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Recent Decrease of Carbon Sink to Russian Forests

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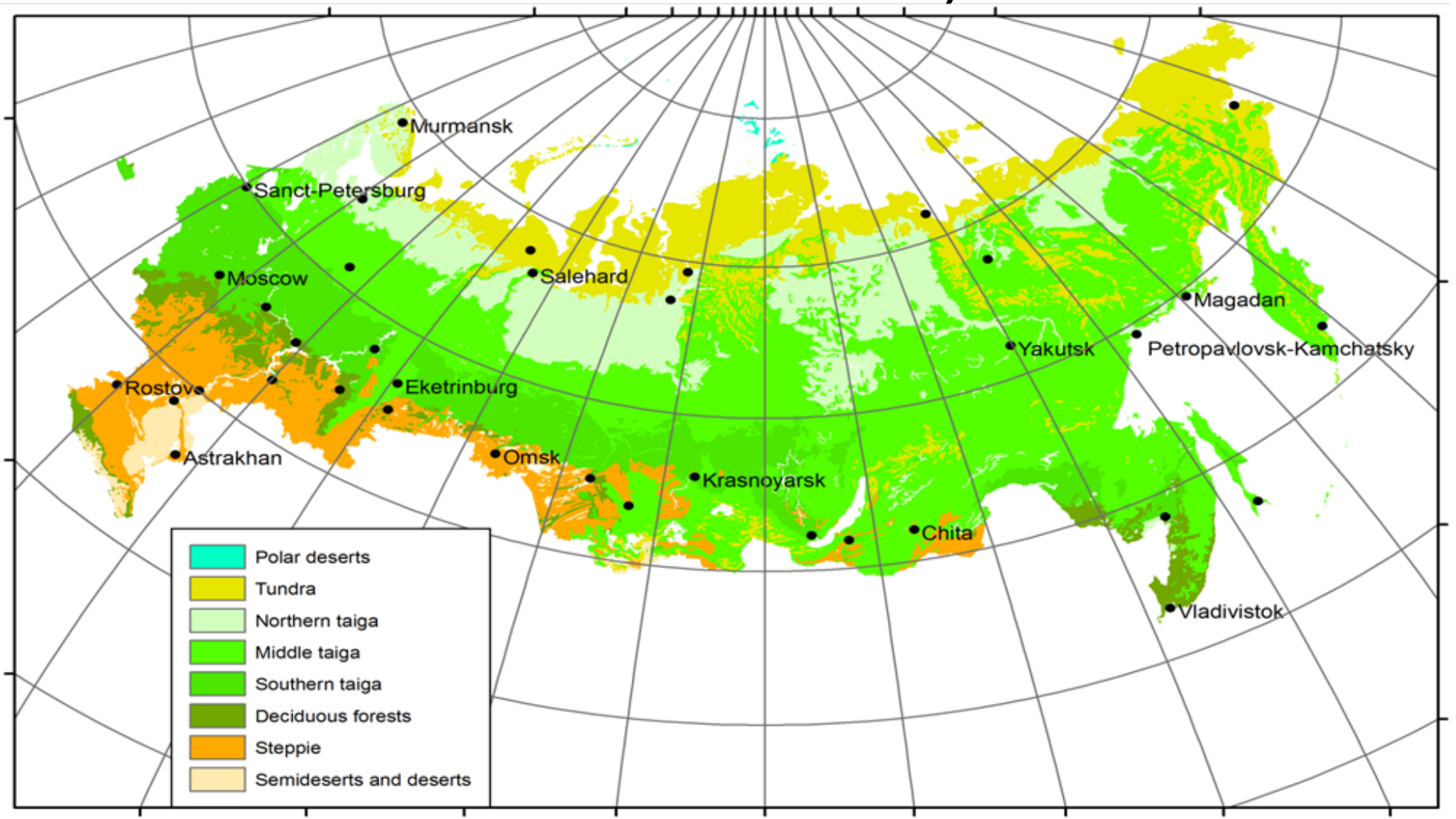
Forested area of Russia is 787 Mha (46.3 % of national area)



Approach to Russian forest GHG inventory

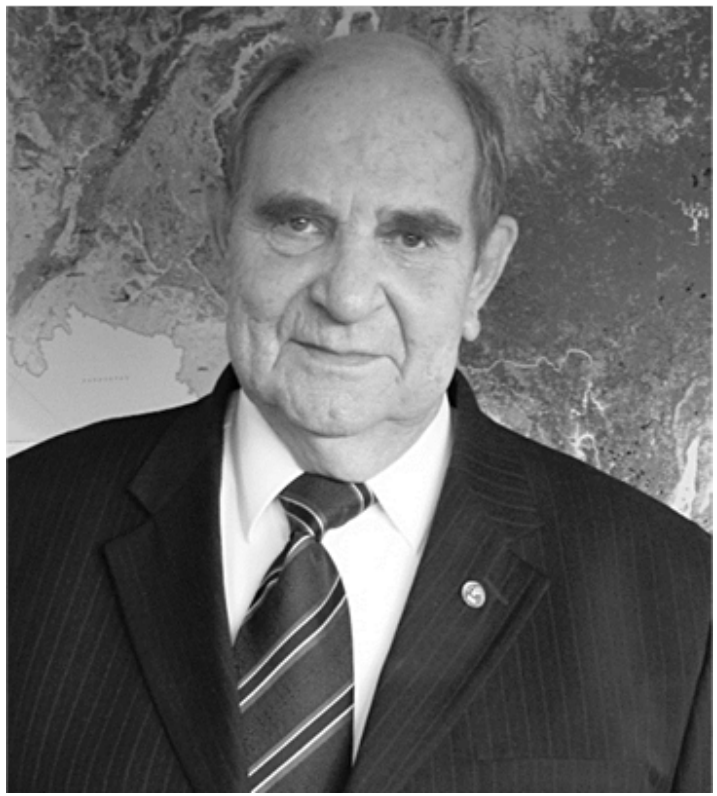
- Traditional forest inventory produces whole-country survey «State Forest Registry» (before 2006 «State Forest Fund Account»)
- SFR databases are used as sources of initial information for GHG accounting.
- The system of calculations has name «ROBUL» (regional estimation of forest carbon budget).

State Forest Registry

- presents compilations of ground forest inventory (accessible forest, 61% of total area) and remote inventory (low accessible forest, 39% of total area) data.
- contains information about area and growing stock of forests in differentiation by dominant tree species, age group, type of forest use.
- contains information about temporary non-forested lands: clear cuts, burnt areas, dead stands etc.
- exists as databases for 1988, 1993, 1998-2008 (as State Forest Fund Account) and 2009-2017.

Base for developing of ROBUL

- Scientific activity of Center of ecology and productivity of forests of RAS, initiated in 1993 by academician A.S. Isaev
- IPCC Good Practice Guidance for LULUCF, 2003.
- Recommendations of UNFCC experts during in-country reviews in 2009 and 2010.



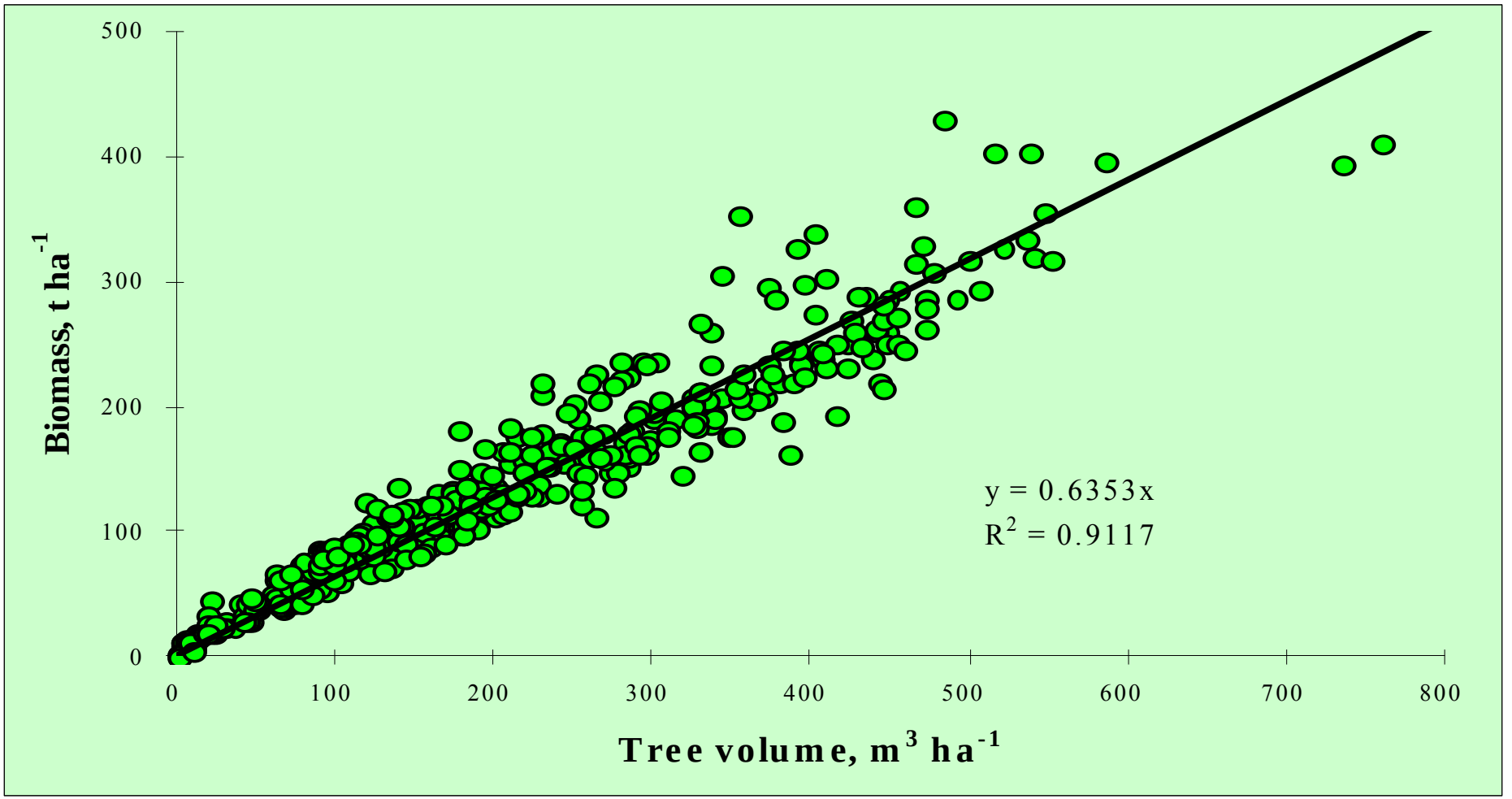
Academician Alexander Isaev

(1931-2018)

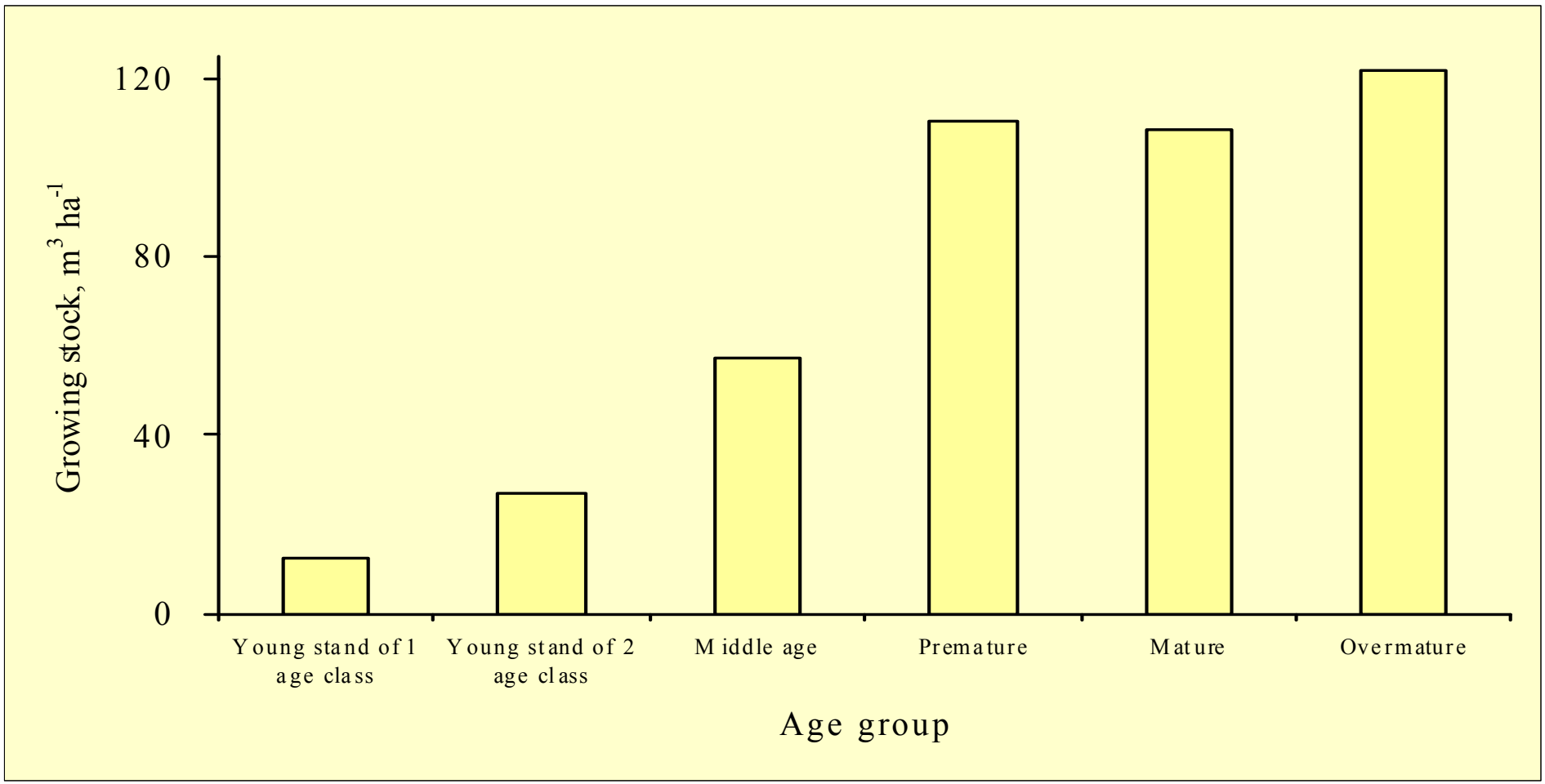
Main features of ROBUL system

- Estimation of carbon pools is performed for biomass, dead wood, litter and soil pools.
- Estimation of carbon in biomass and dead wood is performed using country-specific conversion factors.
- Estimation of carbon pools in litter and soil is performed using mean values per unit of area.
- Estimation of sequestration is performed on the base of carbon pool dynamics in consequent age groups.
- Estimation of carbon losses (felling, fires, insects, extreme weather events) is performed using information of clear cut, burnt and dead stand areas.

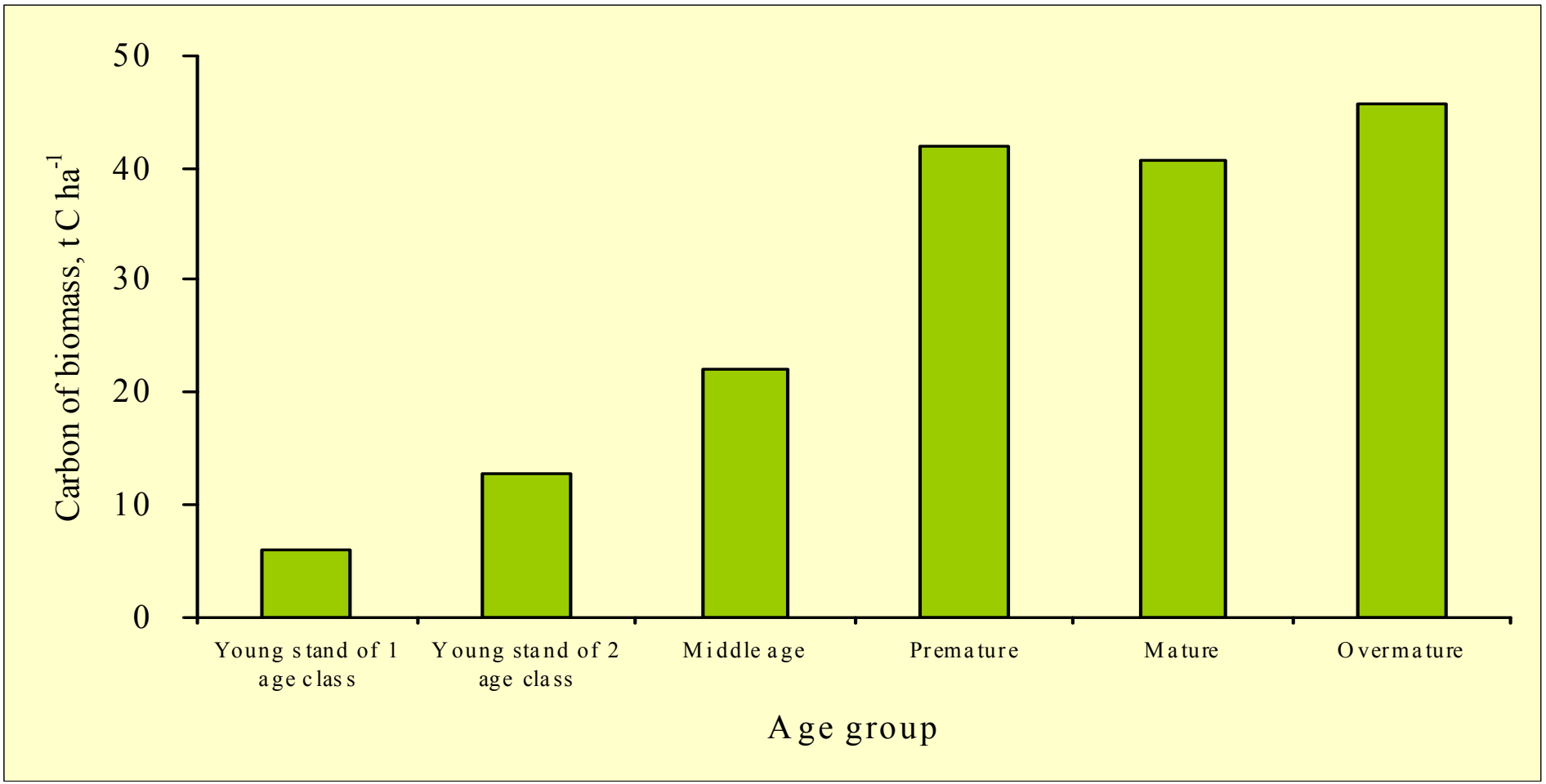
Biomass in relation with growing stock for pine stands



Example of age dynamics of growing stocks (spruce stands of Komi Republic)



Example of age dynamics of biomass carbon (spruce stands of Komi Republic)



Main approach to estimate losses

- Initial information:

  (1) SFR data on clear cuts, burnt and dead stands areas;

  (2) Reforestation periods for these areas (mainly from 3 to 15 years) .
- Mean disturbance rates is calculated as (1)/(2).
- Carbon losses are estimated using mean disturbance rates and mean carbon pools in forests of the region

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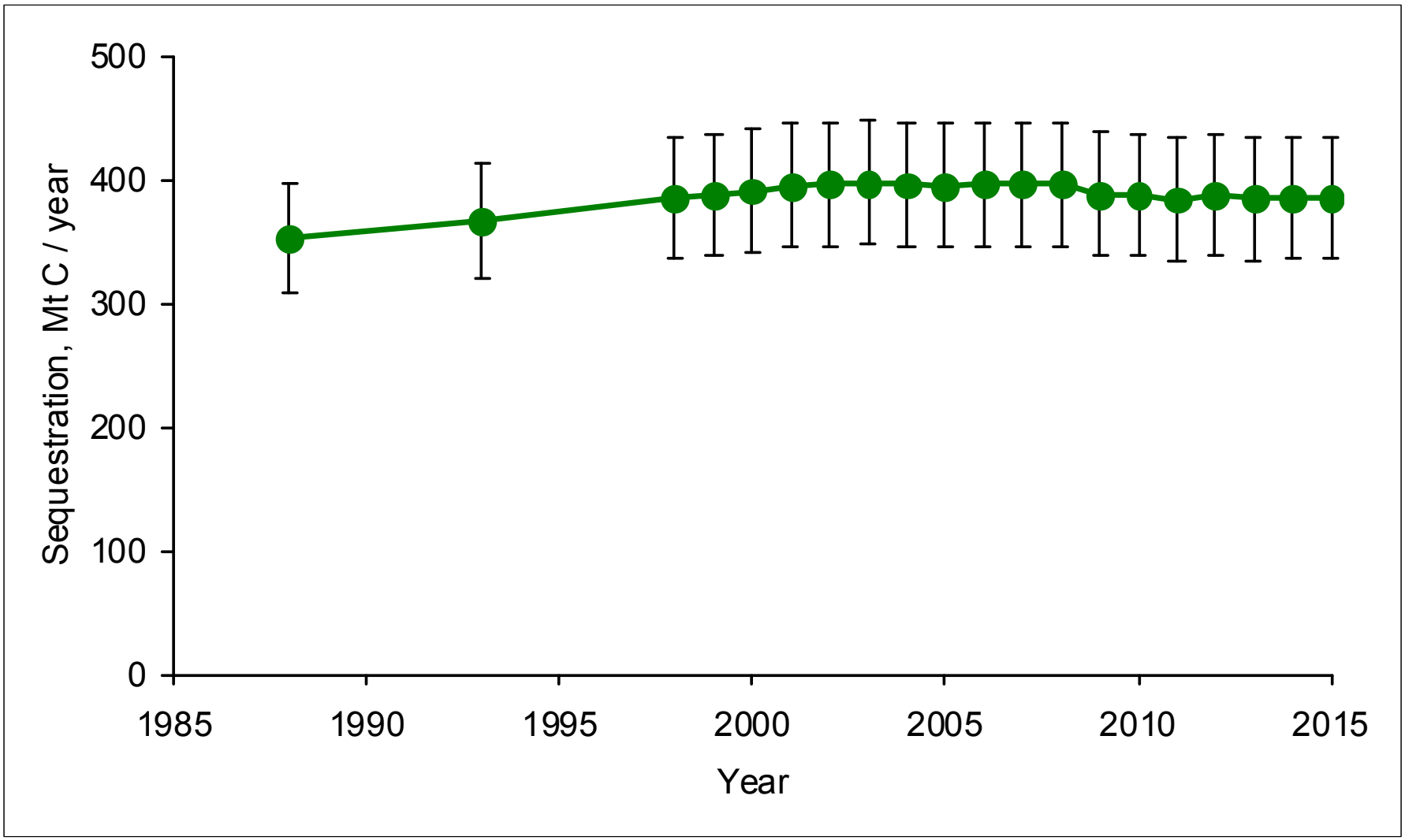
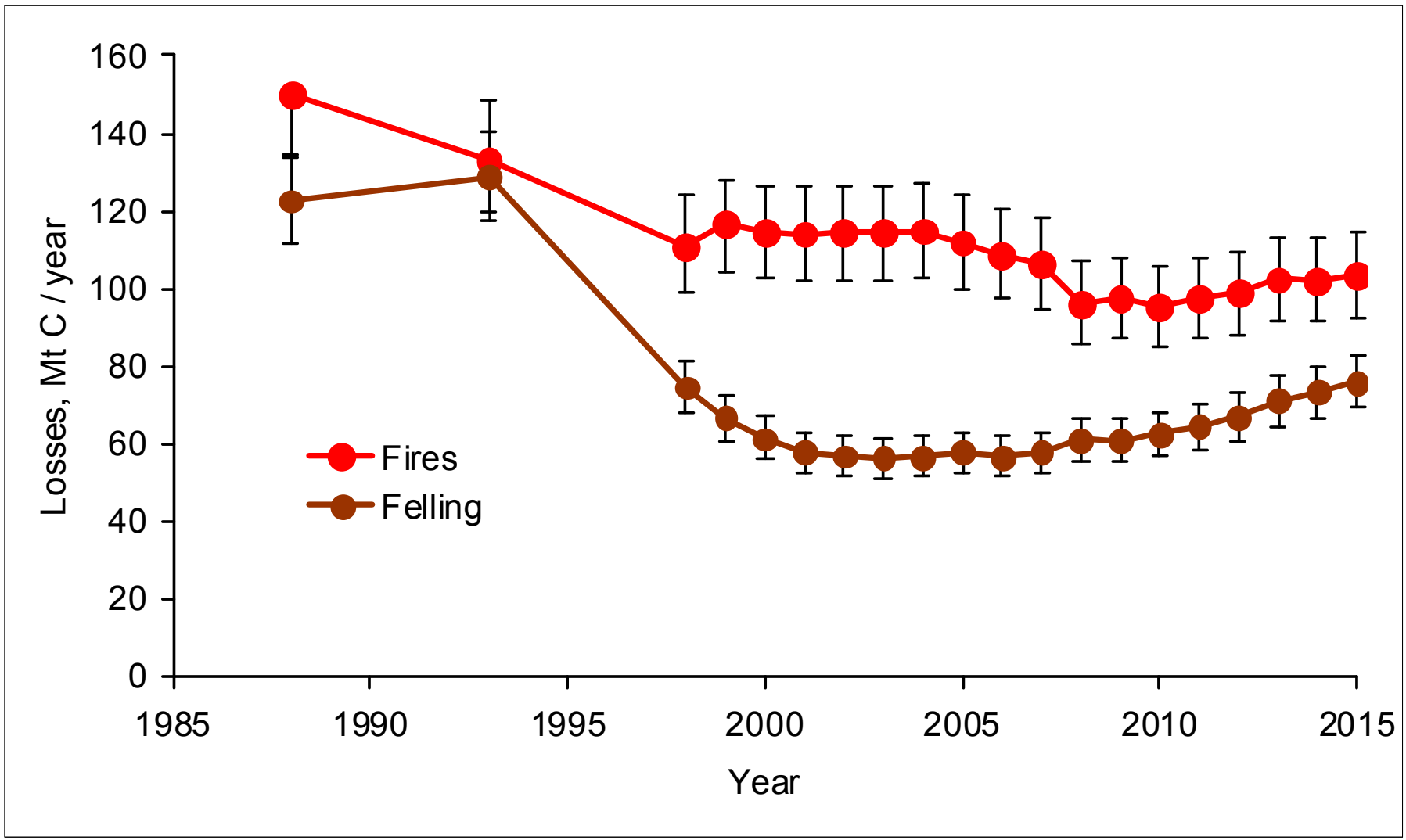
Approach to estimate uncertainties

- Base for estimation – standard errors (68% confident intervals) of parameters (conversion factors and mean values).
- In ROBUL equations parameters are replaced by uncertainties of parameters.
- In ROBUL equations differences are replaced by sums follow rules of uncertainties transformations.
- Uncertainties of area and growing stock values are suggested to be equal 0.

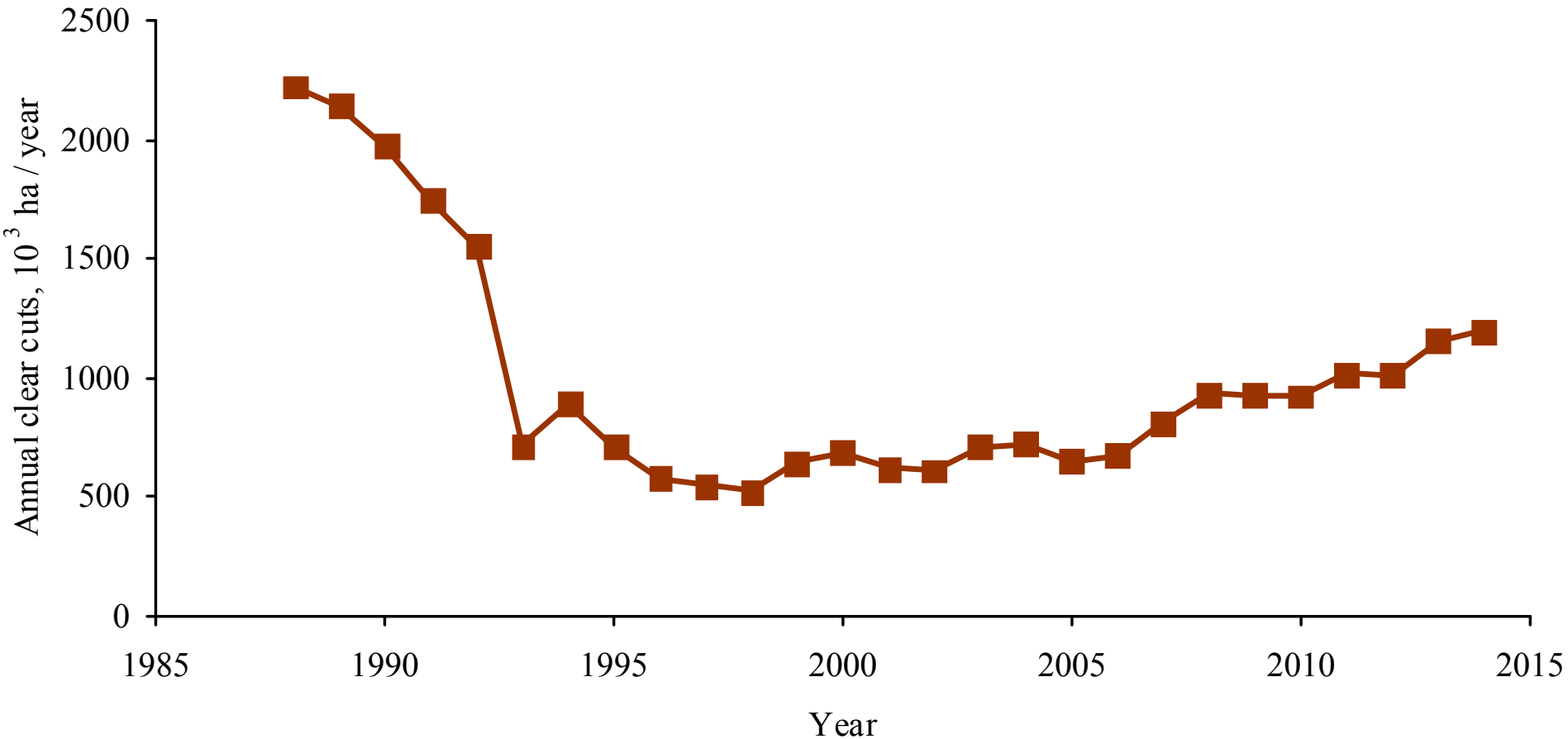
Carbon sequestration in Russian forests



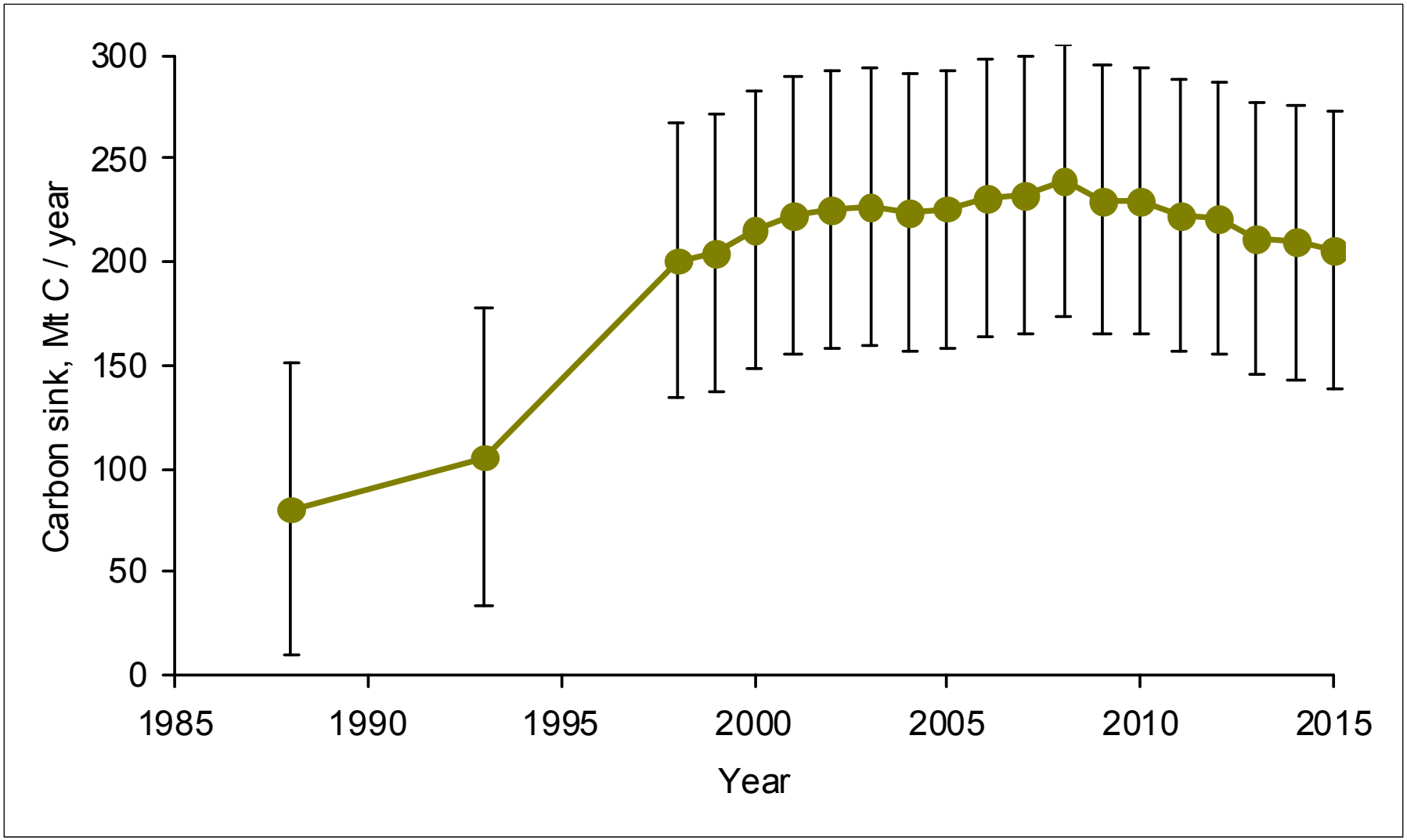
Carbon losses in Russian forests



Annual rates of clear felling by official statistics



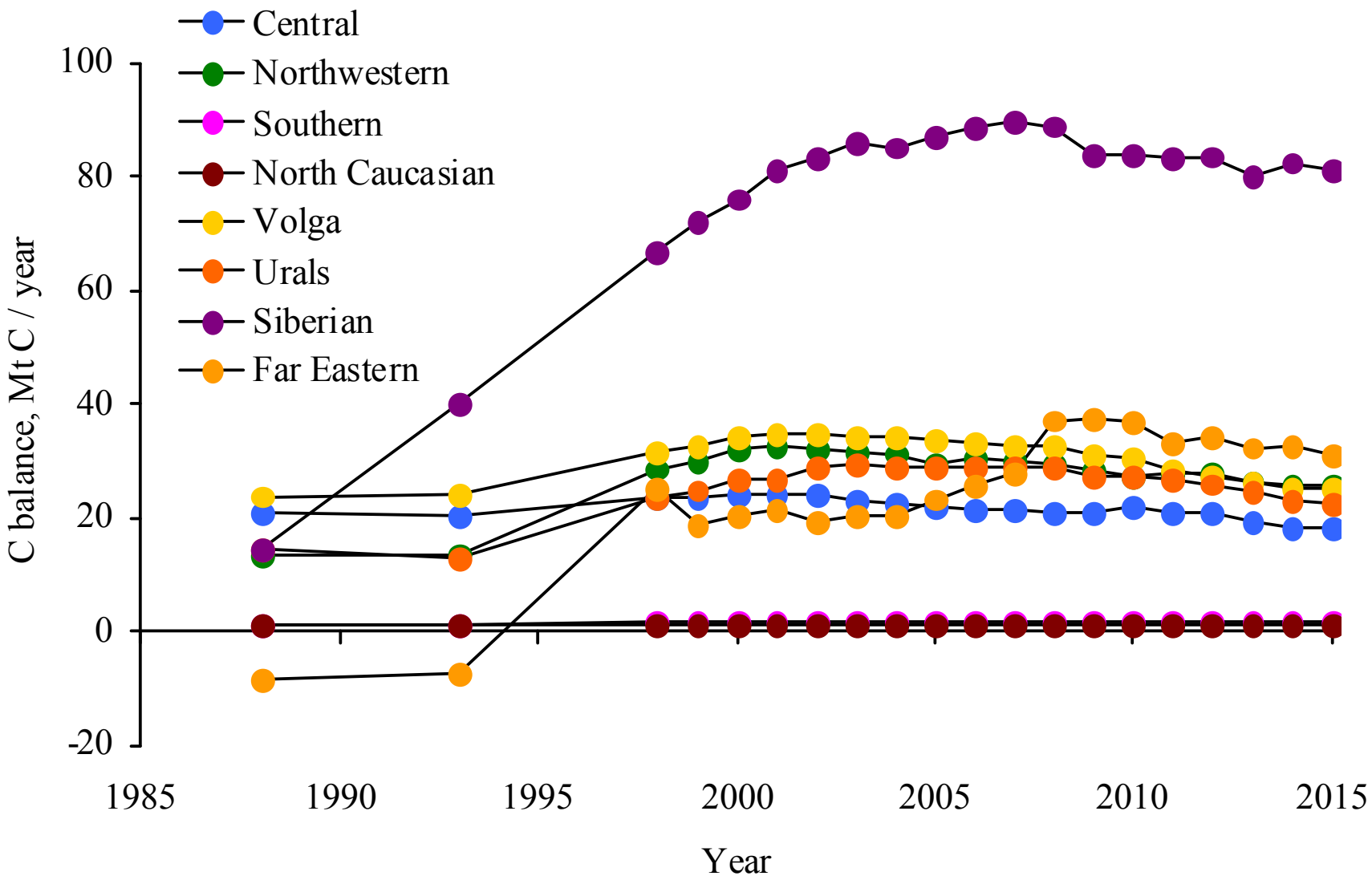
Carbon balance of Russian forests



Zamolodchikov et al., Doklady of sciences, 2017


MAP OF THE FEDERAL DISTRICTS OF RUSSIA
Northwestern Federal District
Central Federal District
Volga Federal District
Urals Federal District
Siberian Federal District
Far Eastern Federal District
Southern Federal District
North Caucasian Federal District

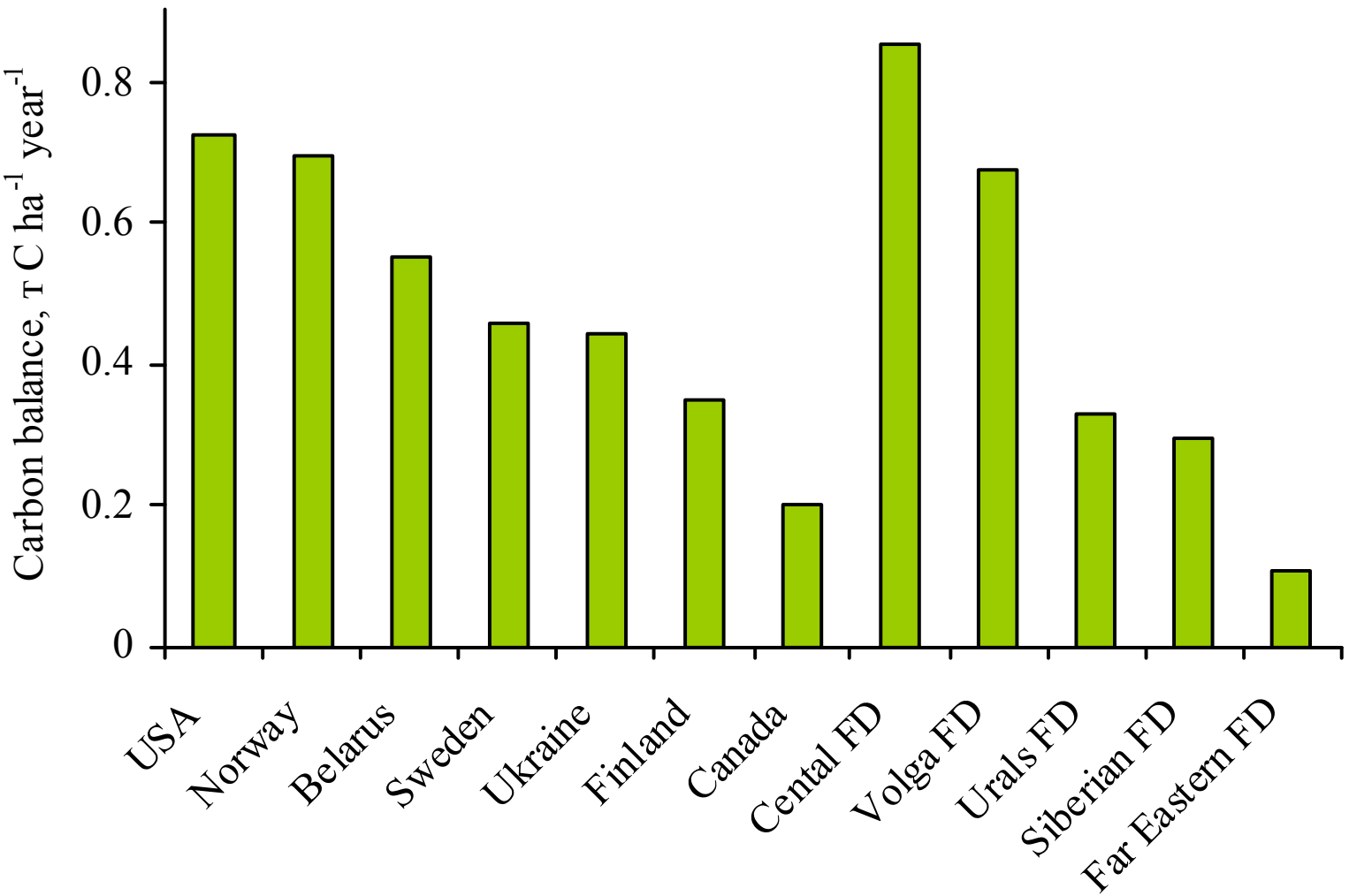
Carbon balance of forests of the federal districts of Russia



Some estimations of carbon sink to Russian forests

Carbon sink, Mt C / year	Tool of assessment	Источник
234±66	ROBUL system	Zamolodchikov et al., 2011, 2013, 2017
280	Estimation using remote sensing NDVI time series	Myneni et al., 2001, Dong et al., 2003
210	Geo-information system IIASA FOR	Nillson et al., 2000, Shvidenko, Nilsson, 2002
560±117 (±600)	Integral land information system (ILIS) IIASA	Shvidenko, Schepaschenko, 2014, Dolman et al., 2013
199 (total Russian area)	DGVM ensemble	Sitch et al., 2015

Comparison of forest sinks between different countries follow UNFCC reporting



Conclusions

- Russian forests were carbon sink from the atmosphere with annual rate 80 Mt C in late 1980th, 230 Mt C in 2000th and 210 Mt C in 2010th
- The recent decrease of carbon sink to Russian forests is explained mainly by increase of forest felling.

- **Focus of Research**

  The focus of research is the inventory of carbon balance of Russian forests. It is relevant to Climate change process through CO2 emissions and absorptions and to people through Paris Agreement.

- **Key Challenges**

  Key challenges are forest exploitation, forest fires and forest fire protection.

- **Suggestion to Address these Challenges**

  It is necessary to regulate forest exploitation, to introduce highly productive forest planting, to improve the system of forest fire protection in Russia.

Acknowledgments

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Thank you very much!
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