

Chinese global land cover validation activities

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Wageningen, The Netherlands

Basic components

- Literature collection and spatialization – a literature database of 6800 articles
- Validation data collection from other global or regional projects
- Field trips
- Validation sample collection and interpretation

Spatialization of global land cover activities in the world

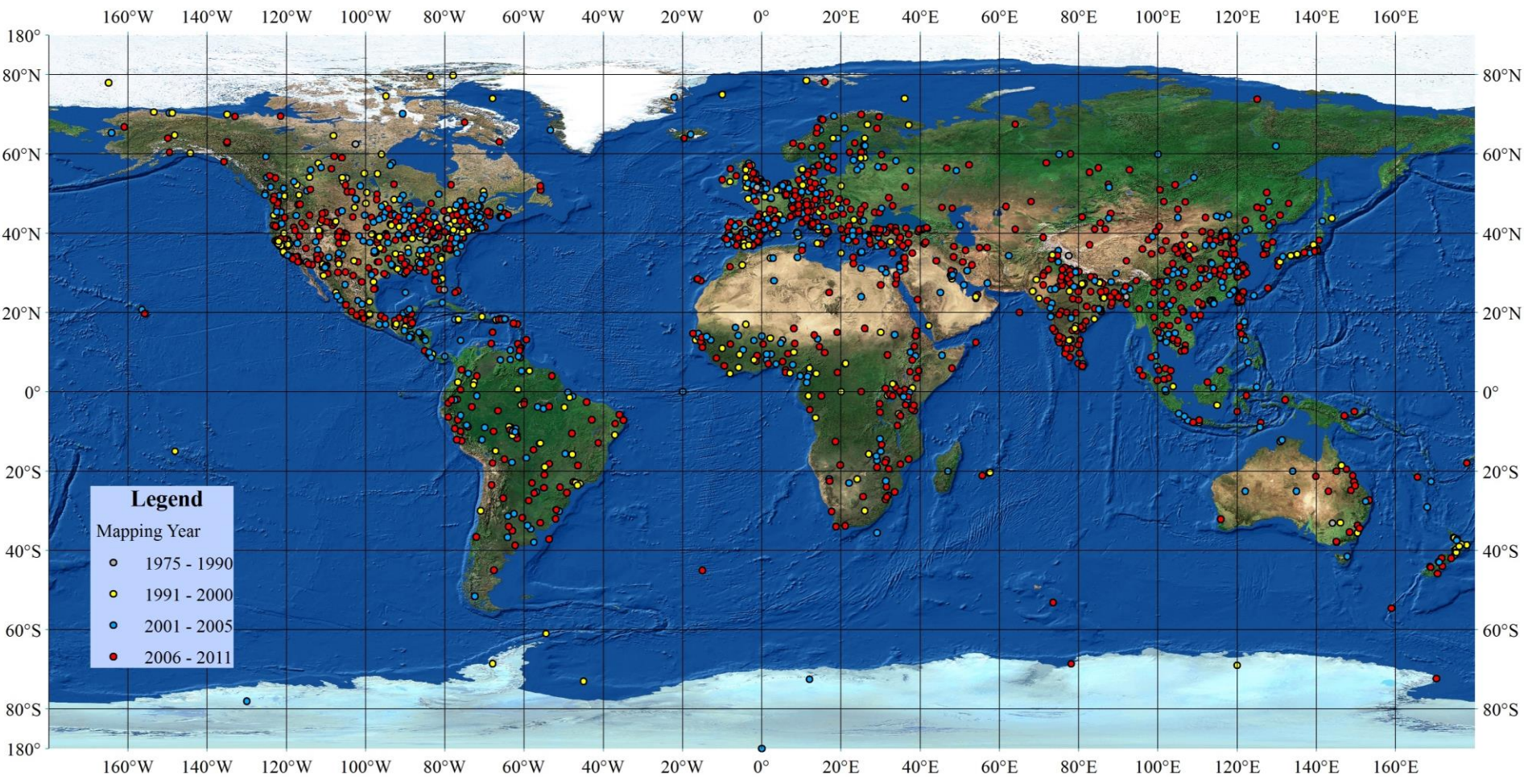
ID	Content	Format	Example (Hansen et al., 2000, IJRS,21(6): 1331-1364)
1	Corresponding author (email)	Author (author's email)	Hansen, M.C. (mhansen@glue.umd.edu)
2	Research domain	Review, Method, Method comparison, change, (application domain)	Land cover
3	Study area-place name	place name1, place name2, ...	Global
4	Study area-lat/lon	[longitude, latitude]	N
5	RS dataset	Dataset 1, dataset 2, ...	AVHRR
6	Other dataset	Dataset 1, dataset 2, ...	N
7	Year for mapping datasets		1992-1993
8	Classification approach	supervised, unsupervised, maximum likelihood, neural network, support vector machine, ...	Supervised classification, decision tree
9	Classification system	classification system, author's own	IGBP, UMD
10	Result map?	{Y, N}	Y
11	Sample location?	{Y, N}	N
12	Accuracy		65%
13	How was accuracy evaluated?	expert, confusion matrix, kappa, roc, ...	Expert
14	Evaluation on current global products?	{Y, N }	N

Feature Target: Topology: <Map Layers>



2362公里
Nagaraja Sagar
Pedda Yaru
Srikakulam

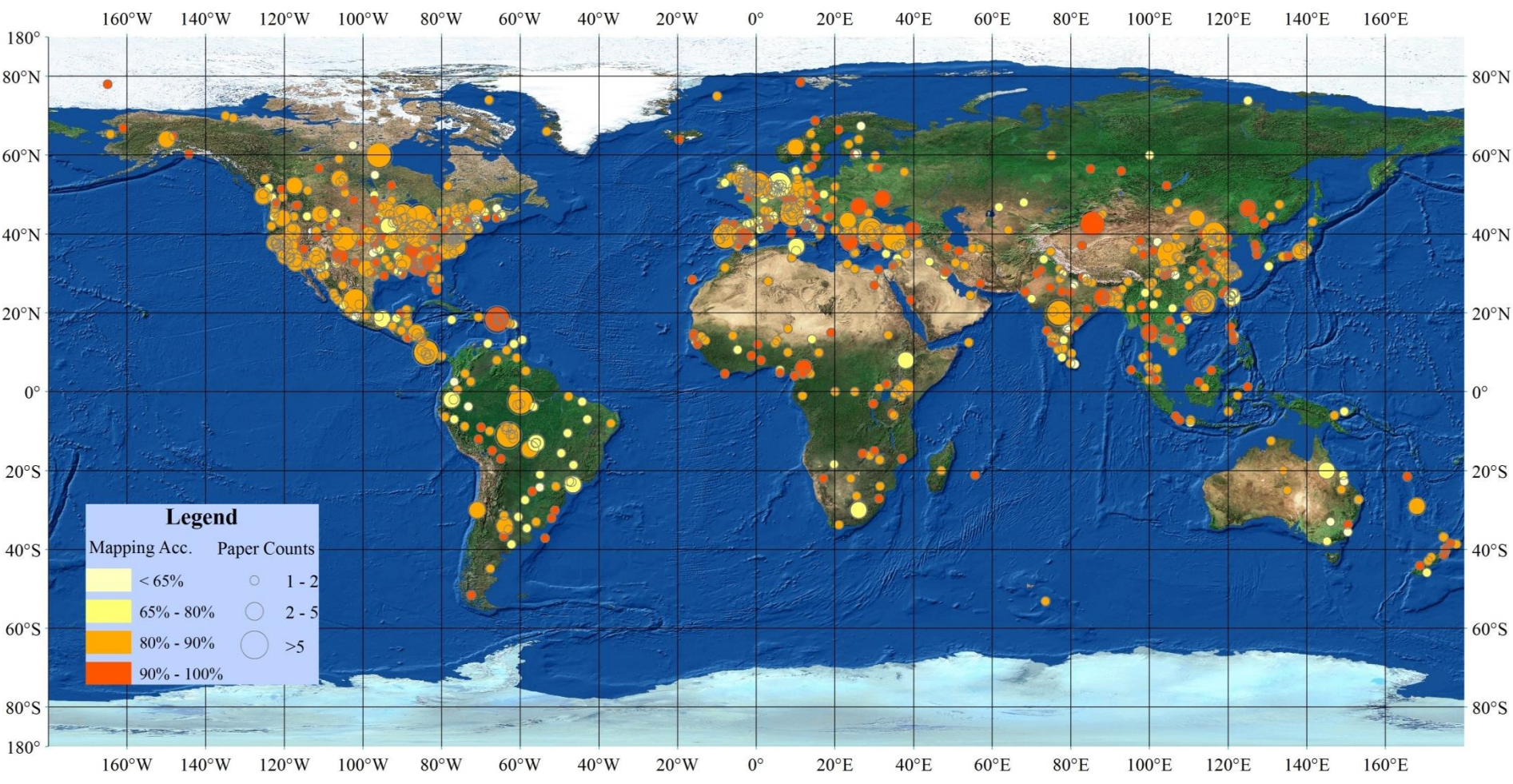
46°27'22.59" 北 127°16'45.99" 东 海拔 408.16 米

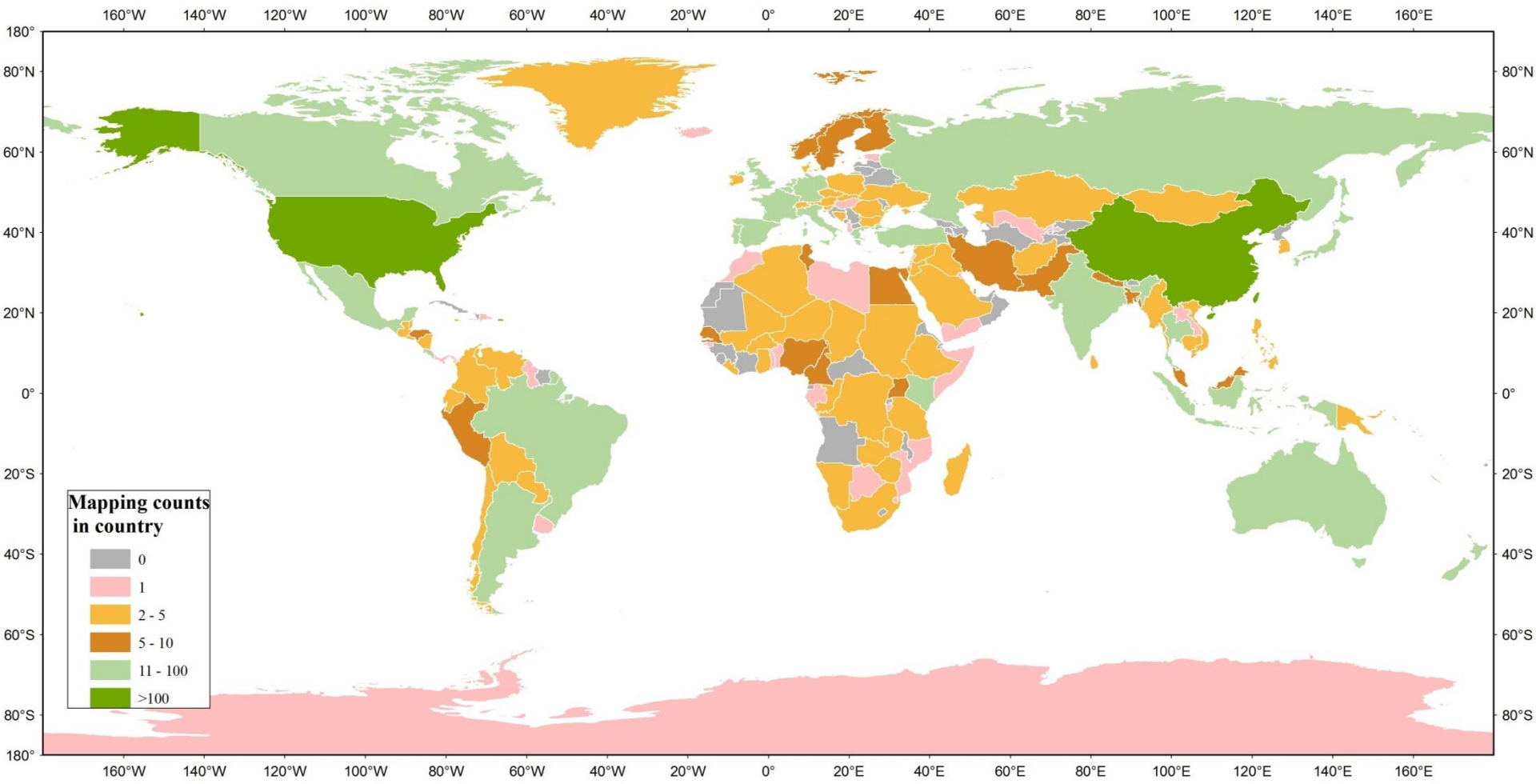


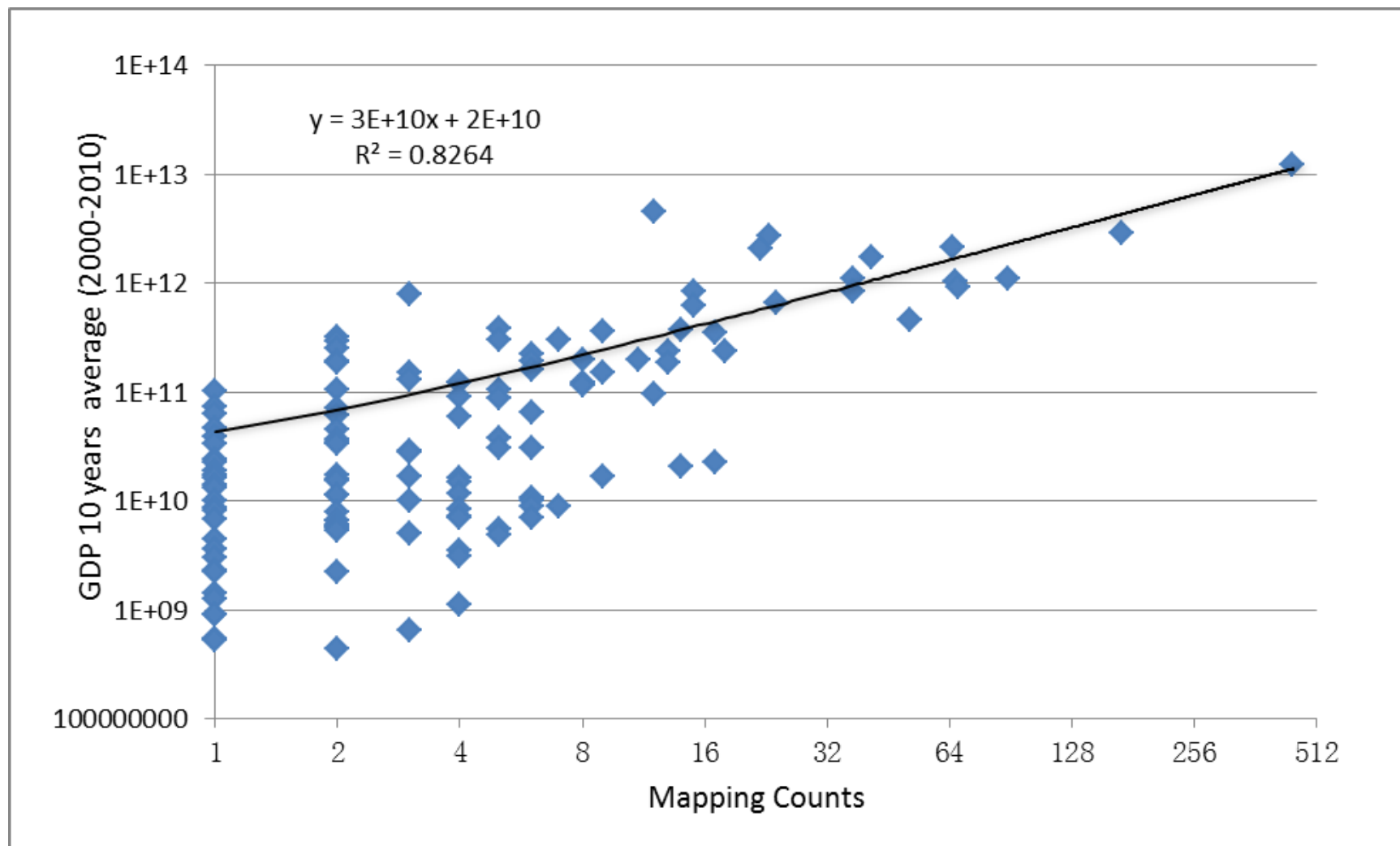
Legend

Mapping Year

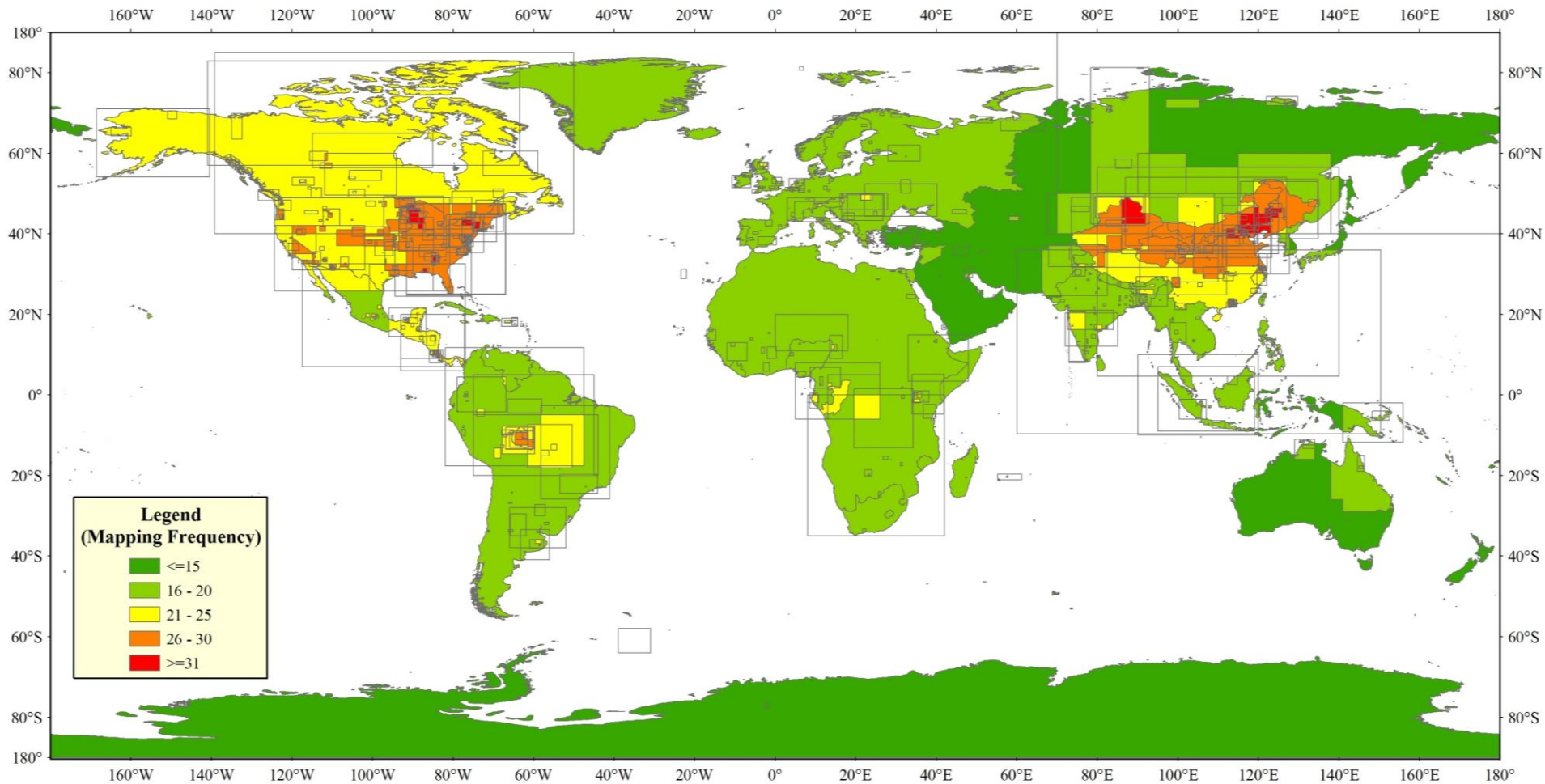
- 1975 - 1990
- 1991 - 2000
- 2001 - 2005
- 2006 - 2011



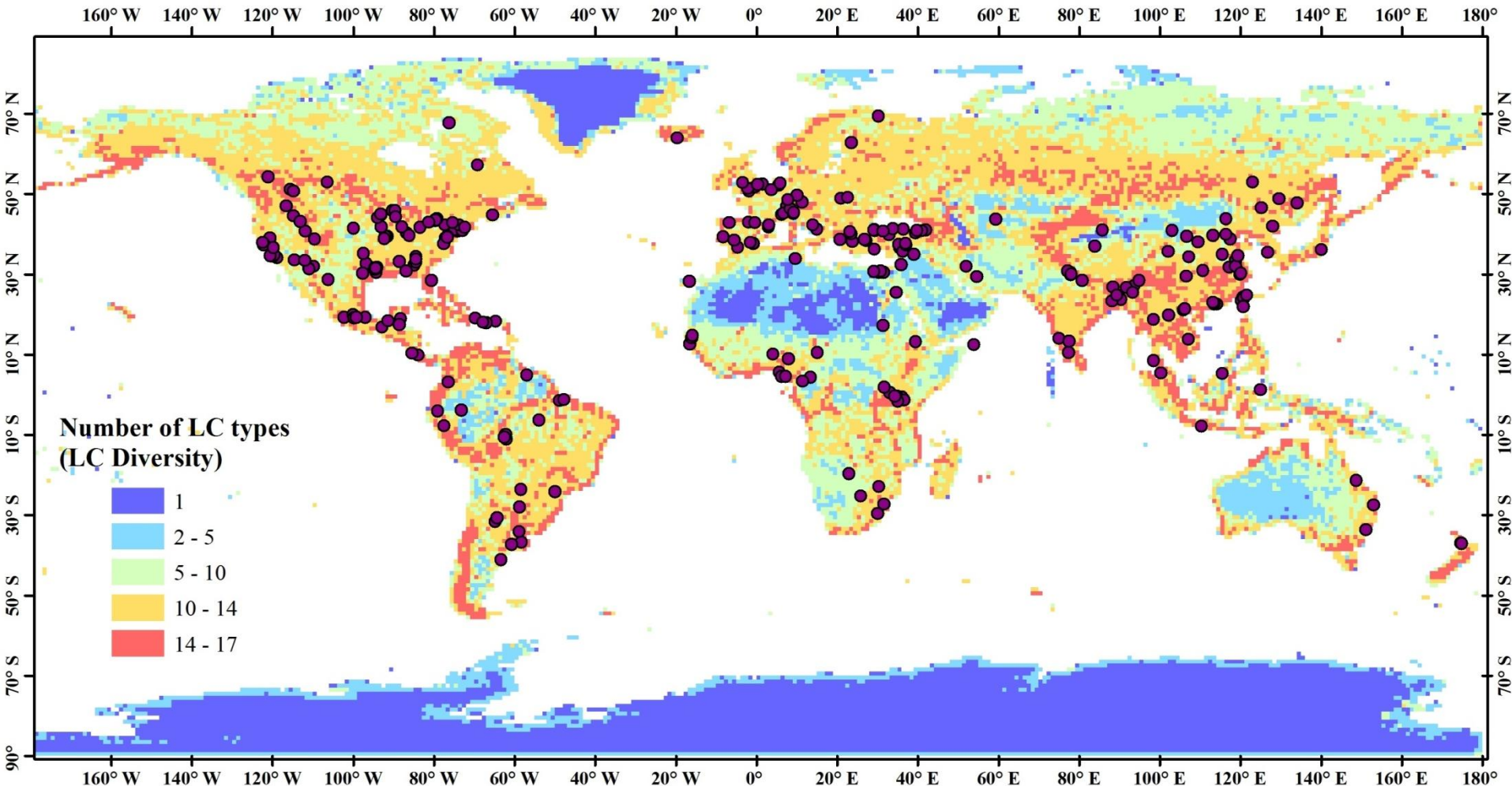




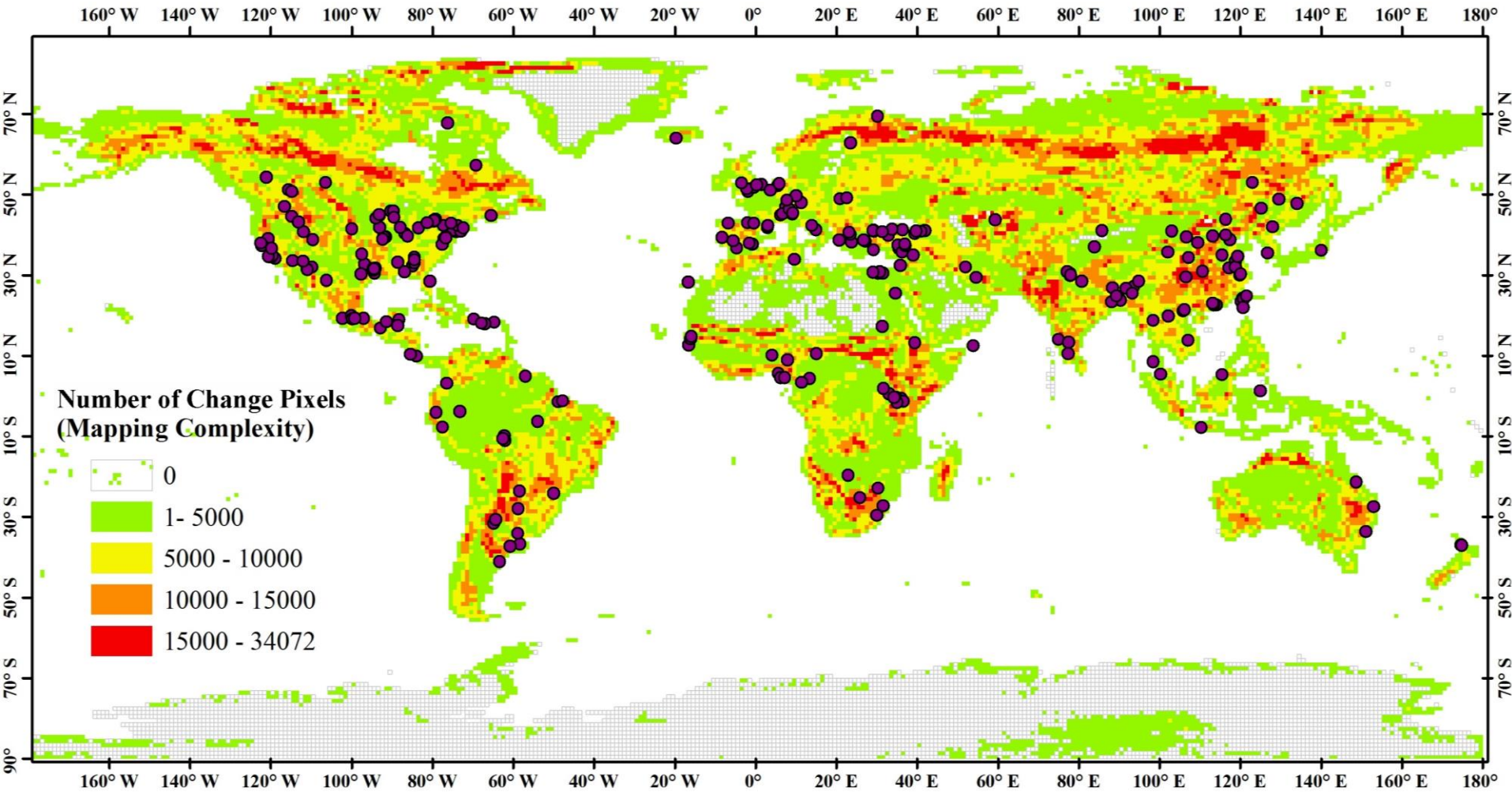
Spatialized land cover mapping activities



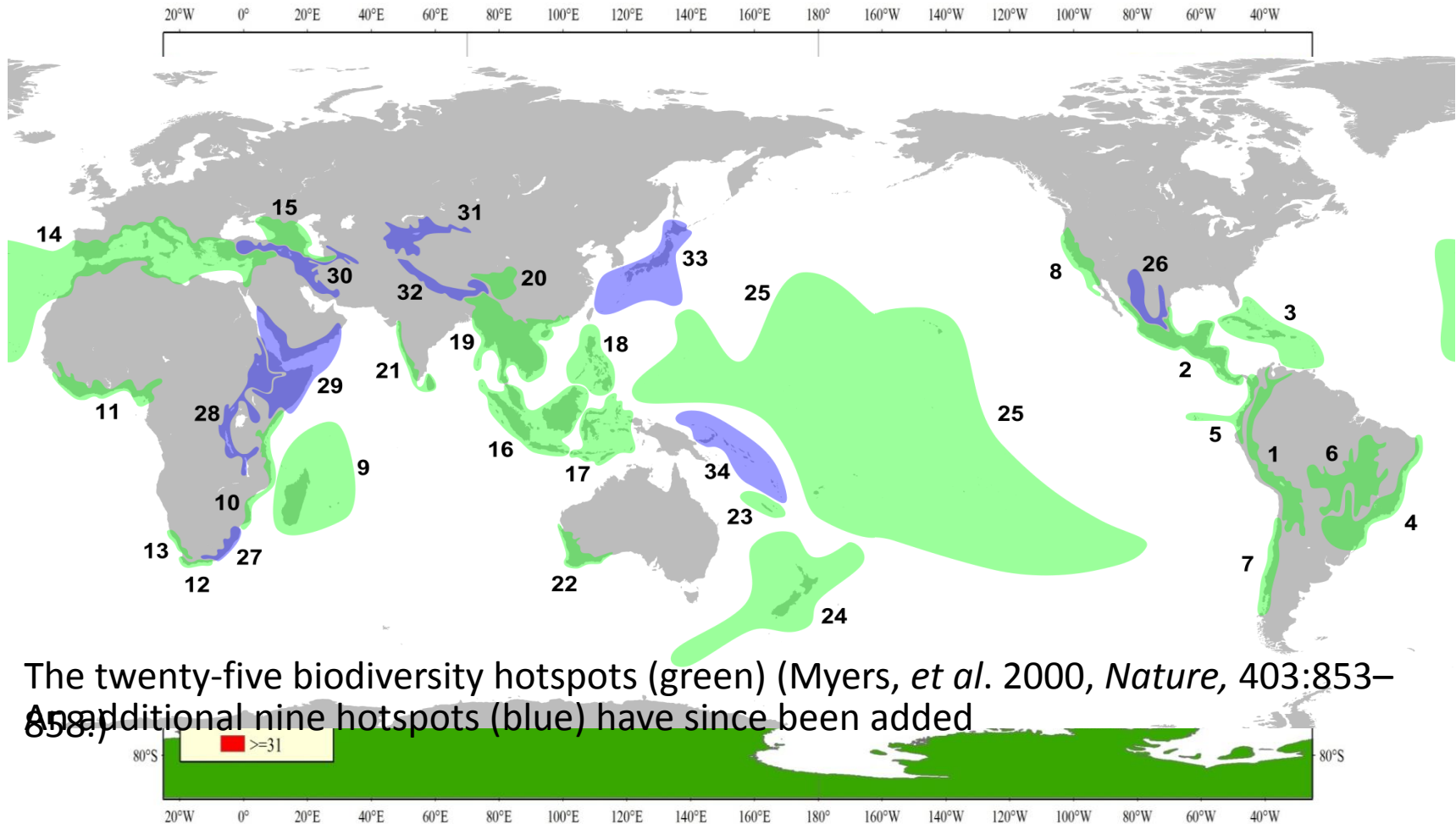
Land cover diversity from MODIS global land cover data products



Land cover complexity

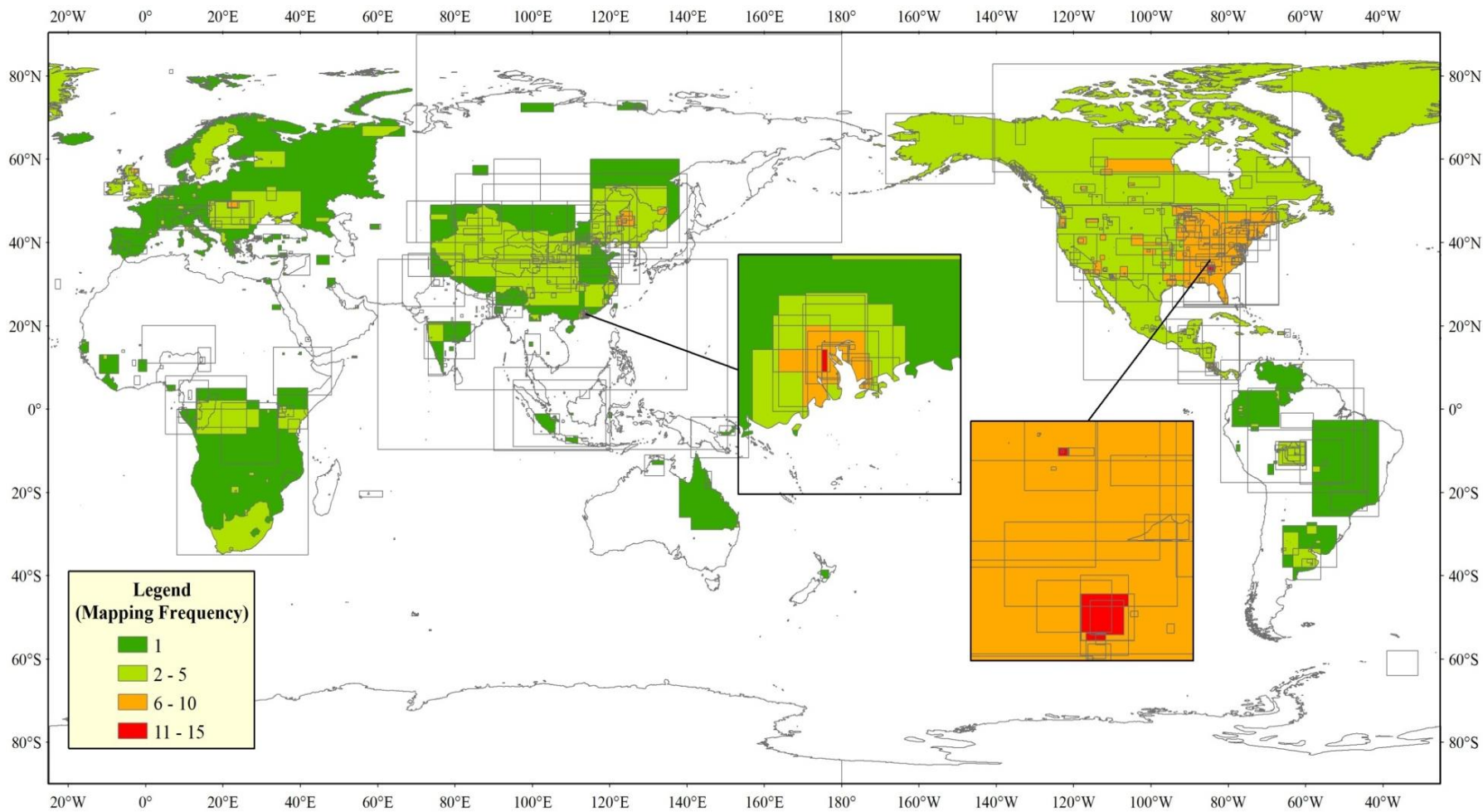


Hot spots of land cover mapping



The twenty-five biodiversity hotspots (green) (Myers, *et al.* 2000, *Nature*, 403:853–858.)
An additional nine hotspots (blue) have since been added

Hot spots of using 30 meter TM/ETM+



Preliminary Fieldwork

Yuanyuan Zhao – Quebec, Canada
Yanlei Chen
Yue Xu

Yuanyuan Zhao – Austria

Nicholas Clinton – Alaska
Le Yu
Zhiliang Zhu

Zhenguo Niu – British Columbia
Xueyan Li
Xiaoyi Wang

Le Yu – India

Lu Liang – Colorado
Yanlei Chen
Zhiliang Zhu

Liheng Zhong – California
Peng Gong

Peng Gong – Brazil

Lu Liang – Chile
Peng Gong

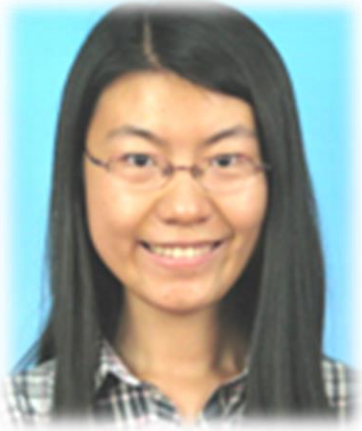
Le Yu - Australia

Validation sample interpretation
(Oct 2011-April 2012) – FROM-GLC
(Oct 2011-Oct 2012) – new improved
samples

Procedure for validation sample collection

- Initial validation sample collection
- Checked by a second interpreter
- Second round of sample verification
- Final round of sample verification – by a single Yuanyuan Zhao for nearly one year

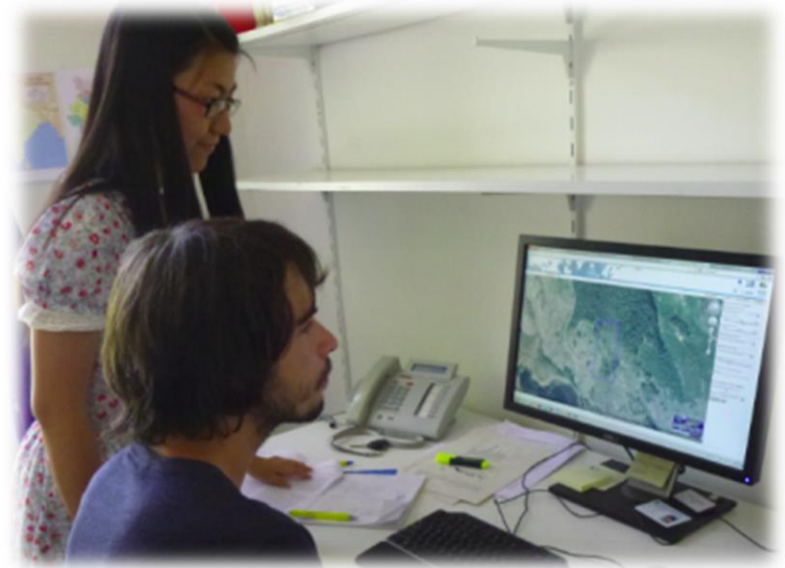
Yuanyuan Zhao, Currently visiting U of Toronto, Canada



Selected to young scientist summer program, IIASA, Luxenburg, Austria

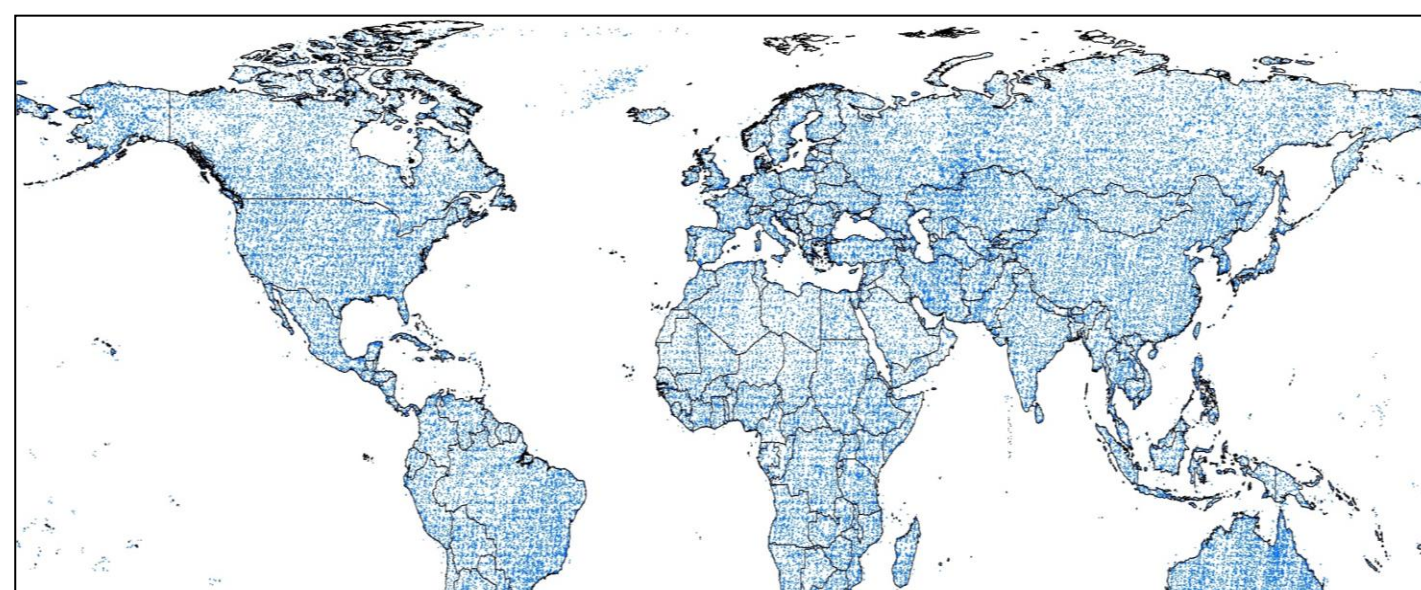
Final controller of the test sample collection team – making the final check of all test samples

Proficient with GA/GM and the crowdsourcing software developed at IIASA for validation sample collection

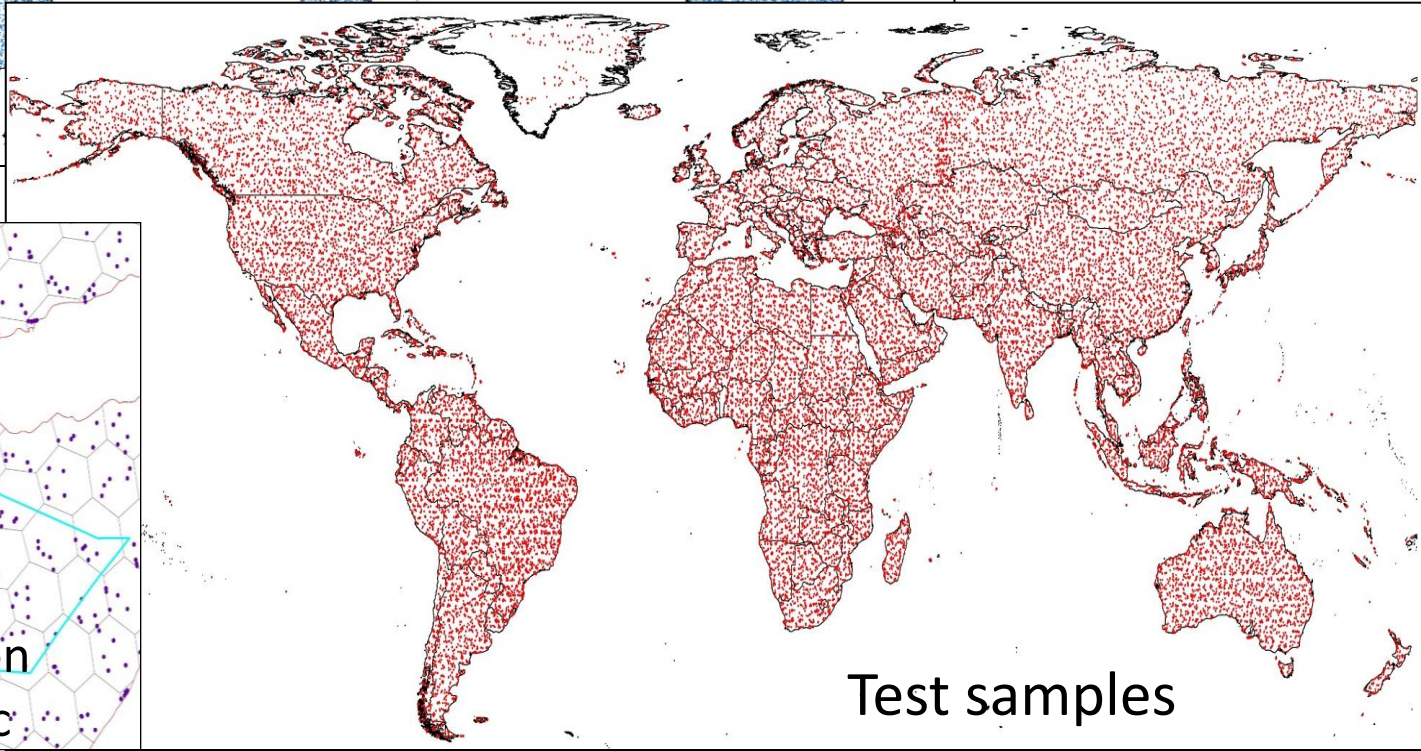


Quality of image interpreters

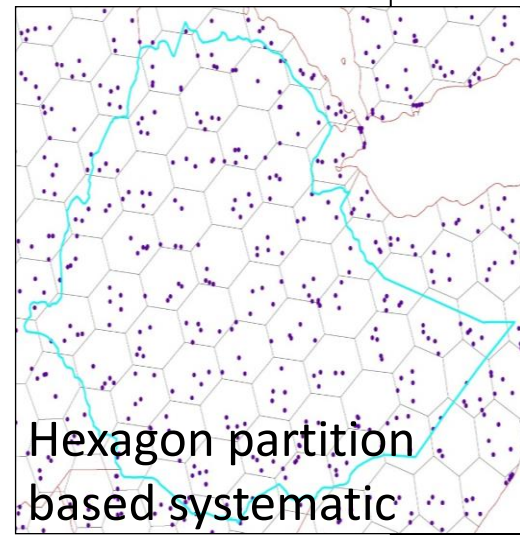
- Interpretation test with over 100 US interpretation keys collected in Florida, Minnesota, Utah, Nebraska, California
- All second round validation sample collectors scored over 70% at level 1
- The final round validation sample inspector scored 90%



Training samples



Test samples

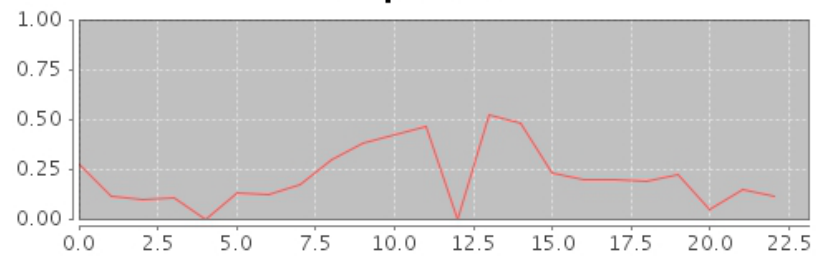


Hexagon partition
based systematic
unaligned sampling

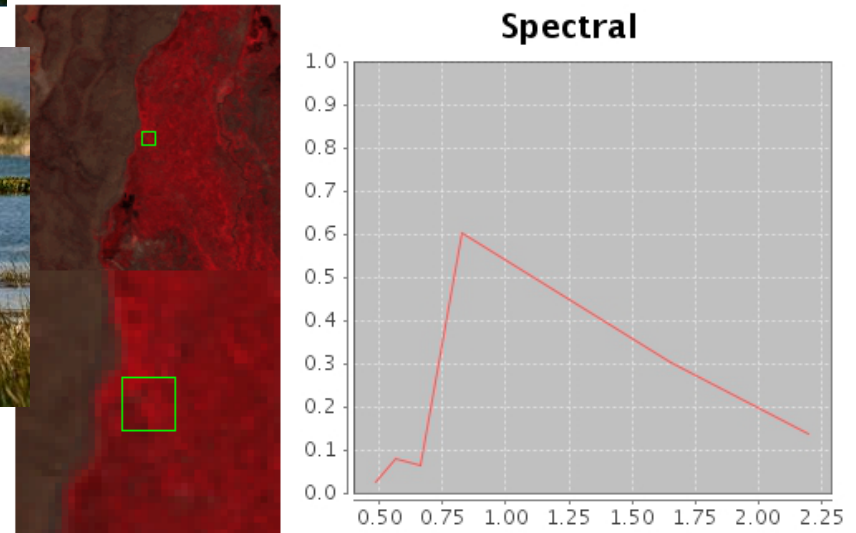


imgName: I5043030_03020100807_rad_ref_trc -118.90947, 42.852928 -- classVal: 40

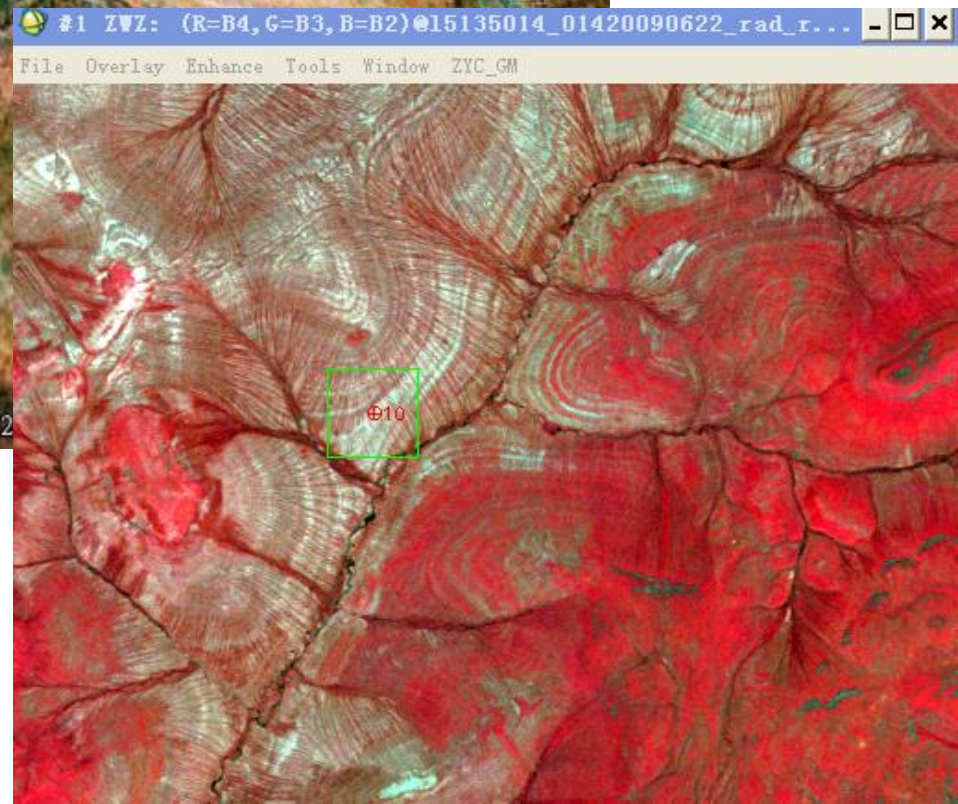
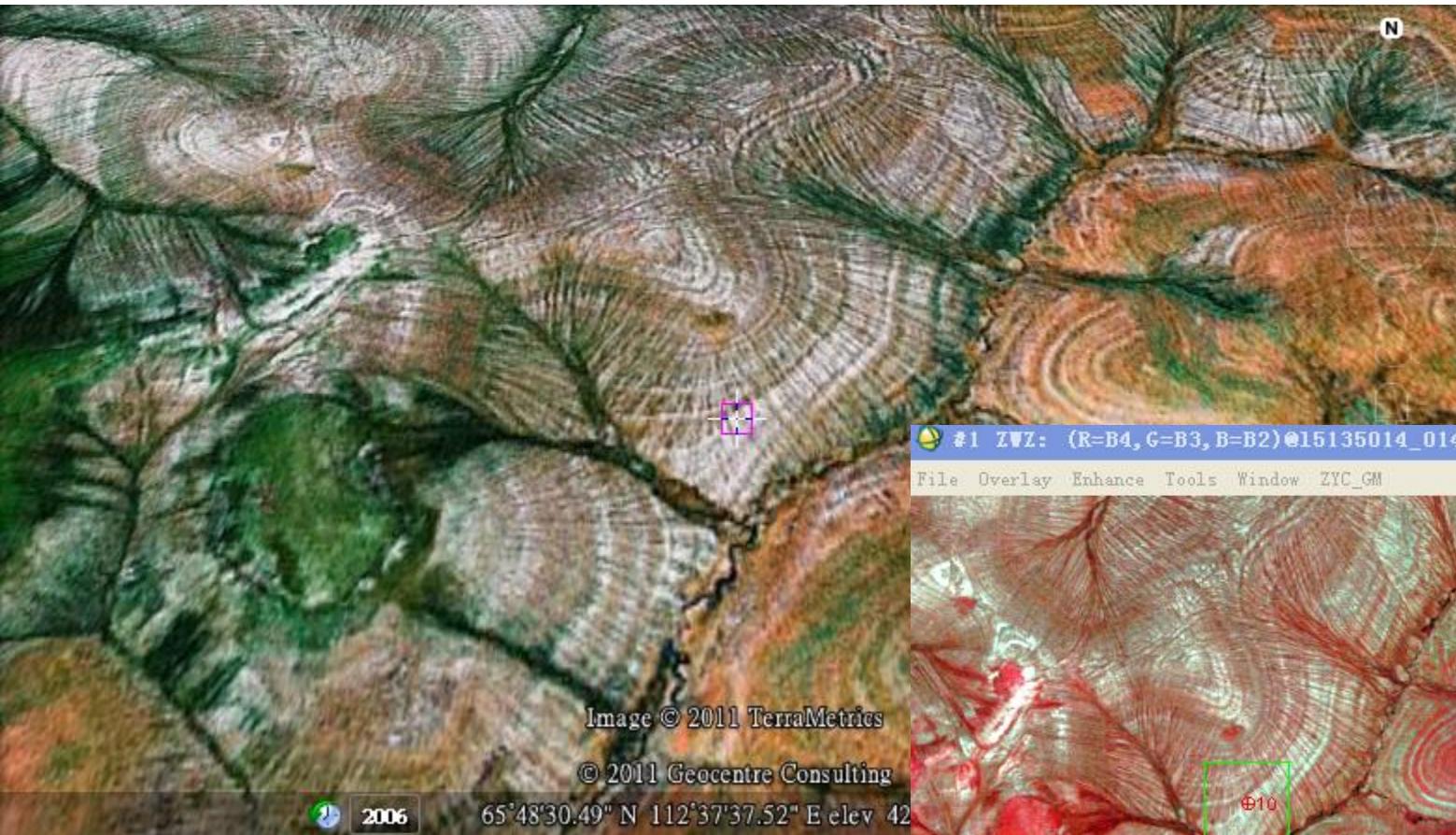
Sequence

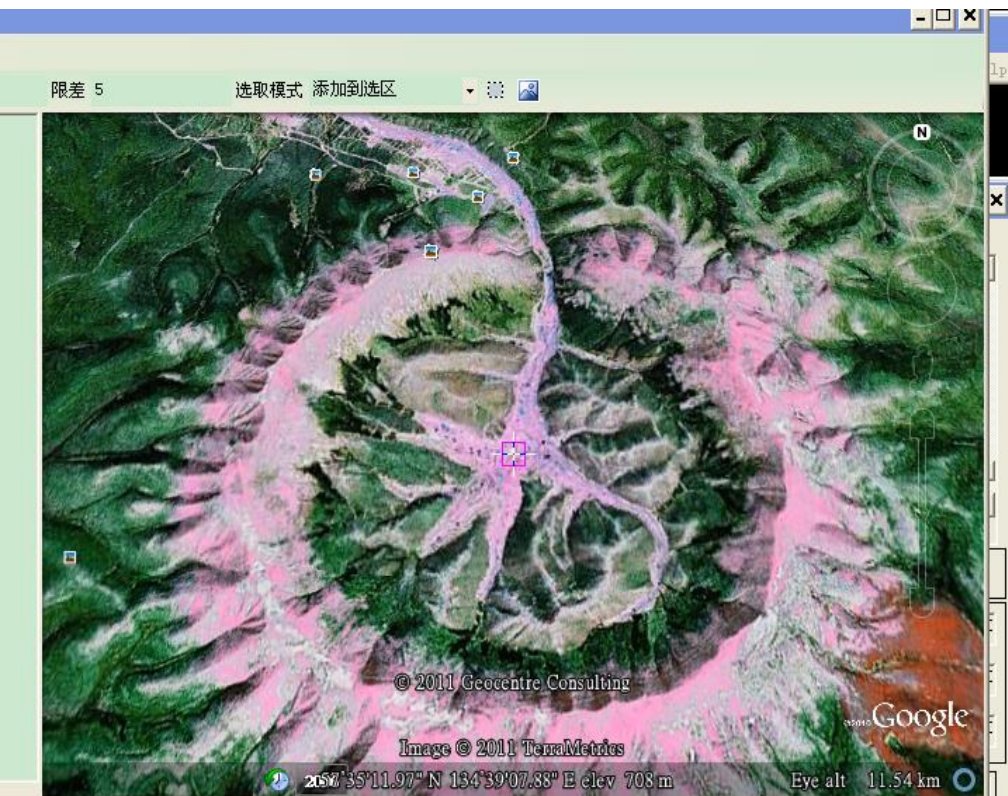


Spectral

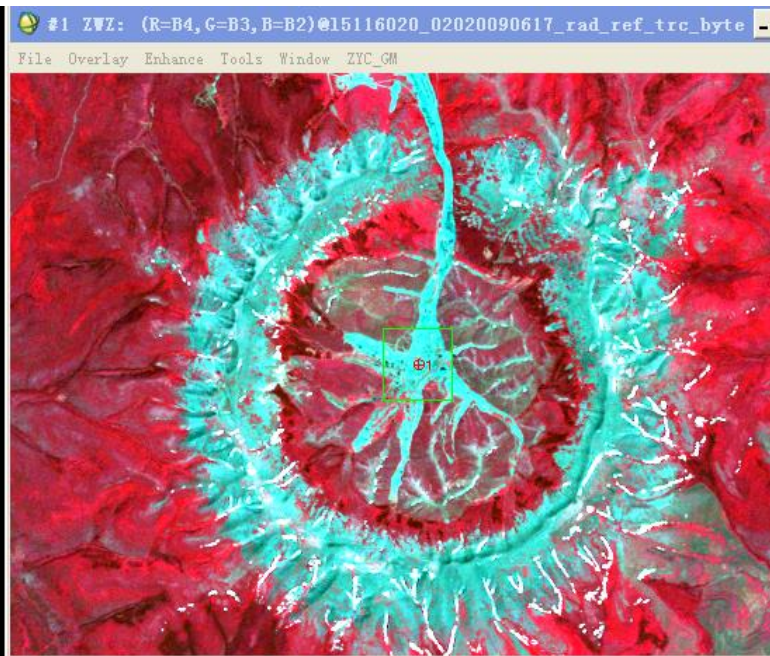


65.808466N 112.62709E





编号	判读ID及索引级属	属性描述	性代	样	高分	波	可信	解译人	检验意见1	检验2意见
34	1 20 15116020_C 9 3	砾石地/岩石	93					姚文博		
35	2 20 15116020_C 2 2	针叶林	22					姚文博	23	
36	3 20 15116020_C 2 1	阔叶林	21					姚文博	u	
37	4 20 15116020_C 11	云	999					姚文博		

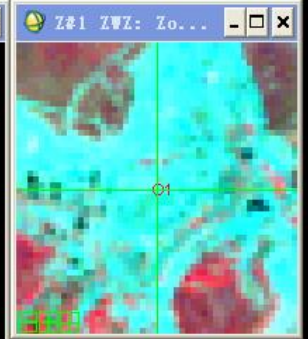


L#1 ZWZ: GCP List (Map) - G...

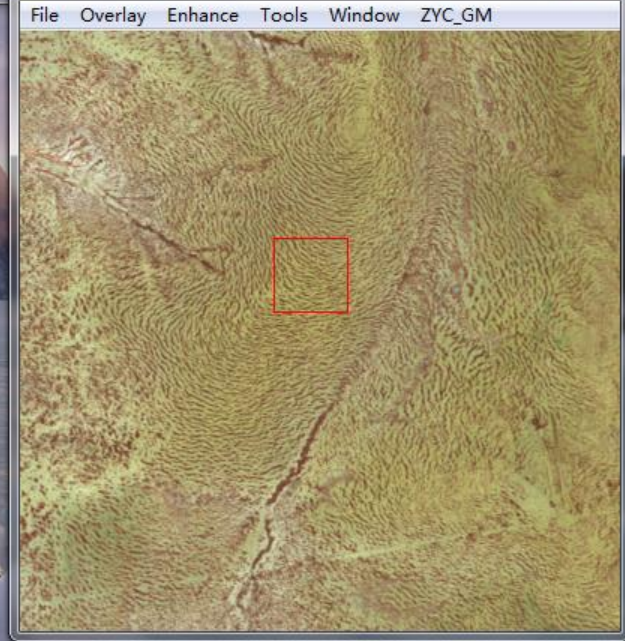
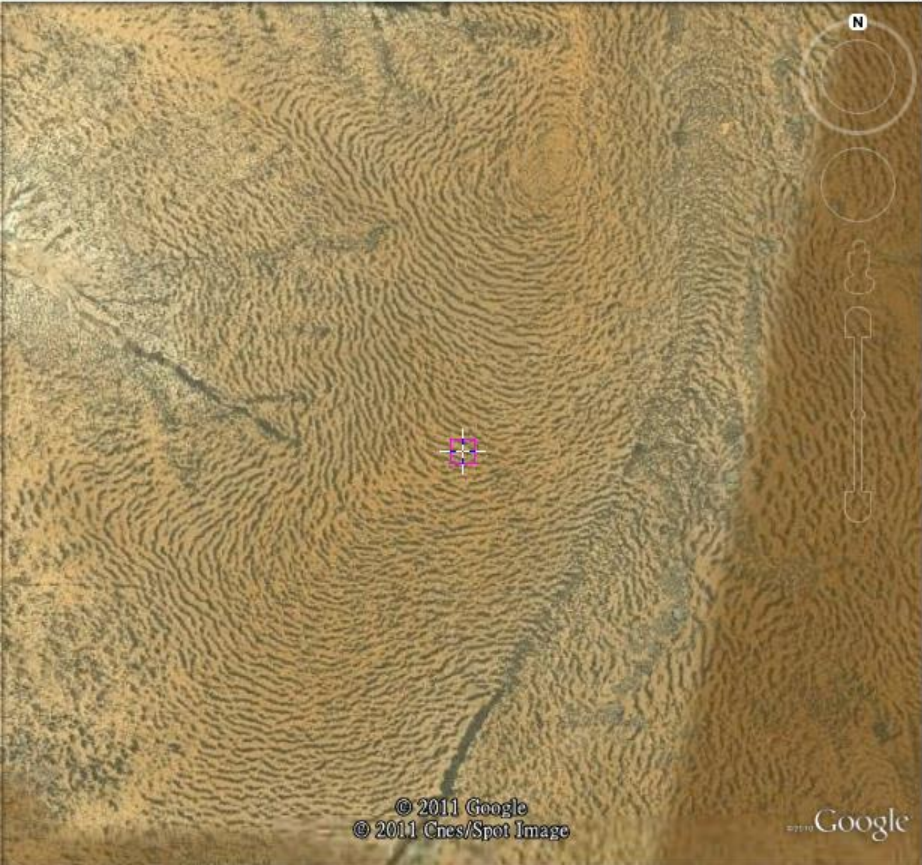
File Options

	Map X	Map Y	Image X	Image Y	Pr
#1+	134.65	57.59	4155.00	2772.25	41
#2+	134.06	57.37	2964.25	3565.50	29
#3+	134.73	57.11	4308.25	4527.75	43
#4+	133.06	56.77	895.00	5759.00	89
#5+	133.41	57.01	1632.00	4871.00	16
#6+	133.34	57.21	1503.25	4134.25	15
#7+	133.44	57.33	1716.00	3698.00	17
#8+	135.36	58.00	5560.50	1229.75	55
#9+	135.44	58.65	5743.00	6248.00	57

Goto On/Off Delete Update Hide List



限差 5 选取模式 添加到选区

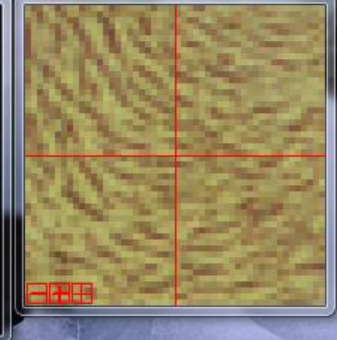
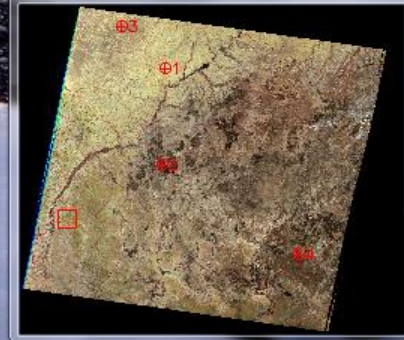


Proj : Geographic Lat/Lon
Datum: WGS-84

29.57239946 E Change Pr
11.07554452 N Units: Deg

Add Point Number of Selected
Show List RMS Error: 0.000000

4 / 4



ENVI 4.8
File Basic Tools Classification Transform Filter Spectral Map Vector Topographic Radar Window Help

↓ 0.08K/S ↑ 0.07K/S

GOME SCIAMACHY
ing NO2
Hg的生物地球化学循环-热点

限差 5 选取模式 添加到选区

© 2011 Google
© 2011 Cnes/Spot Image

影像拍摄日期: 2006/4/24 度 81659'47" 经度 24.497762 海拔 109 米 海拔高度 3.67 公里

#1 ZWZ: (R=B4,G=B3,B=B2)@I5175066_066200...
File Overlay Enhance Tools Window ZYC_GM

GCP#1 ZWZ: GCP Selection(M...
File Options Help zyc_GM

Proj : Geographic Lat/Lon
Datum: WGS-84

24.20454600 E Change P...
-8.40224340 N Units: De...

Add Point Number of Selected
Show List RMS Error: 0.26804...

S#1 ZWZ: Scroll(0.03...
File Overlay Enhance Tools Window ZYC_GM

Z#1 ZWZ: Z...
File Overlay Enhance Tools Window ZYC_GM

Take my red black cord and my jewel

Initial sample summary

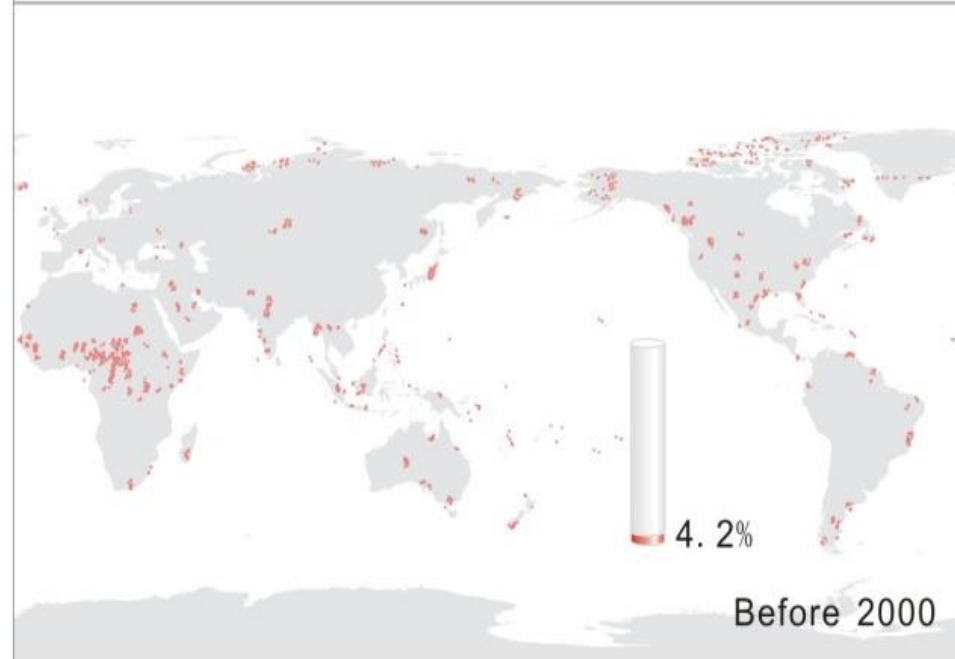
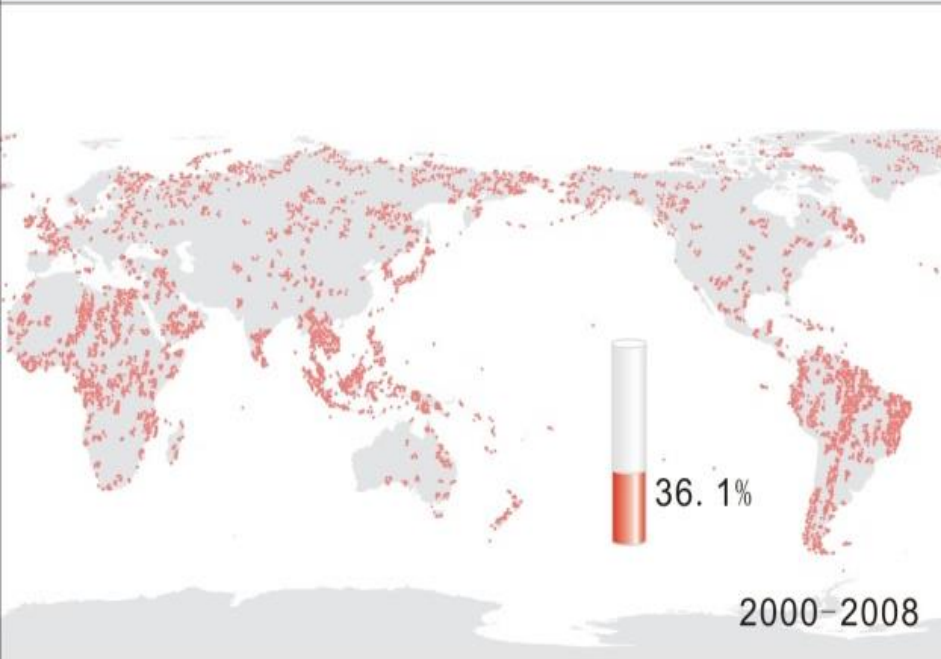
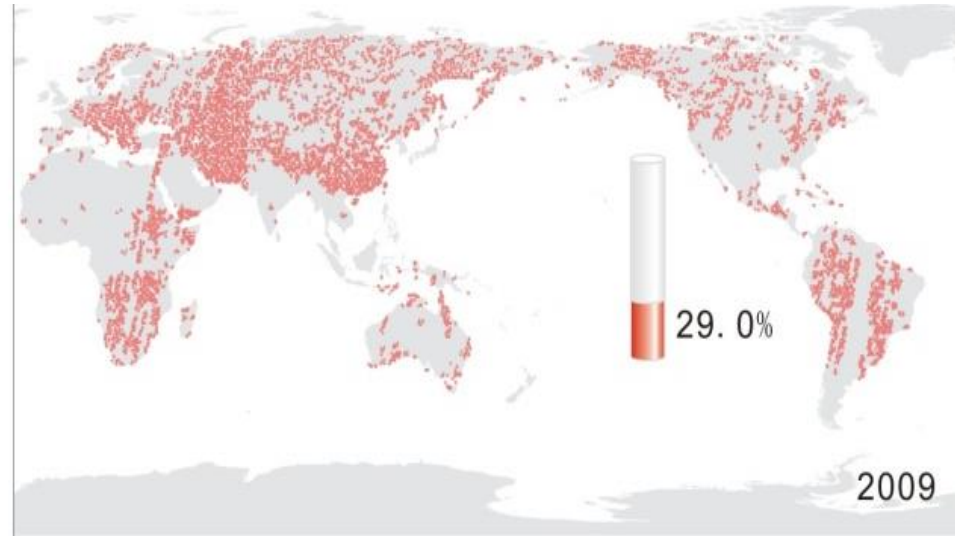
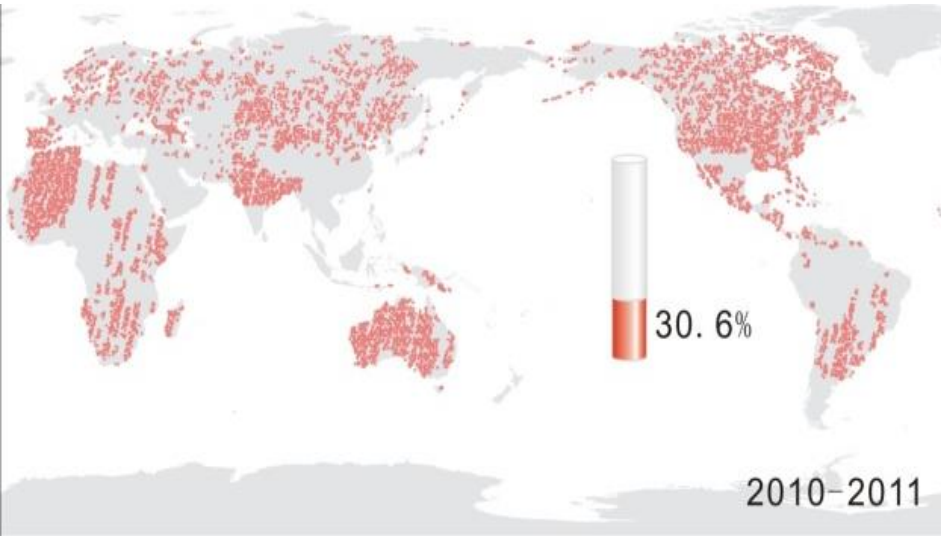
Table 6. Attributes for test sample collection.

ID	Img-name	Type code	Large sample	High resolution	Confidence	Pure	Cross-check	Quality control	Comment	Notes
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Table 7. Summary of test samples ($N = 38,664$).

Sample types and quality	Percentage of total
Large sample – homogeneous area greater than 500 m × 500 m	37.82% (14,623/38,664)
High resolution images available in Google Earth	59.39% (22,962/38,664)
Confidence class – sure	80.80% (31,241/38,664)
Confidence class – not sure	12.42% (4798/38,664)
Confidence class – highly uncertain	6.78% (2625/38,664)
Pure pixel	62.43% (24,138/38,664)

Acquisition time of Landsat images



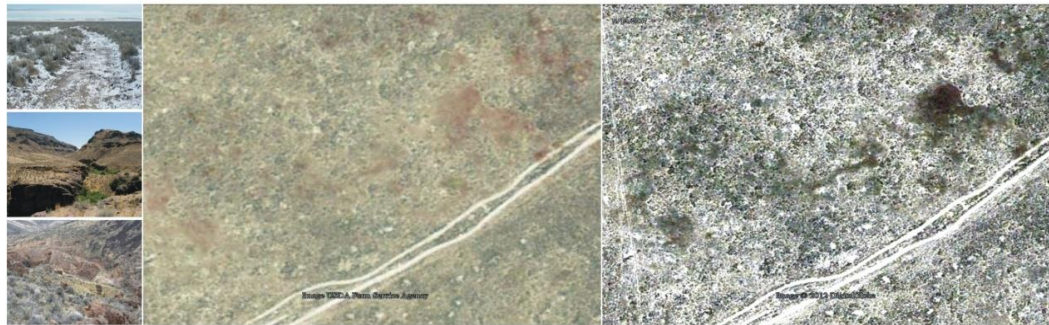
Sample verification



(a)

(b)

(c)



(d)

(e)

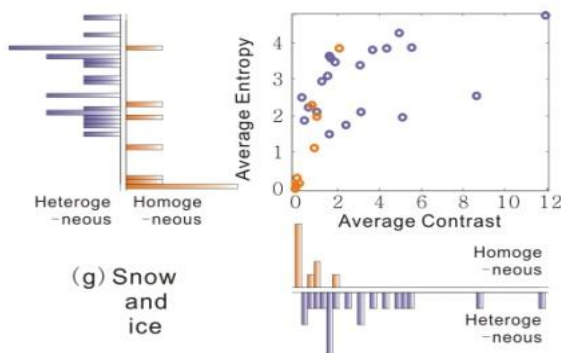
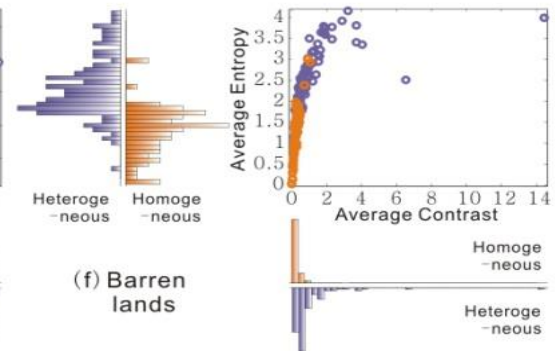
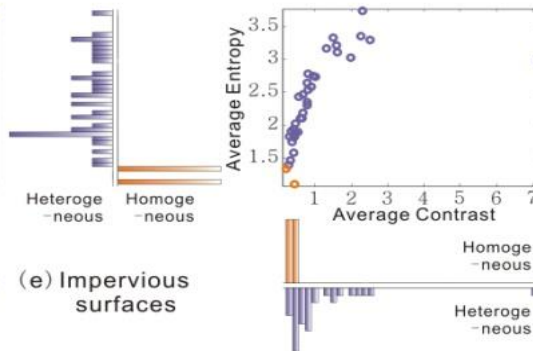
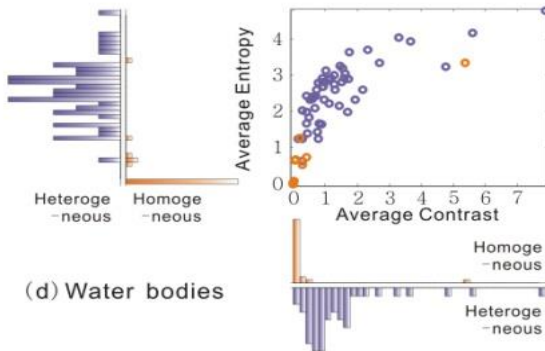
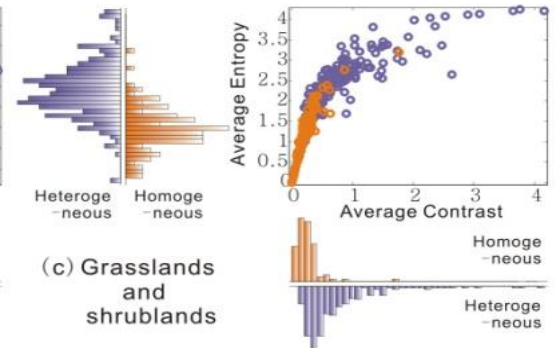
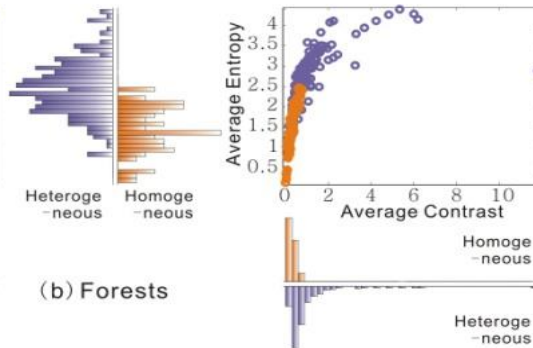
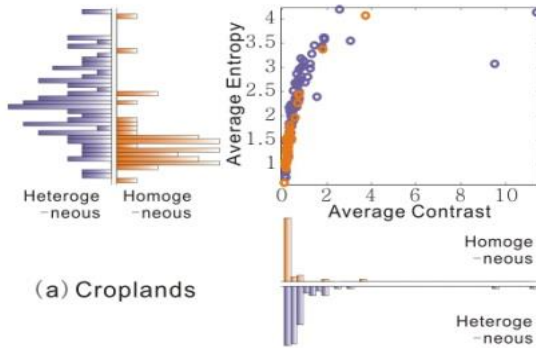
(f)



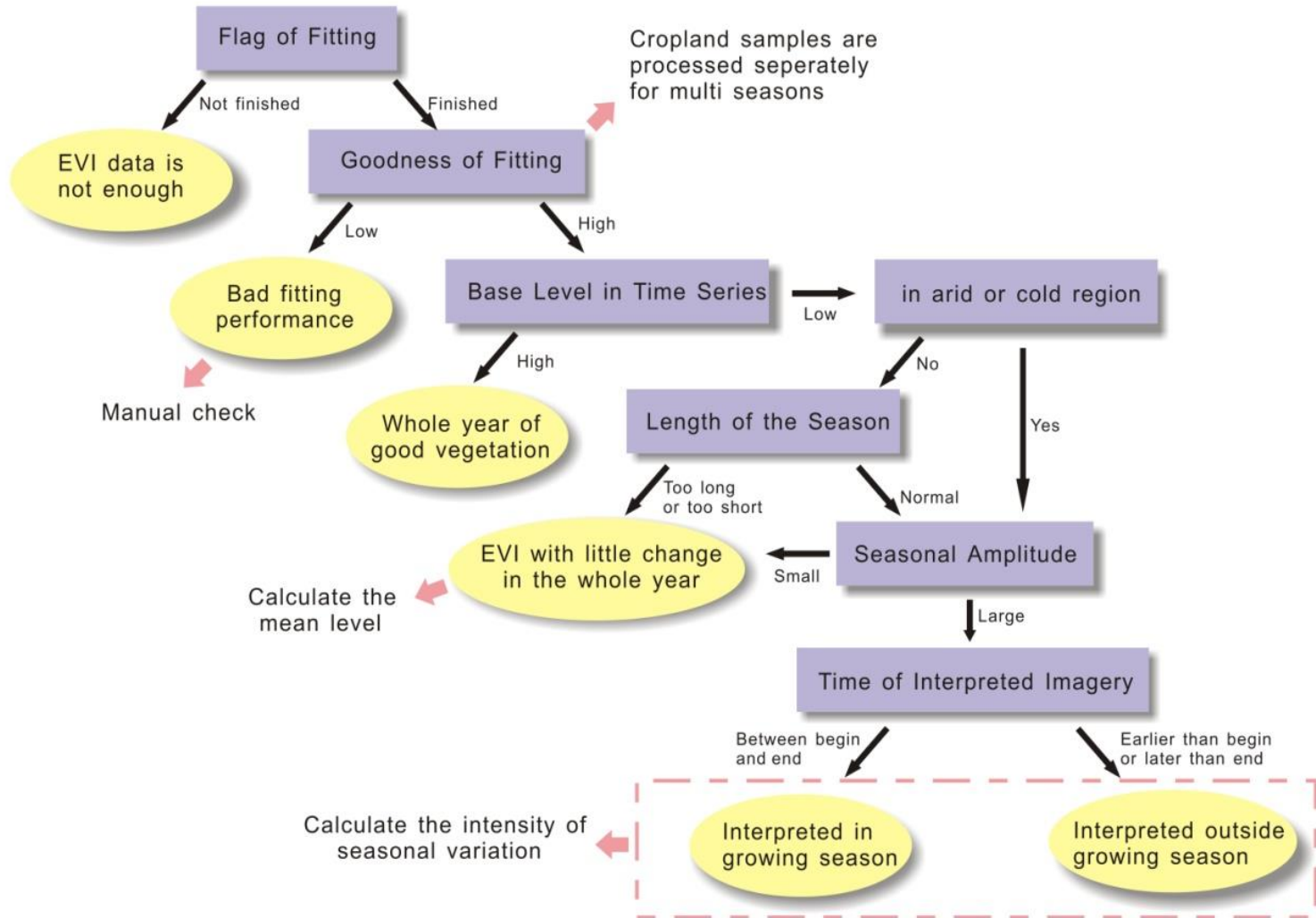
(g)

(h)

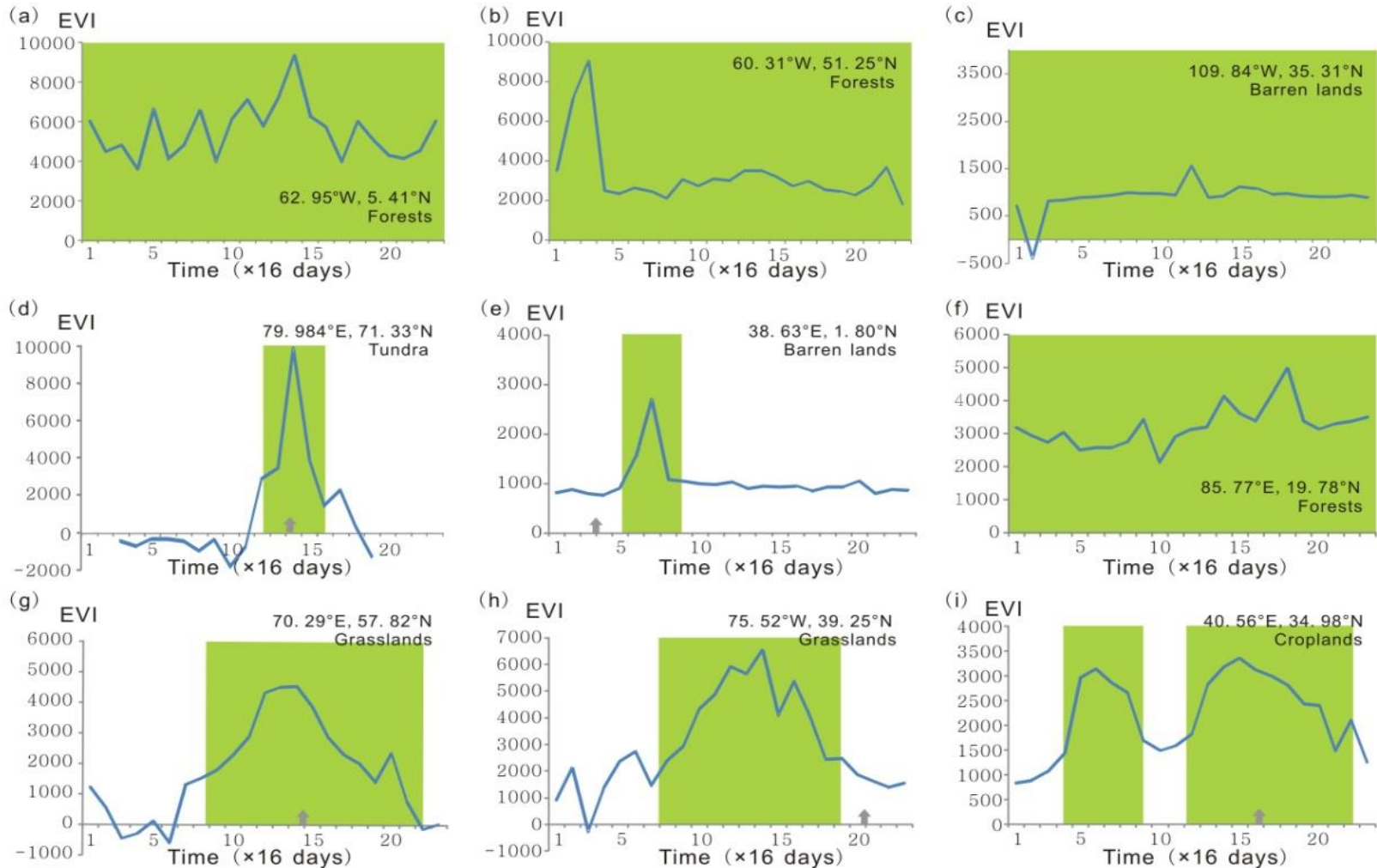
Sample size determination



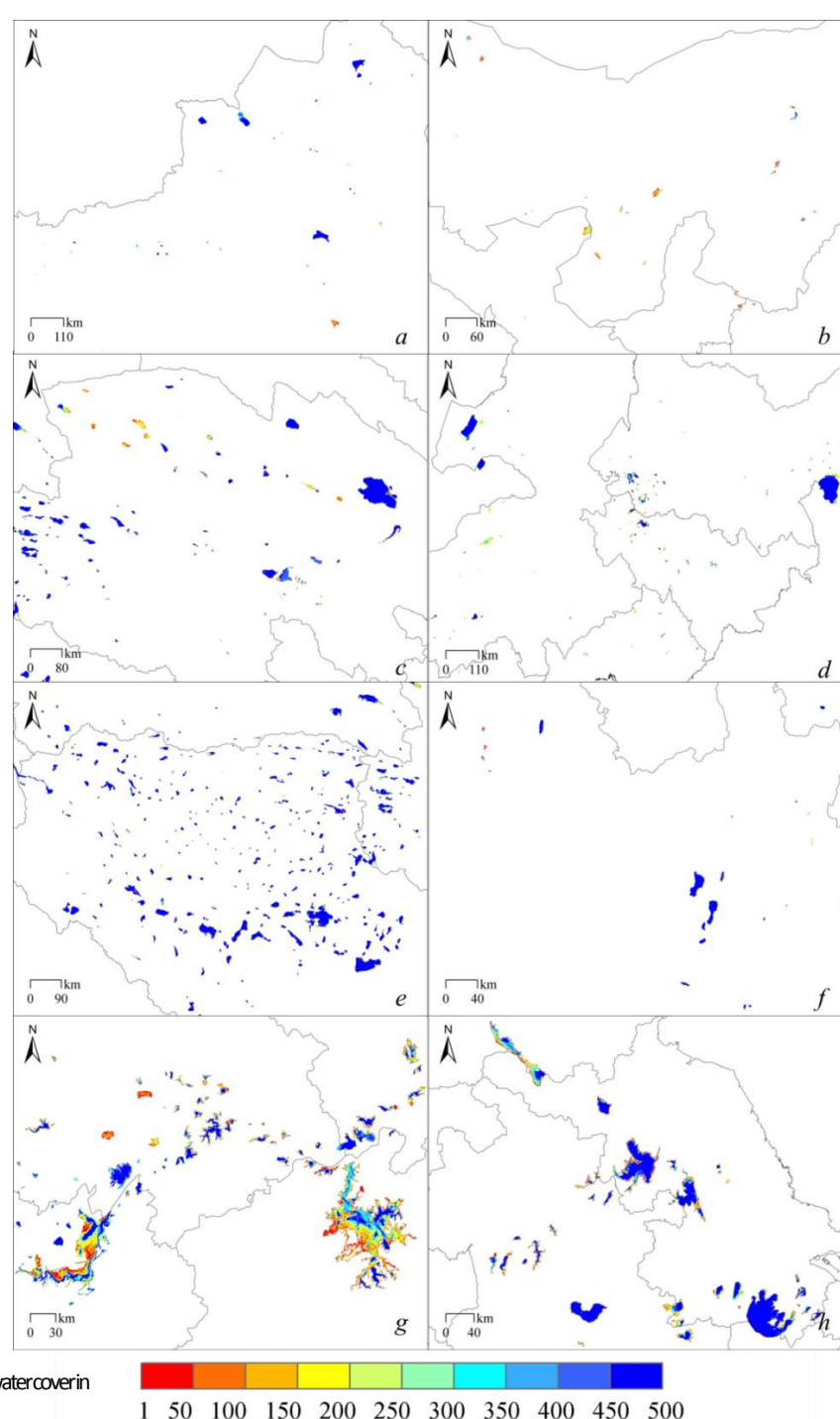
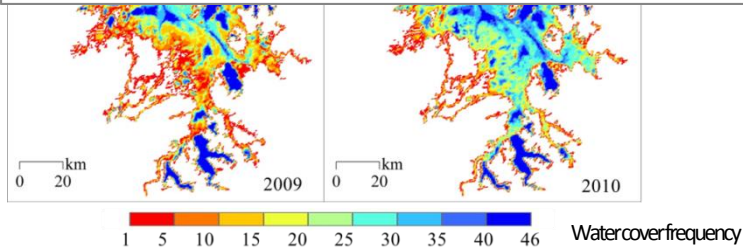
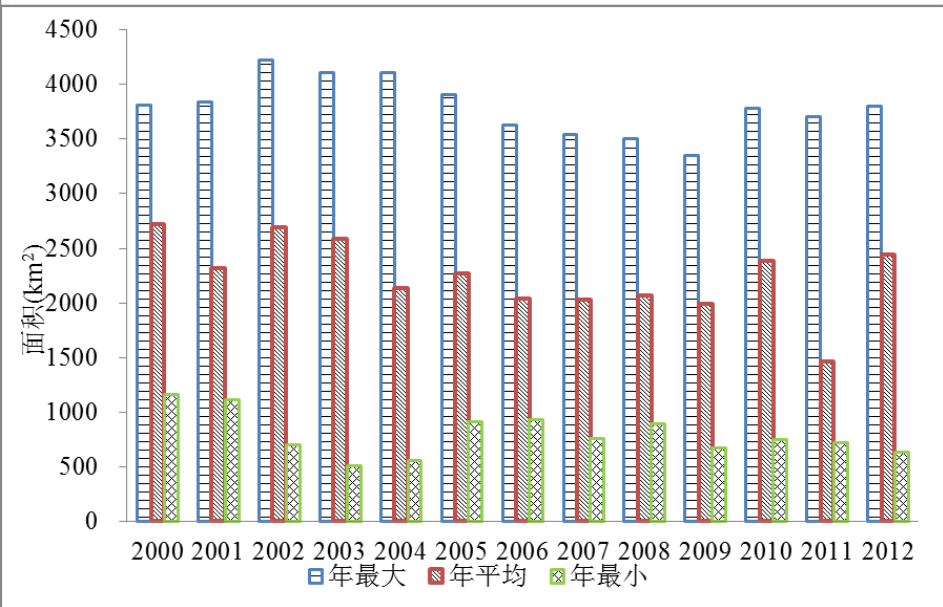
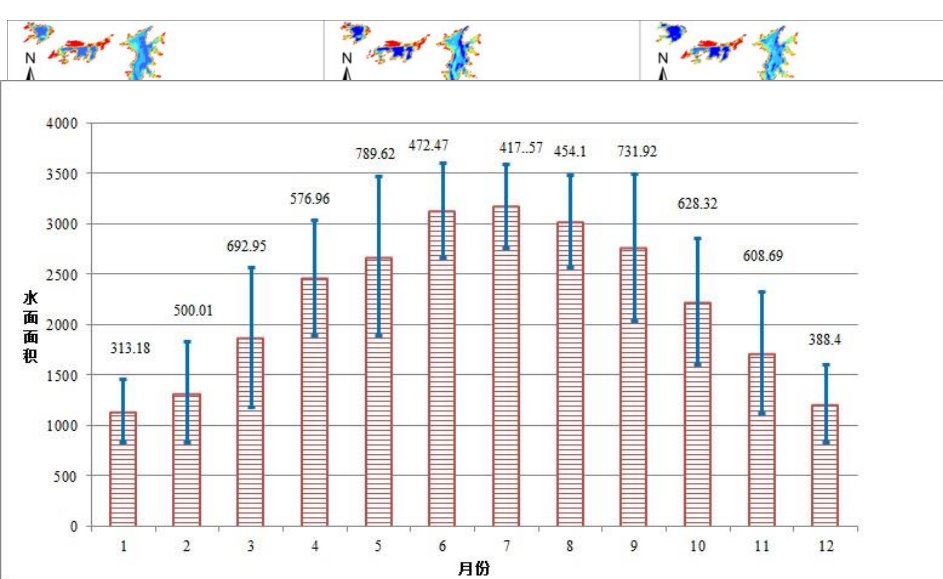
Phenology characterization

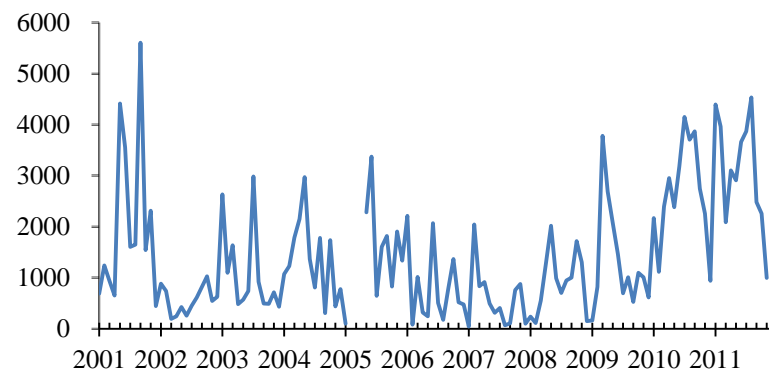
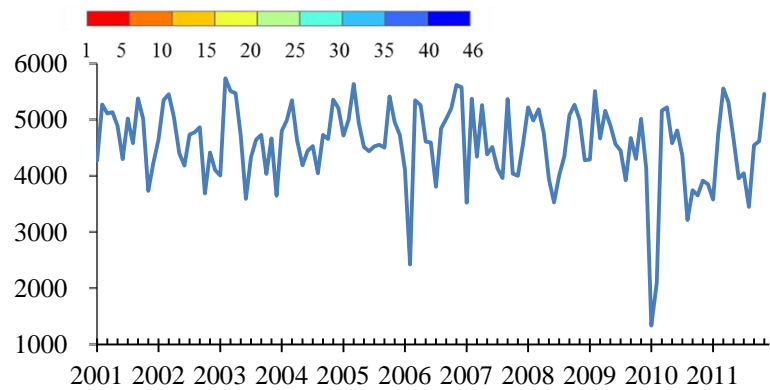
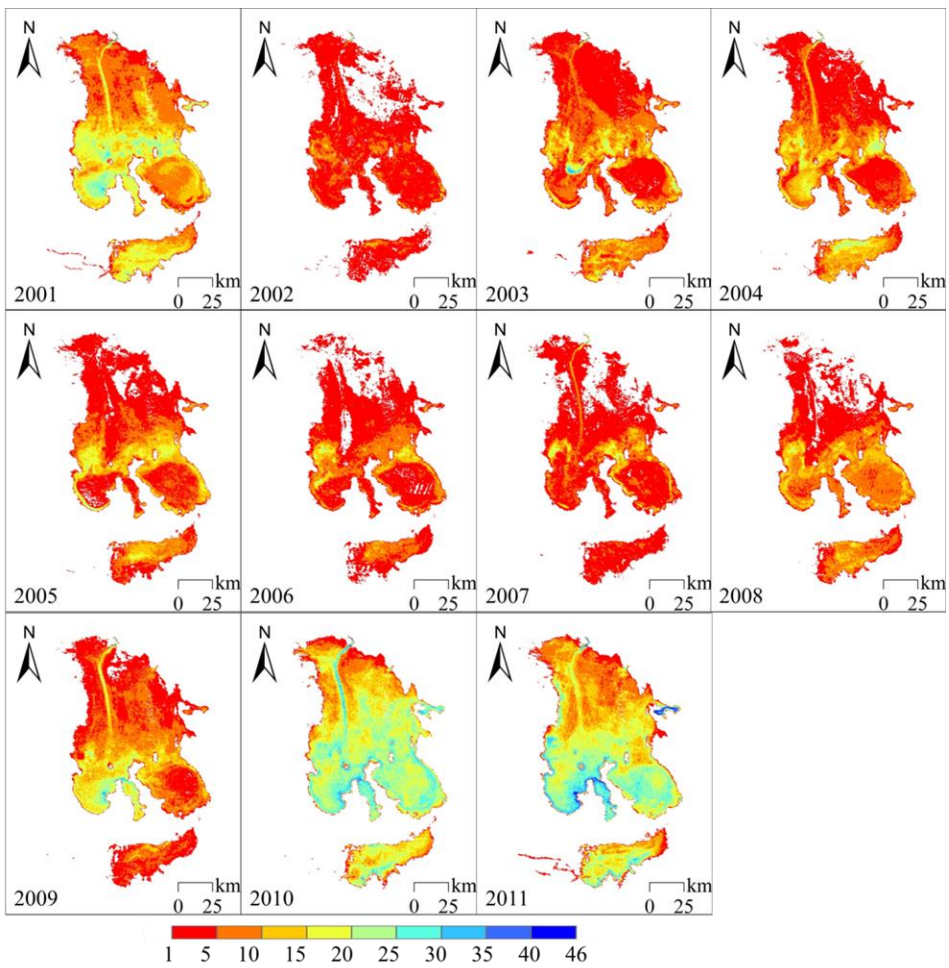
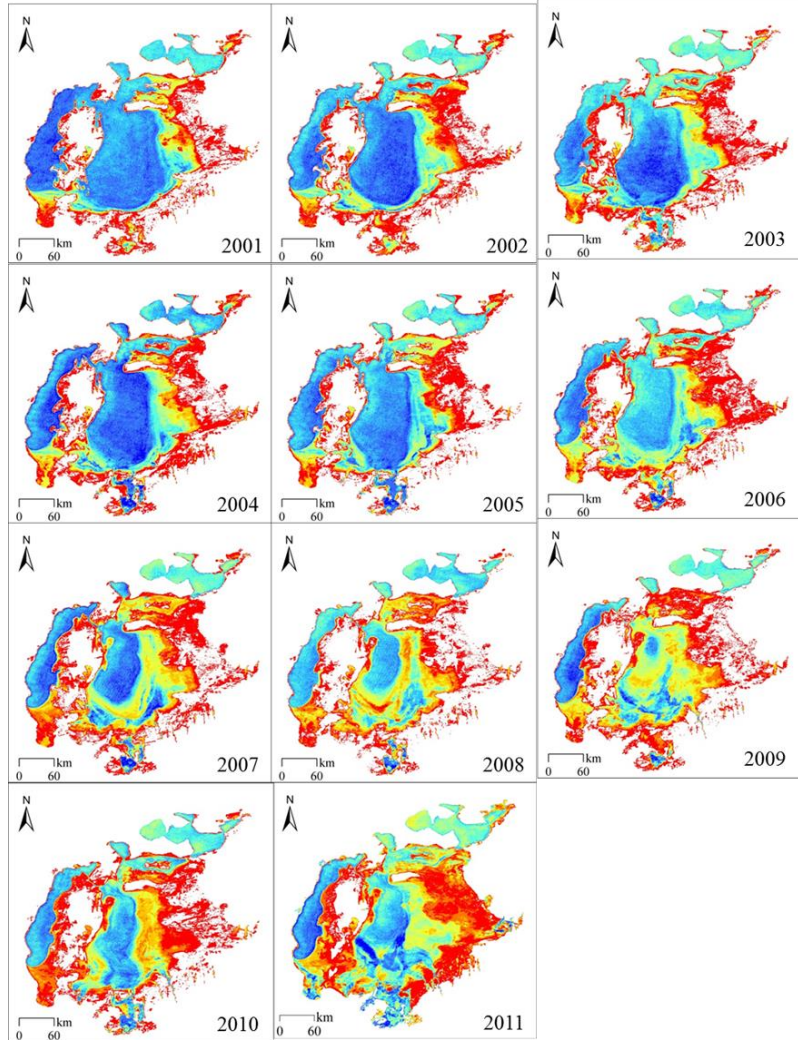


Example of phenology characterization

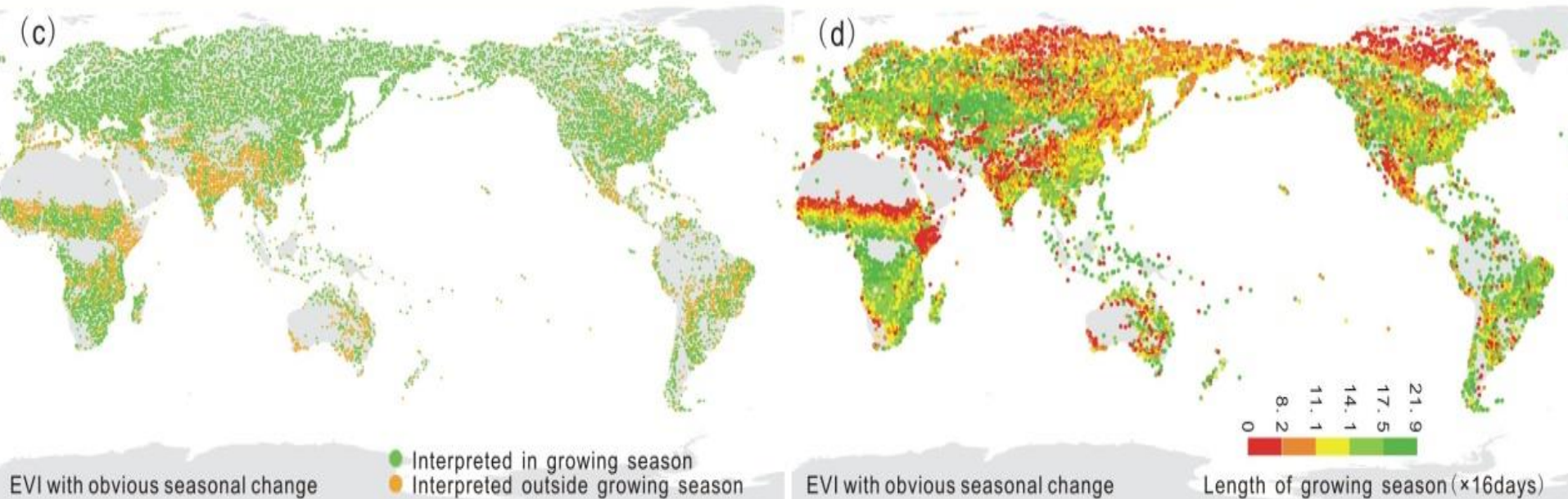
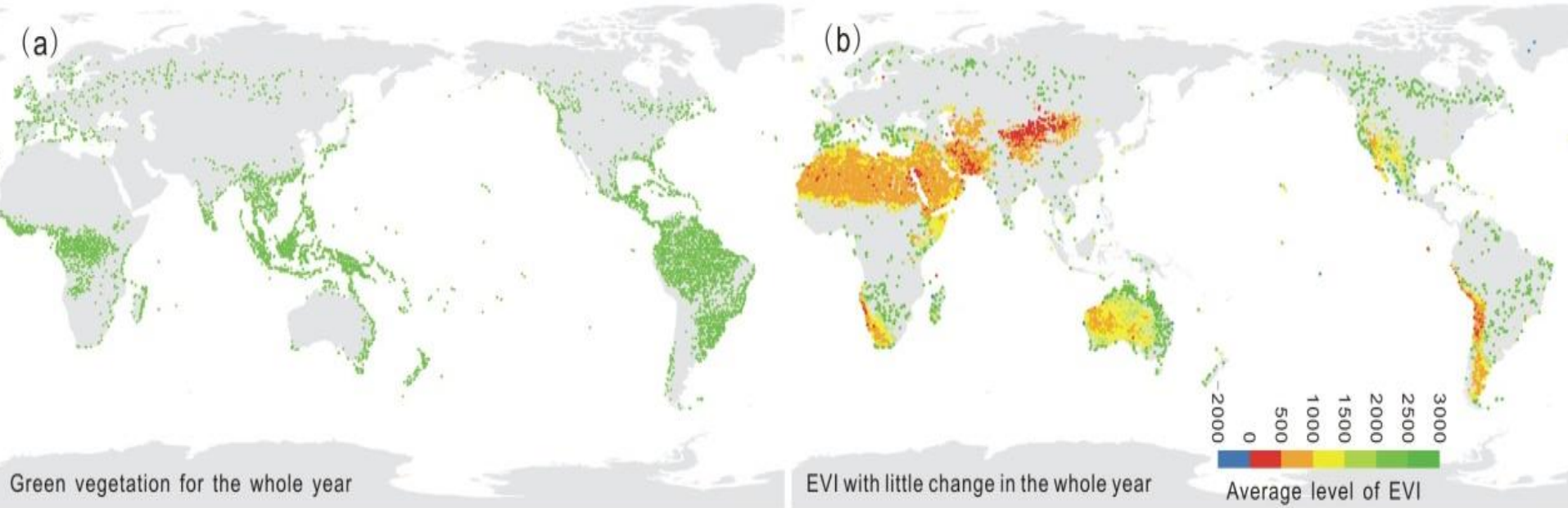


Challenges – samples are time dependent, sustaining this database requires long-term commitment



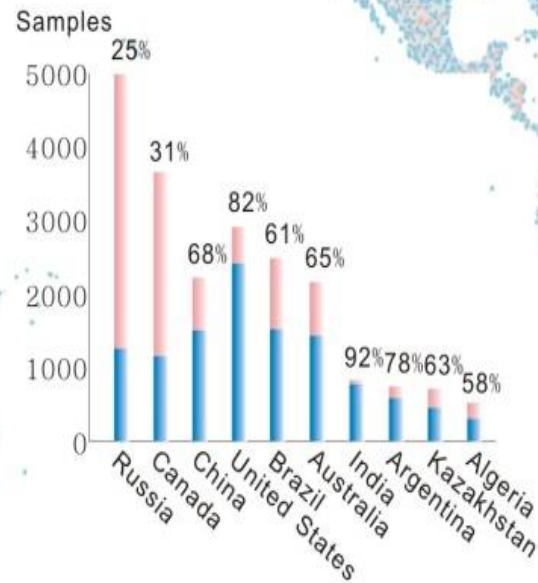
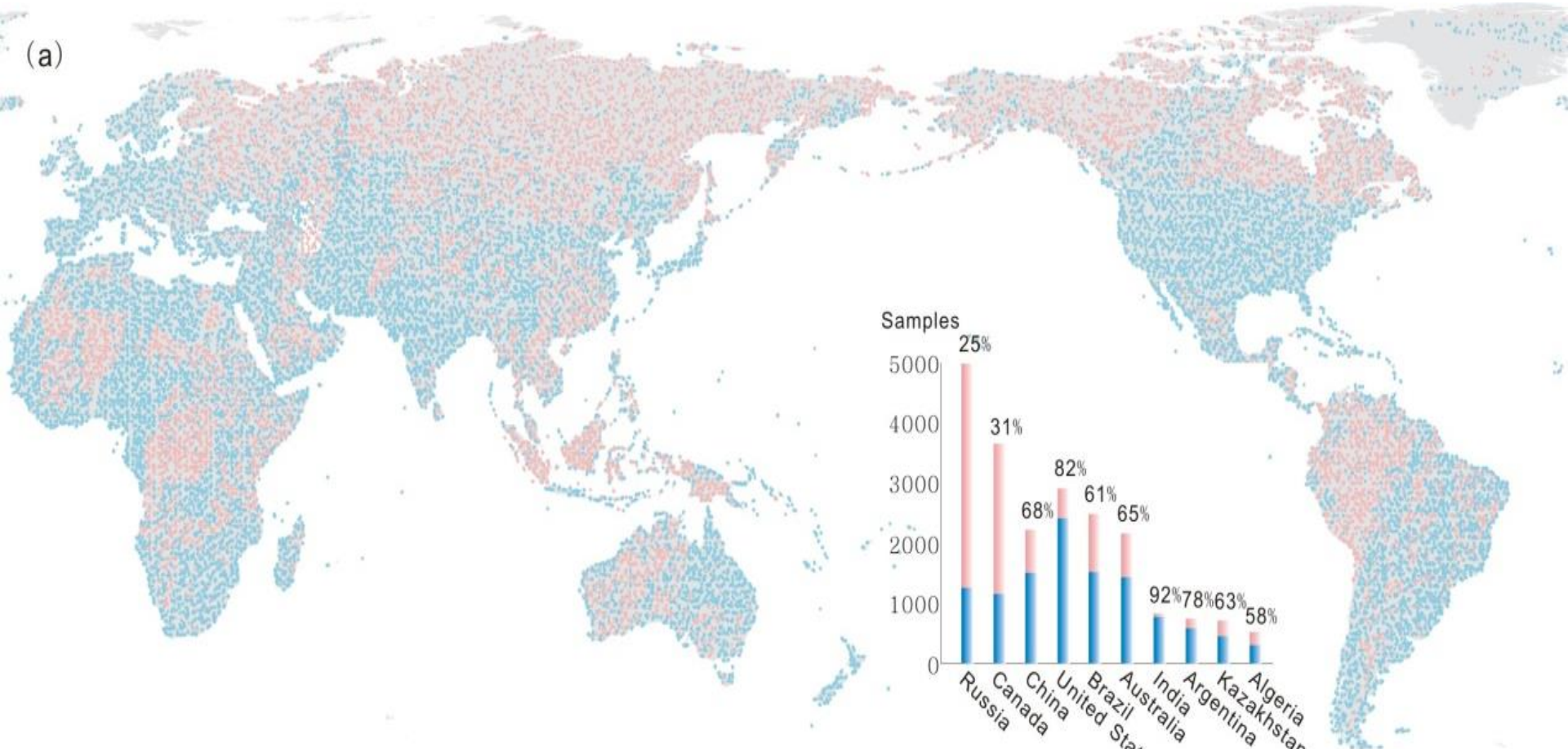


Distribution of phenological samples



High resolution sample distribution

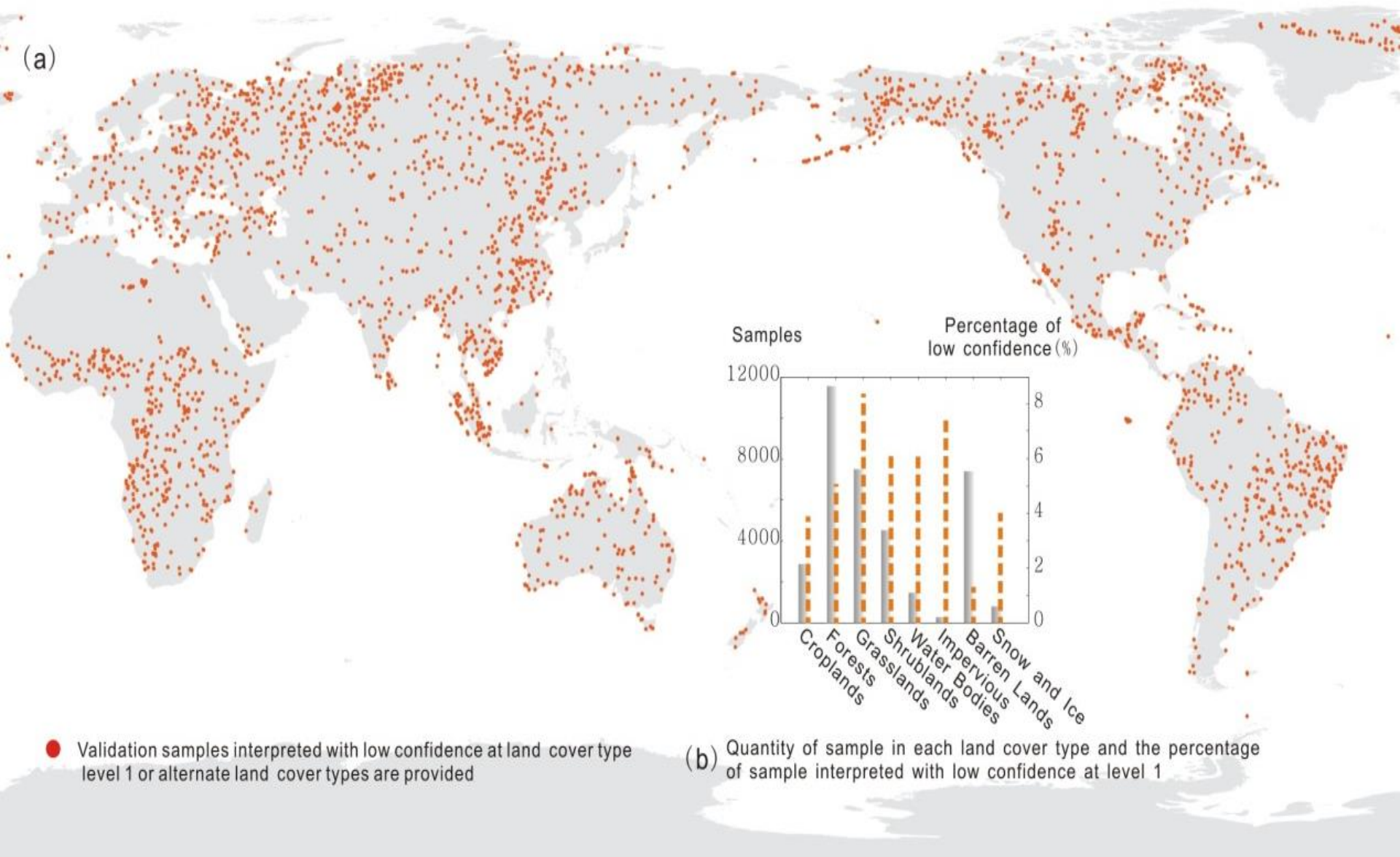
(a)



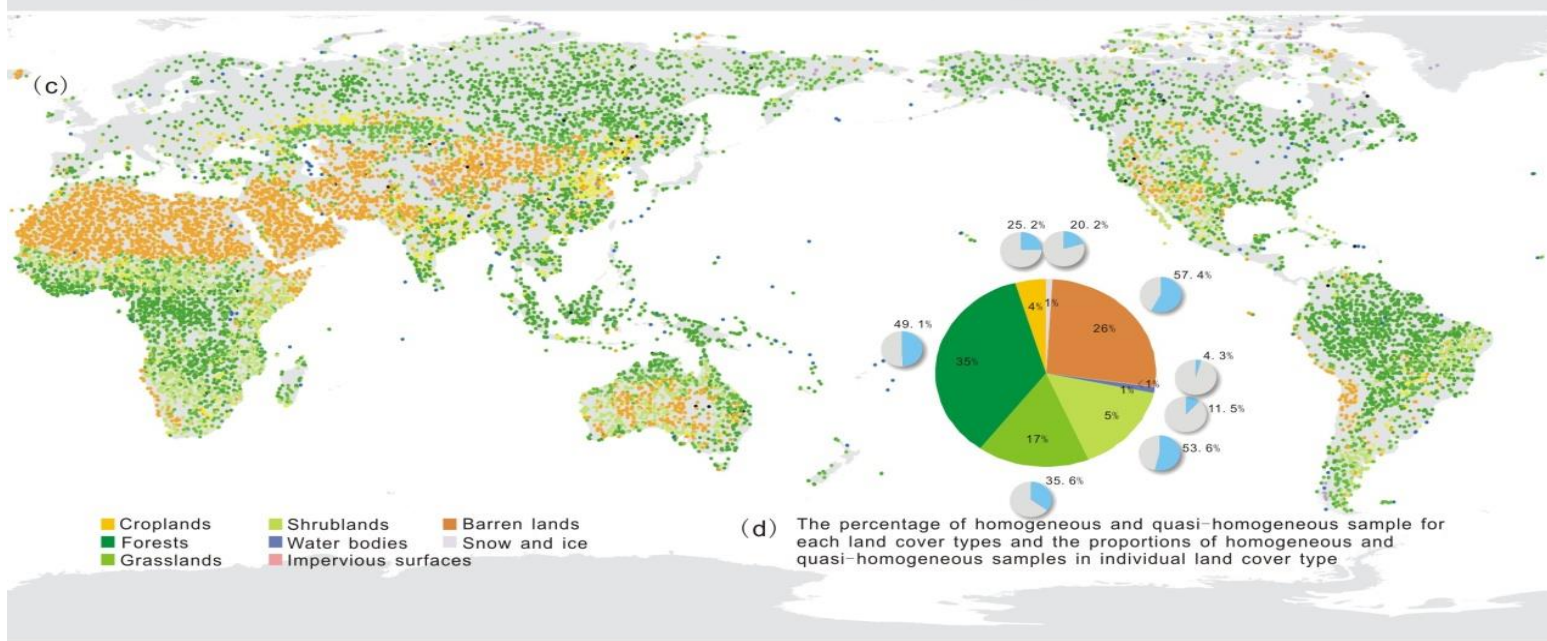
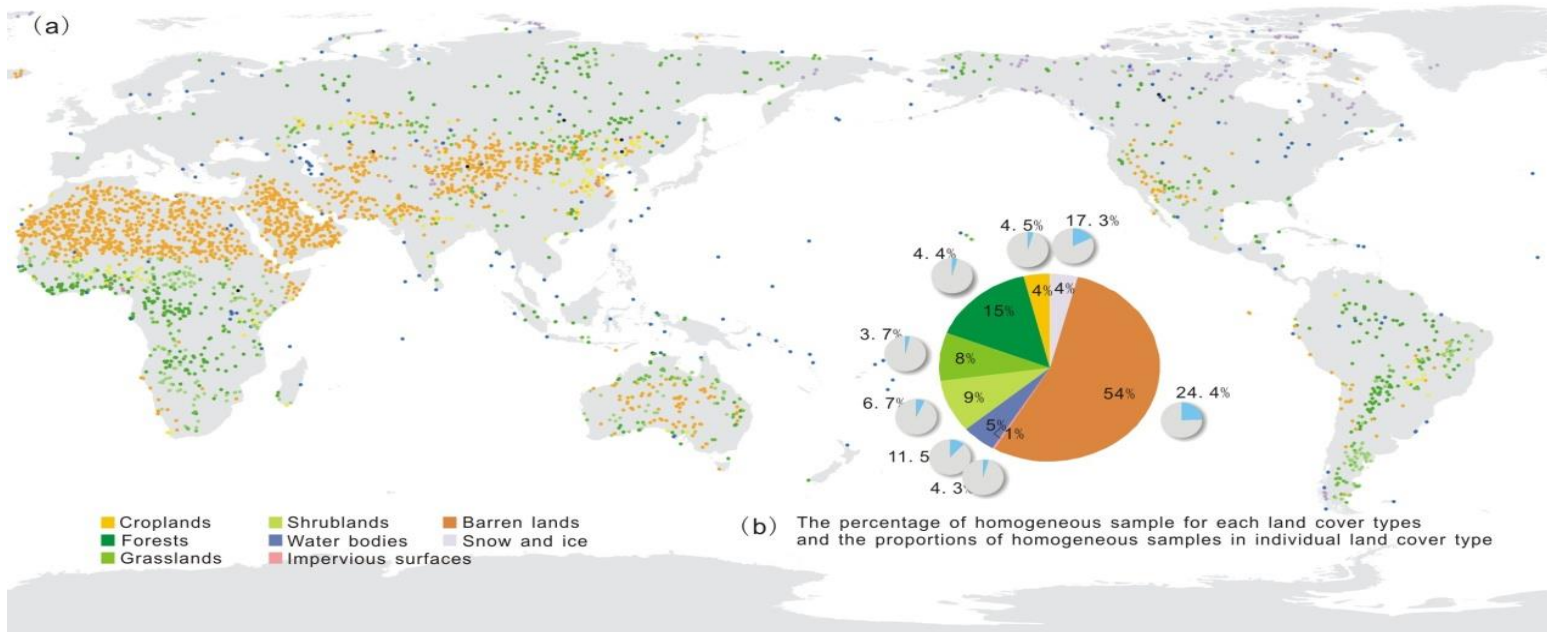
(b) The percentage of samples with high resolution imagery for top ten largest countries in area

- High resolution imagery available on Google Earth
- High resolution imagery not available on Google Earth

Distribution of low confidence samples



Distribution of large samples



Acknowledgements

- Yuanyuan Zhao, Le Yu, Luanyun Hu, Tsinghua University
- Lu Liang, Yanlei Chen, Liheng Zhong, UC Berkeley
- Zhenguo Niu, Jie Wang, Yaomin Zheng, Haiying Zhang, Xiaoyi Wang, Shuang Liu, Institute of Remote Sensing and Digital Earth, CAS
- Congcong Li, Xueyan Li, Yue Xu, Beijing Normal University, China
- Zhiliang Zhu, US Geological Survey

Thank you