

STATE OF THE STEPPE

SOCIAL & ECOLOGICAL DYNAMICS IN CENTRAL MONGOLIA



DUNDGOVI | AIMAG & SOUM LEVEL

Utilizing geospatial and social survey data towards a greater understanding of land cover and land use change (LCLUC), labor, and migration within Mongolia's Provinces of Dundgovi, Tuv, and Govi-Sumber



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PURPOSE OF REPORT

Mongolia, at the heart of Central Asia, is home to one of the largest remaining grassland ecosystems in the world. Grassland comprises 73% of Mongolia, which supports over 67.1 million head of livestock and almost 181,000 herding families. However, rapid social and demographic shifts in rural communities, in combination with a changing climate, pose risks to both sustainable management of herding and grassland resources. Very little is known about how rural out-migration in Mongolia is changing the demographics of rural households, the availability of herding labor, or the subsequent impacts on grassland conditions.

This report showcases the results of a land use and land cover study spanning a period of 6 years within the Mongolian provinces of Dundgovi, Tuv, and Govi-Sumber. It was made possible through collaboration between key stakeholders within the Mongolian government, the Zoological Society Luujin, and researchers at Cornell University and the Smithsonian Conservation Biology Institute, and displays the results of a mixed methods study involving geospatial analyses and the interpretation of a social survey involving 188 nomadic herding families within the region.

Additional information and context outside of this report can be viewed here.



ACKNOWLEDGEMENTS

This report would not have been possible without the funding and support of the National Aeronautics and Space Administration's Land Cover Land Use Change Grant (No. 80NSSC22K0468), and collaboration between researchers at the Luujin Zoological Society, The Smithsonian Institute, and the Department of Natural Resources and the Environment at Cornell University.

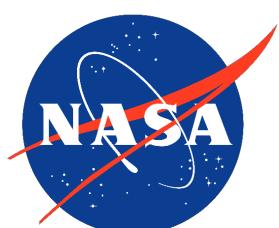
Additionally, we thank the following individuals for their assistance with data collection, logistics, and insights they shared with our research team: Mikel Alvis, Michael Meneshian Oyundelger Enkhtuvshin, and particularly the staff at Luujin Zoological Society, including: Tuvshin Nergui, Odonchirmeg Sukhbaatar, Munkhzaya Myagmarjav, Batbayar Banzragch, Bolor Radnaabazar and Bilguun Batkhuyag.

Finally, we thank the 188 nomadic herding families and the generous gift of their time in assisting our researchers and field technicians in the completion of social surveys which have provided great insight in the creation of this report.

[\(McLaughlin, 2019\)](#)



Cornell University



STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

BACKGROUND |

Dundgovi Aimag is situated centrally within Mongolia, about 240 kilometers south of the capital city Ulaanbaatar. It is comprised primarily of semi-arid steppe. Dundgovi is the second-least populated aimag of Mongolia, with a population of 46,383. The aimag is especially noted for its animal husbandry and livestock products such as cashmere.

ISSUES |

A changing climate in Dundgovi has increased both the frequency and severity of extreme climate events such as drought and dzud. This poses a threat to livestock-based livelihoods throughout the region, as herders are more likely to lose livestock in these events. Herders typically respond to such losses by increasing the number of their herd to act as a buffer. This in turn worsens grassland conditions, as larger herds' reliance on the same area of grassland leads to overgrazing and degradation of grassland ecosystems throughout Dundgovi. Many families, facing economic hardship, are abandoning herding altogether and migrating into larger cities such as Ulaanbaatar to seek non-herding employment. This phenomenon of rural outmigration, while contributing to population growth within cities, is also affecting the ability of remaining rural herders to carry out tasks related to livestock management, herding, and general household labor.

INSIGHTS |

Analysis of vegetation height, cover, and overall volume throughout Dundgovi aimag revealed that vegetation gains largely occurred in the north, while vegetation loss occurred largely in the southern portion of Dundgovi. While vegetation cover is increasing on average across the region, vegetation height has remained the same on average. However, there are noted decreases in vegetation height within the southern soums.

Survey respondents reported a number of interesting findings (pg. 10 of this report). A large majority of respondents reported moderate-significant degradation of both availability and condition of existing grazing lands. This may be a factor in many respondents' decision to shift their herding management practices in the next five years. A slight minority of herders indicated that rural outmigration of family members has affected their herding practices as well as the availability of labor, however a majority indicate that existing practices and labor are adequate for their needs. Despite this, herders within Dundgovi report lower mobility in recent years than in the past, moving fewer times per year as well as shorter distances when they do move.

SOLUTIONS |

Changes in volume of forage may be driven by changes in composition of pasture vegetation, including shifts toward less palatable species. Local monitoring within each soum could target vegetation change hotspots to assess vegetation composition to better understand actual forage quality. To address rural outmigration of herders the national government has to undertake complex measures to increase climate adaptation and strengthen herder resilience. However, at aimag and soum levels the authorities need to support herder education for rangeland management and livelihood diversification. Their specific focus should be on the young herders to create enabling conditions with learning opportunities and social services.



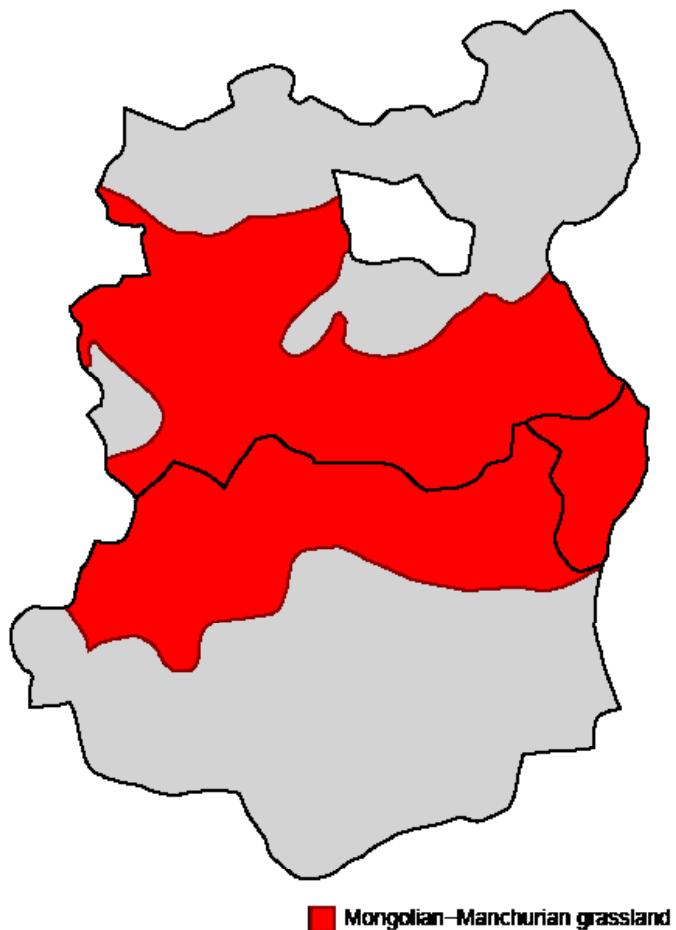
STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

METHODS & CONTEXT

VEGETATION MAP CREATION |

Vegetation maps were created between 2019-2024 through a two-step scaling approach using field observations, unoccupied aerial vehicles (UAVs), and Sentinel-2 imagery. Each pixel of the vegetation cover, height, and volume maps represents the average vegetation value of that characteristic over a 20 x 20 meter area. Our data collection was within the Mongolian-Manchurian grassland eco-region defined by the World Wildlife Fund (the red in the map to the right) in 2023, but we provide predictions across the entire province. While we are confident in our maps' value in most of the surrounding steppe eco-types, data from forested areas are not accurate. More information on the mapping project can be found at the StEPPEs project repository provided in the table of contents.



DUNDGOVI MAP INTERPRETATIONS |

Maps for change in vegetation cover (%), vegetation height (cm) and vegetation volume (m^3) between 2019-2024 are provided below. Change is defined for each pixel as the average annual rate change by estimating the slope of a linear model for each vegetation characteristic value and year. This can be interpreted as the average amount of increasing (blue) or decreasing (red) vegetation seen within the study period.

DUNDGOVI VEGETATION TREND FIGURES |

The average values were for vegetation cover (a), vegetation height (b), vegetation volume (c) are provided for each year in the plot following the map. The trend of these values is displayed as a dashed grey line, and the error bars around the mean represent one standard deviation.

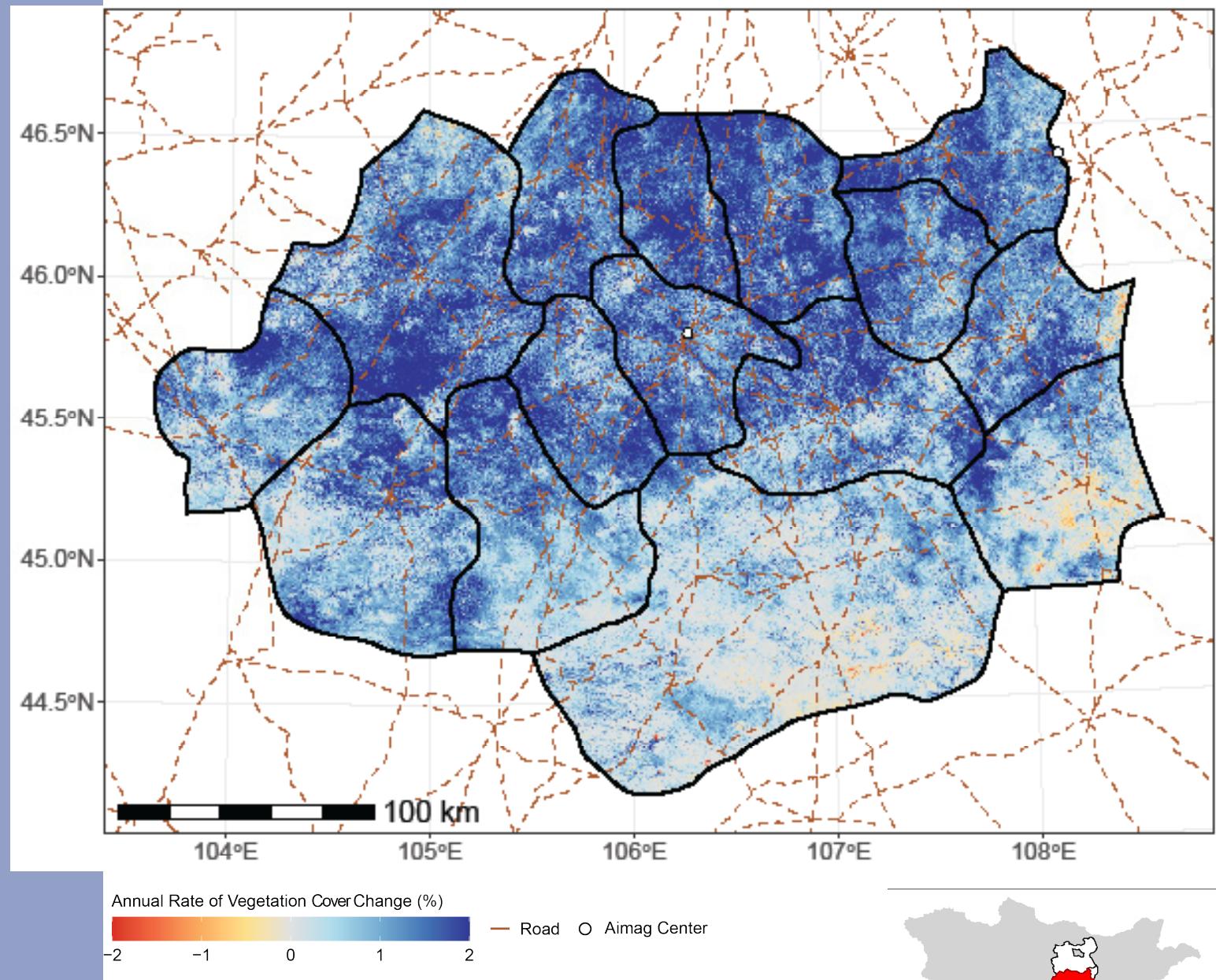
DUNDGOVI HOUSEHOLD SURVEY TABLE |

We also provide seven questions reported during the household survey data collected in the winter of 2023. These data were taken from households within two soums: Deren and Erdenedalai.

STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

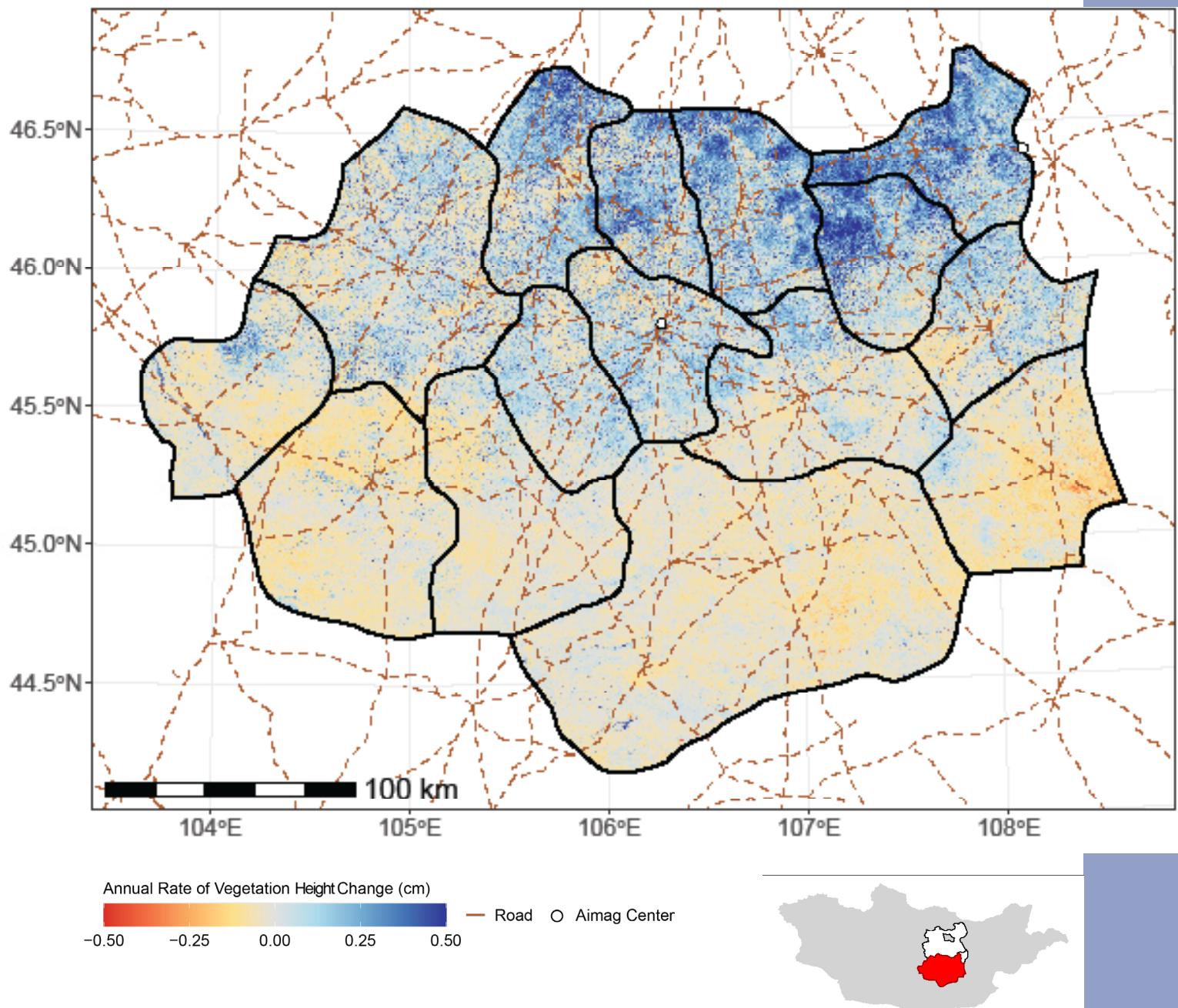
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

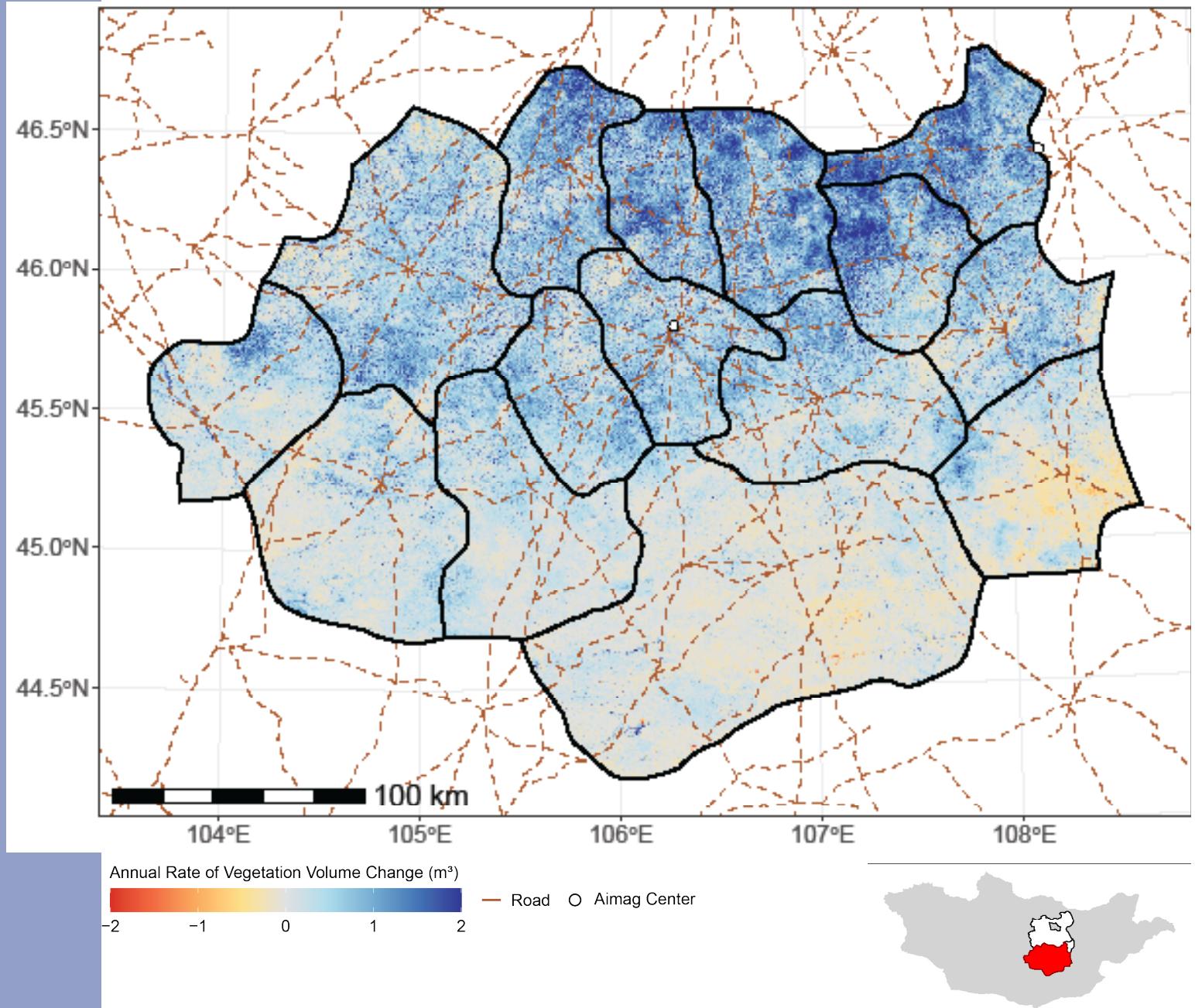
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STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

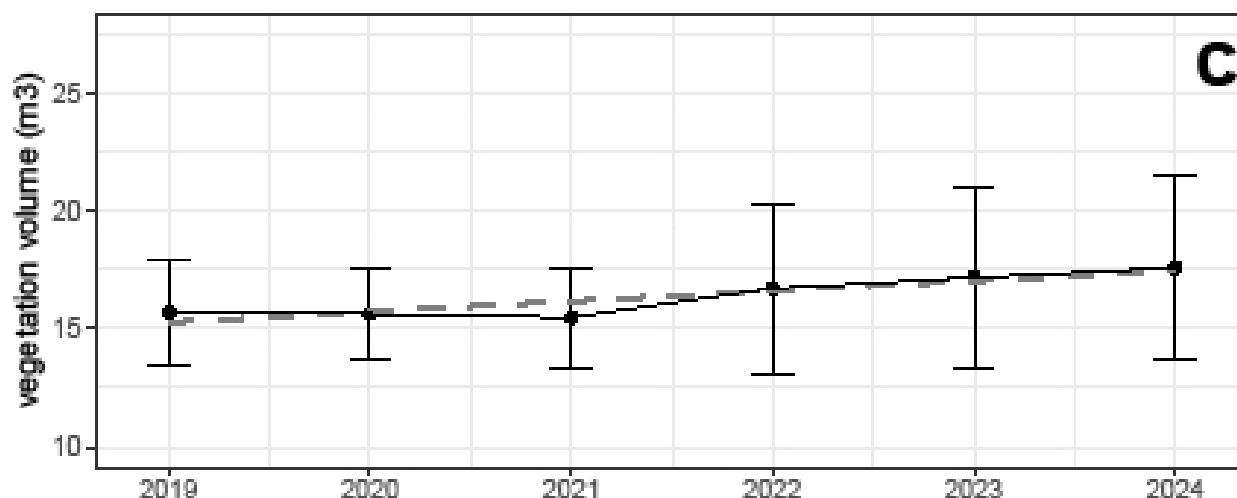
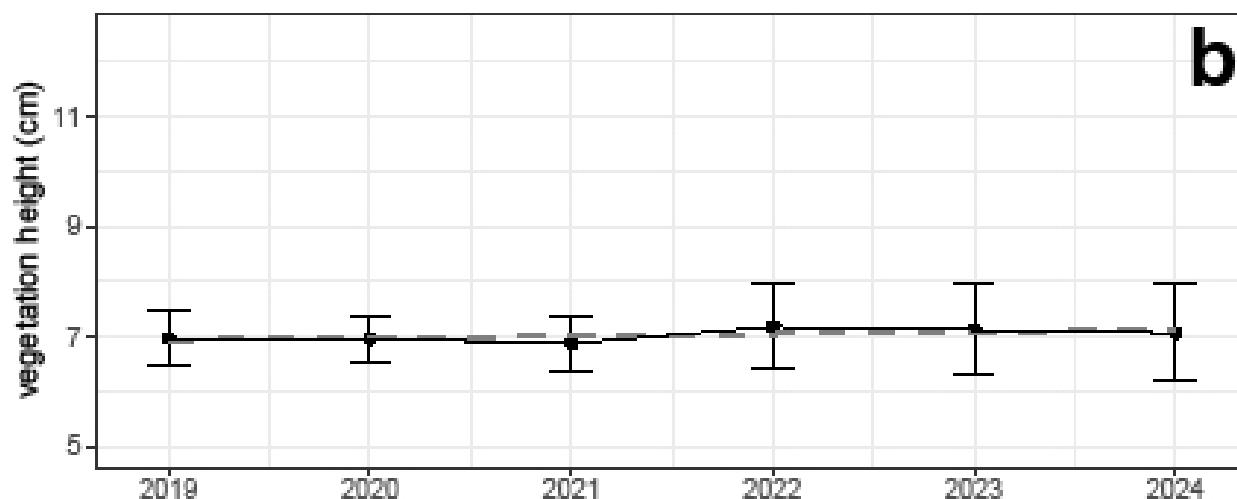
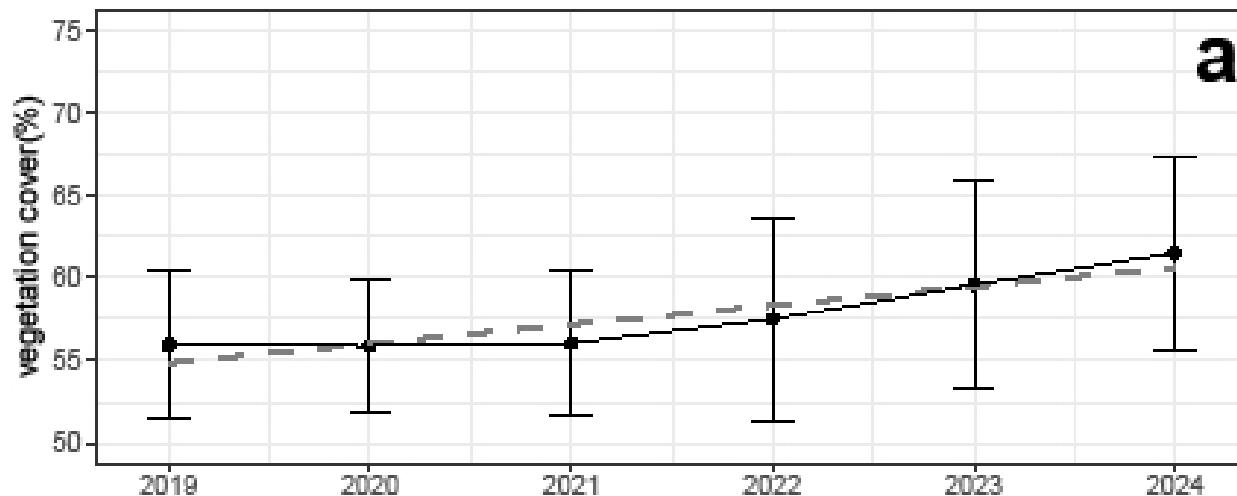
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

AVERAGE VEGETATION TRENDS



STATE OF THE STEPPE 2025 - AIMAG LEVEL

DUNDGOVI

PIXELS WITH PERSPECTIVE: UNDERSTANDING THE SOCIAL DATA

Have you noticed any long term shifts in vegetation/forage?

Soum	Degraded	Improved	No Change	NA	Total
Deren	11	3	4	6	24
Erdenedalai	14	1	4	8	27
Aimag Total	25	4	8	14	51

In the past 5 years, have you changed any of your herd or pasture management practices?

Soum	No	Yes	Total
Deren	13	11	24
Erdenedalai	21	6	27
Aimag Total	34	17	51

In the next 5 years do you plan to make changes to your herd or pasture management?

Soum	No	Yes	Total
Deren	7	17	24
Erdenedalai	17	10	27
Aimag Total	24	27	51

Did you move camp more times last year or this year?

Soum	Equal	Moved more last year	Moved more this year	Total
Deren	17	5	2	24
Erdenedalai	12	12	3	27
Aimag Total	29	17	5	51

Did you travel a greater distance seasonally 10 years ago vs. in the past year?

Soum	Equal	Greater distance	Less distance	NA	Total
Deren	9	10	2	3	24
Erdenedalai	5	13	5	4	27
Aimag Total	14	23	7	7	51

Has the migration in household members to the soum center/Ulaanbaatar impacted herding labor?

Soum	No	Yes	NA	Total
Deren	15	8	1	24
Erdenedalai	12	14	1	27
Aimag Total	27	22	2	51

Has the migration in household members to the soum center/Ulaanbaatar impacted herding practices?

Soum	No	Yes	NA	Total
Deren	16	7	1	24
Erdenedalai	14	12	1	27
Aimag Total	30	19	2	51

STATE OF THE STEPPE 2025 - SOUM LEVEL

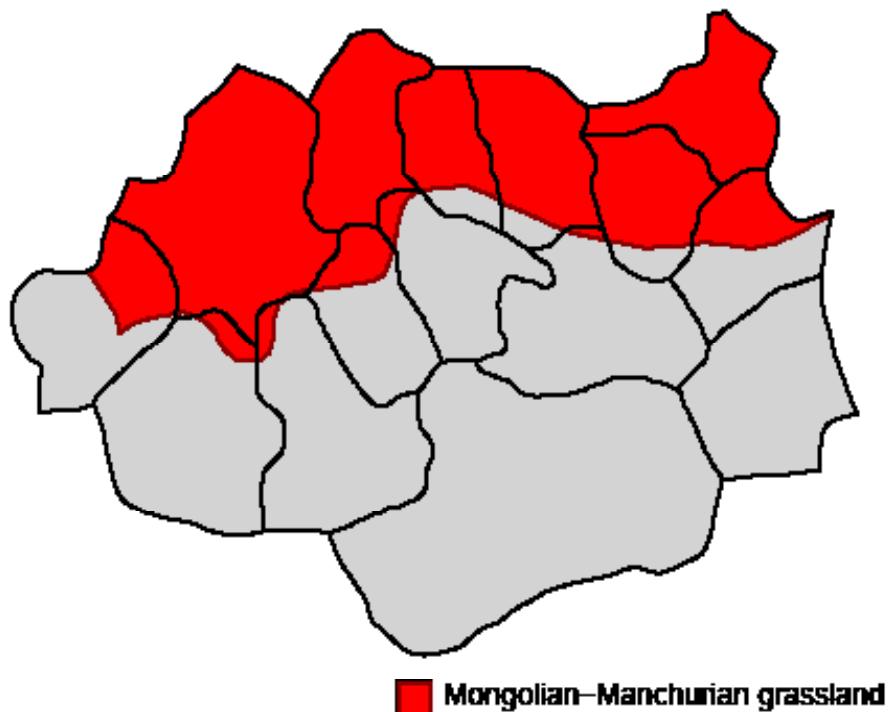
METHODS & CONTEXT

DUNDGOVI SOUM MAP INTERPRETATIONS |

Maps for change in vegetation cover (%), vegetation height (cm) and vegetation volume (m^3) between 2019-2024 are provided below. Change is defined for each pixel as the average annual rate change by estimating the slope of a linear model for each vegetation characteristic value and year. This can be interpreted as the average amount of increasing (blue) or decreasing (red) vegetation seen within the study period.

DUNDGOVI SOUM VEGETATION TREND FIGURES |

The values were averaged of each soum for vegetation cover (a), vegetation height (b), vegetation volume (c) are provided for each year in the plots following the maps. The trend of these values is displayed as a dashed grey line.

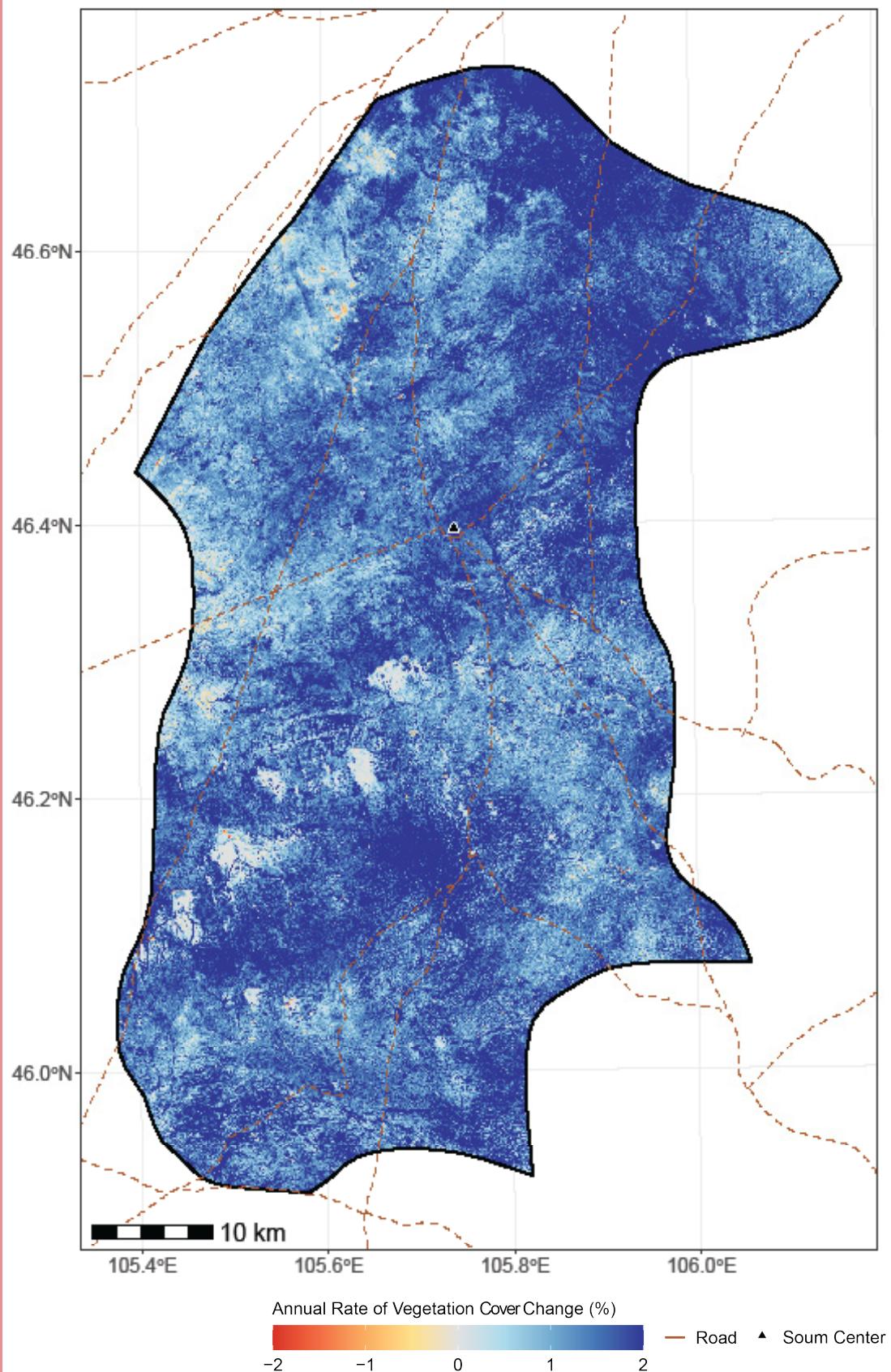


Dundogvi soum Map | The extent of each soum that falls within the Mongolian-Manchurian grassland ecoregion defined by the World Wildlife Fund is in red.

STATE OF THE STEPPE 2025 - SOUM LEVEL

ADAATSAG SOUM

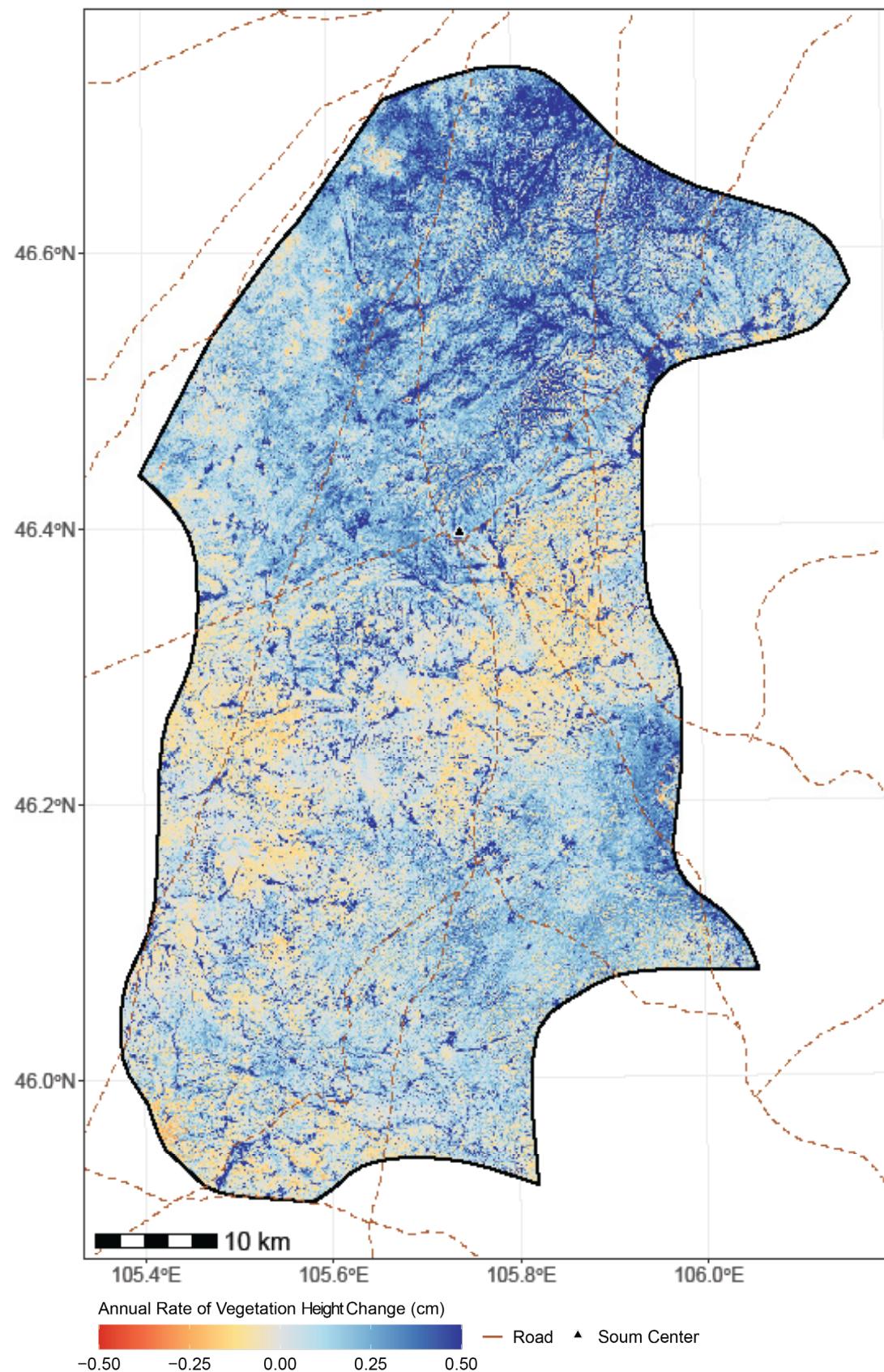
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

ADAATSAG SOUM

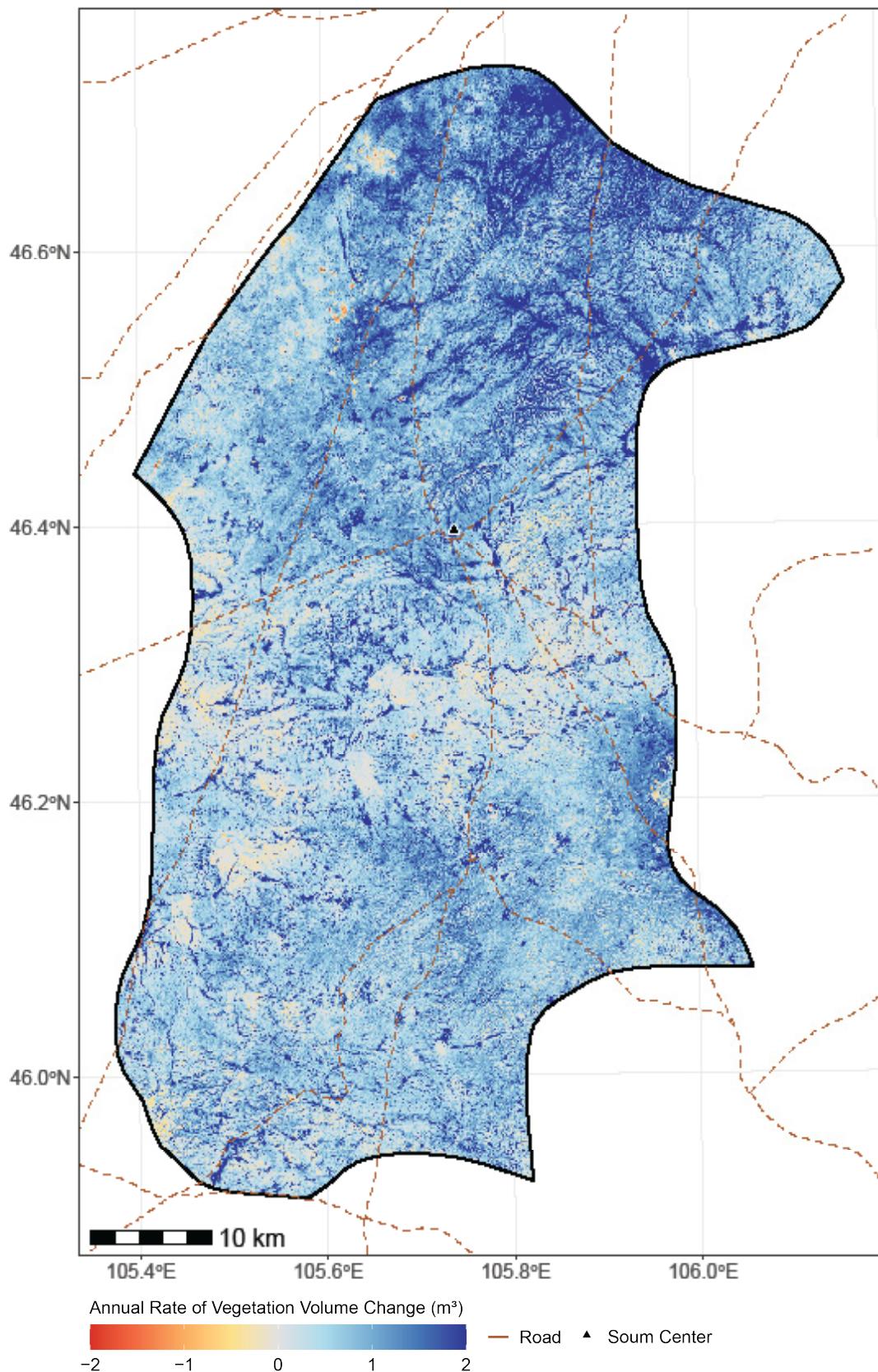
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

ADAATSAG SOUM

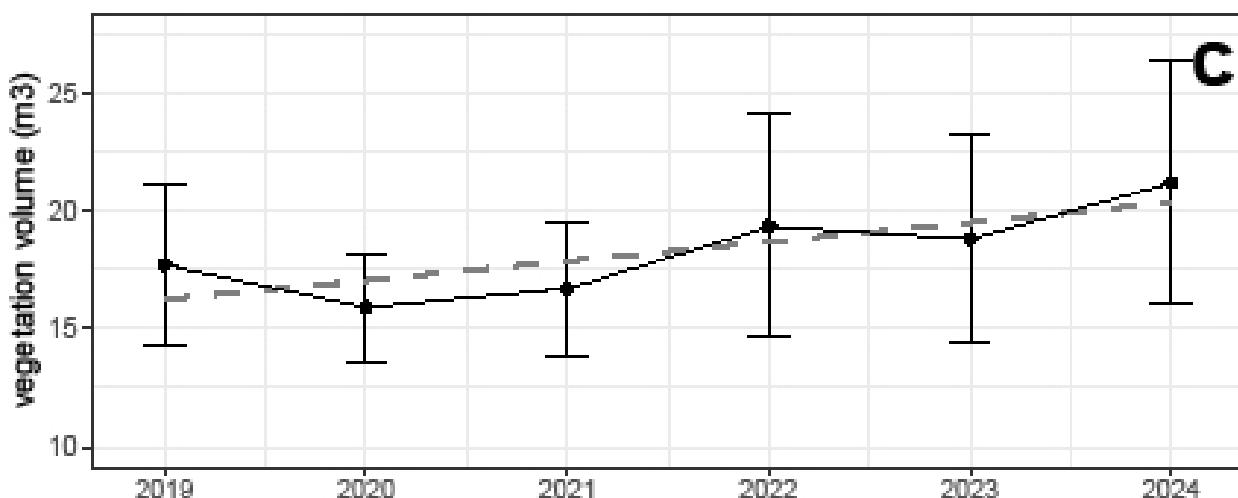
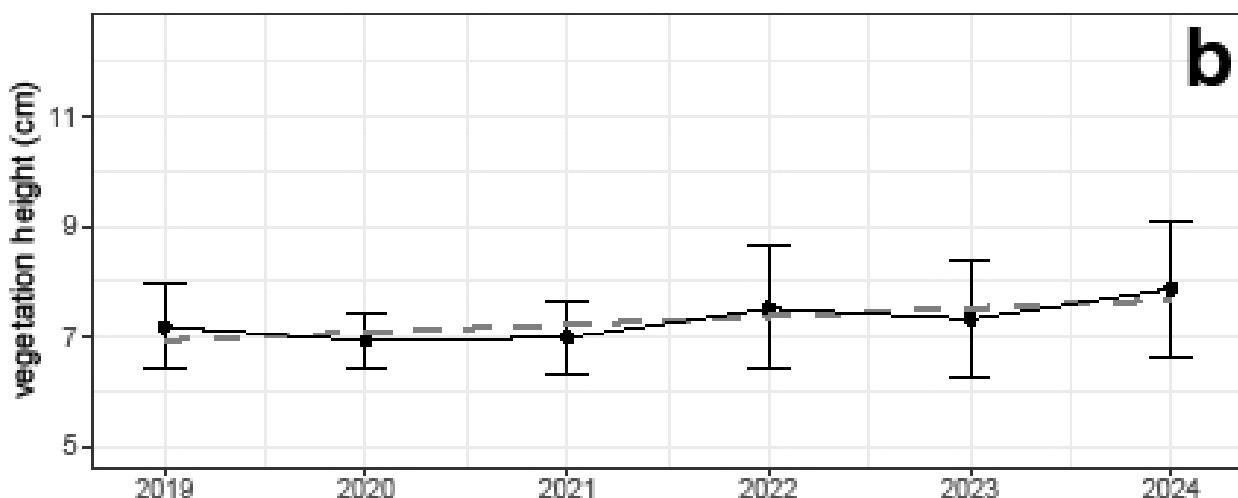
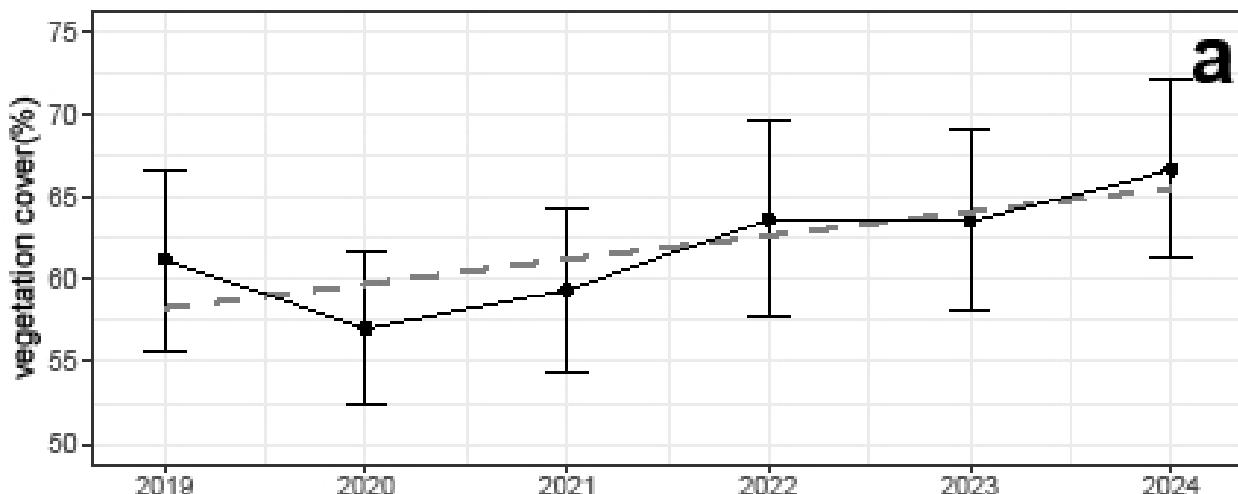
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

ADAATSAG SOUM

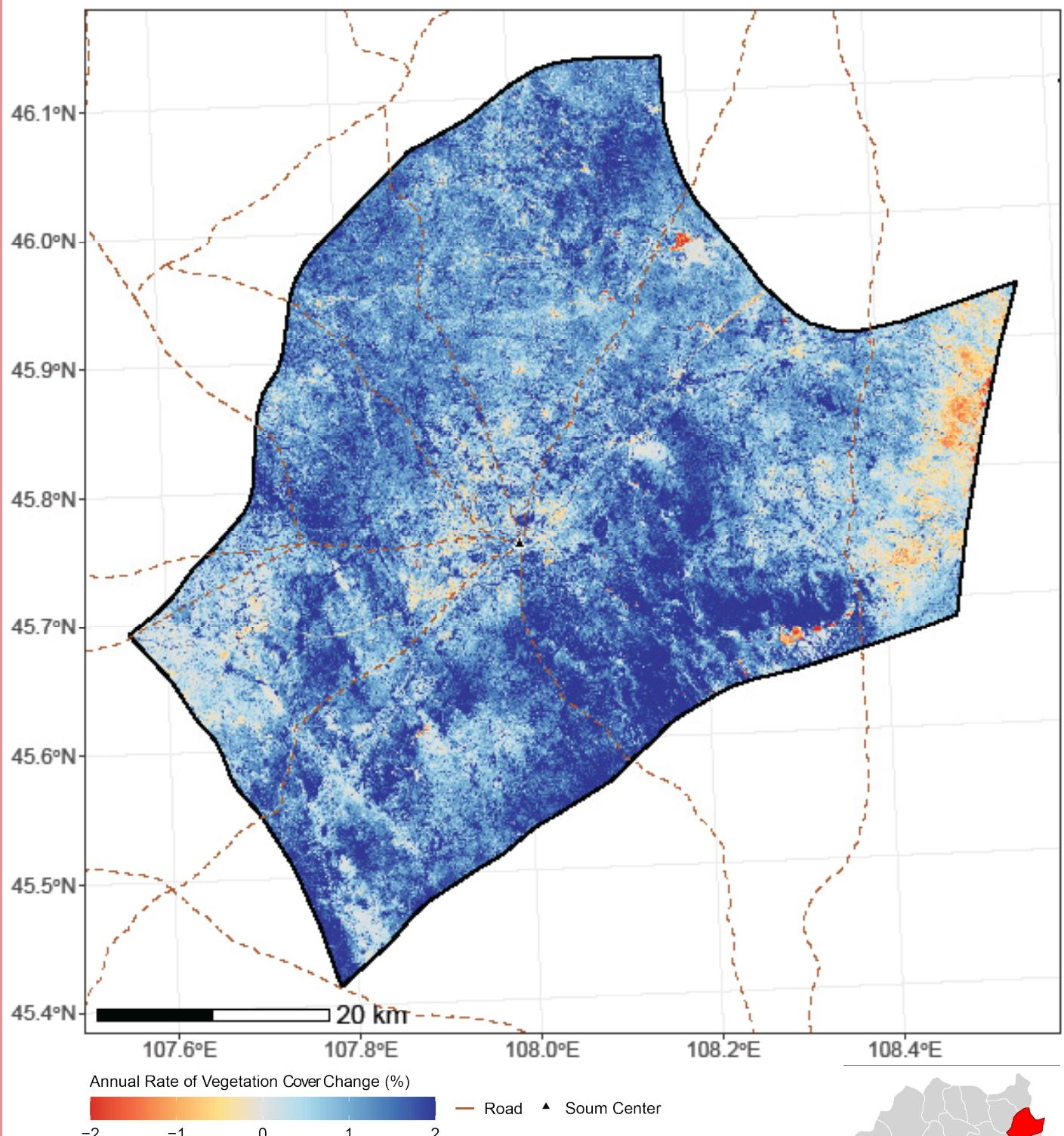
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANJARGALAN SOUM

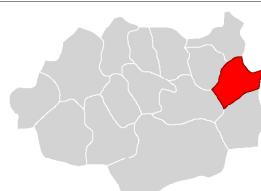
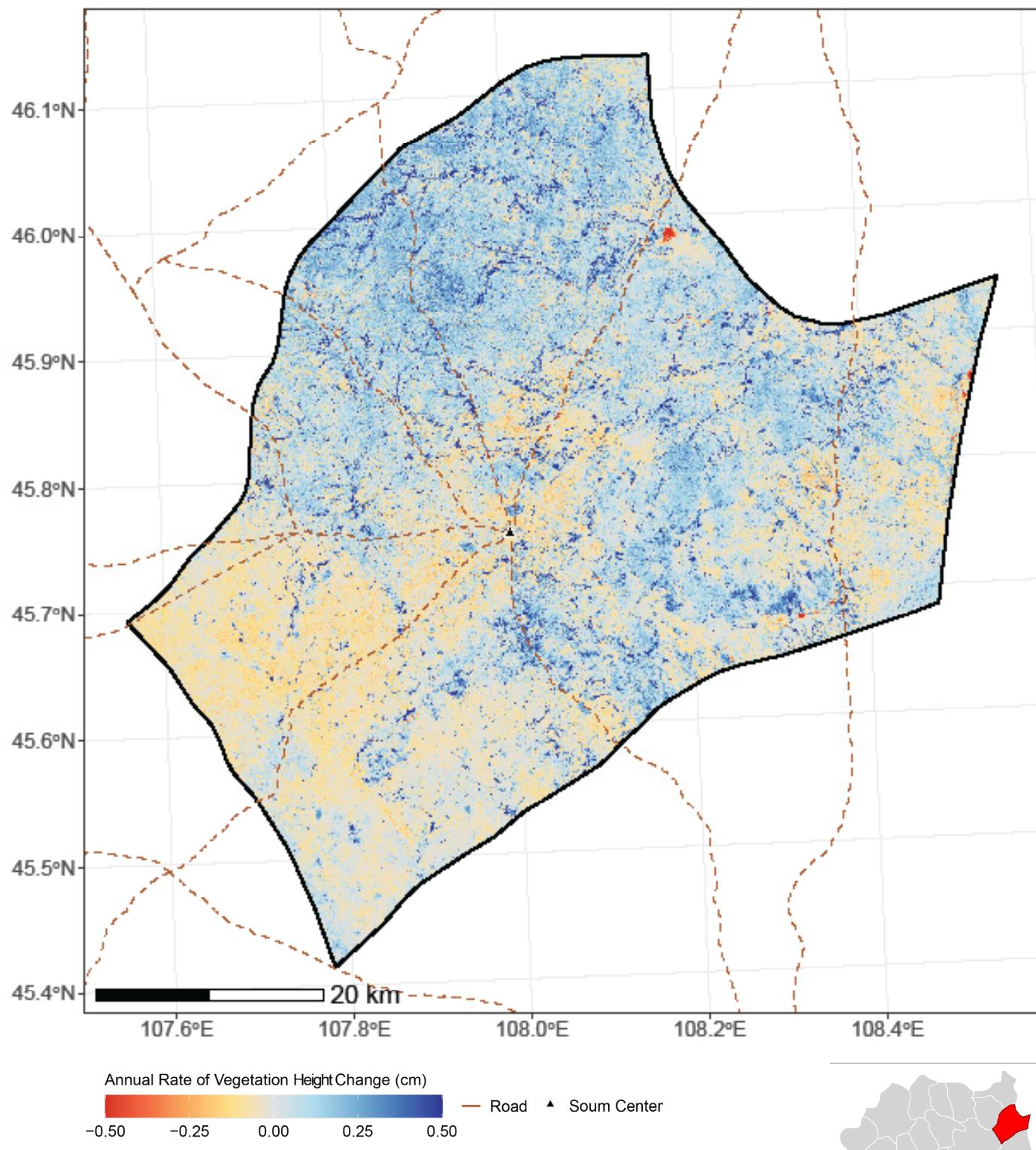
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STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANJARGALAN SOUM

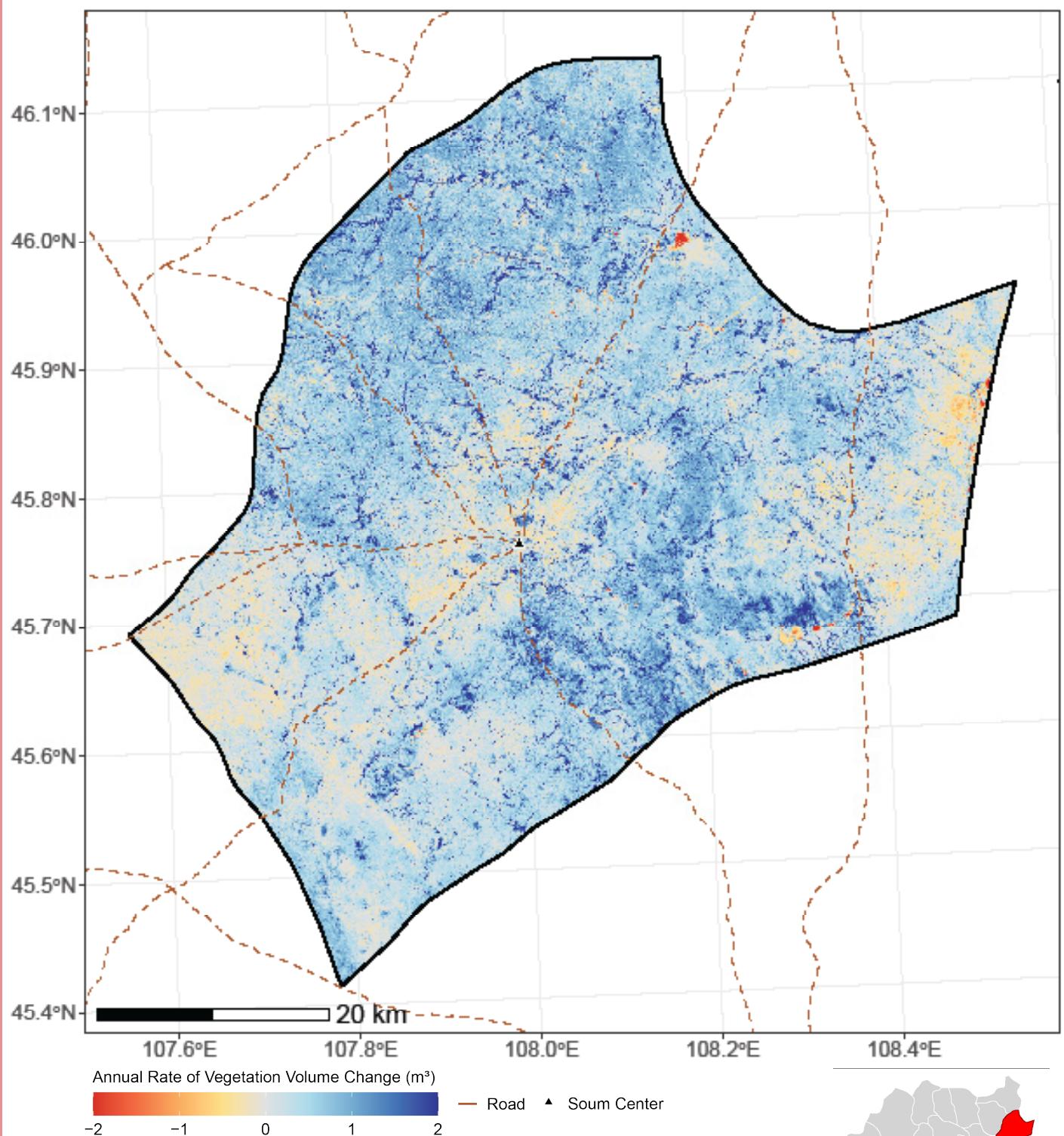
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STATE OF THE STEPPE 2025 - SOUM LEVEL

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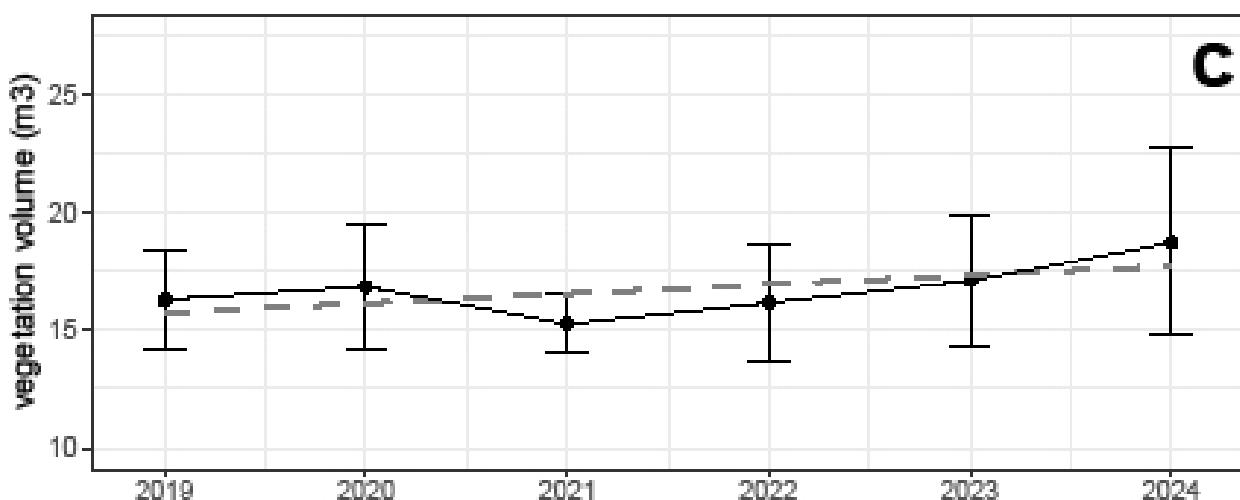
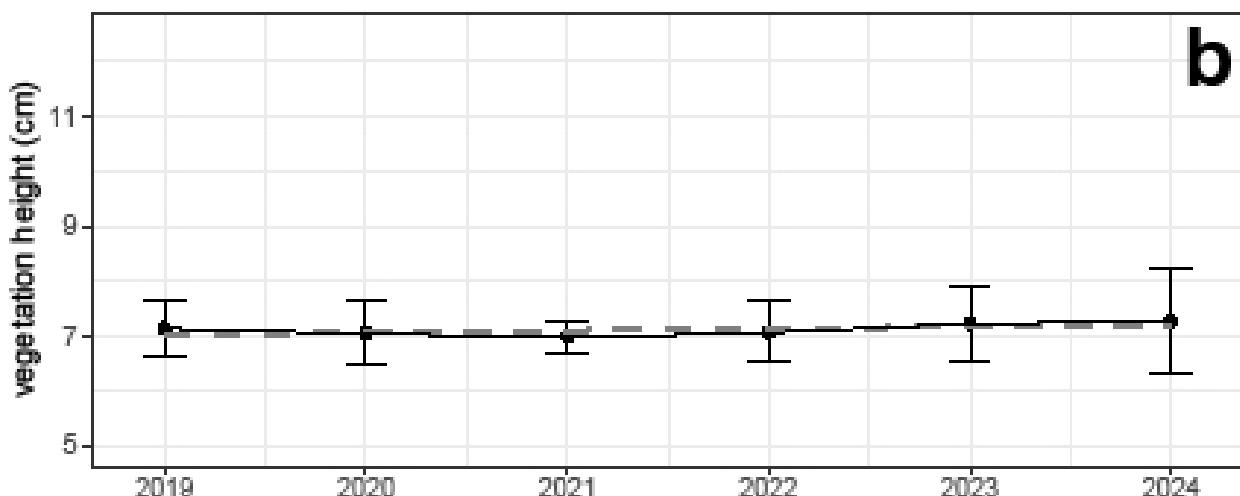
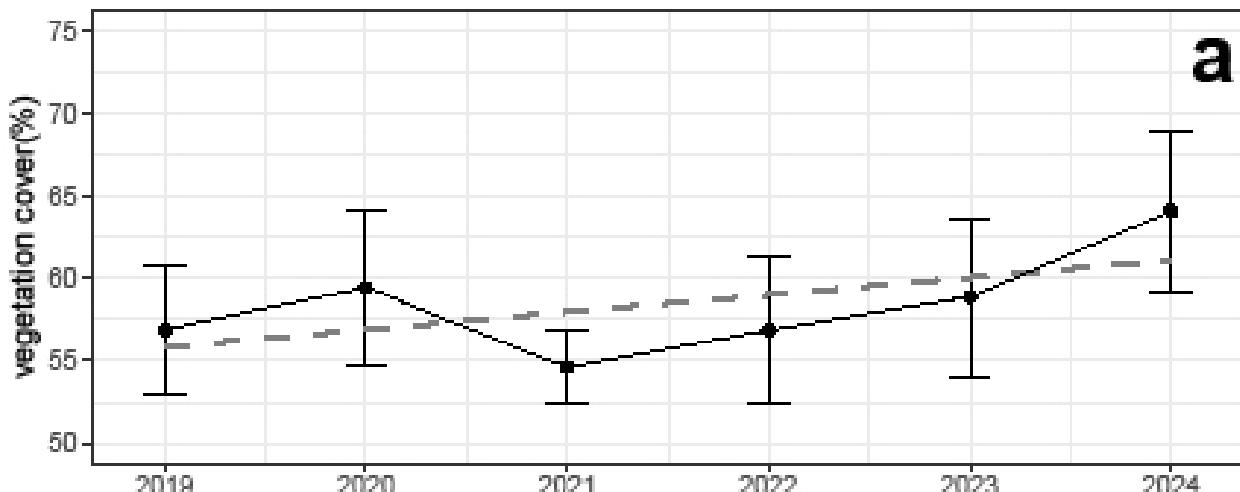
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANJARGALAN SOUM

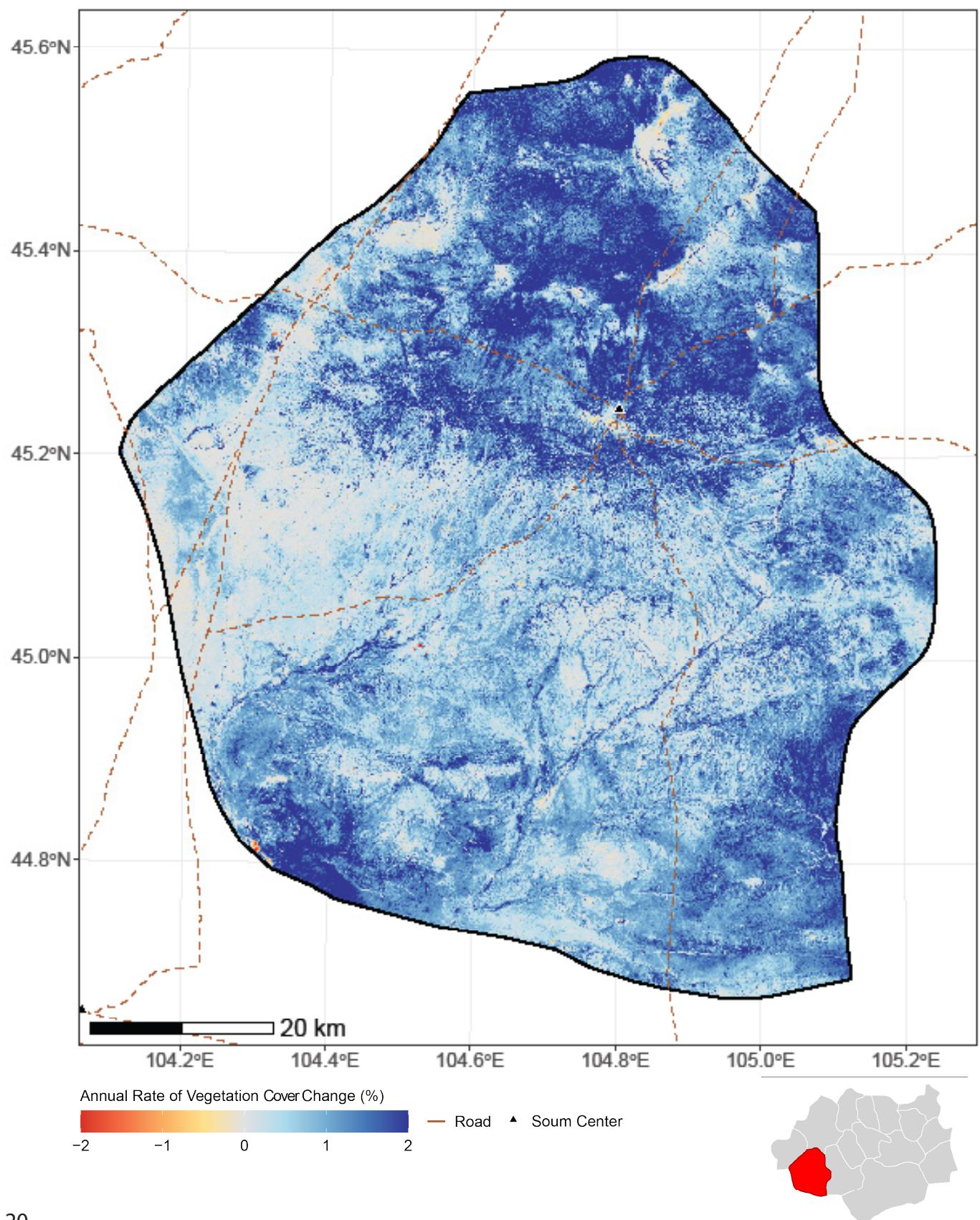
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

DELGERKHANGAI SOUM

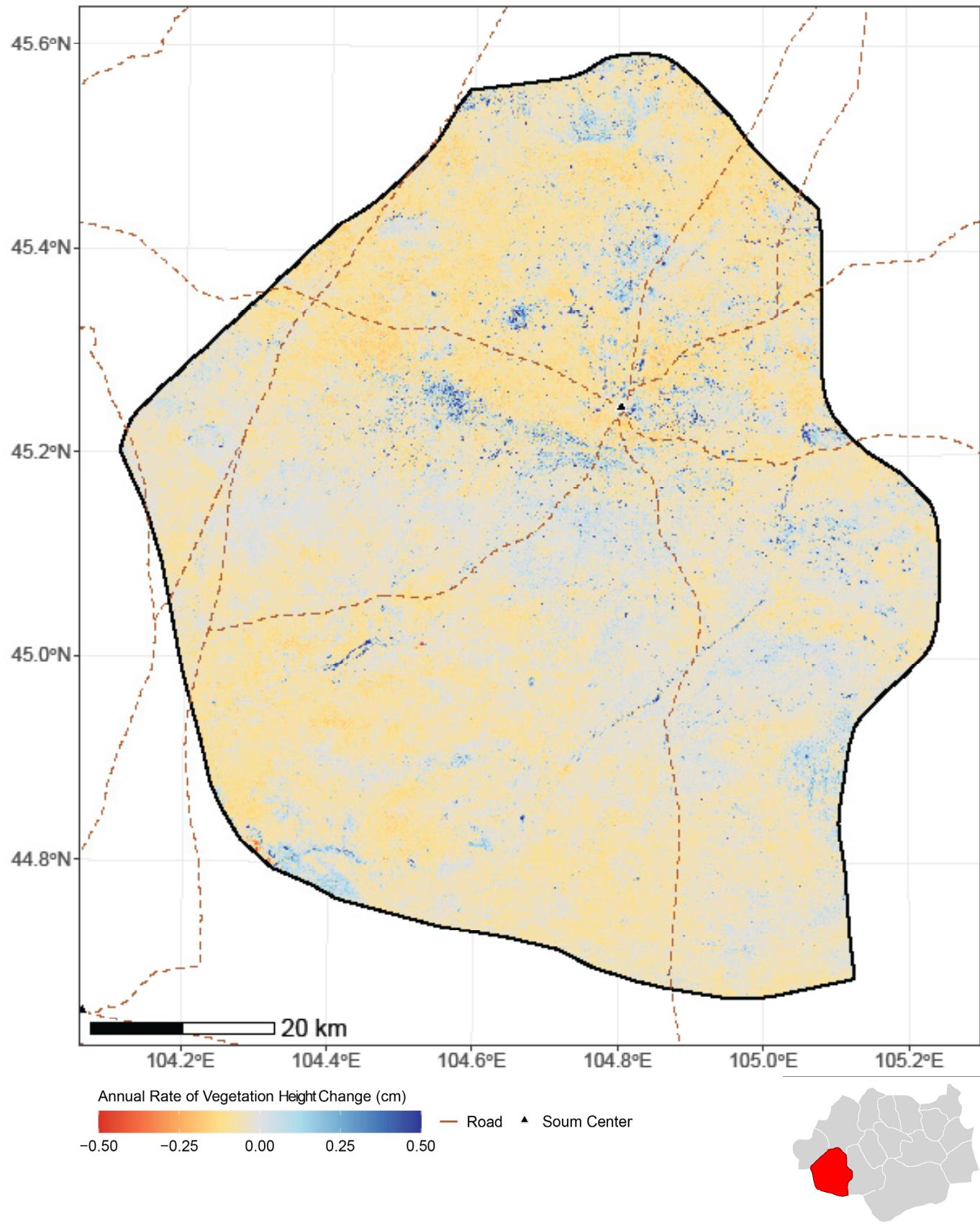
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

DELGERKHANGAI SOUM

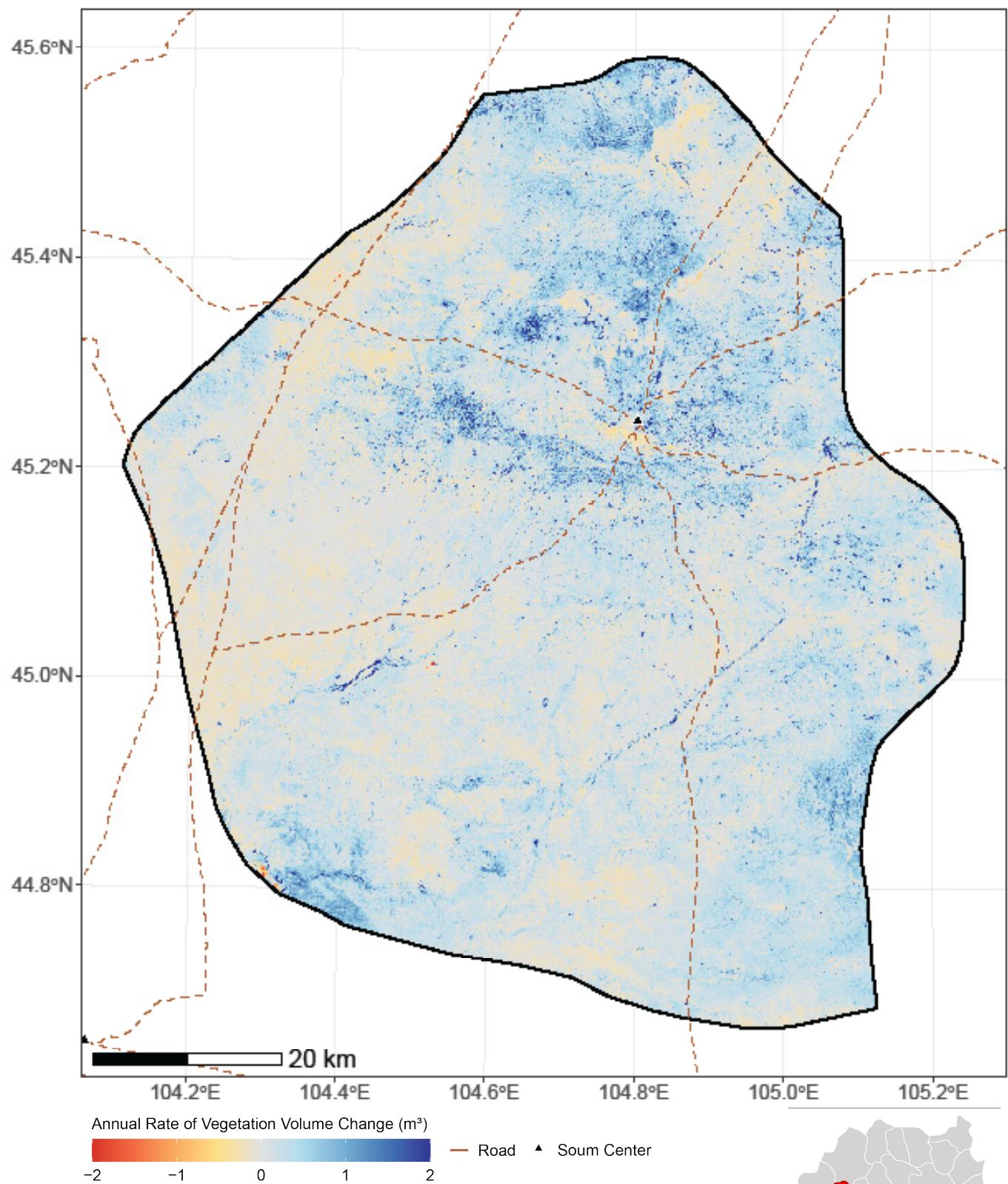
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STATE OF THE STEPPE 2025 - SOUM LEVEL

DELGERKHANGAI SOUM

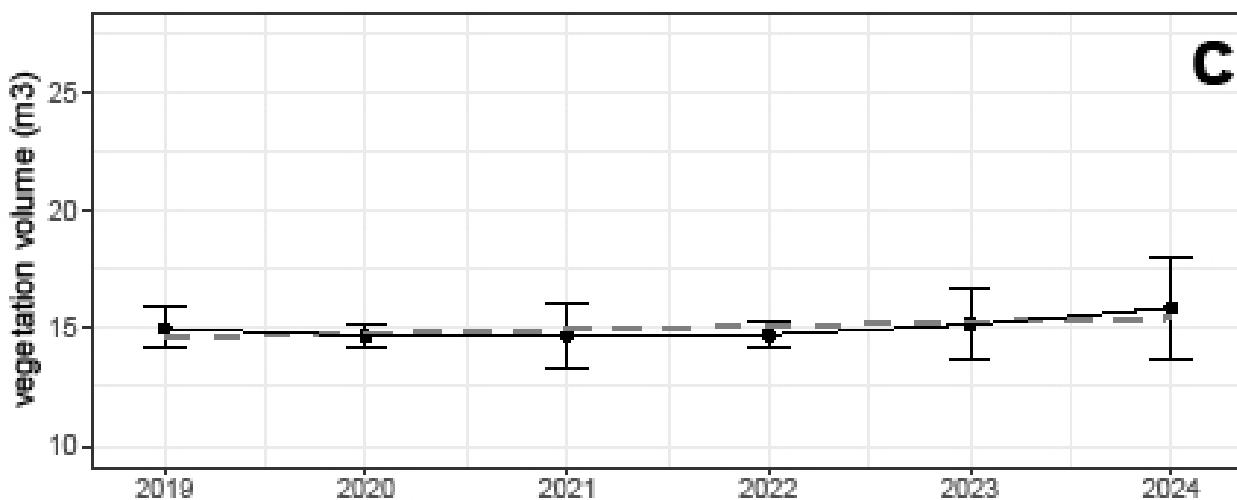
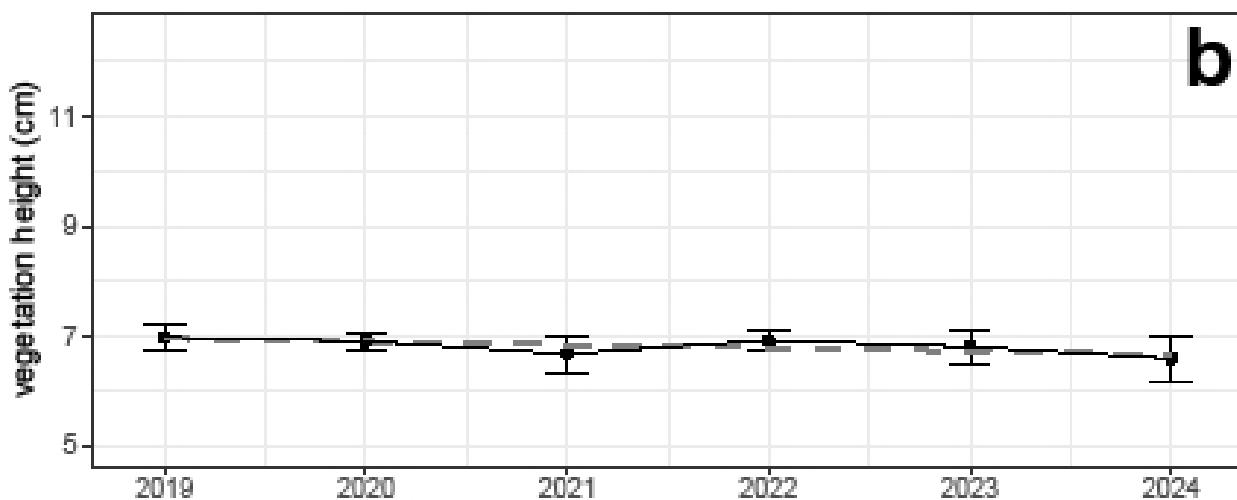
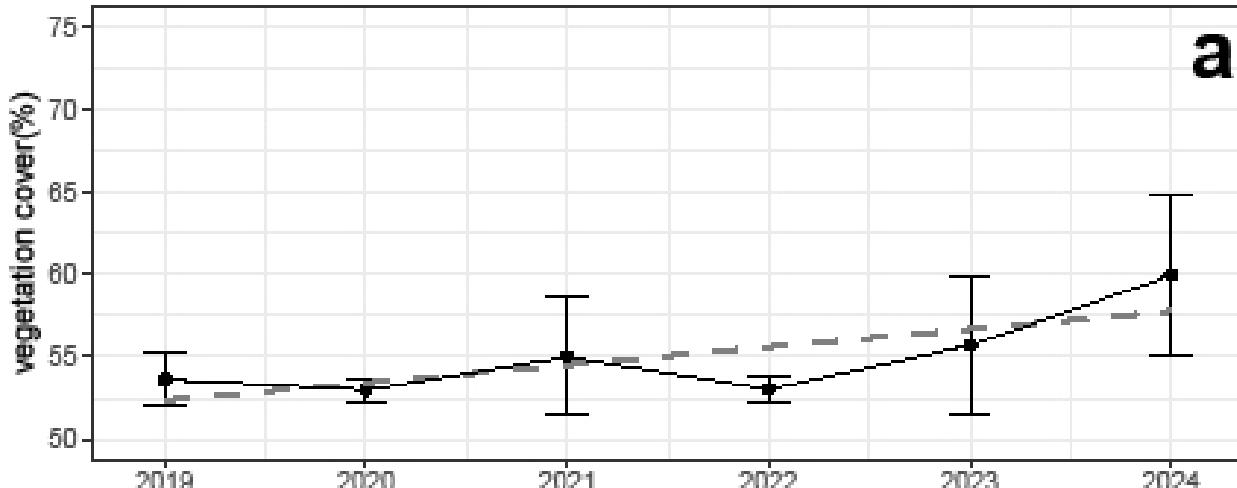
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

DELGERKHANGAI SOUM

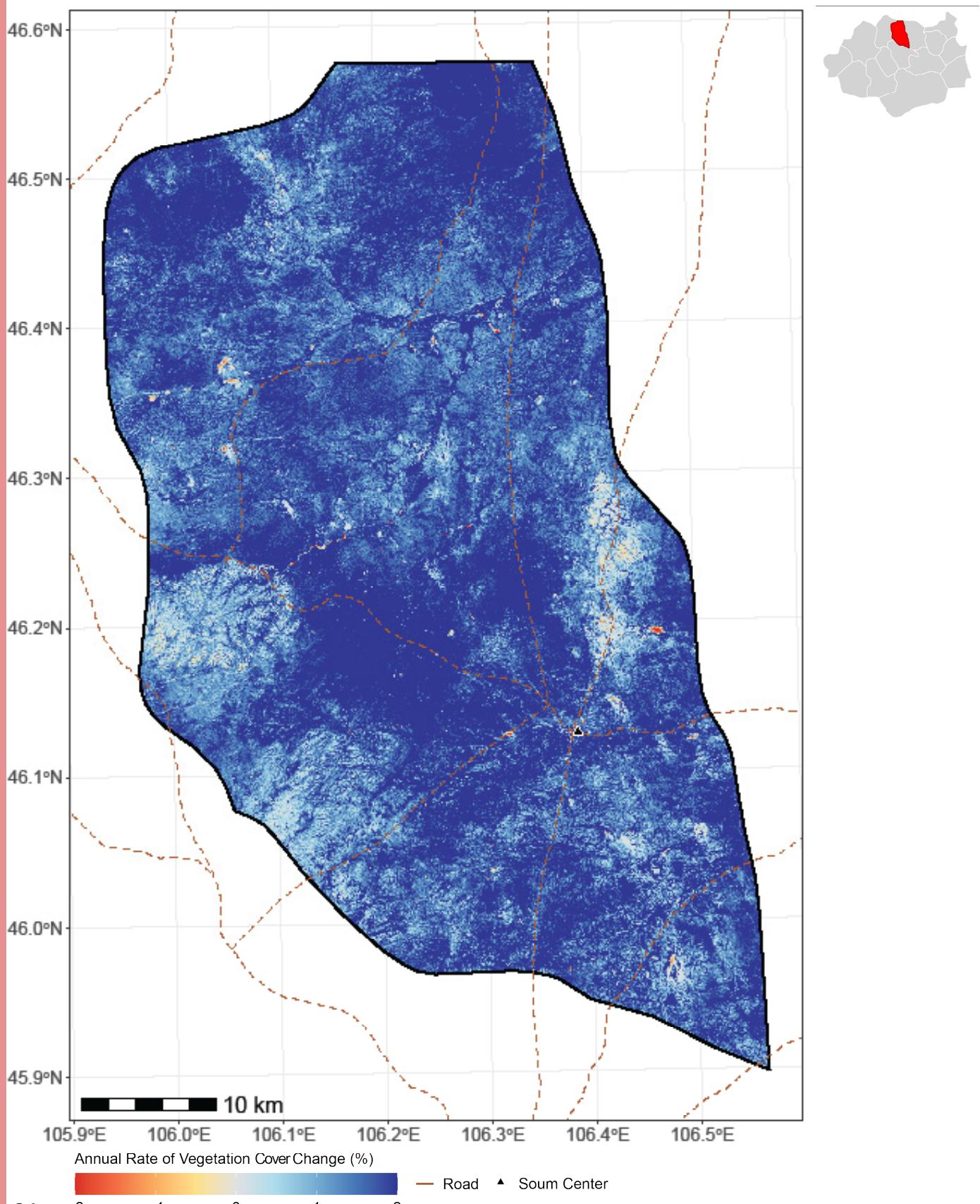
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

DELGERTSOGT SOUM

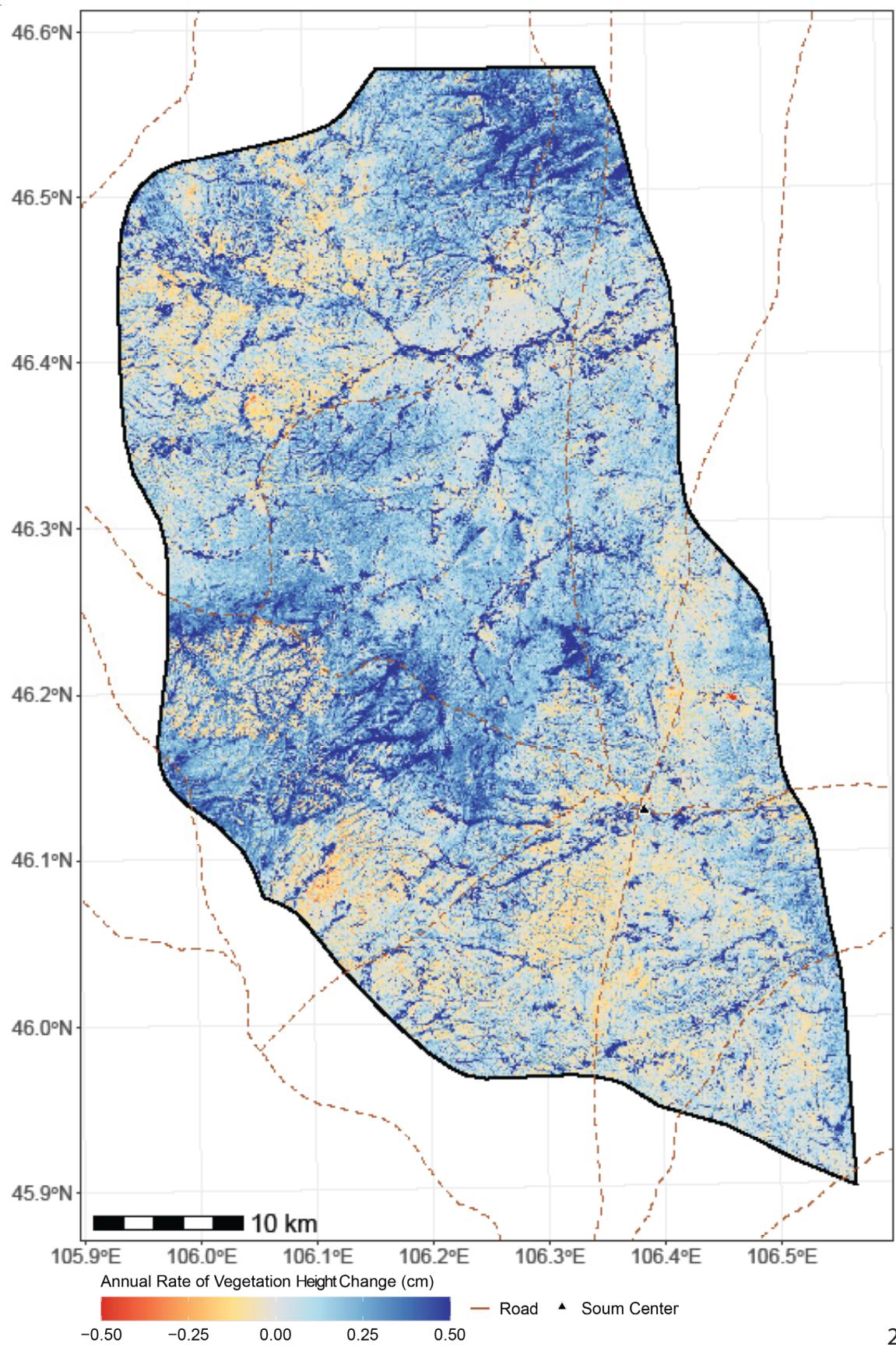
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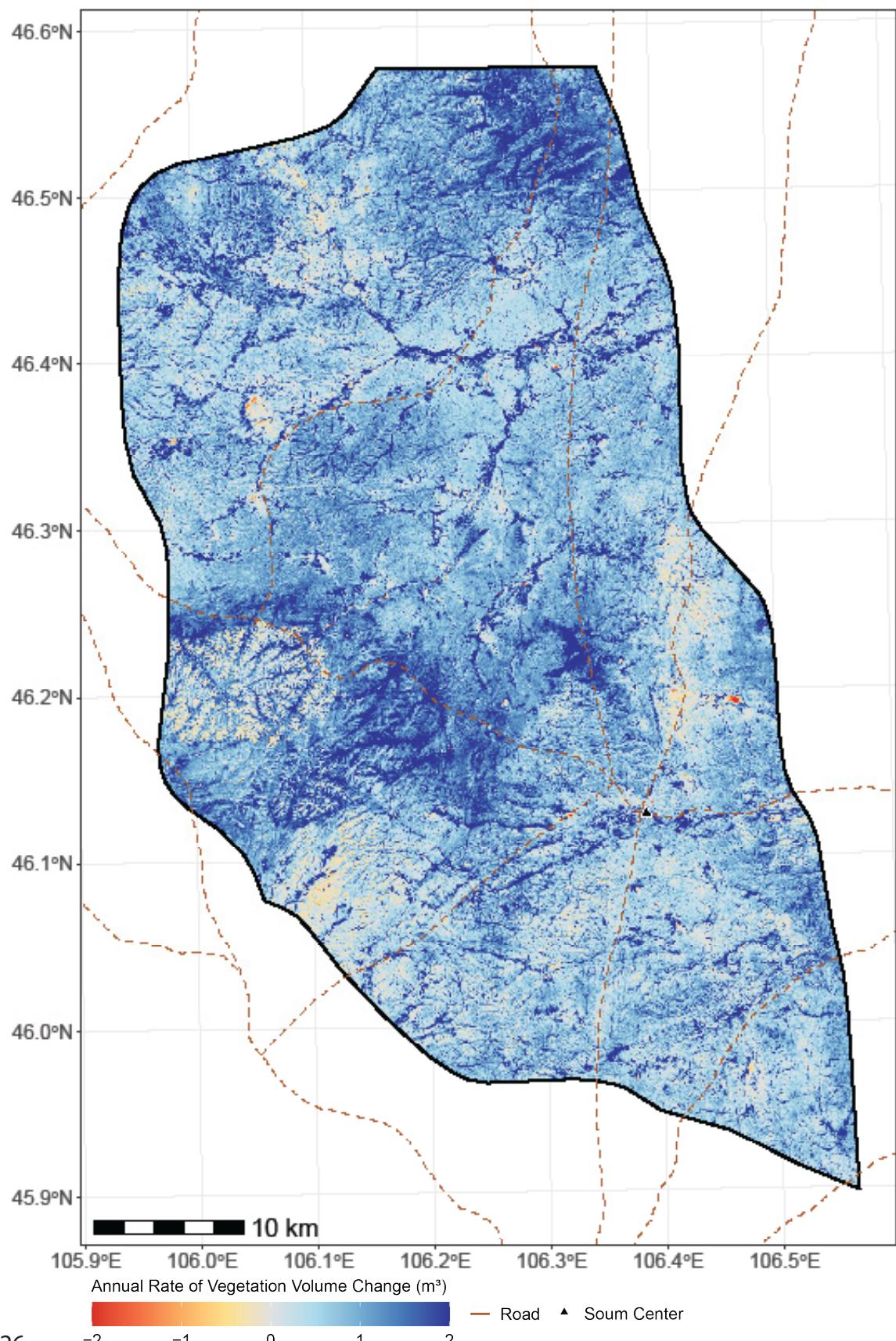
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STATE OF THE STEPPE 2025 - SOUM LEVEL

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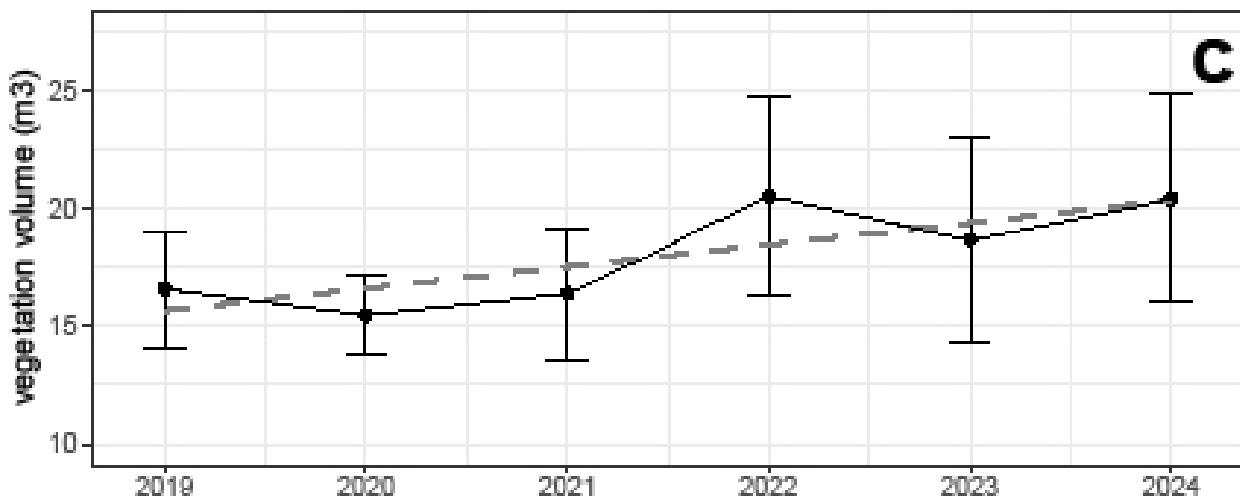
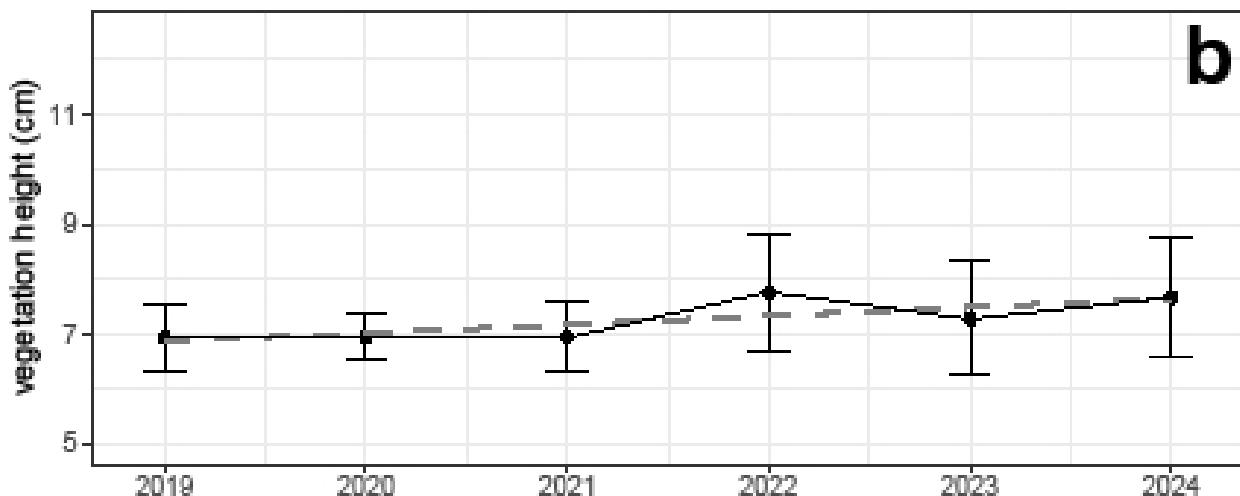
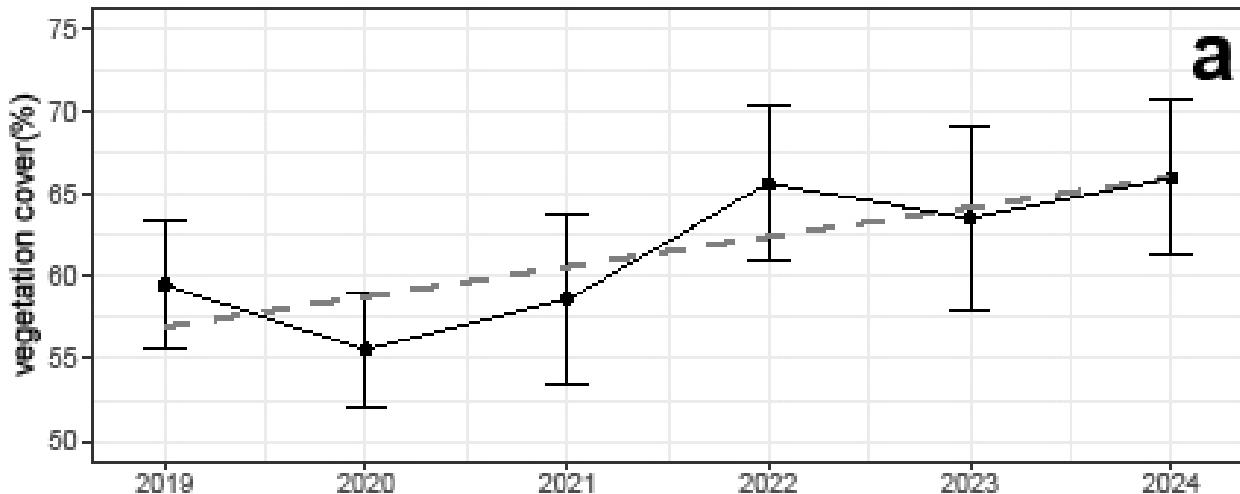
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STATE OF THE STEPPE 2025 - SOUM LEVEL

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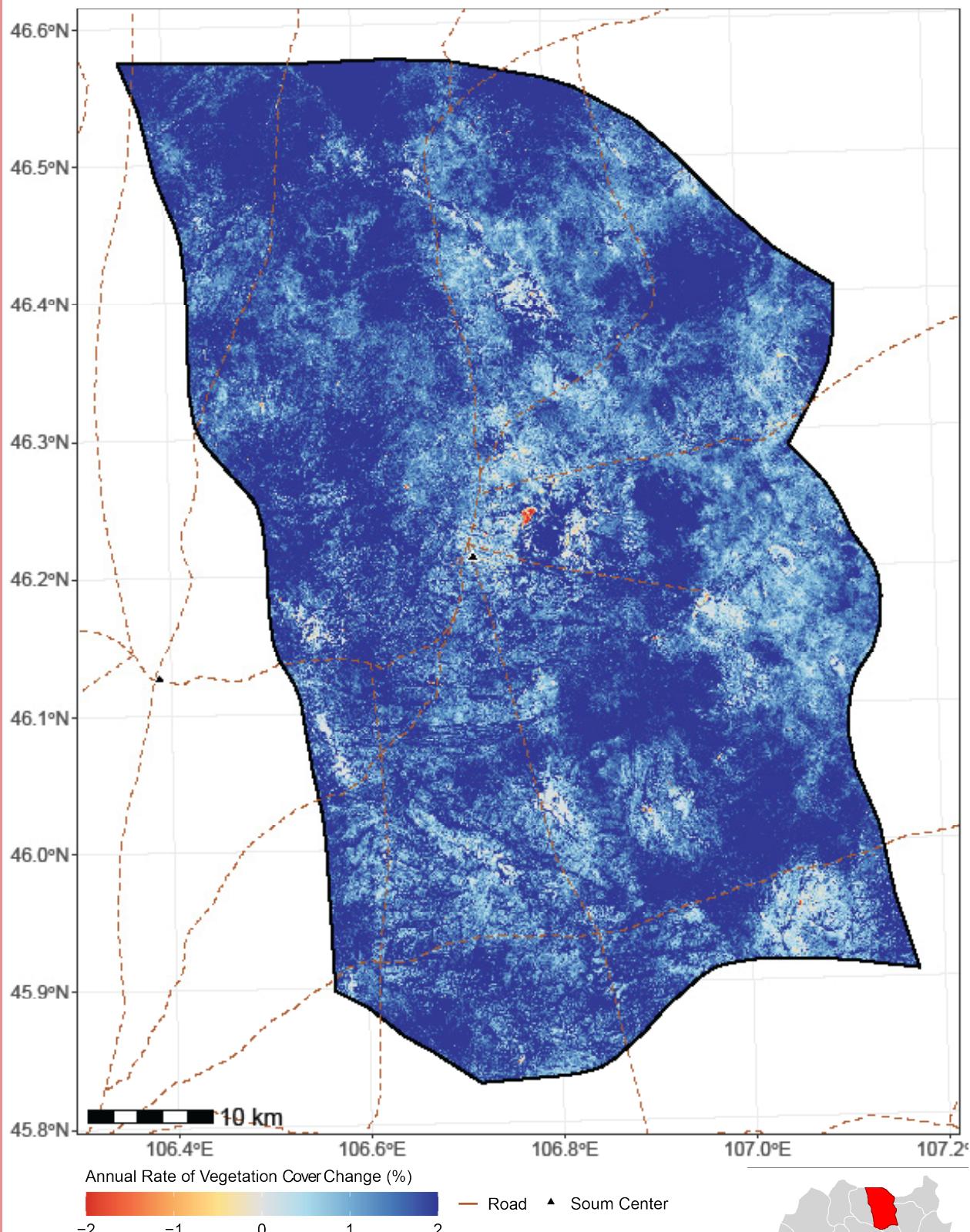
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

DEREN SOUM

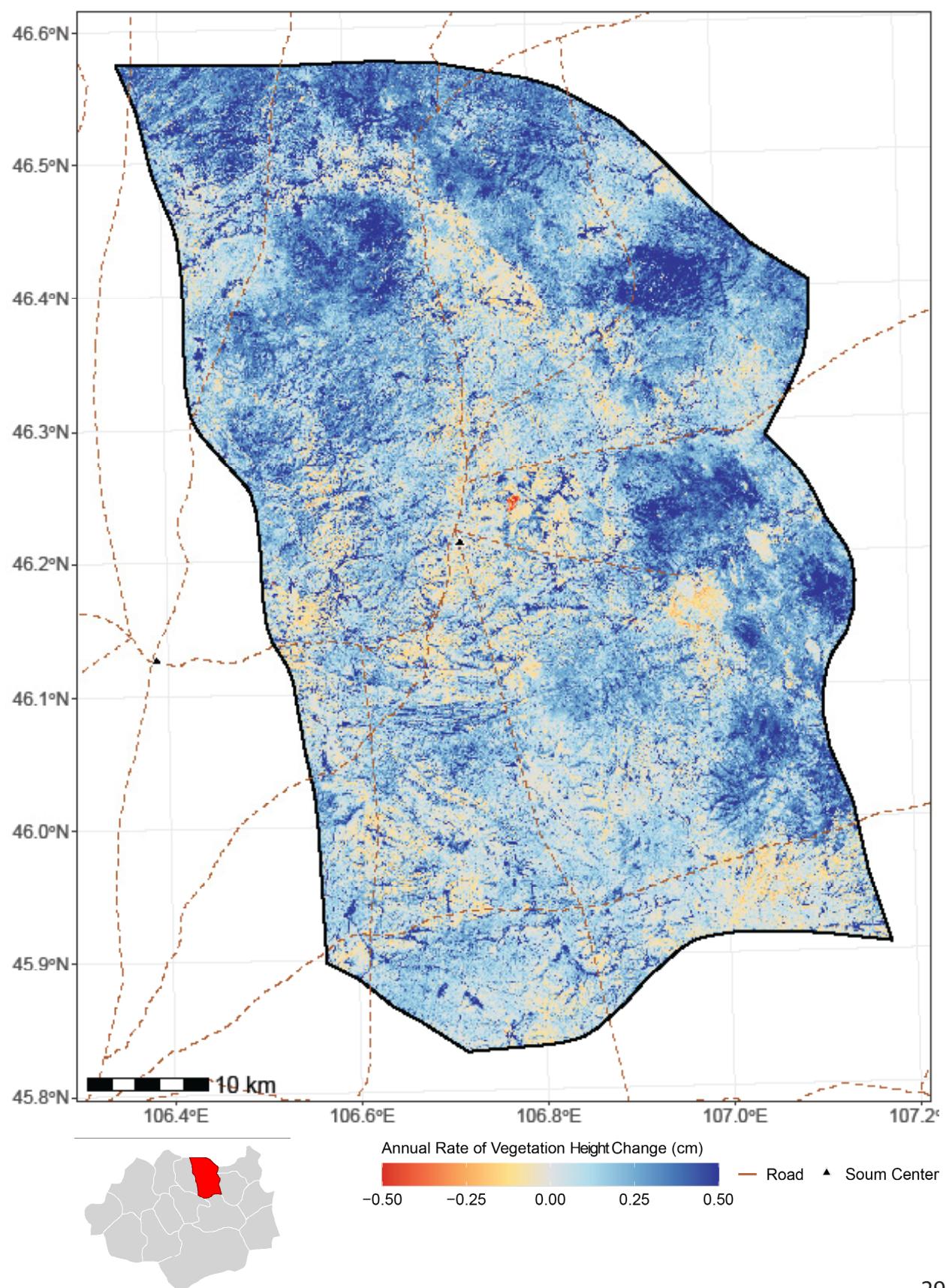
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STATE OF THE STEPPE 2025 - SOUM LEVEL

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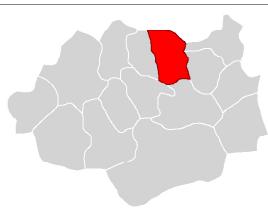
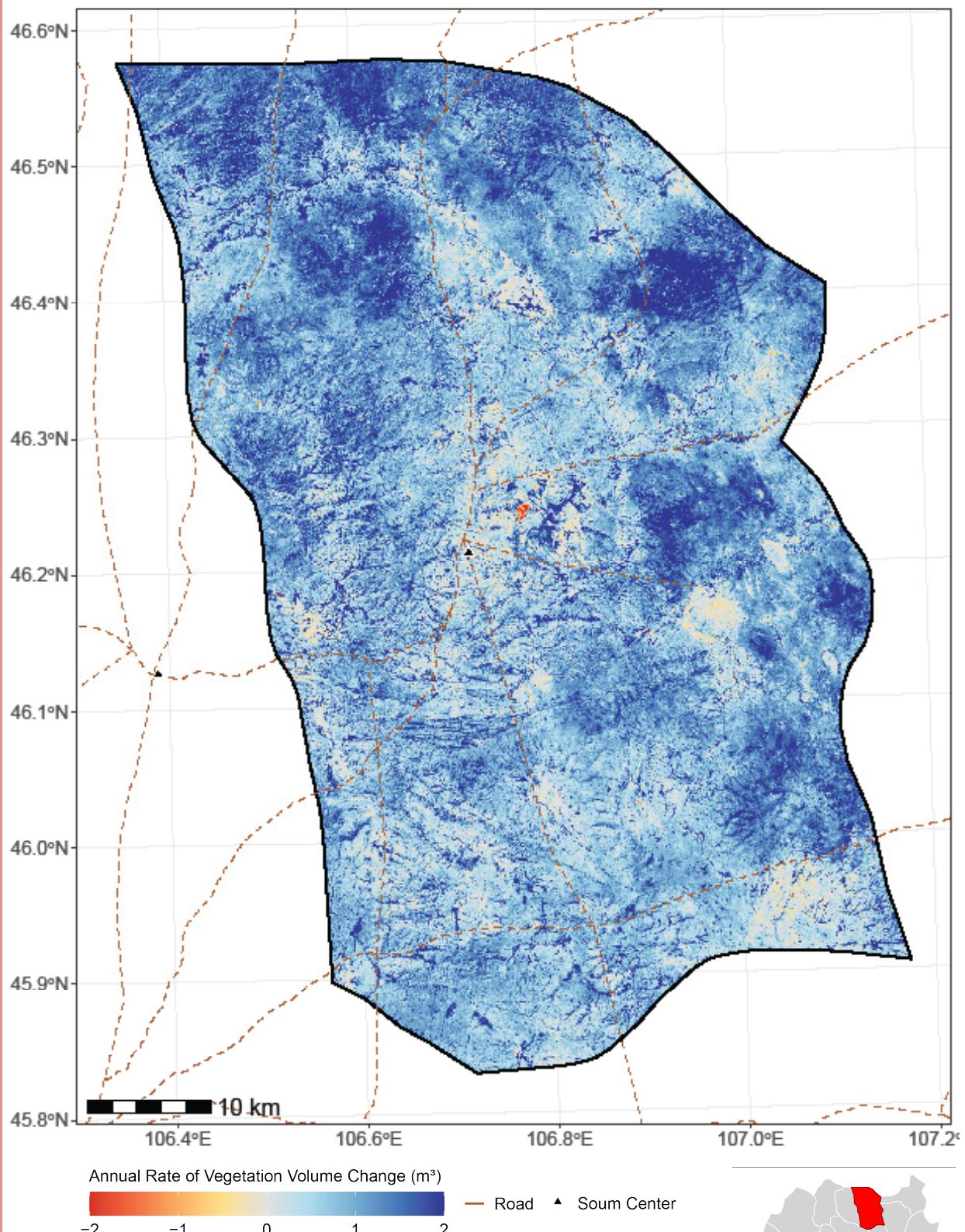
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STATE OF THE STEPPE 2025 - SOUM LEVEL

DEREN SOUM

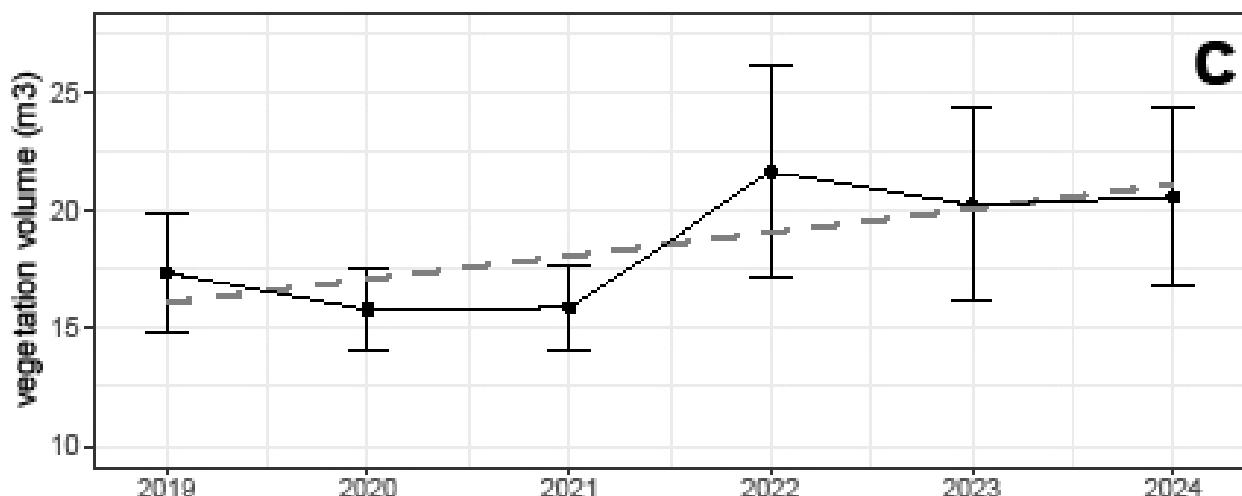
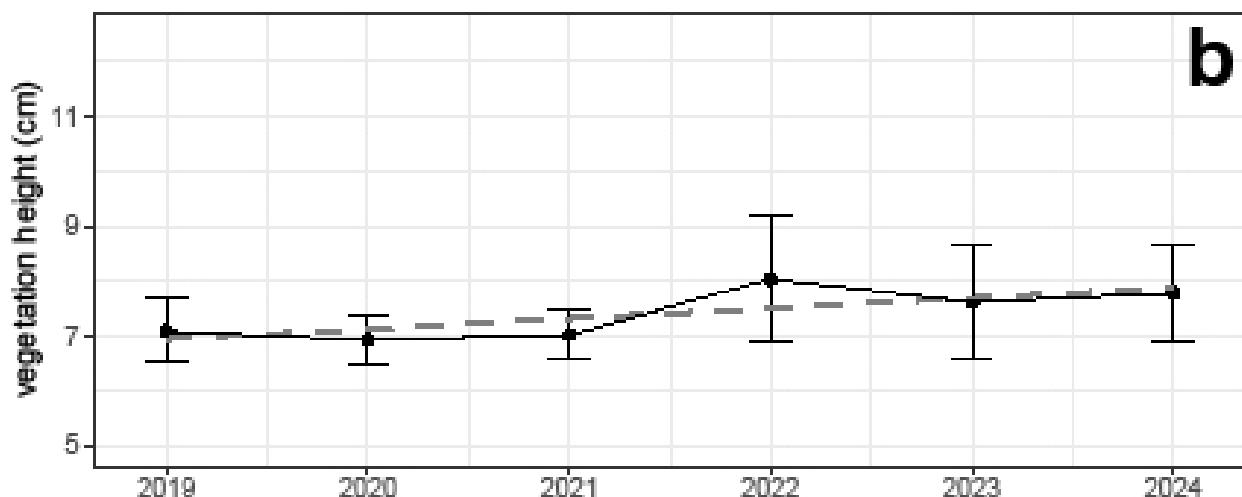
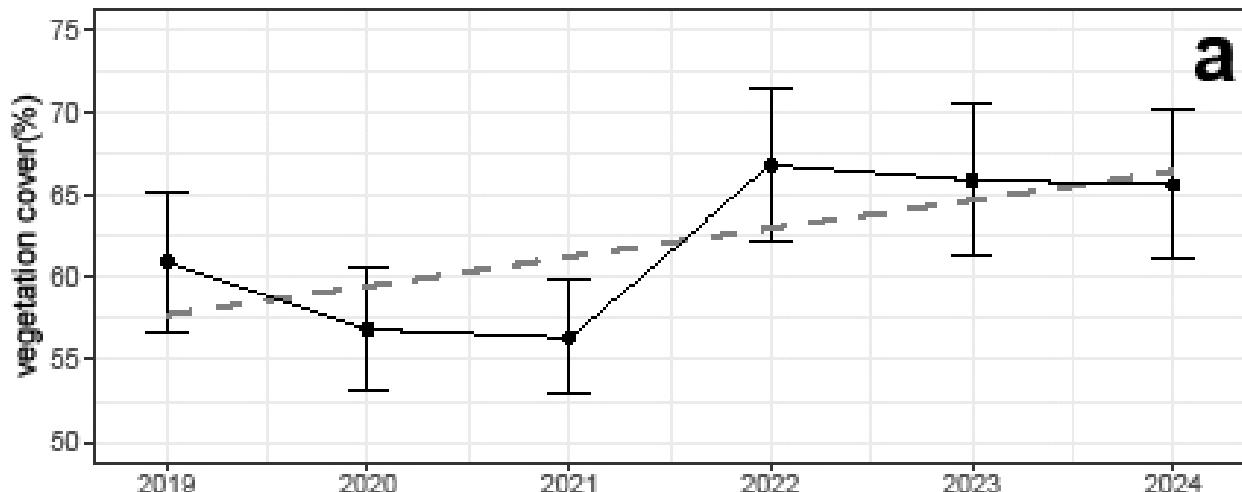
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STATE OF THE STEPPE 2025 - SOUM LEVEL

DEREN SOUM

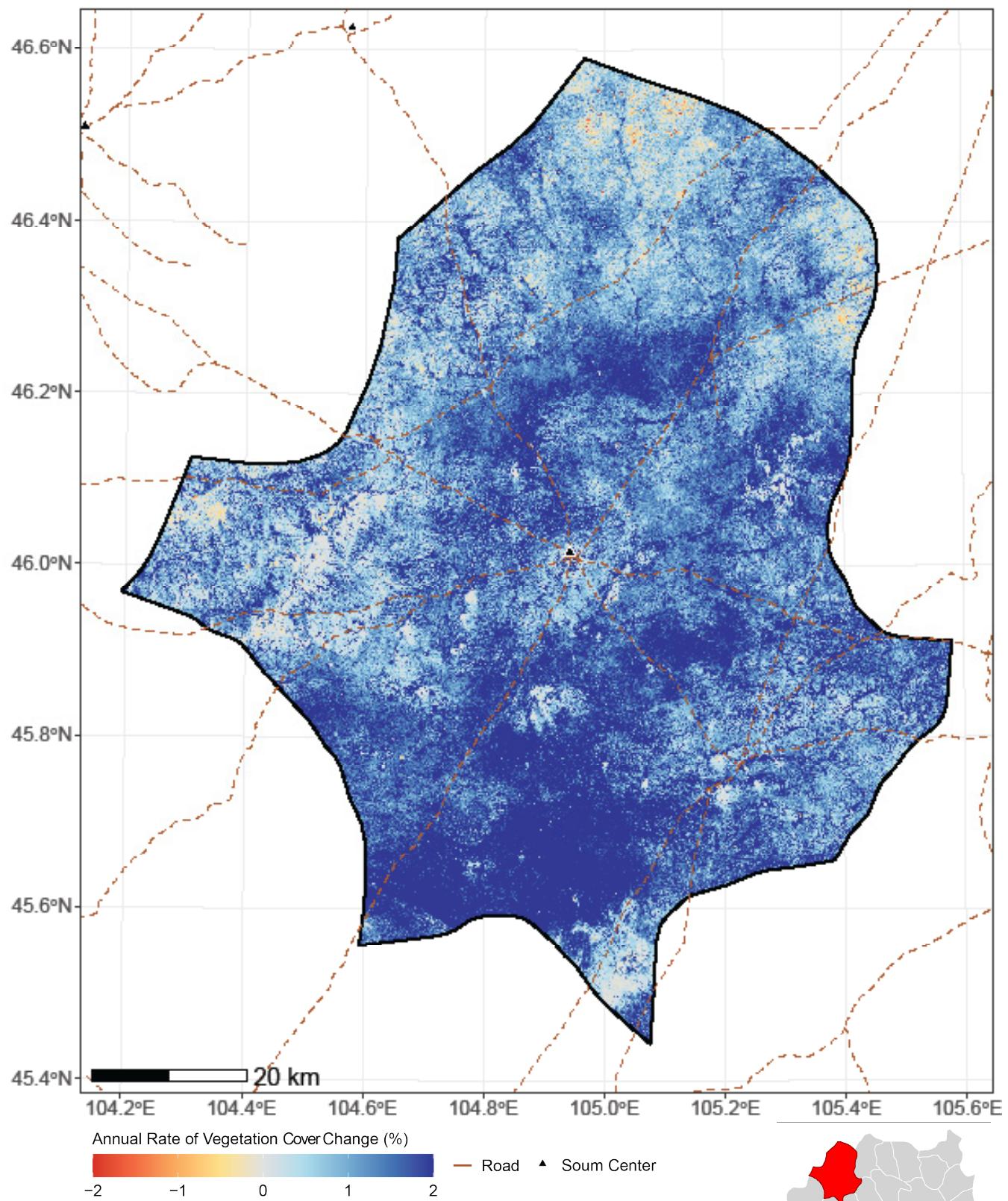
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

ERDENEDALAI SOUM

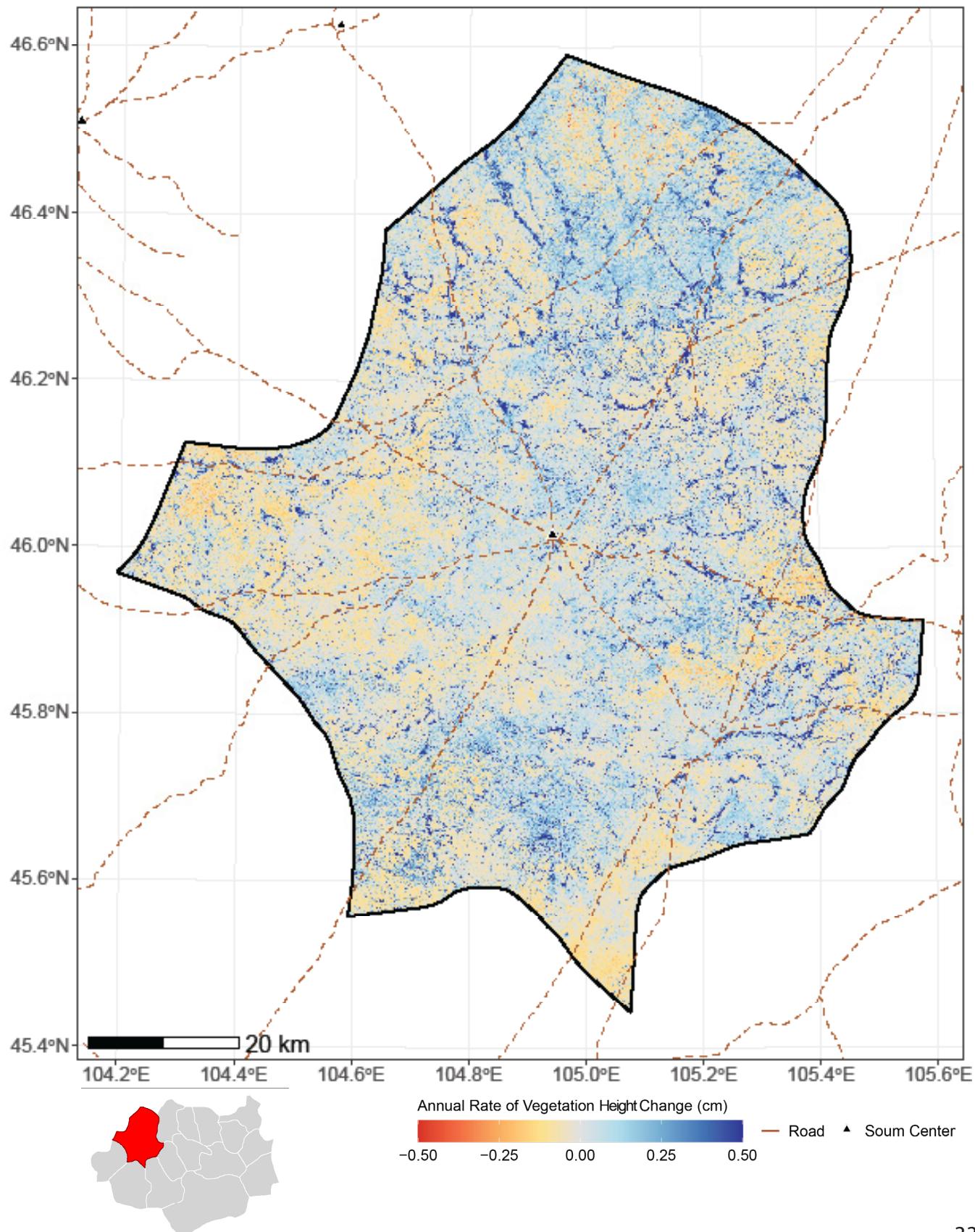
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STATE OF THE STEPPE 2025 - SOUM LEVEL

ERDENEDALAI SOUM

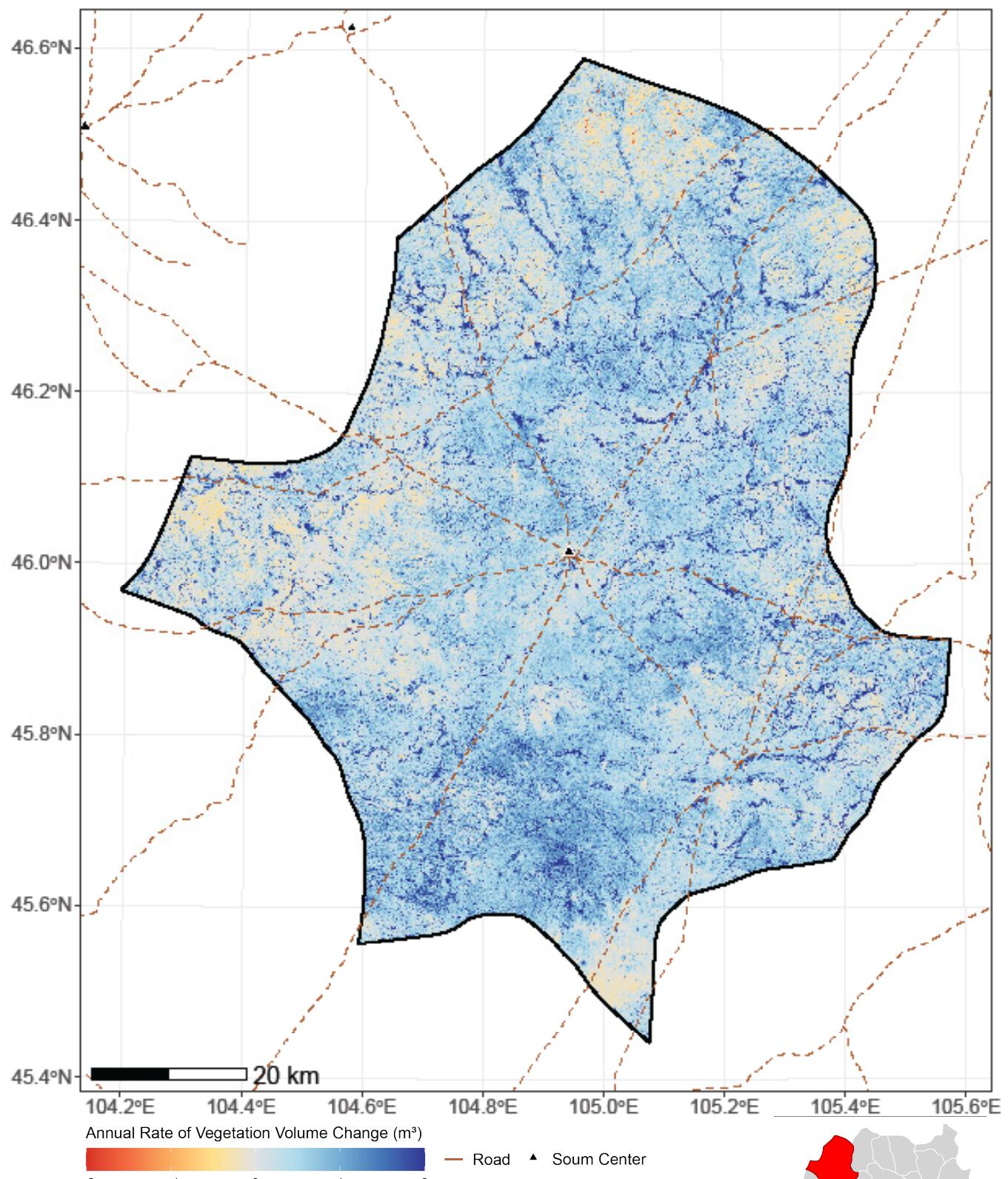
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STATE OF THE STEPPE 2025 - SOUM LEVEL

ERDENEDALAI SOUM

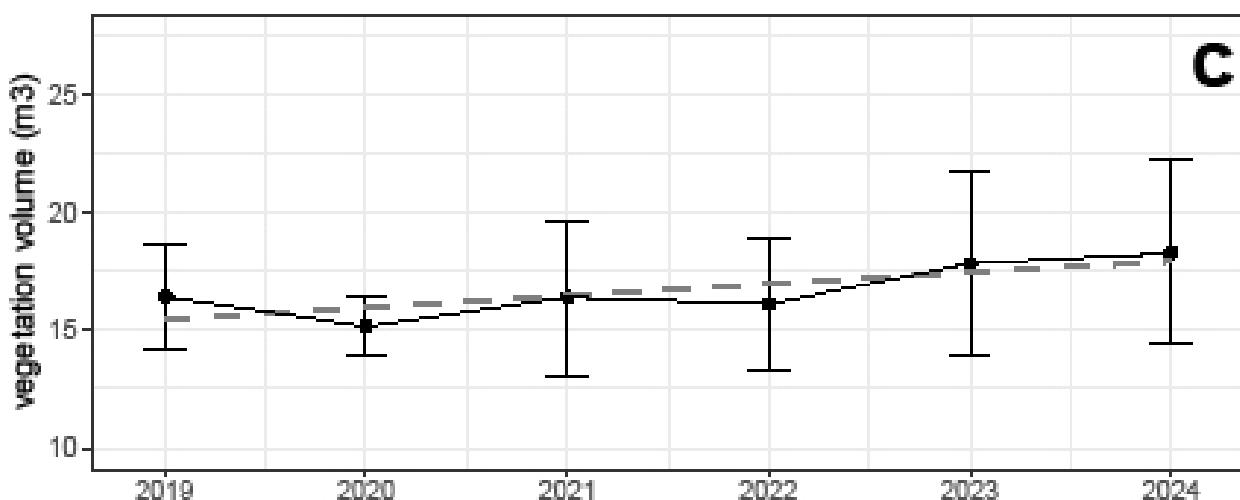
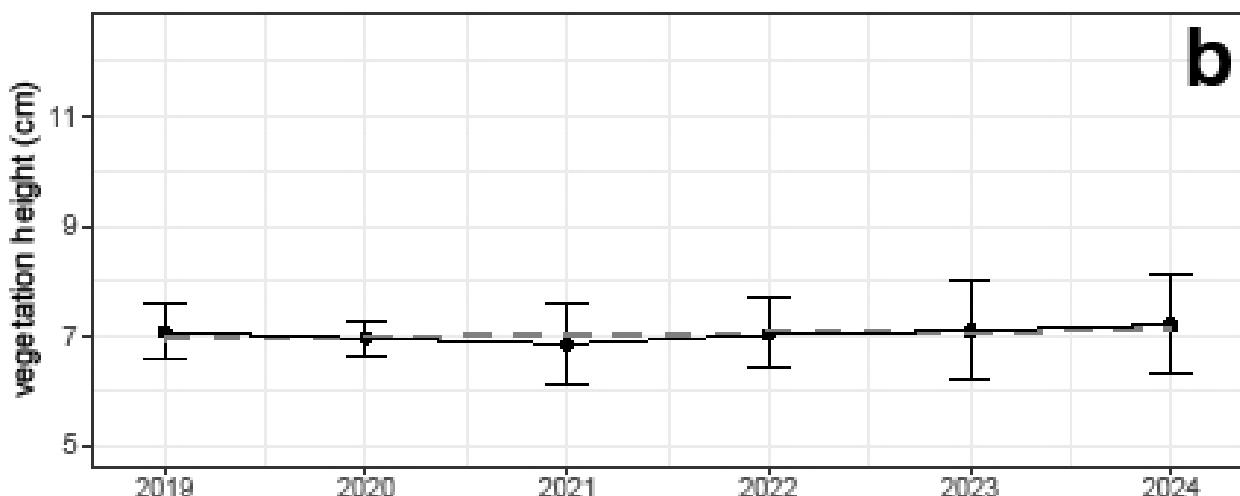
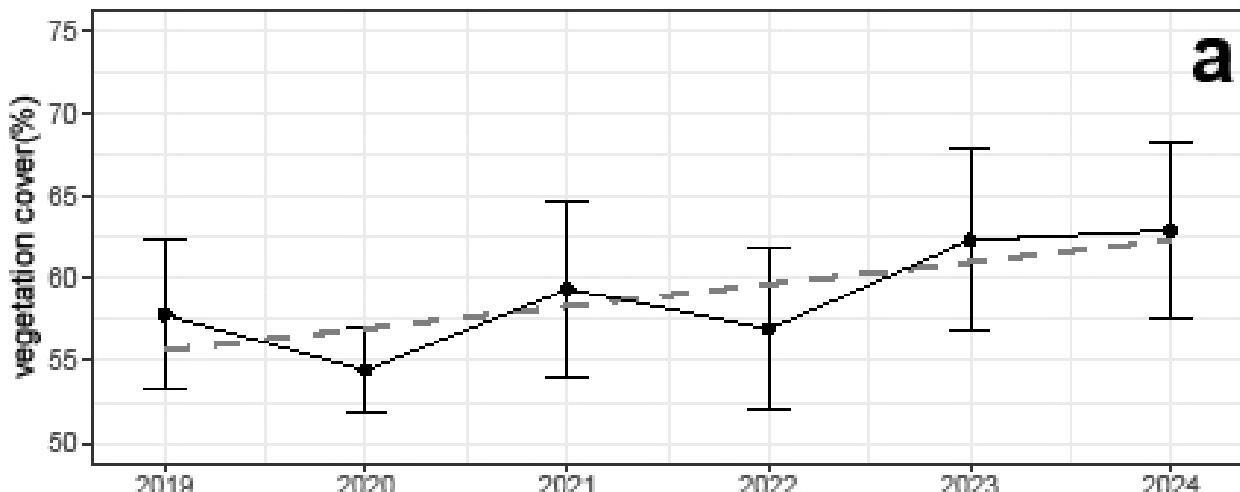
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STATE OF THE STEPPE 2025 - SOUM LEVEL

ERDENEDALAI SOUM

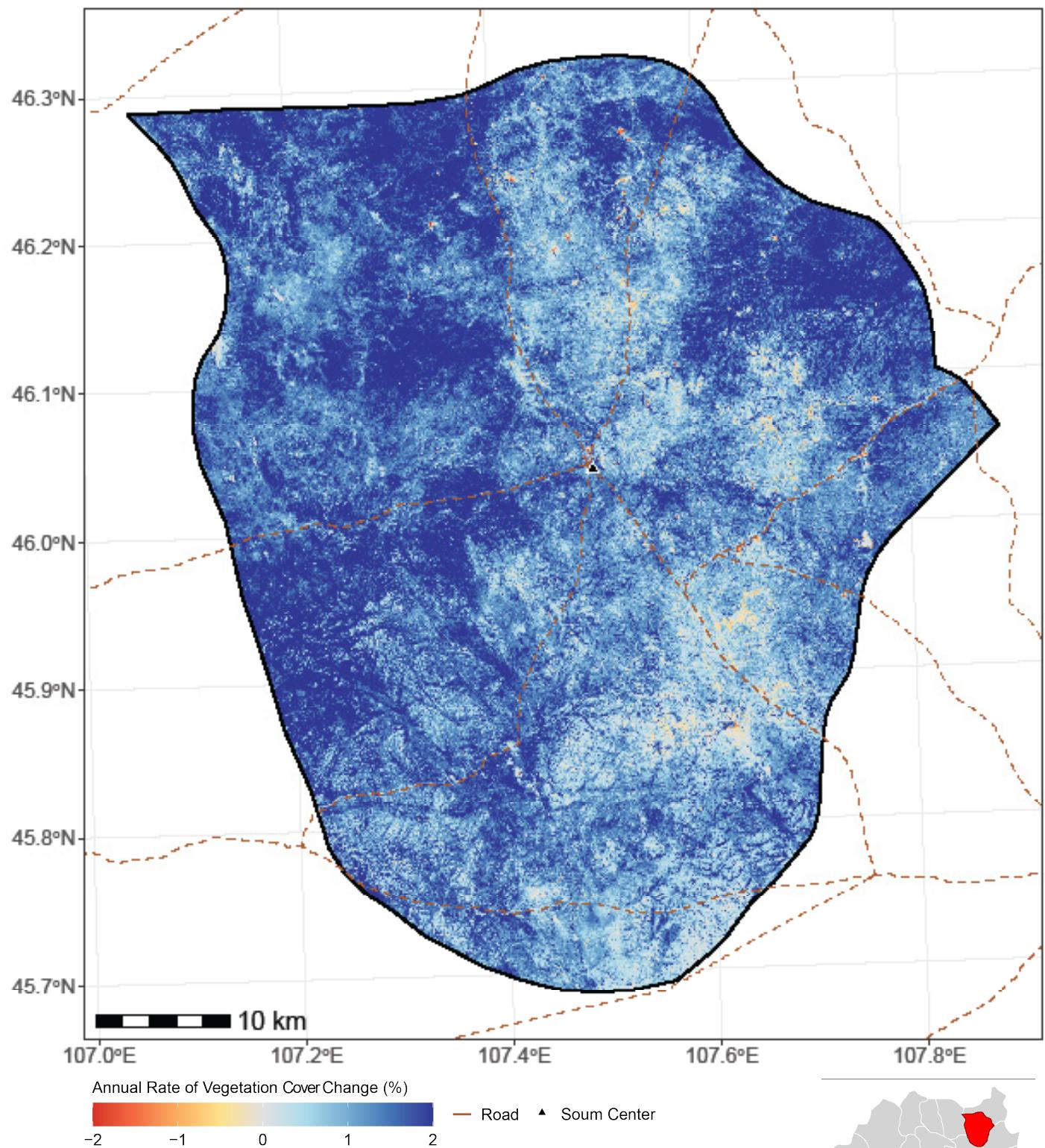
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

GOVI-UGTAAL SOUM

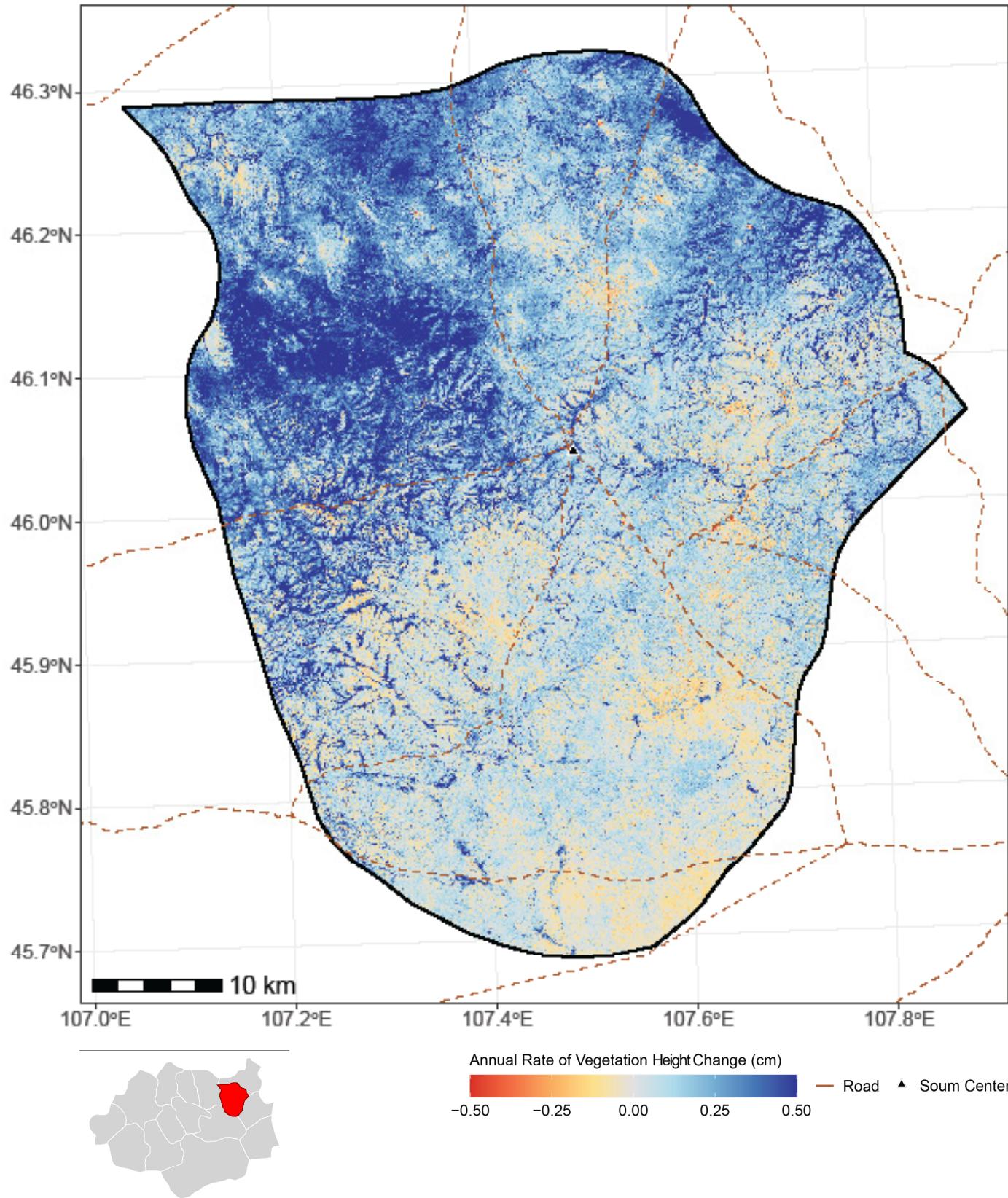
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

GOVI-UGTAAL SOUM

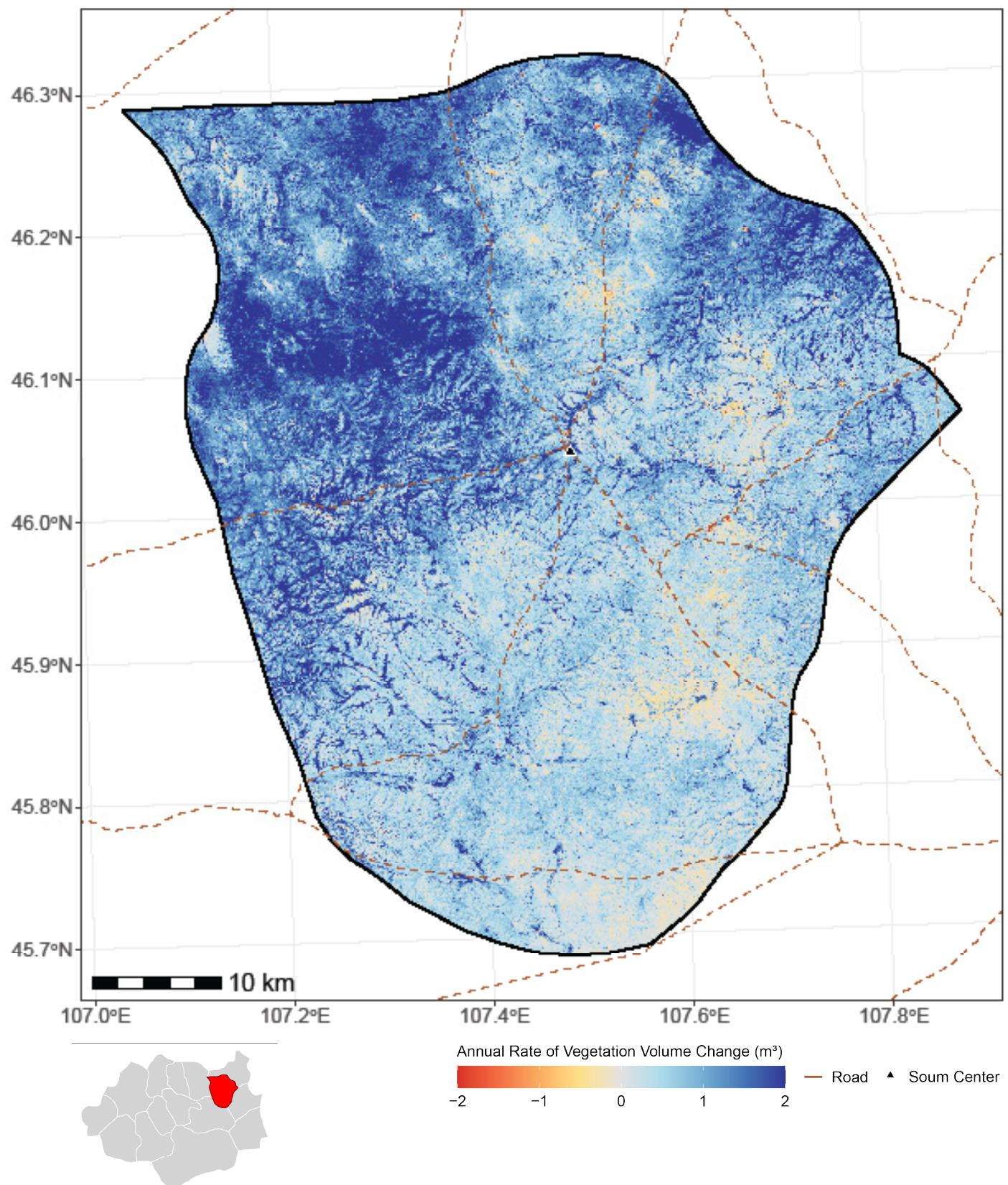
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

GOVI-UGTAAL SOUM

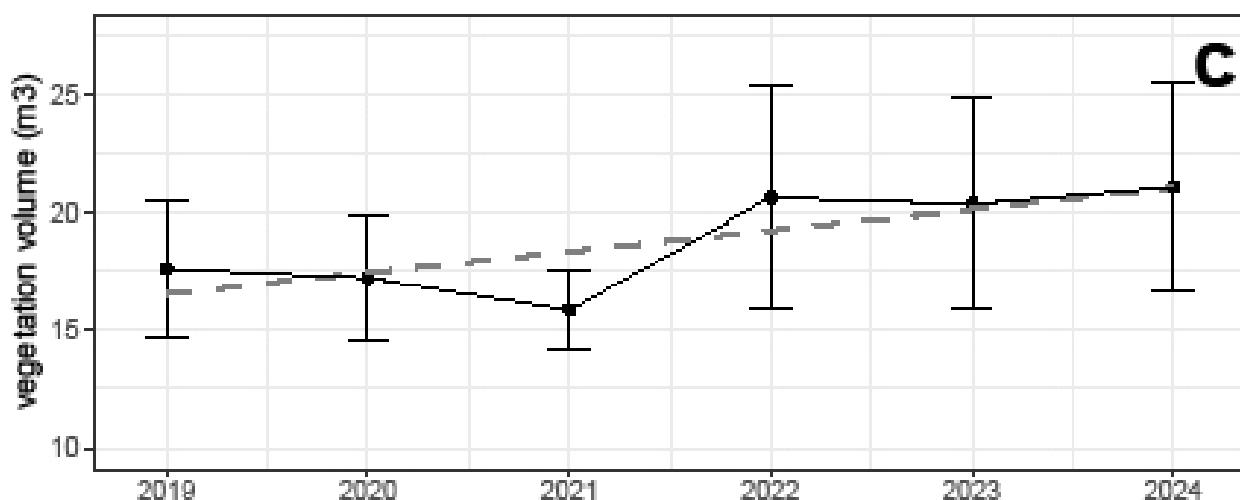
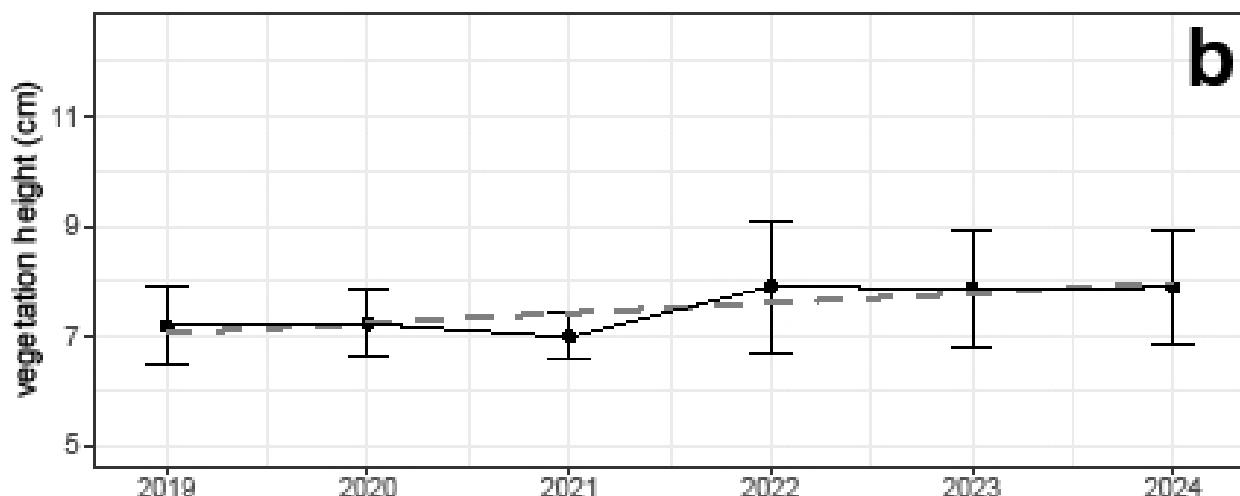
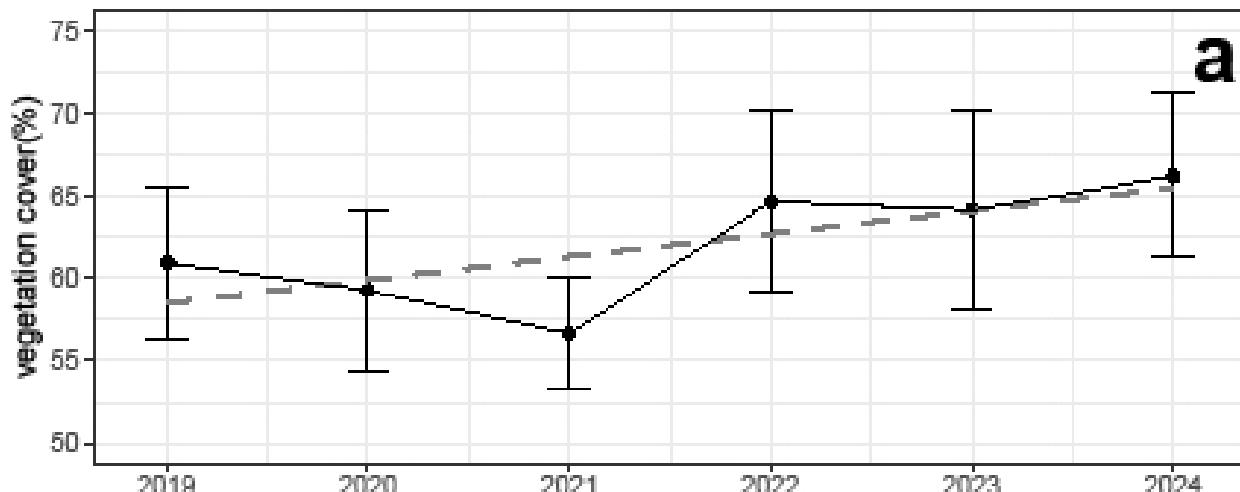
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

GOVI-UGTAAL SOUM

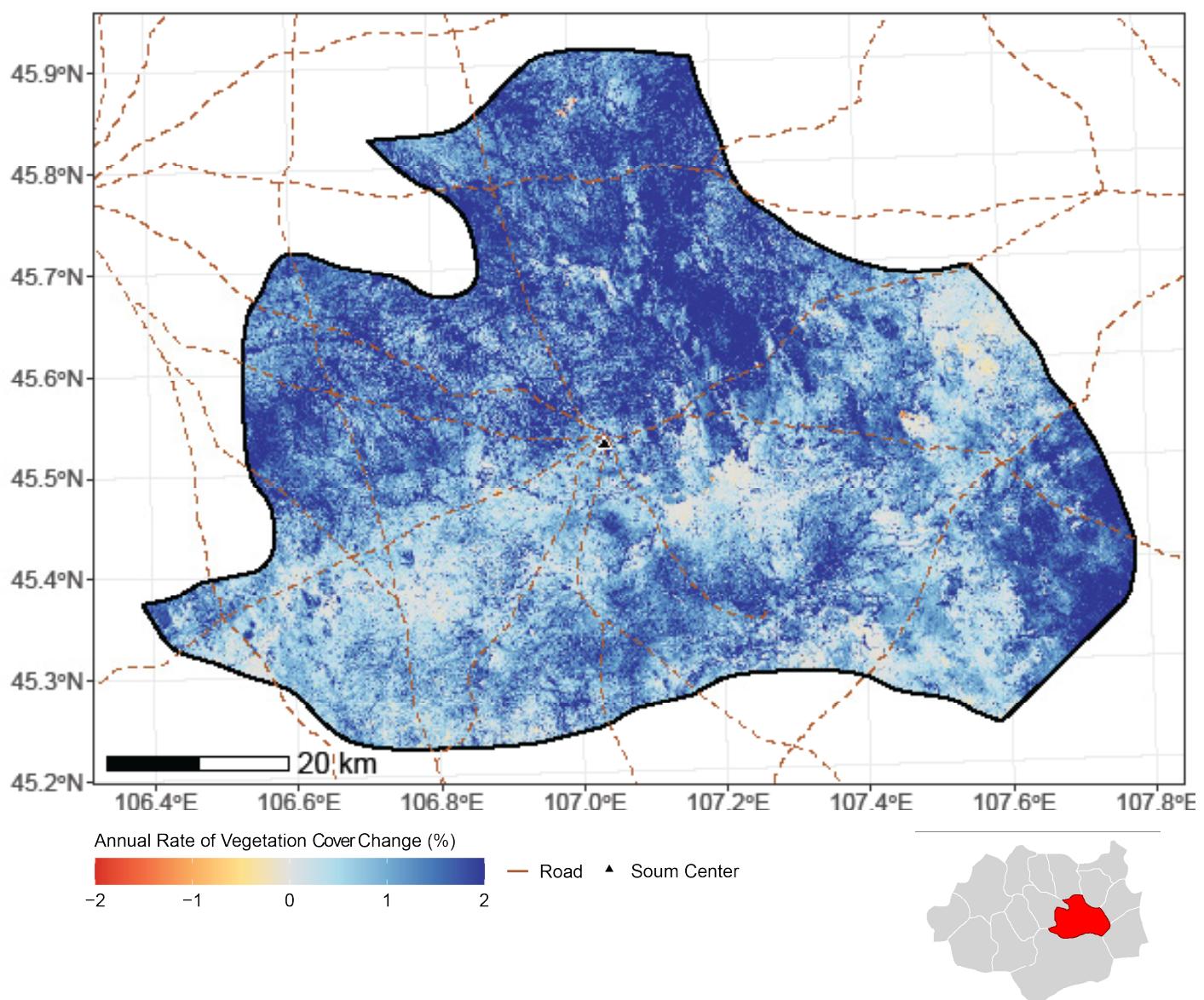
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

GURVANSAIKHAN SOUM

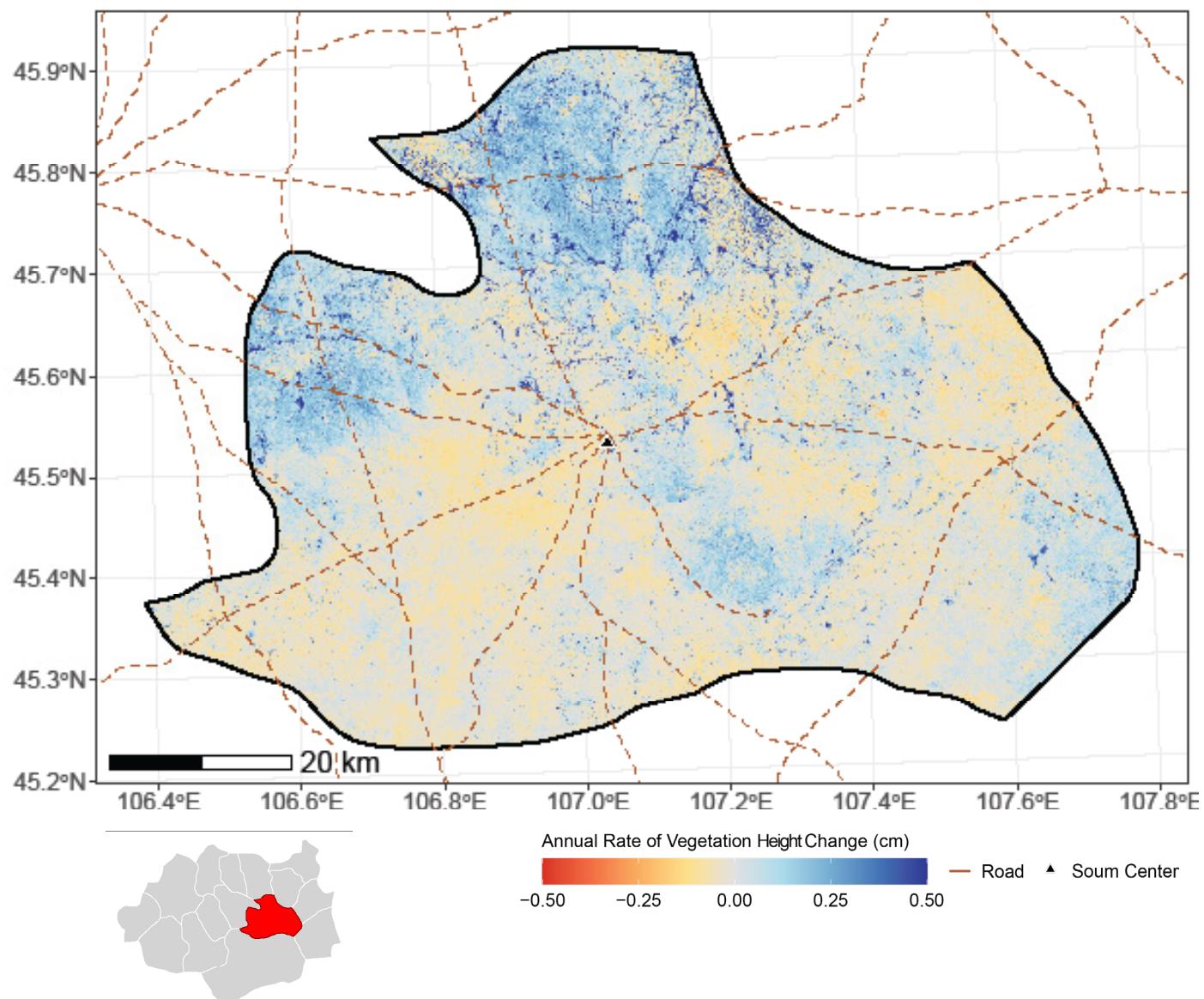
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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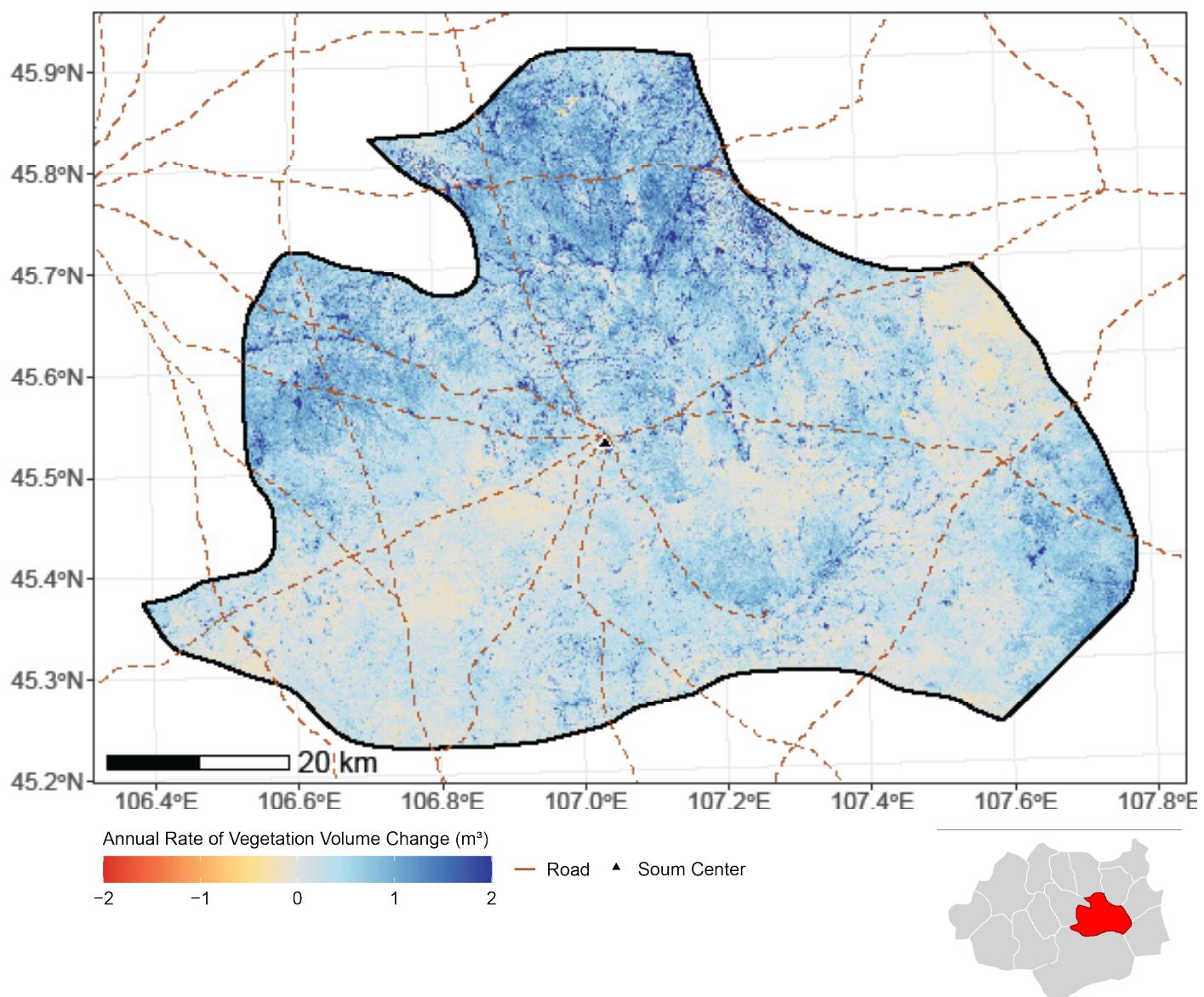
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

GURVANSAIKHAN SOUM

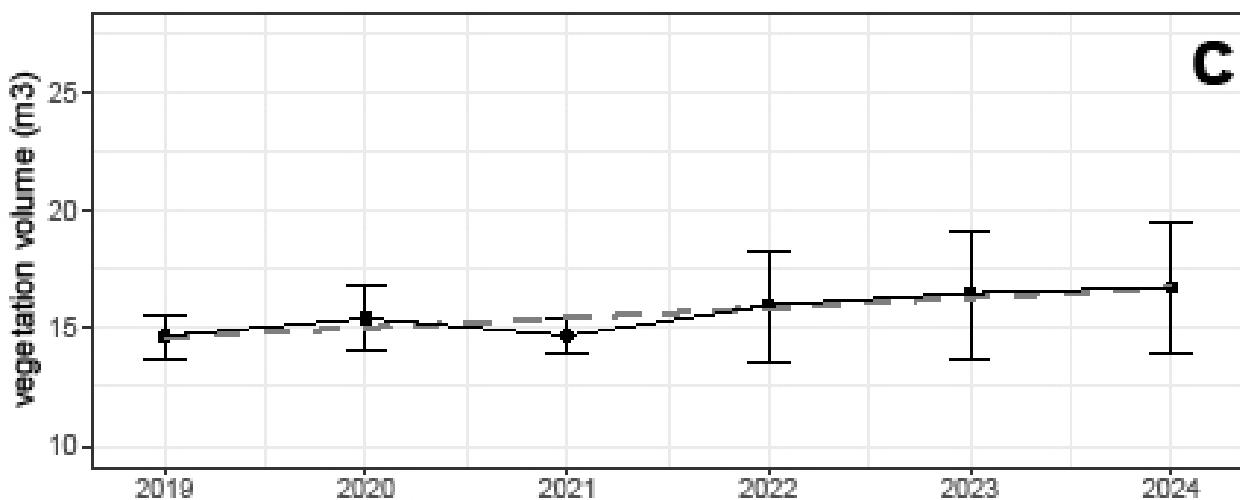
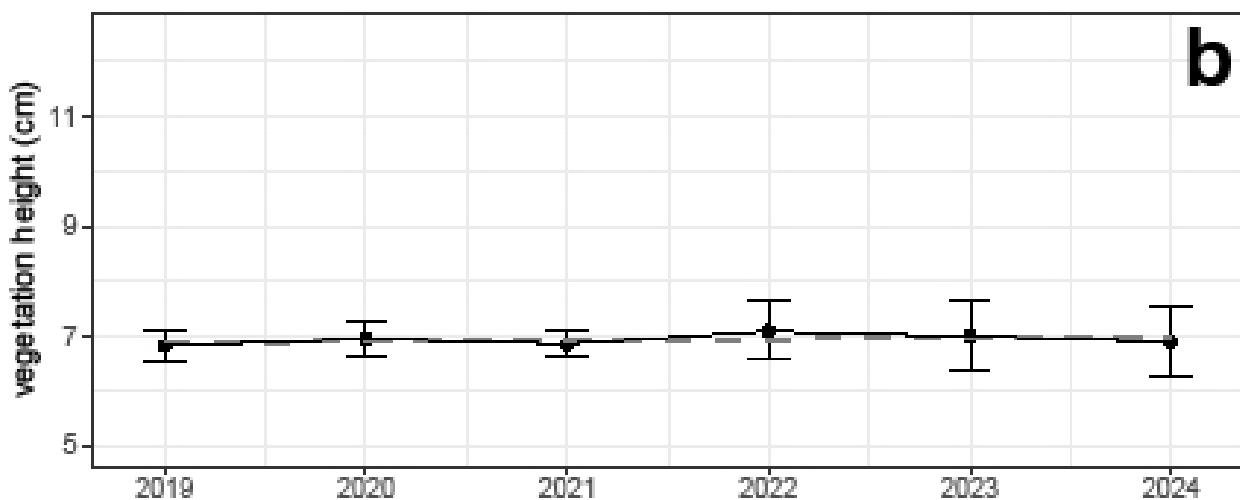
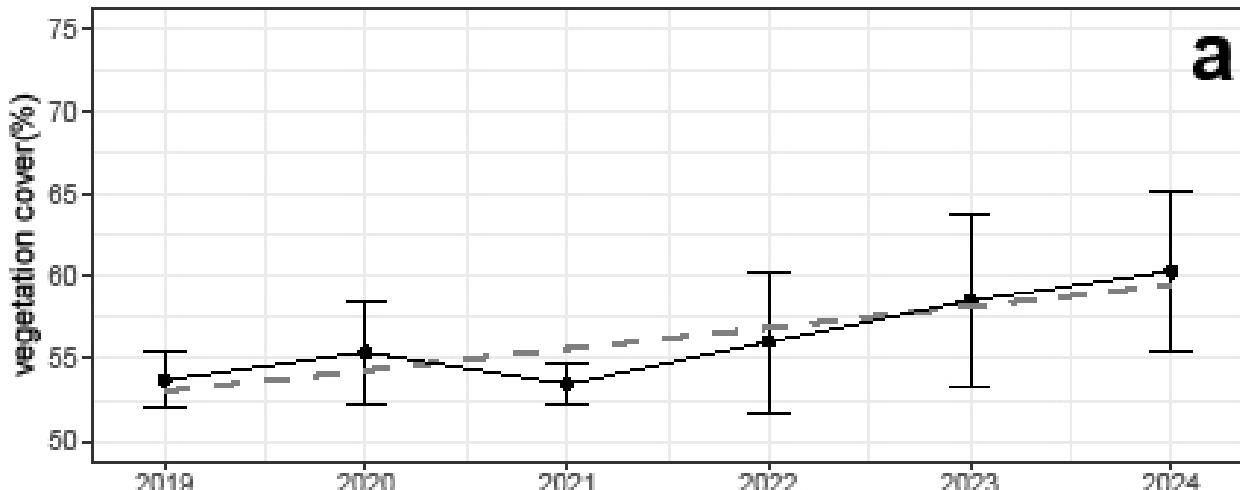
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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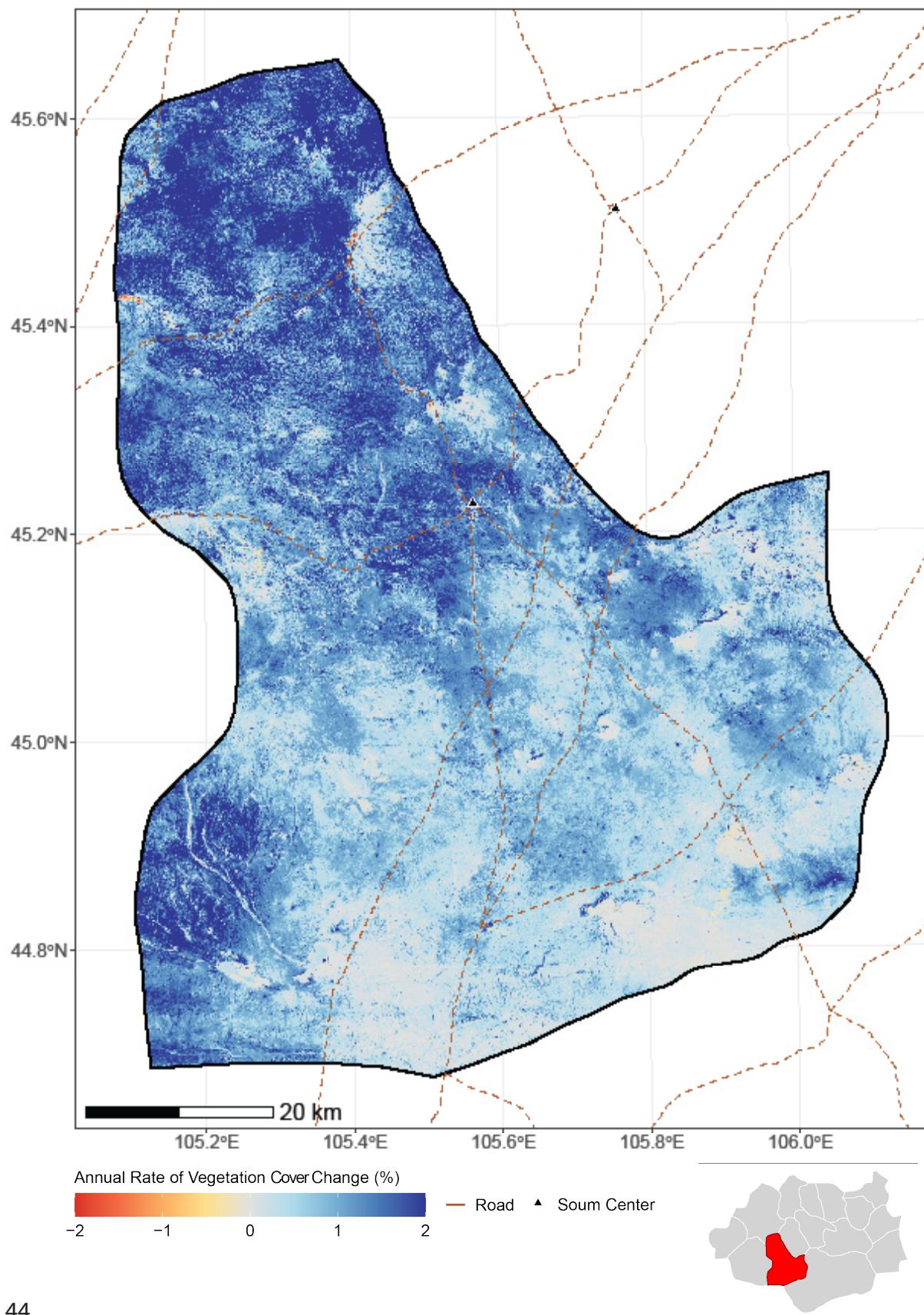
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

KHULD SOUM

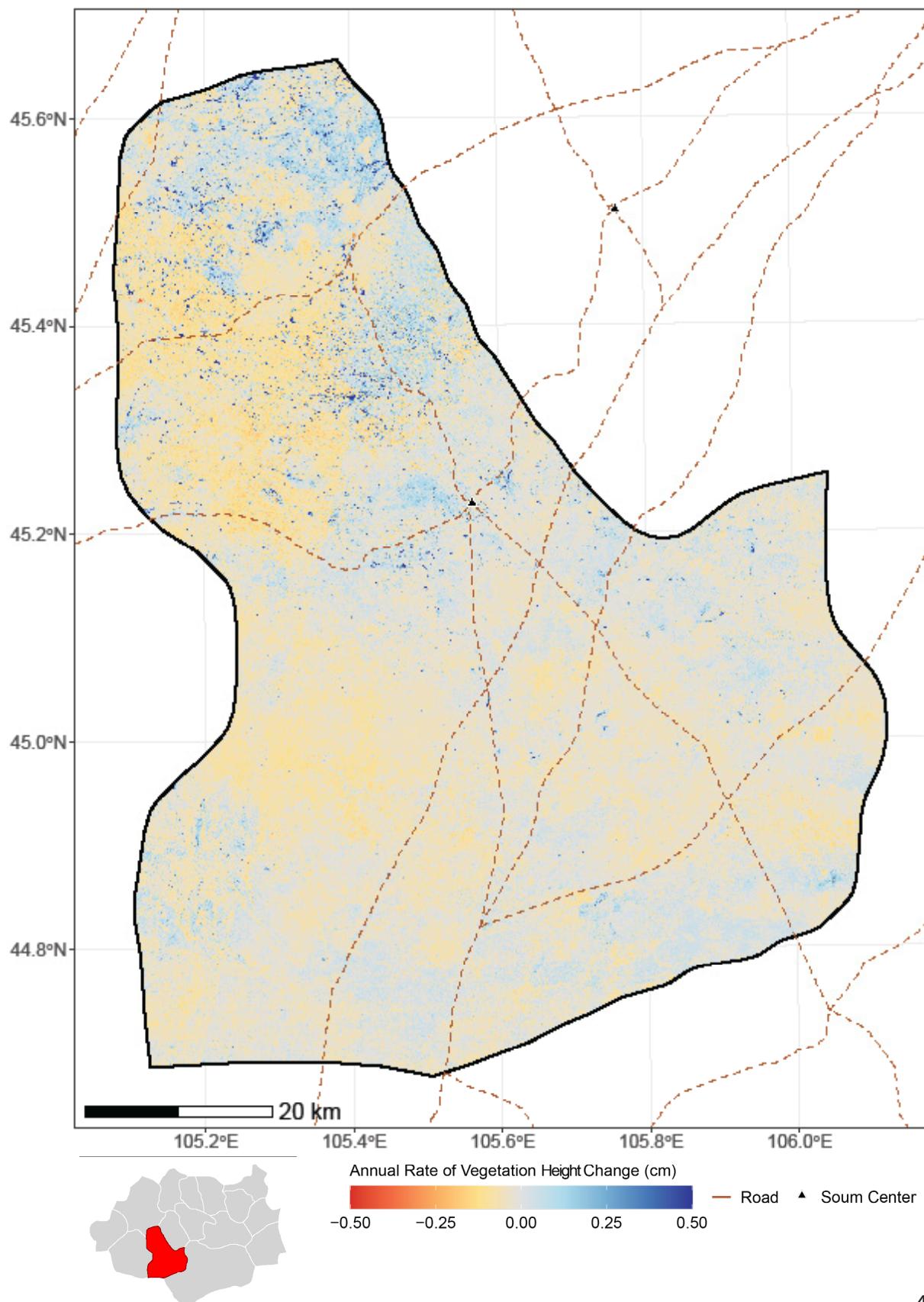
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

KHULD SOUM

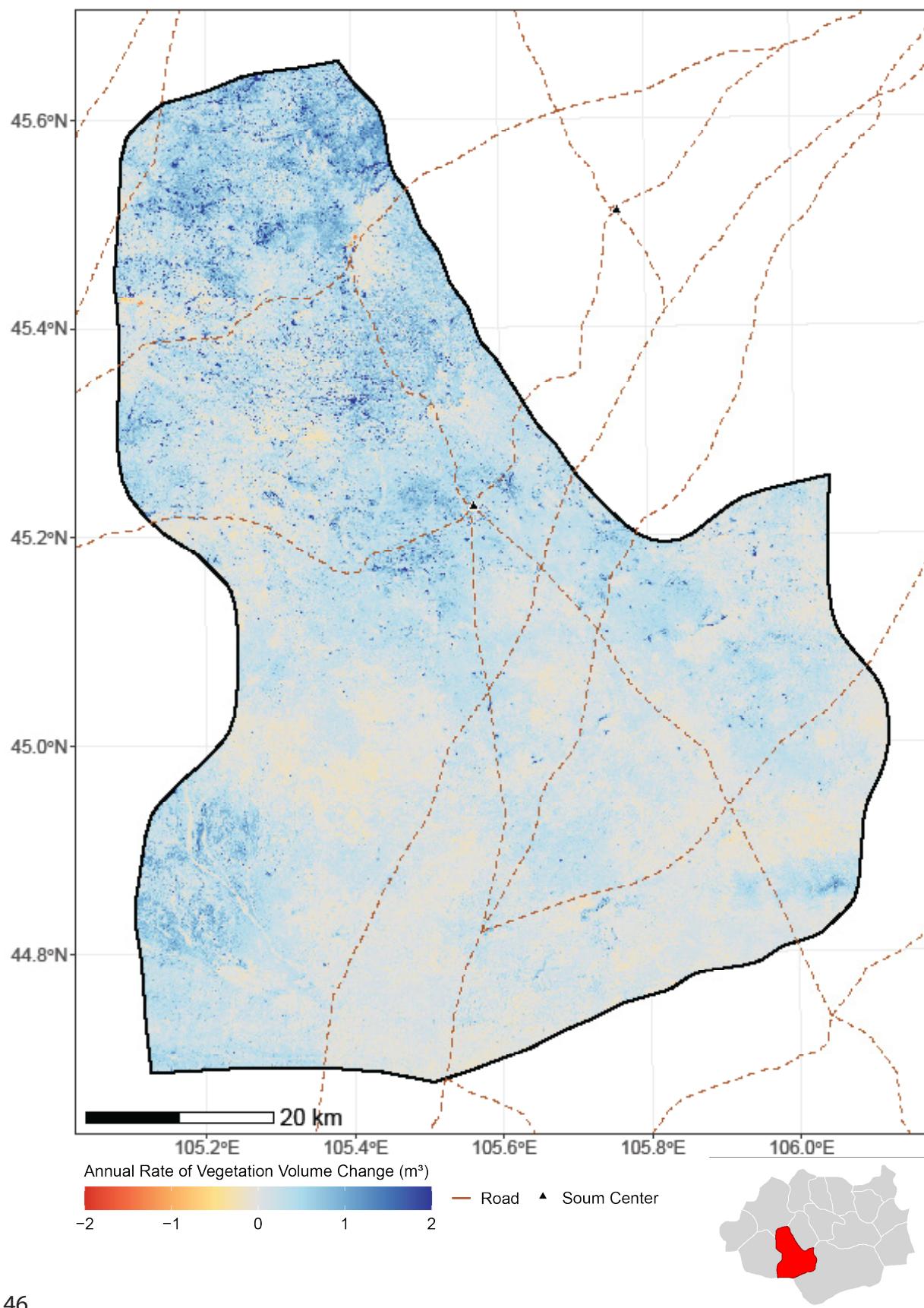
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

KHULD SOUM

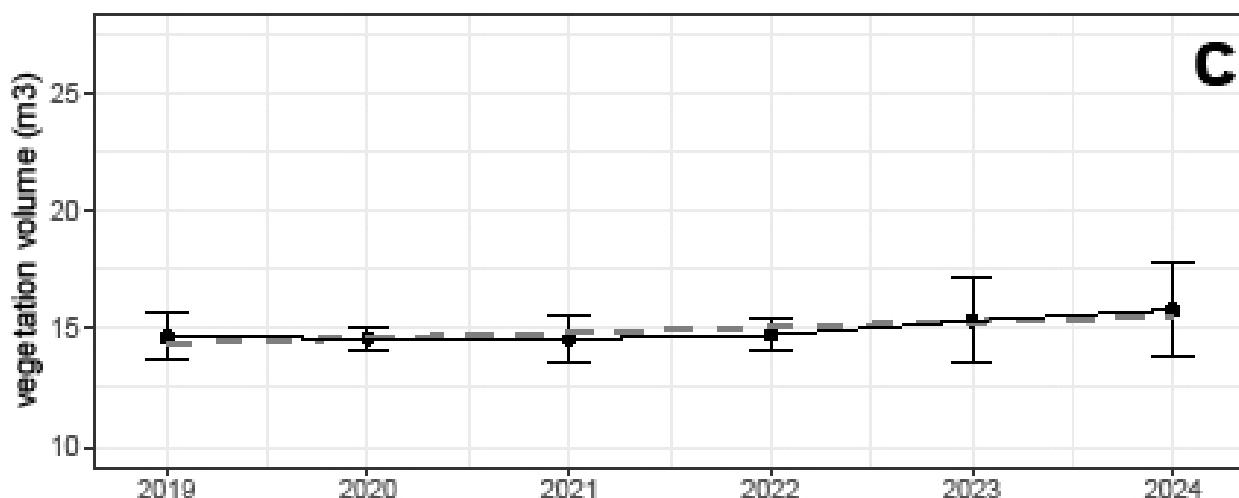
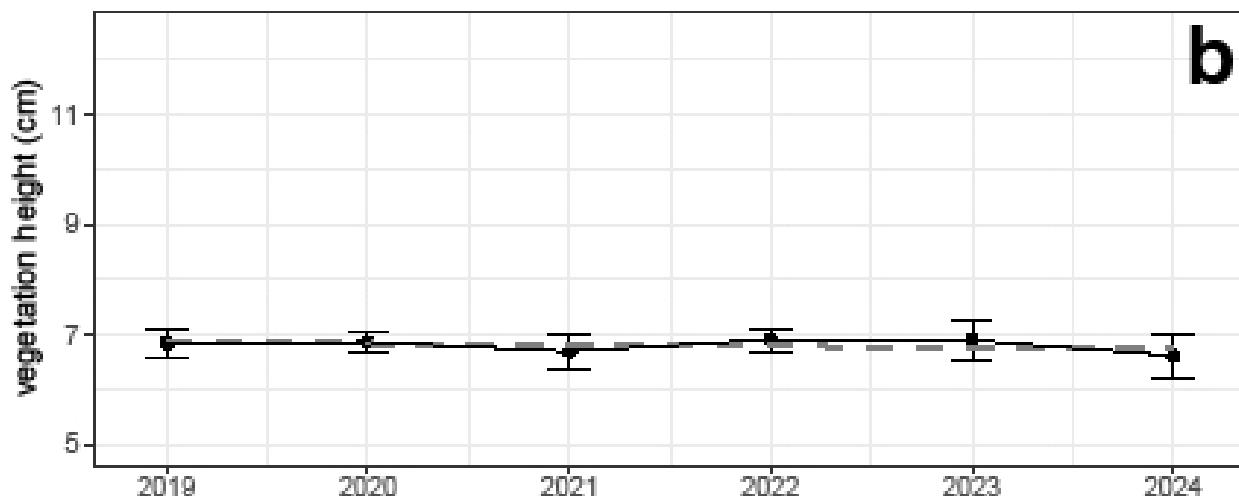
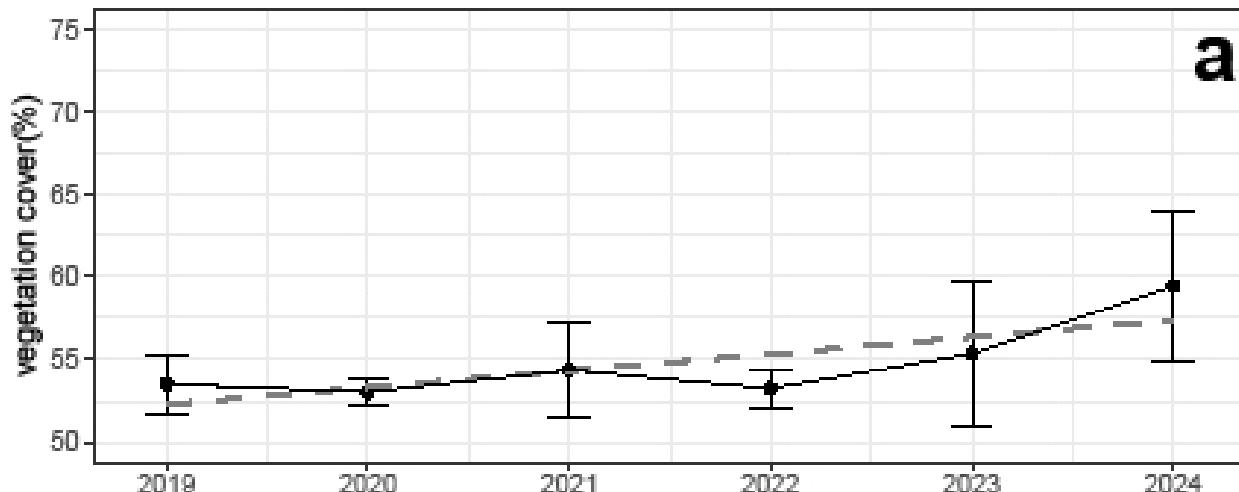
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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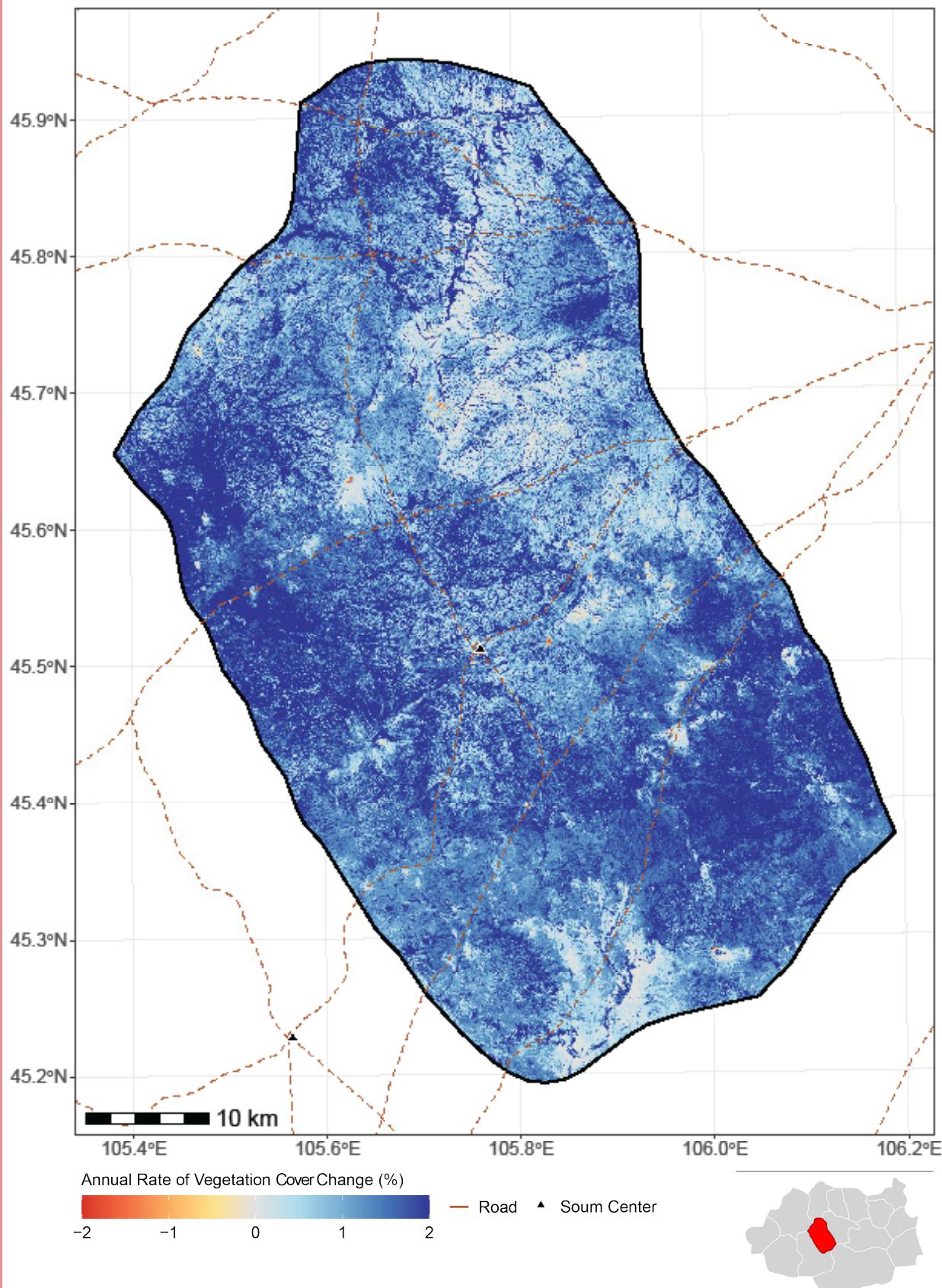
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

LUUS SOUM

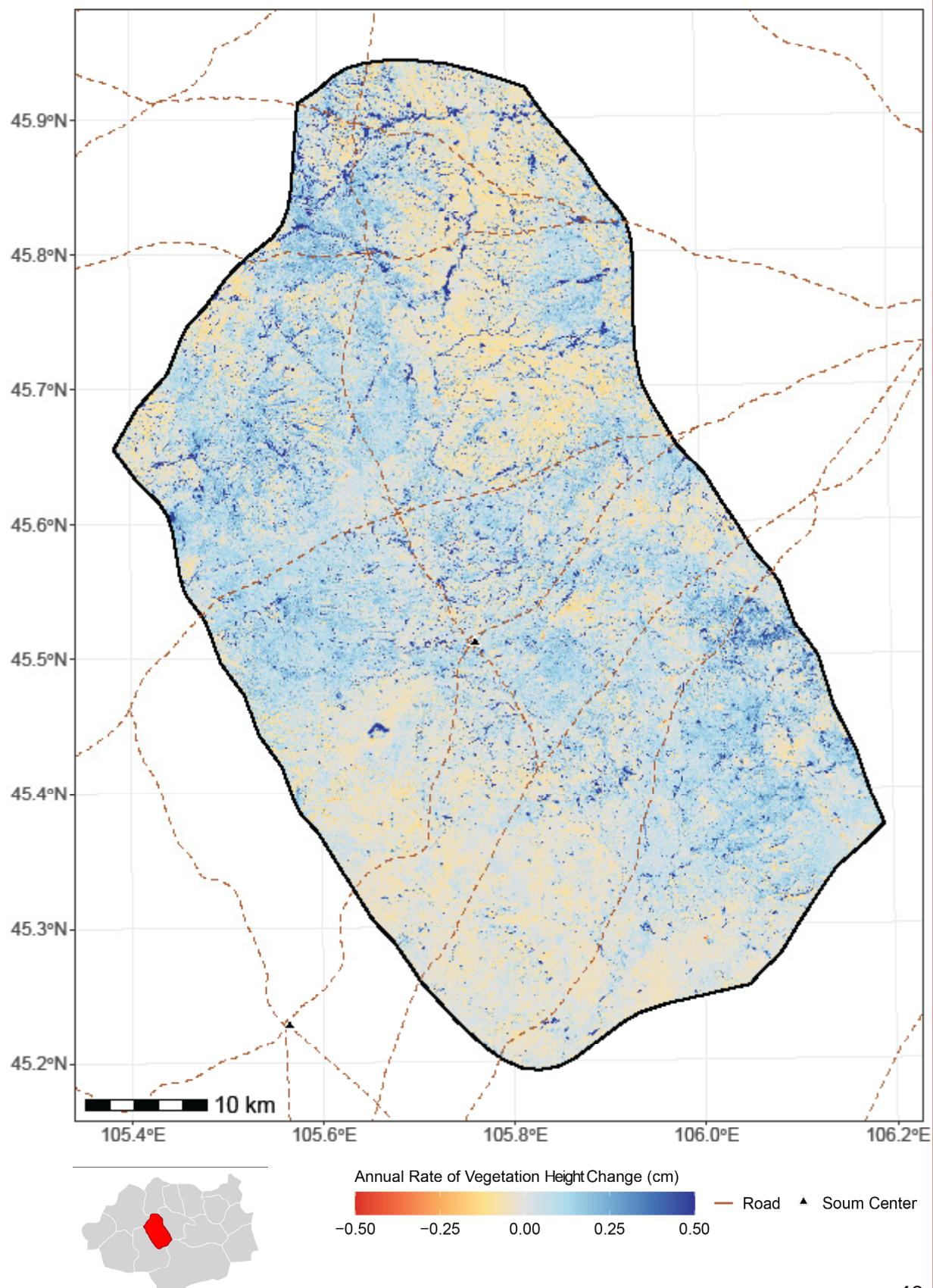
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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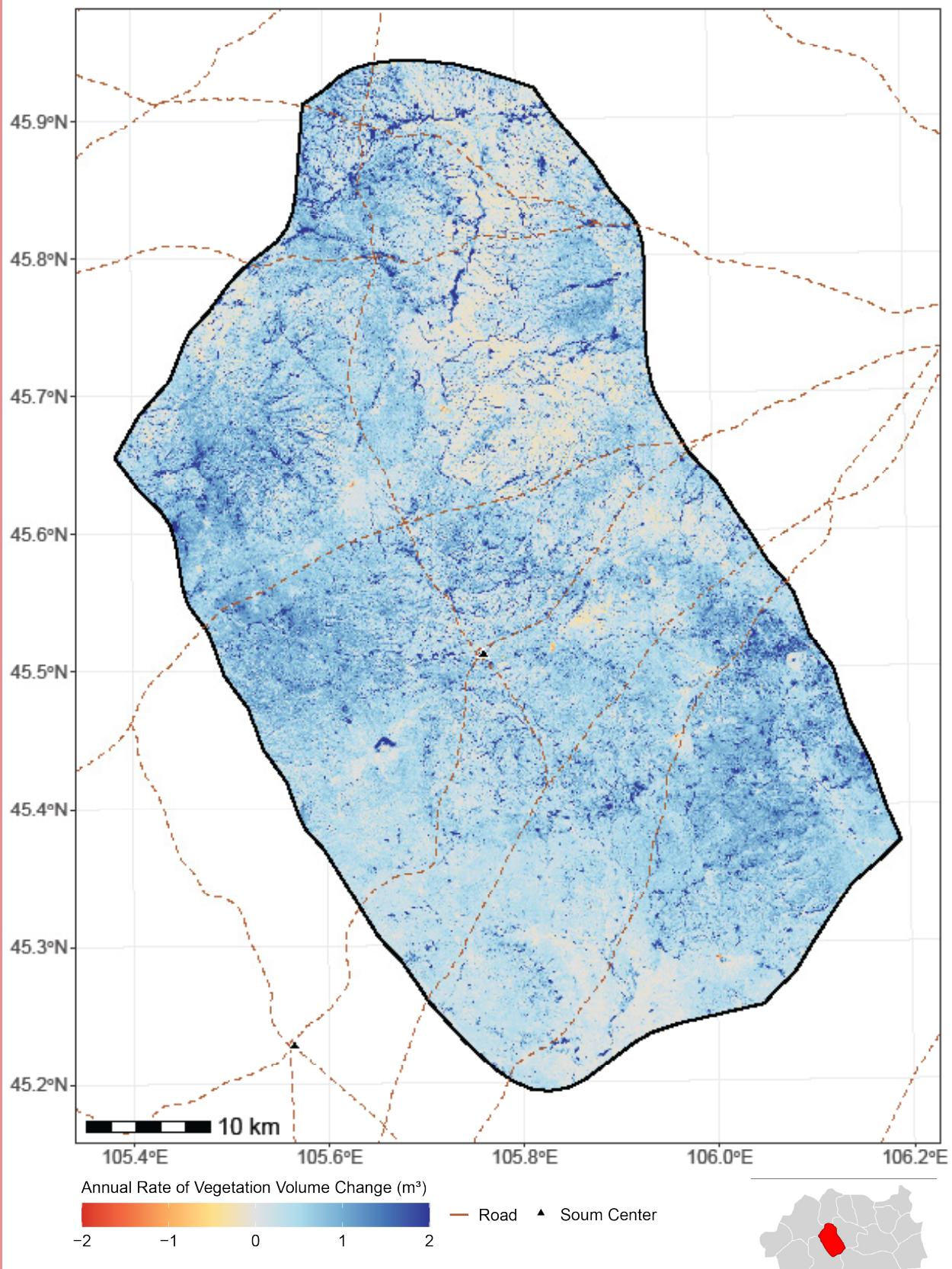
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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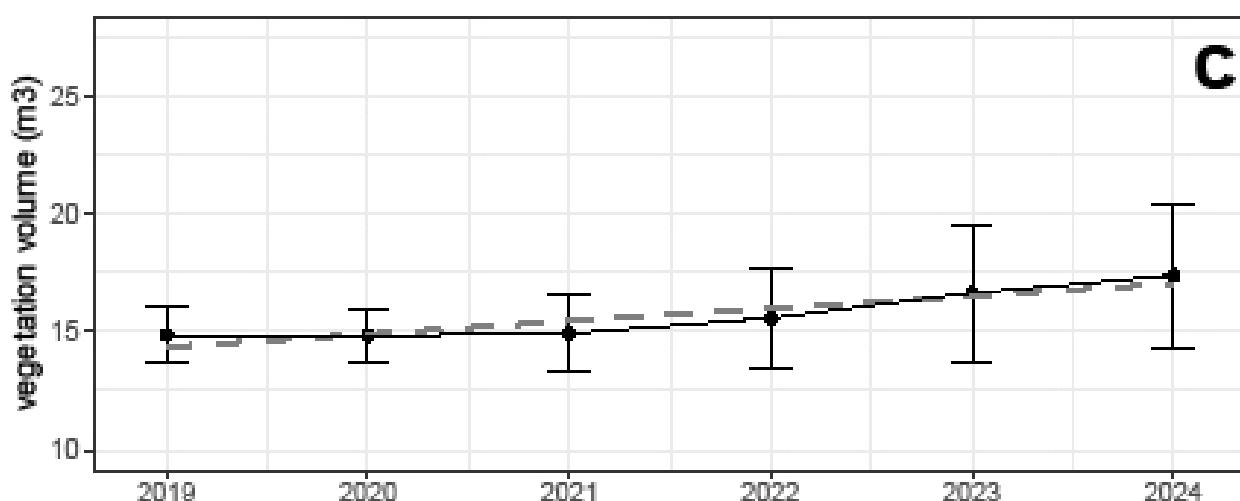
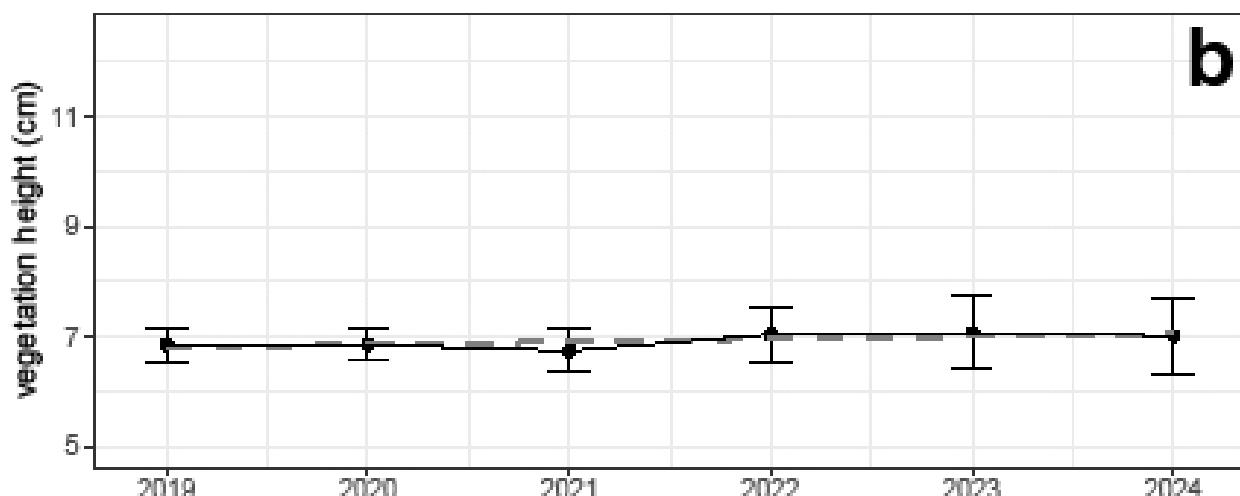
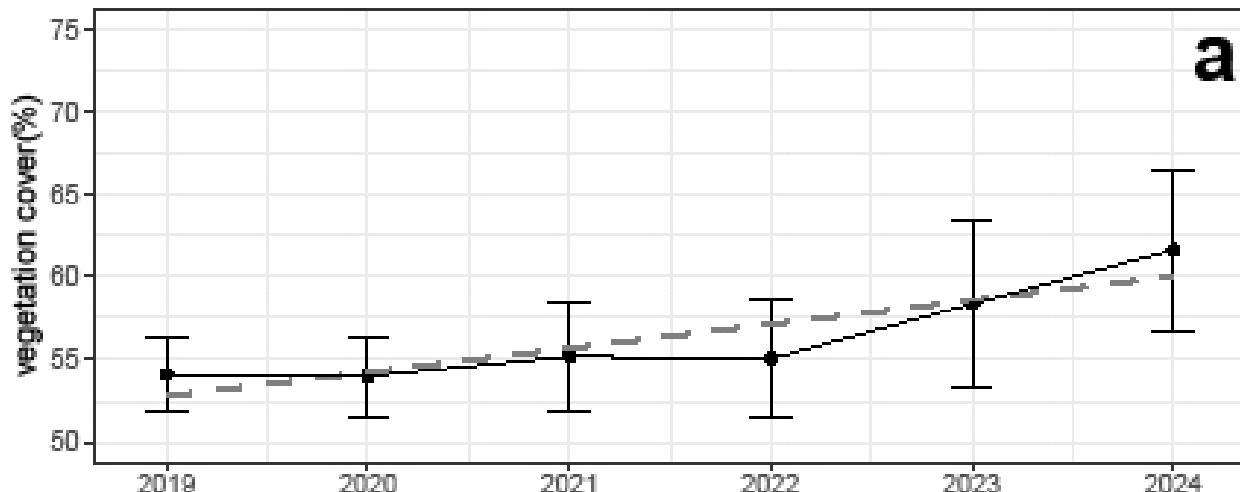
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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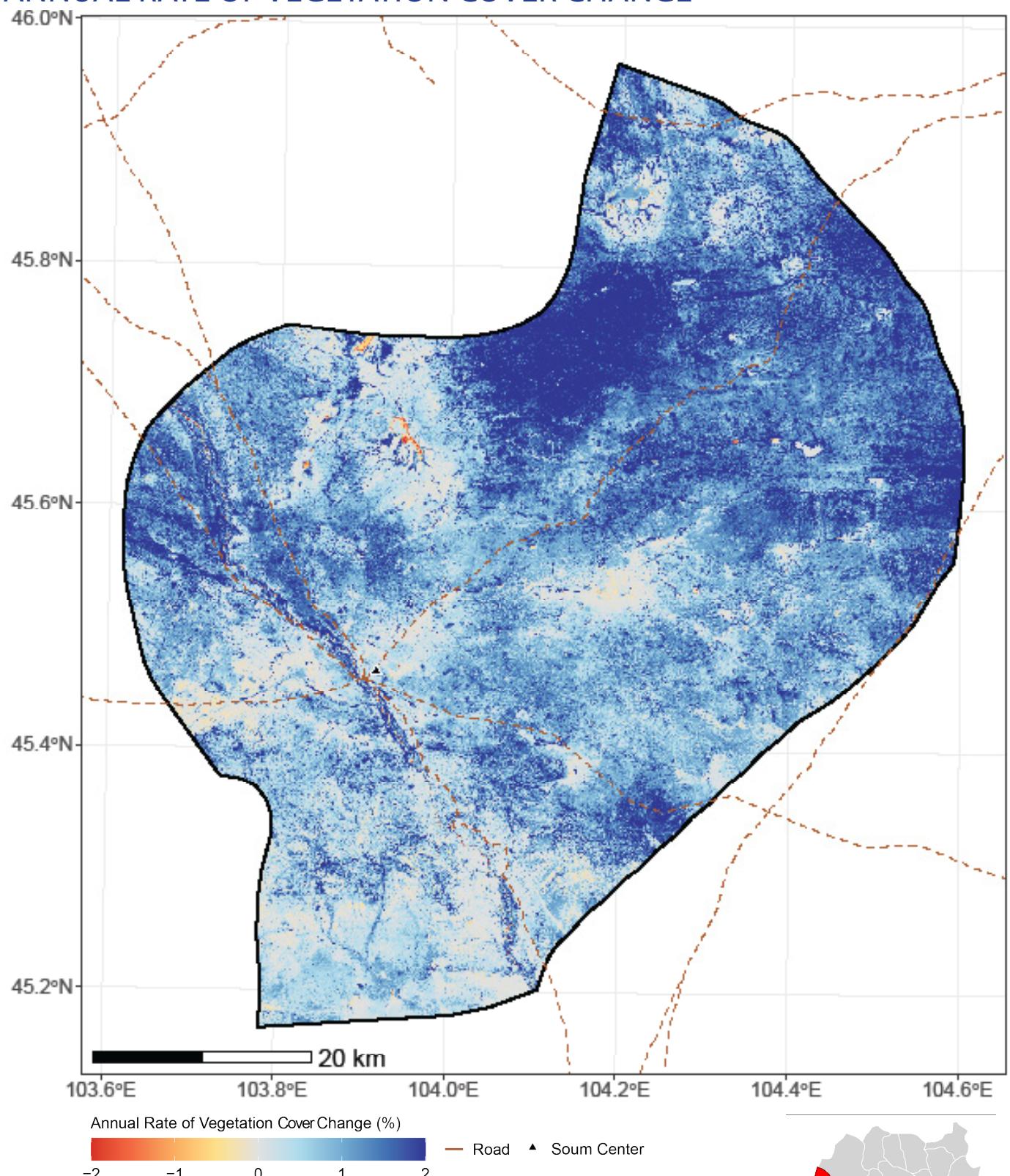
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

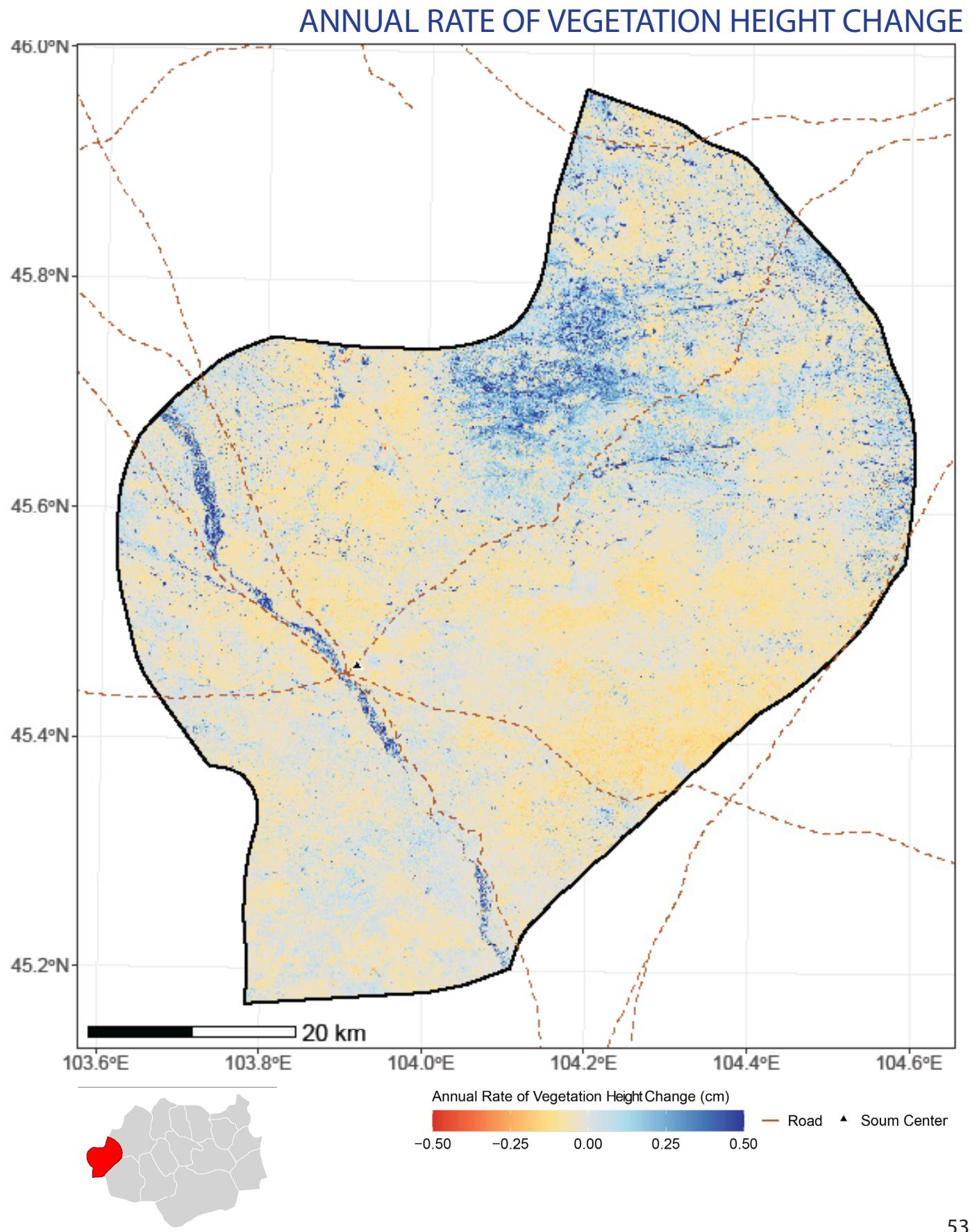
SAIKHAN-OVOO SOUM

ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

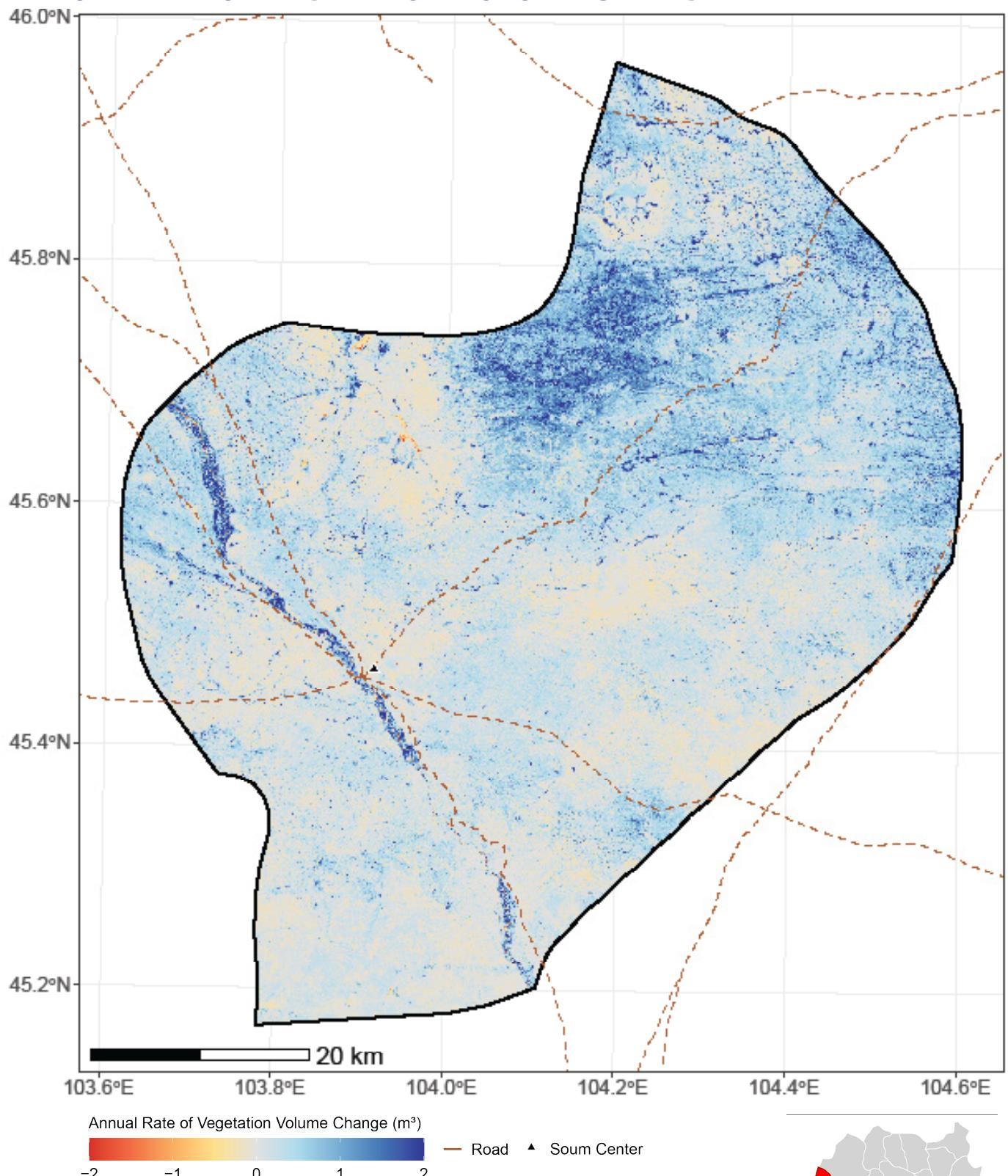
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STATE OF THE STEPPE 2025 - SOUM LEVEL

SAIKHAN-OVOO SOUM

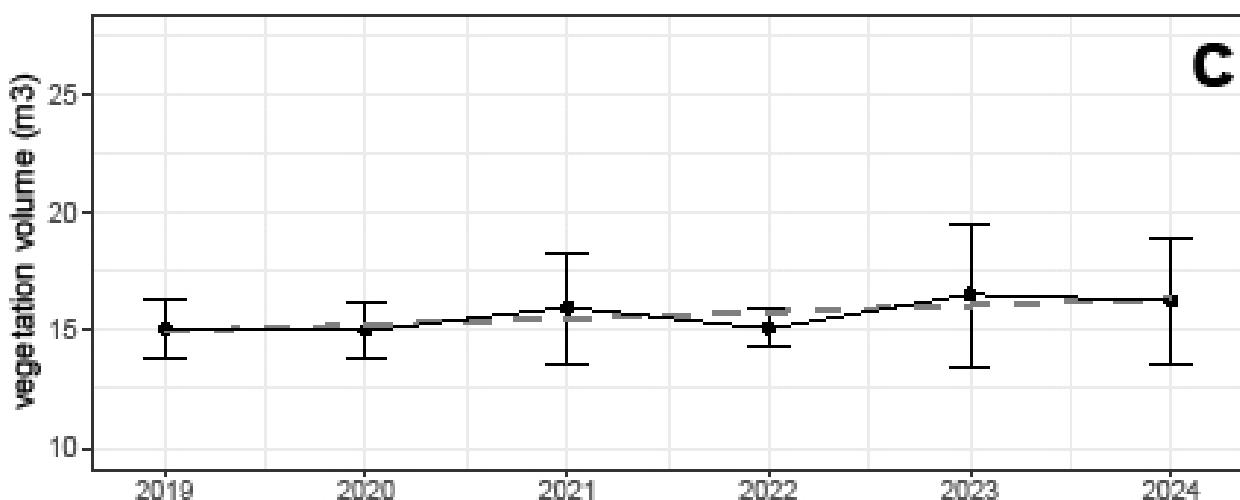
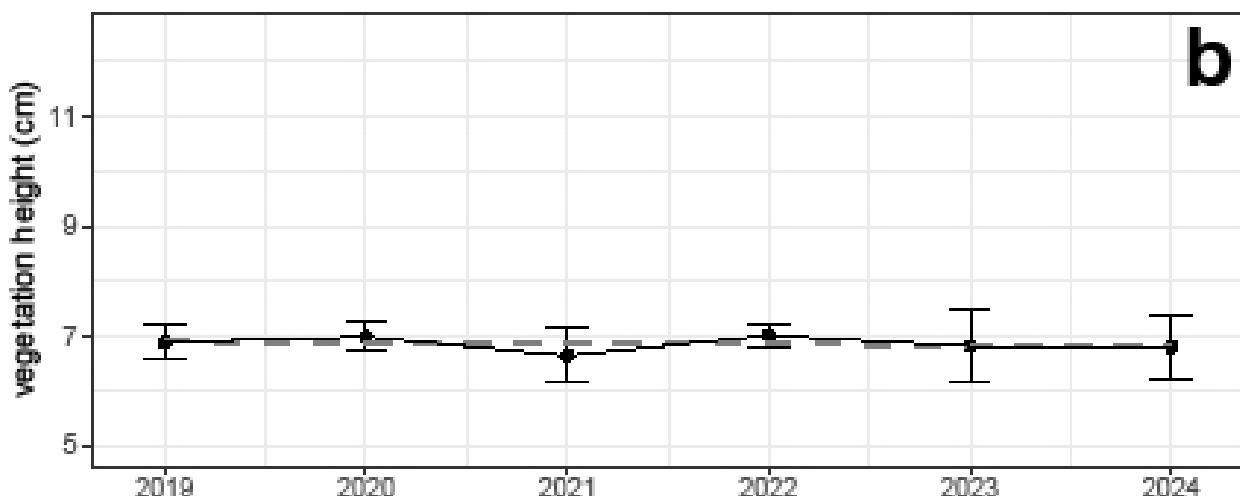
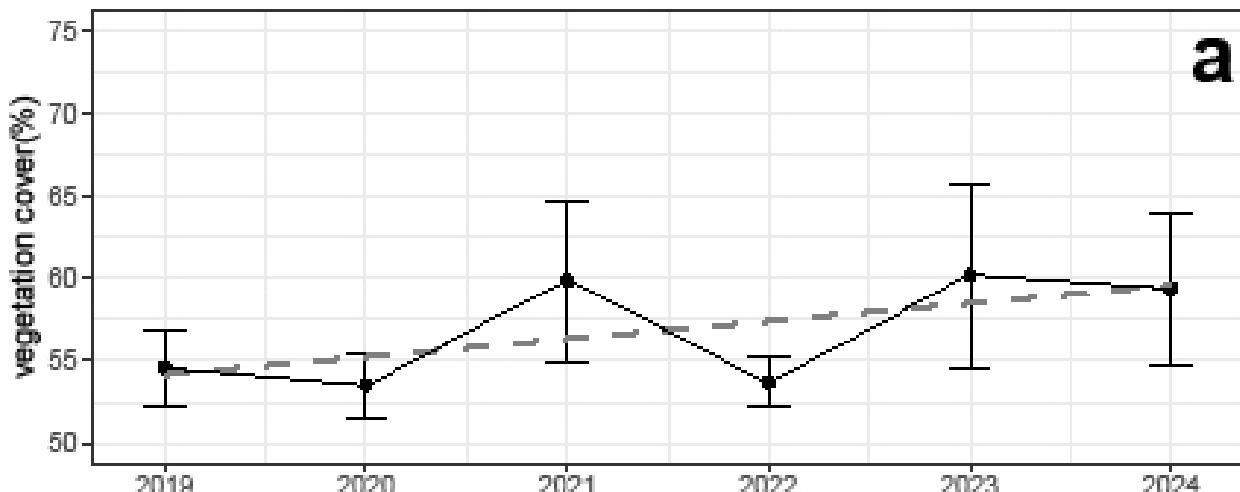
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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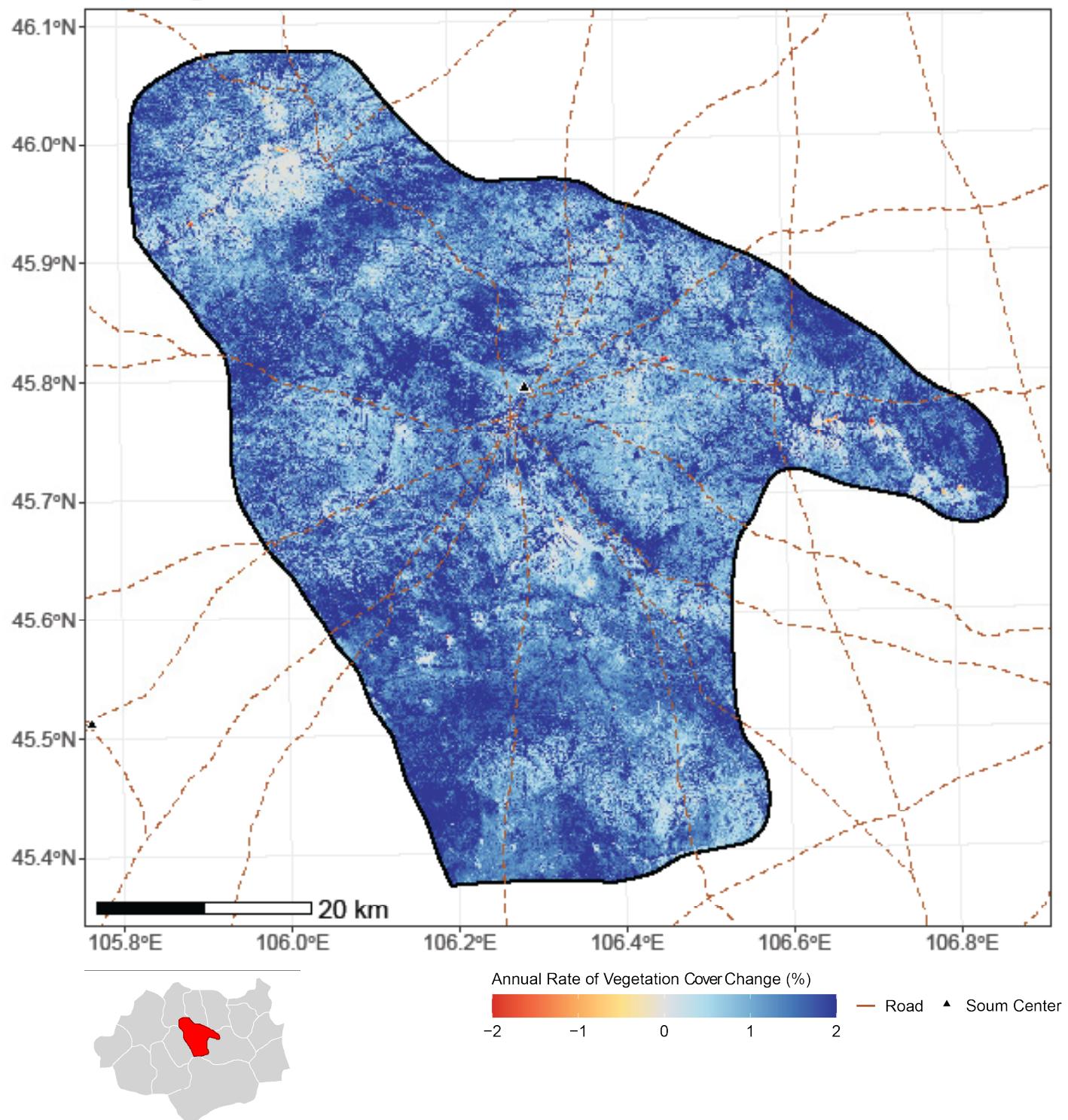
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

SAINTSAGAAN SOUM

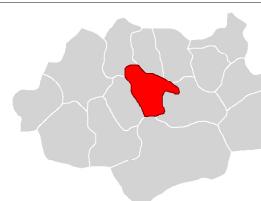
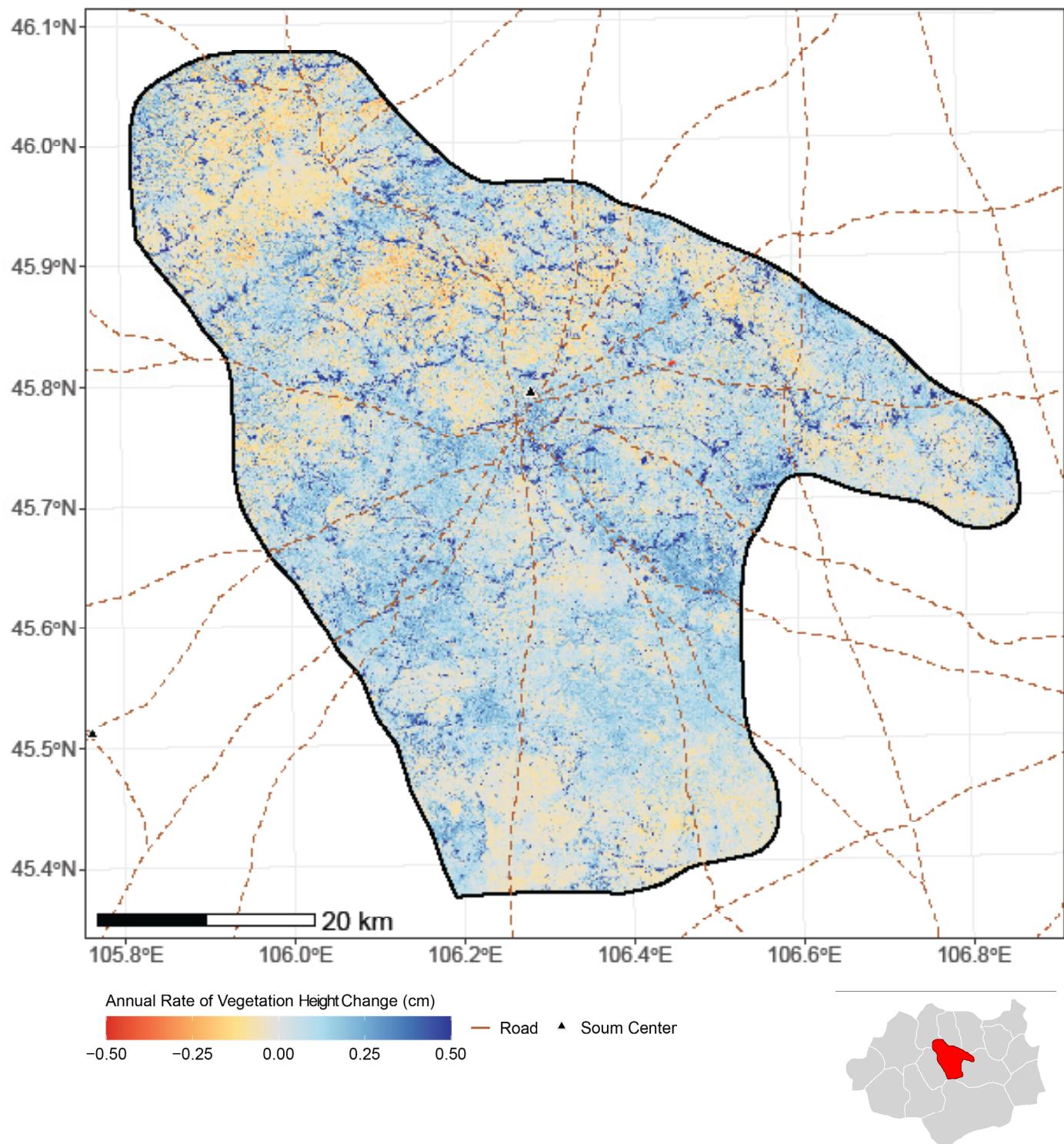
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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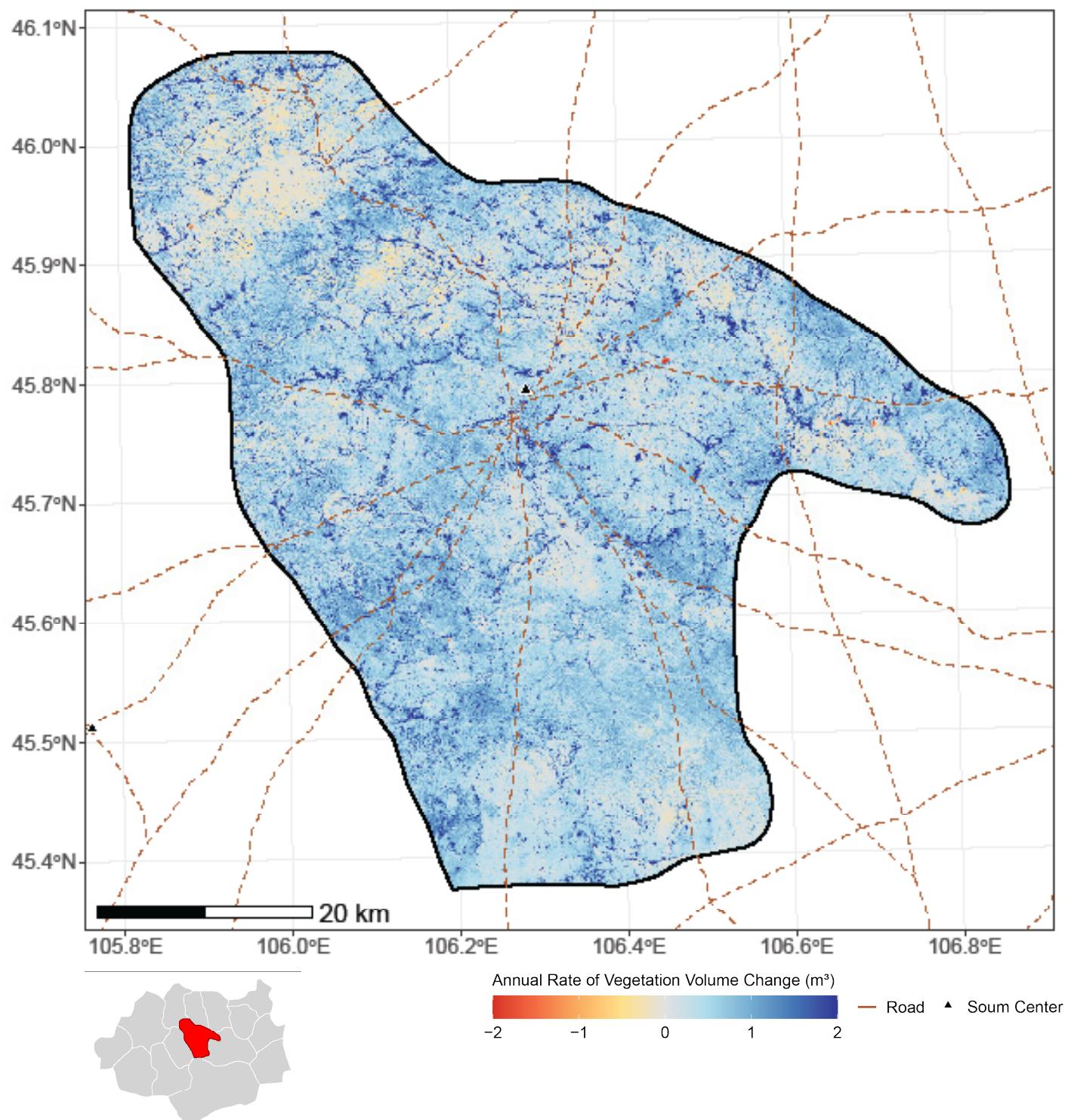
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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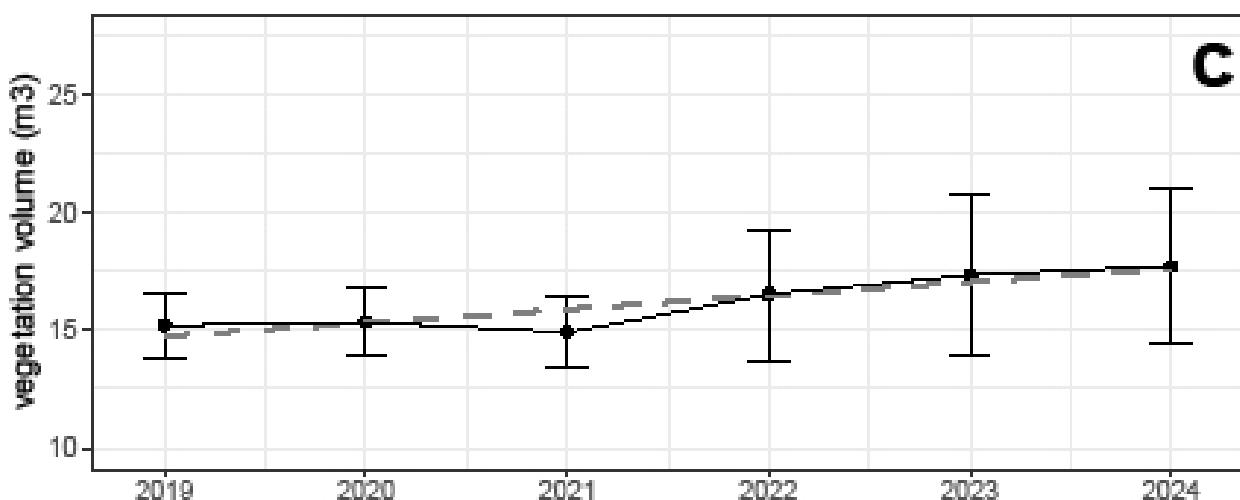
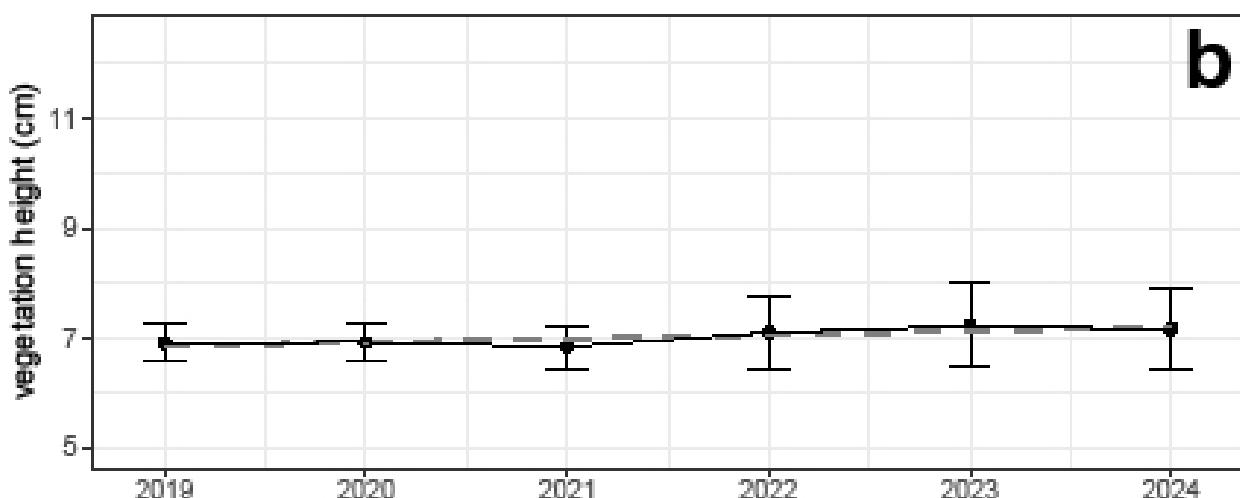
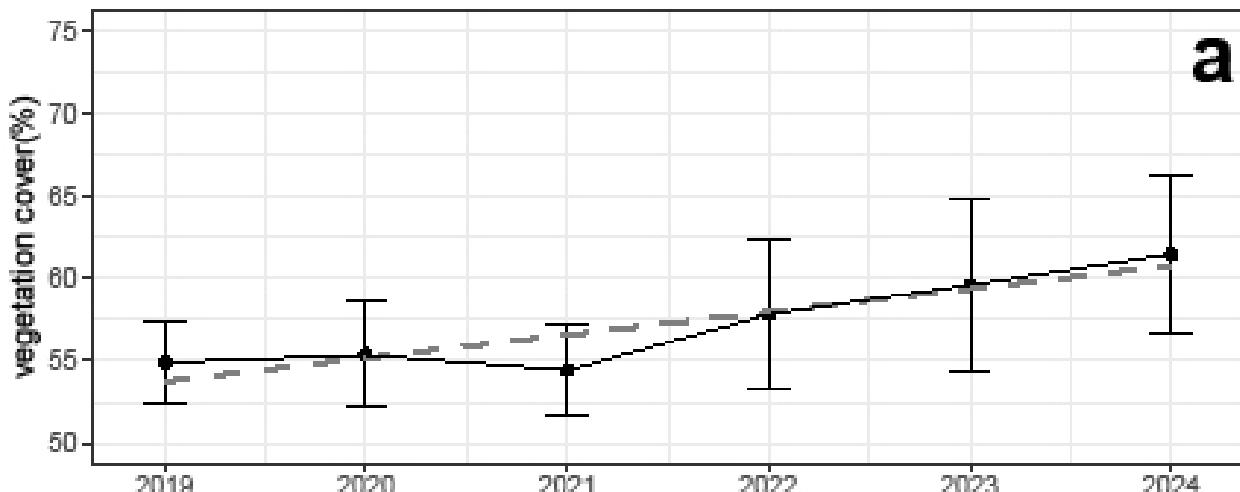
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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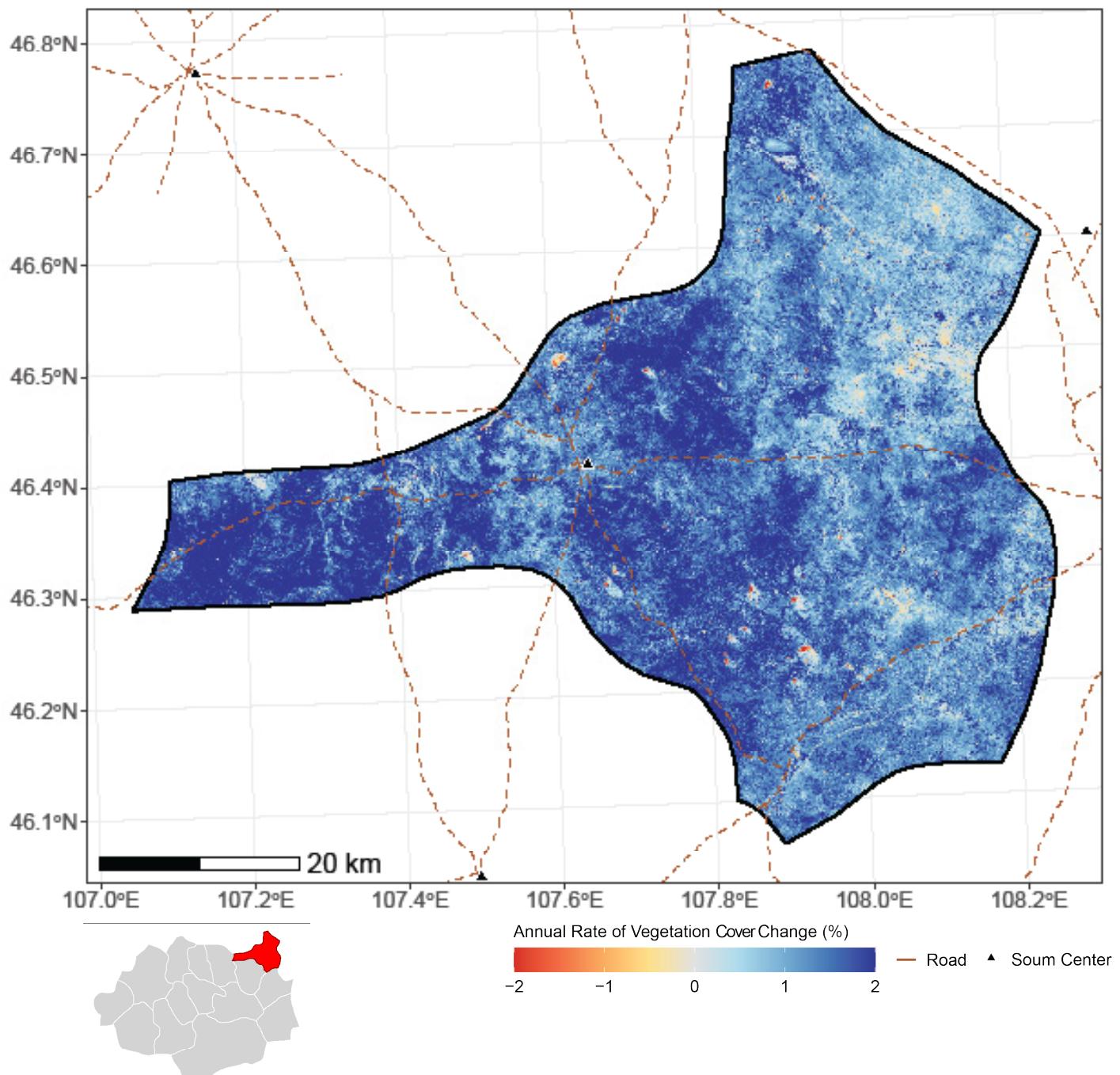
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

TSAGAANDELGER SOUM

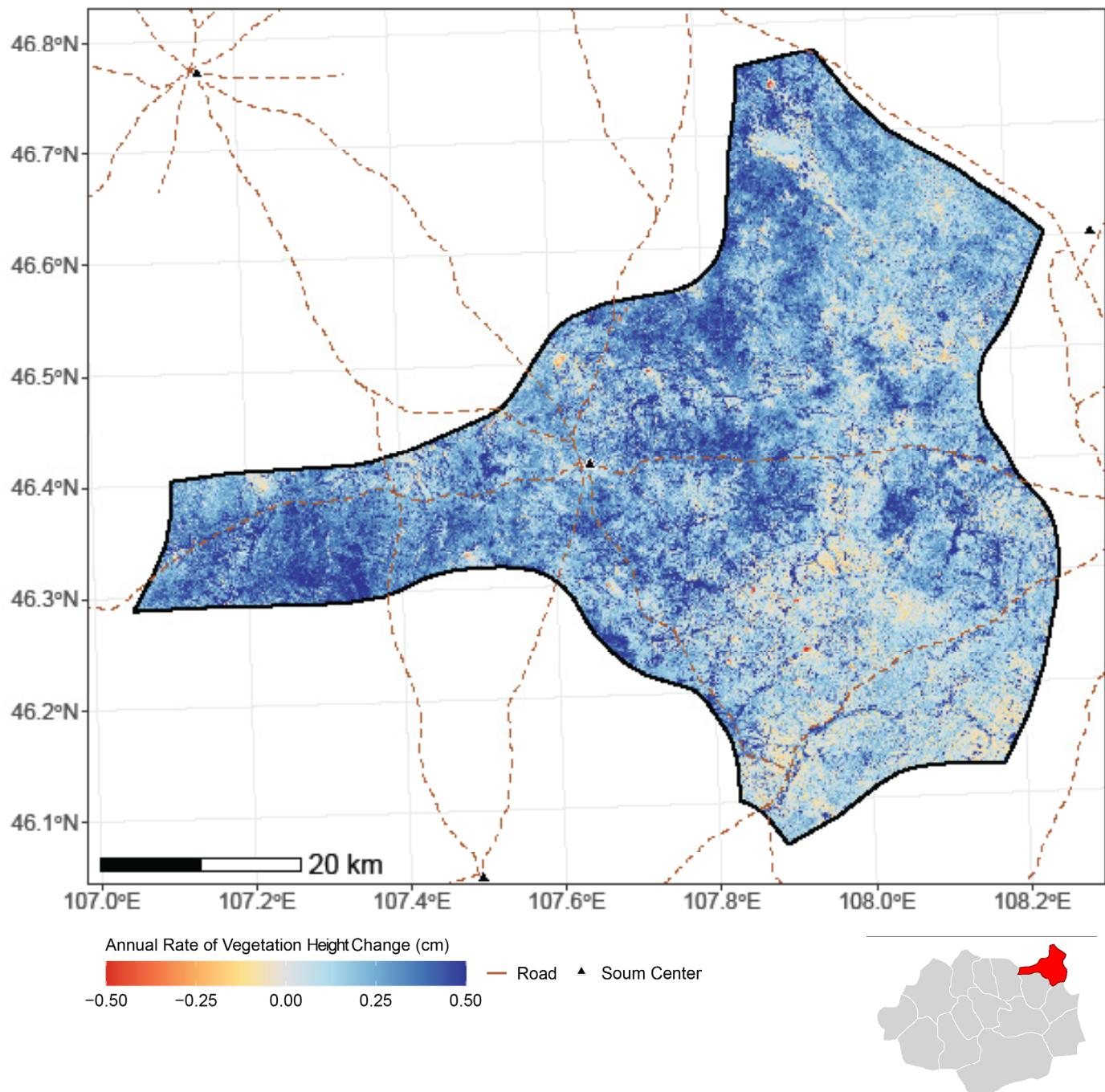
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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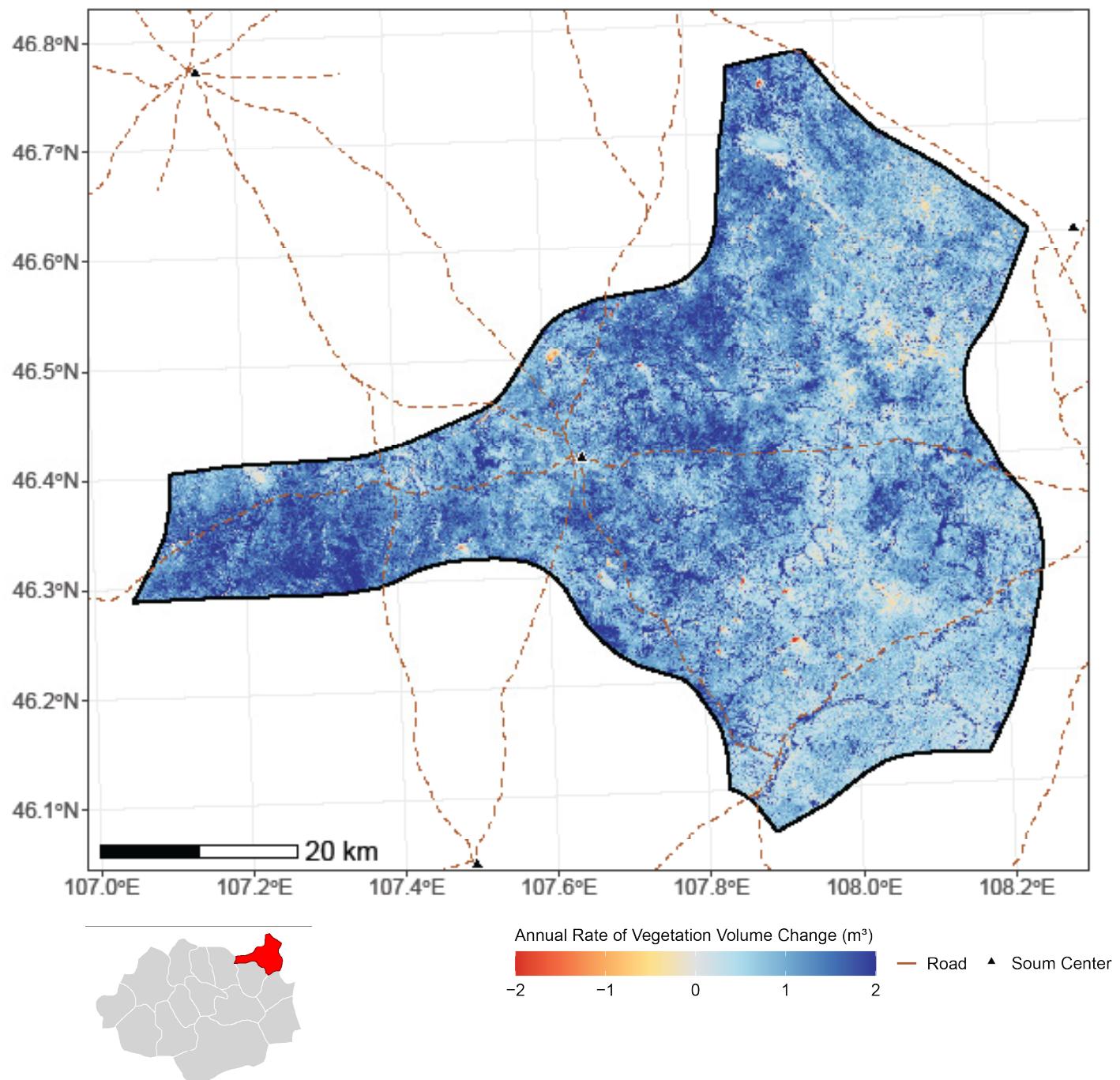
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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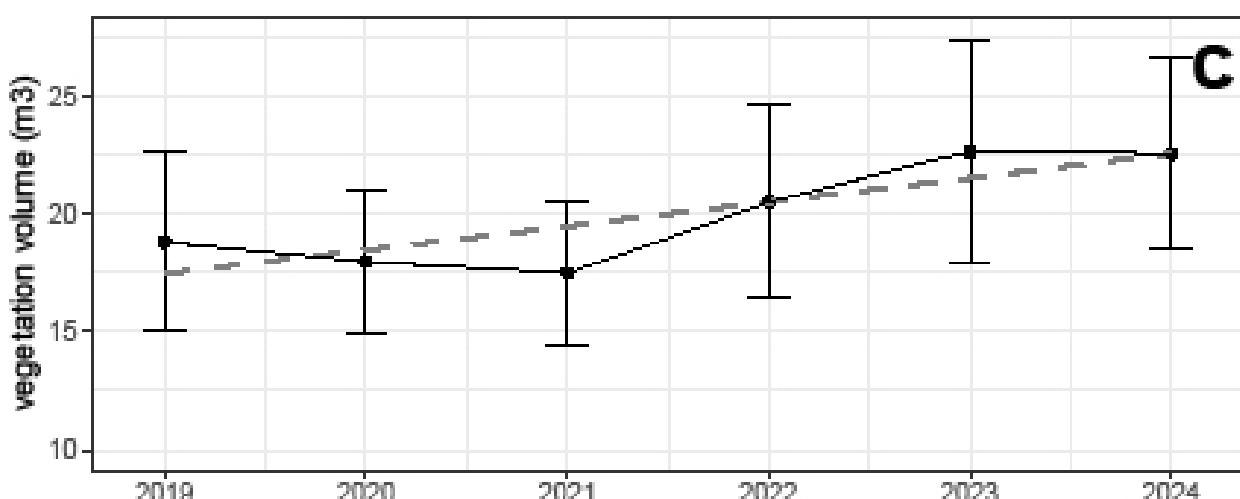
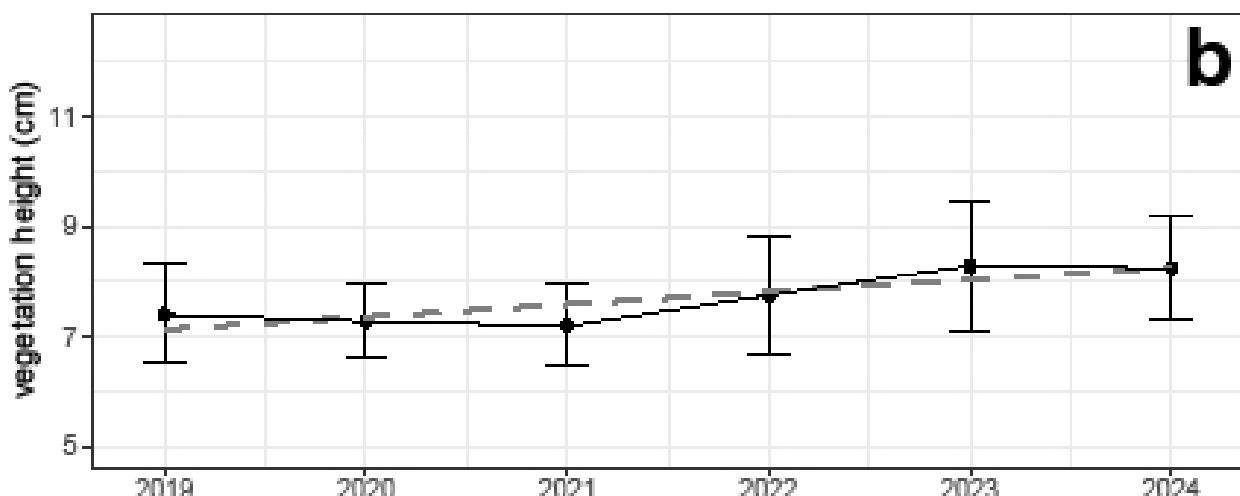
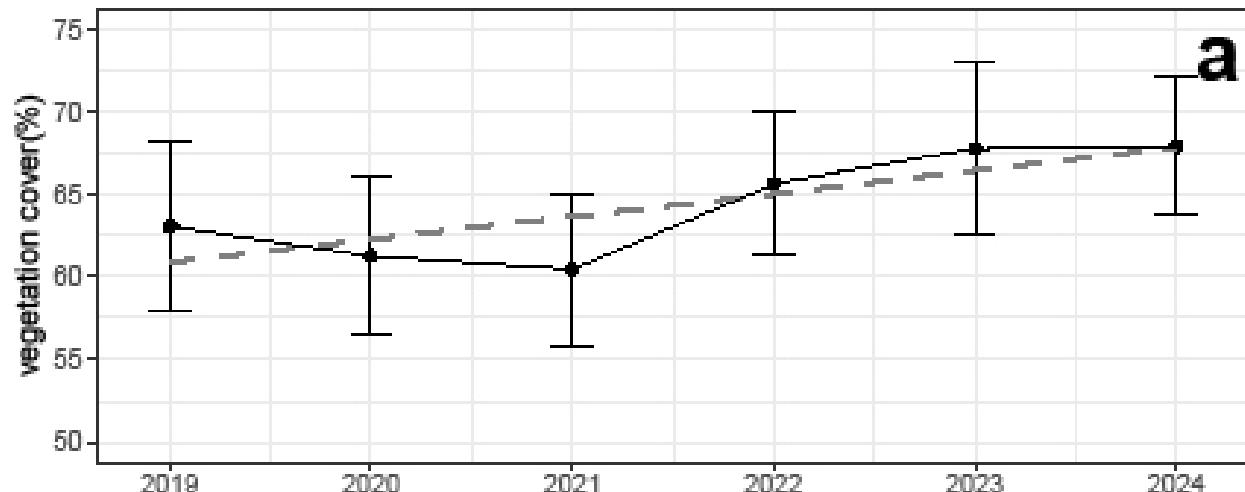
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

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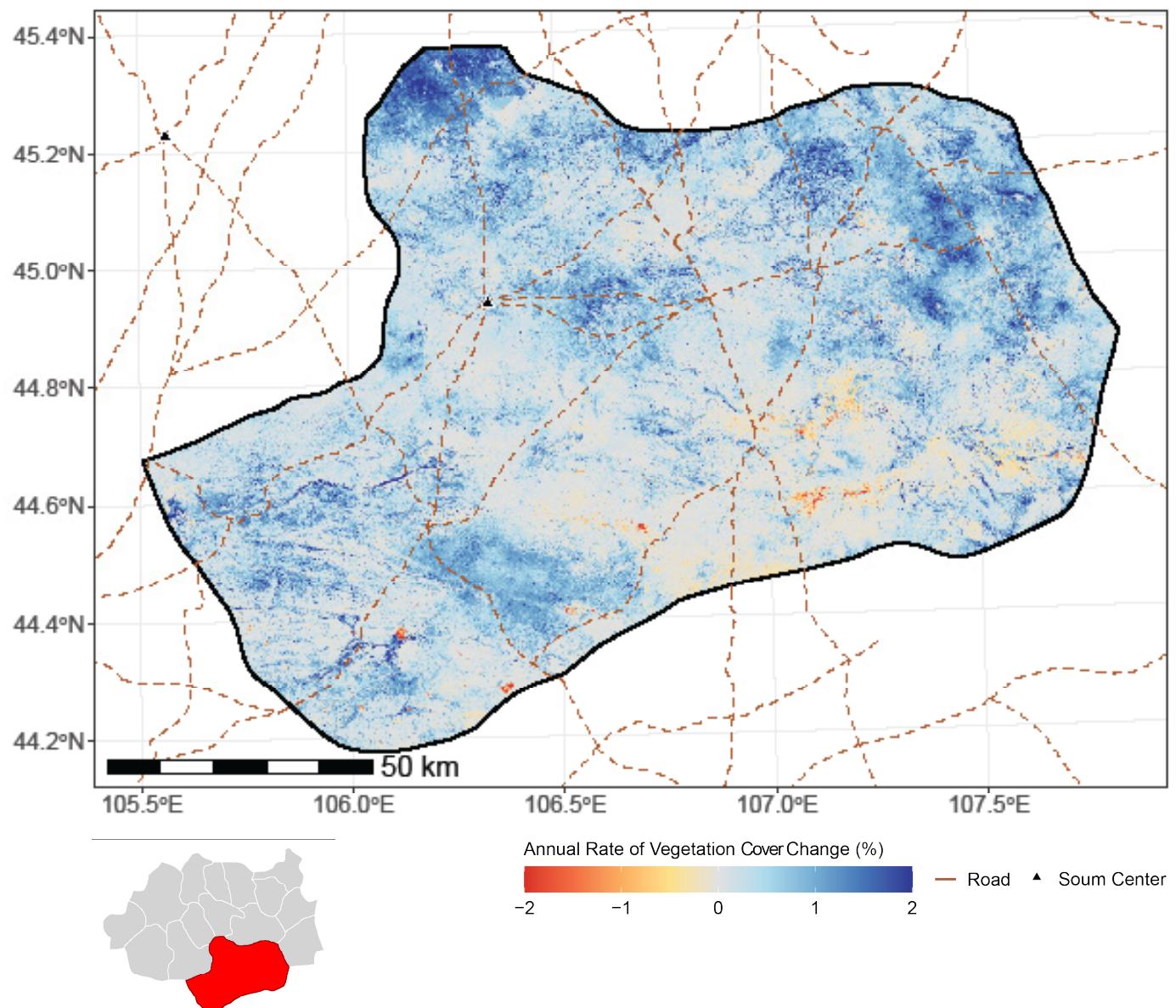
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

ULZIIT SOUM

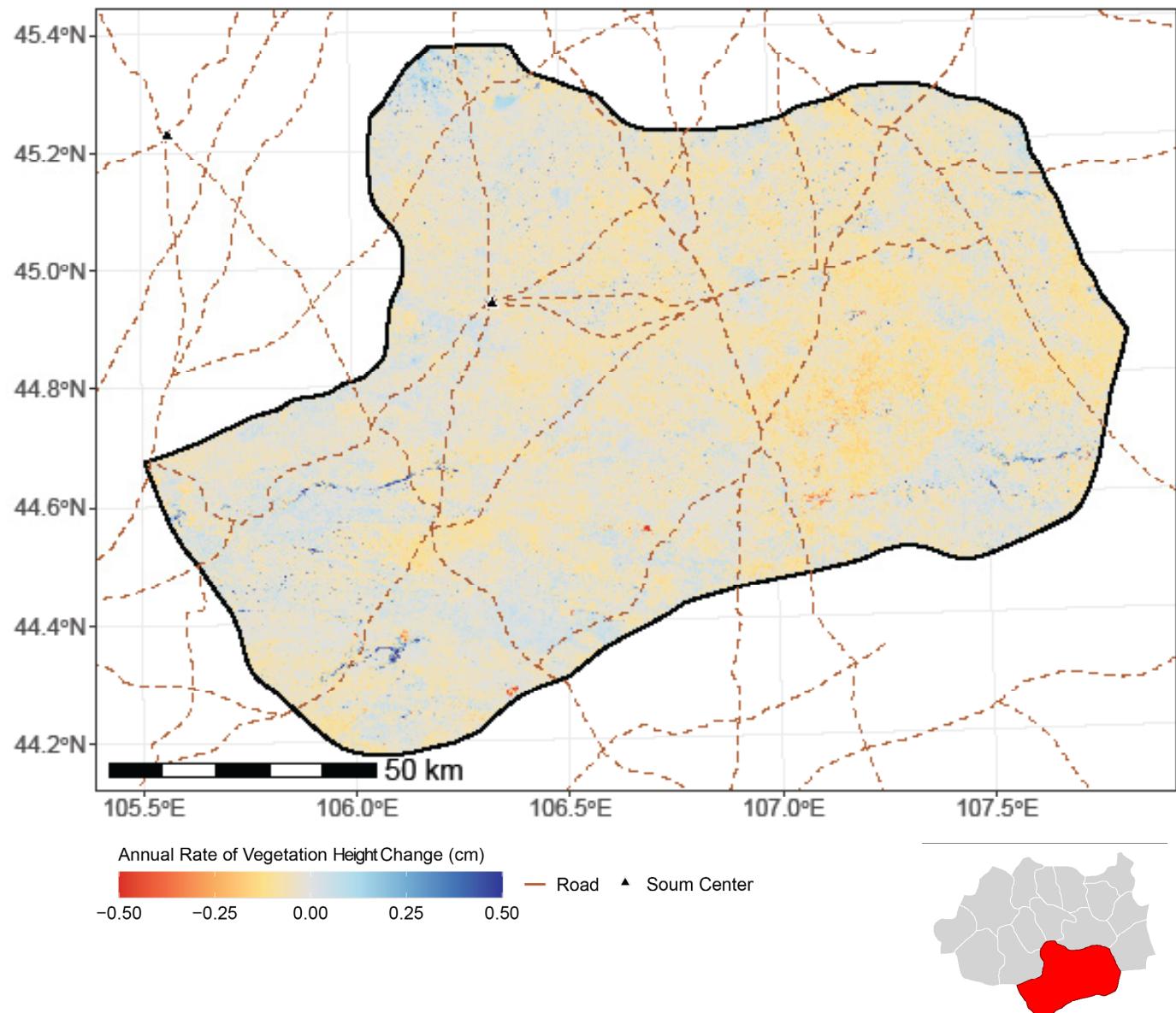
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

ULZIIT SOUM

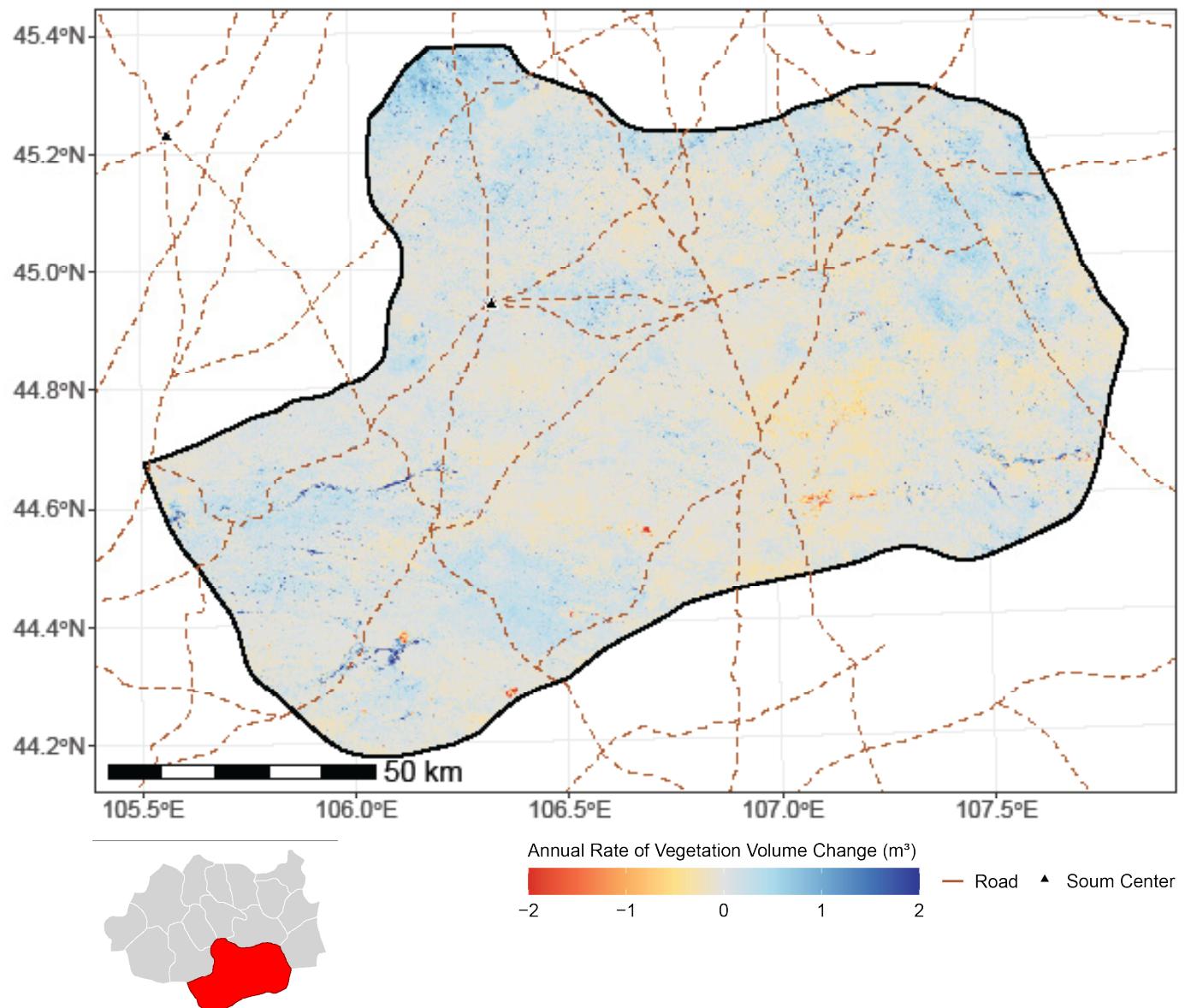
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

ULZIIT SOUM

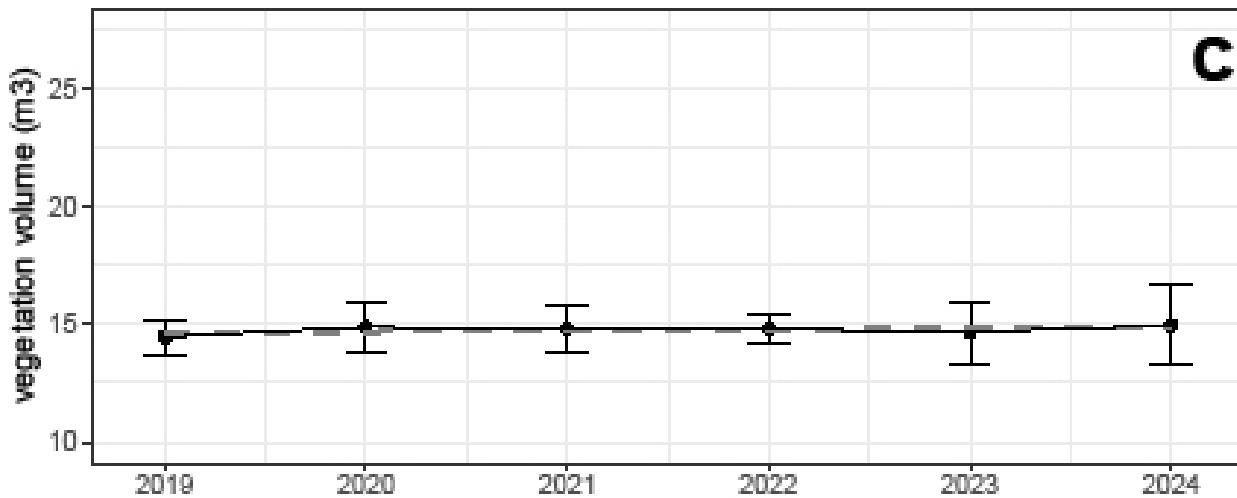
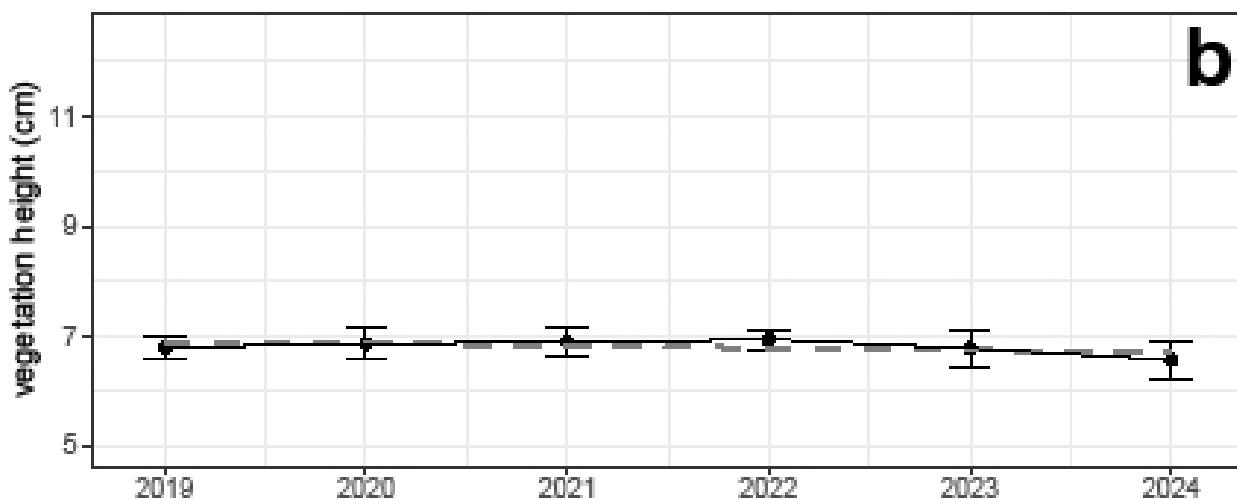
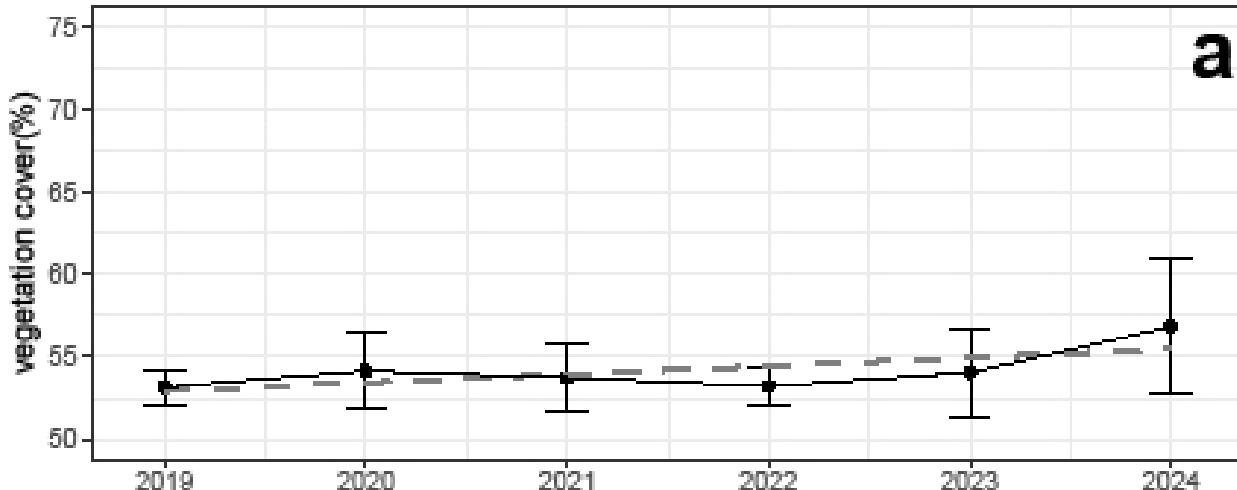
ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

ULZIIT SOUM

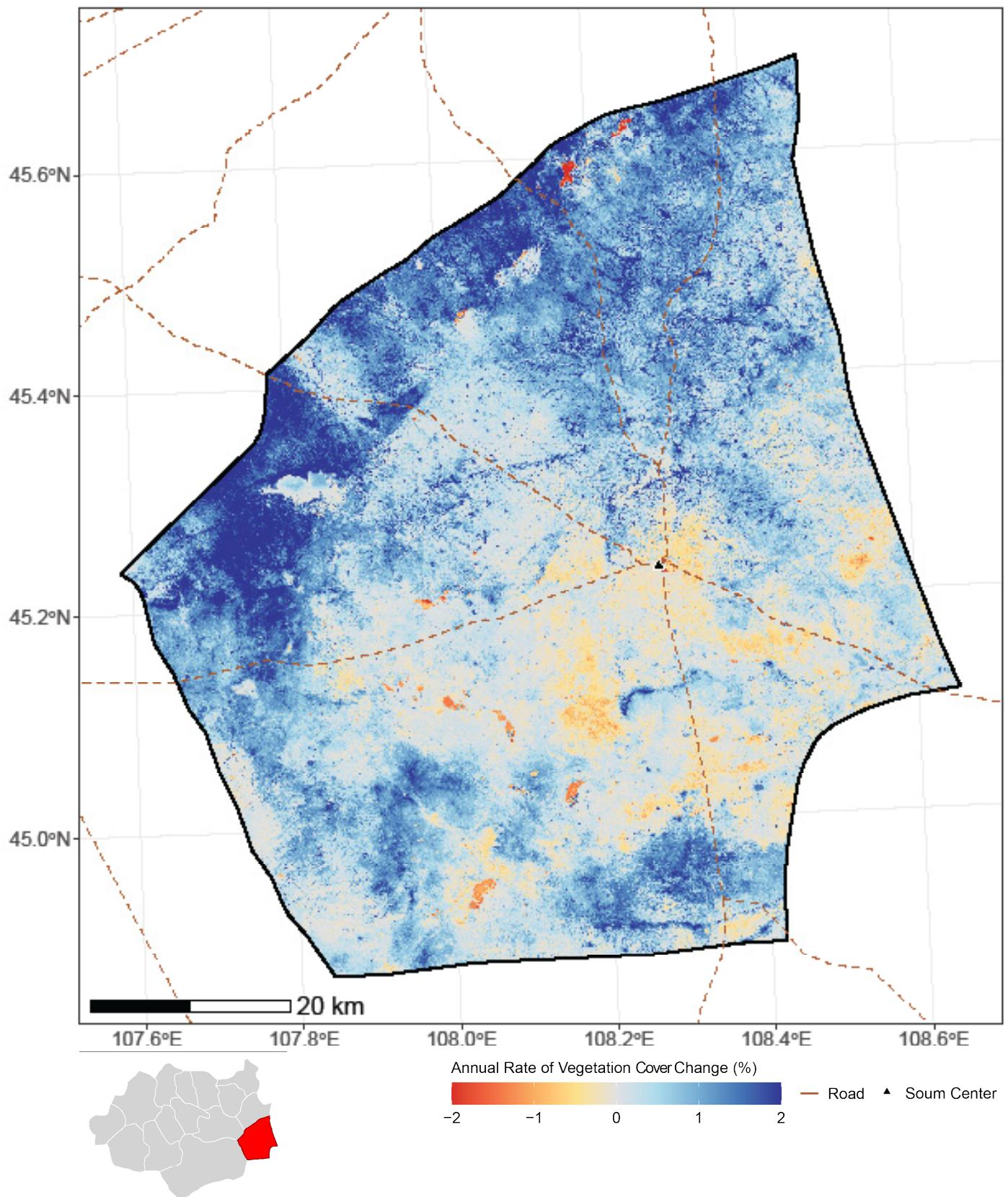
VEGETATION TRENDS



STATE OF THE STEPPE 2025 - SOUM LEVEL

UNDURSHIL SOUM

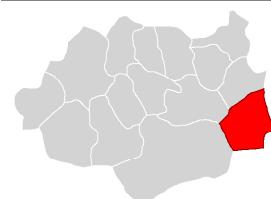
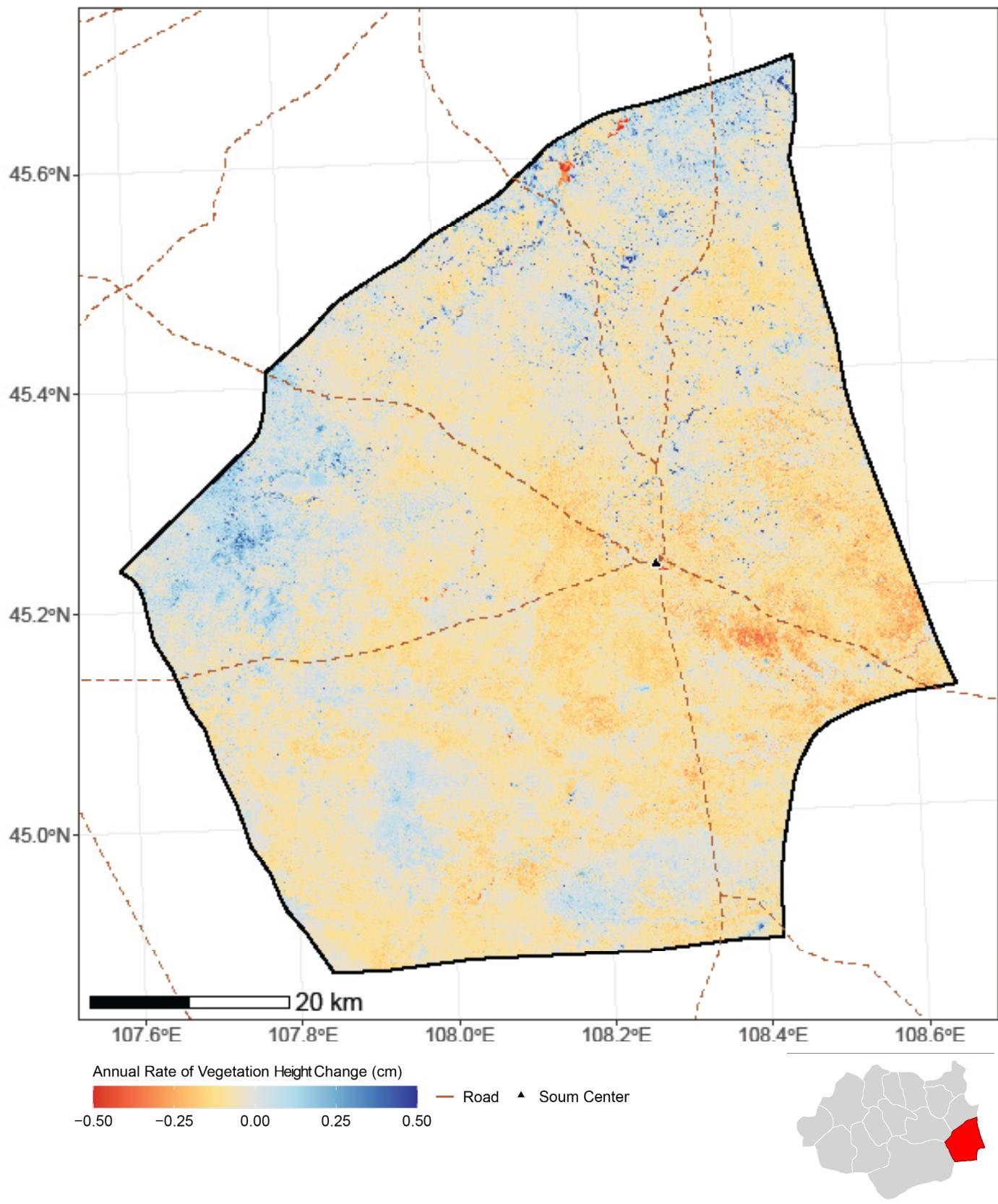
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

UNDURSHIL SOUM

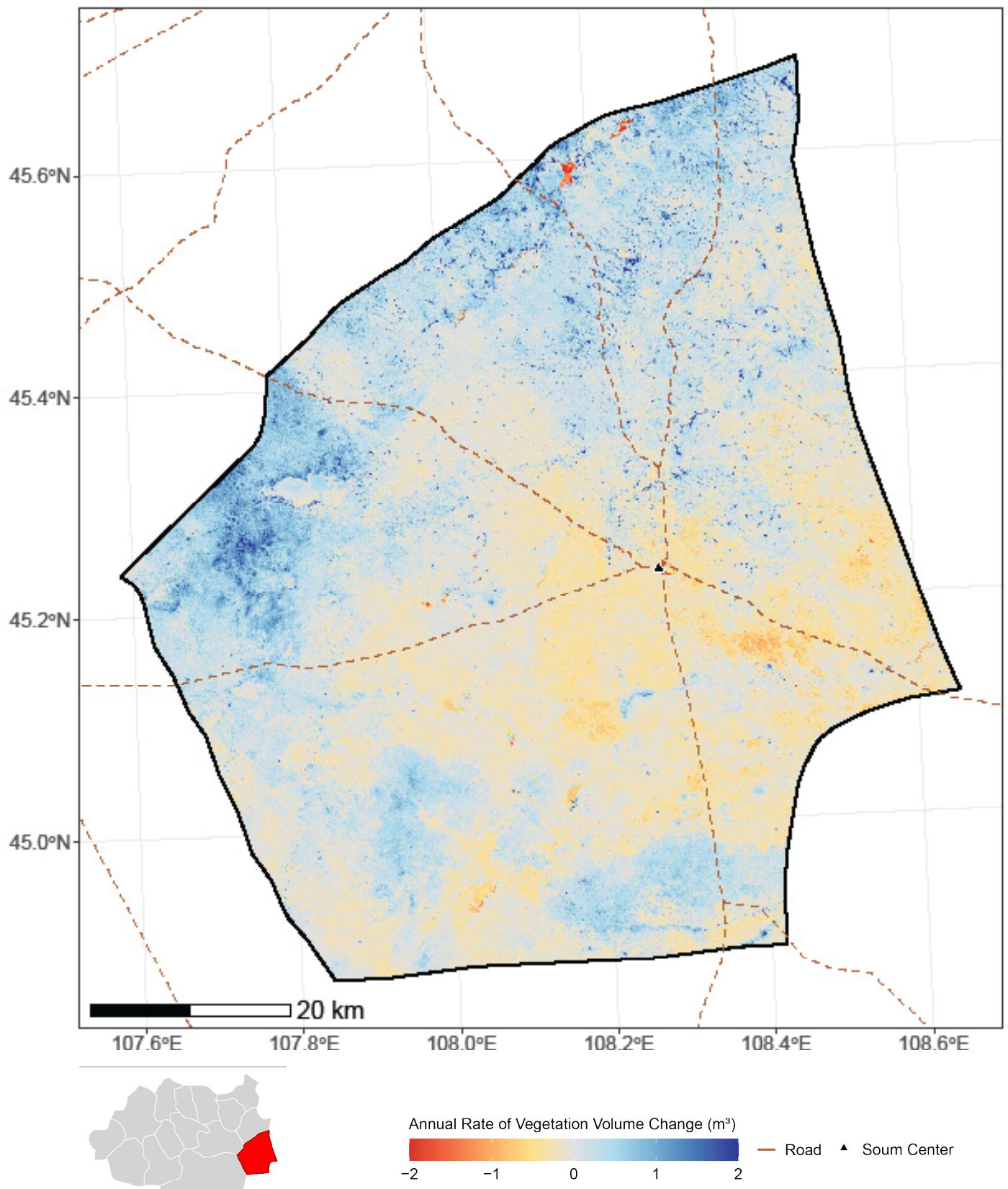
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

UNDURSHIL SOUM

ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

UNDURSHIL SOUM

VEGETATION TRENDS

