Bridging Mitigation and Adaptation: Thoughts on Combining Afforestation with Forest Fire Management and Bioenergy

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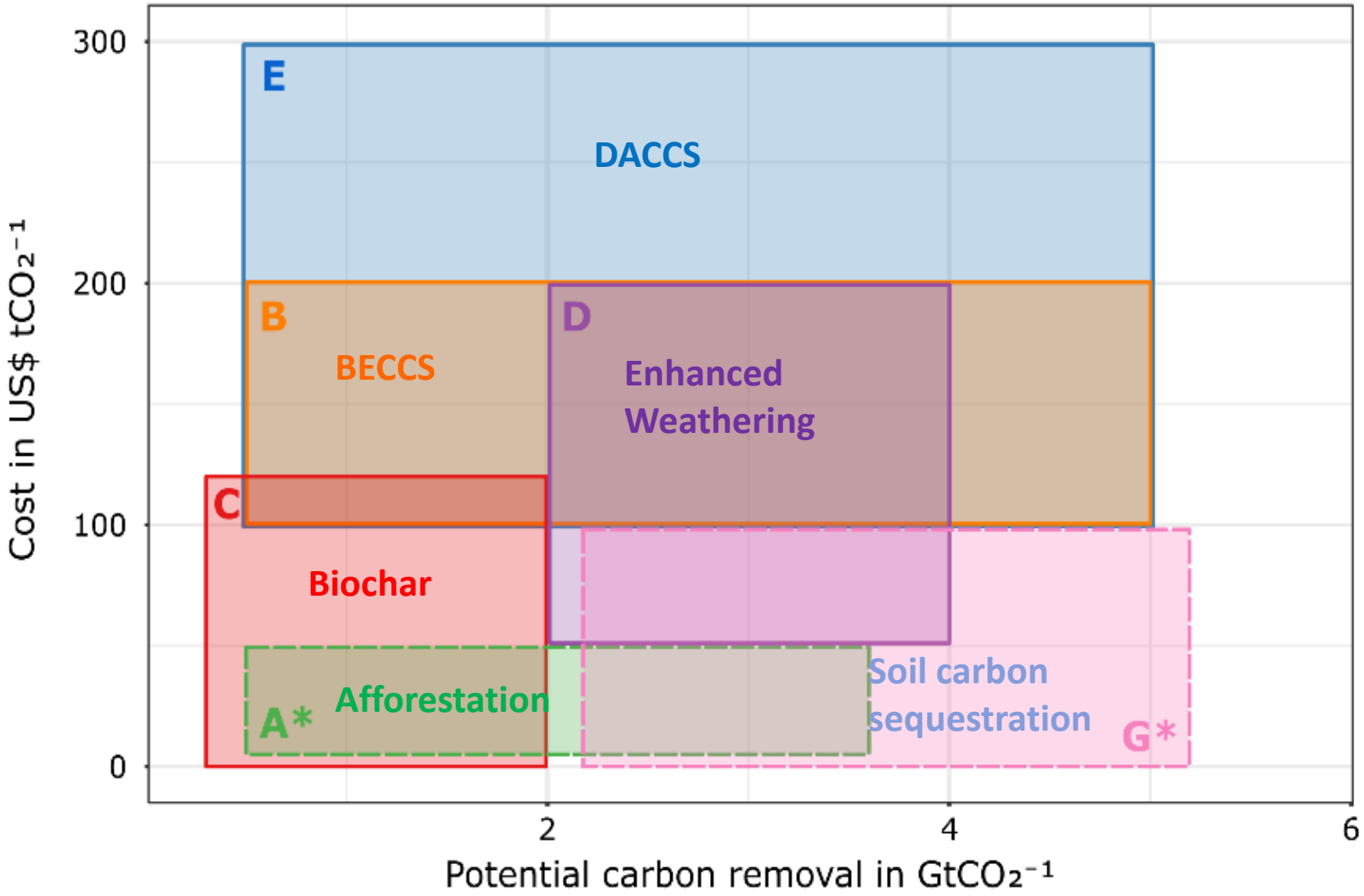
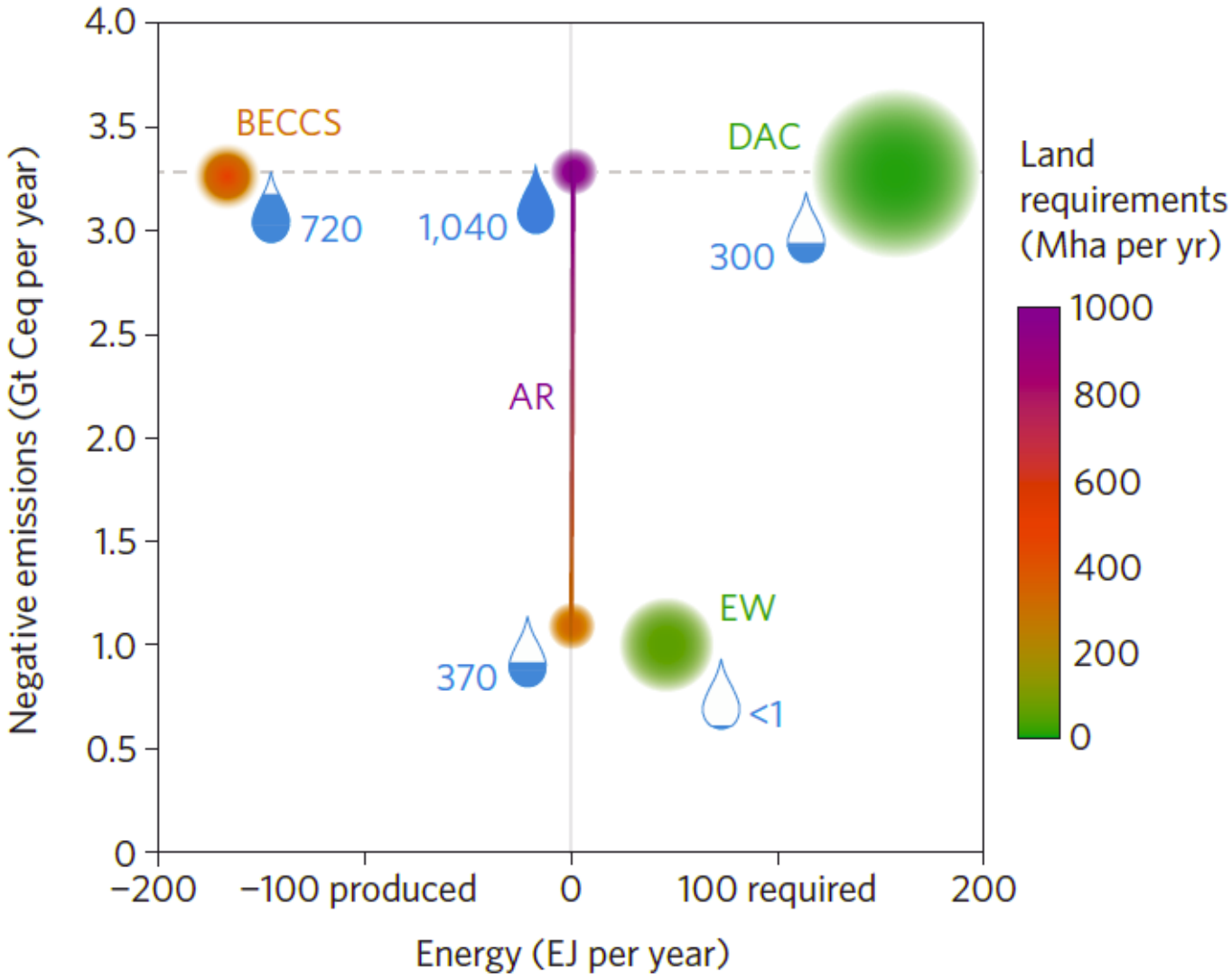
COSTS AND POTENTIALS OF NETS OPTIONS



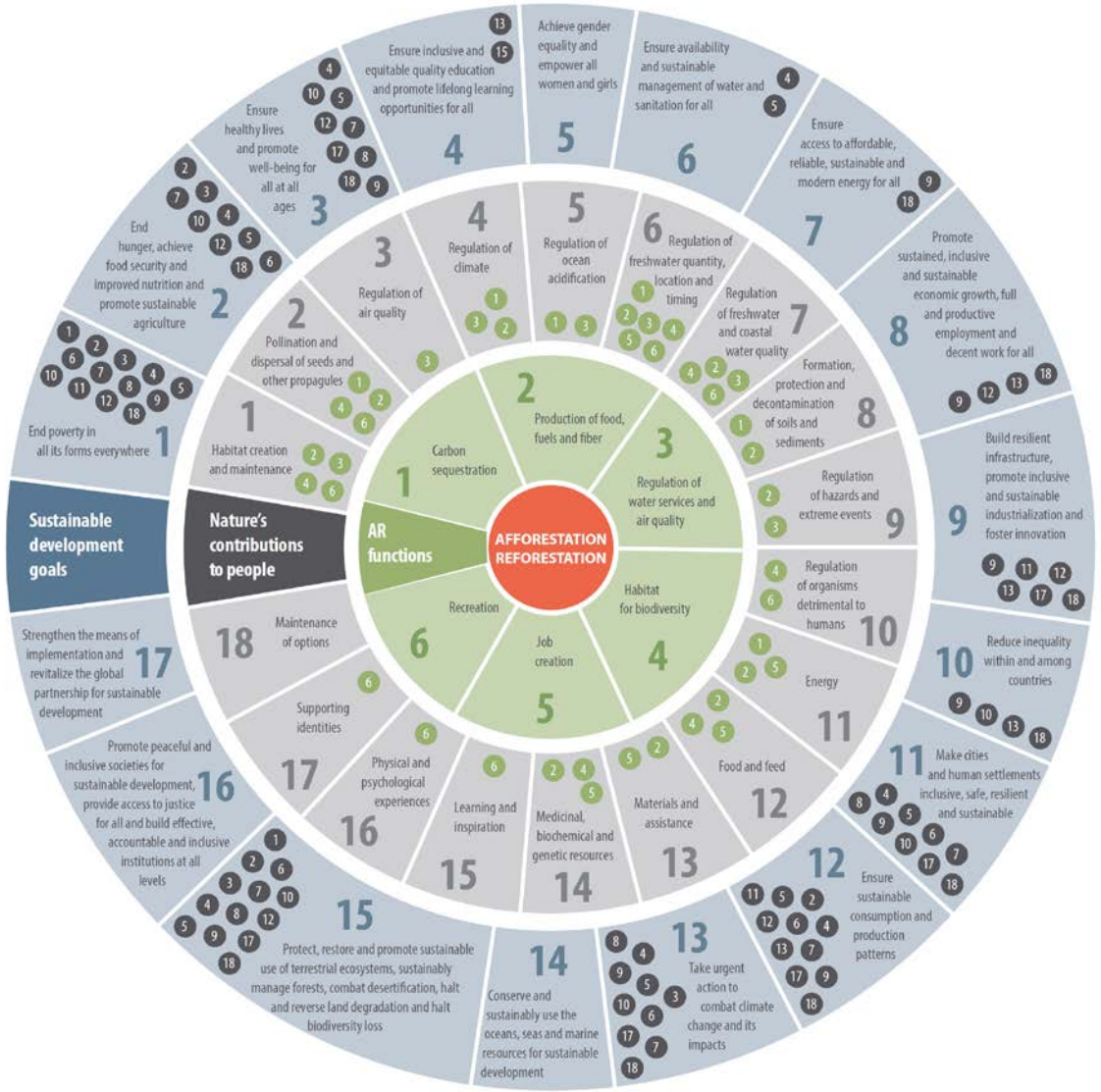
Source: Fuss et al. (2018), Minx et al. (2018), Environmental Research Letters

ECONOMIC AND BIOPHYSICAL LIMITS OF NETS



Source: Smith et al. 2016, Nature Climate Change

LAND-BASED NETS – A/R/R NCP/SDG



Looking at the functions of A/R/R - center circle
carbon sequestration, food production, regulation of air/water quality, habitat, jobs, recreation)

Looking at Nature's Contributions to People (NCPs) – inner circle
Habitat, pollination, climate regulation, ocean acidification, freshwater quantity and quality, protection of soils, hazard regulation, energy, food and feed, materials, medicine, …

Looking at Sustainable Development Goals (SDGs) – outer circle
Poverty, hunger, healthiness, education, equality, water, energy, economy, infrastructure, countries, cities, consumption, …

Afforestation, reforestation Restoration

Source: Smith et al., 2019

→ LOOK A BIT CLOSER INTO AFFORESTATION & REFORESTATION

Big research questions of this ongoing work:

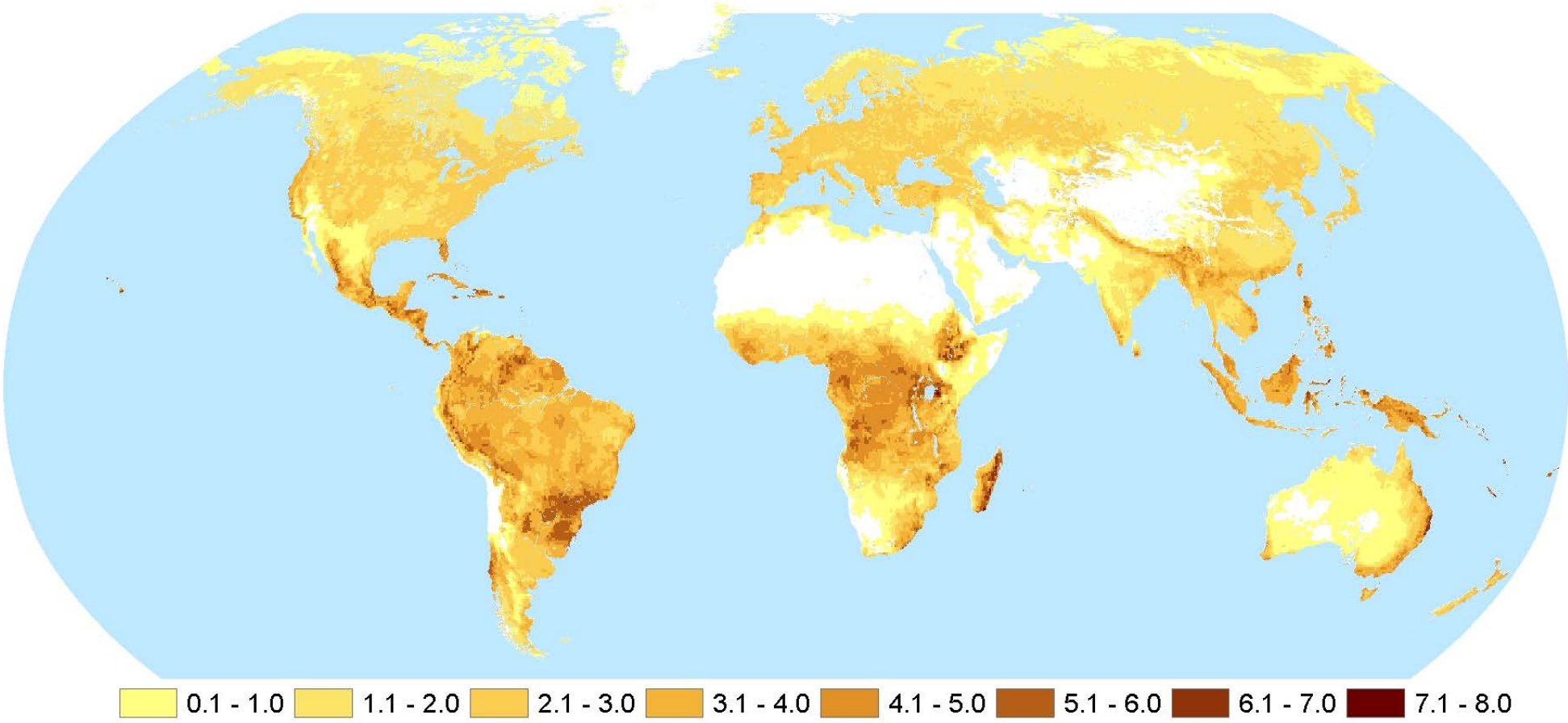
Where is the area that we can use for A/R?

Can we reach the demand indicated earlier?

What could be an appropriate approach/methodology?

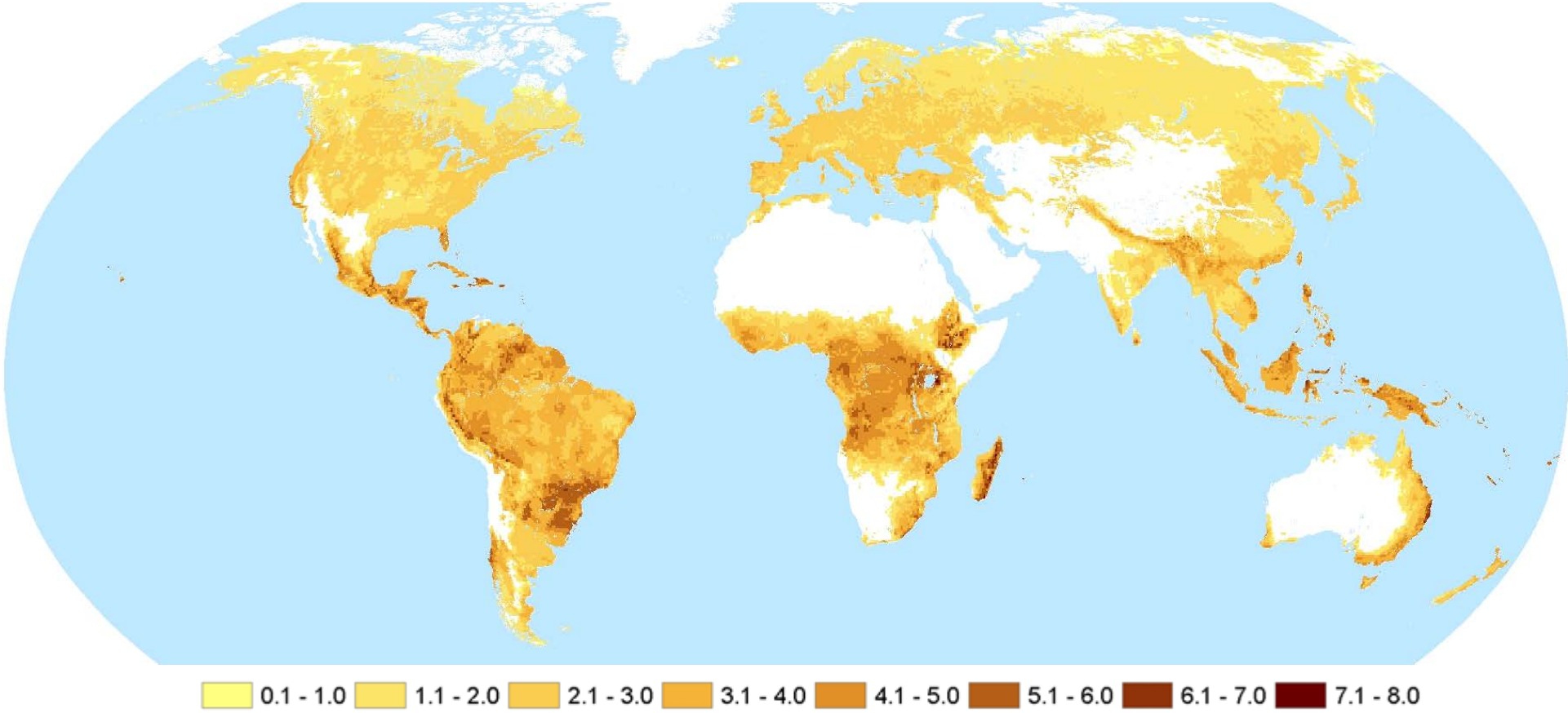
- Globally
- The Mid-Latitude Region
- In Eurasia
-
-

INCREMENT [M^3/HA/Y] OF POTENTIAL FOREST COVER UNDER CURRENT CLIMATE (G4M ESTIMATION)



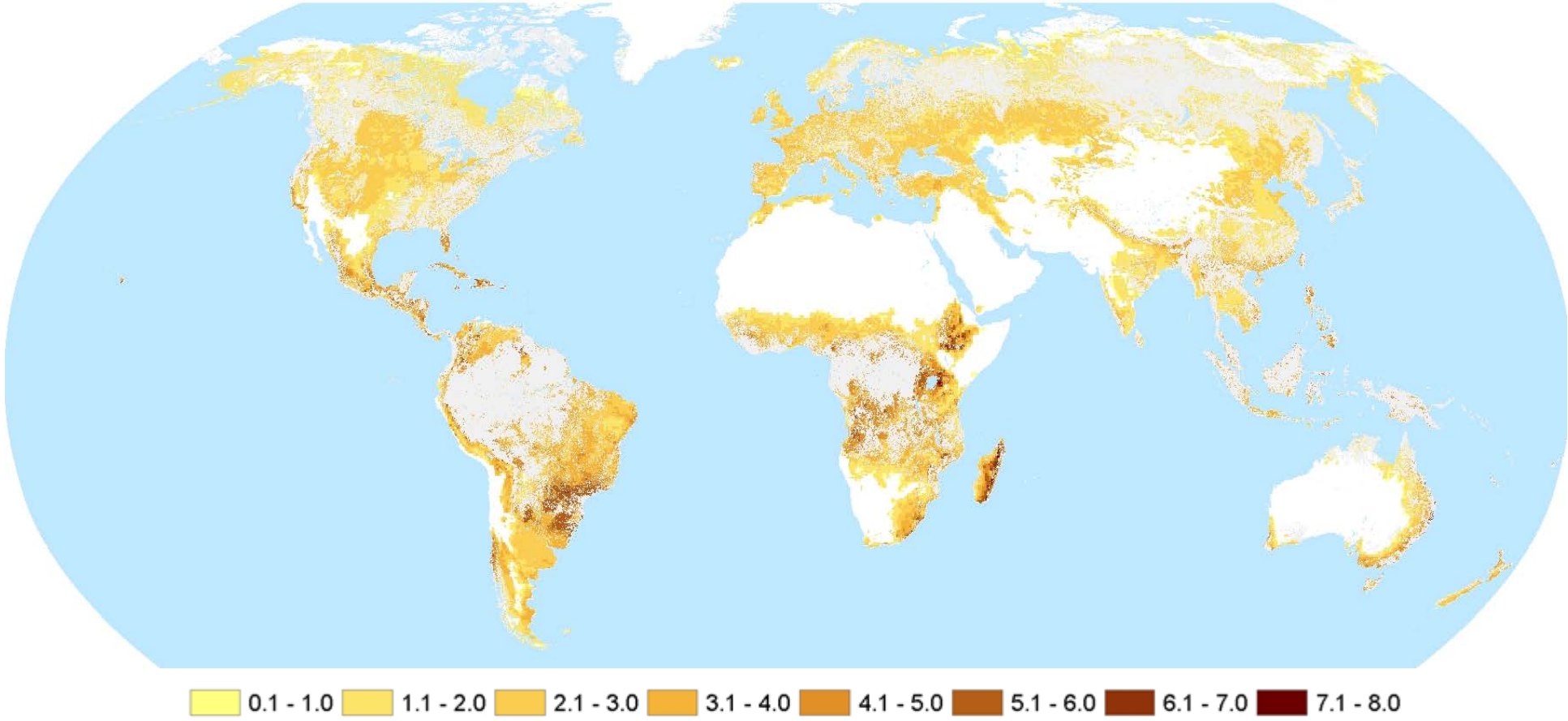
Source: Shchepashchenko et al., 2019

AREA WITH INCREMENT ABOVE 1 M^3 HA^{-1} YR^{-1}



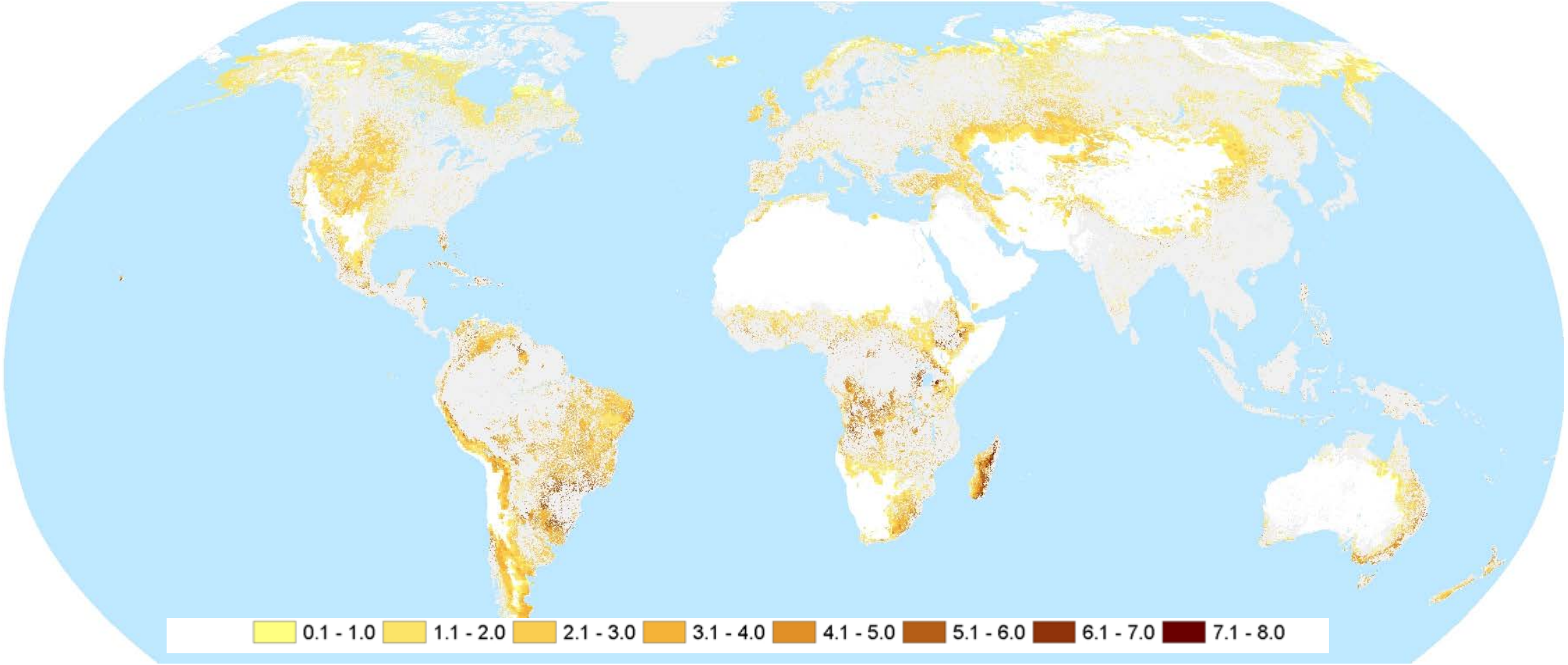
Source: Shchepashchenko et al., 2019

INCREMENT
(CURRENTLY FORESTED LAND SUBTRACTED)



Source: Shchepashchenko et al., 2019

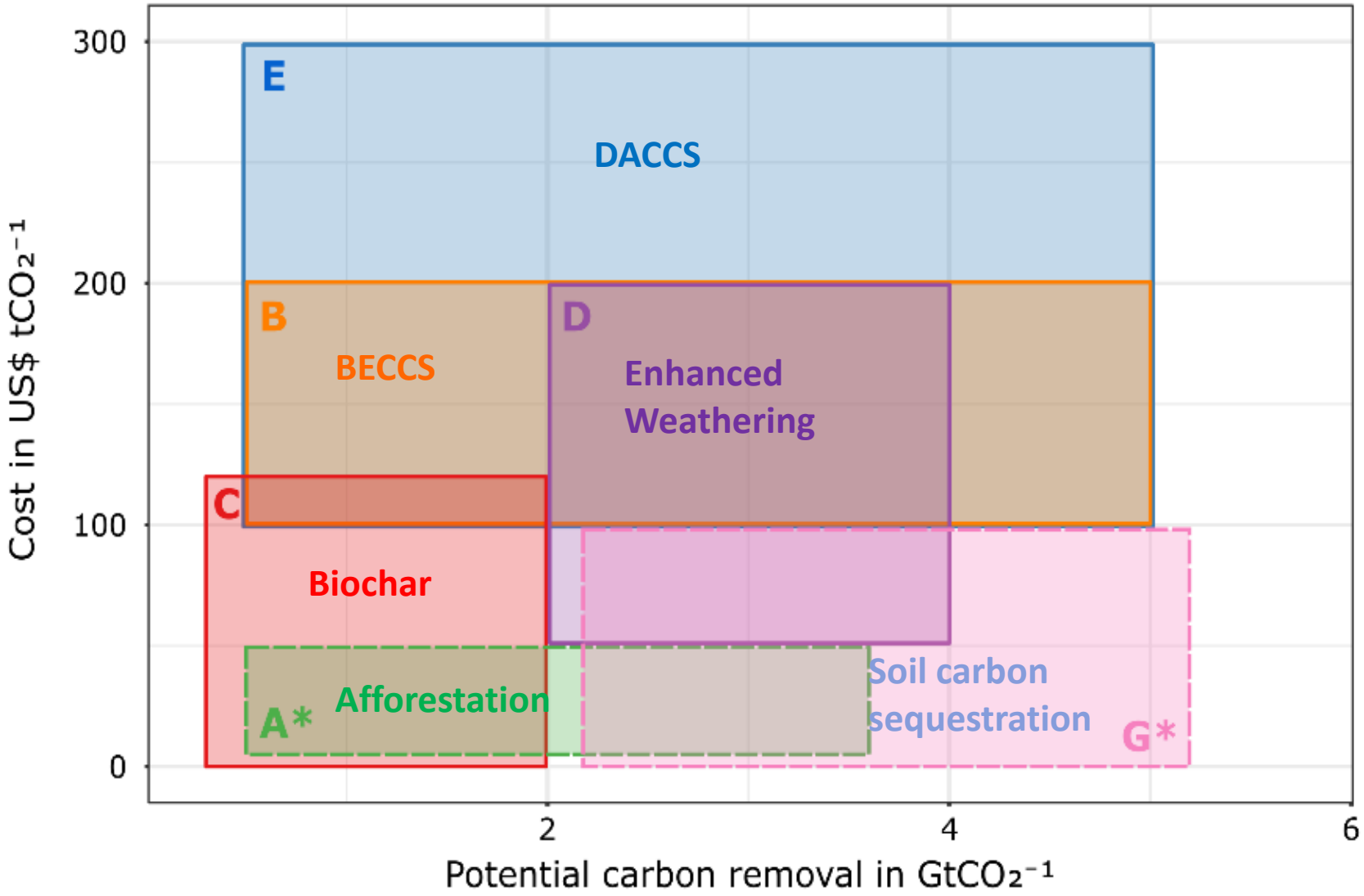
INCREMENT (CURRENT FOREST, CROPLAND & URBAN LAND SUBTRACTED)



- area: 2.3 billon ha
- wood increment: 5.3 billon m3/yr (2.3 m3/ha/yr)
- energy: 5.3 billon m3/yr * 6.2 GJ/m3 = 32.8 EJ/yr
- sequestration to above- and belowground forest carbon 5.3 billion m3/yr * 0.56 (FAO FRA global average) **= 3.0 GtC / yr**

Source: Shchepashchenko et al., 2019

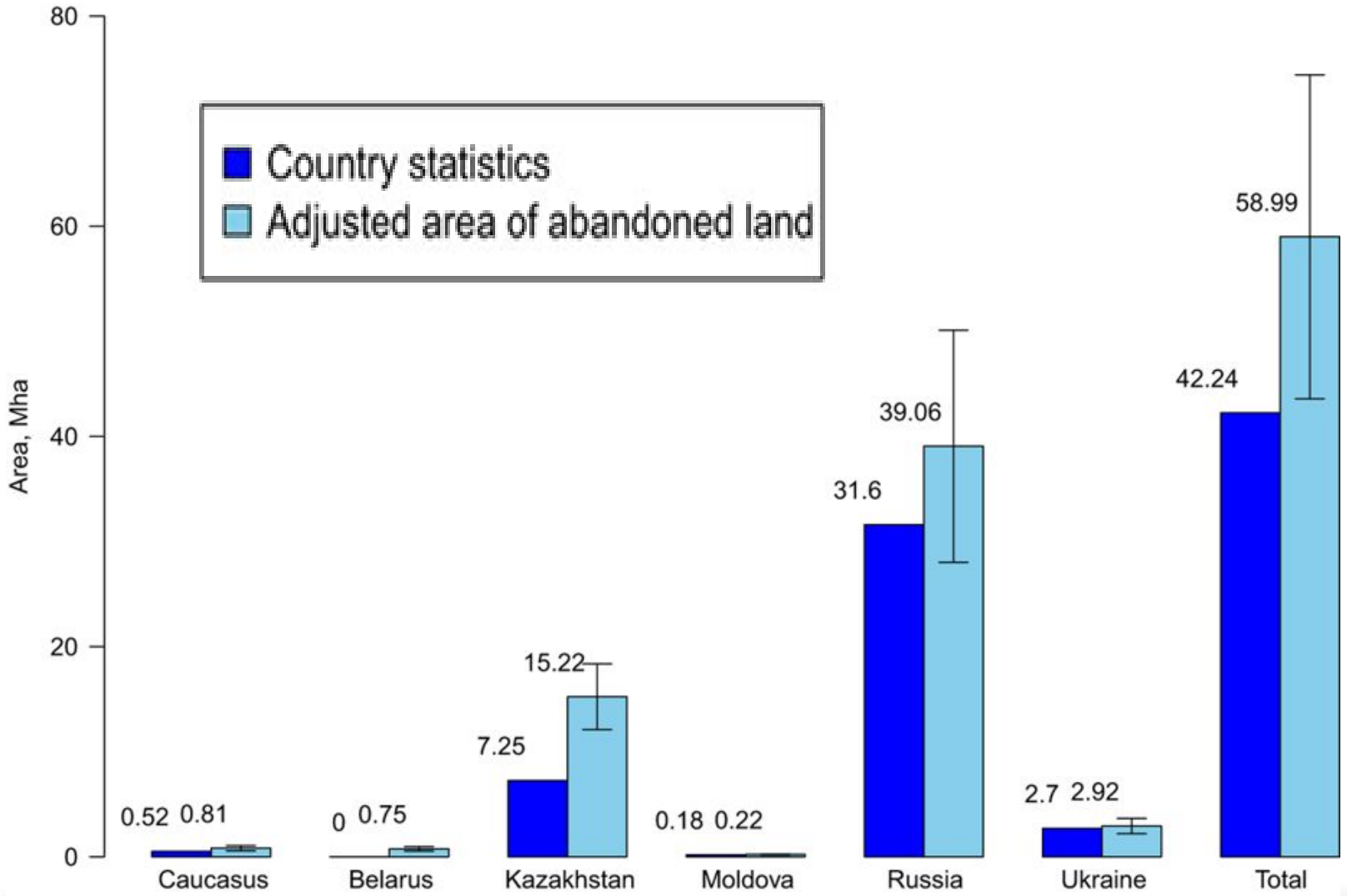
COSTS AND POTENTIALS OF NETS OPTIONS



Source: Fuss et al. (2018), Minx et al. (2018), Environmental Research Letters

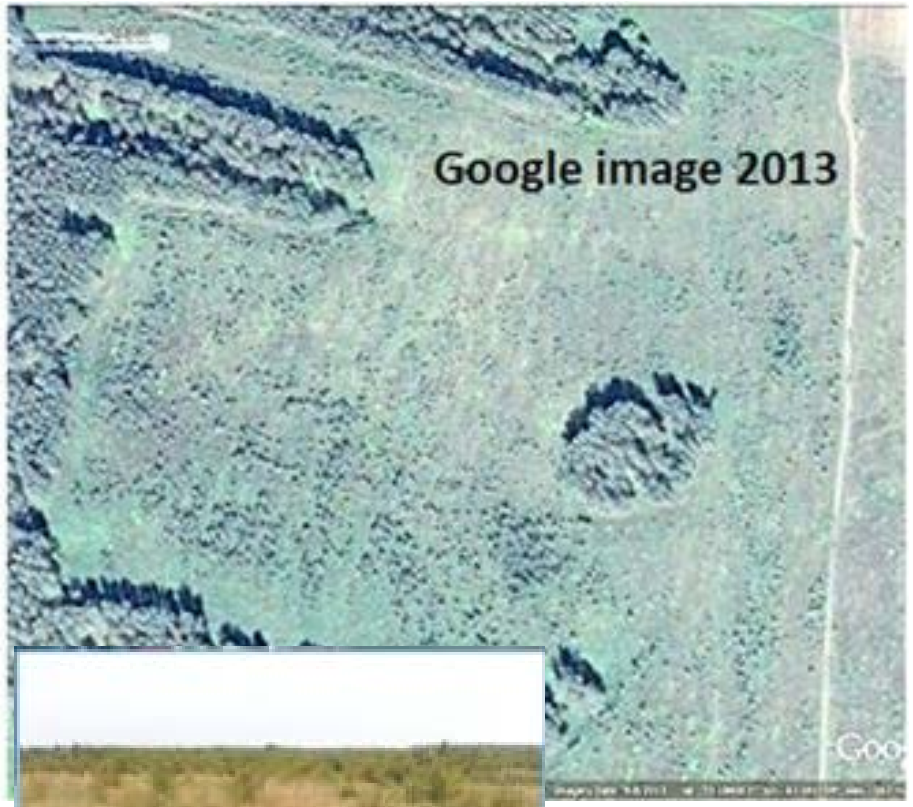
ABANDONED LAND AVAILABLE FOR AFFORESTATION?

AREA OF ABANDONED ARABLE LAND, 10^6 HA



Source: Lesiv, Shchepashchenko et al., 2018

ABANDONED ARABLE FIELD AT VERY HIGH RESOLUTION SPACE IMAGES AND GROUND PHOTO



Source: Shchepashchenko et al., 2019

ABANDONED ARABLE LAND IN 8 FSU COUNTRIES

Source: Lesiv, Shchepashchenko et al., 2018

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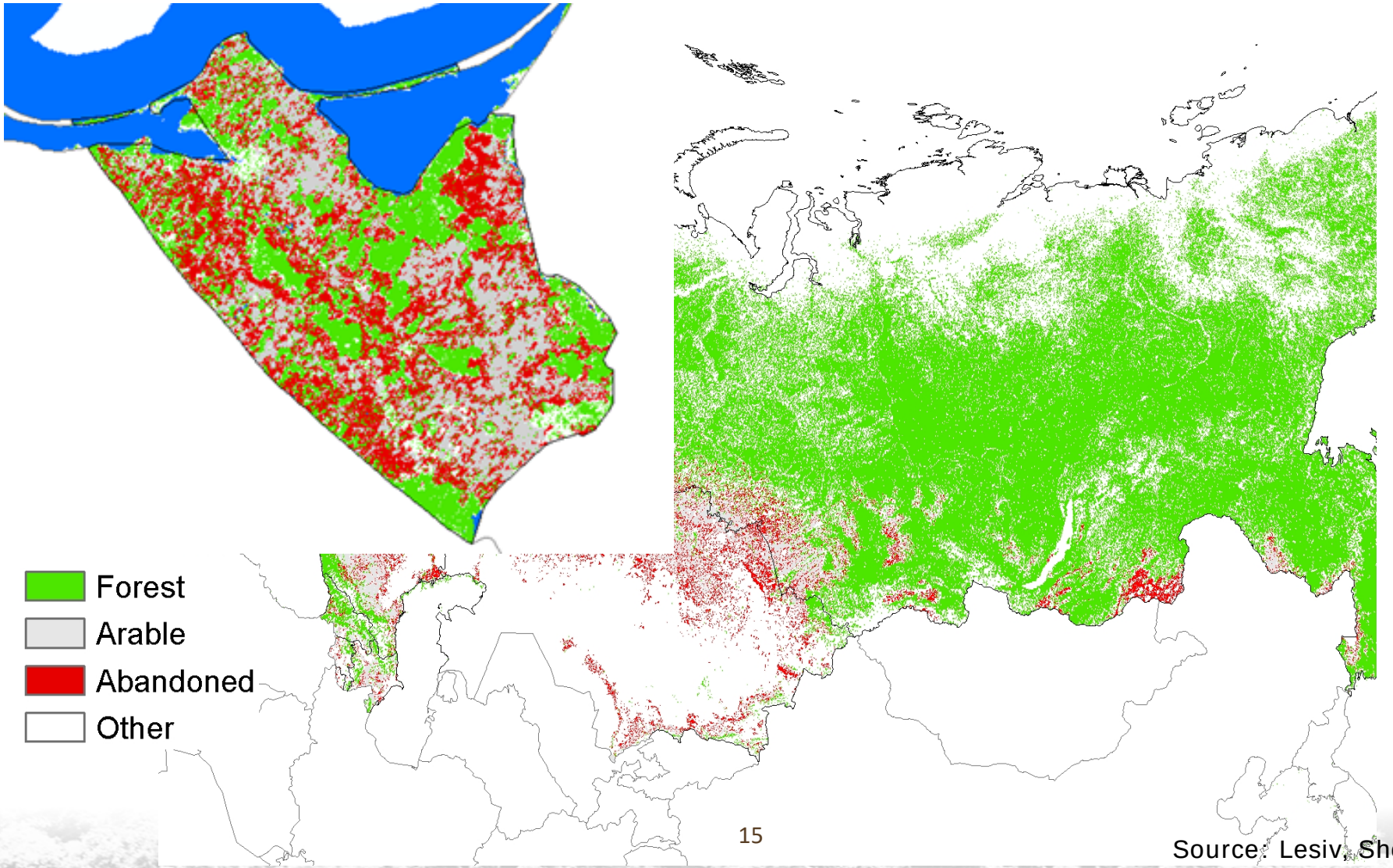
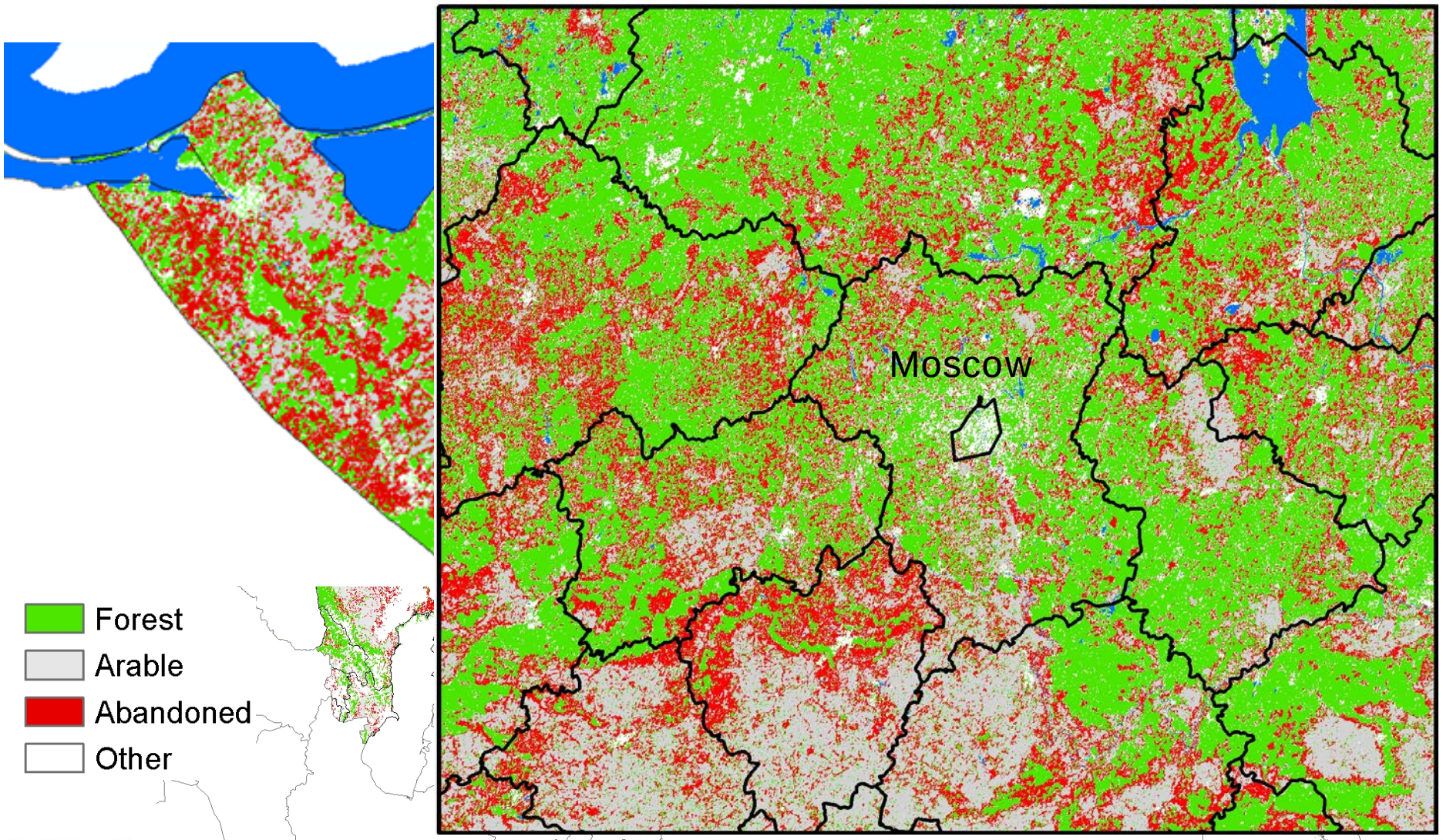


Source: Lesiv, Shchepashchenko et al., 2018

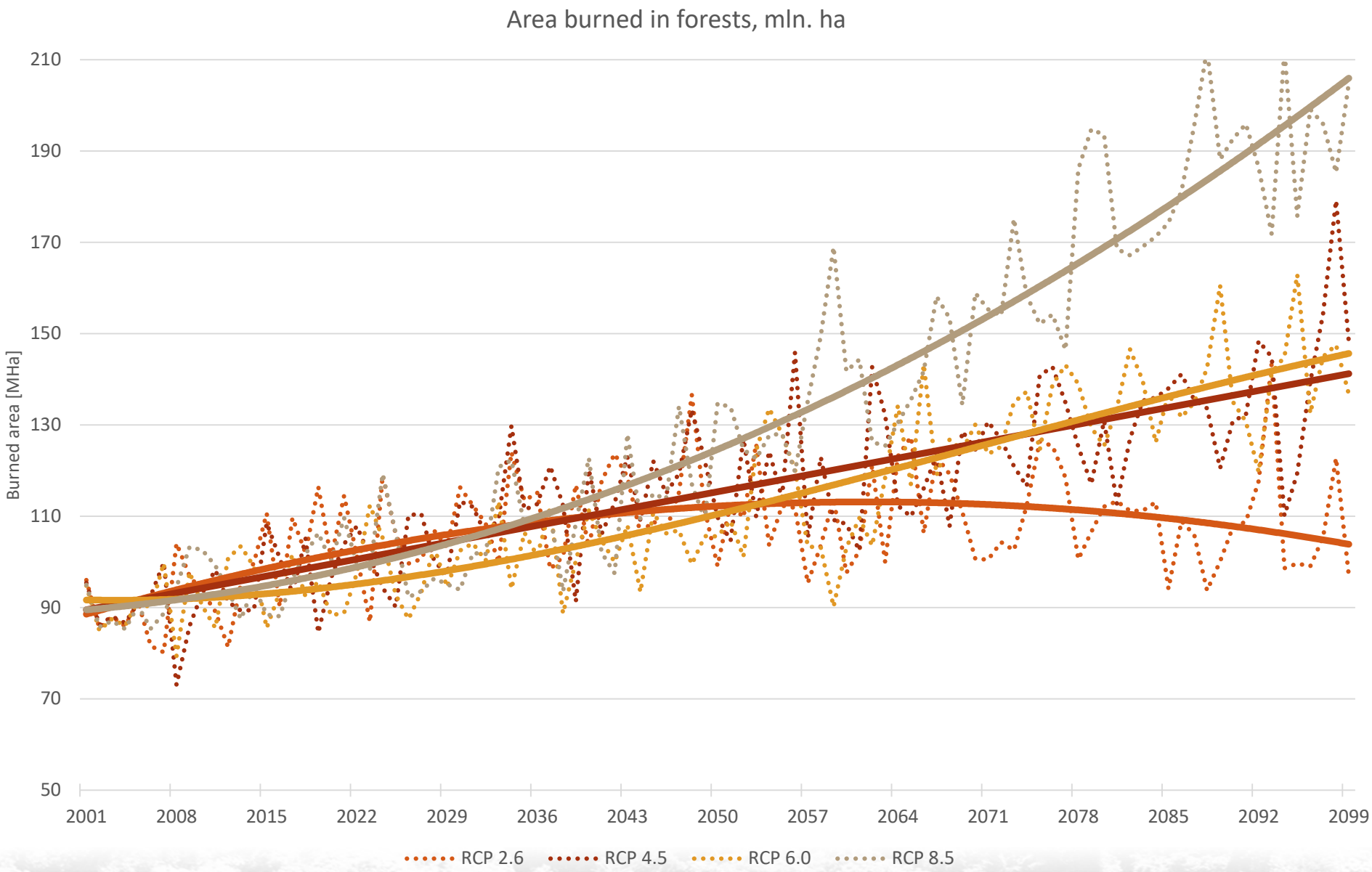
ABANDONED ARABLE LAND IN 8 FSU COUNTRIES



Source: Lesiv, Shchepashchenko et al., 2018

BURNED AREA AVAILABLE FOR AFFORESTATION?

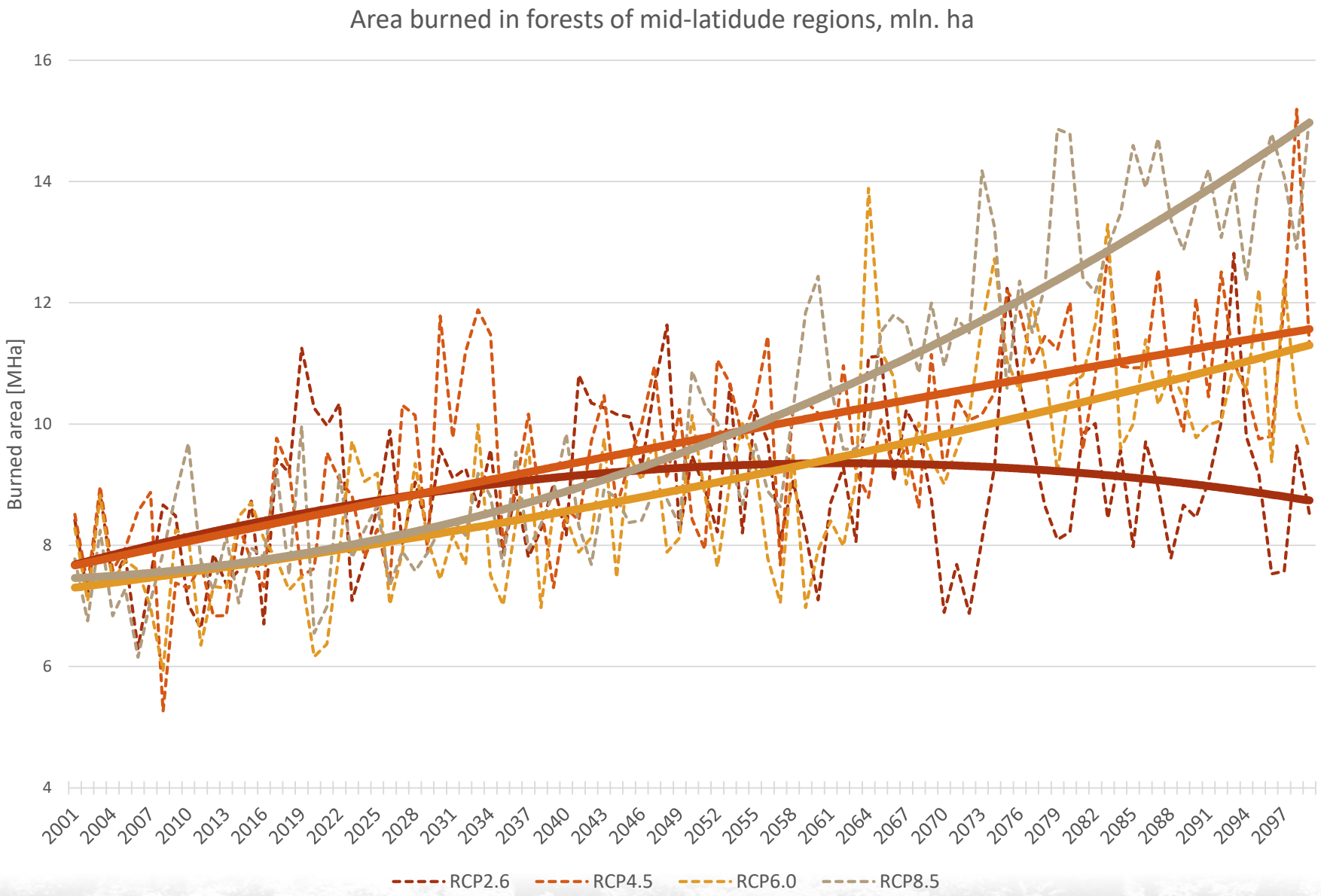
AREA BURNED - GLOBAL PROJECTIONS



IIASA's FLAM Model, preliminary results
Calibration period: 2001-2016
Projection period: 2017-2099
Climate data: HadGEM2-ES model (ISIMIP2b)
Forest growth: G4M

Source: IIASA-FLAM, 2019

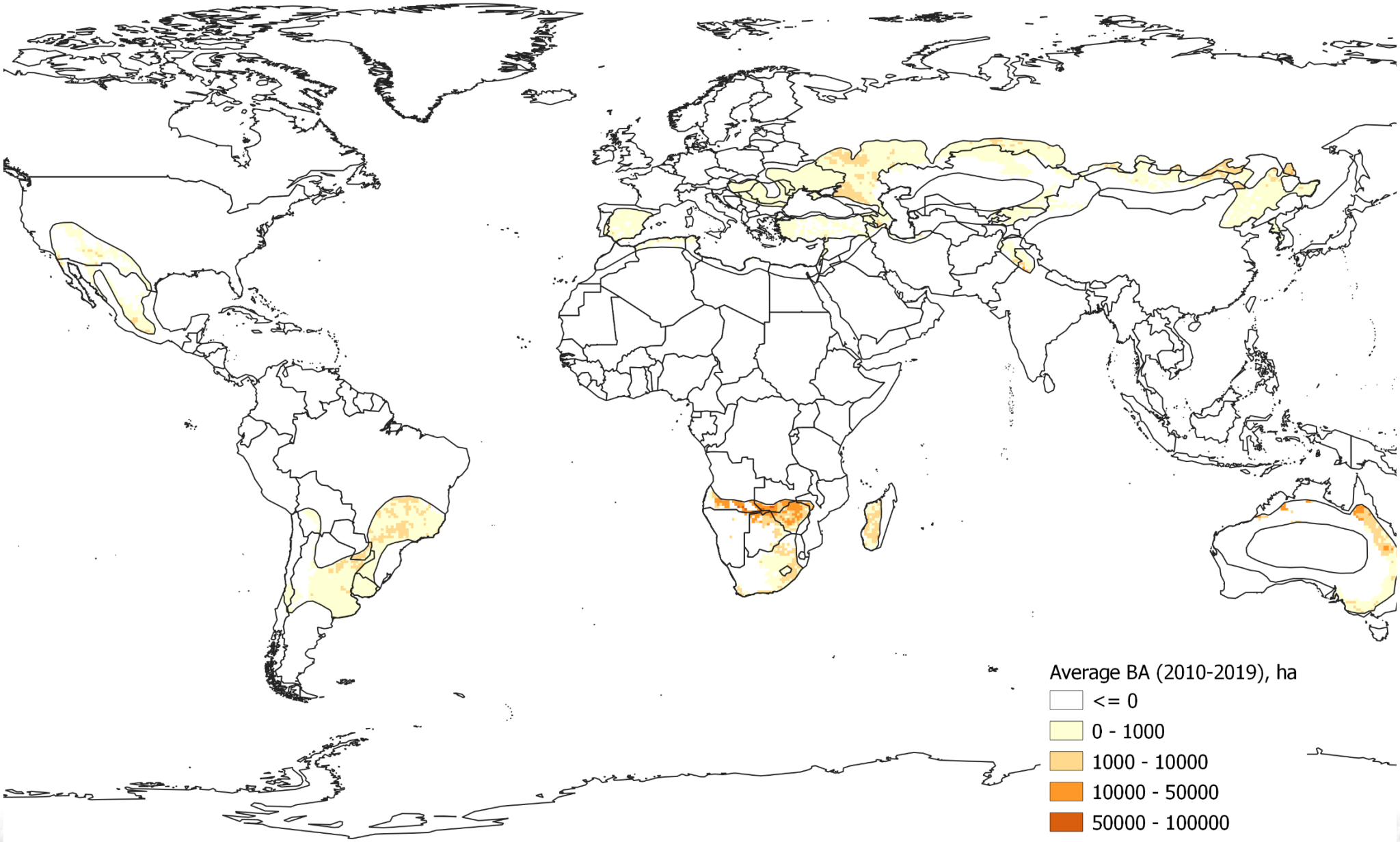
AREA BURNED - PROJECTIONS FOR MID-LATITUDE REGION - PRELIMINARY RESULTS



Calibration period: 2001-2016
Projection period: 2017-2099
Climate data: HadGEM2-ES model (ISIMIP2b)
Forest growth: G4M

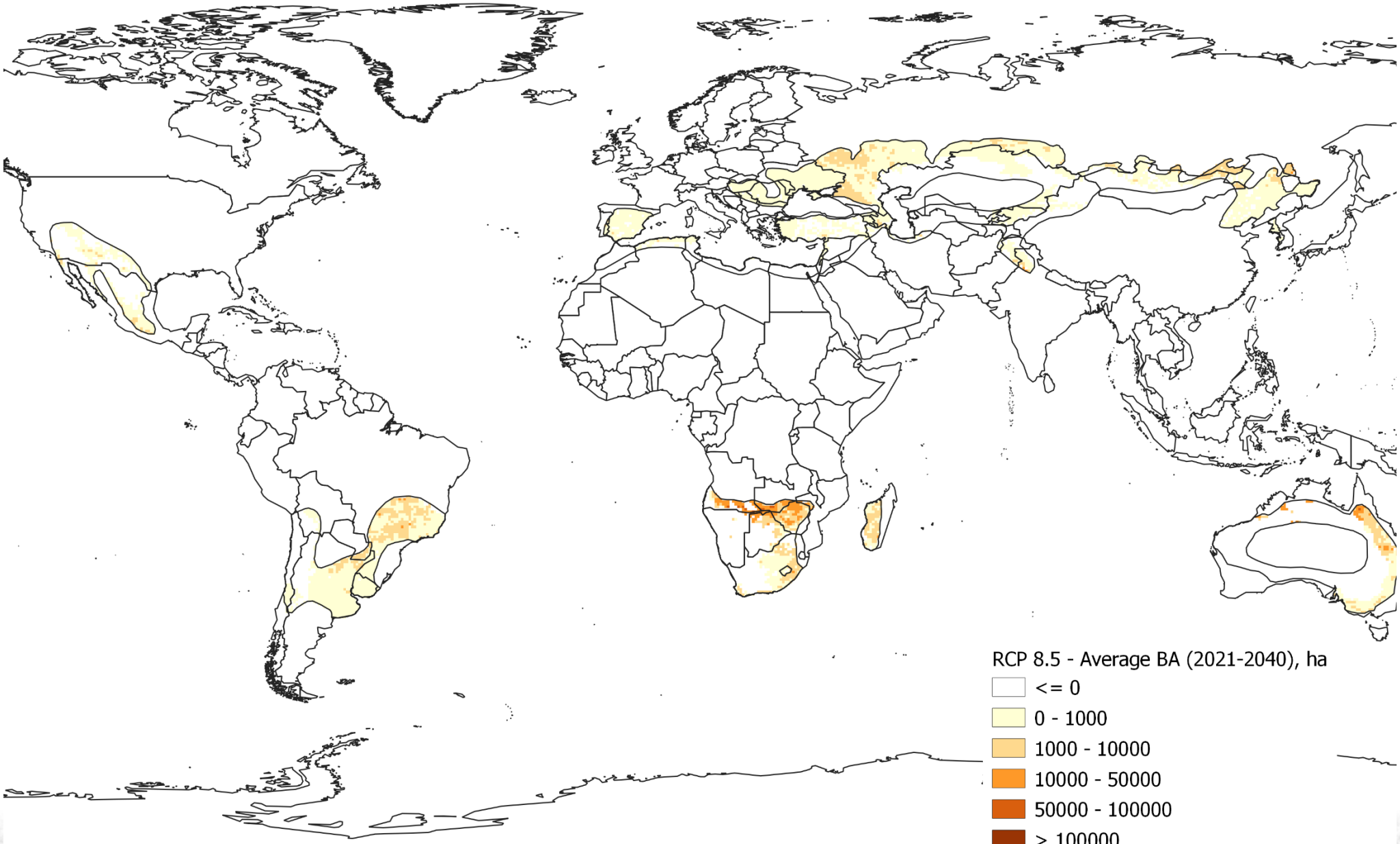
Source: IIASA-FLAM, 2019

AREA BURNED – MLR – 2010-2020 RCP 8.5



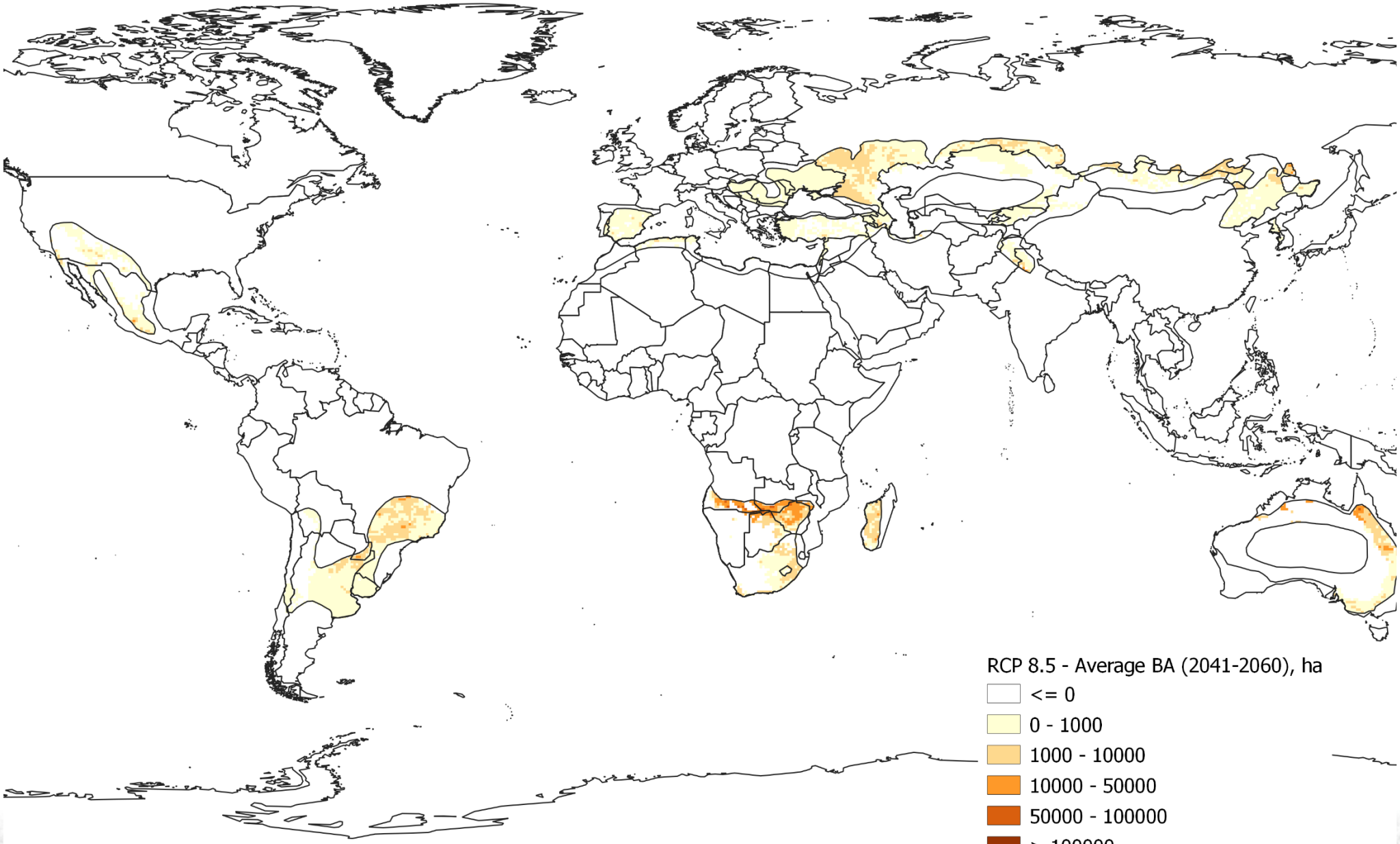
Source: FLAM - IIASA, Krasovskiy et al., 2019

AREA BURNED – MLR – 2020-2040 RCP 8.5



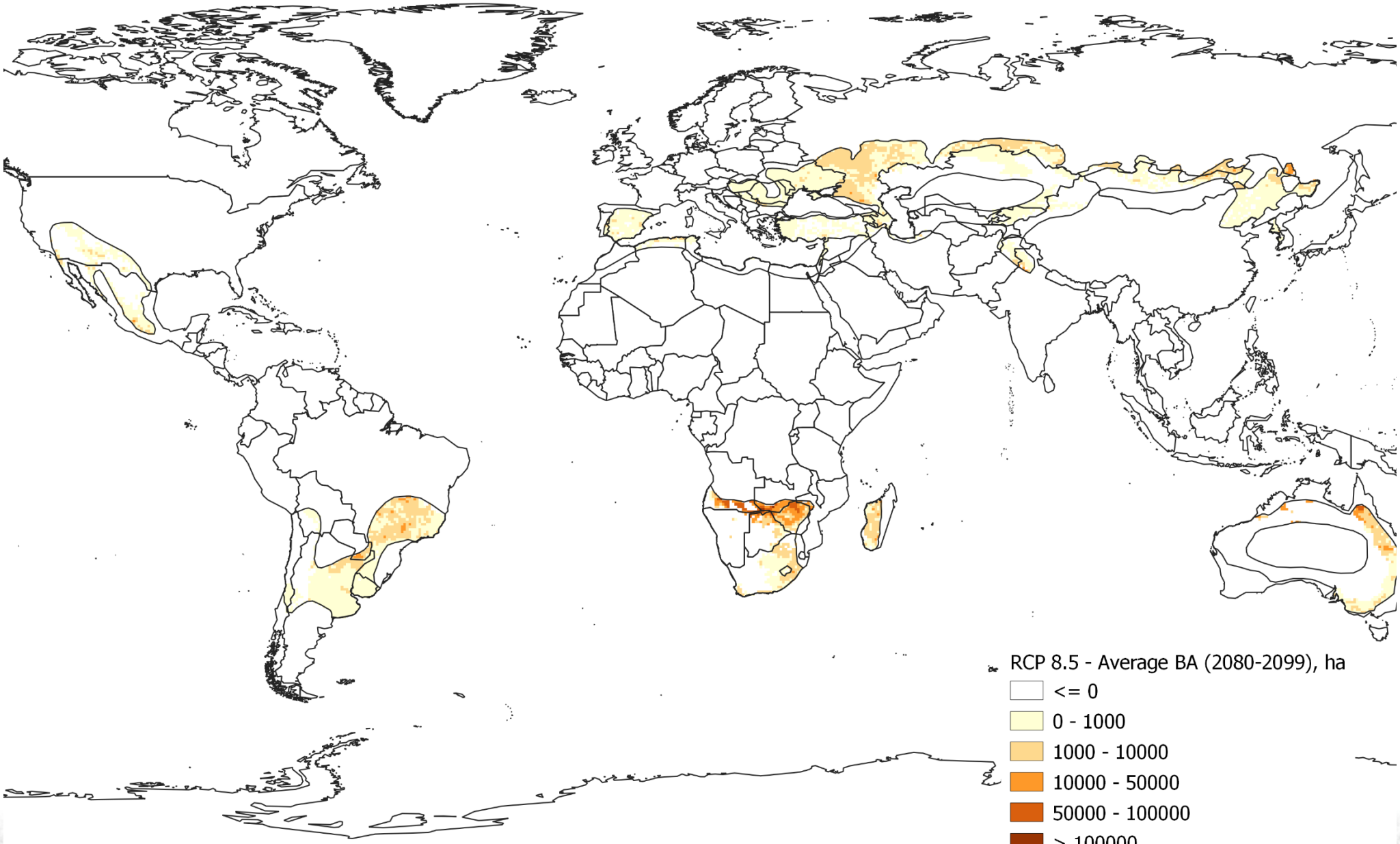
Source: FLAM - IIASA, Krasovskiy et al., 2019

AREA BURNED – MLR – 2040-2060 RCP 8.5



Source: FLAM - IIASA, Krasovskiy et al., 2019

AREA BURNED – MLR – 2080-2100 RCP 8.5

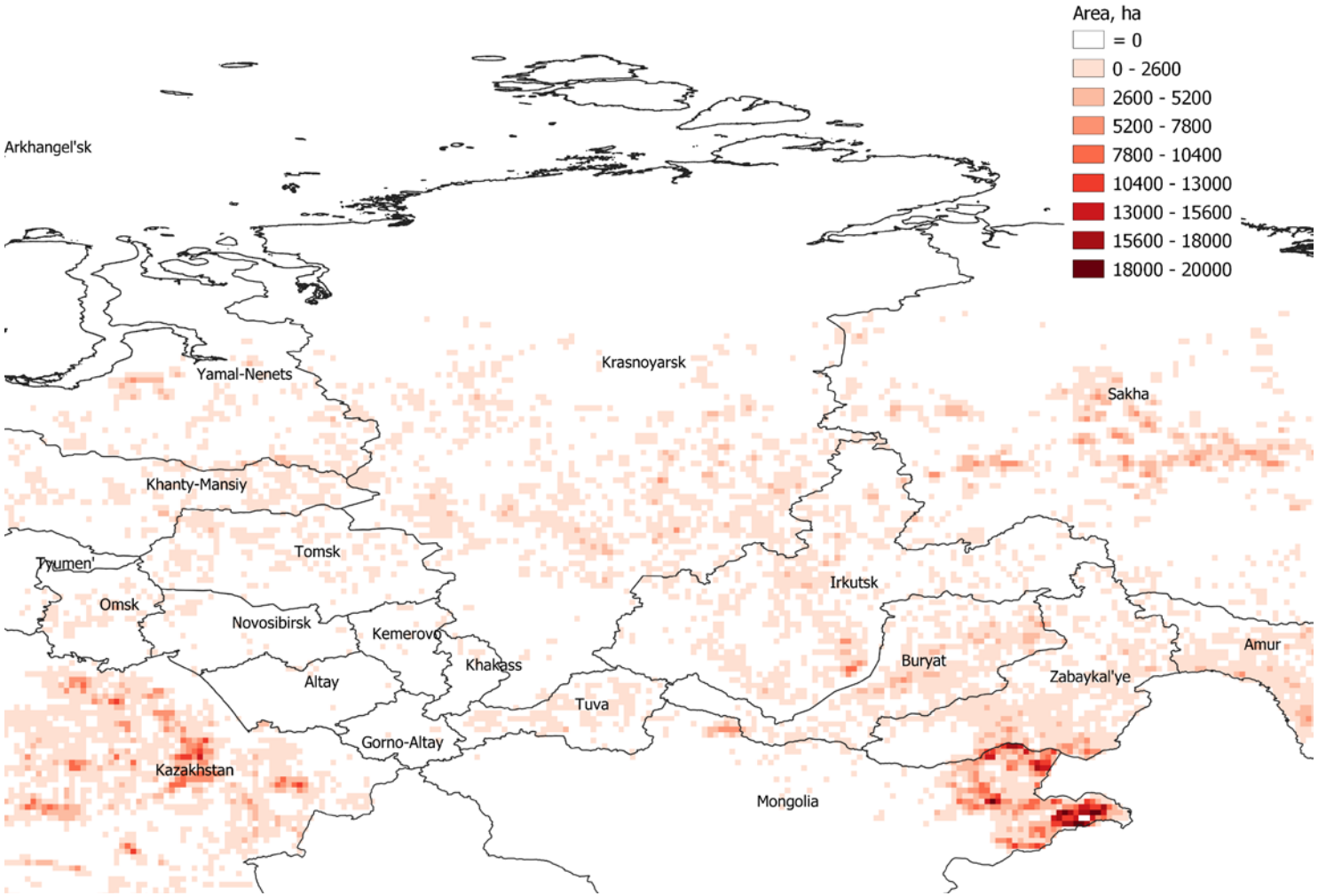


Source: FLAM - IIASA, Krasovskiy et al., 2019

LOOKING INTO BURNT AREA…

→ Additionality: Regrowth Acceleration…

Source: FLAM - IIASA, Krasovskiy et al., 2019



- represents average yearly burned area in 2012-2016 based on the Global Fire Emissions Database GFED version 4. Grid cell is 0.25 arc degree, approx.. 25x25 km^2.
- calculated sum of burned area from 2012 to 2016 and divided by the number of years for each cell. Very simplified and conservative estimate.

Afforestation area is indicated for cells where burned area > 100 ha.

Source: FLAM - IIASA, Krasovskiy et al., 2019

3 SCENARIOS: DO NOTHING/ASSISTED/ASSISTED+

Country	Average Total Ba	Afforestation area	do nothing	assist w/o planting	assist w planting	do nothing	assist w/o planting	assist w planting	do nothing	assist w/o planting	assist w planting
	(MHa)	(MHa)	2030			2050			2100		
Russia	5.5	5.34	10.68	10.68	10.68	32.04	32.04	136.17	85.44	432.54	536.67
Mongolia	1.79	1.79	3.58	3.58	3.58	10.74	10.74	45.65	28.64	144.99	179.90
Kazakhstan	3.55	3.52	7.04	7.04	7.04	21.12	21.12	89.76	56.32	285.12	353.76
Krasnoyarsk	0.73	0.71	1.42	1.42	1.42	4.26	4.26	18.11	11.36	57.51	71.36
Irkutsk	0.38	0.37	0.74	0.74	0.74	2.22	2.22	9.44	5.92	29.97	37.19
			23.46	23.46	23.46	70.38	70.38	299.12	187.68	950.13	**1107.52**

Crude estimates and assumptions…

→ Max support/Assisted+ → 1.1 GtC total sequestration…

Source: FLAM - IIASA, Krasovskiy et al., 2019

→ EVIL IN THE DETAILS?

ADDITIONALITY VS ACCELERATION

What of the measures is an additionality and hence can be claimed as NET?

PERMANENCE

How to ensure permanence of established afforestation/reforestation?

DETAILS ON THE GROUND

Ownership
Acceptance
Detailed conditions
Access
Disturbances
Protection
Monitoring
Accountability
…
…

POSSIBLE STEPS AHEAD/IN ADDITION?

- Russia -

Potential for large-scale afforestation/reforestation w/o burned area

Background assumption:

transition to *sustainable risk resilient forest management*

- Reforestation areas designated for forest: 40 mln ha
- Afforestation abandoned agricultural land: 40 mln ha
- Assisted forest migration (climate change): 200 mln ha
- Establishing protective forest on agricultural land: 8 mln ha
- Rational use of harvested wood products: 200 mln m3

Realization of such a program would result in potential increase of carbon sink of 600 mln t C /yr during 100 years after its realization

Source: Shvidenko et al., 2019

COMBINING ADAPTATION W. MITIGATION W. NEG. EMISSIONS W. BE

- Access to burned area needs development of a (dense) transport grid for rapid interference
- Transport grid for other needs (resources, renewables, transport of electricity, CO2, etc.
- Transport grid for protection measures
- Transport grid for management
  → Bioenergy?
  → BECCS??

TAKE-AWAY MESSAGES

- Reasonable NE Potential through A/R (abandoned ag/fire etc.) – in addition to max. decarbonization and other NETs
- Remote Sensing can help identifying the area
- On-the-ground information need to complete the identification of area
- Hi-res biophysical modeling approach needed to estimate groth potential (technology/fertilizer etc)
- High uncertainty with respect to disturbances (permanence issue)
- Linking biophysical modeling with disturbance modeling
- Climate change can be favorable in some places but... Models need to be able to catch CC
- Techno-economic optimization: identification of low-hanging fruits (costs, accessibility, etc.)
- Where do we start, where should we end? (how desparate are we to reach the goals)
- Cost calculation/estimation of efforts, how much, how long
- Do not forget about the people on the ground (NIMBY effect, what do the people on the ground need etc)
- Co benefits assessment – nature-based solutions offereing green jobs, bioeconomy etc...
- Measures need to be tailor-made for each location/region
- What comes after the reforestation → sustainable & risk-resilient forest management?
- C sequestration is not the only ecosystem service to be considered
- Needs a huge and international effort and there is no time to lose

→ thanks for your suggestions!

CONTACT

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More about IIASA Models

www.iiasa.ac.at/g4m

www.iiasa.ac.at/epic

www.iiasa.ac.at/bewhere

www.iiasa.ac.at/flam