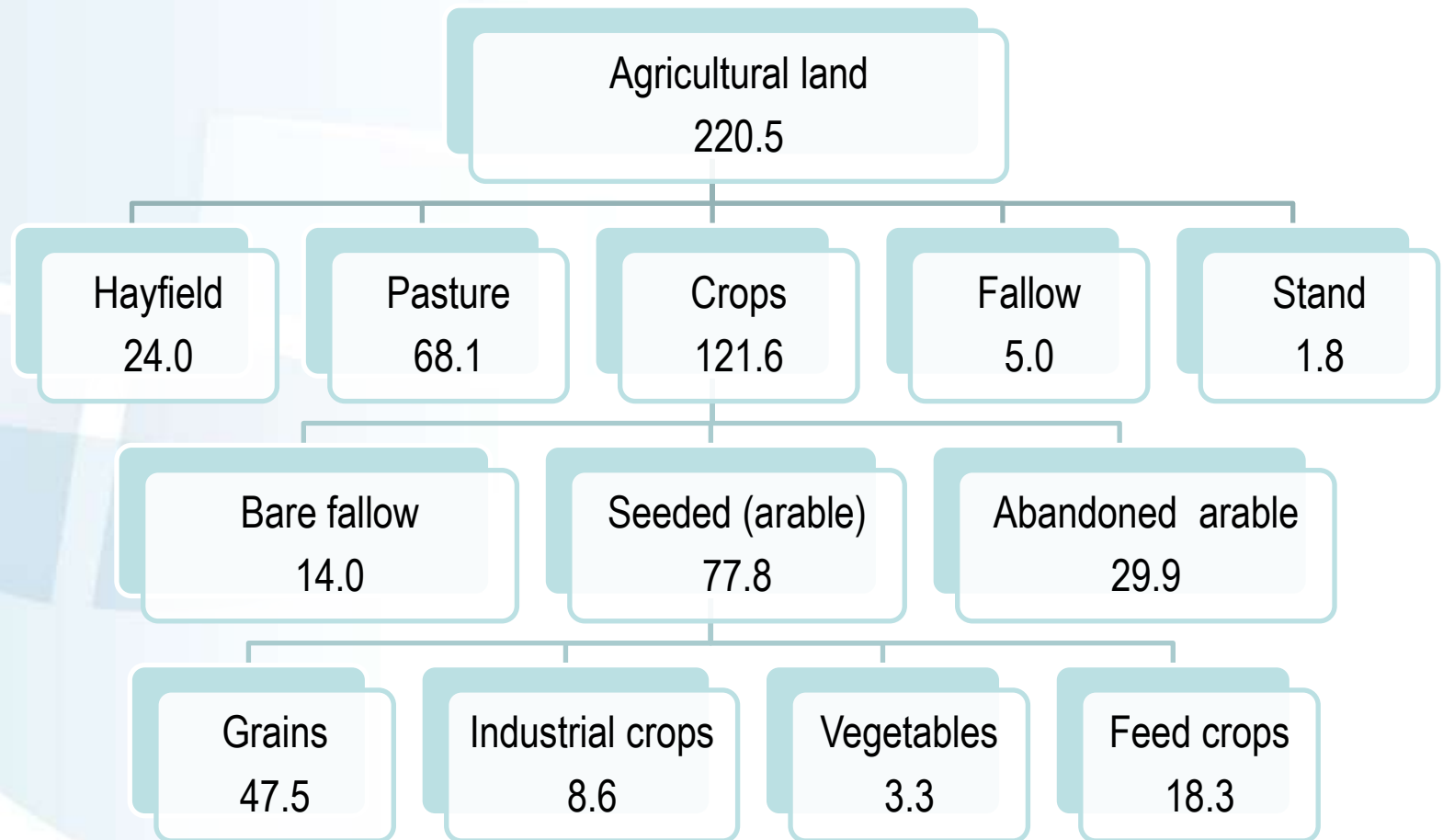


Carbon balance of Russian agricultural land

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Agricultural land use structure in 2009, 10⁶ ha



Source:

1. State (national) report on land use in Russian Federation in 2009

2. GosComStat 2012: <http://www.gks.ru/dbscripts/cbsd/dbinet.cgi?pl=1434002>

Land cover of Russia 2009

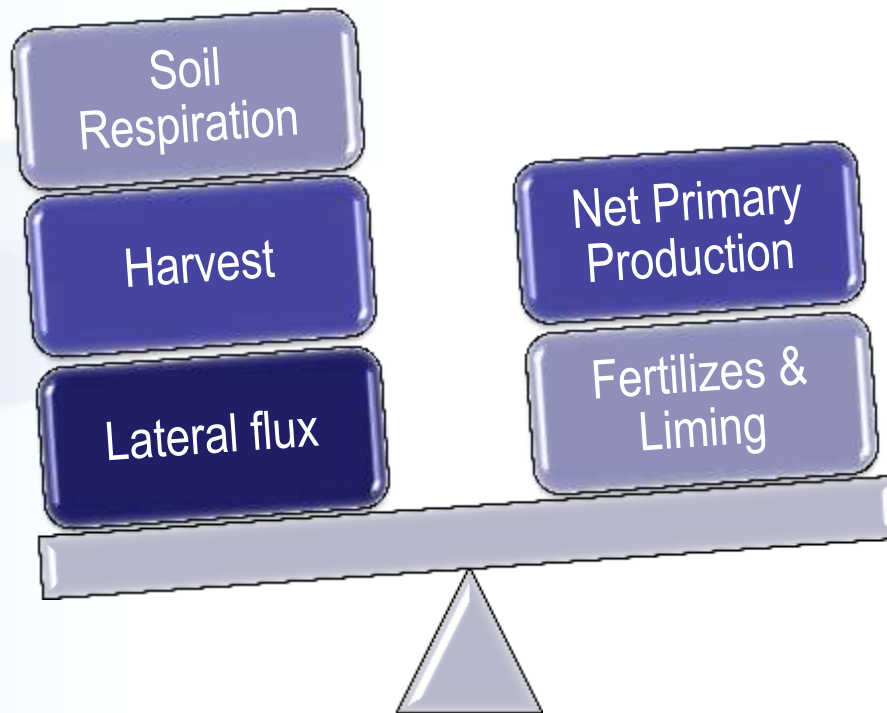
(Schepaschenko et al., 2011)



Carbon balance

Source

Sink



Harvest 2009

Crop	Area, 10 ⁶ ha	Harvested, t C ha ⁻¹	10 ⁶ t C
Grains	47.54	2.88	136.87
Industrial	8.64	0.91	7.89
Vegetables	3.32	1.05	3.50
Feed crops	18.28	0.73	13.31
Bare fallow	13.97		
Total arable	91.75	1.76	161.57
Abandoned	34.90		
Hayfield	24.00	0.75	18.02
Pasture	68.05	0.62	42.19
Total	218.70	1.01	221.78

Source: Russian Federal State Statistics Service (<http://www.gks.ru>)

Net Primary Production

- NPP was estimated via harvest and set of regression models (Rodin, 1998; Levin, 1977; Romanovskaya et al., 2002).

$$\text{NPP} = \text{Harvest} + \text{Residuals} + \text{Loses}$$

- Average NPP for agricultural land was estimated at $437 \text{ g C m}^{-2} \text{ yr}^{-1}$ ($526 \text{ g C m}^{-2} \text{ yr}^{-1}$ for crops).

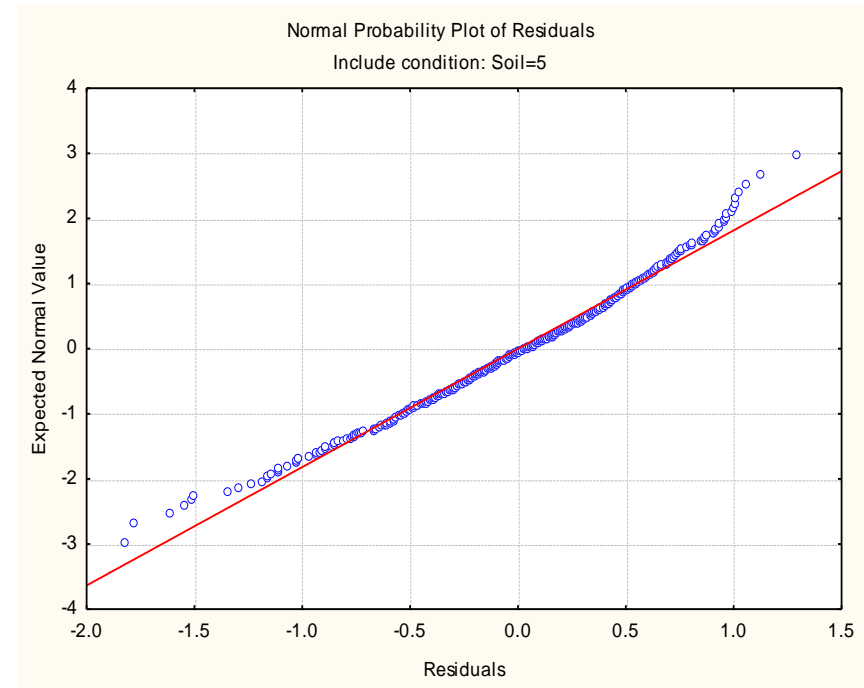
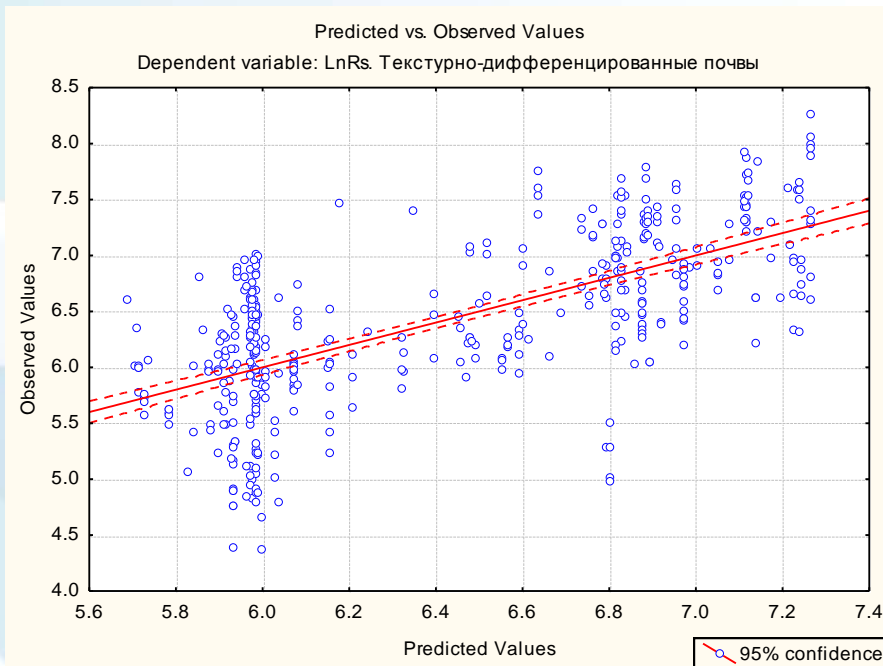
Soil respiration (SR) assessment

Soil respiration was calculated by a model by Mukhortova, Schepaschenko, Shvidenko, et. al., 1011:

- Regression models of total SR dependent upon climatic parameters and soil type (3592 measurements from 1109 studies)
- Regional, vegetation type, land use and disturbances corrections of the models
- Regression model of root contribution to the total SR dependent upon climate and vegetation/ land use type.

Average SR of agricultural land is $344 \text{ g C m}^{-2}\text{yr}^{-1}$
($372 \text{ g C m}^{-2}\text{yr}^{-1}$ for the cropland)

Soil respiration regression model for Texture-differentiated soil



$$\ln(\text{SR}) = C_0 + C_1 * T_{\text{av}} + C_2 * P_{\text{av}} + C_3 * (D_0) + C_4 * (\text{SUM}_T5) + C_5 * (\text{HTC}_5) + C_6 * (\text{HTC}_{10})$$

$R^2 = 0.45, p < 0.01, N = 454$

A map of Heterotrophic Soil Respiration, $\text{g C m}^{-2} \text{ yr}^{-1}$



Other carbon fluxes

We applied the IPCC method (National inventory, 2010; IPCC, 2006) for fertilizer and lateral fluxes assessment

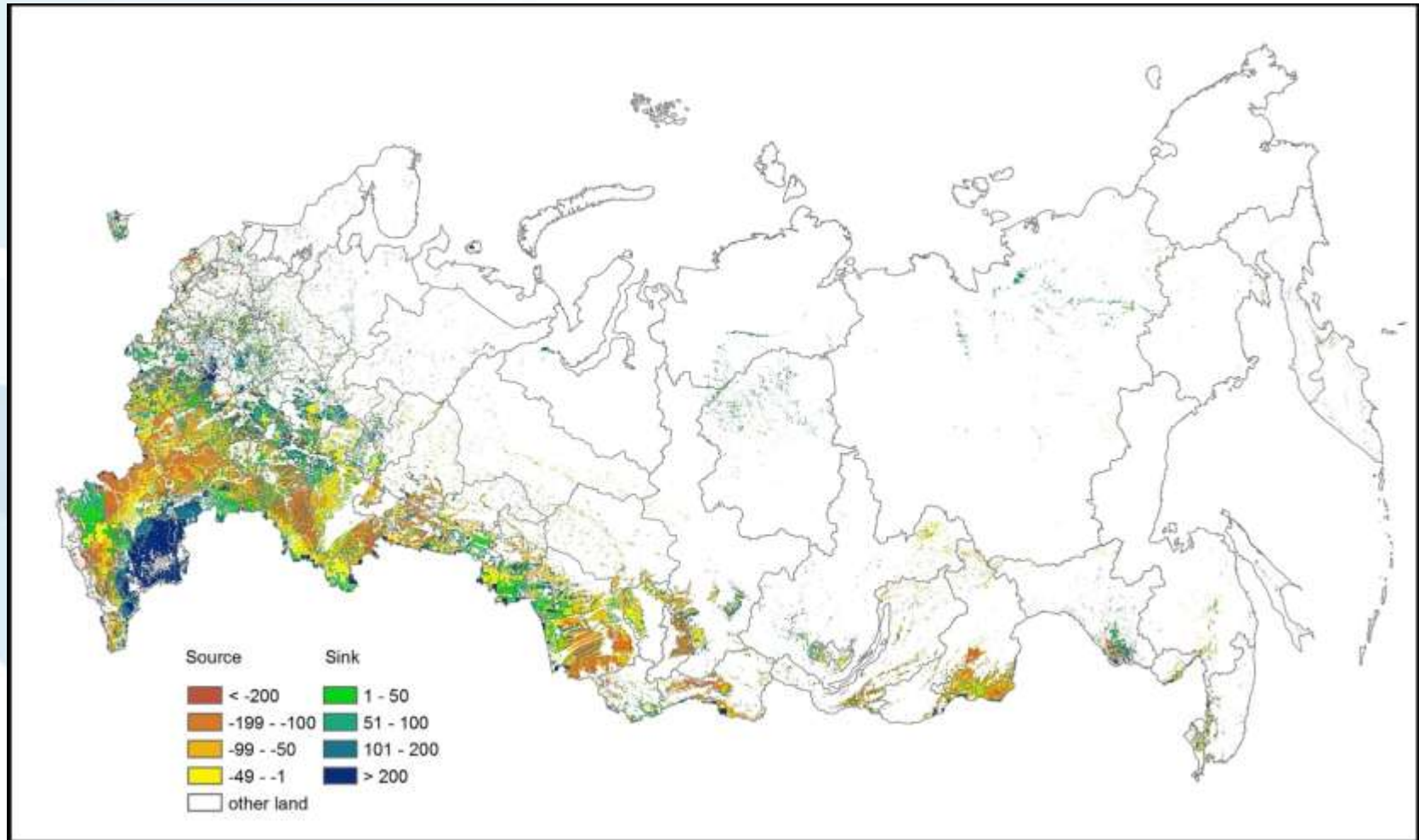
- Fertilizer + liming contribute $160 \text{ kg C ha}^{-1}\text{yr}^{-1}$ for arable land in average
- Lateral flux is estimated as $30 \text{ kg C ha}^{-1}\text{yr}^{-1}$ for agricultural land in average

Carbon Balance in 2009

Crop	Area, 10 ⁶ ha	Balance, 10 ⁶ t C yr ⁻¹	t C ha ⁻¹ yr ⁻¹
Grains	47.54	-5.83	-0.12
Industrial	8.64	-14.17	-1.64
Vegetables	3.32	-5.55	-1.67
Feed crops	18.28	1.24	0.07
Bare fallow	13.97	-48.97	-3.50
Total arable	91.75	-73.28	-0.80
Abandoned	34.90	41.76	1.20
Hayfield	24.00	12.44	0.52
Pasture	68.05	14.12	0.21
Total	218.70	-4.97	-0.02

Agricultural Land Carbon Balance

base on land cover map 2009 (Schepaschenko et al., 2011)



Comparison to UNFCCC national inventory report, t C ha⁻¹yr⁻¹

Our average estimation for agricultural land is **-0.02** t C ha⁻¹yr⁻¹ vs. **+0.04** by NIR UNFCCC

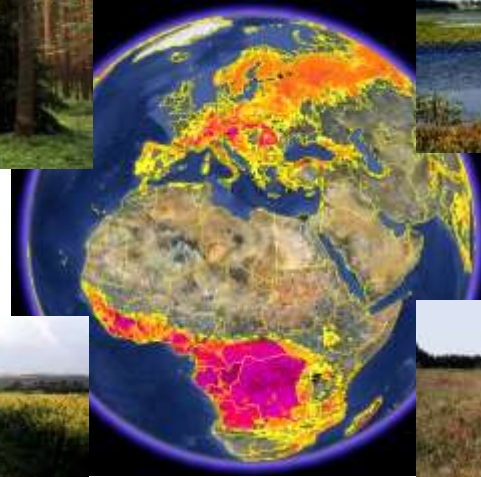
Fluxes	Arable land		Hayfield/Pasture	
	Our estimation	NIR UNFCCC ¹	Our estimation	NIR UNFCCC ¹
Crop residuals	2.70	1.37	3.41	3.20
Fertilizer	0.17	0.11	0.05	0.08
Soil Respiration	-3.64	-1.60	-3.15	-3.03
Lateral flux	-0.03	-0.02	-0.03	-0.02
Balance	-0.80	-0.14	0.29	0.22

¹ United Nations Framework Convention on Climate Change.

National Inventory Report

http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions

Thank you for your attention



More information:

www.iiasa.ac.at/Research/FOR/hlc/

www.Russia.Geo-Wiki.org