

LCLUC PROGRAM: UPDATE

Garik Gutman,
NASA Headquarters
Manager, LCLUC Program

May 2023



INTERNAL NASA LINKAGES

Carbon Cycle and Ecosystems Focus Research Area

Terrestrial
Ecosystems
Program

Ocean Biology
Program

Biodiversity
Program

Applications
Program
Carbon Management
Coastal Management
Water Management
Agri. Management

**Land-Cover/Land-
Use
Change Program**

Water and Energy Cycle
Focus Research Area
Terrestrial Hydrology

Atmospheric
Composition
Focus Area
*Radiation
Science*

25 YEARS OF EXTERNAL INTERACTIONS: NATIONAL

- **U.S. Global Climate Research Program (USGCRP)**
 - LULCC Interagency Working Group
 - Our Changing Planet issues
 - NAS NRC review of land-use models
- **U.S. Geological Survey (USGS)**
 - Landsat program
 - USGS science projects' support
 - Global Land Surveys (Landsat-based)
- **Private sector: Planet Lab, Maxar**
 - NASA Commercial Smallsat Data Acquisition (CSDA)
- **Academia**
 - Research projects' support
- **U.S. Department of Agriculture (USDA) and U.S. Forest Service (USFS)**

EXTERNAL LINKAGES: INTERNATIONAL

- Global Observations of Forest Cover and Land-use Dynamics (GOFC-GOLD) since 1997
- CEOS/GEO
- IGBP/IHDP □ Future Earth
 - Global Land Program (GLP)
- Space agencies (ESA, JAXA, etc.)

- EARSeL (EU Remote Sensing Labs)
 - LULC Special Interest Group
- Regional Initiatives

SAFARI (South Africa)

LBA (Amazon)

NEESPI (Northern Eurasia)

MAIRS (Monsoon Asia)

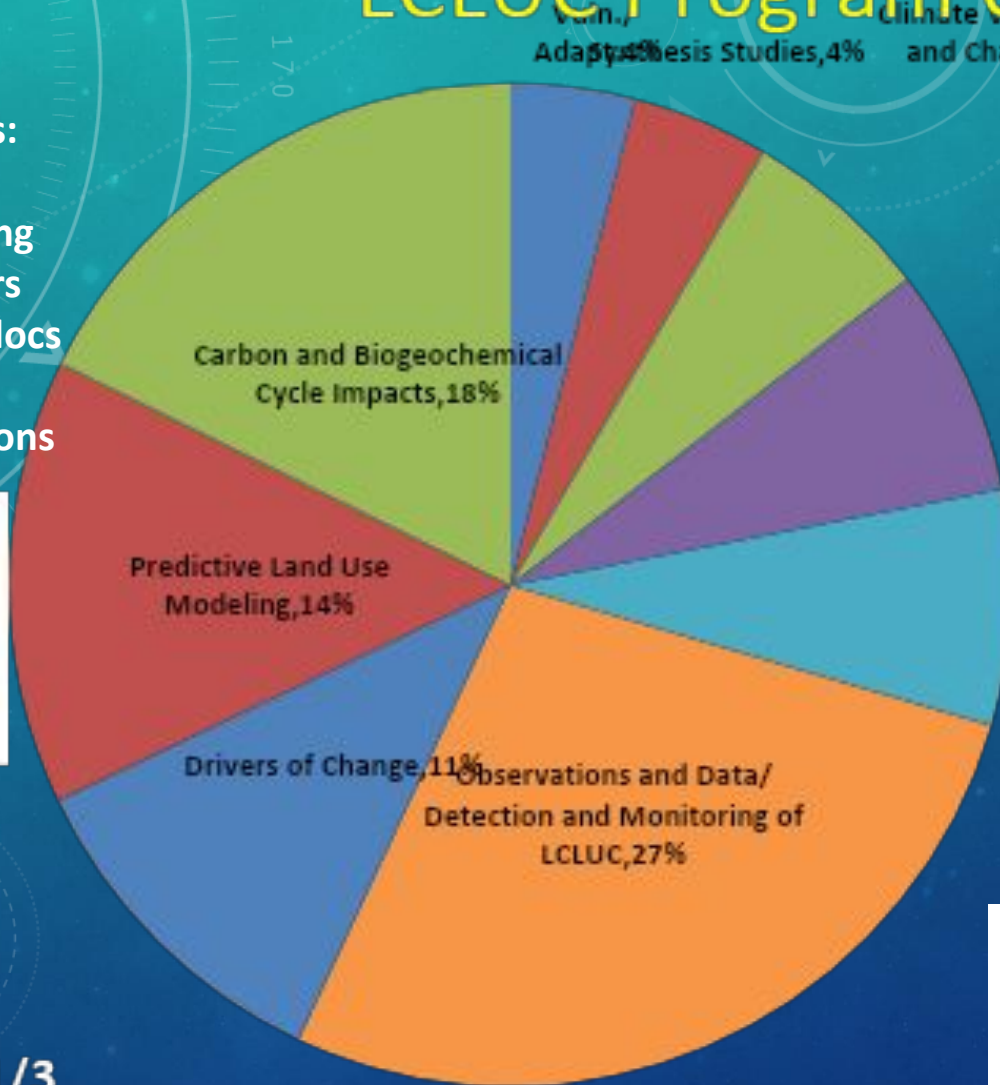
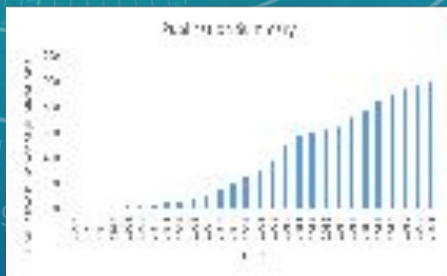
SARI (South/Southeast Asia)



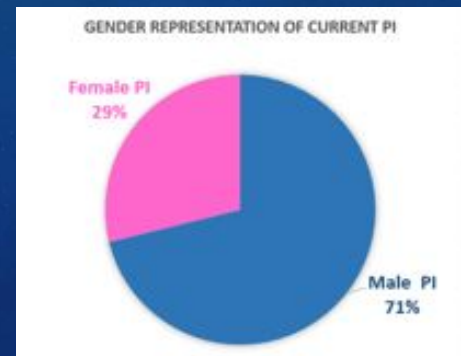
LCLUC Program Content

25-yr Program stats:

- >300 projects
 - ~50 ongoing
- >800 researchers
 - >20 post-docs
 - >50 grads
- >1000 publications



Impacts - 1/3
 Monitoring - 1/3
 Synthesis, other - 1/3



<http://lcluc.umd.edu>

UNIQUENESS OF THE LCLUC GLOBAL SCIENCE PROGRAM

- Socio-economic component: an integral part of the projects
 - impacts of changes in human behavior and economy on LCLUC
 - impacts of LCLUC on society
 - adaption to climate change of land-use systems
 - a mandatory part of all LCLUC proposals, except MuSLI
- Remote sensing component: Multi-Source Land Imaging (MuSLI) component with medium or higher resolution
- Regional Initiatives: focus on Hotspots
- Capacity Building/Education component

LCLUC Science Team Meetings in DC Area

- 2007: Climate/Carbon
- 2008: Joint CC&E Focus Area/Arctic
- 2009: LCLUC impacts on climate
- 2010: GLS LCLUC products
- 2011: 15th Anniversary (review)
- 2011/9: Joint CC&E Focus Area/Ag
- 2012: Urban
- 2013: Wetlands
- 2014: Urban

Spring Blossom

<->

Fall Colors



2015: 20th Anniversary/Industrial Forests

2016: 20th Anniversary/Industrial Forests

International Regional Science Team Meetings



SPACE WEEK
NORDESTE 2023
SPACE SCIENCE AND TECHNOLOGIES FOR
THE BENEFIT OF NATURE AND SOCIETY
AUGUST 14 - 20 2023

2023/8 Fortaleza, Brazil

CIÊNCIA E TECNOLOGIAS ESPACIAIS PARA O BENEFÍCIO DA NATUREZA E DA SOCIEDADE
14 - 20 DE AGOSTO DE 2023
FORTALEZA - CE - BRASIL

LABORIT@UFPA

www.spaceweeknordeste.com.br

AEB NASA

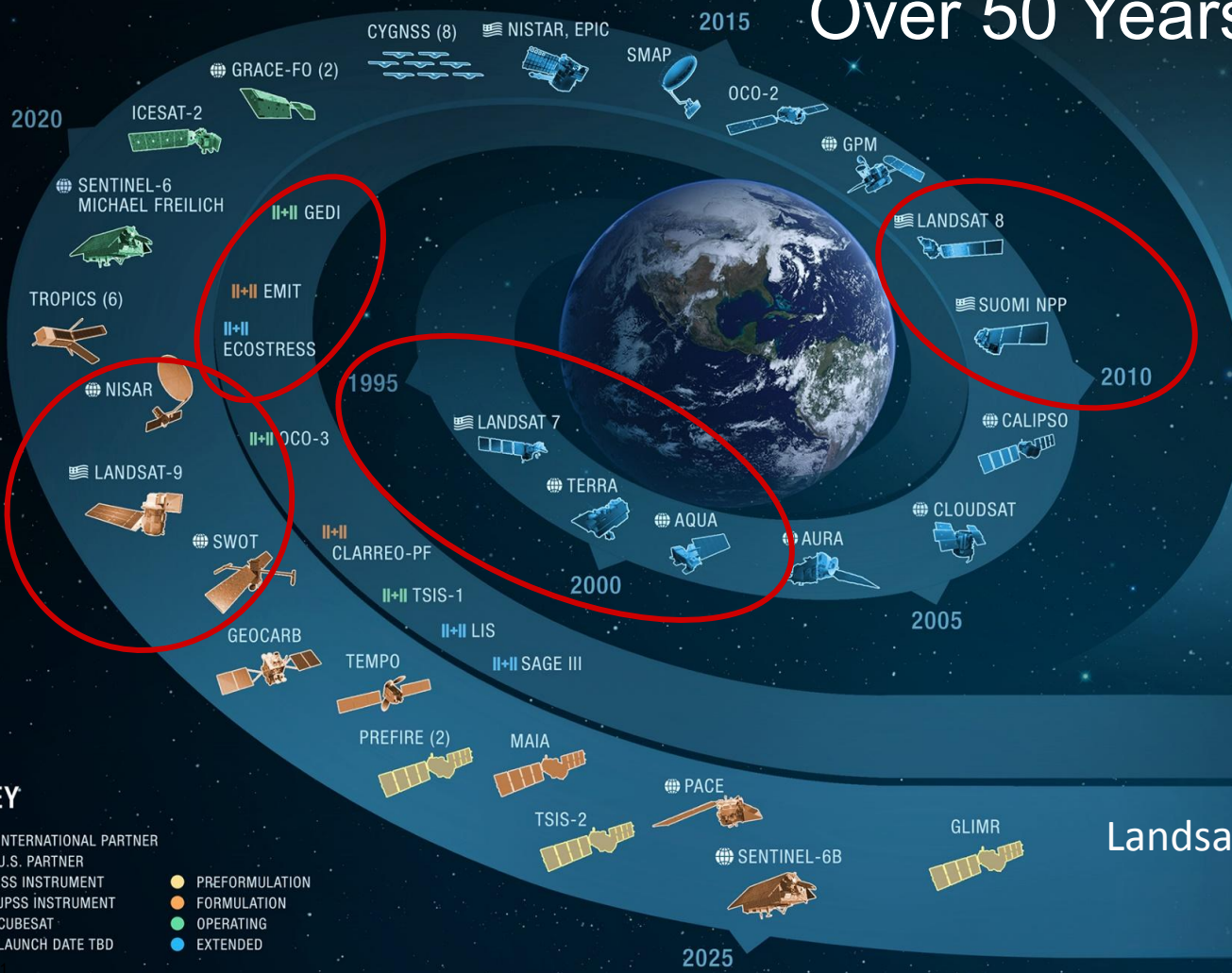
NASA Operating Missions

Over 50 Years in Space!

National Aeronautics and Space Administration



EARTH FLEET



INVEST/CUBESATS

- TEMPEST-D 2021
- CSIM-FD 2023
- HARP 2020
- CIRIS 2022
- CTIM* 2023
- HYTI* 2021
- SNOOPI* 2023
- NACHOS* 2023

JPSS INSTRUMENTS

- OMPS-LIMB 2022
- LIBERA 2027

ISS INSTRUMENTS

MISSIONS

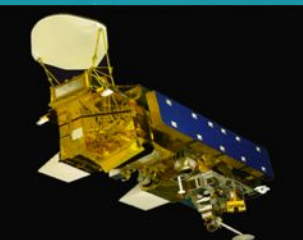
KEY

- INTERNATIONAL PARTNER
- U.S. PARTNER
- ISS INSTRUMENT
- JPSS INSTRUMENT
- CUBESAT
- LAUNCH DATE TBD
- PREFORMULATION
- FORMULATION
- OPERATING
- EXTENDED

Landsat next

NASA LCLUC-Relevant Missions

Systematic Missions - Observation of Key Earth System Interactions



Landsat 5 & 7
3/1/84 & 4/15/99

Terra
12/18/99
ASTER
MODIS

Aqua
5/3/02

Suomi-NPP
10/28/11
VIIRS

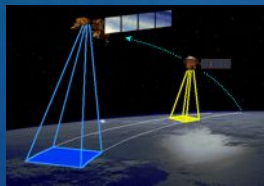
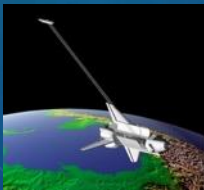
Landsat 8
2/11/13

Landsat 9
9/27/21

Exploratory Missions -

Exploration of Specific Earth System Processes and Demonstration of Technologies

International Space Station (ISS)



ShuttleRadar Topography Mission SRTM
2/11/02-2/22/02
Space Shuttle Endeavour

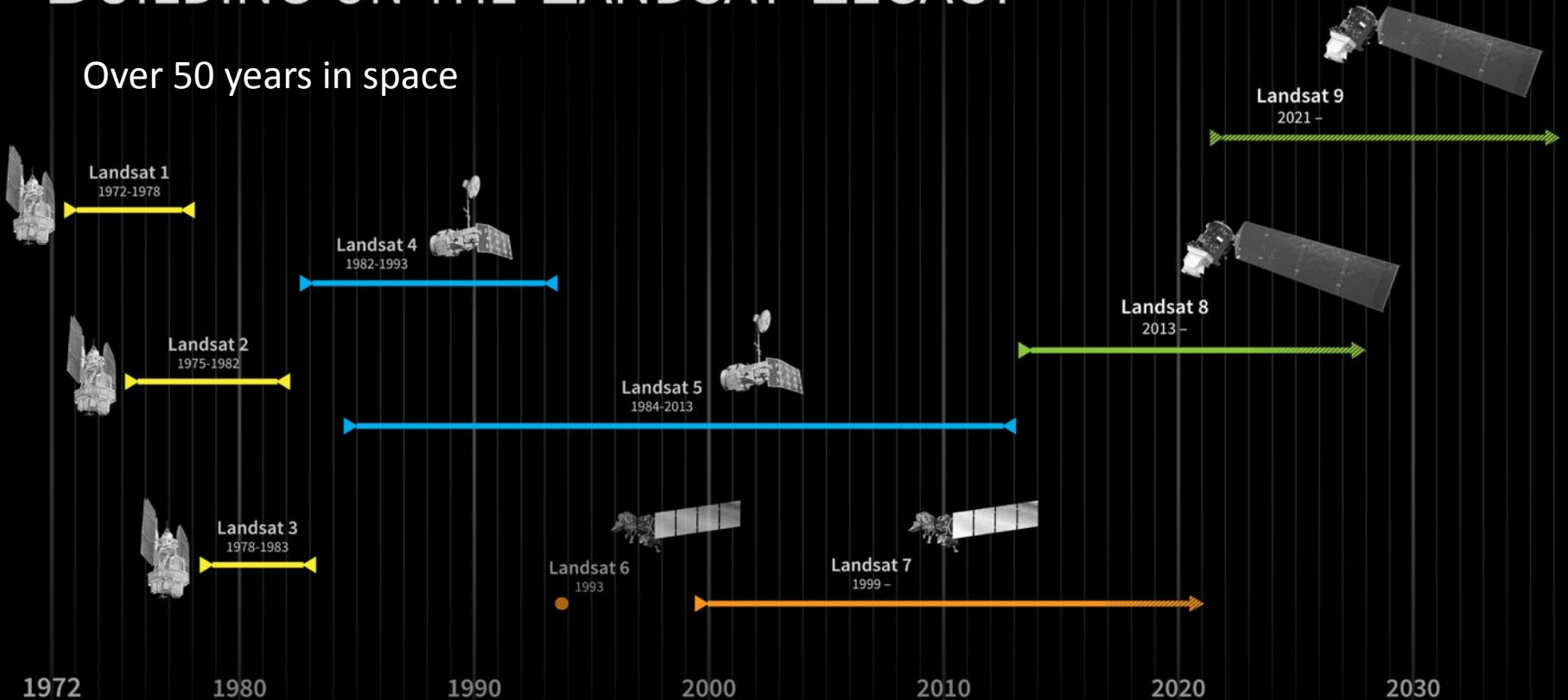
Earth Observing EO-1
ALI (predecessor of Landsat-8)
Hyperion – first hyperspectral in space
11/21/00-3/30/2017

ECOSTRESS (thermal IR)
GEDI (Lidar)
DESI (Hyperspectral)

Deployed in 2018

BUILDING ON THE LANDSAT LEGACY

Over 50 years in space



- The Landsat program: Earth Resources Technology Satellites Program 1966, Landsat 1 (ERTS) launched in July 1972
- Thermal band added for Landsat 3 and beyond
- After launch, Landsat operations are transferred from NASA to USGS to collect, archive, process, and distribute the image data
- Until 2010 expensive, FREE NOW!
- Two-Landsat system frequency revisit time: 8 days -- in some areas may not provide enough observations for monitoring rapid changes (e.g., Ag) but sufficient for slow changes (e.g., Urban)

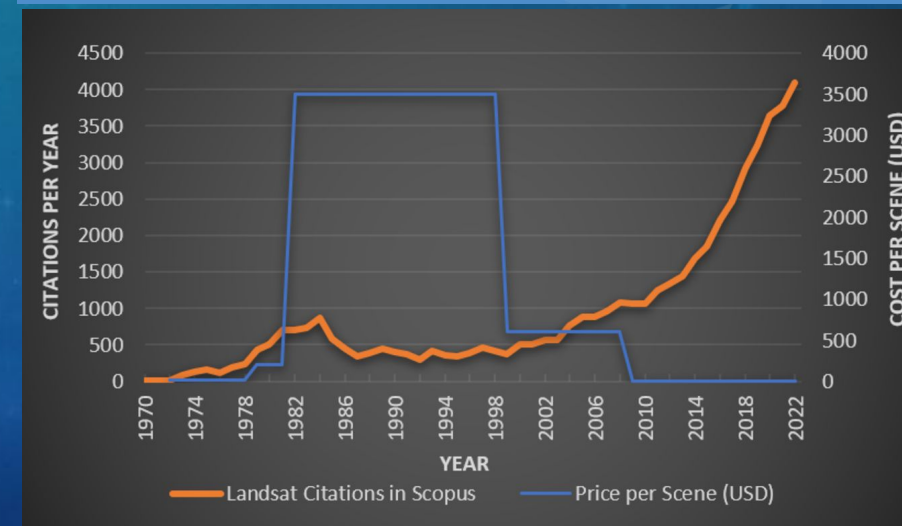
THE ANNIVERSARY OF THE NEW ERA IN LANDSAT DATA USE

April marked the 15-year anniversary of the USGS announcement to 'open' the Landsat archive at the USGS Earth Resources Observation and Science (EROS) Center, making all Landsat data available to download at no charge for users worldwide



Barb Ryan,
former Associate Director of Geography for USGS,
and (more recently) former Secretariat-Director
for the Group on Earth Observations (GEO)

The 100 millionth Landsat scene was recently downloaded from the EROS archive, marking a major milestone for a policy shift that opened the door to previously impossible wide-scale research projects and generated billions of dollars in returns worldwide.



Multi-Source Land Imaging (MuSLI)

- Sentinel-2a: launched in Jun 2015
- Sentinel-2b: launched in Mar 2017
- Sentinel-1a: launched in Apr 2014
- Sentinel-1b: launched in Apr 2016
- Sentinel-1b: set for launch in 2023
- Landsat-7: launched in Apr 1999
- Landsat-8: launched in Feb 2013
- Landsat-9: launched in Sep 2021

COMBINING OPTICAL AND MICROWAVE DATA: LANDSAT + SENTINEL2 + SENTINEL1

Merging Sentinel-2 and Landsat data streams could provide < 5-day coverage required for Ag monitoring

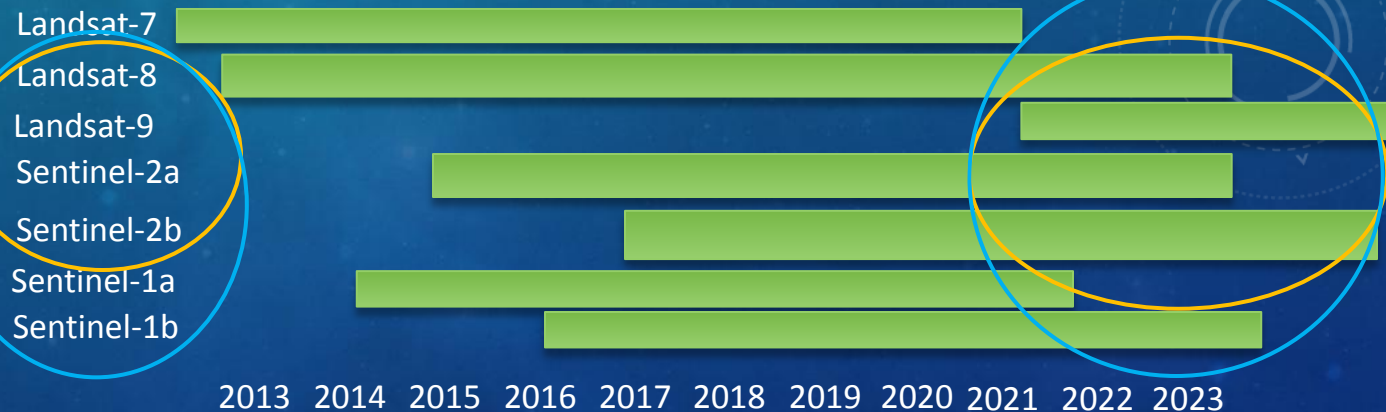
- Both sensors have 10-30m coverage in VNIR-SWIR
- Satellite orbits complementary
 - Landsat-8 & -9 8 days
 - Sentinel-2a & 2b 5 days
- Global ~3 day
- Merging in Sentinel-1 radar data provides all-weather microwave observations



Jeff Masek,
NASA GSFC
Former
MuSLI Project
Scientist
and former
Landsat-9 Project
Scientist



Benjamin Koetz,
Former ESA Project Scientist
for MuSLI



MuSLI Solicitations: LCLUC-2014 (merging Landsat and Sentinel-2); LCLUC-2017 (incl. Radar data); LCLUC-2020 (incl. VHR data); LCLUC-2023 (incl. IR data and all of the above)

NEW OPPORTUNITIES

SENSORS ON ISS FOR LCLUC STUDIES

- ECOSTRESS: Ecosystem Spaceborne Thermal Radiometer Experiment on ISS
 - Prototype HypsIRI Thermal Infrared Radiometer (PHyTIR)
 - 5 spectral bands in the 8-12.5 μm range+1.6 μm (69m x 38m)
- DESI: DLR Earth Sensing Imaging Spectrometer
 - 235 spectral channels with ground res. 30m
- GEDI: Global Ecosystem Dynamics Investigation
 - high resolution laser ranging observations of the 3D structure of the Earth
 - three lasers produce eight parallel tracks of observations
 - each laser fires 242 times per second and illuminates a 25 m spot (a footprint) on the surface over which 3D structure is measured

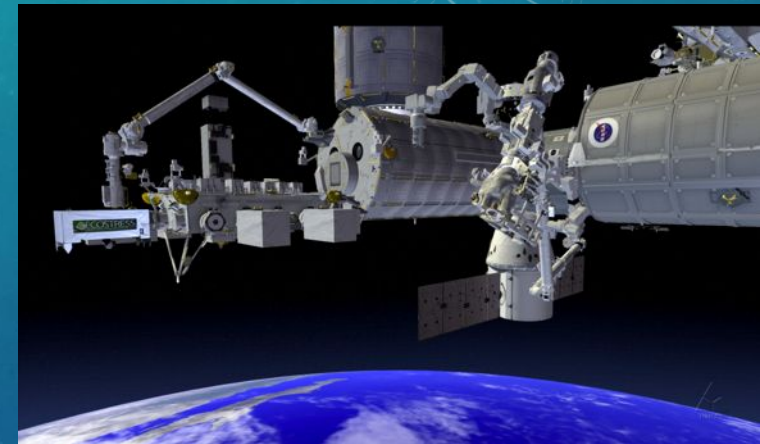
RECENT AND UPCOMING MISSIONS

- SWAT: Surface Water and Ocean Topography
- NISAR: NASA-ISRO SAR

ECOSTRESS: NASA INSTRUMENT ON ISS

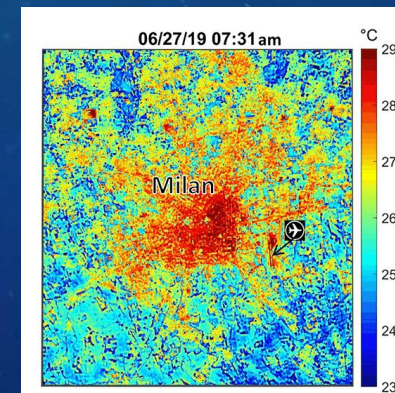
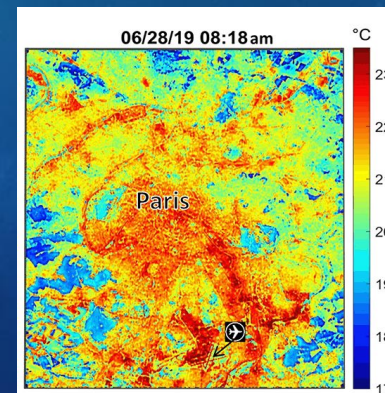
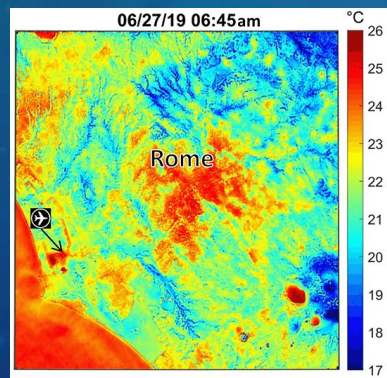
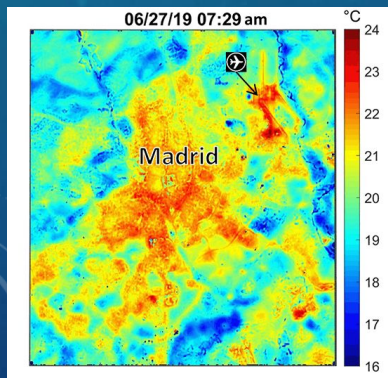
ECOSYSTEM SPACEBORNE THERMAL RADIOMETER EXPERIMENT ON THE INTERNATIONAL SPACE STATION (ISS)

- Prototype HypsIRI Thermal Infrared Radiometer
 - 5 spectral bands in the 8-12.5 μm range +1.6 μm
 - Spatial resolution ~ 70 m
 - **Advantage** over ASTER (on TERRA) – more frequent revisits
- Science objectives
 - Identify critical thresholds of water use and water stress in key biomes (e.g., tropical/dry transition forests, boreal forests)
 - Detect the timing, location, and predictive factors leading to plant water uptake decline and cessation over the diurnal cycle
 - Measure agricultural water consumptive use over CONUS at spatiotemporal scales applicable to improving drought estimation accuracy



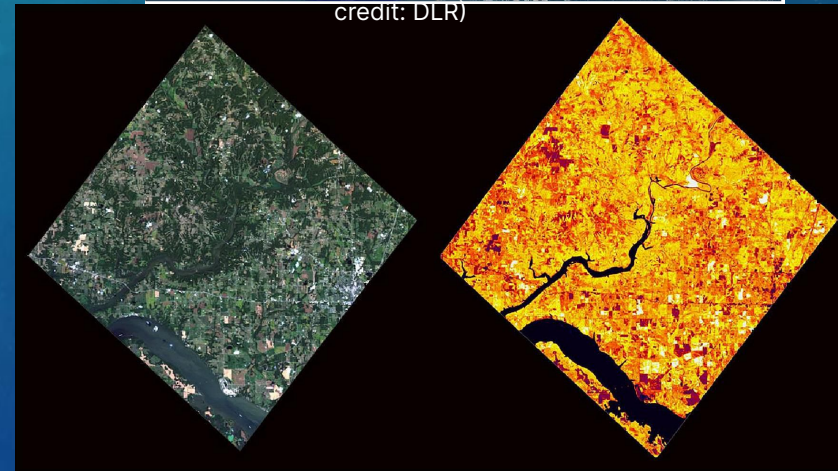
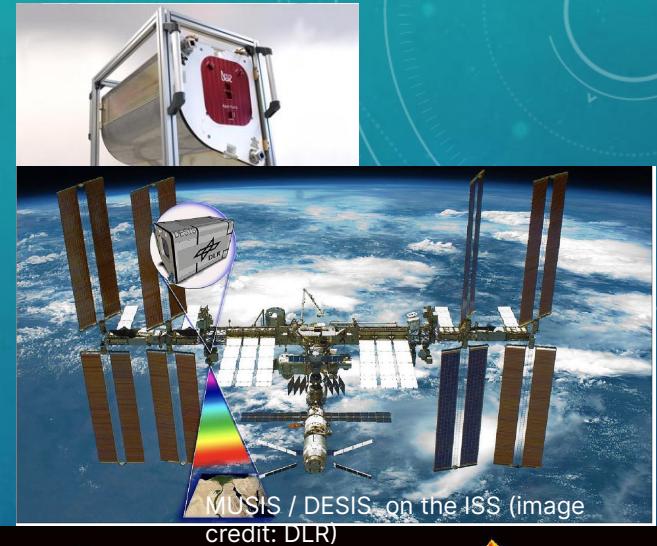
Credit: NASA/JPL-Caltech

Heatwave over Europe: June 2019



DLR EARTH SENSING IMAGING SPECTROMETER (DESIS) ON ISS

- Launched to the International Space Station (ISS) from Cape Canaveral on **29 June 2018**
- Deployed in **Aug 2018** to observe the Earth and provide **hyperspectral data** to support scientific,
- DESIS has **235 spectral channels** with ground resolution 30m
- Can point forwards, backwards and to the sides



First images of the hyperspectral instrument DESIS. Left: Optical image of the environment of **Huntsville, AL**; Right: A processed image showing the vegetation density (image credit: DLR)

https://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10212/332_read-28665/#/gallery/30169

GLOBAL ECOSYSTEM DYNAMICS INVESTIGATION NASA GEDI MISSION

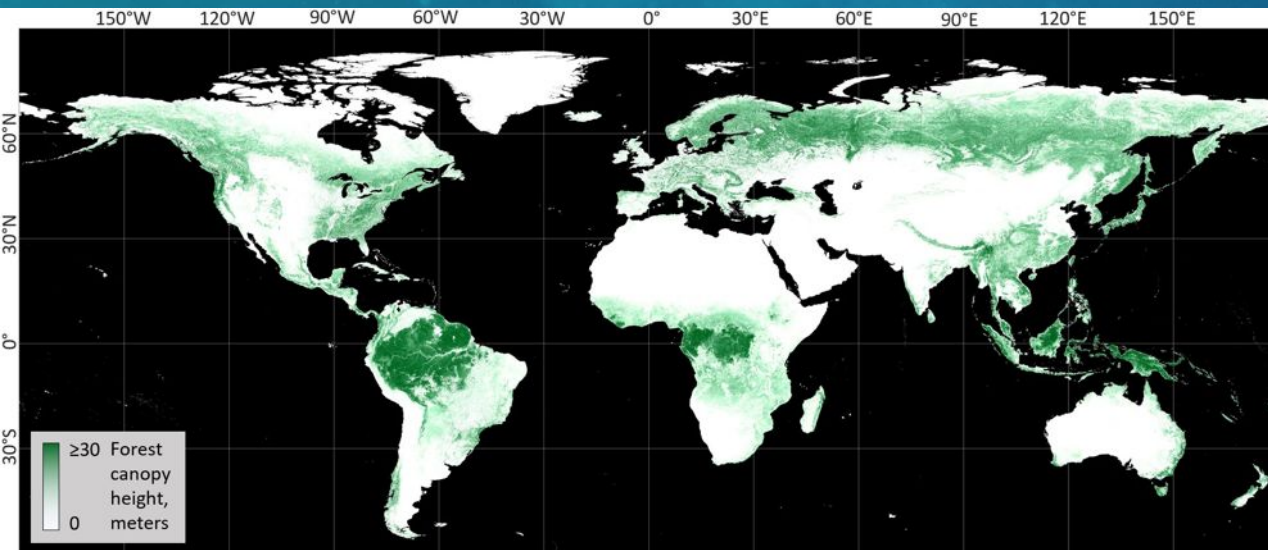
High resolution laser ranging observations

- three lasers produce eight parallel tracks of observations
- each laser fires 242 times per second and illuminates a 25 m spot (a footprint) on the surface



**Global Land
Analysis & Discovery**

Global Forest Canopy Height: 2019



Question	Quantify
What is the carbon balance of the Earth's forests?	Forest Biomass Disturbance and Recovery
How will the land surface mitigate atmospheric CO2 in the future?	Carbon Sequestration Potential
How does forest structure affect habitat quality and biodiversity?	Vertical Forest Structure and its Relationship to Biodiversity

Integration of the GEDI lidar forest structure measurements and Landsat analysis-ready data time-series Potapov et al. 2020, RSE

NASA-CNES SURFACE WATER AND OCEAN TOPOGRAPHY (SWOT)

- SWOT's 120-km-wide swath with overlaps over most of the globe with an average revisit time of 11 days
- Launched **Dec 16, 2022**
- On land, it will collect data on lakes and reservoirs larger than 62,500 m² and rivers wider 100 m with 50-m spatial and 10-cm height resolutions
- All weather - penetrate cloud cover and the dark of night



SWOT will survey nearly all water on Earth's surface for the first time with Ka-band Radar Interferometer (KaRIn, frequency between 26.5 and 40 GHz)

NASA-ISRO SAR (NISAR)

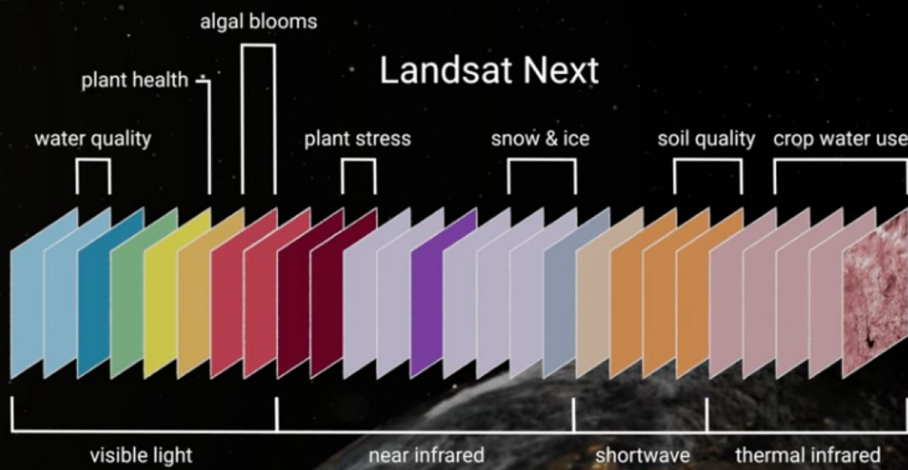
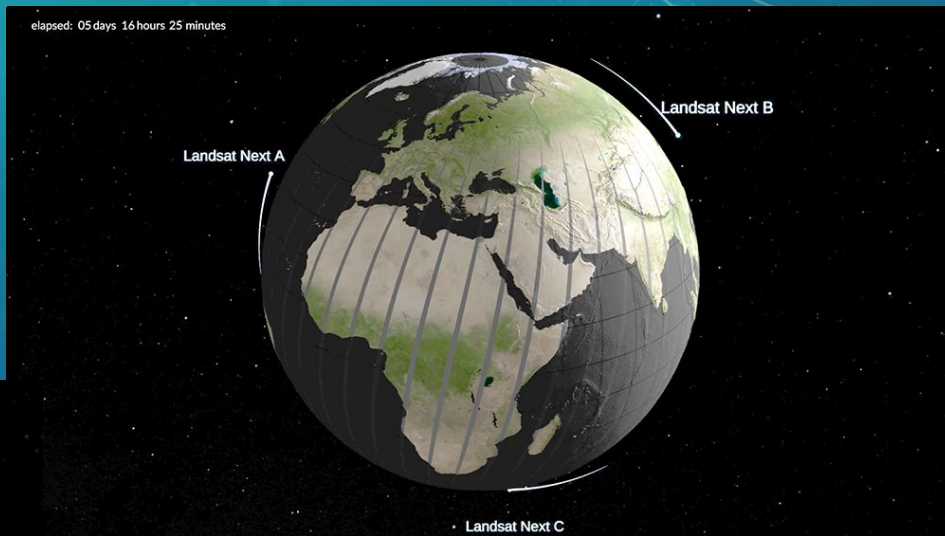
- Will observe Earth's land and ice-covered surfaces globally with 12-day repeat cycle
- Swath of 242 km
- Resolution 3–48 m for L-band
- Resolution of 3-24 m for S-band
- Planned Launch Date: **2024**
- Will observe the distribution of vegetation and biomass to better understand ecosystems' responses to disturbance and recovery
- Will map above-ground woody biomass density for estimating carbon emissions from land-use change with much more accuracy



L-band (24 cm) and S-band (12 cm) polarimetric SAR

MORE DISTANT FUTURE: LANDSAT NEXT

- Constellation of 3 small satellites
- 26 wavelengths bands
- More frequent and finer resolution
- Launch: **late 2030**

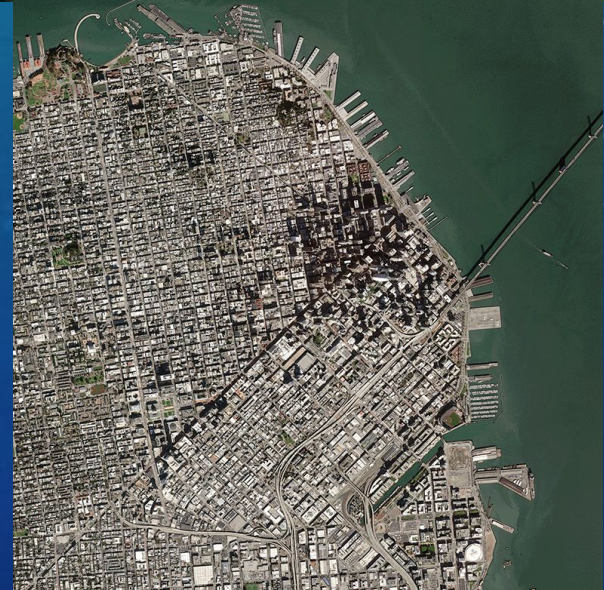
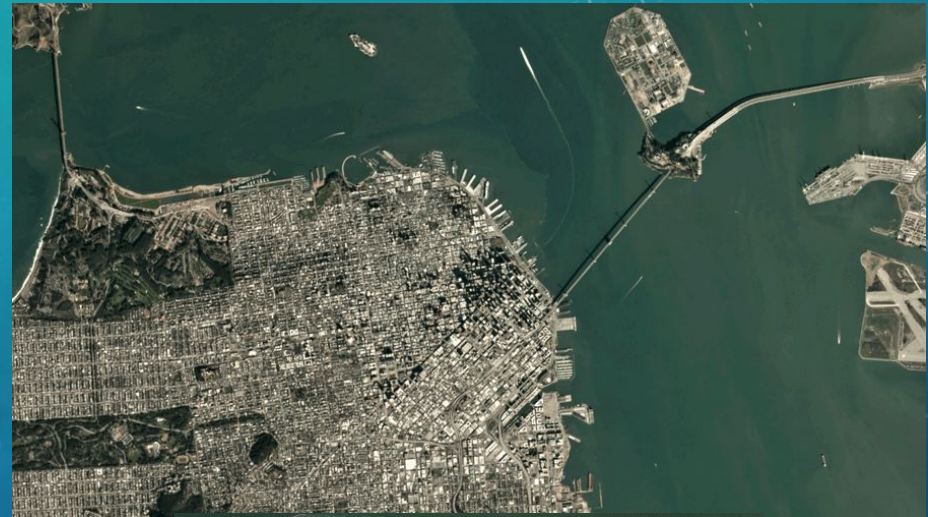


Landsat Next constellation of **three spacecraft** will provide finer spatial resolution (10-20m) and expanded spectral (26 band) imaging capabilities **every six days** (at the equator)

ZOOMING-IN: USING VERY HIGH RESOLUTION DATA

Commercial satellites offer images at fine spatial scale and high temporal resolution

- The first NASA Data Buy 2003 – **Ikonos**
 - **Planet Labs** constellation (>200 sats) acquire daily images of the Earth with 3-m resolution
 - **Maxar (Digital Globe, WorldView)** with 1m resolution
- ▶ **NASA Commercial Smallsat Data Acquisition (CSDA)**
- ▶ Limited Planet datasets are available for free at Universities
 - ▶ Wall-to-wall VHR data over tropics purchased by the government of Norway (to tackle tropical deforestation)
 - ▶ Special Issue in Remote Sensing (2020) on applications of VHR data in LCLUC studies



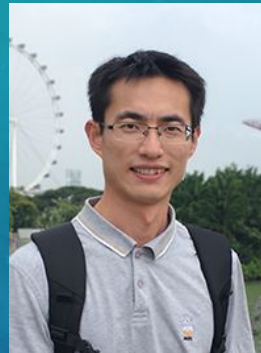
REJUVENATION OF LCLUC: LCLUC-19 SELECTEES



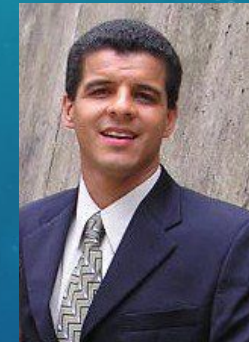
Nick Cuba,
Auburn U.



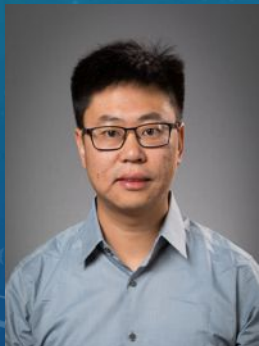
MEHA JAIN,
U. MICHIGAN



Zhenong Jin,
U. Minnesota



Carlos Munoz
Brenes, Conserv. Int.



Xiaopeng Song,
Texas Tech U
U. Maryland



Robert Heilmayr,
UC Santa Barbara



Xin Xi,
MICHIGAN TECH. U



Aaron Sparks,
U. Idaho



Chris Nolte
Boston U.

REJUVENATION OF LCLUC: LCLUC-21 SELECTEES



Qiongyu Huang,
Smithsonian Inst.



McKenzie Johnson,
U. Illinois



Nimrod Carmon,
JPL



Sean Woznicki,
Grand Valley State U.



Eleanor Stokes,
Universities Space
Research Association



Alexey Shiklomanov,
NASA GSFC



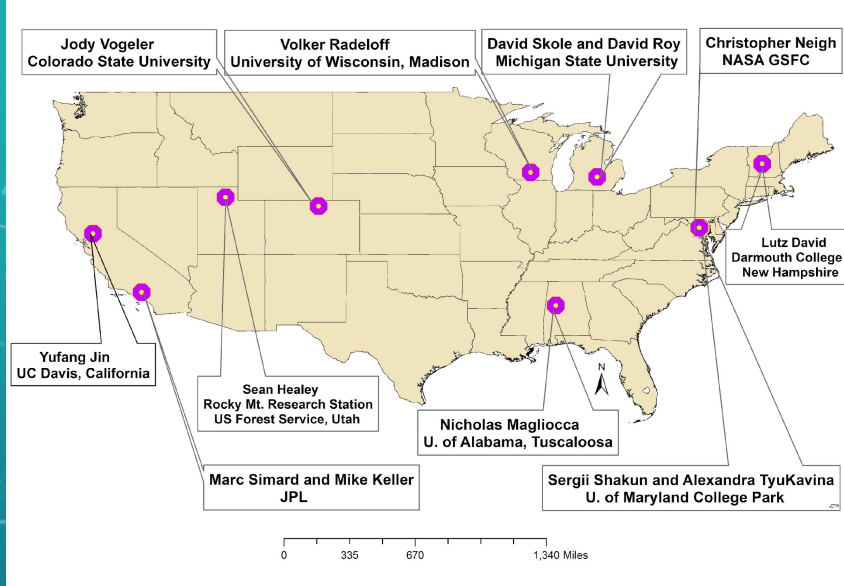
Nina Brooks,
U.



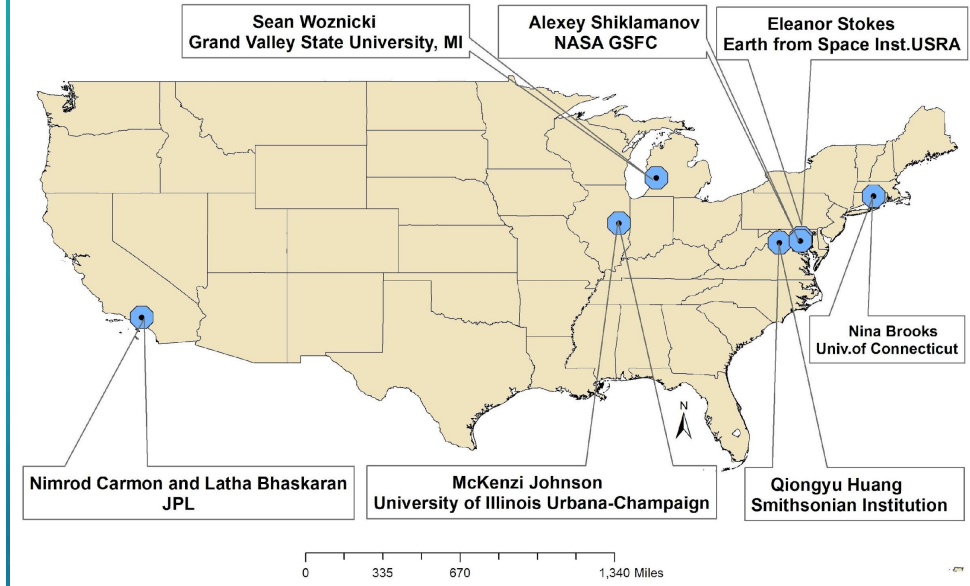
Latha Baskaran,
JPL

National Distribution of PI Institutions

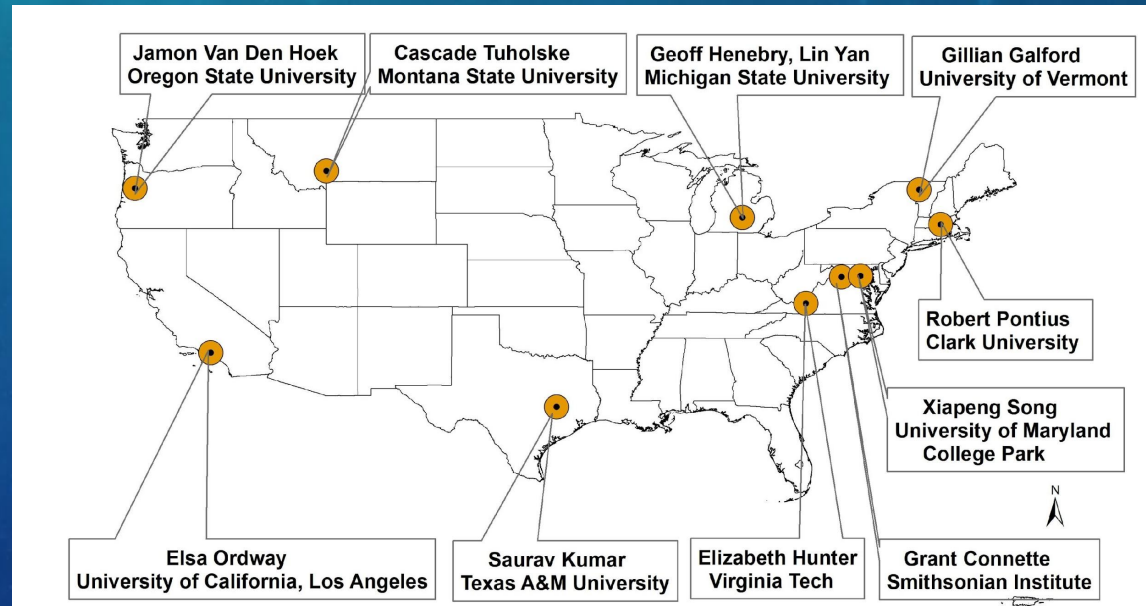
LCLUC-20



LCLUC-21

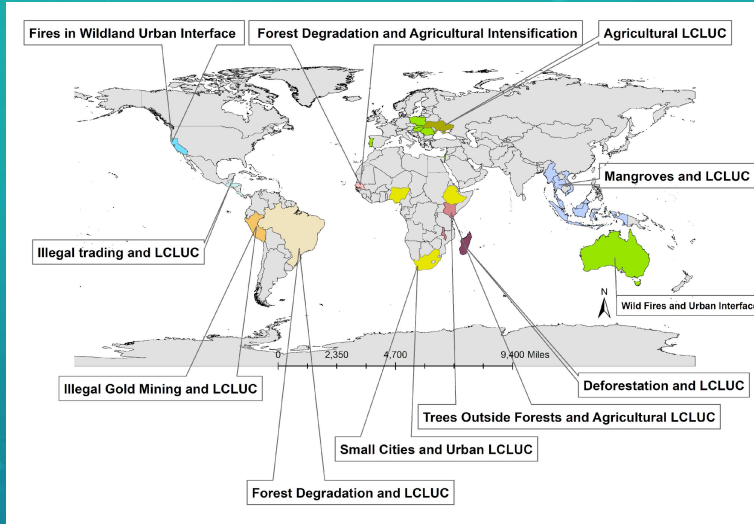


LCLUC-22

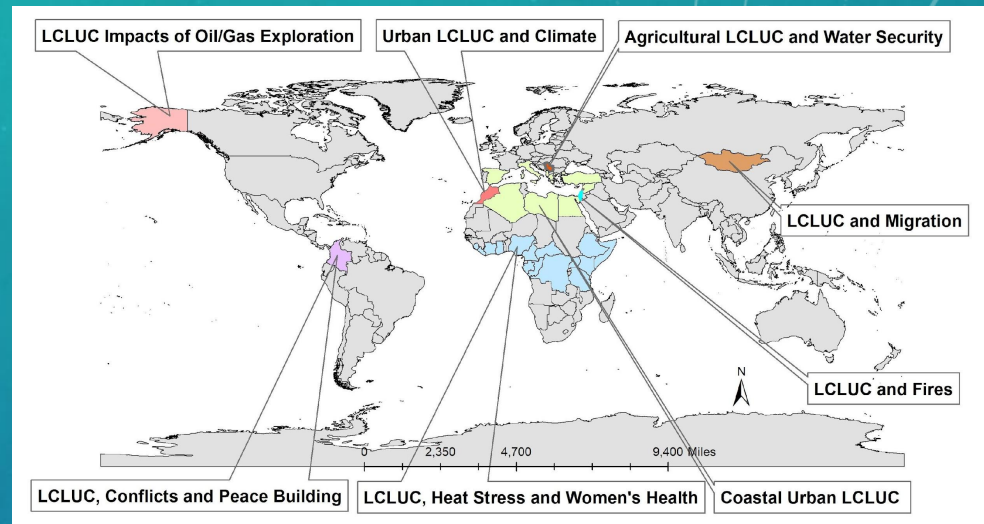


Distribution of Study Regions

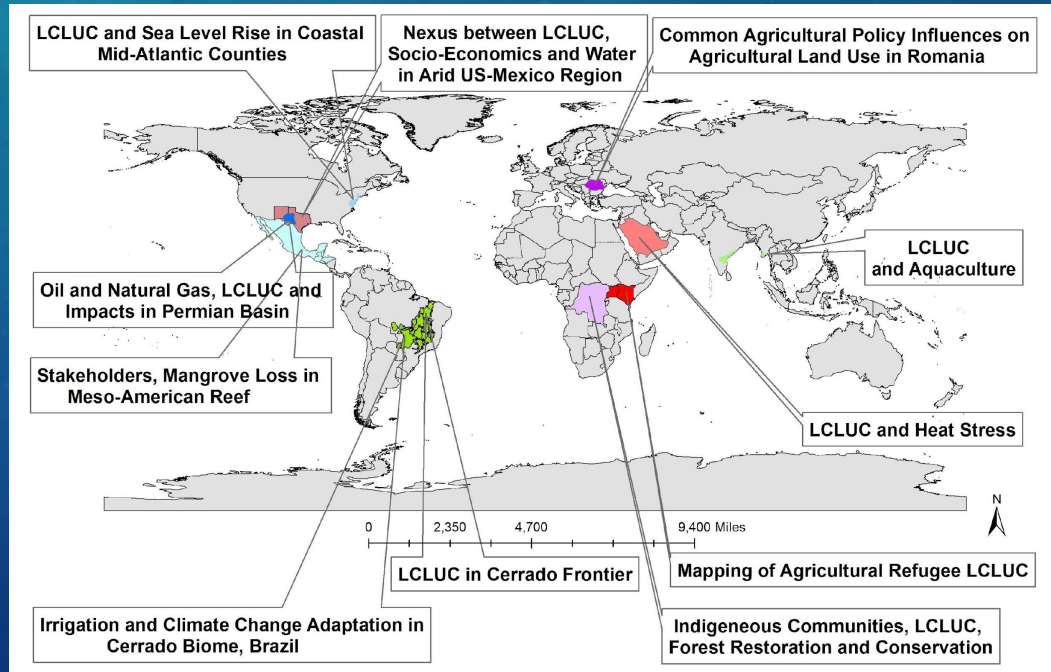
LCLUC-20



LCLUC-21



LCLUC-22



LCLUC MAPPER OPTIONS

Principal Investigators



Regional Collaborators



Indrani Kommareddy
LCLUC Program

Graduate Students



Project Research Areas



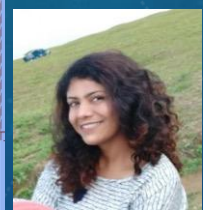
HOTSPOTS OF LAND USE



-  Urban
-  Savanna
-  Agriculture
-  Forest
-  Wetland
-  Extractive Industry / Mining
-  Fire



Indrani Kommareddy
Formerly LCLUC Program



Meghavi Prashnani
LCLUC Program



Rohan Purekar
LCLUC Program

PRECURSOR FOR LCLUC HOTSPOTS MAP



- Home
- Program Information
- Meetings
- People
- Projects
- Data & Information
- Education
- LCLUC Hotspots
- Documents

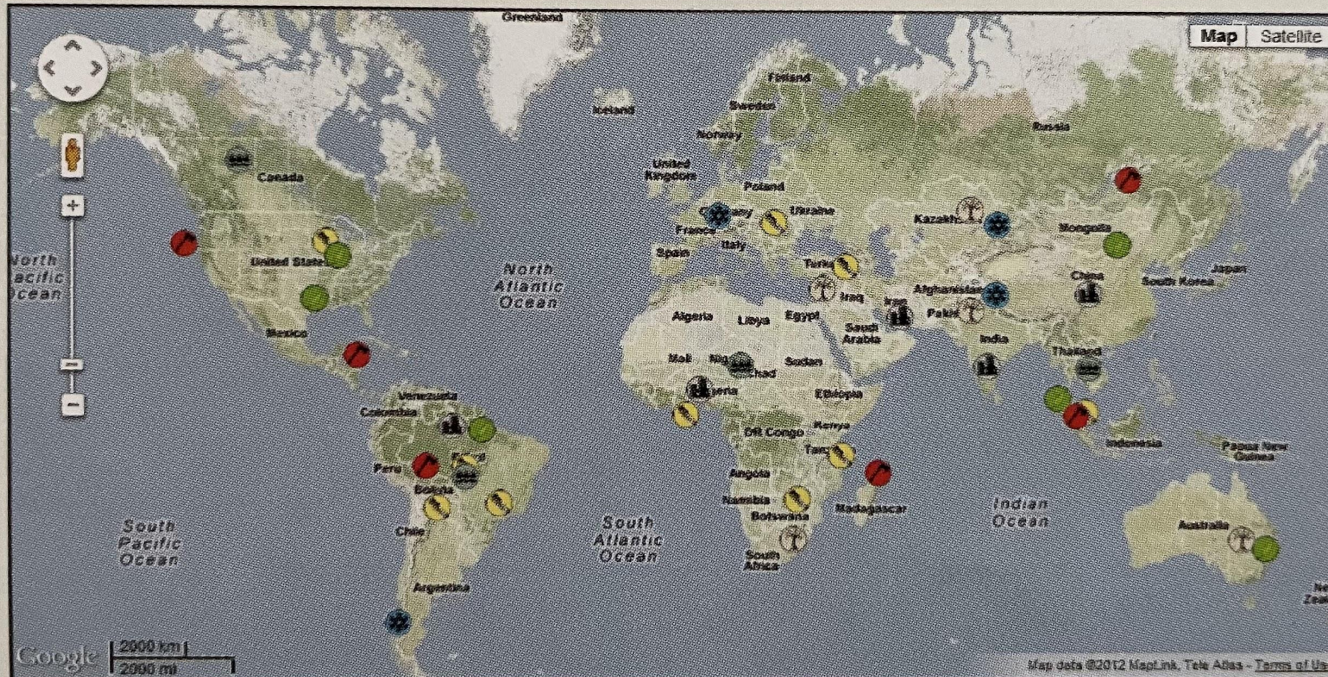
Land-Cover / Land-Use Change Program

GLOBAL MAP OF HOTSPOTS OF LAND COVER AND LAND USE CHANGE

Purpose: The goal of this project is to present examples of current hot spots of land cover and land use change around the globe, through an interactive online map. This project was a collaboration between graduate students in the Department of Geography at the University of Maryland, College Park, and was completed in late 2009. The site is periodically updated as new hotspots are identified by scientists from NASA's Land-Use Land-Cover Change Program.

Hotspot Definition: For the purposes of this project, a "hotspot" is defined as existent or potential change to a region or area through land cover and land use change that has regional to global implications. The hotspots were also considered within the context of pressing environmental and social issues such as climate change, biodiversity, human health, and sustainability. Primary considerations were to identify areas of change within the last five years and areas of continued or potential future change.

Hotspot Categories: Seven broad categories of land-cover land-use change were identified for this project. In some cases the categories are related to one another, and other hotspots can be added as needed.



Disclaimer: The icons on the map represent broad areas, not specific locations or geographic features.

Hotspot Categories

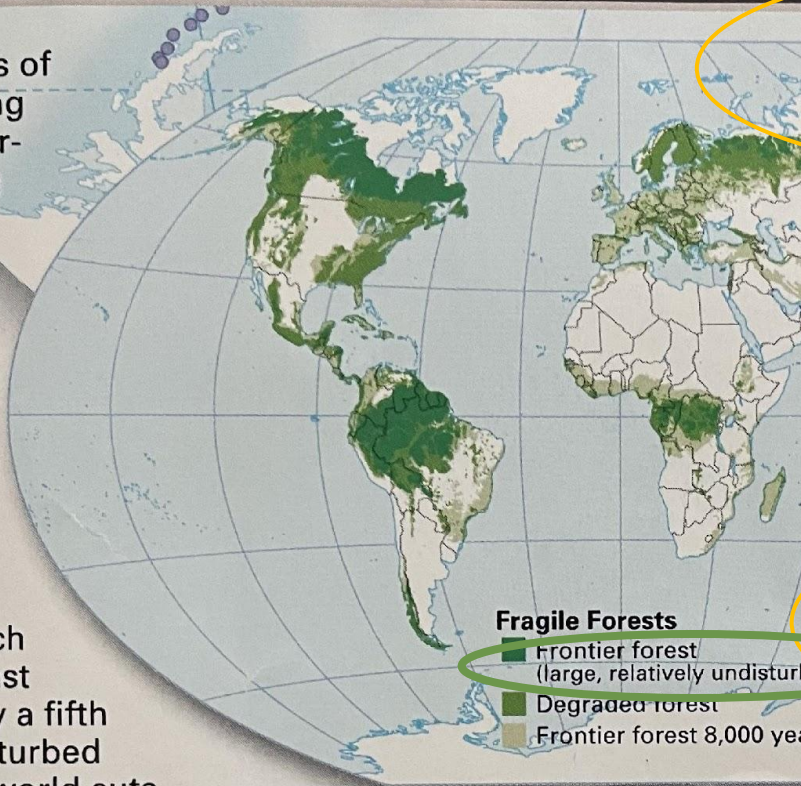
Recenter Map

- Afforestation / Reforestation
- Deforestation
- Glacial Retreat
- Urbanization
- Agricultural Expansion / Abandonment
- Dryland Degradation
- Wetlands Loss

2012

Missing the Forests for the Trees

Forests are the lungs of the planet, capturing vast amounts of carbon dioxide, releasing oxygen, and protecting soil, fresh water, and up to 90 percent of all terrestrial species in the bargain. Yet humans continue to mow down forests as if they were lawns. Half the forests that stood 8,000 years ago have been destroyed—much of them during the past 400 years—while only a fifth remain in large undisturbed tracts. Each year the world cuts an area larger than Florida, with the greatest rates of deforestation occurring in South America, Africa, and Southeast Asia. Forests are such massive reservoirs of carbon that their loss in the tropics alone released about a fifth of all human-caused carbon dioxide emissions in the past decade.

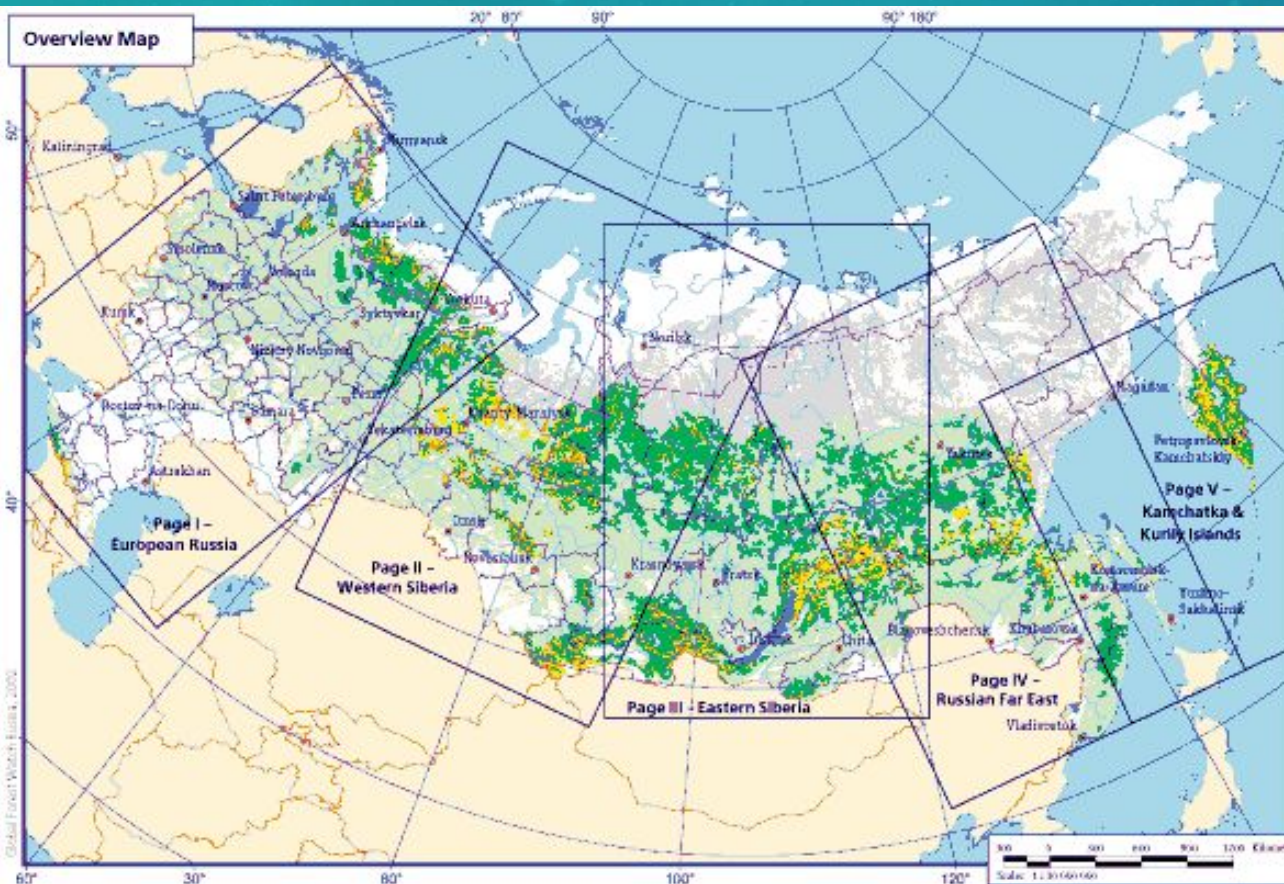


This Sumatran forest was cleared for a timber plantation in 2001. An estimated 1 million acres of forest are lost each year. Seven percent of the logs processed in the region are illegal.

Main map sources: Global cropland, pasture, and urban data: Jonathan A. Foley, Navin Ramankutty, Center for Sustainability and the Global Environment, University of Wisconsin; International Food Policy Research Institute. Population graph: UN World Population Prospects (2000 rev.), and World Urbanization Prospects (2001 rev.), esa.un.org/unpp. Highly degraded land: Global Assessment of Human Induced Soil Degradation (GLASOD), International Soil Reference and Information Centre; UN Environment Programme (UNEP). Protected areas, coral reefs, and mangroves: UNEP World Conservation Monitoring Centre. World Heritage sites: UNESCO. Soil conservation: World Overview of Conservation Approaches and Technologies. Threatened frontier forests: World Resources Institute (WRI). Coral reef biodiversity hotspots: Center for Applied Biodiversity Science, Conservation International; C. M. Roberts et al., *Science*, vol. 295, Feb. 15, 2002. Dead zones: Burke et al., *Pilot Analysis of Global Ecosystems* (2000)

Inset map sources: Large marine ecosystems: Kenneth Sherman, NOAA; Fish decline data: Villy Christensen, Reg Watson, Daniel Pauly, Sea Around Us Project, University of British Columbia. Ocean pollution chart: Global Programme of Action, UNEP. Air pollution graph: 2001 World Development Indicators, World Bank. Alien species: Global Invasive Species Programme. Habitats and global warming: Jay R. Malcolm, University of Toronto; Adam Markham, Lara Hansen, World Wildlife Fund. Energy statistics: U.S. Department of Energy. Frontier forests: Dirk Bryant, Global Forest Watch, WRI. Soil degradation data: GLASOD

Pre-NEESPI Product: Intact Forest Landscapes of Northern Eurasia: NASA + World Resource Institute + Green Peace Russia



Peter V. Potapov,
UMD
Svetlana Turubanova,
UMD

DATA ASPECTS

LCLUC PIs must provide metadata on data products generated under NASA-funded projects

- NASA LCLUC program expects its PIs to make their data and products available to the community for free and **open access**

- LCLUC metadata page

- Very High-Resolution (VHR) data for NASA-affiliated scientists

Metadata

Displaying 1 - 35 of 35

Search by Keywords

Apply

Reset

Metadata Title	Project name	Team	Institution	Project Start Date	Project End Date
Land-Use Status, Change and Impacts in Vietnam/Cambodia/Laos	Land Use Status, Change and Impacts in Vietnam, Cambodia and Laos	<u>Son Nghiem</u> , Andrea Gaughan Forrest Stevens	Jet Propulsion Laboratory	05/01/2018	12/31/2021
Understanding the Role of Land Cover/Land Use Nexus in Malaria Transmission Under Changing Socio-Economic Climate in Myanmar	Understanding the Role of Land Cover/Land Use Nexus in Malaria Transmission Under Changing Socio-Economic Climate in Myanmar	<u>Tatiana Loboda</u> , Mark Carroll Julie Silva Myaing Nyunt Christopher Plowe Kathleen Stewart	University of Maryland	05/01/2017	03/01/2020
Complex Forest Landscapes and Sociopolitical Drivers of Deforestation - The Interplay of Land-use Policies, Armed Conflict, and Human Displacement in Myanmar	Complex Forest Landscapes and Sociopolitical Drivers of Deforestation - The Interplay of Land-use Policies, Armed Conflict, and Human Displacement in Myanmar	<u>Peter Leimgruber</u> , Qiongyu Huang Melissa Songer Joseph Sexton Min Feng Saurabh Channan Enze Han Kevin Woods	Smithsonian Institution	05/01/2017	05/01/2020

Commercial Smallsat Data Acquisition (CSDA) Program Update

The commercial data currently distributed by NASA are available under different scientific use licenses and various access portals. The Commercial Smallsat Data Acquisition (CSDA) program evaluates and procures data from commercial vendors that advance NASA's Earth science research and applications activities. Currently, data acquired during the evaluations of Planet, Maxar (formerly DigitalGlobe, Inc.), and Spire Global are available. Data from the Teledyne Brown Engineering, Inc., DLR Earth Sensing Imaging Spectrometer (DESI) also are available through a separate collaboration with the International Space Station (ISS).

More Info: <https://earthdata.nasa.gov/esds/csdap/commercial-datasets>

PDF file:

 CSDA_ROSES_data_access_overview[1].pdf

OPEN SCIENCE @NASA WILL BE COVERED IN THE LAST SESSION (THE WRAPUP)

LCLUC 2023-MUSLI

- Proposals on the enhanced use of MuSLI methods, which would combine **infrared data (from SWIR to TIR)** with optical and/or microwave data, to study LCLUC
- Does NOT require the incorporation of a socio-economic research it but may be included
- Two-step procedure

Step-1: 48 submitted
26 encouraged

05/23/2023
Step-2 due date

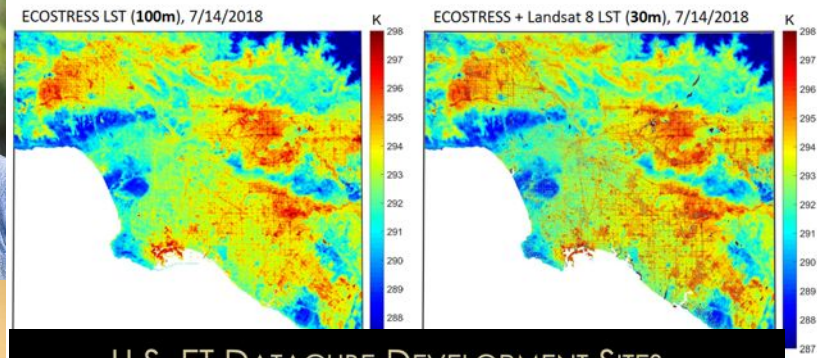
- Anticipated 10 selections for 2.5M/year for three years

THERMAL IR IN LCLUC STUDIES ASTER, LANDSAT, ECOSTRESS

A High Spatio-Temporal Resolution
Land Surface Temperature (LST)
Product for Urban Environments



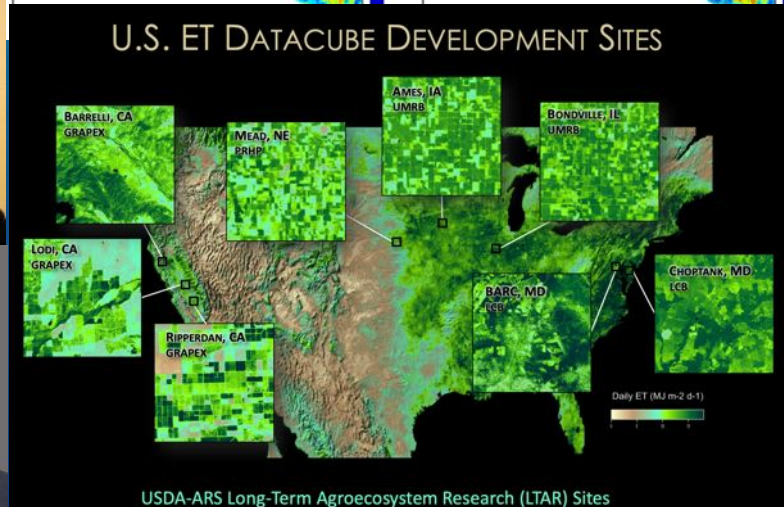
Glynn Hulley, JPL



Water Use in Agricultural and Modeling



Martha Anderson,
USDA



Simon Hook, JPL

Coordination, Calibration and Algorithm
Development of the Thermal Infrared Activities
for the ESA Land Surface Temperature
Monitoring (LSTM) Mission and NASA Surface
Biology and Geology (SBG) Designated
Observable

- * ECOSTRESS was not decommissioned in 2022 !!
- * The 2nd most requested product in the LP DAAC AppEEARS data access tool (among 120+ products)

EARTH SCIENCE TECHNOLOGY OFFICE (ESTO)

COMPACT INFRARED RADIOMETER IN SPACE (CIRIS) ALREADY IN SPACE

- A novel NASA-funded infrared radiometer
- Third year in Earth orbit - a new milestone for a small satellite that may make a huge impact on infrared imaging
- Developed by Ball Aerospace with support from NASA's [ESTO](#)
- Technology validation mission gathering infrared images of Earth's surface
- **New uncooled bolometer** and associated calibration system **without a cryogenic cooler**, reducing the weight, complexity, and cost
 - Three calibration views: one that looks towards space and two that look towards flat-panels coated with vertically aligned carbon nanotubes (an extremely black substance)
- CIRiS isn't the first space-based infrared imager, but it is **one of the smallest**. (weighing less than four pounds)

MORE DISTANT FUTURE: ESTO ROSES-2019 SELECTED PROPOSALS ON IR SENSORS (SEE ESTO WEBSITE FOR DETAILS)

- *Super Uncooled Multi-Band Radiometer Sensor (SUMRS)*
- DRS Network & Imaging Systems, LLC
- In response to the Sustained Landsat Imaging Technology ESTO call in 2020
- For potential infusion into the architecture and design of missions
- Will provide temporal/spatial simultaneous imaging in 6 spectral bands at 30m with a sensitivity better than the current LANDSAT 8/9 TIRS
- <https://esto.nasa.gov/project-selections-for-sli-t-19/>

- *Versatile Compact Broad Field of View Land Imager*
 - *Jet Propulsion Lab*
 - Spectral coverage from the near infrared to the very long wavelength infrared
- ## Looking into the future: beyond Landsat-Next (10)

EDUCATION AND OUTREACH

- E-Newsletters
- Webinars

Curator: Melanie R.

LCLUC Agriculture Hotspots Webinar Series 2023

Dr. Robert Heilmayr
University of California, Santa Barbara

“Crop species mapping to understand the agricultural impacts of conservation policy in Paraguay.”

Kendra Walker
University of California, Santa Barbara

Friday 17th March, 2023
11:00AM – 12:00PM EST

[Event Update, Register Here](#)

LCLUC Agriculture Hotspots Webinar Series 2023

“Policy, Market, and Climate Change Impacts on Maize Production in Mexico.”

Meha Jain
University of Michigan

Friday 28th April 2023
11:00 AM -12:00 PM EST

- LCLUC website
- Facebook page

LCLUC Agriculture Hotspots Webinar Series 2023

“Soybean Expansion in South America: Quantifying Historical Land-Use Change, Modeling Socioeconomic Drivers and Projecting Future Trajectories”

Dr. Xiao-Peng Song
University of Maryland

Friday 31st March 2023
11:00 AM - 12:00 PM EST

Webinar Recording

LCLUC Agriculture Hotspots Webinar Series 2023

“The Impact of Investment on Irrigated Rice, Dryland Agriculture and Afforestation in Senegal using SAR and Optical Time-Series Imagery in Data Fusion Approaches”

Christopher Neigh
NASA Goddard

LCLUC Webinars series 2023

The Program needs

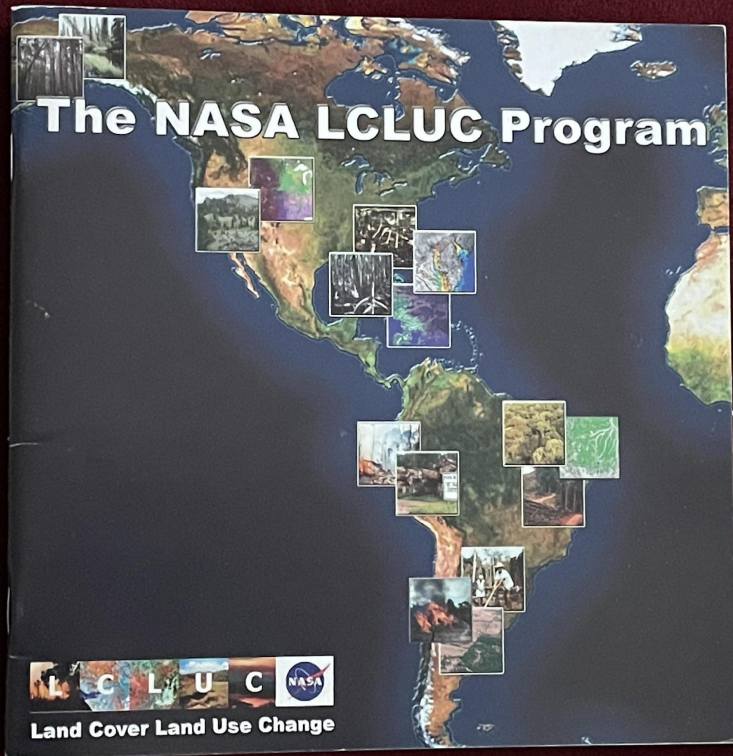
- One-pagers showcasing the project
- Statistics on grad. students
- Publications
- Media
- Project info for the Mapper

Meghavi is the POC for all the info
(cc Chris, Krishna and me)

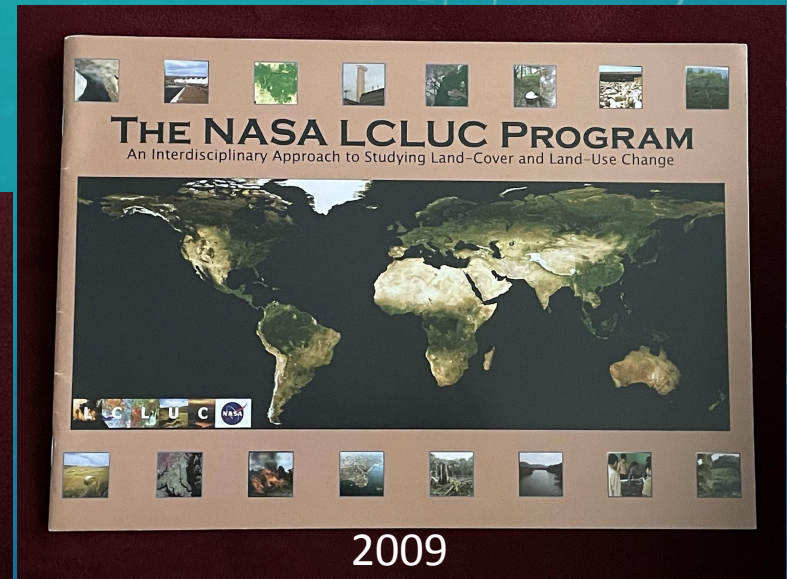
A GLIMPSE INTO LCLUC HISTORY: THE BROCHURES

BEFORE WE STARTED E-NEWSLETTERS

The first LCLUC brochure
designed and compiled by Inbal Reshef

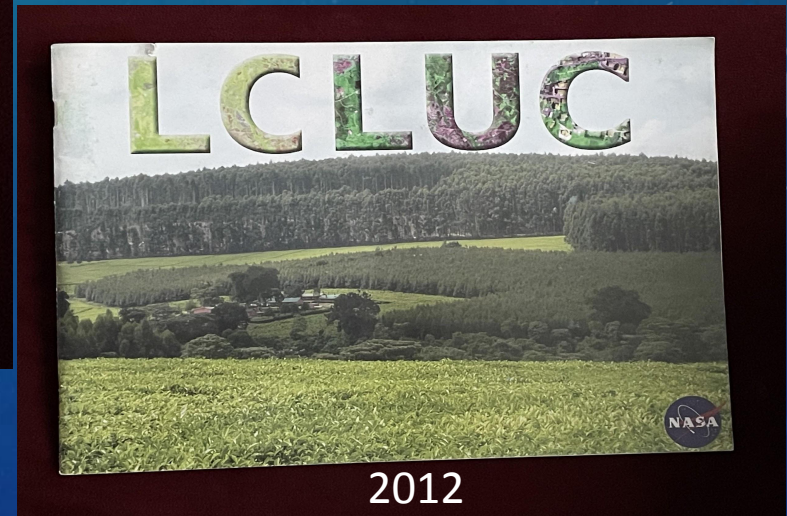


2006



2009

Design: Lydia Prentiss

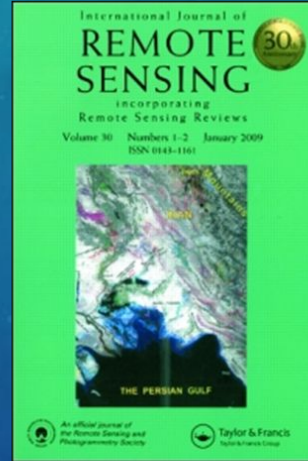
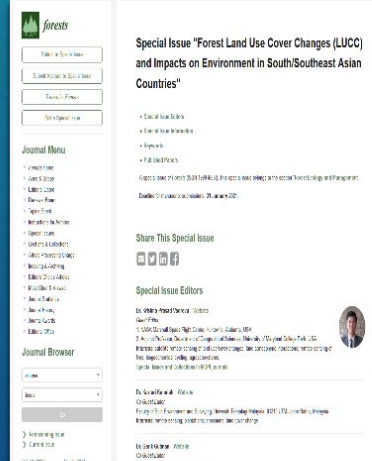
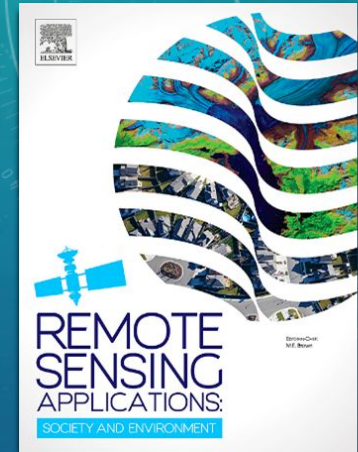
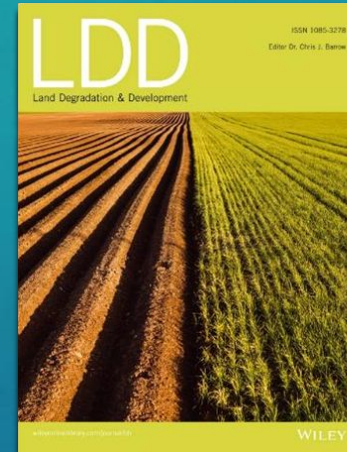
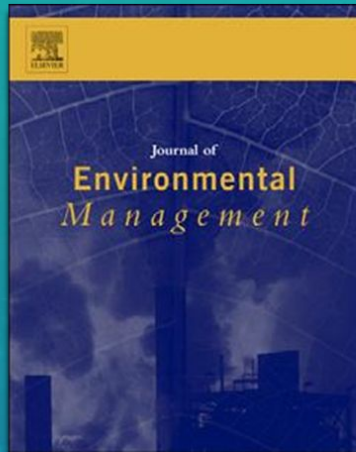
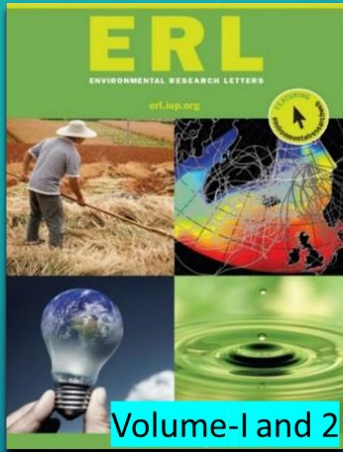


2012

Design: Catherine Nakalembe

Each of them are on exhibit (not for distribution) –
for younger researchers to look into LCLUC history

SARI Special Issues Krishna's Publishing House Journals



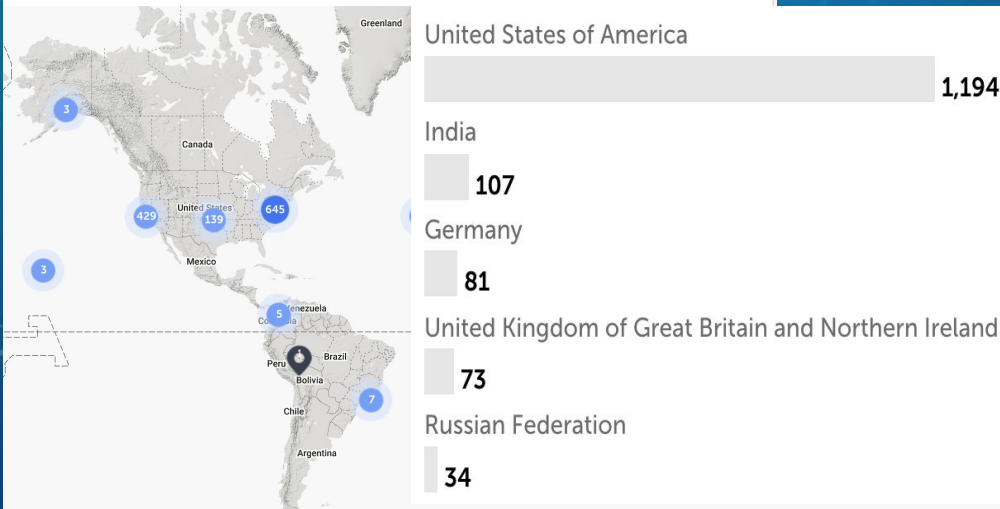
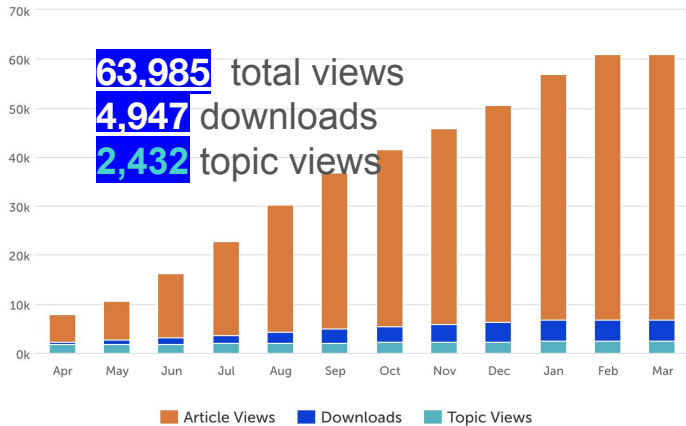
>200 articles in these special issues involving more than 100-institutions from the US, South/Southeast Asia and worldwide

OUR CHANGING PLANET: HALF-A-CENTURY LANDSCAPE DYNAMICS OBSERVED FROM SPACE

EDITORS: G. GUTMAN, C. JUSTICE, E. VERMOTE

Last 12 months

60,927 total views | 54,045 views | 4,450 downloads | 2,432 topic views



7 Articles

The 2 most viewed articles:

- Global Trends of Forest Loss Due to Fire From 2001 to 2019. Tyukavina et al. (**31,795**)
- The Global 2000-2020 Land Cover and Land Use Change Dataset Derived From the Landsat Archive: First Results. Potapov et al. (**21,279**) volume 3 - 2022 |

LCLUCERS IN MEDIA AND AWARDS: 2022-2023

Exceptional Public Achievement Medal



BBC world news interviewed Dr. Inbal Becker Reshef on how satellite information can be used to improve food security and agricultural decisions. Feb 2022

Exceptional Service Medal



The Washington Post referred to Garik Gutman in a story on US irrigated lawns. Aug 2022



Chris Justice, interviewed by AGU Third pod from the Sun – AGU's podcast. Jan 2023

Kuno Award for Applied Sciences



Eleanor Styokes, contributed to the story on the recent earthquake in Turkey and Syria (tracking electrical infrastructure damage) highlighted in the Washington Post, 2023



NASA Earth Observer referred to Sergii Skakun's work on crop monitoring in Ukraine under war situation. Dec 2022



The New York Times referred to Jeff Fox' work in a story on how Nepal grew back its forests. Nov 2022
Radio Free Asia referred to Jeff Fox's work on crops with a story that Southeast Asia remains world rice bowl as pockets of region suffer crop disasters. Nov 2022



Much of the tree growth in the tropics in the first decade of the century consists of plantations — not natural forest- LCLUC project's findings by PI Nick Magliocca, Co-I Mathew Fagan and team were featured in Nature's Research Highlights. Oct 2022

THANKS GO TO

- Organizers: C. J. and Co.
- Mary, Meghavi, Jack, Melanie, Rohan
- Our major, loyal sponsor



Enjoy Spring Blossoms

