



CEOS Working Group on Calibration and Validation

Land Product Validation

Subgroup

Land cover – validation datasets and methods

Martin Herold and Pontus Olofsson

Available reference datasets (on GOFc portal)

Name	Sampling design	Sample size	Sample unit/size	Source or reference data	Legend protocol	Legend	Rreference
GLC 2000	2 stage stratified cluster sampling	1265 253 PSU 5SSU in each PSU	3by3 pixels	Landsat 2000, aerial photographs, thematic maps, NDVI profile	If many LC types are there, 2 main covers were recorded >80% >75%	LCCS 22 class	Mayaux et al 2006
GlobCover	Stratified random sampling	4258 3167 certain	5by5 pixel	SPOT VGT-NDVI profile, Google Earth,	dominance, Record more classes if there is	LCCS 22 class	Defourny et al 2009
STEP	stratified	1780		Landsat, high and low resolution images (Google Earth)	Google Earth	IGBP 17 classes + other classes	Friedl et al., 2000 Sulla-Menashe et al., 2011
VIIRS	stratified random sampling	500	5by5 km blocks	VHSR (<2-m)	manual interpretation aided by Google Earth and MODIS time-series	IGBP legend, and LCCS in the future	Olofsson et al., 2012 Stehman et al. 2012

http://www.gofcgold.wur.nl/sites/gofcgold_refdataportal.php

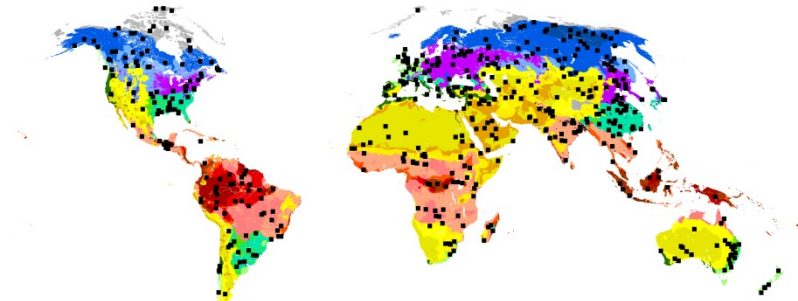
Upcoming datasets and future updates

Dataset name	Provider	Sample size	Suitable for	Coverage	Reference
VHSR	Boston U.	500	Validation	Worldwide	Olofsson, et al., 2012
GlobCover 2009	ESA/UCL		Validation	Worldwide	Bontemps, et al., 2011
Landsat GLC map	China	38664	Validation	Worldwide	Gong, et al., 2013
GLCNMO	International Steering Committee for Global Mapping	600	Training/Validation	Worldwide	Tateishi, et al., 2011
LC CCI	ESA	13000	Validation	Worldwide	Achard et al., 2011
NELDA dataset	NELDA	11	Validation	Northern Eurasia	Clark & Aide, 2011b
Global urban ground truth data	University of Tokyo	3734	Validation	Worldwide	

- Updates to come for: GlobCover 2005, VIIRS, STEP

Different global sampling designs

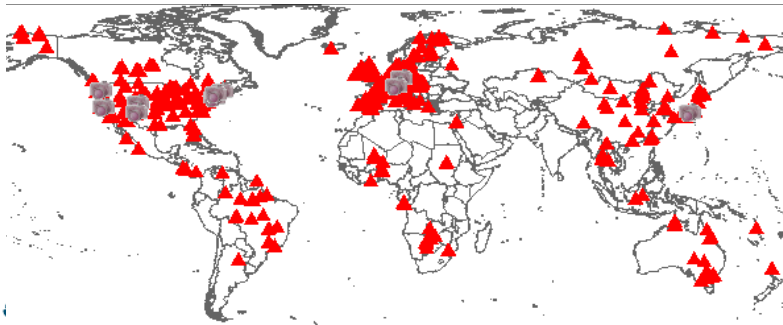
Stratified random



Systematic



Opportunistic



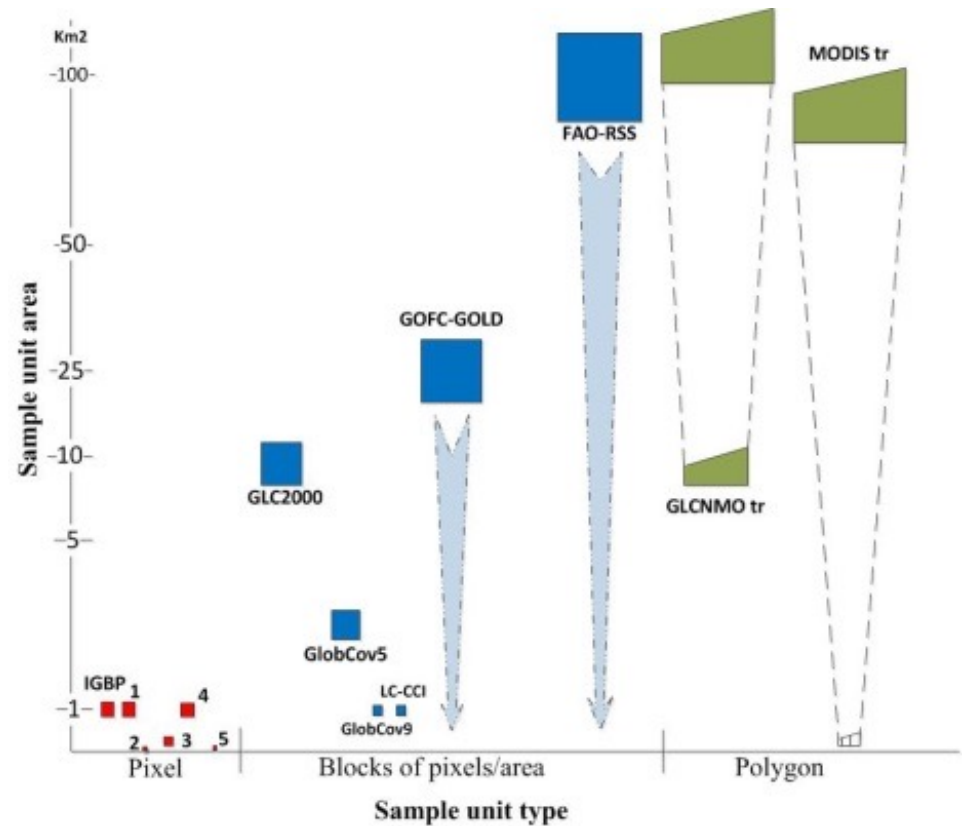
1. Multiple sample designs available/used
2. Different feasible globally and can be
3. Need for augmentation regionally
4. Eventually addressing change
5. Design vs. model-based error estimation

Response design: interpretation and samples

Classification schemes of the datasets

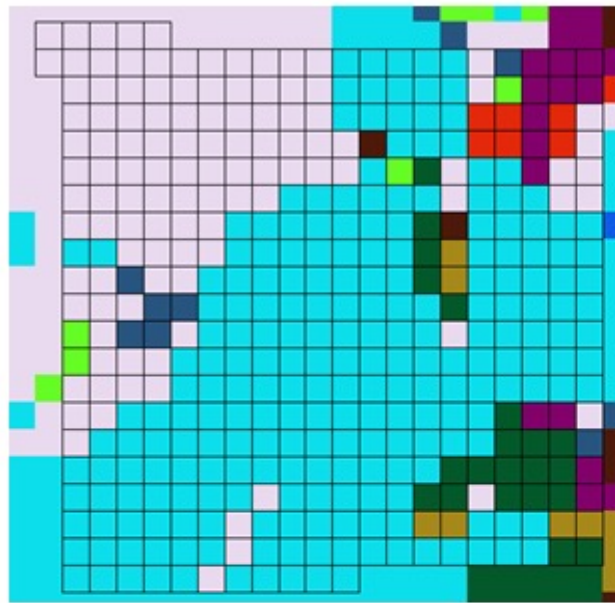
Datasets	IGBP	LCCS	Other	Number of classes
IGBP-DIS	✓			16
GLC 2000		✓		22
GlobCov5		✓		22
GlobCov9		✓		22
GLCNMO-val		✓		20
GLCNMO-tr		✓		14
MODIS-tr	✓			17
FAO-FRA		✓		9
LC-CCI		✓		22
GOFC-GOLD		✓		12
GEO-Wiki	✓	✓		17-22
VIEW-IT			✓	7

Sample unit type and size

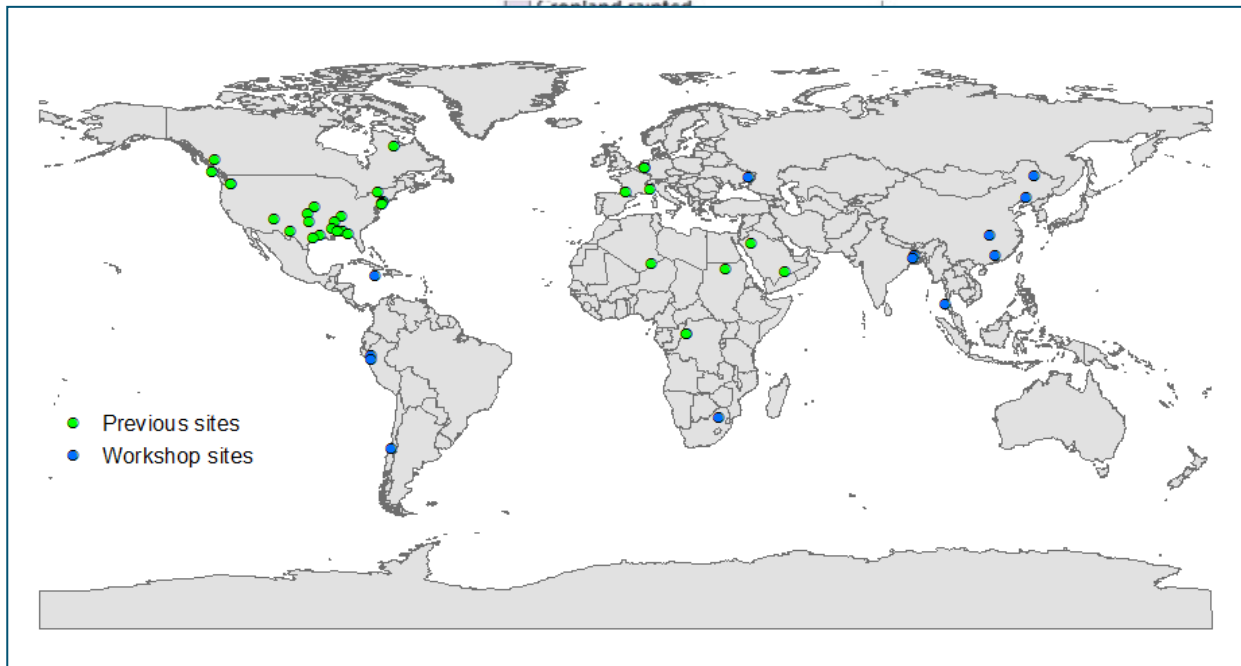
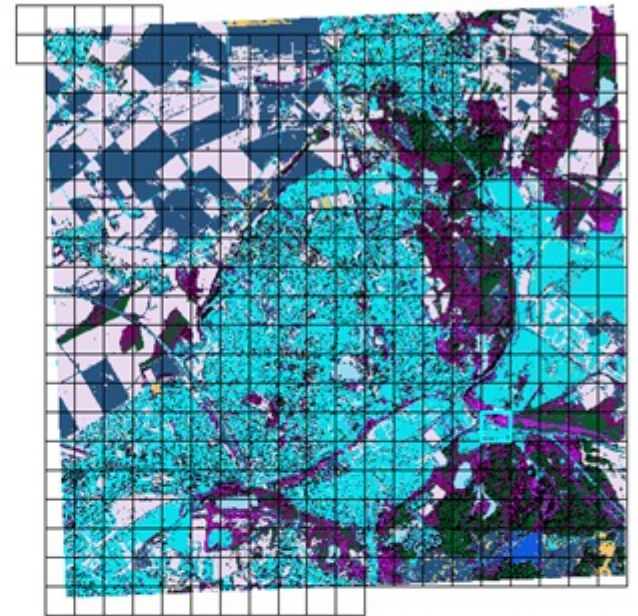


1. GLCNMO v; 2. Geo-Wiki Globcover; 3. Geo-Wiki MODIS; 4. Geo-Wiki GLC2000; 5. View-IT

LC-CCI map



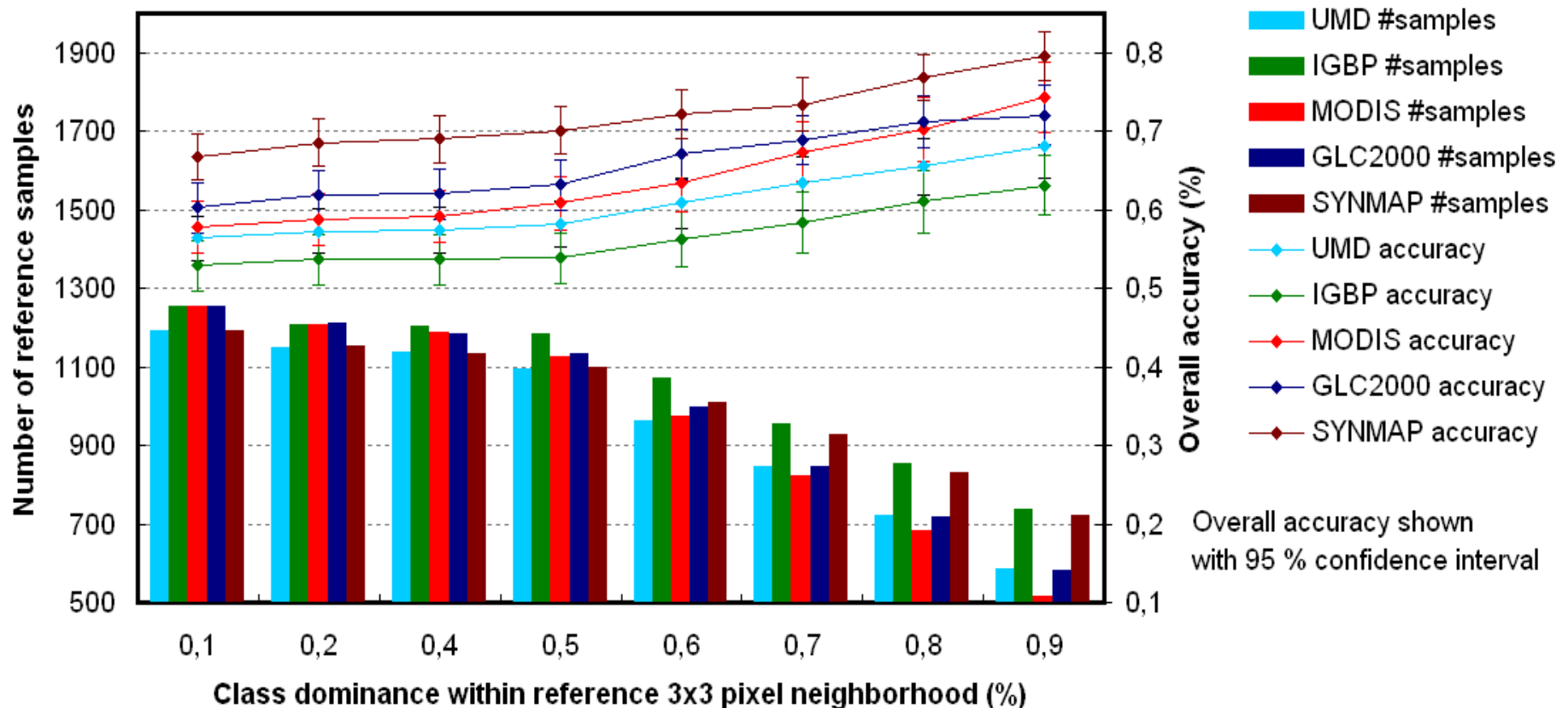
VHR classified map



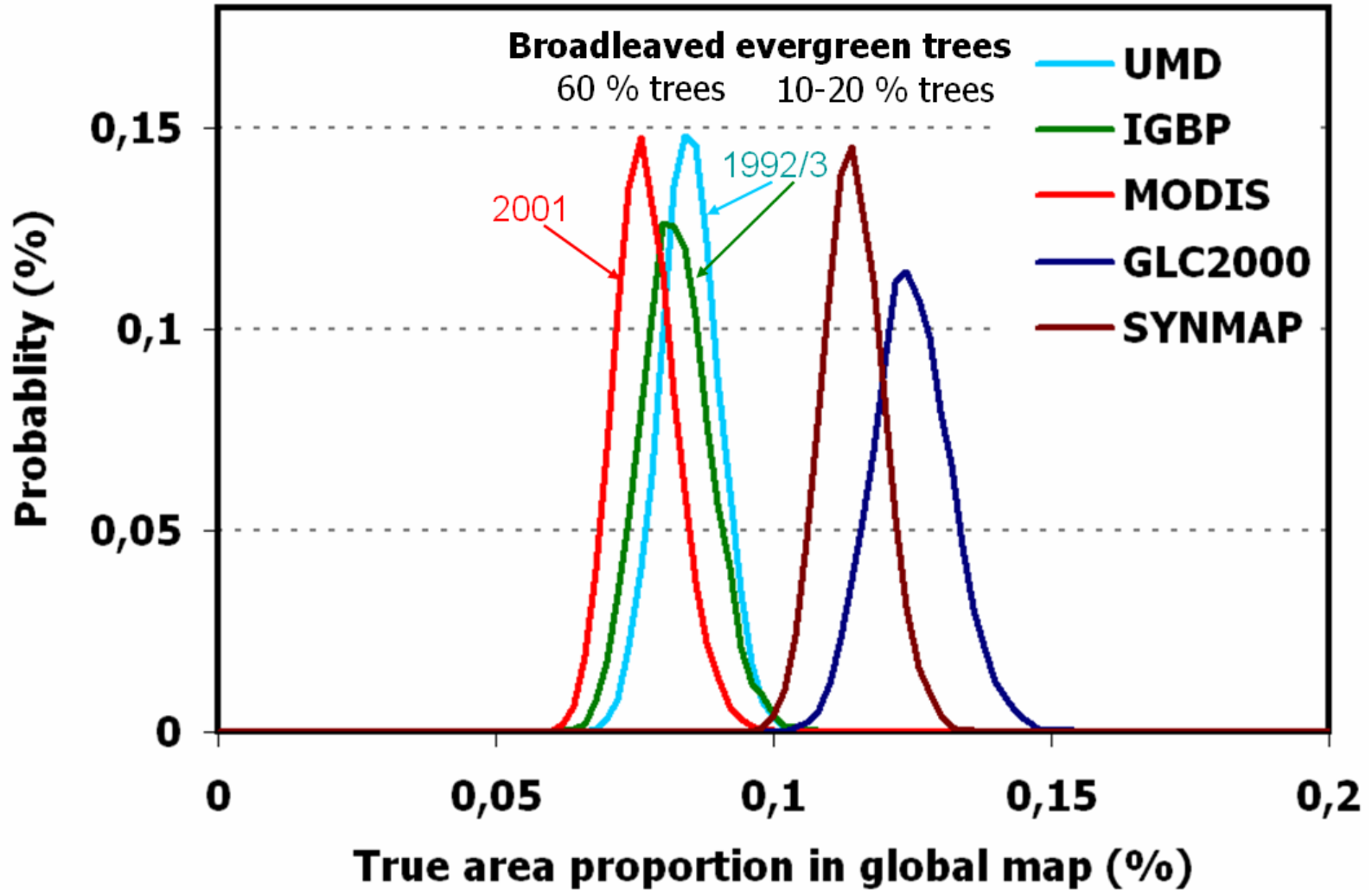
- 0
- 10
- broadleaf deciduous
- needleleaf evergreen
- water
- 30
- barren
- build up
- 40
- shrub
- cropland
- grassland
- shadow

Error analysis designs

1. Classics are error matrix, overall accuracy, class-specific accuracies, omission and commission error, incl. confidence intervals
2. Increasing demand for area and area change estimates

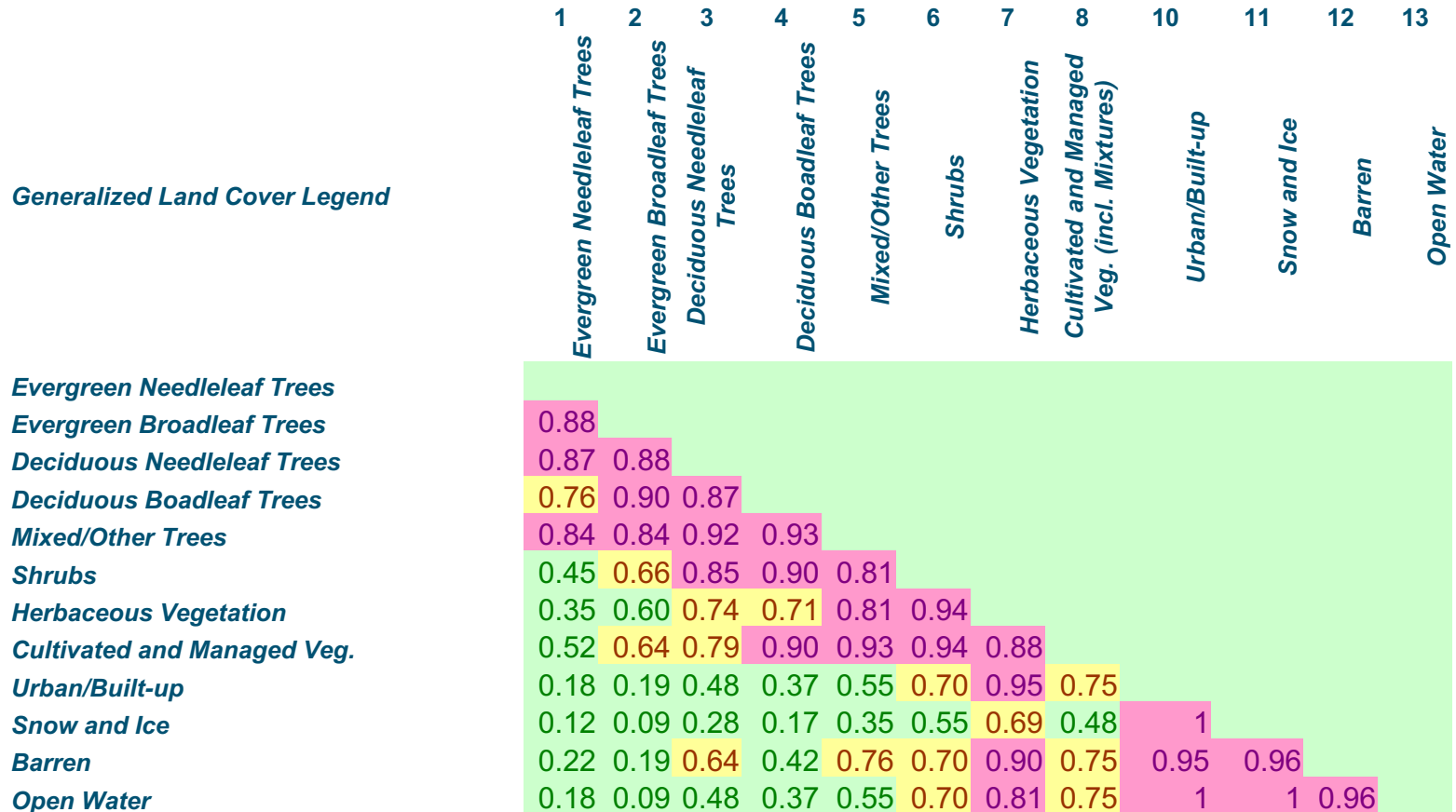


Assessing global area estimates



Weighting of error matrix for different uses

Matrix of the similarity between the 12 generalized land cover classes as average for 9 land surface model parameters.



Weighting:

close to 0 – no/less credit for mistake

close to 1 – the mistake is decreasingly serious

Olofsson, P. *et al.* (2013). Good Practices for Assessing Accuracy and Estimating Area of Land Change. *Remote Sensing of Environment*, in revision

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Towards stage 4 validation

1. Stage 4 validation is focus area of GOFC-GOLD efforts and as part of ESA's LC-CCI phase 2
2. Sampling design less of an issue
3. Key problems are in the response design:
 - VHR data interpretations would be ideal but coverage, cost and effort are high
 - SPOT/Landsat data + time series most useful for stability
 - “Generic” interpretations, incl. changes
 - Efforts to engage communities (“crowd”, projects, countries – GEO?)
4. Plan for related GOFC-GOLD workshops and prototyping as part of LC-CCI phase (JRC as lead)



→ **SENTINEL-2**
FOR SCIENCE WORKSHOP

20–22 May 2014 | ESA-ESRIN | Frascati (Rome) Italy



Participants: Sentinel-2 users and interested parties - from scientist to value adding

Themes:

- Agriculture
- Land Cover
- Forestry
- Wetlands & coastal waters
- Methodologies, techniques & calibration

Abstract submission: until 31 January 2014 (2 week extension)

Participation fee: free of charge

→ Further info on www.esa.int/Our_Activities/Observing_the_Earth/Copernicus



GOFC-GOLD

Global Observation of Forest Cover and Land Dynamics



THANK YOU

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Relevance of cal/val coordination for biomass

1. Series of large area research products:
 - Not validated and not systematically inter-compared
 - Reference data issues
 - Scaling
2. Prospects to produce more maps ...
3. CEOS interest (carbon)
4. ESA BIOMASS mission on the horizon
5. GTOS TCO manual for carbon
6. Some area to be active for LPV?



Terrestrial Carbon Observations:
Protocols for Vegetation Sampling
and Data Submission