Land Abandonment in Russia: Understanding Recent Trends and Assessing Future Vulnerability and Adaptation to Changing Climate and Population Dynamics

End date: January 2013

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Land Abandonment & Agricultural Development

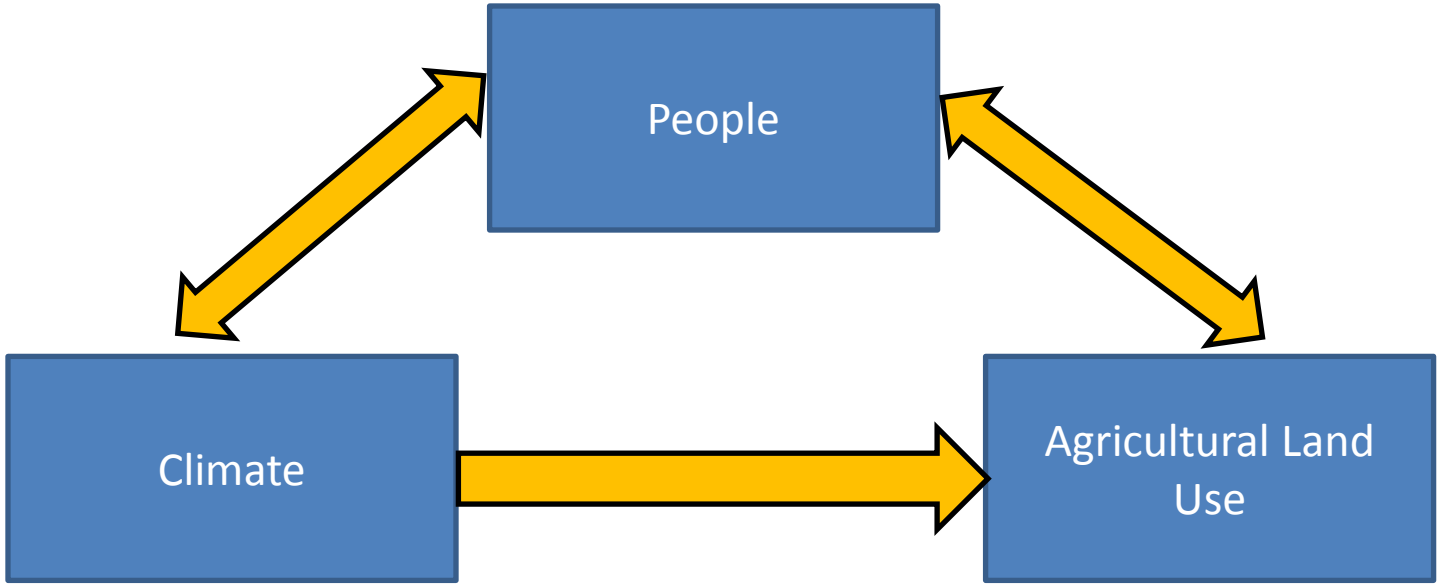
But most of all,
this is a story about people.

Overview

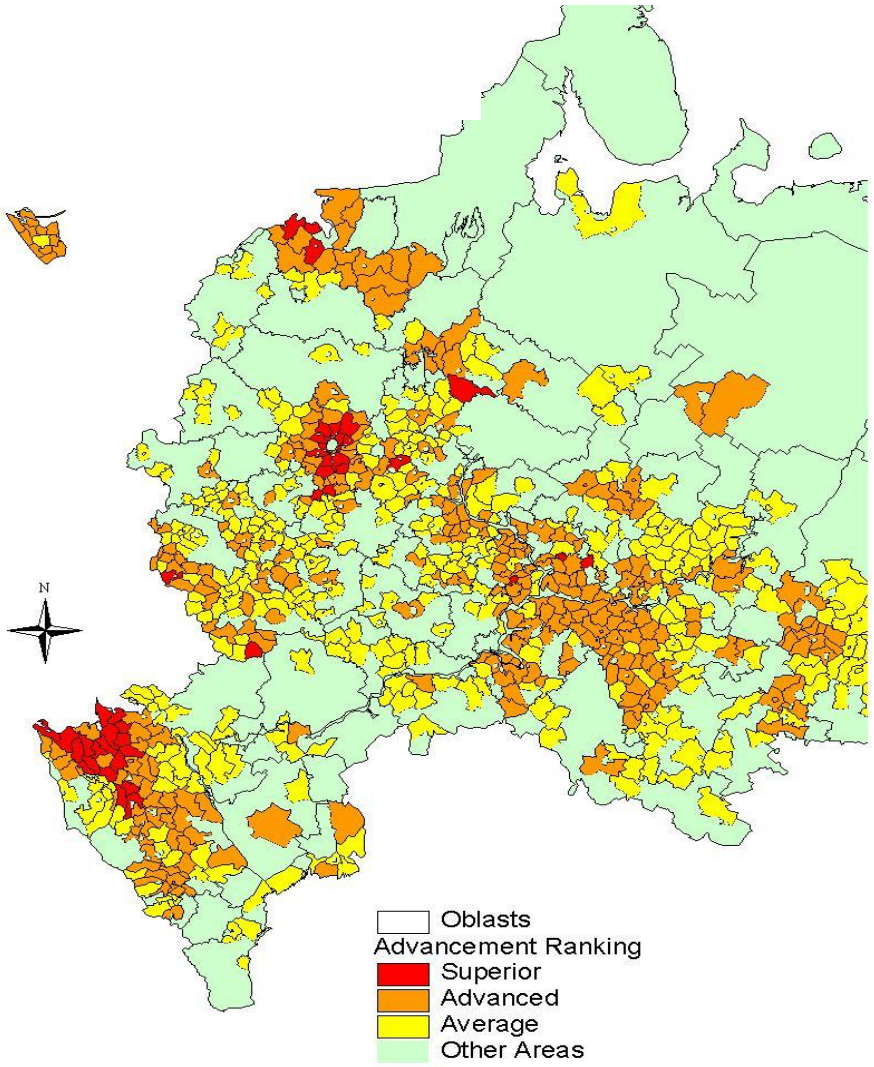
- Introduction to our study
- Results from the first 20 months of our project – abandonment AND resurrection
- An example of climate adaptation and land use monitoring (instead of only land cover)

Introduction

- Interdisciplinary project in land change science: integrating social, geographical, climate and remote sensing sciences.
- Goal: improve the current understanding of the interaction of climate change and the spatio-temporal impacts of agricultural reform in Russia.



Emerging Archipelago of Commercial Farming 1990 - 2000



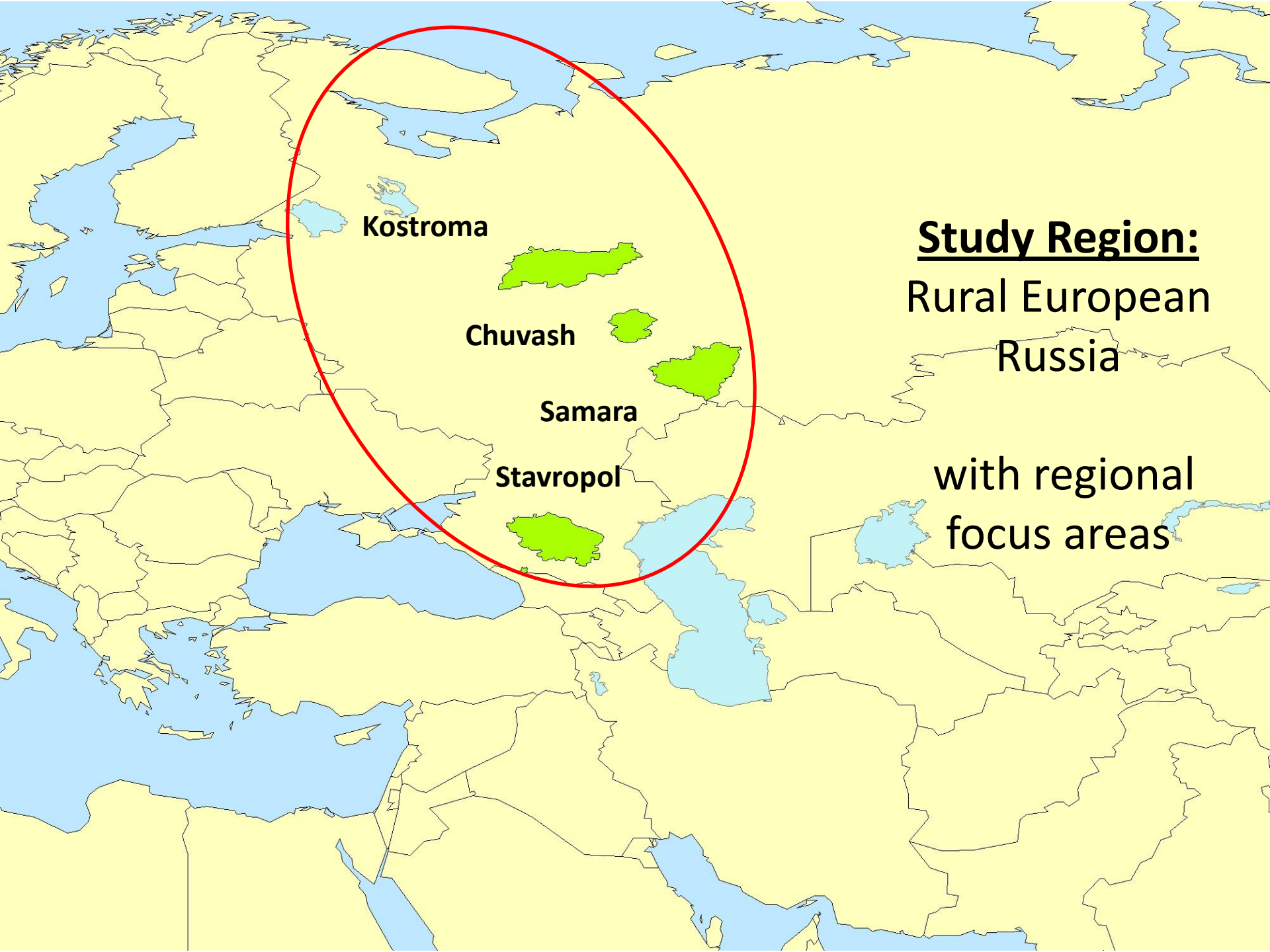
Successful farming can be found in:

- Southern oblasts
- Urban suburbs
- National republics of the Volga and Ural regions

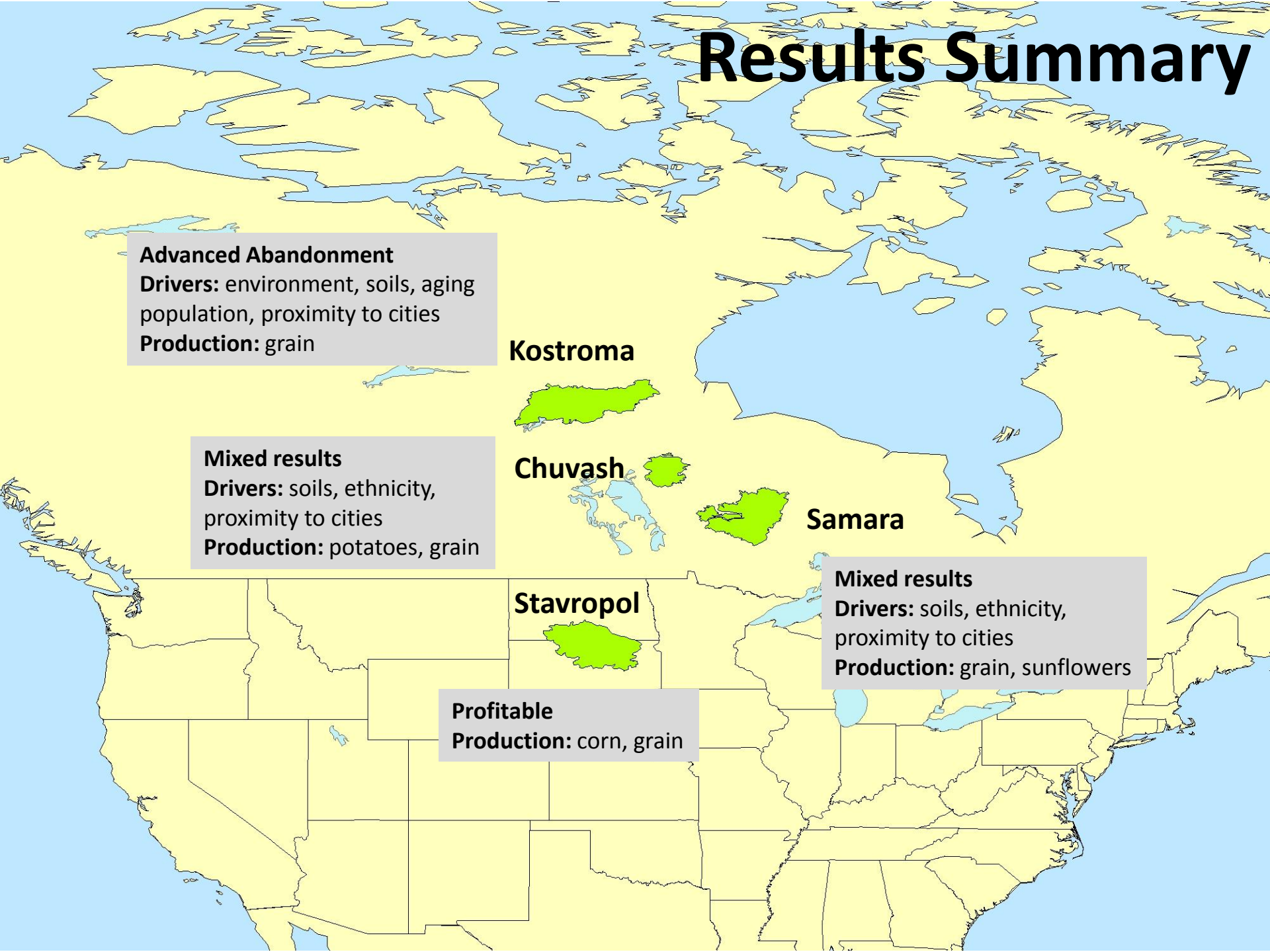
2010: How are things now?

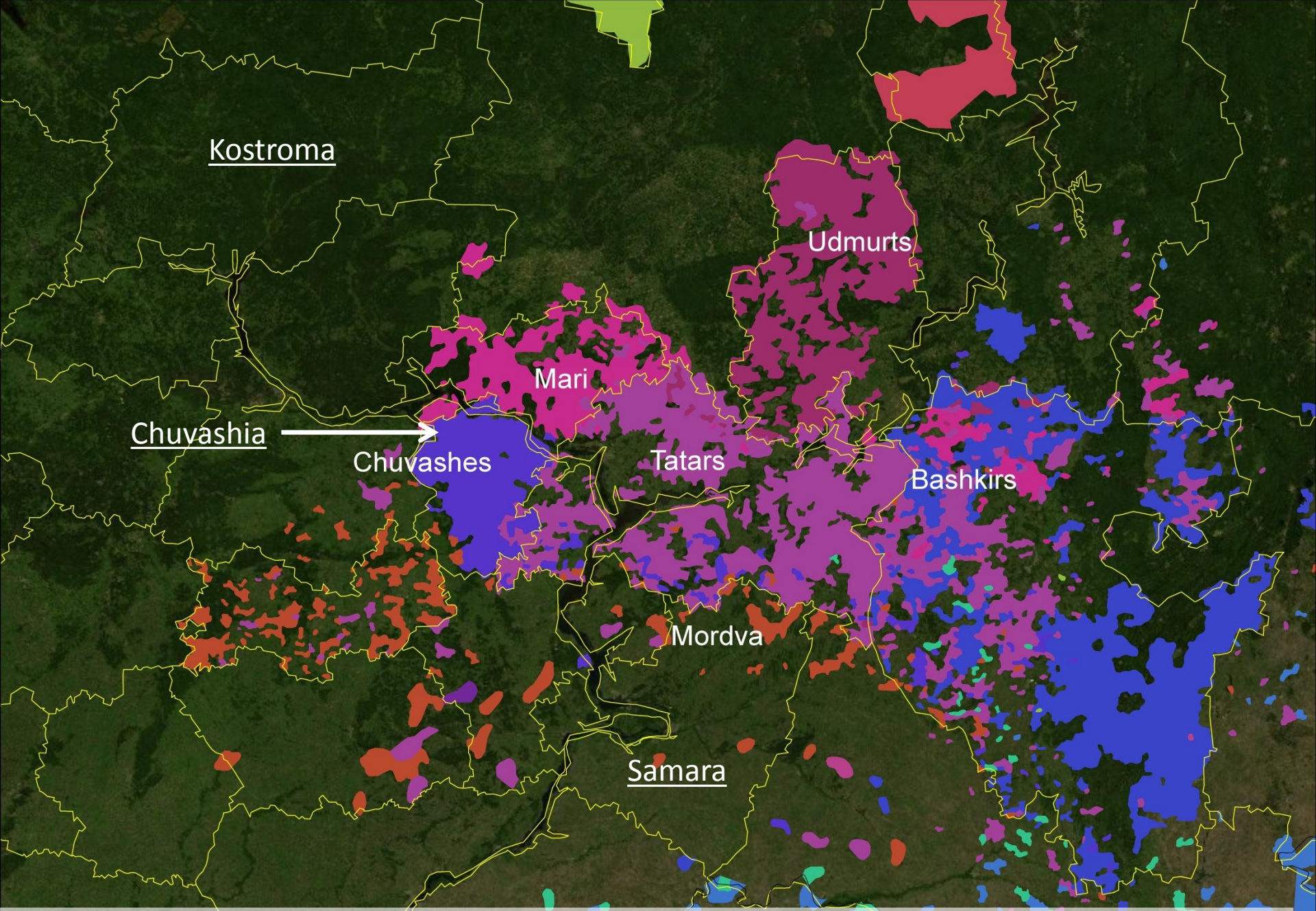
Adaptation to markets & climate

Ioffe and Nefedova, 2006


Kostroma
Chuvash
Samara
Stavropol
Study Region:
Rural European Russia
with regional focus areas

Results Summary





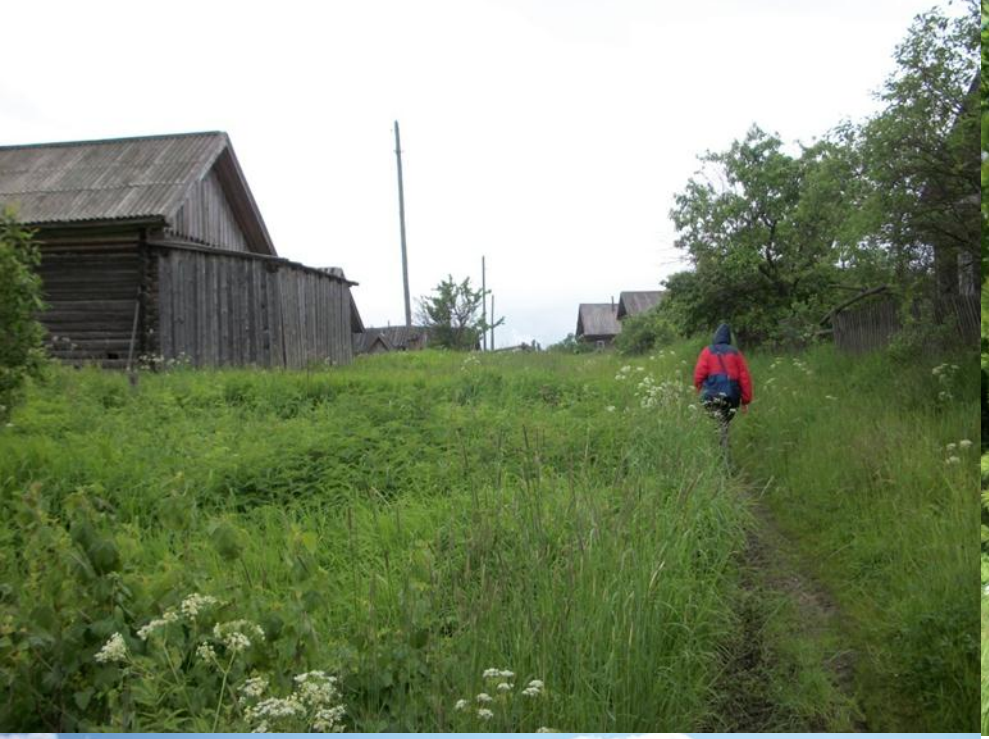
Weidmann, Nils B., Jan Ketil Rød and Lars-Erik Cederman (2010). "Representing Ethnic Groups in Space: A New Dataset". Journal of Peace Research.

Field Methods

- We visited typical settlements and enterprises in 4/5 selected *subdistricts* within each of the 4 selected study regions.
- Among the people we interviewed were:
  - the head of each selected rayon
  - the chief of agriculture of each selected rayon
  - the heads of *at least* 3 different farms
  - the administration heads of the corresponding villages

  In addition:
  - The ministers economics and agriculture in Samara oblasts
  - Several faculty members of the department of Geography at Chuvash Republic University
  - Agronomists and other agricultural specialists in Samara, Chuvash and Stavropol

- In total we performed between 20 and 30 interviews per region (4).
- Each interview lasted between thirty and ninety minutes.
- The interviews were typically attended by one to five respondents.
- Among the farmers and administrators interviewed, there were people from Baskhir, Tatar and Chuvash ethnicities.
- Interviews took place in May/June 2010, June 2011 and September 2011.
- We also visited regional statistical offices to update data collected in 2000.



Kostroma Oblast

- Abandonment is advanced.
- Many villages are abandoned completely.
- Others have only a few elderly people left.

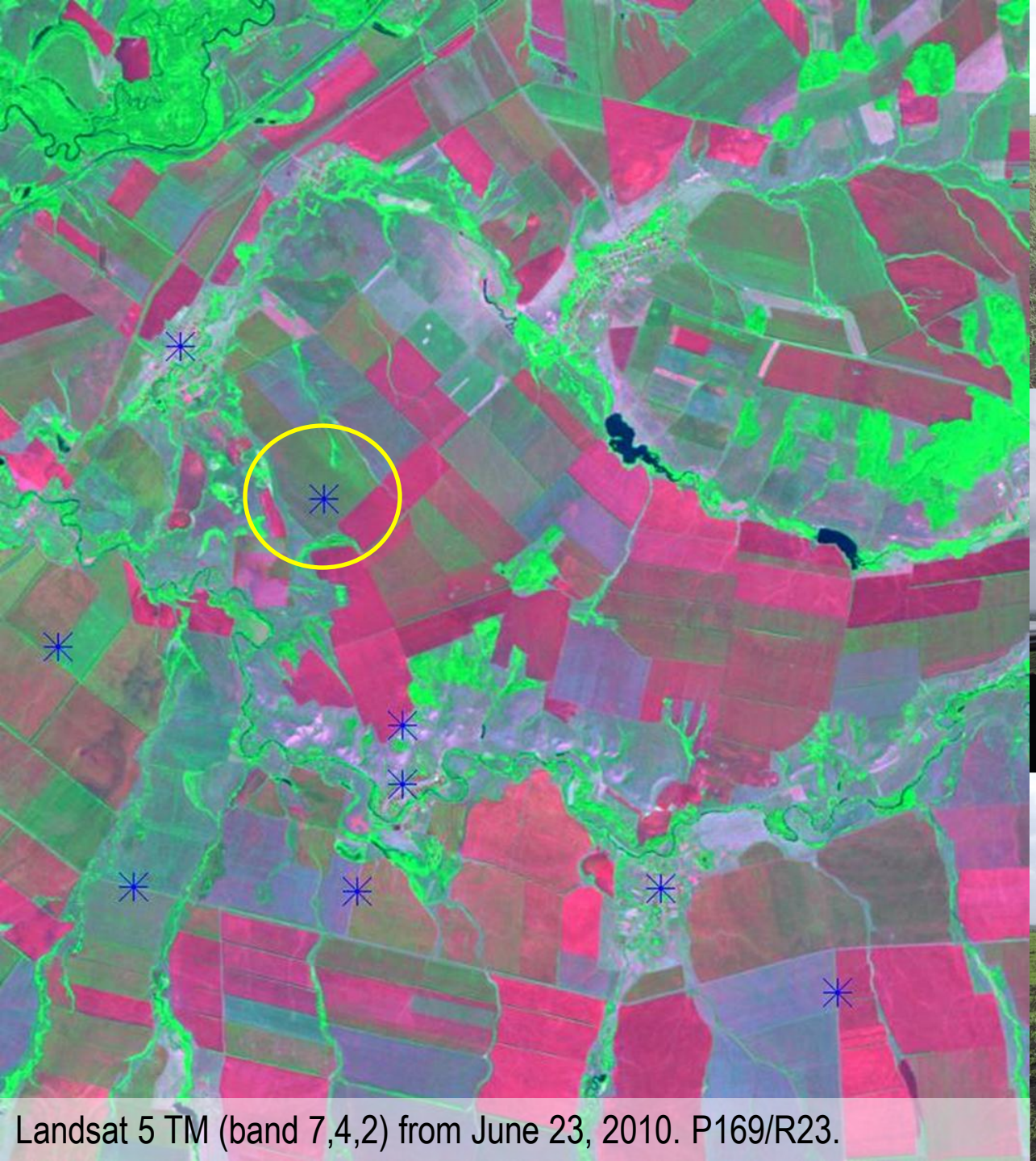
Stavropol Krai

- Krasnodar and Stavropol (along with Moscow and Leningrad) have the best collective enterprises in Russia, with high productivity of land and livestock.
- Despite the 2008-2010 financial crisis and last year's drought enterprises still survive.
- Stavropol is second in Russia with respect to grain production (behind Krasnodar).
- There are some abandoned areas on the plains of the North Caucasus but it is far less than in other regions of Russia.

Mixed results.
Why?
Kostroma
Chuvash
Samara
Stavropol

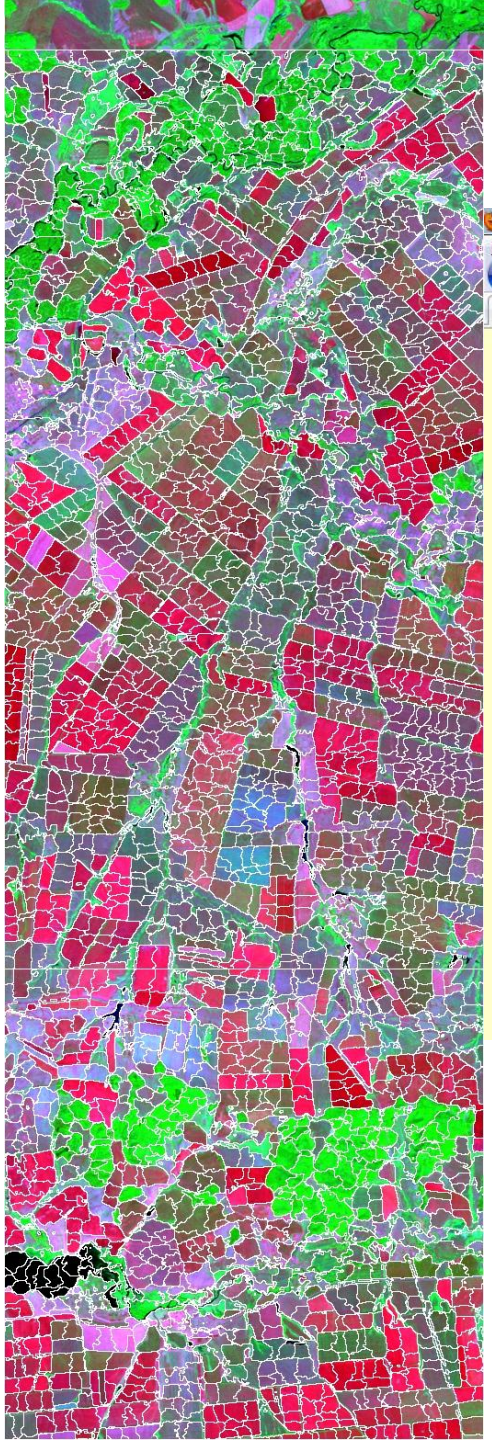
Samara Agriculture

- Since 1997, agriculture is growing (except in 1998).
- Agriculture area is gradually emerging from the crisis, but it is changing its sectoral and territorial structure.
- There was a clear shift from livestock to crop farming:
  - the proportion of crop growing in the Samara region rose from 41% in 1991 to 60% in 2003.
  - cattle loss from 1,012,000 to 212,000
- Adaptations to climate and new markets are ongoing.



Landsat 5 TM (band 7,4,2) from June 23, 2010. P169/R23.

May 25th, 2010



Classify land use - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://ags.ou.edu/~kdebeurs/Home/23Jun2010/

Classify land use | http://ags.ou.edu...10/23Jun2010.csv

Previous Next

23Jun2010_set12 segment 1221

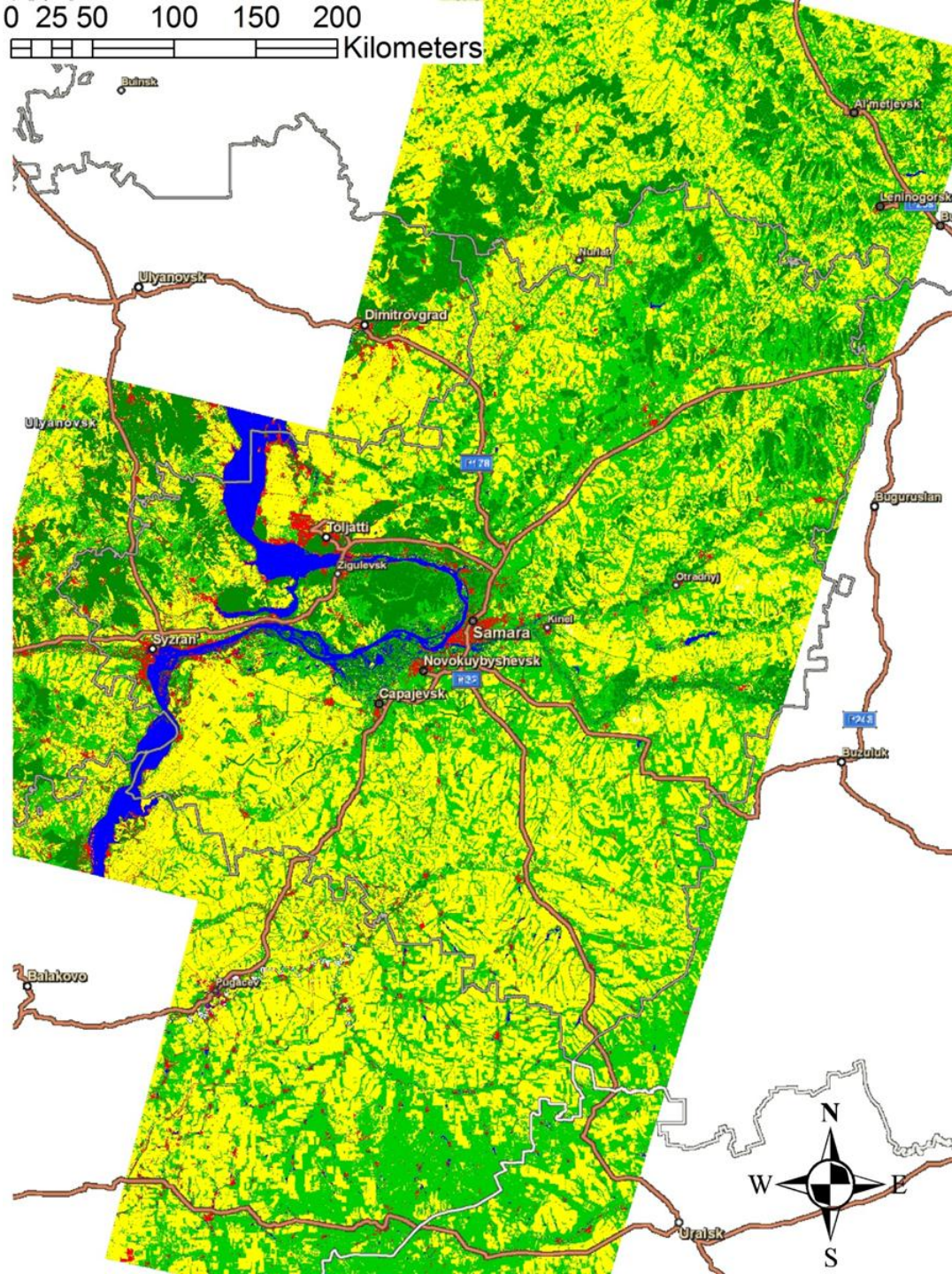
Landuse	Percentage
Fallow Croplands	100

Save values

Land Cover

	Reference Data	
		UAC
Classified	Water	0.938
	Forest	0.963
	Grassland	0.555
	Cropland	0.918
	Urban	0.722

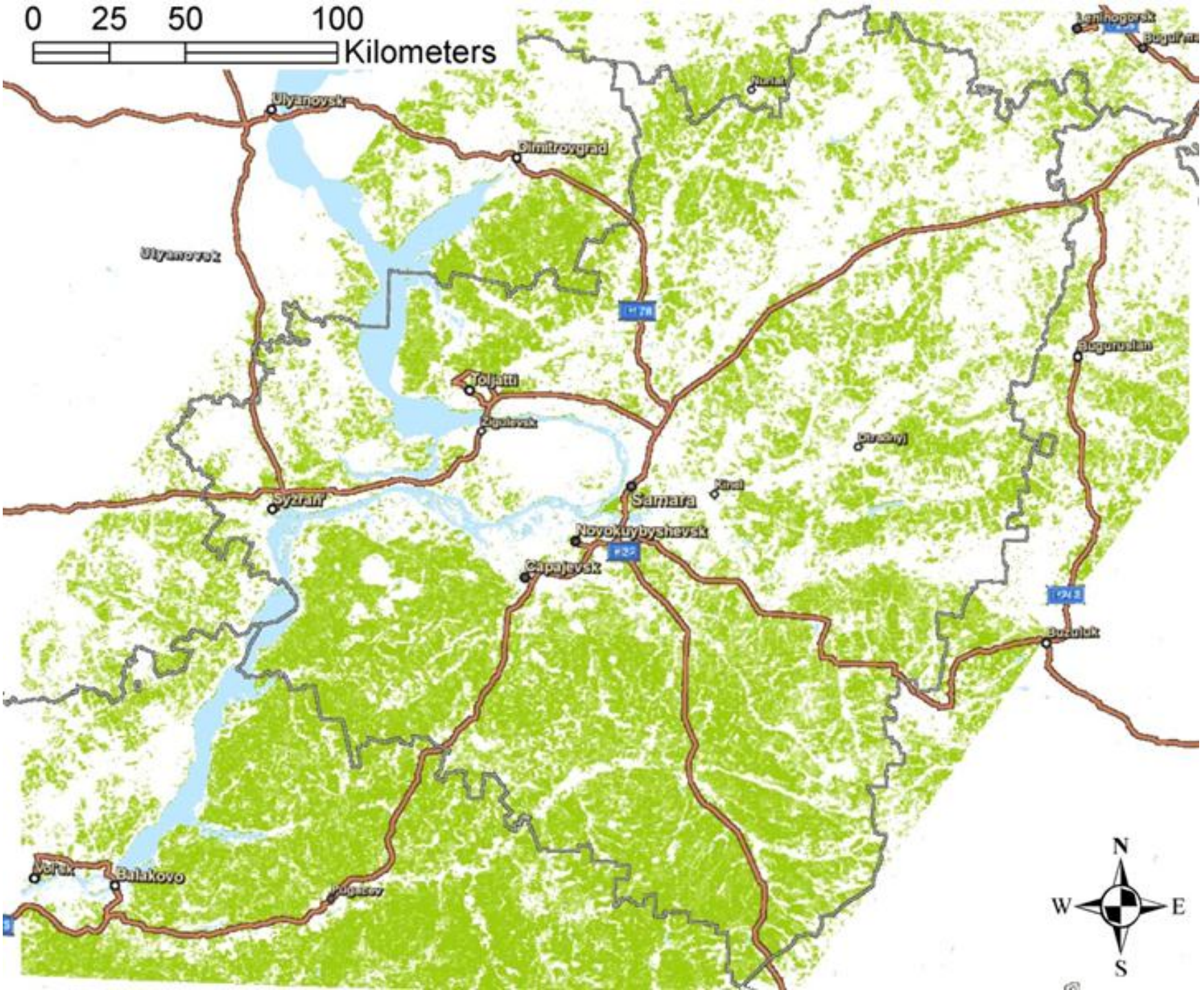
Overall Accuracy: 0.862
Kappa Coefficient: 0.8017

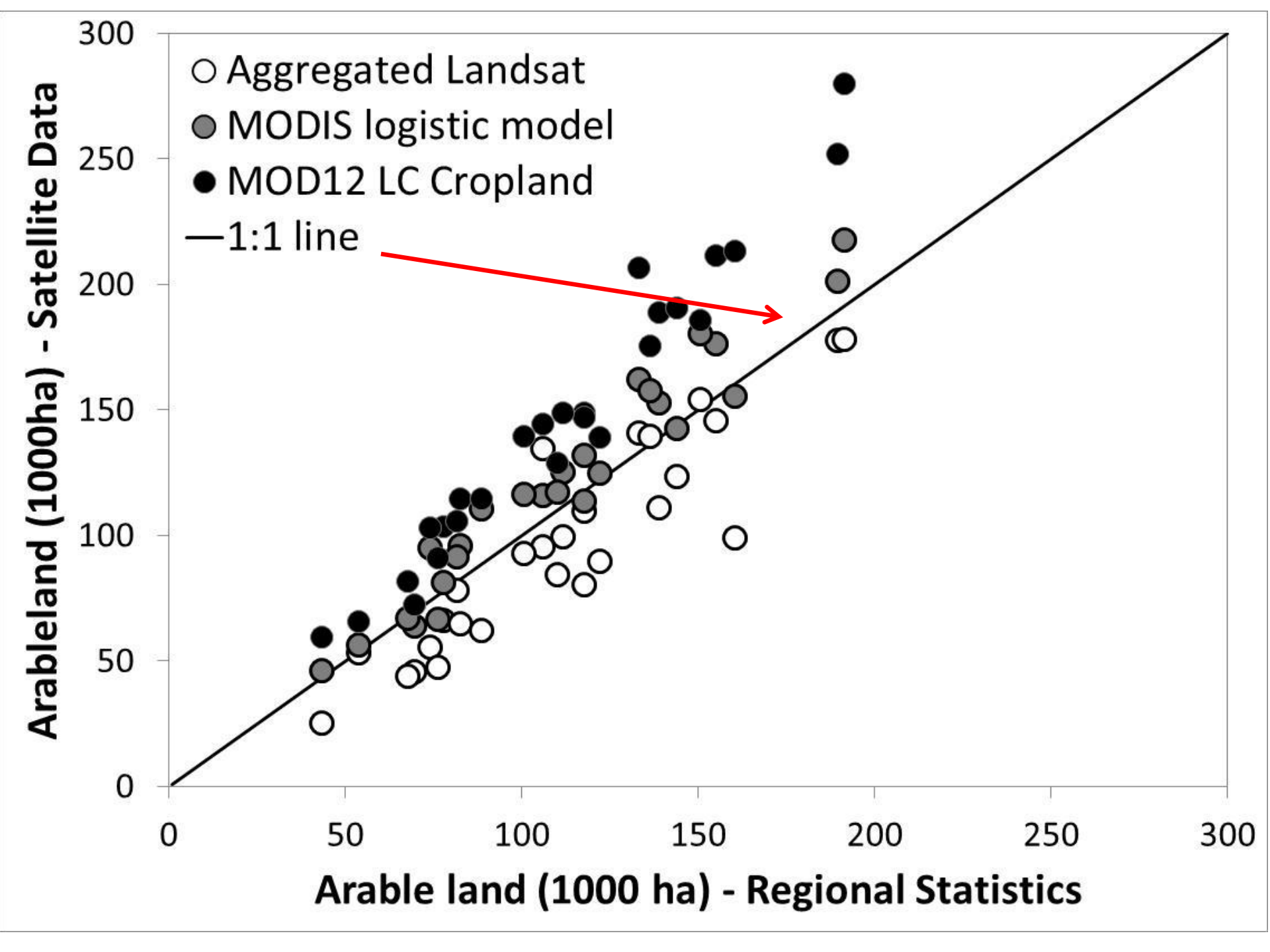


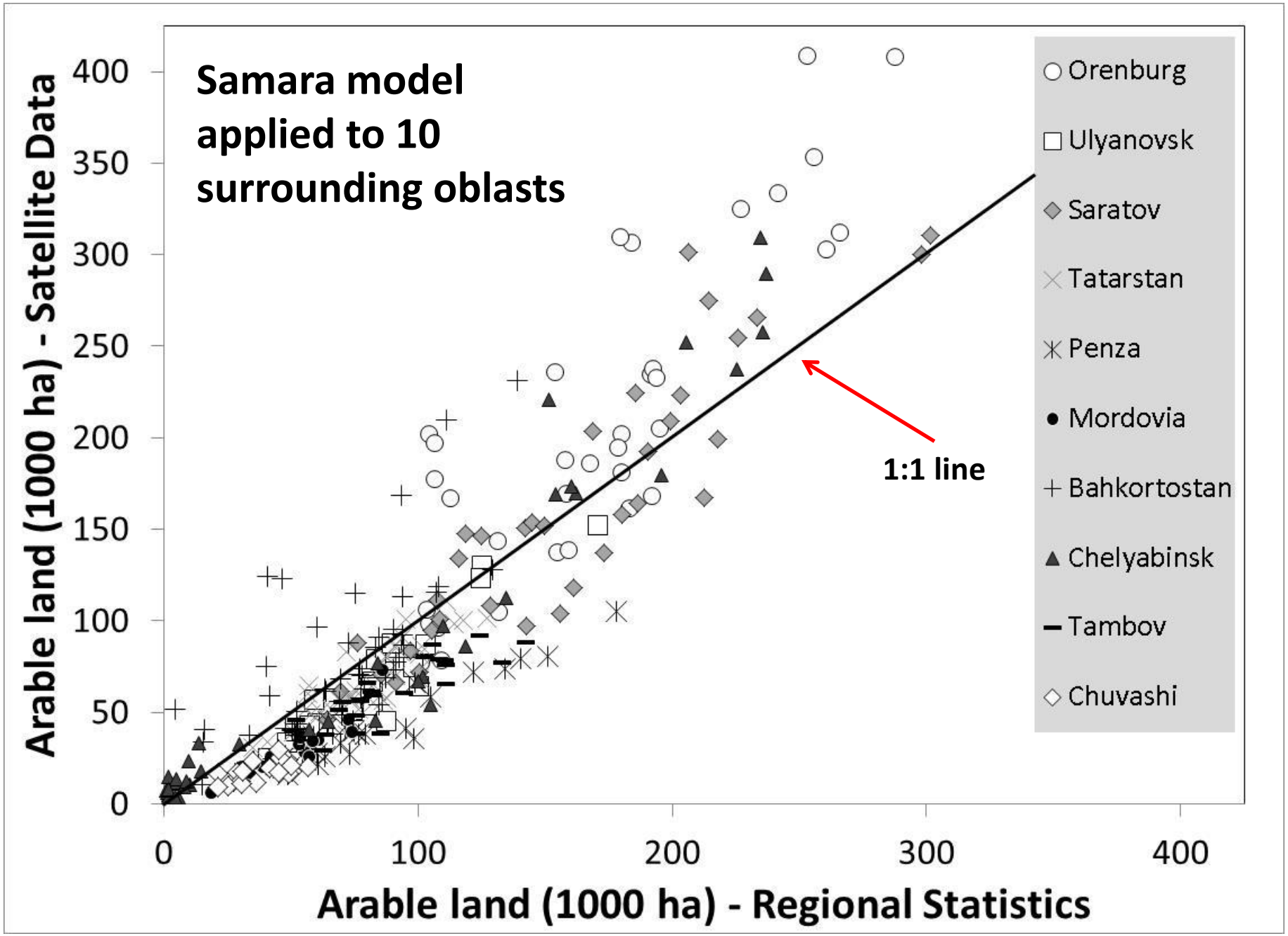
Logistic model

- Model to link land surface phenology estimates based on MODIS with Landsat based land cover estimates.
- Use phenology measurements to understand if cropland is actually cropped for a particular year.

	% Correct	AUC	Cohen's Kappa
Forest	0.93	0.94	0.92
Cropland	0.70	0.83	0.59

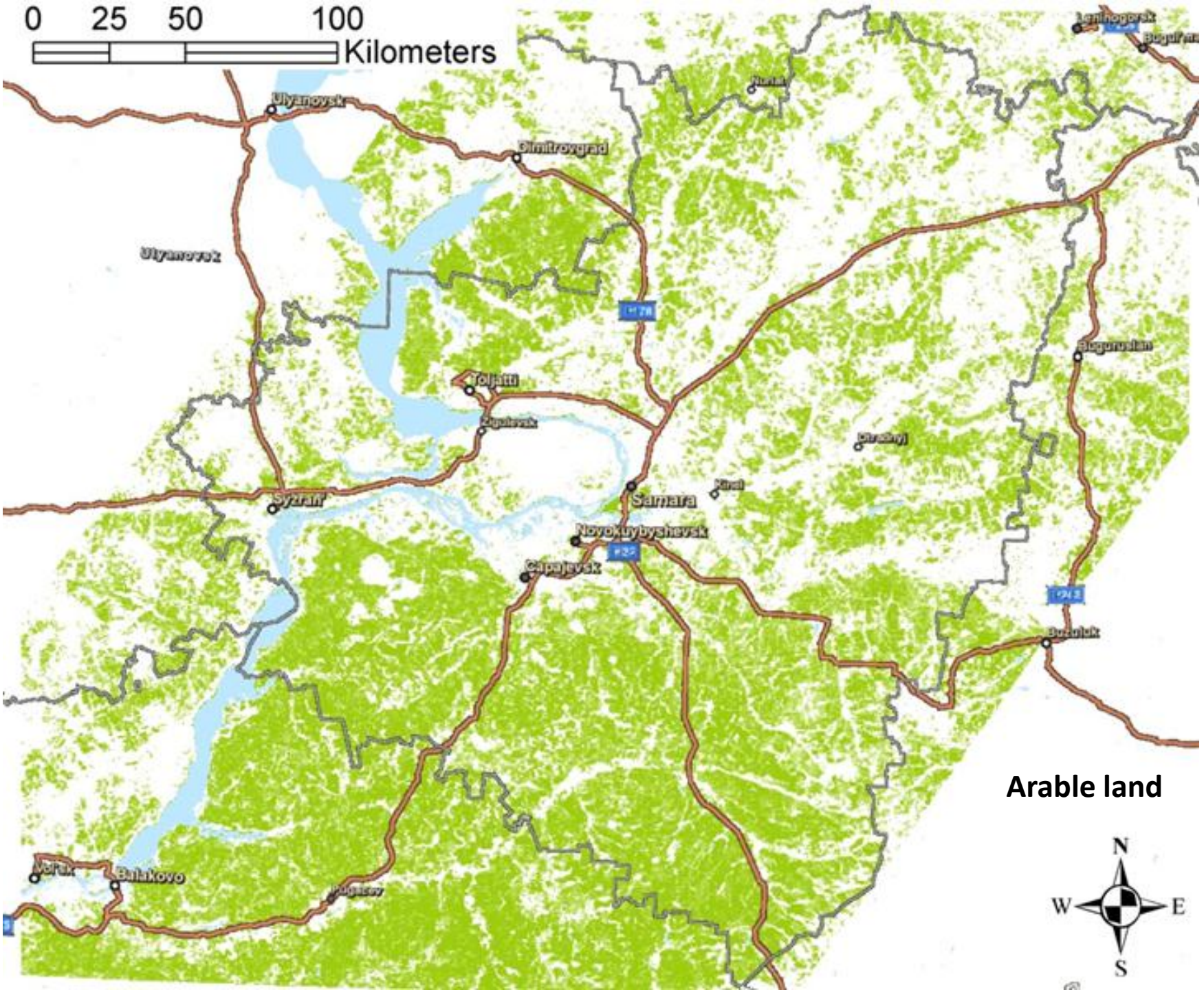

0 25 50 100
Kilometers
Ulyanovsk
Dimitrovgrad
Ulyanovsk
Tolyatti
Zhigulevsk
Syzran'
Samara
Novokuybyshevsk
Chapayevsk
Balakovo
N
W
E
S

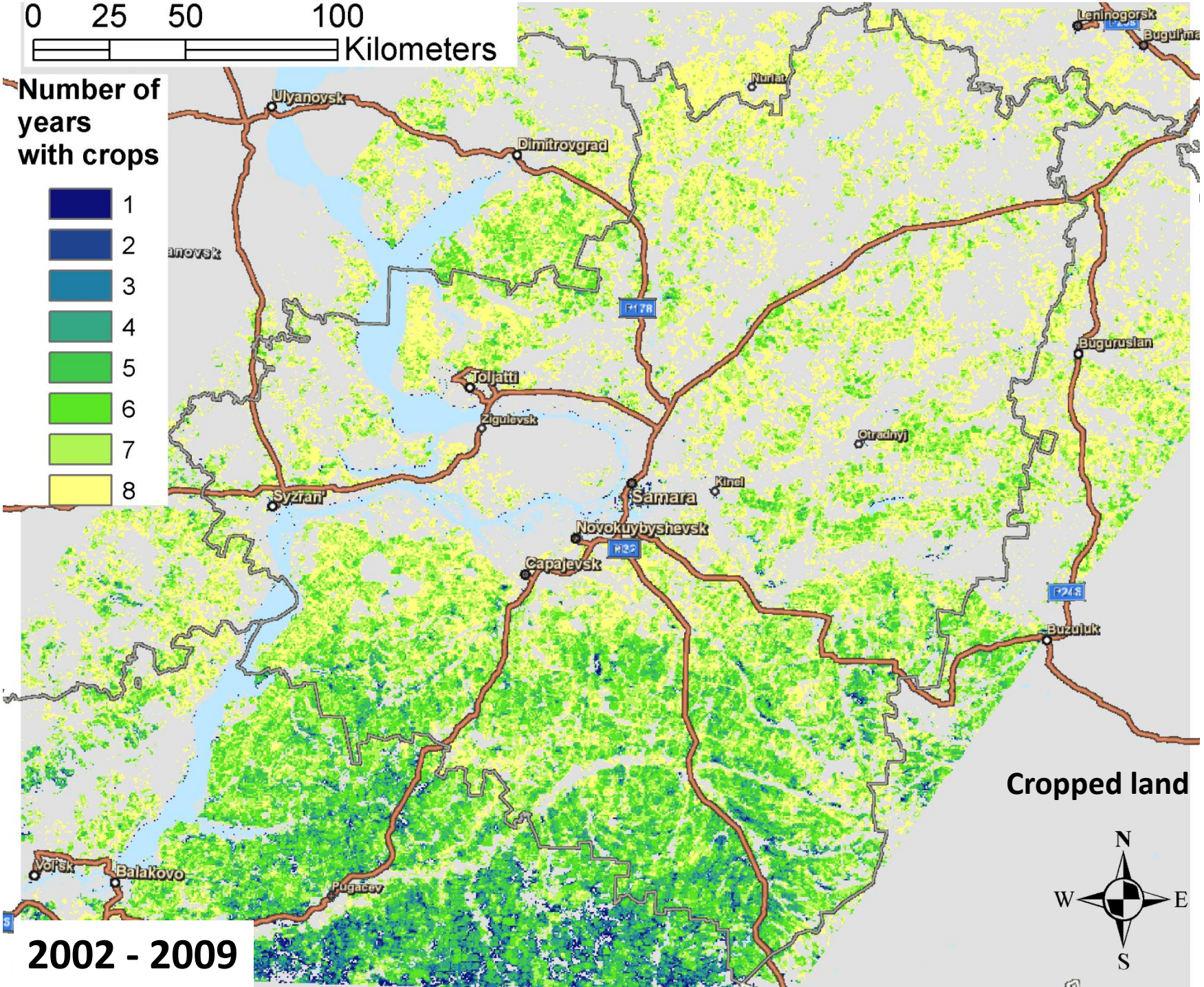

Aggregated Landsat
MODIS logistic model
MOD12 LC Cropland
1:1 line
Arableland (1000ha) - Satellite Data
Arable land (1000 ha) - Regional Statistics
0
50
100
150
200
250
300

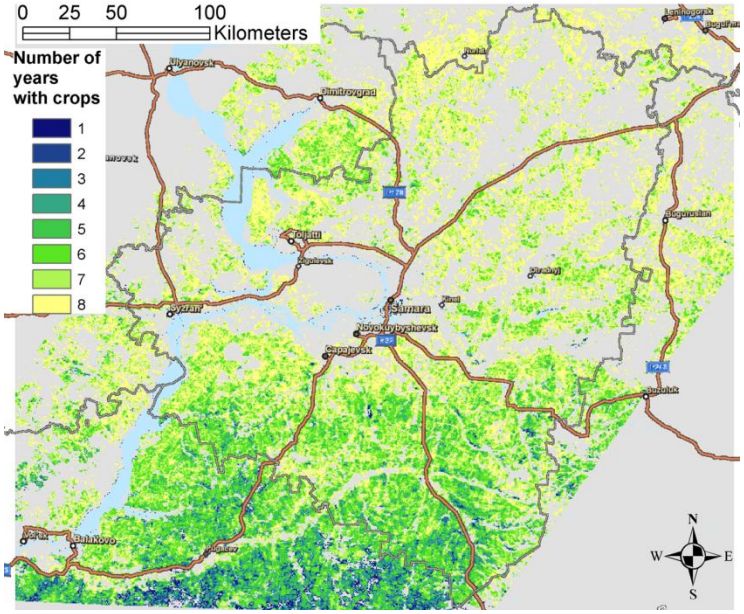

Samara model applied to 10 surrounding oblasts
1:1 line
Orenburg
Ulyanovsk
Saratov
Tatarstan
Penza
Mordovia
Bahkortostan
Chelyabinsk
Tambov
Chuvashi
Arable land (1000 ha) - Satellite Data
Arable land (1000 ha) - Regional Statistics
0
50
100
150
200
250
300
350
400
0
100
200
300
400

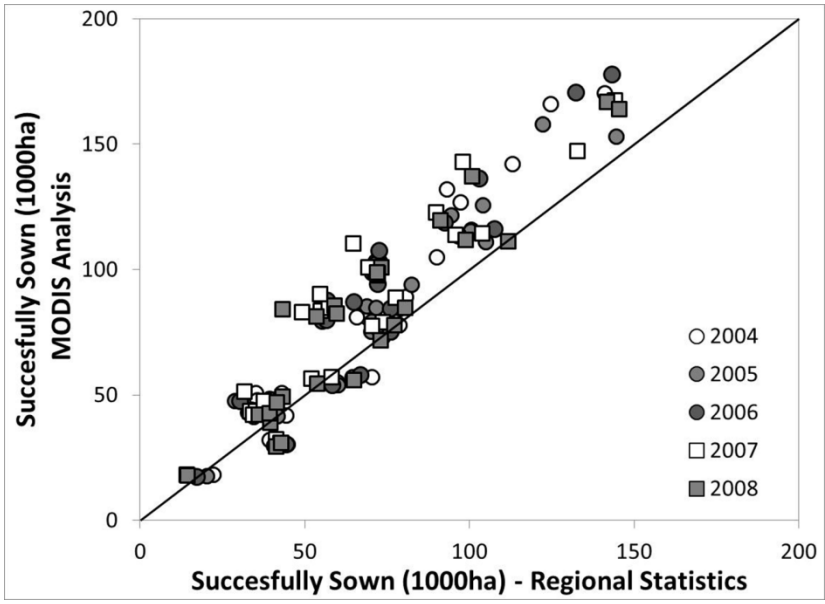
Land Cover vs. Land Use

- Integrated assessment models typically target large areas.
- However, decision-makers increasingly want to understand the effect of climate change and policy changes in regional areas.
- For ***regional*** integrated assessment models it is even more important to focus on land use instead of land cover.
- Besides understanding whether an area is considered cropland, it is important to know whether the cropland is actually used and if so in what way.
- First step → how often is an area successfully cropped?


0 25 50 100
Kilometers
Ulyanovsk
Dimitrovgrad
Tolyatti
Syzran'
Samara
Novokuybyshevsk
Chapayevsk
Balakovo
Arable land
N
W
E
S


0 25 50 100
Kilometers
Number of years with crops
1
2
3
4
5
6
7
8
Ulyanovsk
Dimitrovgrad
Nurlat
Leninogorsk
Buguruslan
Otradnyj
Tol'jatti
Zigulevsk
Syzran'
Samara
Kinel
Novokuybyshevsk
Capajevsk
Buzuluk
Balakovo
Pugacev
Cropped land
N
W
E
S
2002 - 2009





	Successfully Sown Land			
	Intercept (1000 ha)	Slope	R^2_{adj}	RMSE (1000 ha)
2004	-11.451*	1.331	0.915	12.215
2005	-3.856*	1.189	0.906	11.732
2006	-3.944*	1.271	0.899	13.423
2007	6.984*	1.156**	0.857	14.979
2008	1.646*	1.160**	0.864	14.916
Overall	-1.457*	1.213	0.884	13.578

*: not significant different from 0 (*p = 0.05*).

**: not significantly different from 1 (*p = 0.05*).

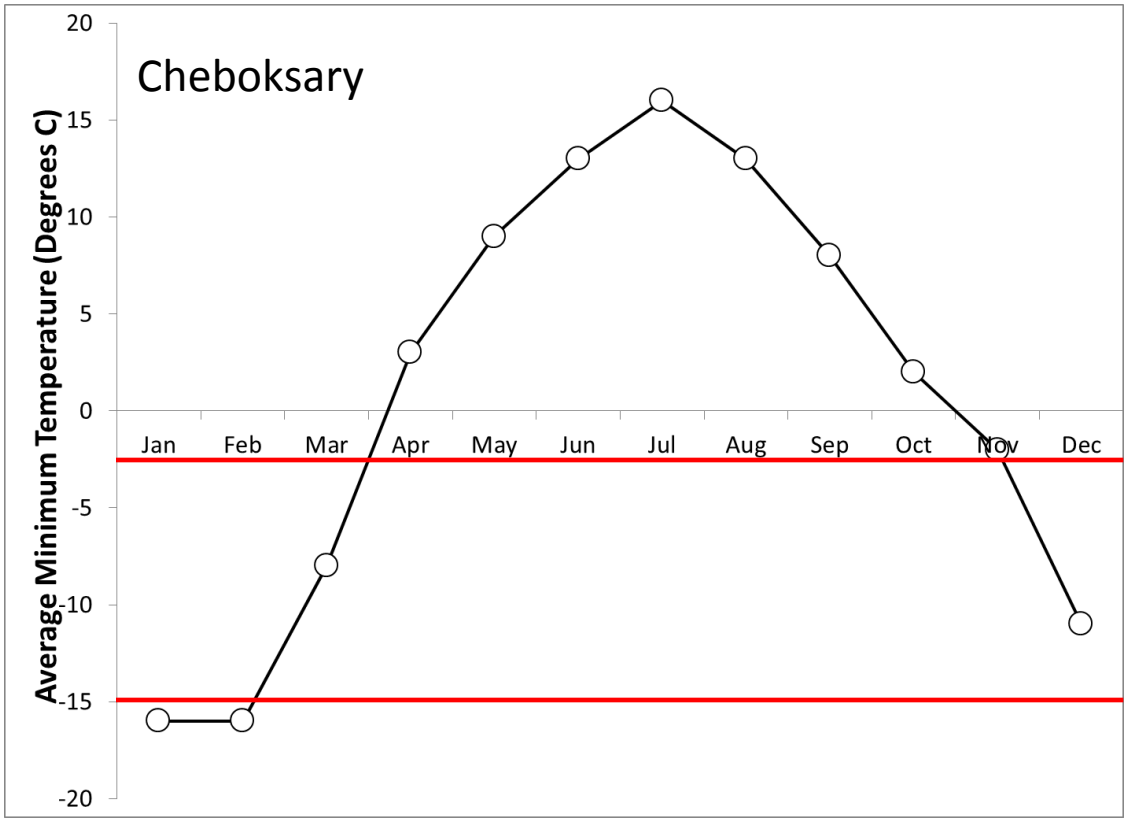
Why is this important?

- Shorter-term climate adaptations include changing crop season (e.g., winter vs. spring grains), cultivars, and sowing dates (IPCC and citations therein, 2007).
- Farmers in Samara previously:
  - 7-year crop rotation → variety of grain + 1 year fallow.
- Now, crop rotation schedules are changing:
  - 3- year crop rotation → fallow-grain-sunflower.
- Also switch is underway: spring wheat → winter wheat and to grow different products such as chickpeas.

Winter Wheat or Spring Wheat?

- Winter wheat: lower seed and herbicide costs + higher yields.
- Production risks are the major concern → winter kill.
- In North Dakota: **winter** wheat abandonment has decreased from 18% to 13%. **Spring** wheat abandonment has been between 4 and 5%.
- Most hardy varieties:

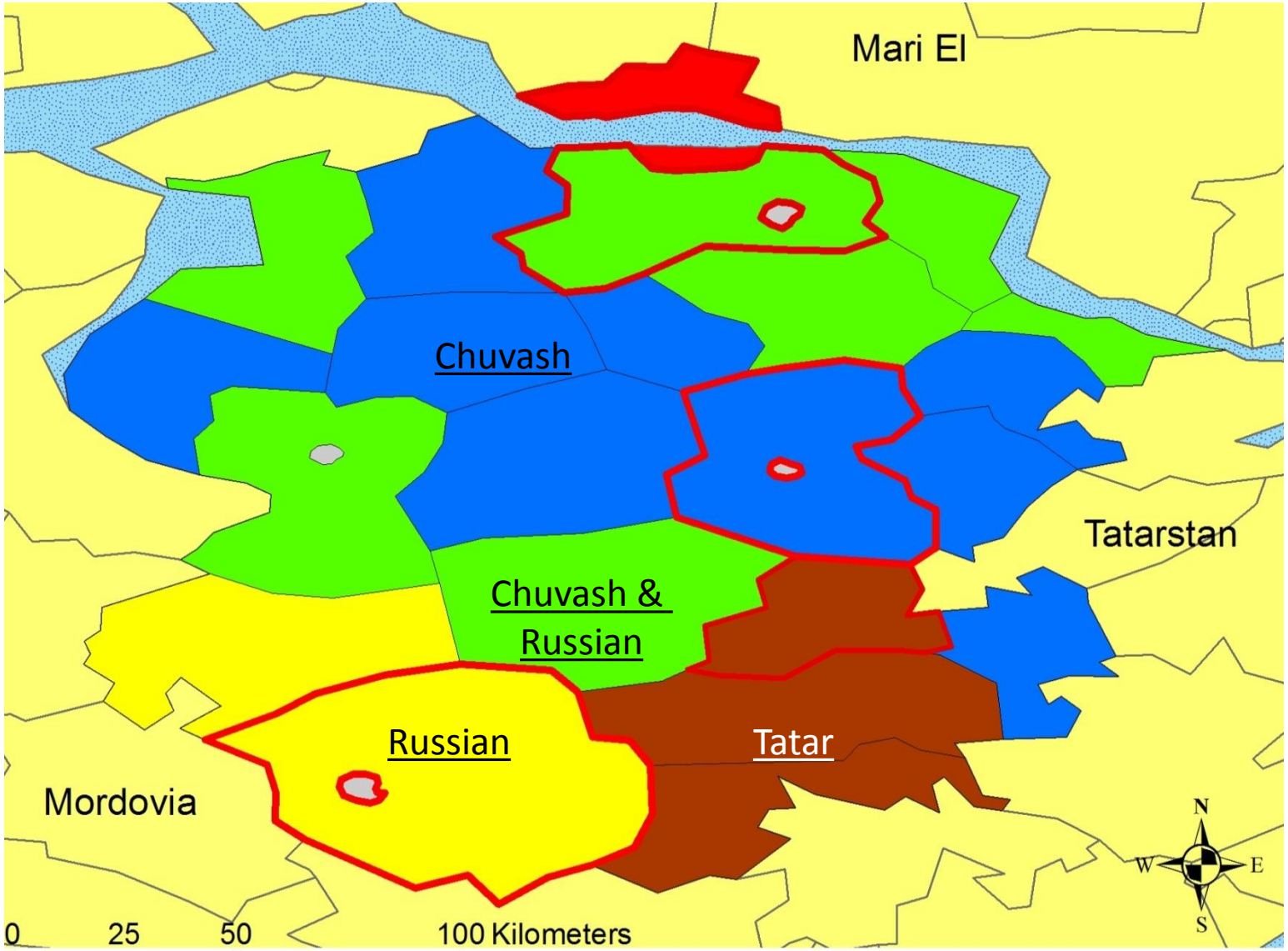
Temperature (ºC)	Maximum Length (days)
-3	150.0
-15	6.0
-26	0.5
-29	0.0



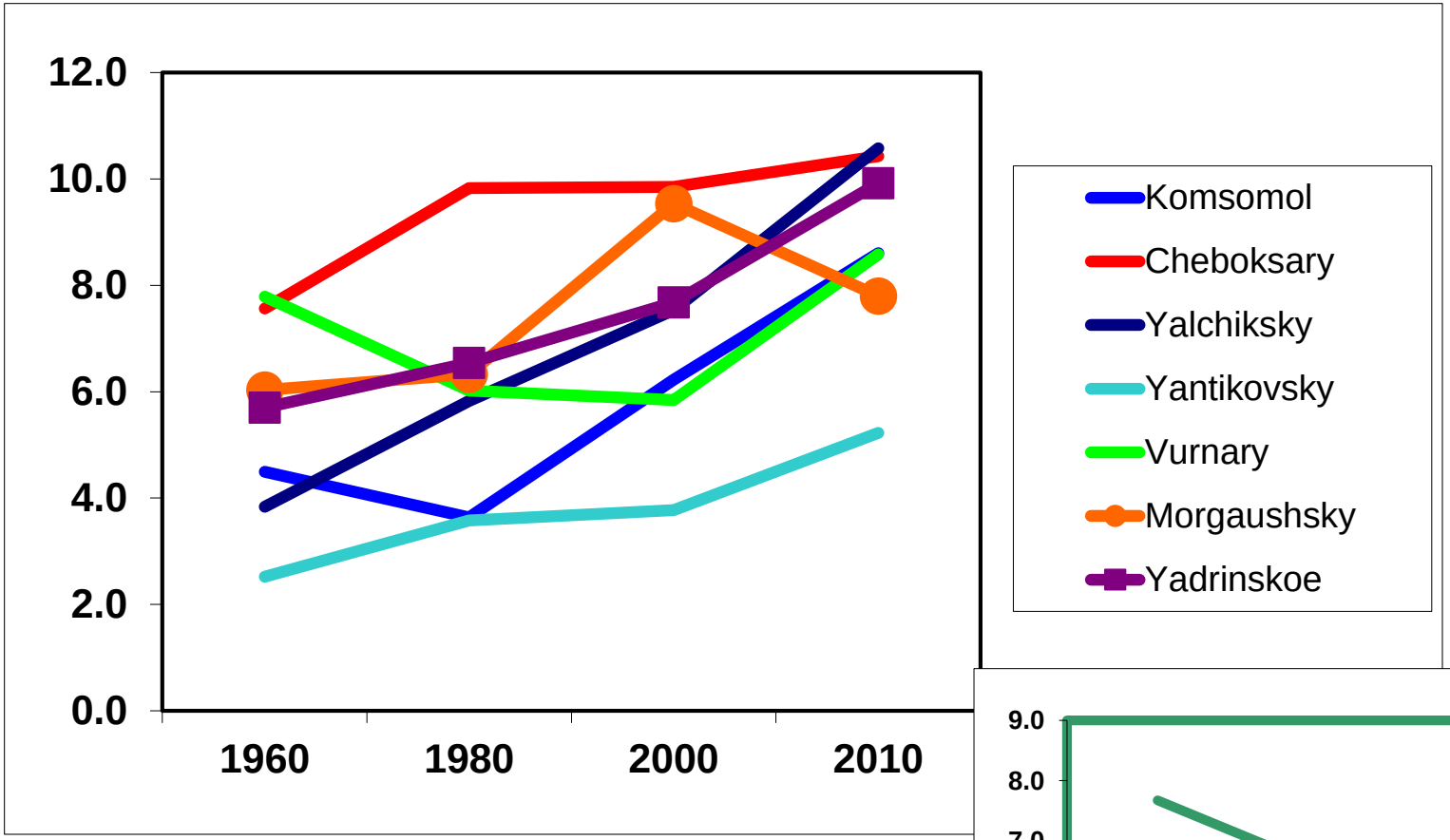
Abandonment? No, Resurrection!

Preliminary results from Chuvash Republic

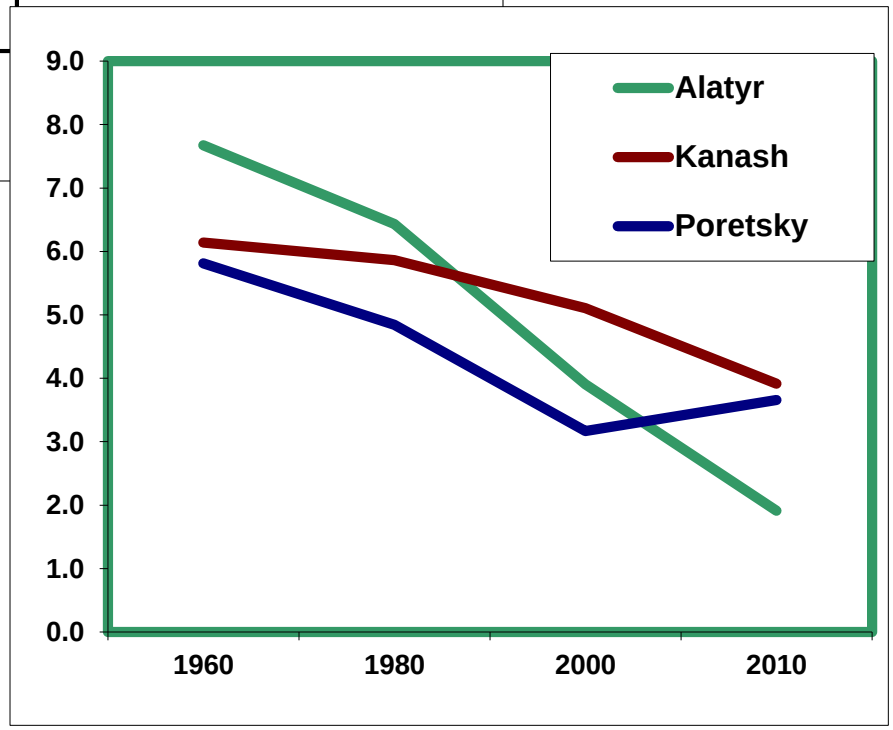
National Composition of the population of Chuvash Republic



Years	Cheboksary	Krasnoche taysky	Kozlowski	Alatyr	Poretsky	Komsomol
		Chuvash		Russian		Tatar
Yield of grain crops to the average for the republic						
1960	**0.9**	**1.0**	**0.7**	**1.1**	**1.2**	**0.9**
1976—1980	**1.1**	**0.8**	**0.8**	**0.8**	**1.0**	**1.2**
1986—1990	**1.2**	**0.8**	**0.8**	**0.7**	**0.9**	**1.2**
1997—2000	**1.2**	**1.0**	**0.7**	**0.7**	**0.8**	**1.4**
Milk yield per cow						
1960	**0.9**	**0.8**	**0.9**	**1.2**	**1.1**	**1.0**
1980	**1.1**	**0.8**	**0.8**	**0.9**	**0.9**	**1.1**
1990	**1.2**	**0.9**	**0.9**	**0.7**	**0.8**	**1.1**
2000	**1.2**	**1.1**	**0.6**	**0.8**	**0.8**	**1.4**
Share in oblast's milk production, %						
1960	**7.6**	**2.4**	**2.7**	**7.7**	**5.8**	**4.5**
1981—1985	**9.8**	**3.0**	**3.5**	**6.4**	**4.8**	**3.6**
2000	**9.9**	**4.3**	**1.3**	**3.9**	**3.2**	**6.2**
Share of rural population, %						
1959	**5.6**	**4.2**	**3.8**	**6.1**	**4.1**	**3.8**
1990	**8.5**	**4.4**	**2.6**	**4.1**	**3.5**	**5.1**
2000	**9.6**	**4.1**	**2.9**	**4.0**	**2.5**	**4.9**

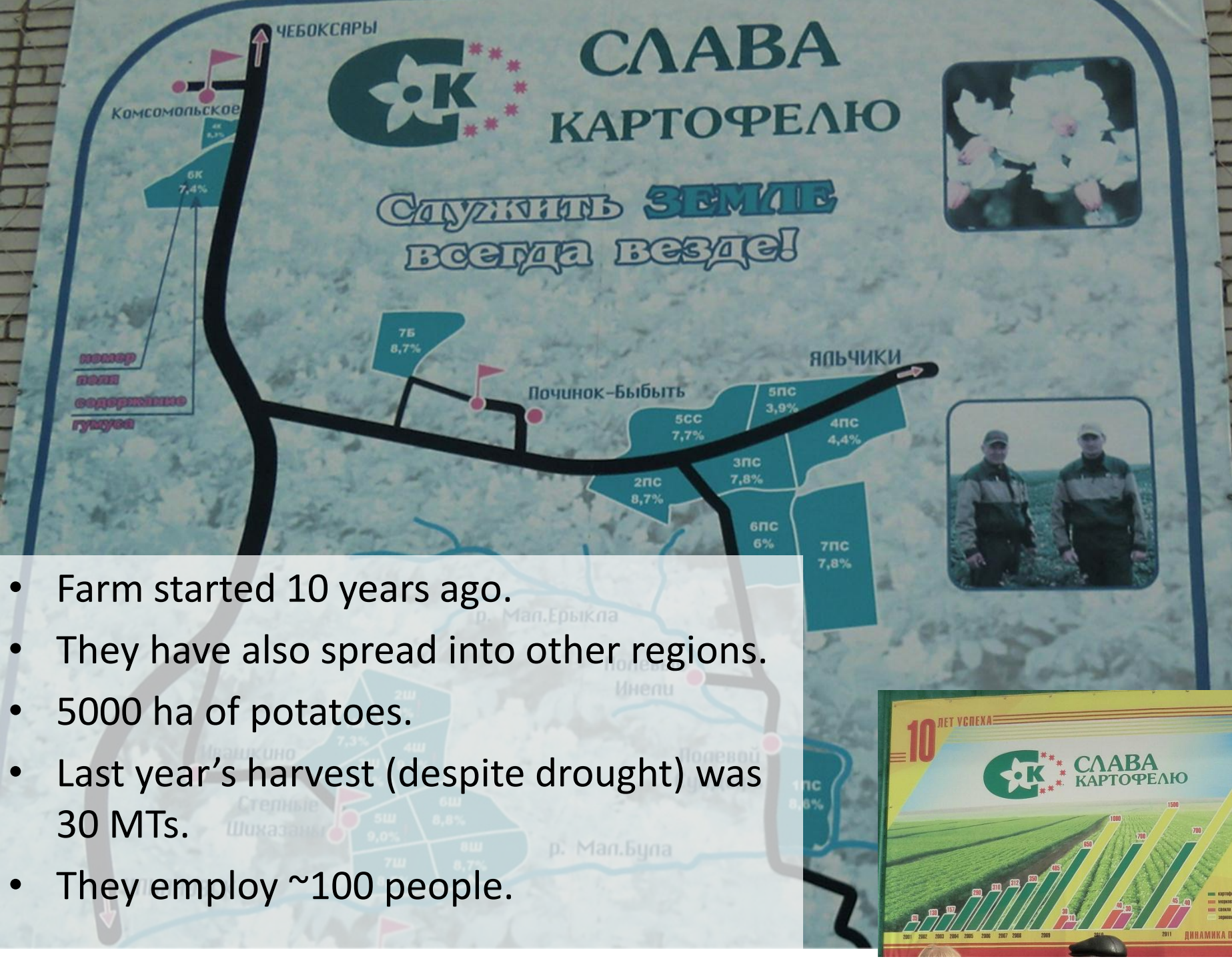


Milk production
(proportion of contribution to Republic)
from 1960 to 2010



Tatar owners, established in 2007 based on an old collective farm bought in an auction that they greatly remodeled.

- Mother company is in Tatarstan (13,000ha).
- The owner invested 1 billion rubles (~ $30 million).
- Sale: 2000 - 2500 pigs per week.
- Most of their work is automated → 100 employees.
- They also grow 500 hectares of winter grains (since 2011). In the near future they aim to grow another 1500 hectares.



- Farm started 10 years ago.
- They have also spread into other regions.
- 5000 ha of potatoes.
- Last year's harvest (despite drought) was 30 MTs.
- They employ ~100 people.

Agriculture in Alatyr rayon – Mordovian agricultural firm

<u>Cultivated Area</u>

1990 – 41k ha

2004 – 0 ha

2010 – 22k ha

of the currently cultivated area

16k ha – new agricultural firm

Thank you!