Land Product Validation (LPV) Sub-group Meeting

Fernando Camacho – (EOLab/U. Valencia) – Chair
Michael Cosh – (USDA) – Vice Chair
Subgroup meeting
01 Feb 2022

NEXT LPV TELECON 05 Apr 2022
Attendance

Participants
Fernando Camacho
Michael Cosh
Jaime Nickeson
Zhuosen Wang
Gareth Roberts
John Bolten
Carsten Montzka
Louis Giglio
Sylvain Leblanc
Frank Göttscbe
Sasha Tyukavina
Else Swinnen
Victor Rodríguez-Galiano

Glynn Hulley
Laura Duncanson
John Armston
Mat Disney
Chris Crawford
Joshua Gray
Sophie Bontemps

Not attending
Dominique Carrer
Hongliang Fang
Tomoaki Miura
Marie Weiss
Simon Gascoin
Proposed agenda items

• Welcome
• LPV Chair Transition
• LPV Work Plan
• LPV Bonn???
• Focus Area Web Status
• Focus Area Reporting
CEOS LPV Chair transition

• Last telecon of Fernando Camacho as LPV Chair. Thank you to all of you to make a success this three-year term, with two new Good Practices validation protocols endorsed, an online validation tool (SALVAL) developed, new reference data and several validation exercises of new sensors and datasets conducted by LPV.

• Since March, 1ST Mike Cosh will be the new CEOS LPV Chair. All the best to Mike and the LPV to continue doing a good contribution to CEOS and the satellite validation community.

• Searching for a new Vice Chair. Candidates send applications to Mike and Jaime.

• ESA is willing to propose a candidate to Vice-Chair, probably Fabrizio Niro, to be confirmed in the coming days.

• Voting the vice-chair candidates by March (before next WGCV meeting).
LPV Work Plan 2019 – 2022 Wrap Up

### Closed Work Plan Items

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Lead</th>
<th>Start</th>
<th>End</th>
<th>Status</th>
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<tbody>
<tr>
<td>Biomass</td>
<td>Calibration and production of biomass products from CEOS missions</td>
<td>L. Duncan</td>
<td>2017</td>
<td>Q4/2019</td>
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<tr>
<td>Biomass</td>
<td>Biomas valuation paper</td>
<td>L. Duncan</td>
<td>2018</td>
<td>Q2/2019</td>
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<td>Biomass</td>
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<td>L. Duncan</td>
<td>2018</td>
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<td>Biophysical</td>
<td>Biophysical Workshop at IGARSS</td>
<td>H. Fang</td>
<td>2019</td>
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<td>Biophysical</td>
<td>Data sharing platform under FAIR principles for ground references</td>
<td>M. Weiss</td>
<td>2019</td>
<td>Q2/2020</td>
<td>closed</td>
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<tr>
<td>Chair</td>
<td>Revise hierarchy table including FRM concept</td>
<td>F. Camacho</td>
<td>2019</td>
<td>Q2/2019</td>
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<tr>
<td>Chair</td>
<td>Investigate suitability of ICOS delivered data for validation</td>
<td>F. Camacho</td>
<td>2019</td>
<td>Q1/2020</td>
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<td>Chair</td>
<td>Stabilize mechanism to collaborate with GEOGLAM related to Essential</td>
<td>F. Camacho</td>
<td>2019</td>
<td>Q4/2019</td>
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<tr>
<td>Chair</td>
<td>Promote a new W3C/V SR task (LPV/IVS) in the context of PM4VOS</td>
<td>F. Camacho</td>
<td>2019</td>
<td>Q3/2019</td>
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<tr>
<td>Chair</td>
<td>Update D/PRECT 2.0 to 2.1</td>
<td>F. Camacho/Fang</td>
<td>2021</td>
<td>Q4/2021</td>
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<td>Land Cover</td>
<td>Workshop on LC product validation</td>
<td>FA leads</td>
<td>2020</td>
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<td>paper on vIRIS validation</td>
<td>Mura</td>
<td>2019</td>
<td>Q2/2020</td>
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</table>

*Development of a coordinated cal/val strategy across NASA and ESA biomass missions that protocols, data sharing, and the establishment of round-based carbon super-sites. Background paper for the ISSI special issue on the need for biomass product validation and CEOS W3C/V Biomass Protocol.*
**LPV Work Plan 2019 – 2022 Wrap Up**

### Started / On-going Work Plan Items

<table>
<thead>
<tr>
<th>CEOS LPV Work Plan 2019-2021</th>
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<tbody>
<tr>
<td><strong>Albedo</strong></td>
<td><strong>A. H. Zhou</strong></td>
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<td>CV-20-01</td>
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<td>S. Bonnemps</td>
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<td><strong>Phenology</strong></td>
<td>F. A. Leads</td>
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<td>19-LPV-23</td>
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<td>19-LPV-22</td>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
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<tbody>
<tr>
<td>- Protocols for Surface downwelling radiation started by I. Grant. Not sure about someone is planning to work on it.</td>
<td></td>
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<tr>
<td>- SALVAL tool developed (<a href="http://www.salval.eolab.es">www.salval.eolab.es</a>). Need for MODIS C6.1 → Zhou sen task.</td>
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<tr>
<td>- CEOS BRIX-II – Laura Duncanson</td>
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<td>- CEOS SRIX4Veg – 1st Workshop 28 March, Field campaign July 2022 in Barrax.</td>
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<tr>
<td>- Protocols for Land Cover (Cropland) in preparation/discussion with GEOGLAM EAV.</td>
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<tr>
<td>- Protocols for Phenology - Josh (update needed)</td>
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<tr>
<td>- Protocols for VI – Tomoaki and Else (update needed)</td>
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<tr>
<td>- Protocols for Burned Area – Louis and Gareth</td>
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</tbody>
</table>
LPV Work Plan 2019 – 2022 Wrap Up

Pending

<table>
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<th>CEOS LPV Work Plan 2019-2021</th>
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<td><strong>Active Fire/BA</strong></td>
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<td>FA leads</td>
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<tr>
<td>FA leads</td>
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<td><strong>Chair/Bioph</strong></td>
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<td>F. Canacho/FA leads 21-LPV-01</td>
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<tr>
<td><strong>VI</strong></td>
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<td>FA leads</td>
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</tbody>
</table>

- Protocols for Active Fire and Burned Area validation. Not sure about the plan.

- Update LAI protocol with FAPAR. Identified key scientist to contribute, but no progress since then.

- Provide feedback to ICOS on LAI/FAPAR protocols – action for the Biophysical team

- Promote special sessions AGU, EGU – Improve promotion and communication of LPV

Recommendation: Redefine LPV action plan for the next three years, with all of ongoing and pending actions in mind.
Thank you, Fernando!!

Thanks for your leadership these past 3 years, and your dedication to LPV throughout your involvement with us.

Much progress has been made under your tenure, with protocol published and planned and validation exercises executed and planned.

We expect our paths will continue to cross and look forward to that continued interaction.

All the best to you!!!
LPV Bonn???

- We had discussions about a potential LPV Plenary in Bonn this year at LPS 2022.
- Not sure we have sufficient attendance, no much response on that question, and much less sure about travel with COVID still very much in the picture, many meeting still planned for virtual or hybrid.
- Virtual is possible... thoughts?
Status of updates by focus area.

Some only need a review, changes are not required, just assure all is current!

Product lists are now up to date.

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Home Page</th>
<th>Product table</th>
<th>Collaboration Page</th>
<th>References</th>
<th>Listserv</th>
<th>Letters to Community</th>
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<tr>
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<td>May 2021</td>
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<td>May 2021</td>
<td>Sep 2021</td>
<td>Oct 2019</td>
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<td>Mar 2021</td>
<td>Dec 199</td>
<td>May 2020</td>
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<td>Mar 2021</td>
<td>Nov 2021</td>
<td>Mar 2021</td>
<td>April 2019</td>
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<td>Dec 2020</td>
<td>Mar 2020</td>
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<td>July 2020</td>
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<td>Nov 2021</td>
<td>May 2021</td>
<td>May 2021</td>
<td>May 2019</td>
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</tbody>
</table>
Focus Area Reports

- Fire/Disturbance
- LST&E
- Surface radiation
- Phenology
- Soil Moisture
- Vegetation Indices
- Biomass
- Snow
- Land Cover
- Biophysical (LAI/FAPAR)
• We did some LAI vertical profile measurement at a deciduous needleleaf forest site in China. The data were used to compare with terrestrial, airborne and GEDI LAI profile data.

• Hongliang wrote a Chinese article to introduce and promote the FRM concept in China. Similar concepts maybe adopted in Chinese networks.

• We examined the temporal variation of GEOV2 and MODIS LAI uncertainty based on the product QA information.

• New journal launched by Chinese Academy of Sciences, JORS.
Publications

– Wang et al., 2022. Retrieval and validation of vertical LAI profile derived from terrestrial, airborne, and spaceborne LiDAR data at a deciduous needleleaf forest site. *Agricultural and Forest Meteorology* (submitted) *(validation of the vertical LAI profile).*


Fire Disturbance (1/3)

Product Update
- VIIRS NightFire Product (Elvidge et al., 2013)
  - Sub-pixel thermal anomalies detected using NIR, SWIR and MIR channels
  - Information on time of detection source size ($m^2$), radiant heat intensity
  - Version 3.0 available from Dec 2017 – present; daily resolution
    - [https://eogdata.mines.edu/products/vnf/](https://eogdata.mines.edu/products/vnf/)

- ESA Fire CCI
  - Sentinel-2 burned area product for Africa (FireCCISFD20)
  - 20m and 0.25° spatial resolution
  - 2019 (2016 exists)

Webpage
- Products page updated
- Collaboration page up to date
- References up to date
Fire Disturbance (2/3)

Recent Publications


  - Stage 3 validation of FireCCI51, C3SBA10 and MCD64A1 c6 burned area products using proposed “alternative approach to estimate spatial accuracy by disentangling the spatial from the temporal component of BA detection errors”

Recent Publications

  - Validated Landsat and MODIS burned area maps using subset of Landsat-based training data
Conferences

• Thermal infraRed Imaging Satellite for High-resolution Natural resource Assessment (TRISHNA) Days Workshop: **March 22-24, 2022, Toulouse, France**

• International Earth Surface Working Group (IESWG) Workshop: **Apr 05-07, 2022, fully virtual, hosted by Finnish Meteorological Institute (FMI)**

• ESA Living Planet Symposium (LPS): **May 23-27, 2022, Bonn, Germany**

• Int. Radiation Symposium (IRS) 2022: **Jul 4-8, 2022, Thessaloniki, Greece**

• EUMETSAT Meteorological Satellite Conf.: **Sep 19-23, Brussels, Belgium**

• 6th Recent Advances on Quantitative Remote Sensing (RAQRS) Conf.: **Sep 19-23, 2022, Valencia (Torrent), Spain**
**Project News**

- **LSA SAF (EUMETSAT):** LST validation station at Gobabeb, Namibia operates nominally; however, still irregular data transmission (internet issues).

- **ESA LST_cci Phase 1** has been completed; **Phase 2** started on 1st of Jan 2022 and has “a key objective to improve the current suite of LST ECV Products, and produce new LST ECV Products, in order to meet as a minimum, the threshold requirements for LST set by the Global Climate Observing System (GCOS), and where possible the target requirements”.

- **Copernicus LAW:** five new LST validation stations are now operational. LST Validation Protocol and Radiometer Calibration Report have been updated. While the AOD & WV parts ended in Dec 2021, ESA extended the LST part to Dec 2022 (allows for Covid-19 related delays of the stations deployment).

- **ECOSTRESS collection 2 (build 7)** improved LST&E and cloud mask products about to start reprocessing. Gobabeb and Lake Tahoe in situ validation data used for cold calibration adjustment.

- **Landsat 9 surface temperature validation and assessment** underway at core US stage—validation sites (JPL, RIT).
LST & Emissivity (3/4)

LAW Project - Copernicus Space Component Validation for Land Surface Temperature, Aerosol Optical Depth and Water Vapor Sentinel-3 Products

Validation for Land S3 Products

LST validation stations

- KIT forest (Germany)
- Svartberget (Sweden)
- Hyytiälä (Finland)
- Robson Creek (Australia)
- Puéchabon (France)

Robson Creek (Australia)
Located at 16.11°S; 145.38°E

This site is another site known under the TERN network as the Robson Creek Rainforest SuperSite which includes three sub-sites: FNLQ Rainforest, Robson Creek and Daintree/Cape Tribulation.

The biome is 5 in the ALB2 classification; i.e. closed to open (more than 15 %) broadleaved evergreen and/or semi-deciduous forest.

Image from https://supersites.tern.org.au/supersites/fnpq-robinson

https://law.acri-st.fr/home


Surface Radiation

- Updated list of radiation products on LPV website

- *In-situ* albedo measurements
  - National Tibetan Plateau Data Center (https://data.tpdc.ac.cn/en/) --- Several sites in China

- SALVAL
  - Fernando is leading a paper on albedo products validation with SALVAL. Preparing C6.1 MCD43 albedo over the validation sites.

- Published papers
Land Surface Phenology (1/4)

- New paper published on the calibration of “High Resolution Vegetation Phenology and Productivity” product
  - Tian et al., 2021. Calibrating vegetation phenology from Sentinel-2 using eddy covariance, PhenoCam, and PEP725 networks across Europe. RSE, 260, 112456

- New paper published in RSE
  - Moon et al., 2021. Multiscale assessment of land surface phenology from harmonized Landsat 8 and Sentinel-2, PlanetScope, and PhenoCam imagery. RSE, 266, 112716

- New LSP conference: PHENOLOGY 2022 - Phenology at the crossroads
  - 20-24 June in Avignon, France
  - Submissions open from 10 January 2022 to 1 March 2022

- New special issue in Science of Remote Sensing: Identifying the climate and human impacts on vegetation dynamics and their sustainability using Earth observation data

- New paper under review from Gray’s group: assessing LSP with FLUXNET2015 data
Land Surface Phenology (2/4)

A) NDVI
- Bias = 31 d
- R = 0.69

B) EVI2
- Bias = 20 d
- R = 0.78

C) PPI
- Bias = 11 d
- R = 0.9

D) NDVI
- Bias = 34 d
- R = 0.82

E) EVI2
- Bias = 30 d
- R = 0.74

F) PPI
- Bias = 17 d
- R = 0.81

G) Best VI threshold
- thres = 50%

H) Worst VI threshold
- thres = 5%
Land Surface Phenology (3/4)

**Image Description**

The figure shows scatter plots and correlation coefficients for different vegetation indices (NDVI, EVI2, PPI) and their relationships with land surface phenology phases. The plots compare leaf emerged vs deciduous, leaf unfolded vs deciduous, leaf unfolded 50% vs deciduous, leaf unfolded vs evergreen, leaf unfolded 50% vs evergreen, fresh green 25% vs meadow, coloration 50% vs deciduous, and leaf fallen 50% vs deciduous.

**Correlation Coefficients**

- Leaf emerged vs deciduous: NDVI R = 0.2, EVI2 R = 0.29, PPI R = 0.2
- Leaf unfolded vs deciduous: NDVI R = 0.22, EVI2 R = 0.33, PPI R = 0.37
- Leaf unfolded 50% vs deciduous: NDVI R = 0.52, EVI2 R = 0.61, PPI R = 0.61
- Leaf unfolded vs evergreen: NDVI R = -0.03, EVI2 R = 0.63, PPI R = 0.52
- Leaf unfolded 50% vs evergreen: NDVI R = 0.15, EVI2 R = 0.46, PPI R = 0.41
- Fresh green 25% vs meadow: NDVI R = 0.07, EVI2 R = 0.13, PPI R = 0.08
- Coloration 50% vs deciduous: NDVI R = 0.04, EVI2 R = 0.12, PPI R = 0.03
- Leaf fallen 50% vs deciduous: NDVI R = 0.01, EVI2 R = 0.13, PPI R = 0.01

The plots show the VI amplitude threshold (%) on the x-axis and the correlation coefficient (R) on the y-axis. The graph also includes scatter plots for PEP725 phase (day of year) vs VI SOS (day of year) with R values for NDVI, EVI2, and PPI.
Land Surface Phenology (4/4)

Diagram a: EVI2 and GPP for different years.

Diagram b: Greenup, MidGreenup, and MidGreendown trends over MODIS DOY.

Diagram c: Comparing Flux and MODIS EVI2 for different biomes.

Diagram d: Boxplots of growing season length and difference for different biomes.
Soil Moisture

News:
• QA4SM: Sentinel-1 radar high resolution data now available for validation
• SMAP Validation paper published:

Workshops:
• 6th Satellite Soil Moisture Validation and Application Workshop, postponed to 7-9th June 2022, Perugia, Italy
• World Congress on Soil Science, 31 July - 5 August 2022, Glasgow (https://22wcss.org)
• 7th Satellite Soil Moisture Validation and Application Workshop, Fall 2024?, New Orleans, USA?
Protocol
• Section on inter-comparison is being prepared.

Validation
• Continuing with an inter-comparison exercise between VIIRS and GOES-R VIs using in situ data from AmeriFlux as a reference

Special Session
• Convening a conference session at AOGS 2022 VIRTUAL, IG16 "Earth Monitoring from Operational Geostationary Satellite", co-conveners, Weile Wang, Kazuhito Ichii, & Tomoaki Miura, 01-05 August 2022 (Abstract Submission Due: 23 February 2022)
Operational Production

PROBA-V C2
- Evaluation of 1-year TDS of TOC refl and NDVI
- Comparison against PV C1 and MOD13A3 C6
- Abstract sent to LPS2022

CGLS
- NDVI 300 m V2 (S3)
  - External review of CGLS NDVI 300 m V2 was successful
  - Product upgraded to pre-operational status
  - Publication in preparation
- Preparation of NDVI 300 m V2 started (PROBA-V)

LSA-SAF
- Preparation of METImage NDVI consistent with MetOp-A/B/C-AVHRR ENDVI

S3-MPC
- Evaluation of SYN_VGT products (incl. NDVI) based on last PB (IPF/PB for S3A is 06.09/2.77, for S3B 06.09/1.55, 14 June 2021)
• USGS Collection 2 Landsat Analysis Ready Data fractional snow cover area (fSCA) products for the CONUS and Alaska will be released in February

• NASA’s Terrestrial Hydrology Program is currently supporting a NASA Snow Albedo team to conduct hydrological testbed scoping studies in 2022
Above Ground Biomass (1/2)

- Biomass Reference Network - GEO-TREES
- Biomass Harmonization Activity for the UNFCCC GST
- Web platform presented at COP26

[Image of Biomass Earthdata Dashboard]

[Link]: https://earthdata.nasa.gov/maap-biomass
Next Steps for Biomass Harmonization Team

• **Update dashboard**
  • Add GEDI L4B and GEO-TREES page
  • More visibility for input agencies / institutions
  • Add Mangroves?

• **Early 2022 focus on validation**
  • Using NFI data (jurisdictional-level validation in partner countries)
  • Using airborne lidar biomass maps (biome-level)
  • Explore optical record (e.g. Planet) for monitoring reference sites

• **Validation results will guide harmonization concepts**
  • Current plan - harmonization of estimates at a sub-national jurisdictional level, Draft paper

• **Expand work on country engagement to more Silvacarbon and SERVIR countries**
  • Currently 5 countries, but conversations to start with many more (20+)
  • Planned Silvacarbon meeting in Feb 2022
Land Cover (1/3)

General updates:

• Started the outline of updated Land Cover and Change validation guidelines;

• Planning of the joint workshop between CEOS LPV and GEOGLAM on the validation of agricultural land cover products/essential agricultural variables.

  Proposed in-person workshop date: second half of 2022

  Workshop co-leads: Chris Justice (NASA Harvest), Sasha Tyukavina (UMD/CEOS LPV), Sophie Bontemps (UCLouvain/CEOS LPV)

  Funding: NASA ROSES 21 under the F2.Topical Workshop call
  Deadline to apply for funding: May 13, 2022
  Approval to submit a proposal received from NASA Program Managers Brad Doorn (Applied Sciences) and Garik Gutman (LCLUC)
**Land Cover (2/3)**

**New datasets:** Global cropland extent and change, 2000-2019 (UMD GLAD)

<table>
<thead>
<tr>
<th>Table 3 Regional and global map accuracy metrics</th>
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<tr>
<td>From: Global maps of cropland extent and change show accelerated cropland expansion in the twenty-first century</td>
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<table>
<thead>
<tr>
<th>Region</th>
<th>Cropland 2000-2003 (%)</th>
<th>Cropland 2016-2019 (%)</th>
<th>Stable cropland (%)</th>
<th>Cropland gain (%)</th>
<th>Cropland loss (%)</th>
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<tbody>
<tr>
<td>Africa</td>
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<tr>
<td>OA</td>
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<td>96.5 (0.8)</td>
<td>97.2 (0.6)</td>
<td>97.9 (0.6)</td>
<td>99.4 (0.3)</td>
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<td>77.3 (3.2)</td>
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<td>57.5</td>
<td>48.5</td>
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<tr>
<td>PA</td>
<td>65.8 (6.3)</td>
<td>70.6 (7.9)</td>
<td>94.6 (8.2)</td>
<td>49.4 (12)</td>
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OA, overall accuracy; UA, user's accuracy; PA, producer's accuracy. The s.e.m. of accuracy metrics is shown in parenthesis.

https://glad.umd.edu/dataset/croplands/

Global UA and PA of cropland extent 86-90% of stable cropland 83-88% of cropland change 67-73%

Global sample size: 3500 pixels
Land Cover (3/3)

New datasets: Global land cover and land use, 2019 (UMD GLAD)

Global land use extent and dispersion within natural land cover using Landsat data

Matthew C Hansen1, Peter V Potapov2, Amy Pickens3, Alejandro Tyukavina4, Andres Hernandez Serna5, Viviana Zalcos6, Svetlana Turubanova7, In Trinni Kommande8, Stephen V Stehman2, Xiaopeing Song9, Michael Rast9

Accepted Manuscript online 29 December 2021 © 2021 The Author(s). Published by IOP Publishing Ltd

Land cover / land use class UA and PA vary:

- permanent surface water 98-99%
- permanent ice 80-94%
- bare ground 92%
- cropland 70-92%
- ...wetland 52-60%
- built-up land 43-84%

Global sample size: 950 points

https://glad.umd.edu/dataset/global-land-cover-land-use-v1