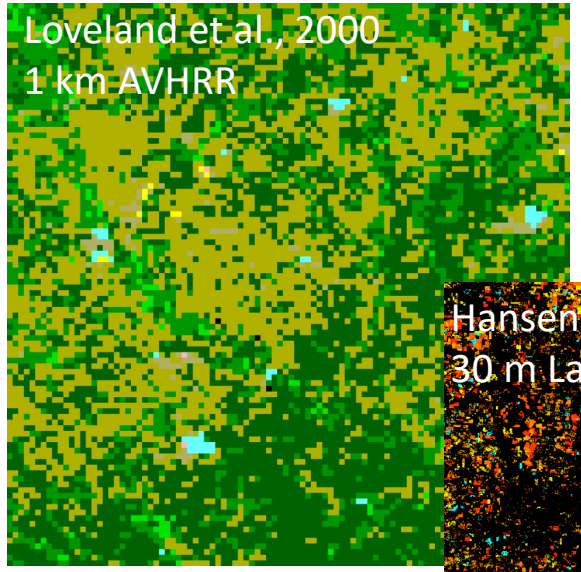
Russian forest sequesters substantially more carbon than previously reported

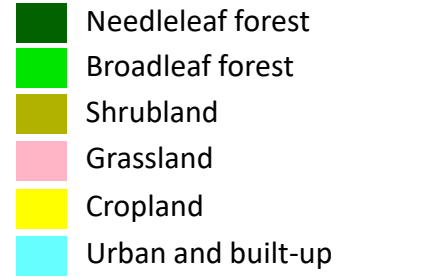
Dmitry Schepaschenko[1,2,3], Elena Moltchanova[4], Stanislav Fedorov[5], Victor Karminov[1,7], Petr Ontikov[5], Maurizio Santoro[8], Linda See[2], Vladimir Kositsyn[6], Anatoly Shvidenko[2,9], Anna Romanovskaya[10], Vladimir Korotkov[10], Myroslava Lesiv[2], Sergey Bartalev[11], Steffen Fritz[2], Maria Shchepashchenko[7] & Florian Kraxner[2]

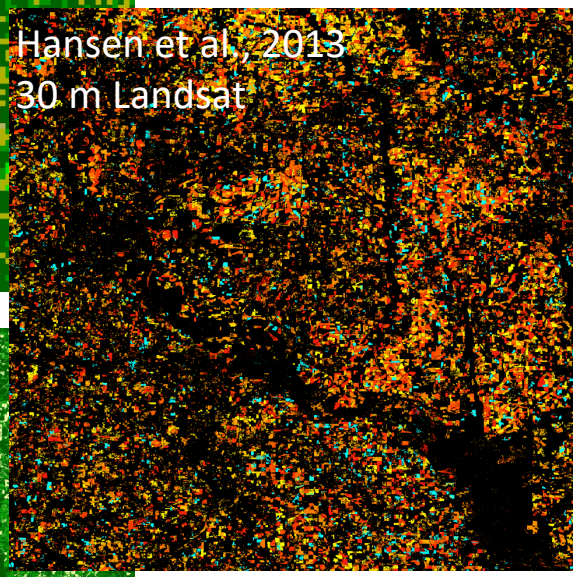
Since the collapse of the Soviet Union and transition to a new forest inventory system, Russia has reported almost no change in growing stock (+1.8%) and biomass (+0.6%). Yet remote sensing products indicate increased vegetation productivity, tree cover and above-ground biomass. Here, we challenge these statistics with a combination of recent National Forest Inventory and remote sensing data to provide an alternative estimate of the growing stock of Russian forests and to assess the relative changes in post-Soviet Russia. Our estimate for the year 2014 is $111 \pm 1.3 \times 10^9$ m^3, or 39% higher than the value in the State Forest Register. Using the last Soviet Union report as a reference, Russian forests have accumulated 1163×10^6 m^3 yr^{-1} of growing stock between 1988–2014, which balances the net forest stock losses in tropical countries. Our estimate of the growing stock of managed forests is 94.2×10^9 m^3, which corresponds to sequestration of 354 Tg C yr^{-1} in live biomass over 1988–2014, or 47% higher than reported in the National Greenhouse Gases Inventory.

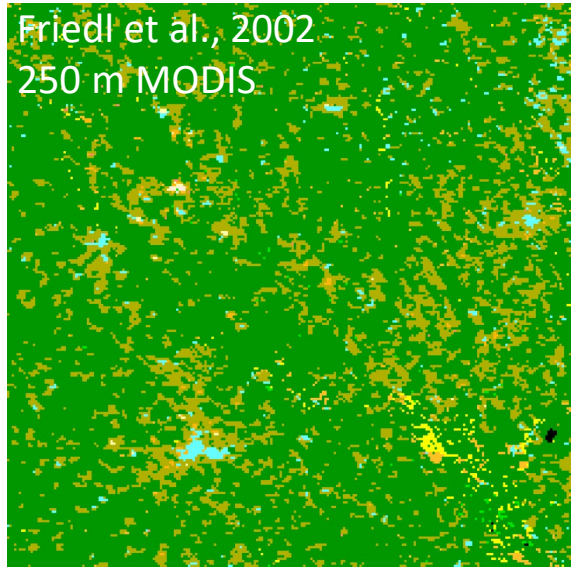
The NFI data (with plot coordinates) are restricted for sharing and use. For the first time, we obtained access to a portion of the primary NFI data with precise location information under the condition that the initial data processing was physically undertaken at the location of the authorized division ("Roslesinforg") of the Federal Forestry Agency.

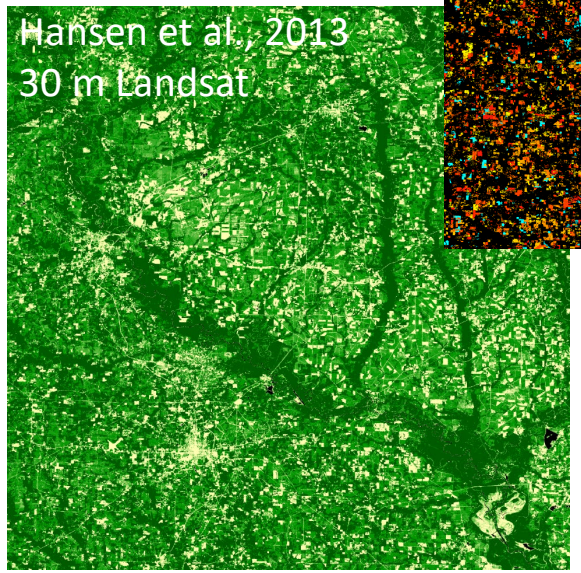


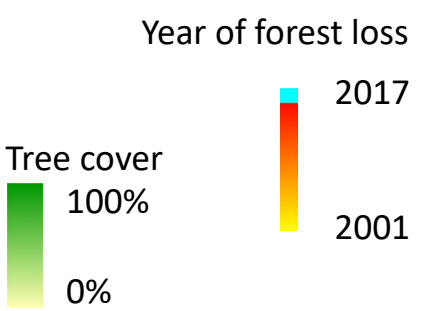












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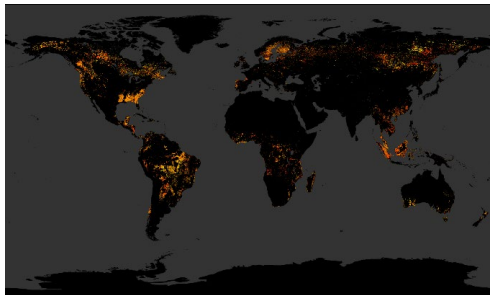
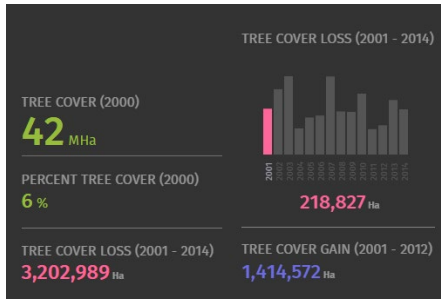
Sample Analysis for Map Uncertainty and Area Estimation



Direct area extraction from the national or global maps



Satellite-based maps provides spatially consistent, wall-to-wall data…

However:

- All maps derived from remotely sensed data contain errors due to data limitation, classification/change detection algorithm limitation, analyst errors and bias, etc.
- Errors usually introduce bias in area estimations. The map errors may be spatially biased.
- The uncertainty of classification may not be estimated from the map alone.

Recommend "good practice" for area reporting

National (continental, global) land cover mapping and monitoring

Stratified sampling design
Regression estimators

Map accuracy
Map adjustment

Sample analysis (national or sub-national)

- Map validation.
- Estimation of the unbiased area of land cover classes and changes with known uncertainties.
- Additional thematic attribution (i.e., change drivers).

Sample analysis that employs probability sampling allows to estimate the **unbiased area** of land cover classes and change; estimate area **uncertainty**; and perform **value-added thematic analysis** based on sample reference data (e.g., to differentiate land cover change by drivers).

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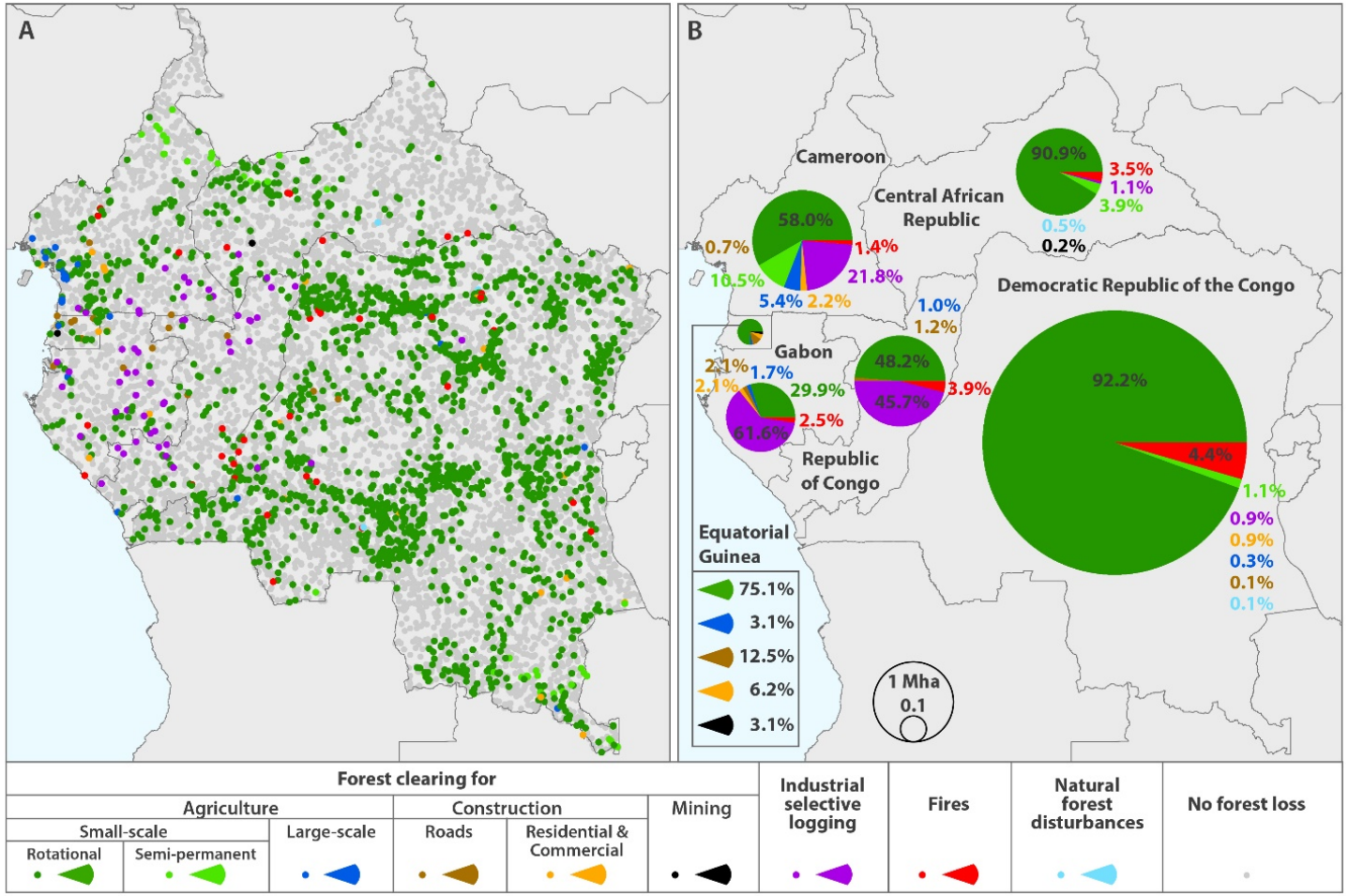
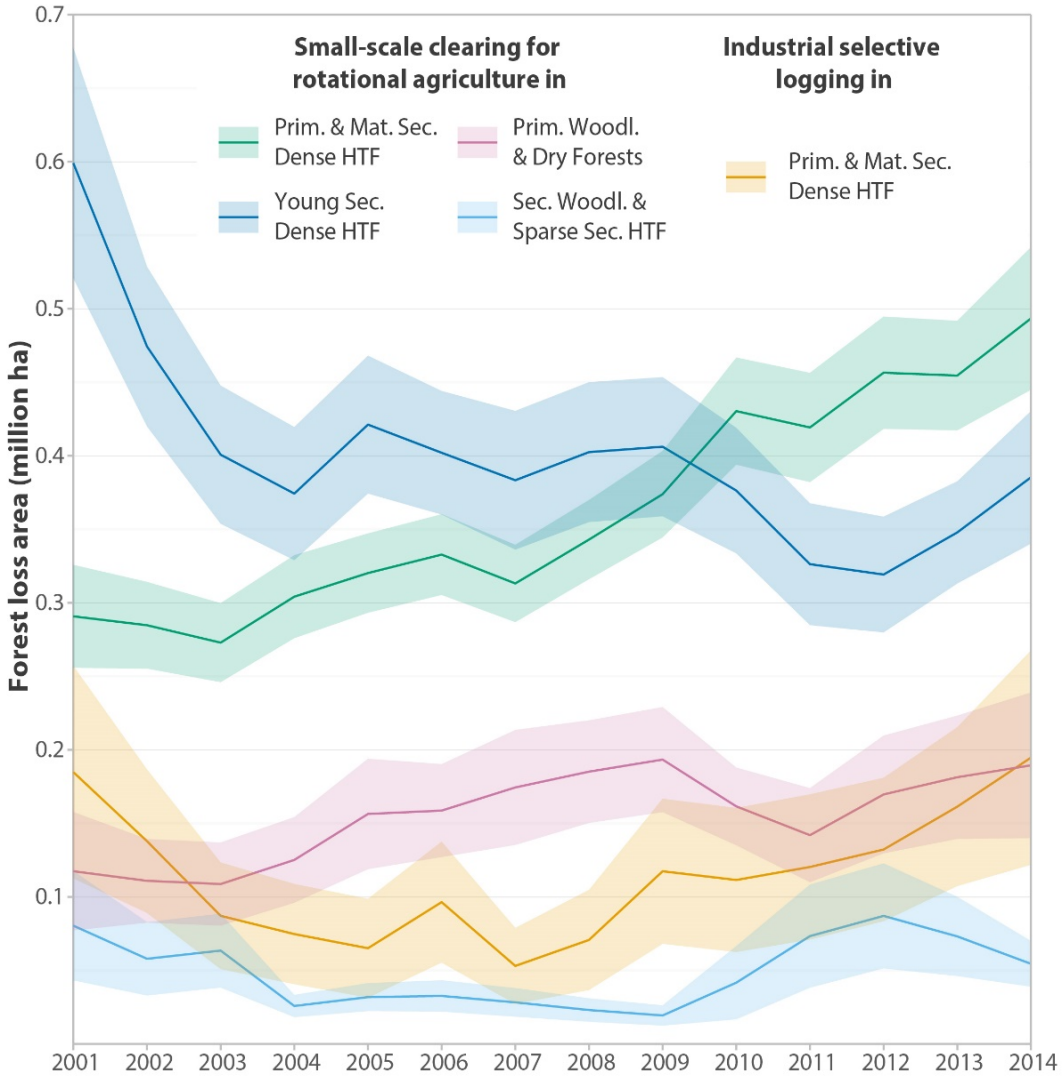
Sample Analysis for Map Uncertainty and Area Estimation





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ENVIRONMENTAL STUDIES

Congo Basin forest loss dominated by increasing smallholder clearing

Alexandra Tyukavina[1]*, Matthew C. Hansen[1], Peter Potapov[1], Diana Parker[1], Chima Okpa[1], Stephen V. Stehman[2], Indrani Kommareddy[1], Svetlana Turubanova[1]

DOI: 10.1126/sciadv.aat2993

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