



**Nature-based solutions for
climate change adaptation
of EN+ Energy Segment**

En+ Group – leader

in low carbon aluminium & renewable energy production

5.5%
of global aluminium production

73.7 bln kWh
low-carbon hydro power generation

19.5 GW
total installed capacity of power generating facilities



5 ●
HPP

15 ●
CHPP

Abakan
SPP

Power Segment



15,2 GW

4,3 GW

5,2 MW

Total capacity

73,7 bln kWh

16,9 bln kWh

5,8 mln kWh

2024 production level

11 ●

aluminium smelters³

8 ●

alumina refineries

7 ●

bauxite production facilities

Metals Segment



4,2 Mt per year

10,4 Mt per year

22,0 Mt per year

Total capacity

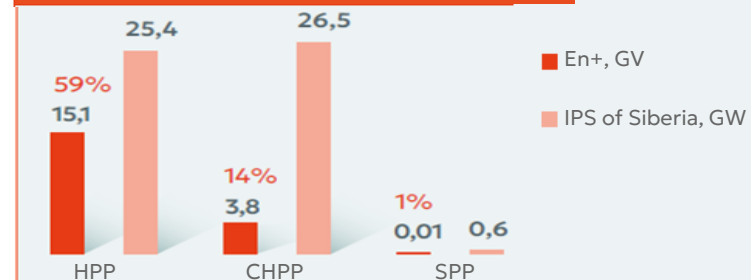
3,9 Mt

6,4 Mt

15,9 Mt

2024 production level

En+ share in IPS of Siberia installed capacity by generation type

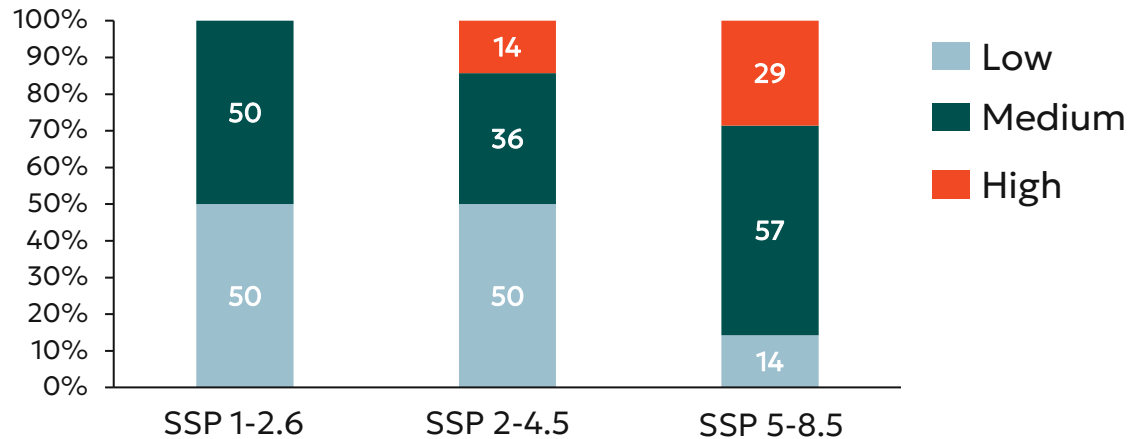


30%

of IPS of Siberia installed capacity – En+ HPPs

Exposure of the Group production facilities to climate risk factors

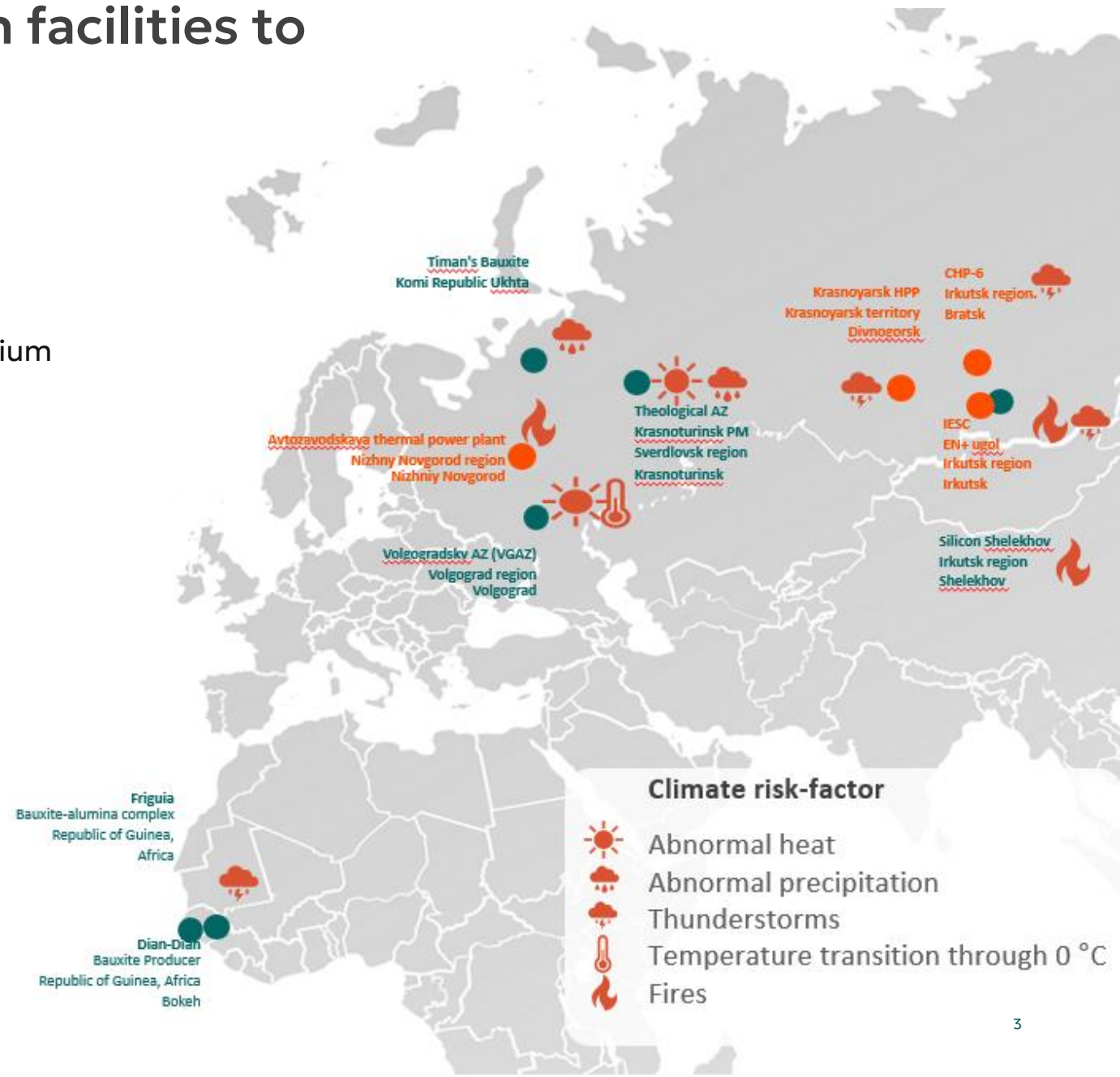
Share of assets exposed to physical risk¹
for different climate scenarios, %



1 of 5

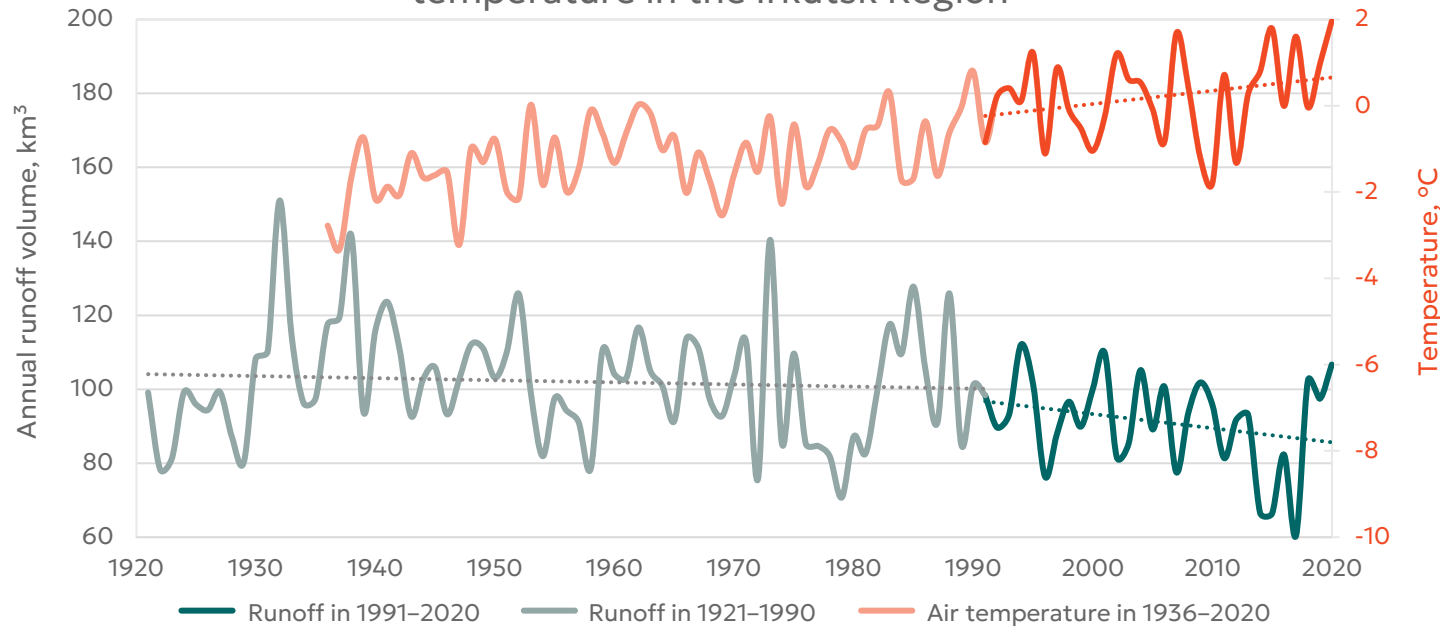
climate risks of RUSAL production facilities on average is related to the impact on the energy infrastructure

¹ – by the number of critical risks on the asset:
0...1 – low; 2 – medium; 3 and more – high



Actual climate changes in Lake Baikal & Angara River basin¹

Dynamics of annual Angara River runoff volume & mean annual air temperature in the Irkutsk Region²



2-3% / 10 years

mean decrease in annual precipitation in the south of the catchment area

4% / 10 years

mean decrease in the Angara River water runoff¹

0.3°C / 10 years

mean air temperature increase in 1991-2020

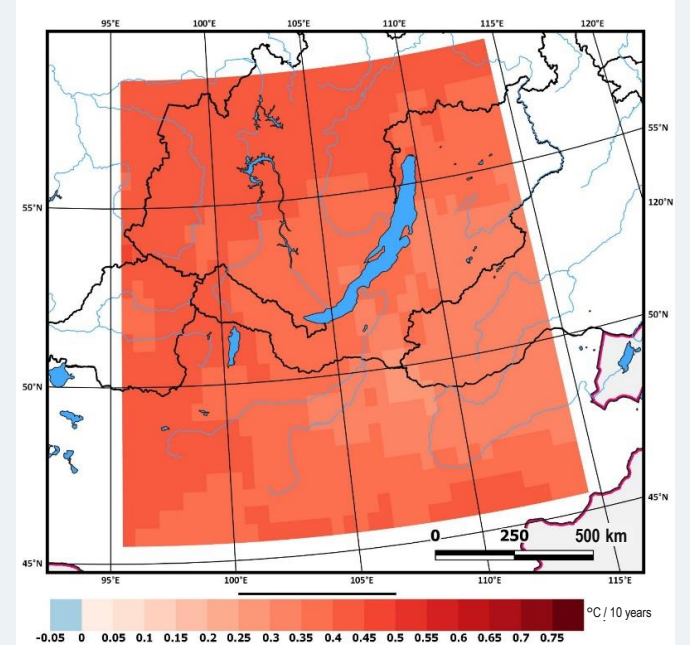
5% / 10 years

mean HPP power generation decrease² in 1991-2020

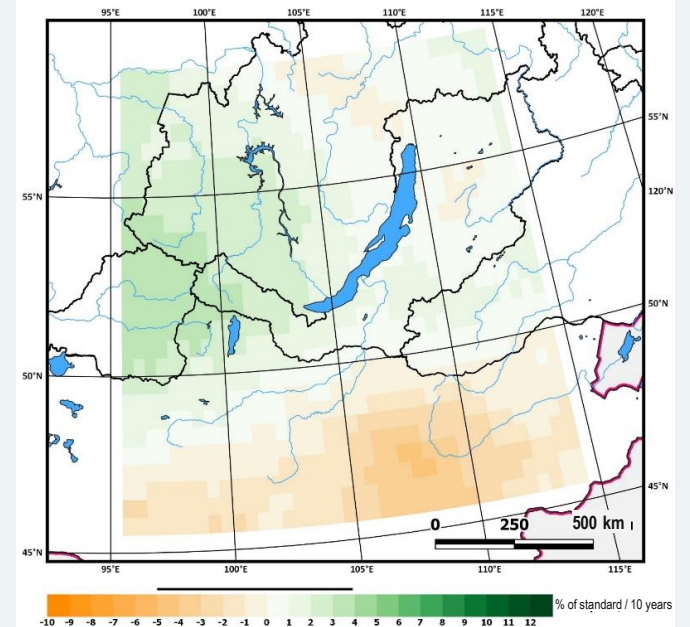
¹ – to the Ust-Ilimsk HPP cross-section

² – total for Irkutsk, Bratsk & Ust-Ilimsk HPPs

Rate of change in mean annual air temperature in 1991-2020



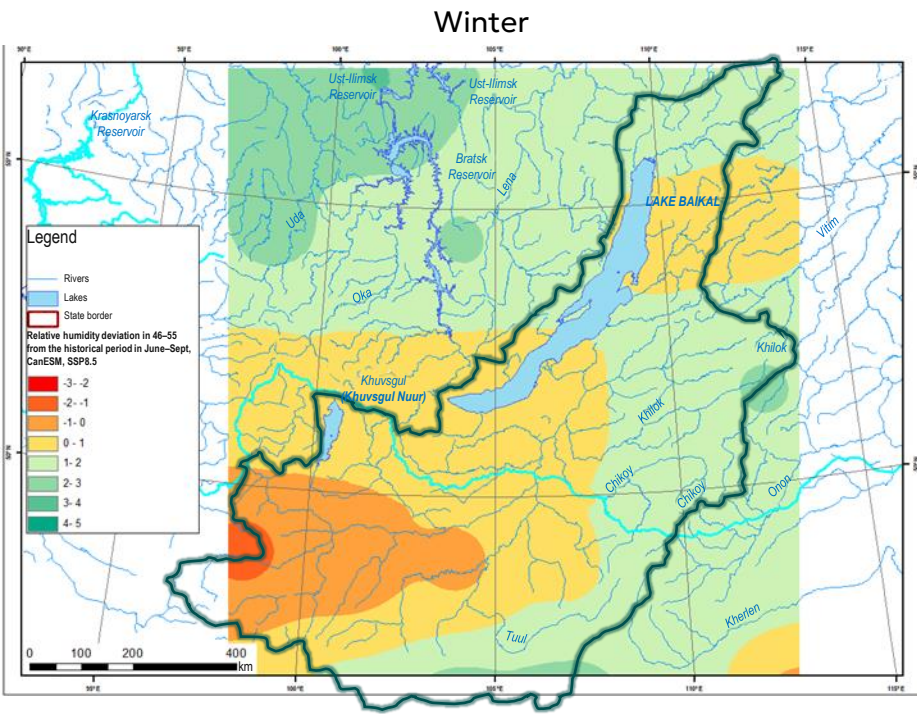
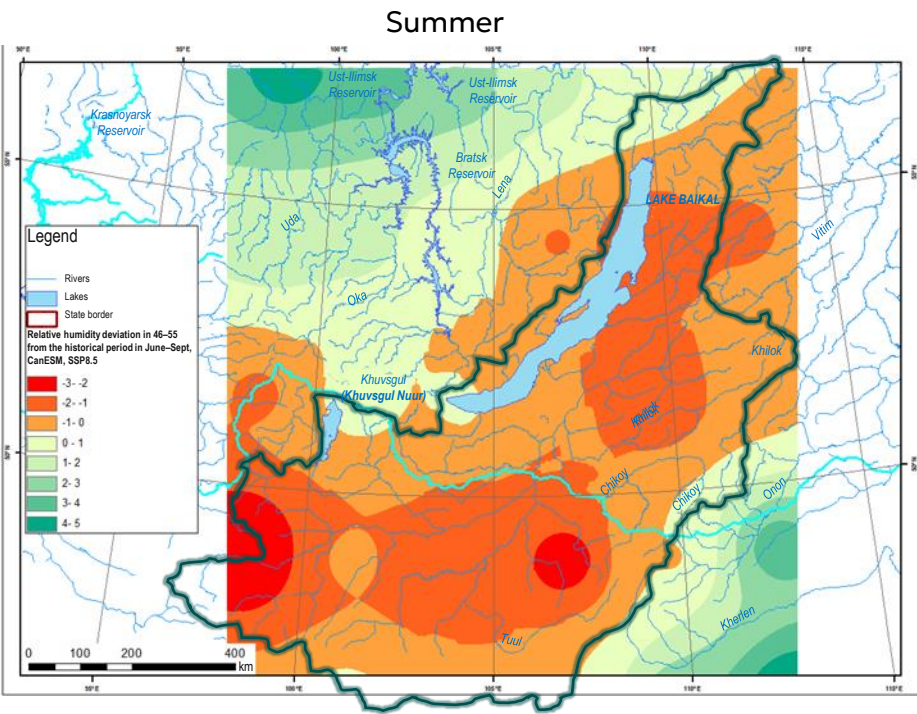
Rate of change in annual precipitation layer in 1991-2020





Climate aridity is projected to increase in the Baikal basin by 2050

Relative air humidity change forecast¹



2–3% Decrease in relative air humidity in the south of the catchment area

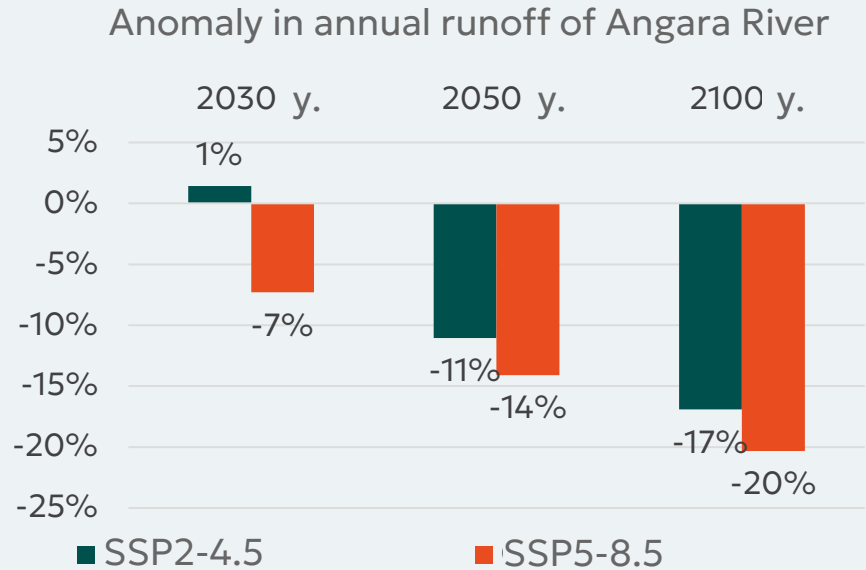
The climate will become more arid with prolonged periods of droughts and rains

- Key climate risks:
- decrease in the annual volume of useful water inflow to HPP cross-sections;
 - increase in flood and drought risks;
 - increase in fire hazard.

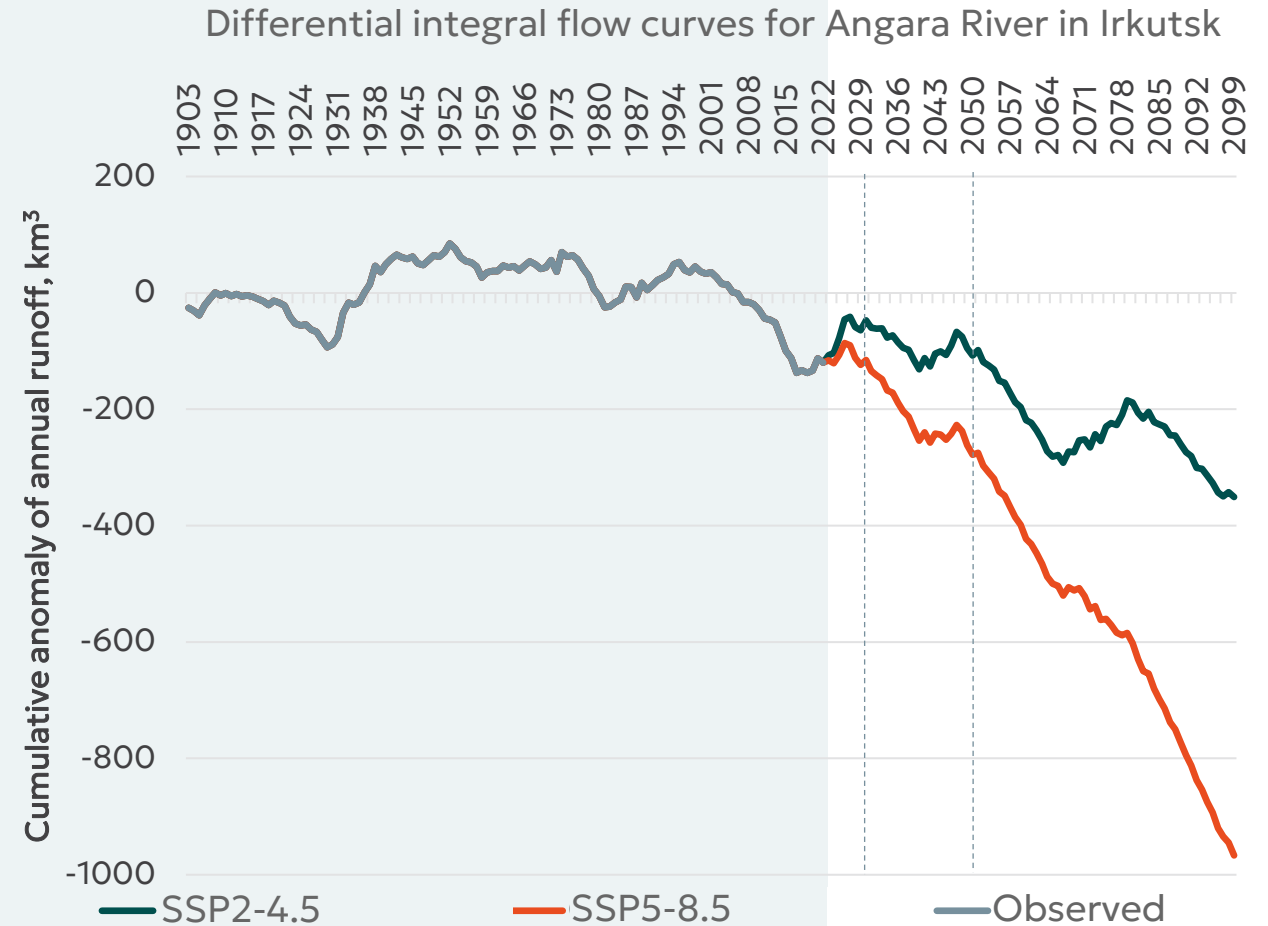
The increasing risk of forest fires will contribute to increasing water scarcity

¹ – Under the SSP5-8.5 scenario based on the CanESM5-CanOE model for 2046–2055 relative to 1990–1999

11-14% - projected decrease of annual inflow to Lake Baikal by 2050¹



Scenario analysis of climate projections has shown that the identified climate-related trends in runoff reduction will take place in the future

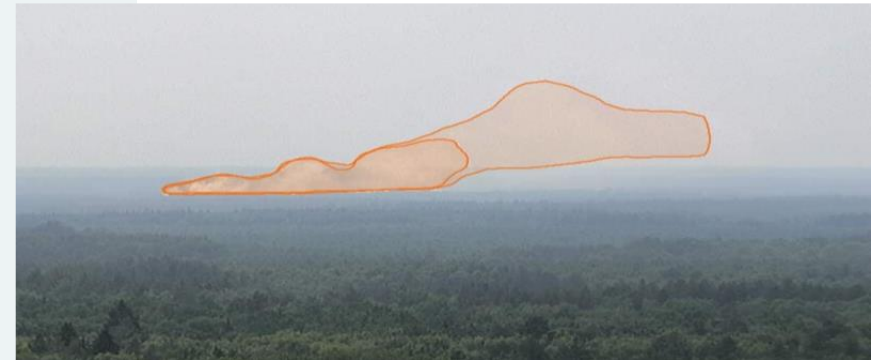


¹ – relative to the baseline period 1985-2014

What measures can be taken to preserve the water resources in Lake Baikal catchment?

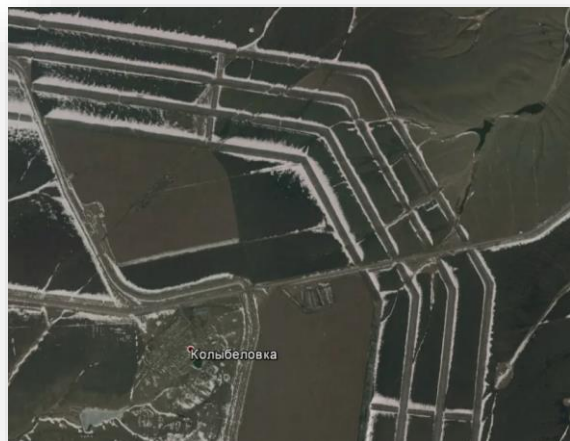
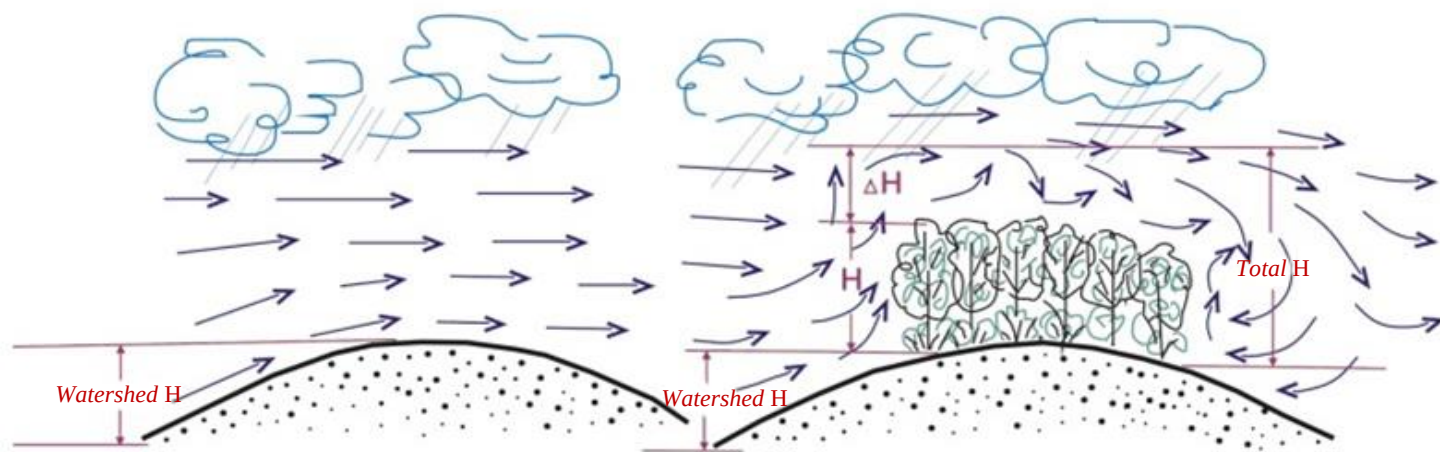
Nature-based solutions:

1. Introduction of sustainable livestock farming practices within ecological carrying capacity of pastures
2. Improving efficiency of forest fire control through early detection measures using AI
3. Forest fire protection using UAVs Rapid detection and containment of fire outbreaks
4. Forest pest control Early-stage detection of forest pest outbreaks using satellite imagery & remote sensing techniques
5. Planting forest and shrub vegetation in Selenga River basin under Mongolia's '**Billion Trees**' national movement





Forest and shrub planting projects



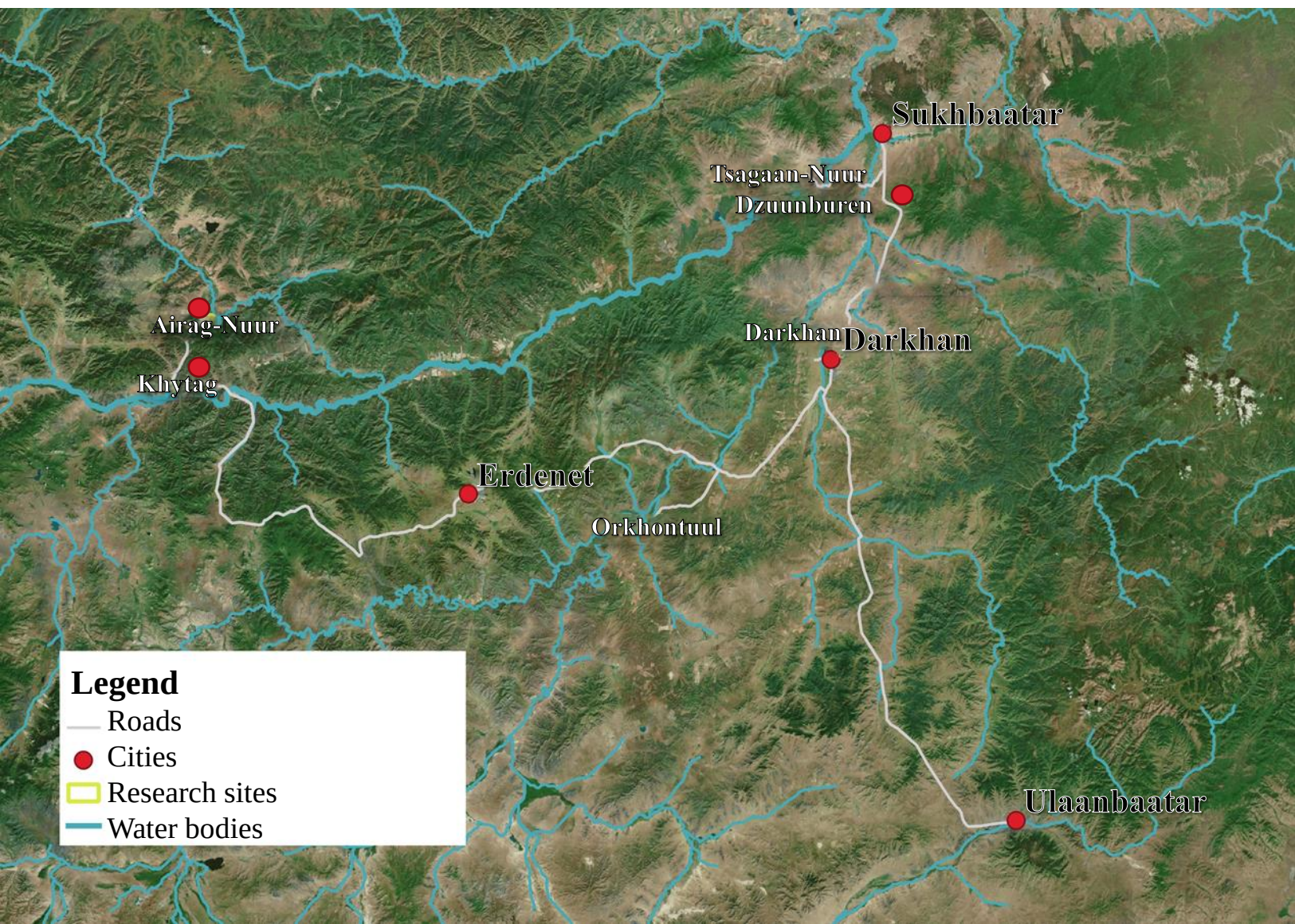
Snow accumulation in shelterbelts

The lower part of snow and rain clouds moves over terrain irregularities, 'crashing' into ridges and 'rising' over depressions. When 'crashing' into watersheds and forests growing on them (shelterbelts), turbulent mixing of air flows sharply intensifies in clouds, and in the boundary zone of the barrier (over watershed forests), concentration of hydrometeorological particles (steam, ice crystals, snowflakes, small water droplets) acting as condensation centres that merge and fall to the ground increases.

- Planting woody and shrub vegetation in Selenga River basin will help preserve water content of the river & its tributaries by retaining moisture & snow, and ensuring more even runoff distribution throughout the year
- To combat desertification, it is proposed to create plantations of specially selected crops that will help reduce impact of dry winds & soil degradation, thereby slowing down or preventing land desertification
- It will be useful to apply experience of Russian scientists who worked on similar projects in southern regions in the 20th century



Pilot sites proposed by scientists for development of standard plantation designs:



AGREEMENT ON COOPERATION
BETWEEN

FEDERAL SCIENTIFIC CENTRE OF
AGROECOLOGY, COMPLEX
MELIORATION AND PROTECTIVE
AFFORESTATION OF THE RUSSIAN
ACADEMY OF SCIENCES (FSCA RAS),
VOLGOGRAD, RUSSIAN FEDERATION

AND

INSTITUTE OF GEOGRAPHY AND
GEOECOLOGY OF THE
MONGOLIAN ACADEMY OF
SCIENCES (IGG MAS),
ULAANBAATAR, MONGOLIA

SCIENTIFIC COOPERATION IN THE
SELENGE RIVER BASIN

СОГЛАШЕНИЕ О
СОТРУДНИЧЕСТВЕ МЕЖДУ

ФЕДЕРАЛЬНЫМ НАУЧНЫМ
ЦЕНТРОМ АГРОЭКОЛОГИИ,
КОМПЛЕКСНЫХ МЕЛИОРАЦИЙ И
ЗАЩИТНОГО ЛЕСОРАЗВЕДЕНИЯ
РОССИЙСКОЙ АКАДЕМИИ НАУК
(ФНЦА РАН), ВОЛГОГРАД,
РОССИЯ

И

ИНСТИТУТОМ ГЕОГРАФИИ И
ГЕОЭКОЛОГИИ АКАДЕМИИ НАУК
МОНГОЛИИ (ИГГ АНМ), УЛАН-
БАТОР, МОНГОЛИЯ

НАУЧНОЕ СОТРУДНИЧЕСТВО В
БАССЕЙНЕ РЕКИ СЕЛЕНГЫ

For IGG MAS
Director,
Dr. Dashtseren Avirmed

For FSCA RAS
Director,
Professor, Doctor of Agricultural Sciences,
Honoured Worker of Agriculture of the
Russian Federation
A.I. Belyaev



Project plan



Year 2026

Study of climatic, hydrological, biological and other conditions of the Selenga River basin

Outcome: Selection of pilot sites for planting

Year 2027

Design of protective phyto-reclamation plantations in the southern part of the Selenga catchment area

Outcome: Design of protective shelterbelts

Year 2028

Calculation of the economic effect of ecosystem services provided by protective shelterbelts

Outcome: Economic justification of the project

Objective

- Develop a concept and a set of science-based process design solutions to combat desertification processes in the Selenga River basin within Mongolia to counter climate-driven runoff reduction, i.e., stabilise the runoff through nature-based solutions.

Expected outcome

- Economically viable project for planting protective vegetation in the southern part of the Selenga catchment area



Questions are warmly welcomed!



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