Land Cover and Carbon Cycling at High Latitudes

in Northern Eurasia

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with contributions from NELDA Project team and D. Pflugmacher, D. McGuire, M. Hansen, D.Hayes

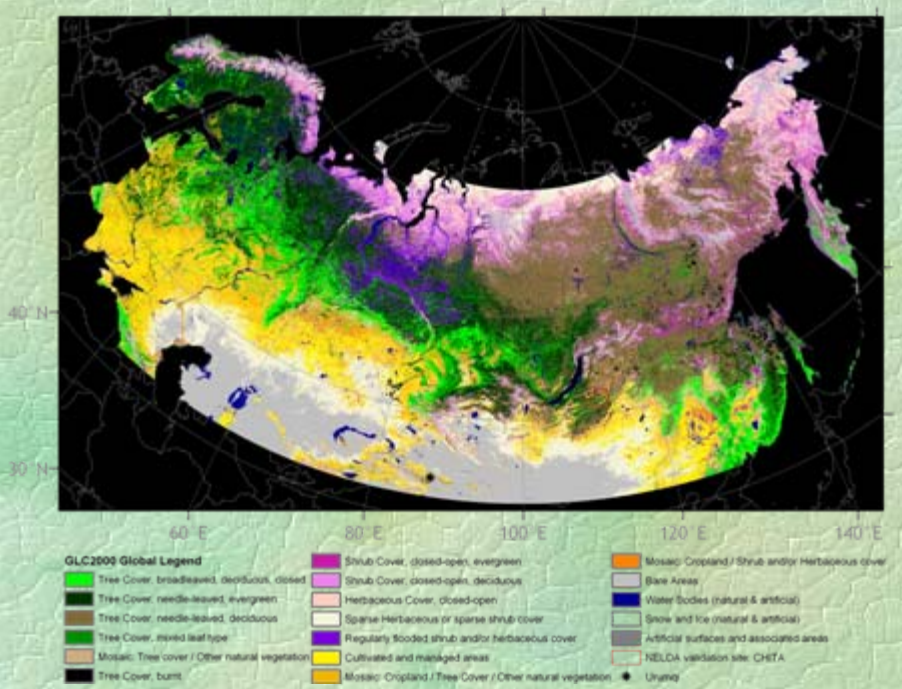
Part 1

Vegetation Cover in the Eurasian Arctic: Distribution, Monitoring, and Role in the Carbon Cycling

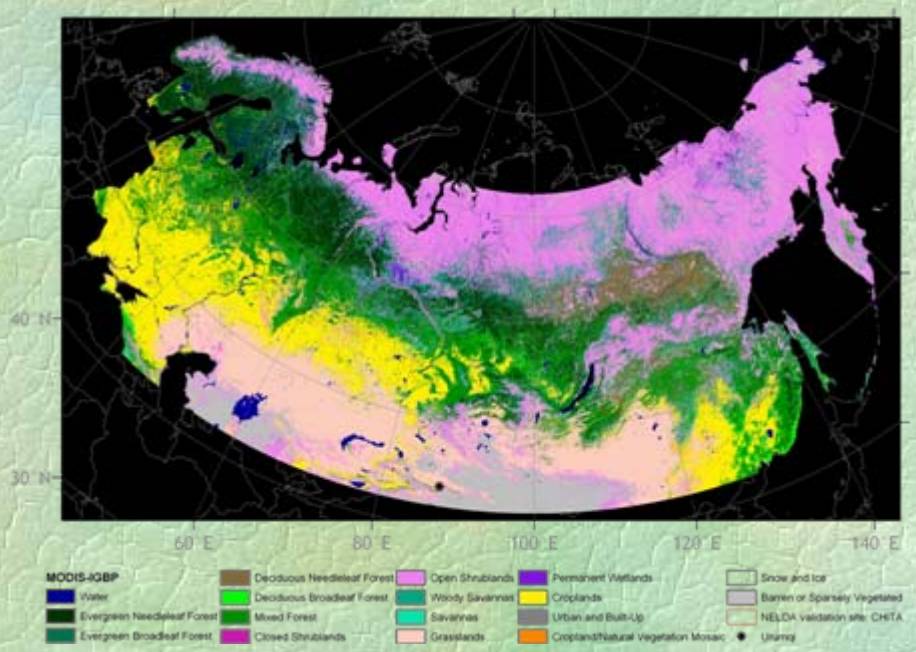
(in "*Eurasian Arctic land cover and land use in a changing climate*", G. Gutman, editor)

Land Cover of Northern Eurasia

GLC2000



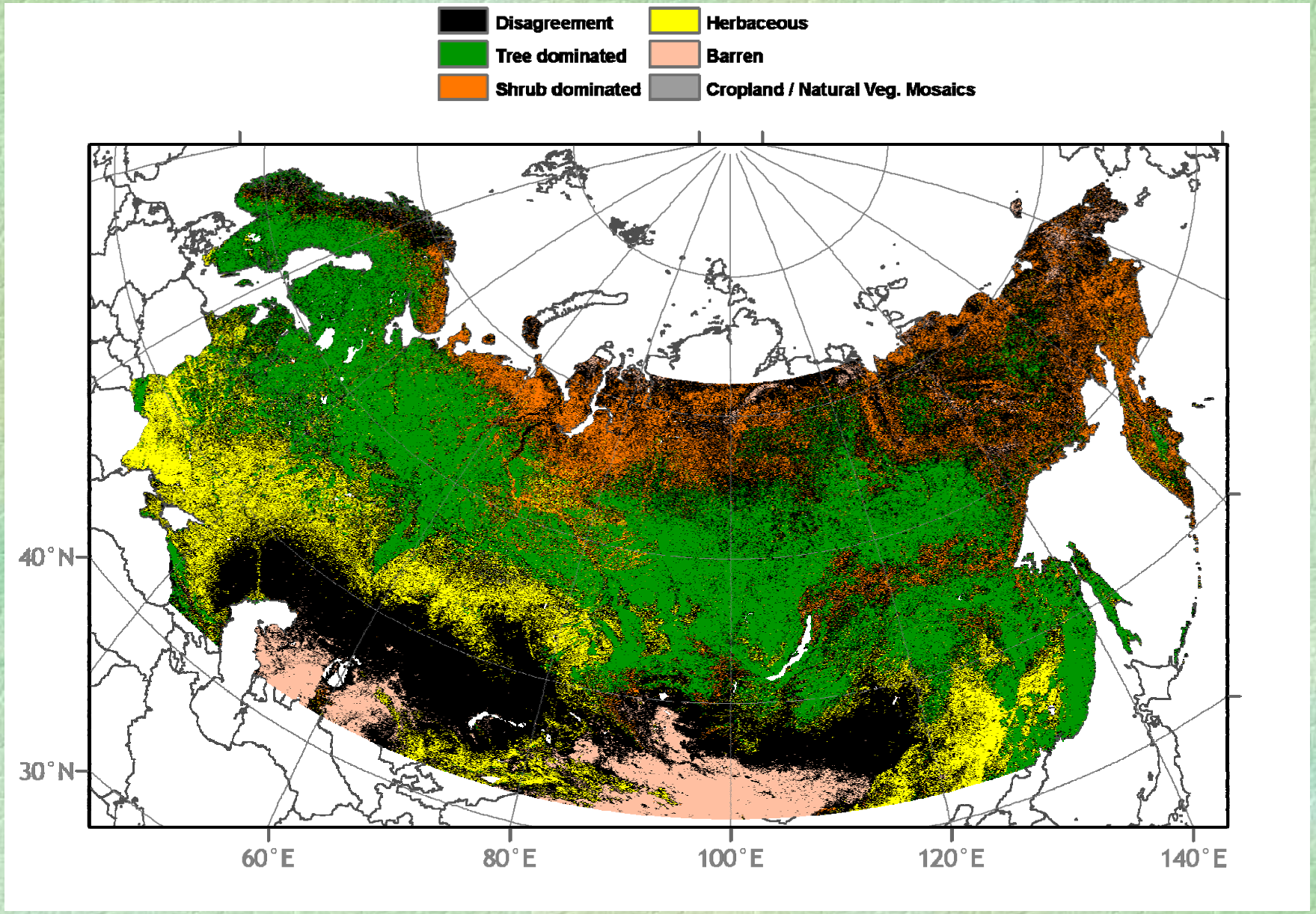
MODIS-IGBP 2001

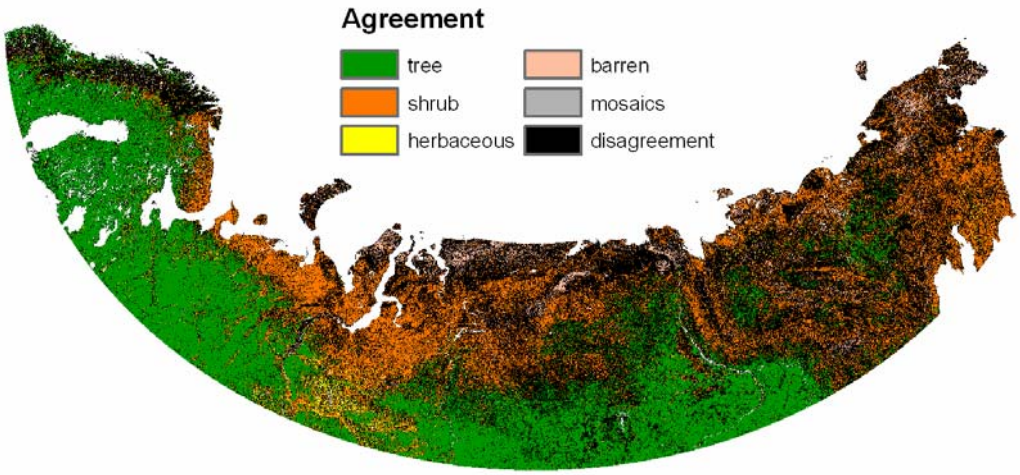


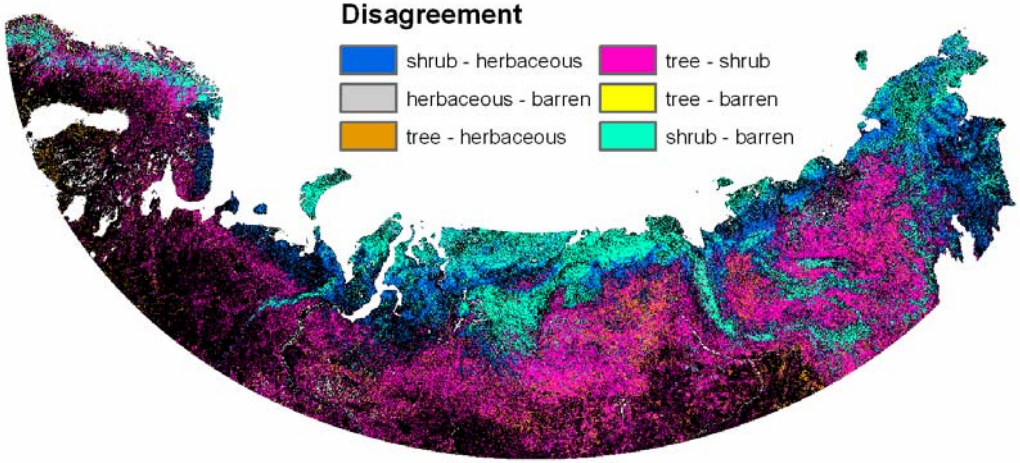
Similarity matrix for the GLC2000 and MODIS-PFT legends

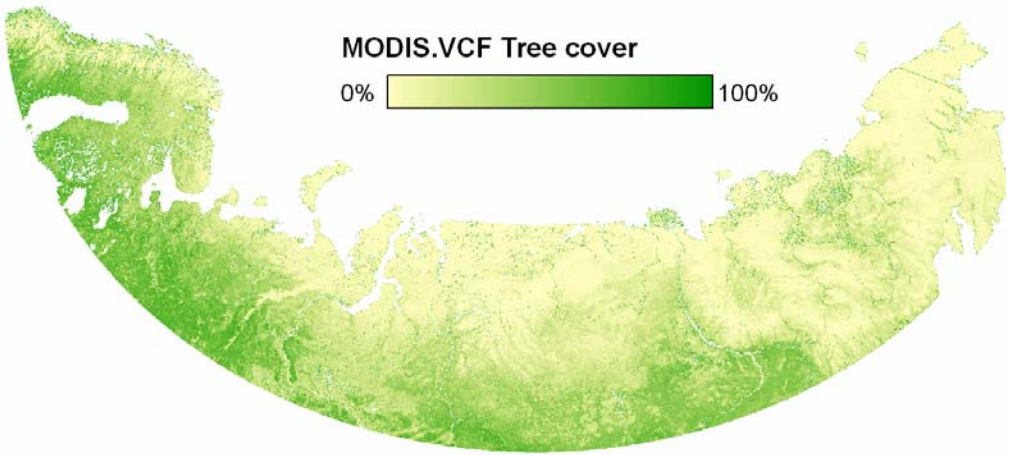
GLC-2000.LCCS (rows) MODIS.PFT (columns)		1 Needleleaf evergreen tree	2 Broadleaf evergreen tree	3 Needleleaf deciduous tree	4 Broadleaf deciduoud tree	5 Shrub	6 Grass	7 Cereal crop	8 Broadleaf crop	9 Urban and built-up	10 Snow and ice	11 Barren or sparsely vegetated	0 Water
1	Tree Cover, broadleaved, evergreen	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
2	Tree Cover, broadleaved, deciduous, closed	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
3	Tree Cover, broadleaved, deciduous, open	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
4	Tree Cover, needle-leaved, evergreen	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
5	Tree Cover, needle-leaved, deciduous	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
6	Tree Cover, mixed leaf type	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
7	Tree Cover, regularly flooded, fresh water	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
8	Tree Cover, regularly flooded, saline water	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
9	Mosaic: Tree cover / Other natural vegetation	T	T	T	T	S	H	th	th	tb	tb	tb	lw
10	Tree Cover, burnt	T	T	T	T	ts	th	th	th	tb	tb	tb	lw
11	Shrub Cover, closed-open, evergreen	ts	ts	ts	ts	S	sh	sh	sh	sb	sb	sb	lw
12	Shrub Cover, closed-open, deciduous	ts	ts	ts	ts	S	sh	sh	sh	sb	sb	sb	lw
13	Herbaceous Cover, closed-open	th	th	th	th	sh	H	H	H	hb	hb	hb	lw
14	Sparse Herbaceous or sparse shrub cover	tb	tb	tb	tb	sb	hb	hb	hb	B	B	B	lw
15	Regularly flooded shrub and/or herbaceous cover	ts	ts	ts	ts	S	H	H	H	hb	hb	hb	lw
16	Cultivated and managed areas	th	th	th	th	sh	H	H	H	hb	hb	hb	lw
17	Mosaic: Cropland / Tree Cover / Other natural vegetation	T	T	T	T	S	H	H	H	hb	hb	hb	lw

Agreement in dominant vegetation cover (54%)

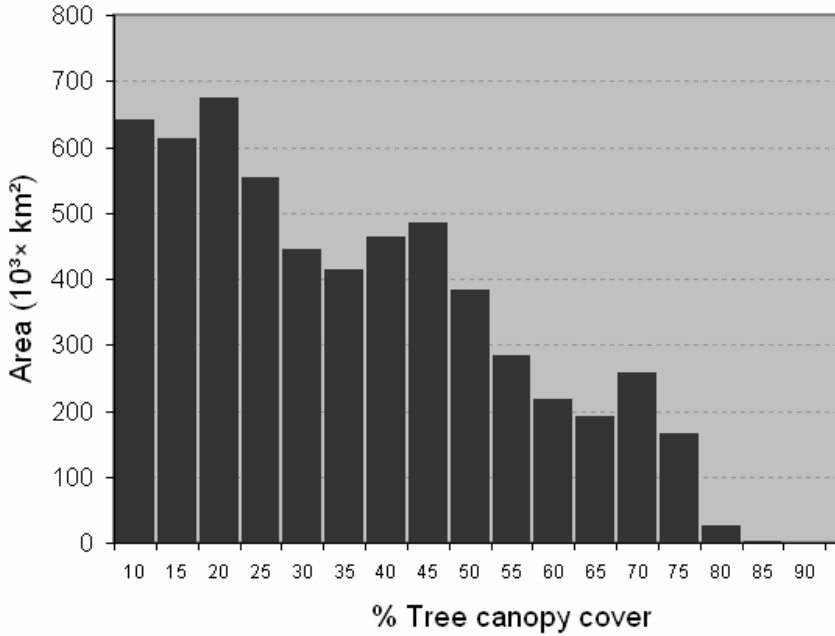








Agreement in dominant vegetation cover (53%)

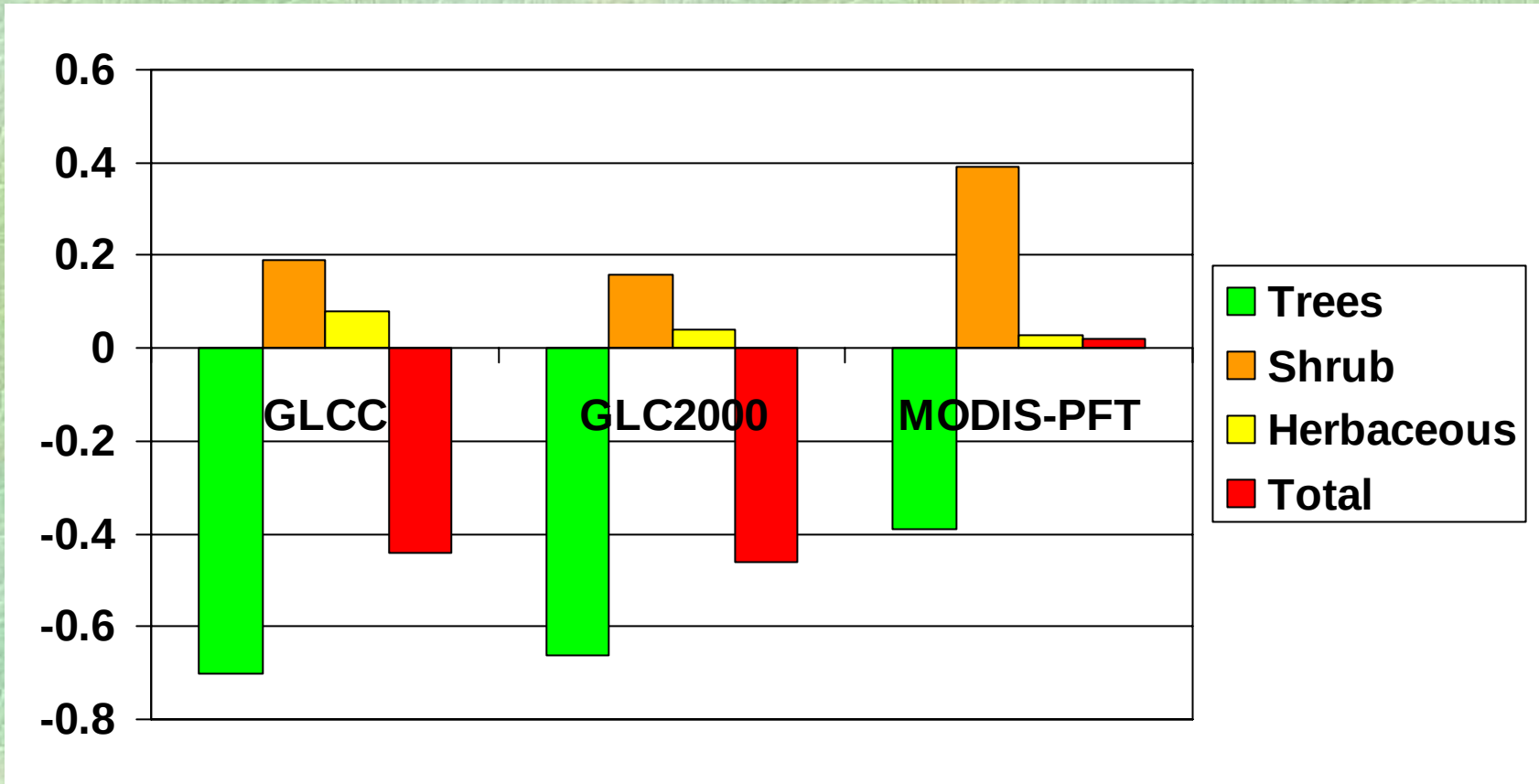


Agreement matrix for GLC-2000 and MODIS.PFT

dominant vegetation types excluding water, 1000 km^2

	MODIS.PFT					
GLC-2000	Tree	Shrub	Herbaceous	Barren		Agreement
Tree	**2,395**	1,697	351	7	4,450	54%
Shrub	200	**1,922**	105	31	2,258	85%
Herbaceous	24	698	**160**	34	916	17%
Barren	12	973	64	**183**	1,232	15%
	2,630	5,290	680	255	8,855	
Agreement	91%	36%	23%	72%		53%

Regional C balance estimates for 1996 – 2006: TEM model simulations over GLCC-based land cover and extrapolations over GLC2000 and MODIS-PFT maps



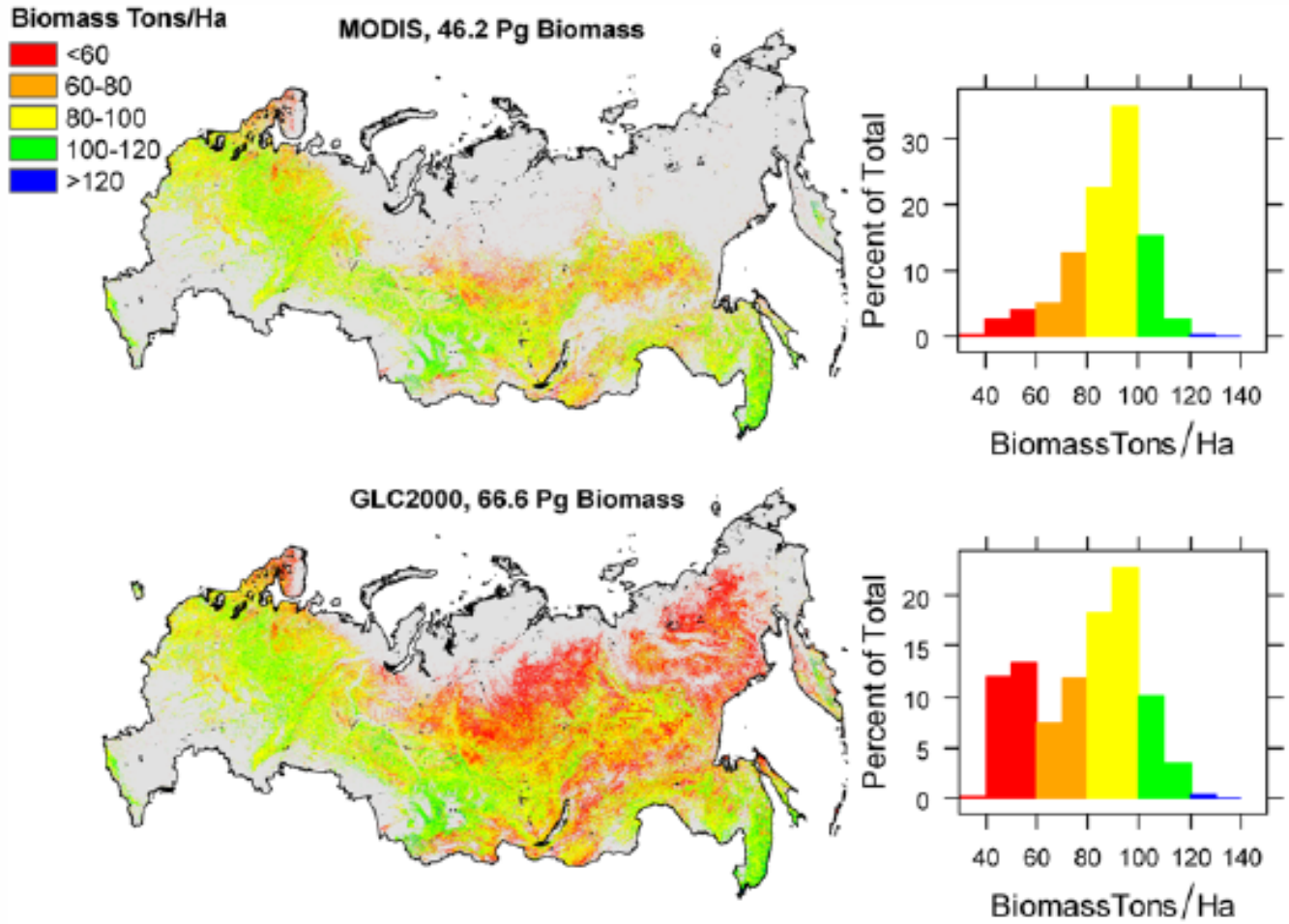
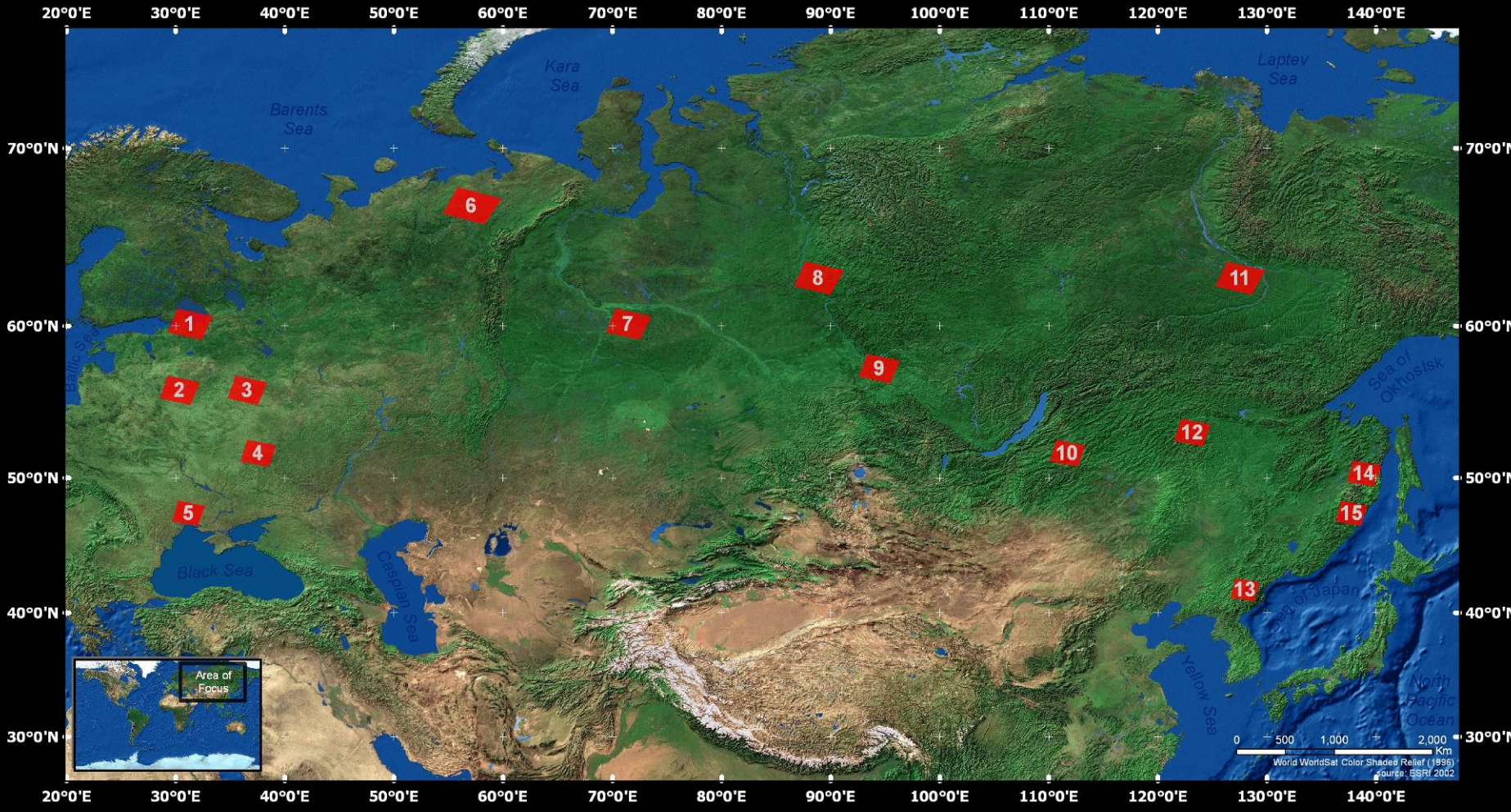


Figure 4. (a) Map of Russian forest biomass as predicted by the MODIS land-cover product (MOD12Q1). (b) Map of Russian forest biomass as predicted by the GLC2000 land-cover product (Bartalev *et al* 2003).

Live biomass of Russian forest is estimated at 46 and 67 Pg biomass for the MODIS and GLC2000 maps, respectively)

Take home messages

- Map selection matters



NELDA Sites

1	St Petersburg	(p184 r18)	5	**	(p r)	9	Priangar'e	(p141 r20)	13	Changbai	(p116 r31)
2	**	(p r)	6	Komi	(p171 r13)	10	Chita	(p129 r24)	14	Siberia-North	(p111 r25)
3	Moscow	(p179 r21)	7	**	(p r)	11	**	(p r)	15	Siberia-South	(p111 r27)
4	**	(p r)	8	**	(p r)	12	DaXinAnLing	(p122 r23)			

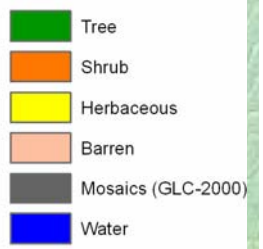
Projection: World_Miller_Cylindrical
Datum: WGS_84

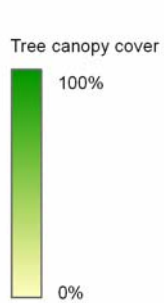
NELDA

GLC-2000

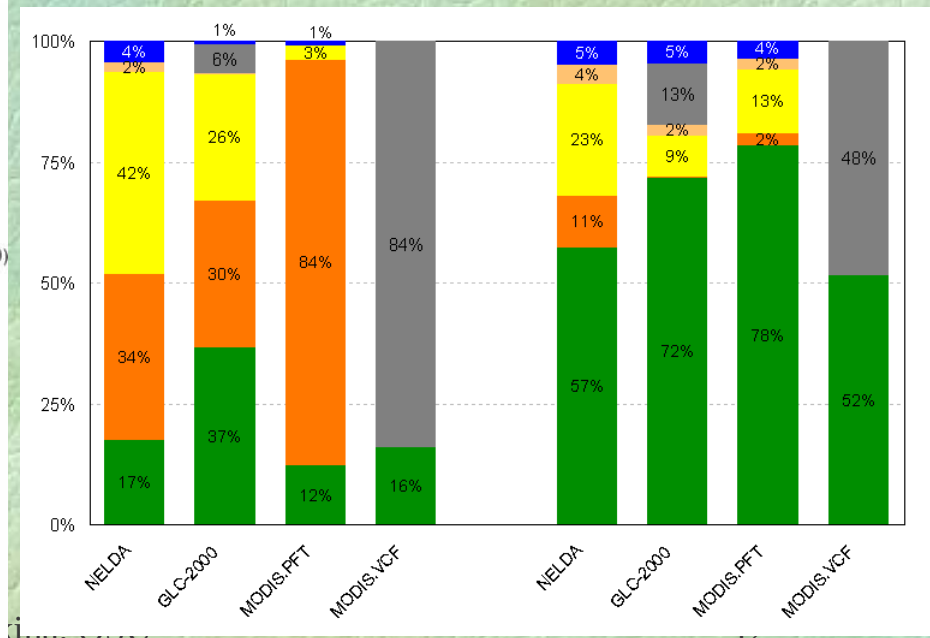
MODIS.PFT

MODIS.VCF



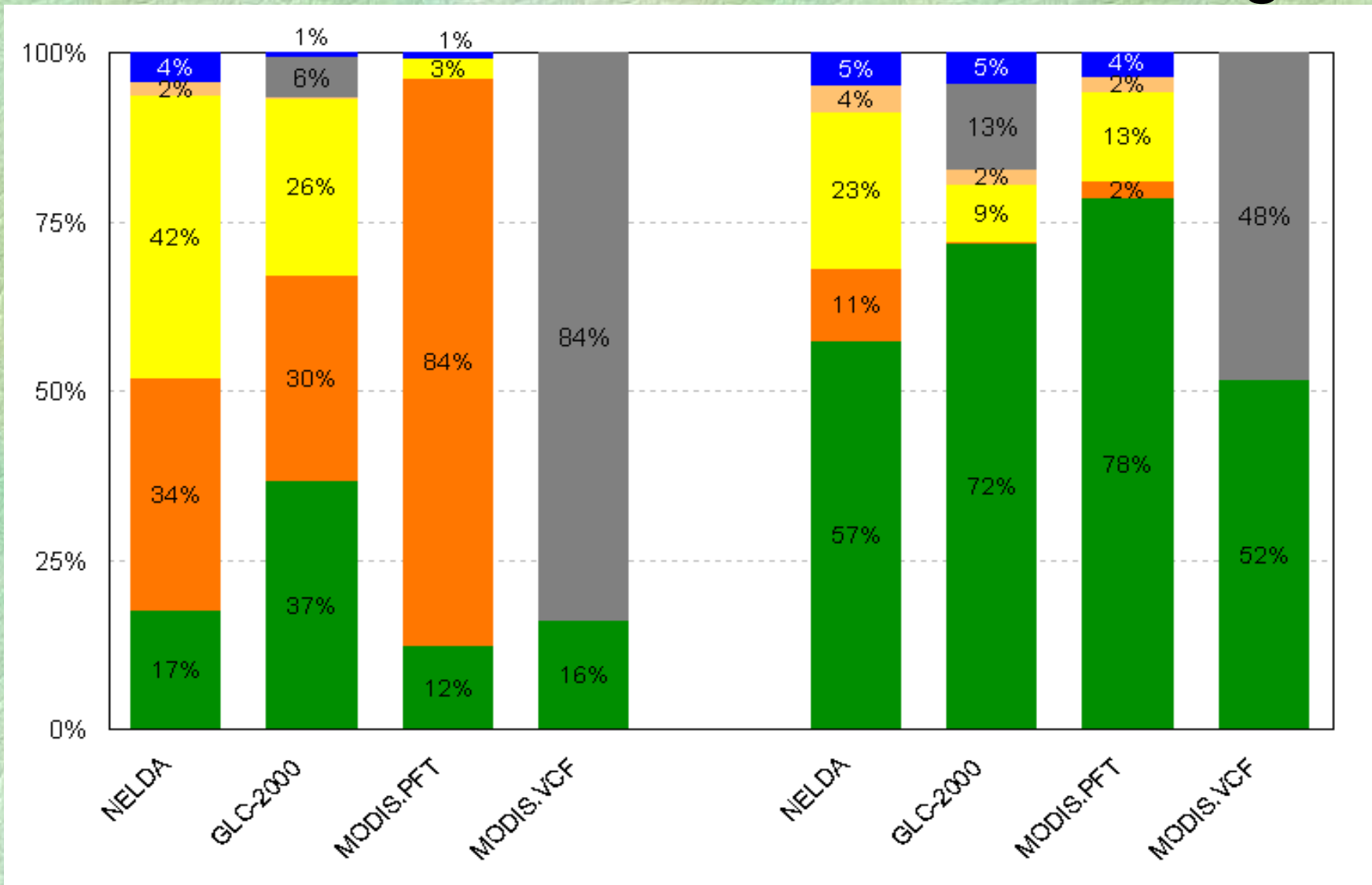


Land cover maps for tests sites



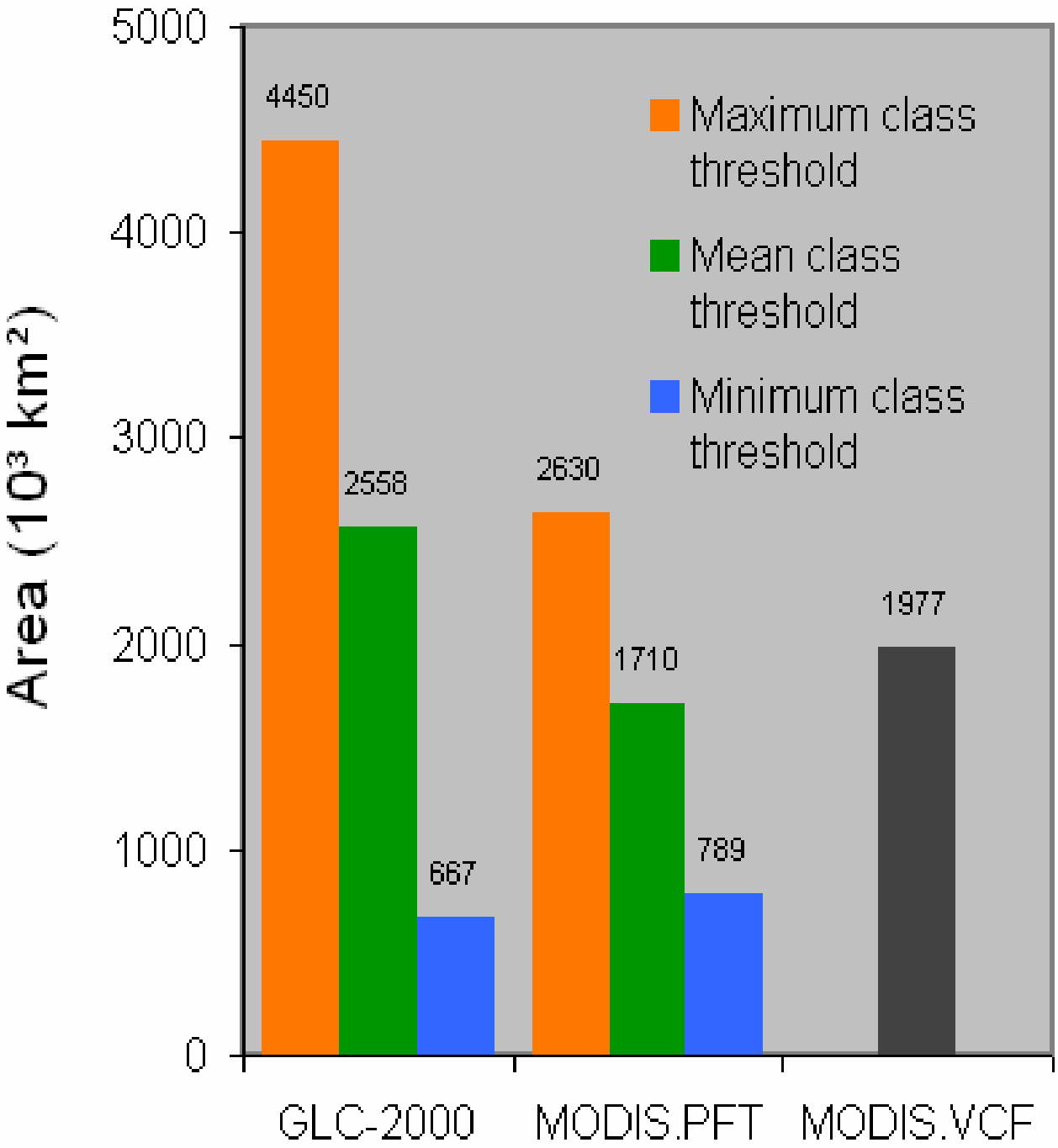
Land cover maps for test sites

Komi **St. Petersburg**



Take home messages

- Map selection matters
- Maps performance depends on location and classes of interest



Tree cover representation on GLC-2000, MODIS.PFT, and MODIS.VCF

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Meeting the challenge of mapping peatlands with remotely sensed data

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Landsat

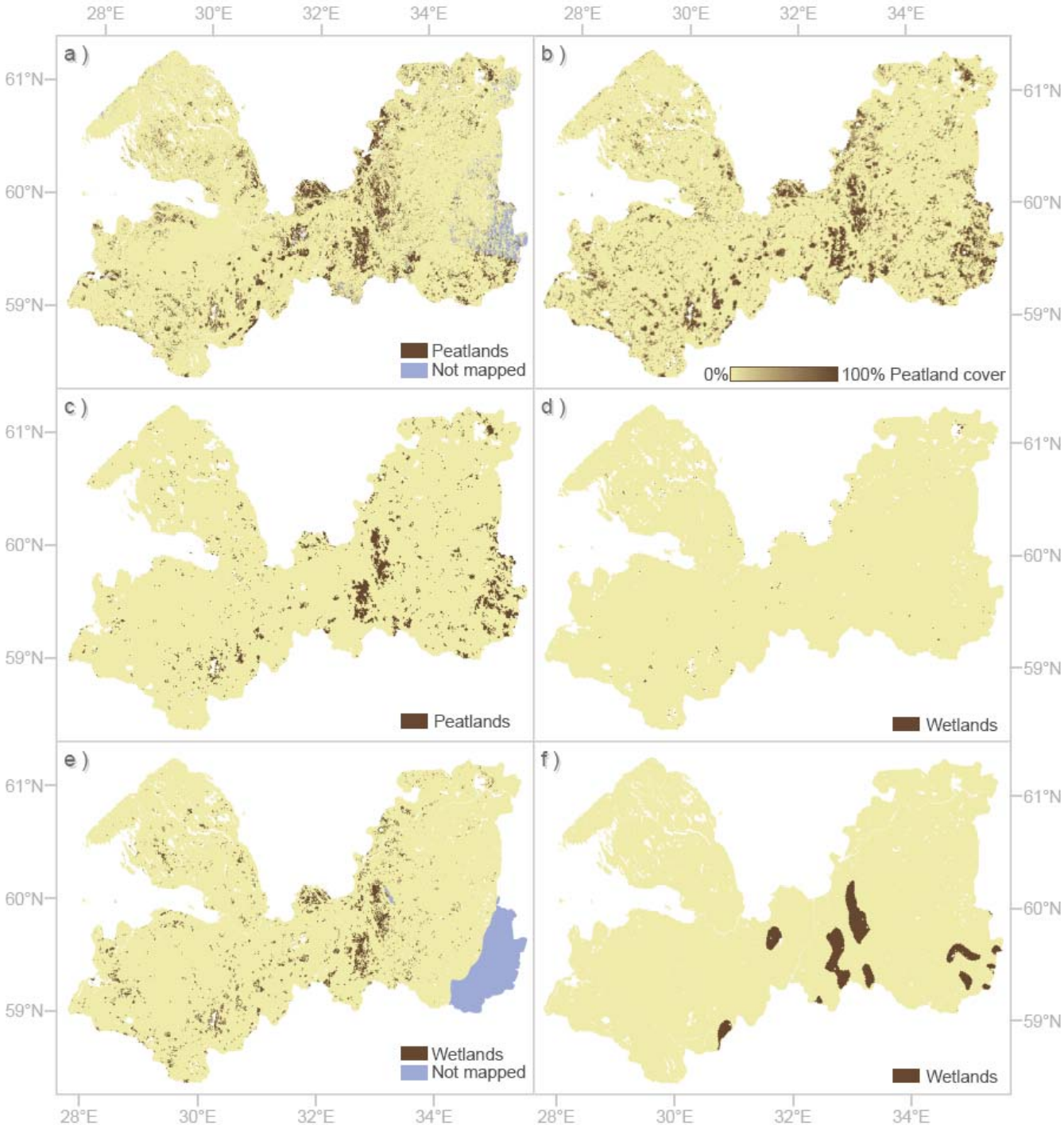
9.7%

GLC-2000
N. Eurasia

4.1%

BALANS
IRS 1C/1D
WiFS data
1997-2000

4.4%



MODIS
fractional
cover

9.8%

MODIS-
IGBP

0.2%

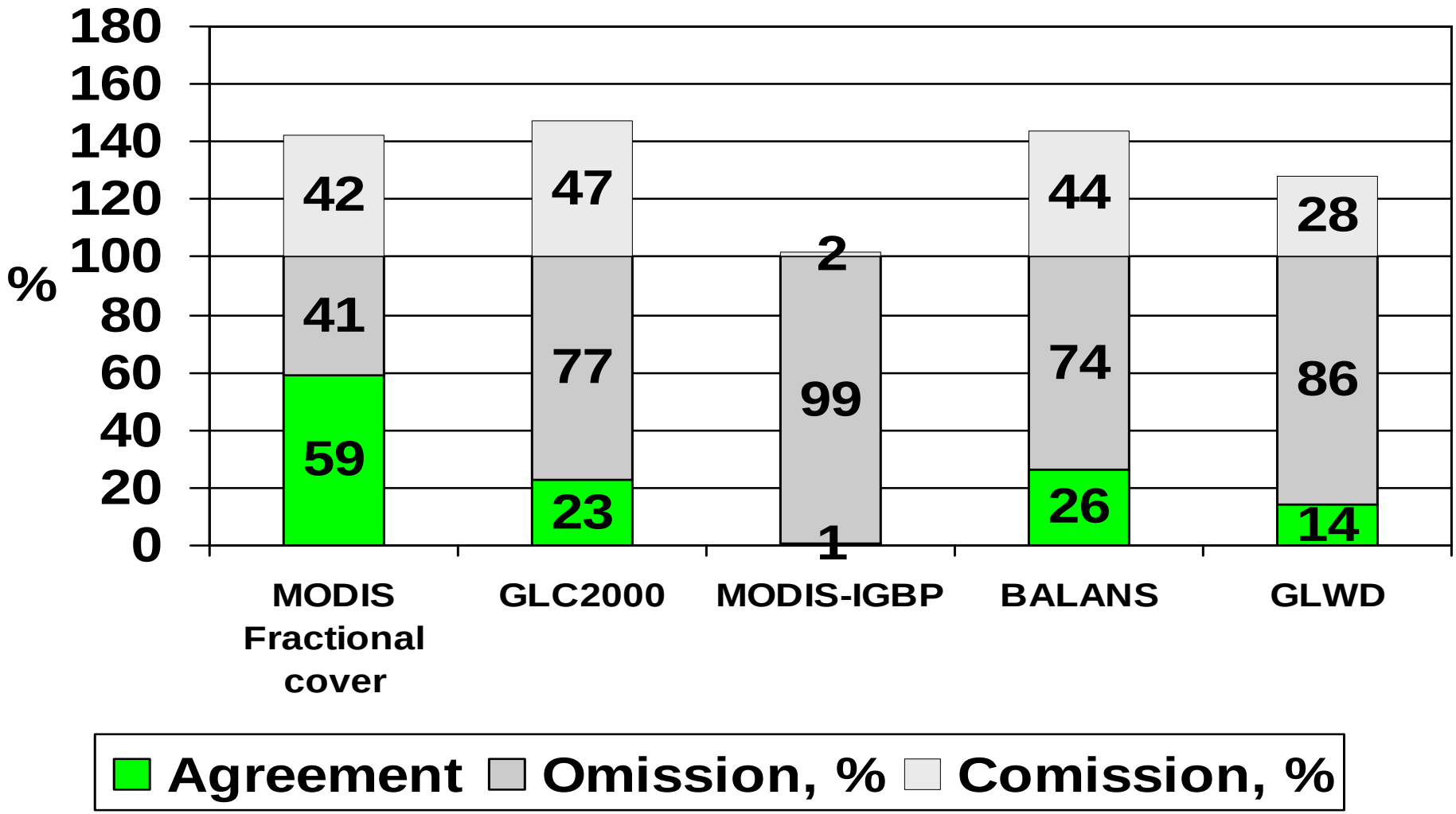
GLWD

3.3%

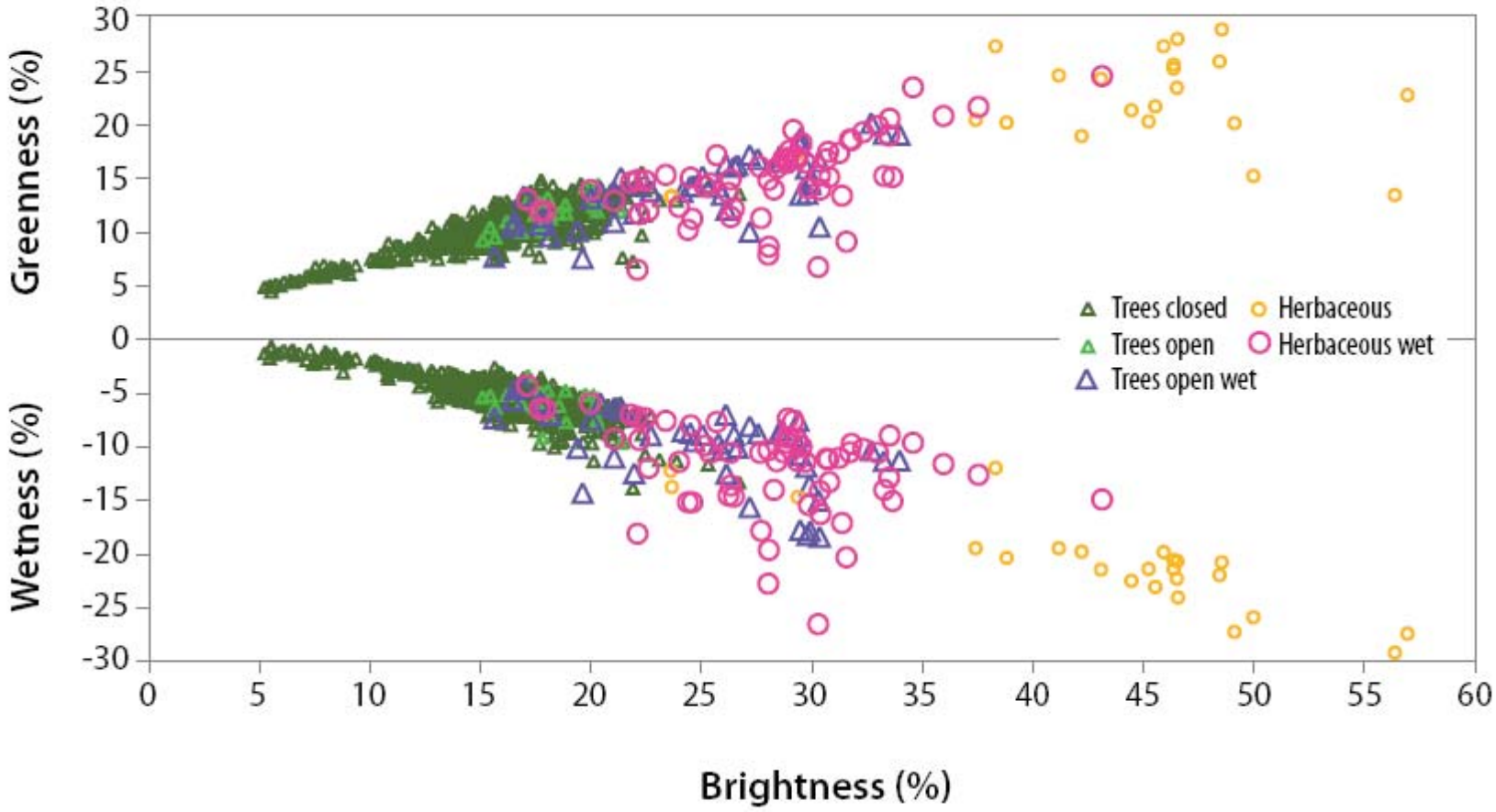
Effect of map resolution

- Landsat-resolution map – 6870 km^2
- Aggregate to 1 km resolution
- Count pixels with >50% peatland area
- Peatland area 4627km^2

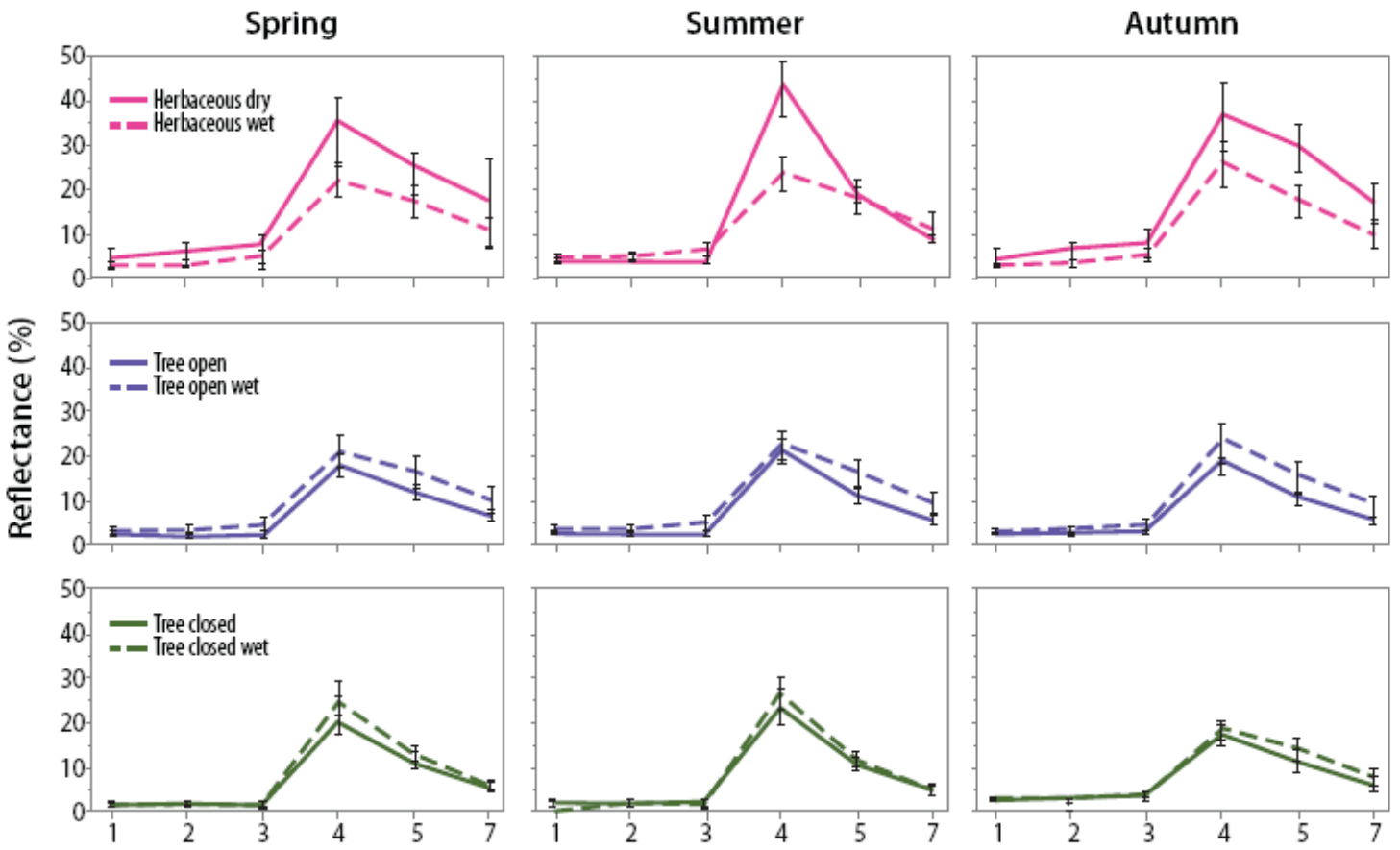
Peatland area on coarse resolution products in comparison with Landsat-based map



Average reflectance of ground polygons in Tasselled Cap spectral indices derived from Landsat ETM+ 2 October 2000



Mean reflectance and standard deviation of different vegetation types as observed in ground polygons-- Landsat TM/ETM+ Bands



Take home messages

- Map selection matters
- Maps performance depends on location and classes of interest
- Improved mapping of a specific classes of interest is possible
  - Requires focused effort

Conclusions

- Availability of land cover datasets is improving but
  - Disagreement is substantial
  - Validation remains a challenge
  - Assessment of strengths and weaknesses is important
- Remotely sensed data provides a rich source of information from which accurate and spatially consistent results can be extracted but
  - Data availability seems to exceed our capacity to utilize it
  - Development of methods remains a critical need
  - Effective system for setting priorities for product development