STATE OF THE STEPPE

SOCIAL & ECOLOGICAL DYNAMICS IN CENTRAL MONGOLIA

GOVISUMBER | 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 Province of Govisümber

Ginger Allington[1], Ryan Blackburn[1], Tungalag Ulambayar[2], Qiongyu Huang[3], Jessie Dearing[1], Anudari Bayarkhangai[3]

1 Cornell University, Dep. of Natural Resources & the Environment
2 Zoological Society Luujin
3 Smithsonian Conservation Biology Institute

TABLE OF CONTENTS

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 Govisumber. It was made possible through collaboration between key stakeholders within the Mongolian government, the Zoological Society of Luujin, and researchers at Cornell University and the Smithsonian Conservation Biology Society, 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.

(https://github.com/RCBlackburn/StEPPES)

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 wtih 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

Zoological Society LUUJIN

Cornell Atkinson Center for Sustainability

NASA

Smithsonian
National Zoological Park
Conservation Biology Institute

STATE OF THE STEPPE 2025 - AIMAG LEVEL

GOVISÜMBER

BACKGROUND |

Govisümber Aimag is situated centrally within Mongolia, abouot 250 kilometers south of the capital city Ulaanbaatar. It is comprised primarily of semi-arid steppe. Govisümber is the least populated aimag of Mongolia, with a population of 17,399. The aimag is especially noted for it's natural beauty and livestock products such as cashmere.

ISSUES |

A changing climate in Govisümber 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 Govisümber. 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 Govisümber aimag revealed that vegetation loss and gain appear to be spatially clustered, however, the average amount of vegetation has remained stable over the last six years. While there was a noticible dip in all vegetation characteristics in 2021, average vegetation conditions have returned across the aimag. Shiveegovi soum stands out by seeing large increases in vegetation cover and height in 2024. Survey respondents reported a number of interesting findings (pg. 10 of this report). A large majority of respondents reported moderate to 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 the availability of labor to complete herding tasks. However a slight majority of these same herders state that current herding practices are still adequate to meet their needs. Herders within Govisümber report slightly lower mobility in recent years than in the past, moving equal or 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. In addition, coordination of otor movements could target zones with increasing vegetation volume. We also recommend that regional administrators begin tracking the location and total area of fenced pasture, as this may impact mobility and localized vegetation conditions.

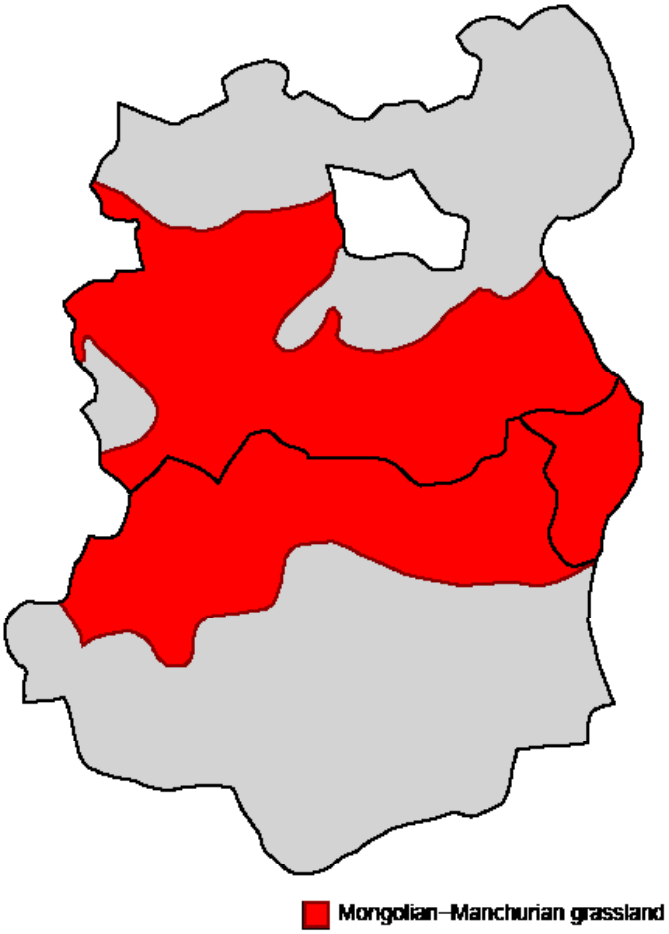
STATE OF THE STEPPE 2025 - AIMAG LEVEL

GOVISÜMBER

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, hieght, and volume maps represents the average vegetation value of that charcteristic over a 20 x 20 meter area. Our data collection was within the Mongolian-Manchurian grassland ecoregion 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.



GOVISÜMBER 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 of 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.

GOVISÜMBER VEGETATION TREND FIGURES |

The average values 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

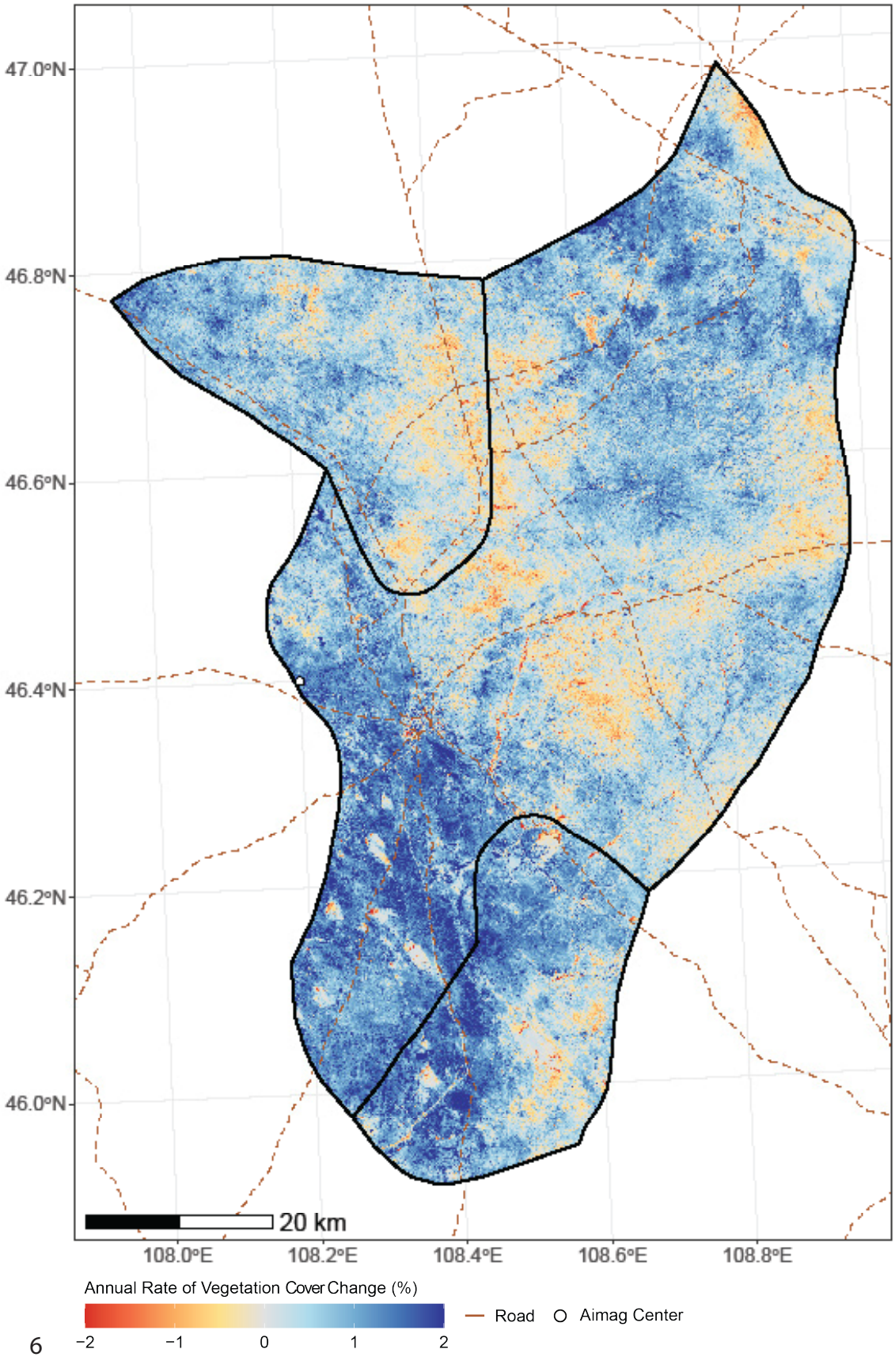
GOVISÜMBER HOUSEHOLD SURVEY TABLE |

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

STATE OF THE STEPPE 2025 - AIMAG LEVEL

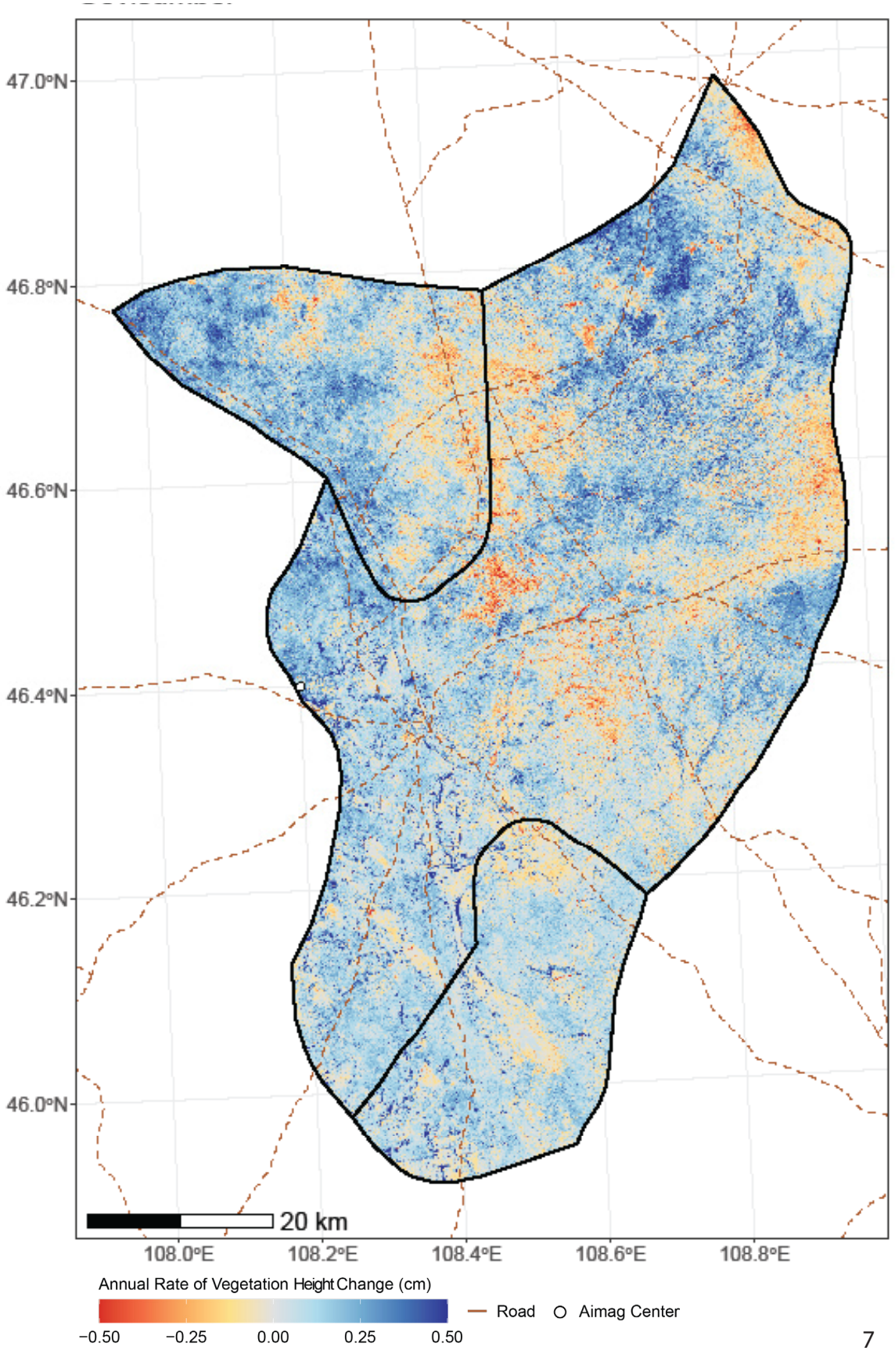
GOVISUMBER

ANNUAL RATE OF VEGETATION COVER CHANGE



GOVISUMBER

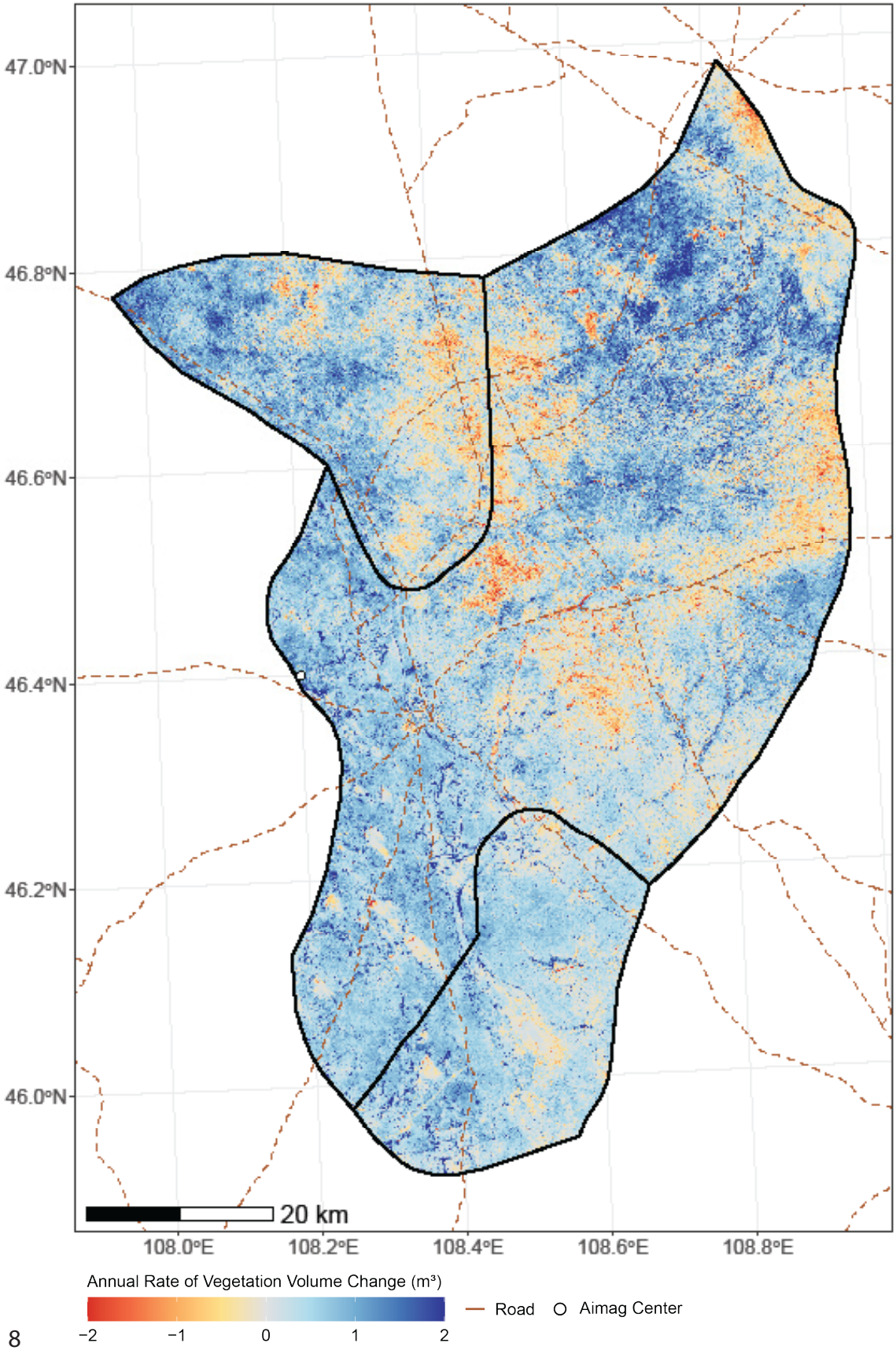
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - AIMAG LEVEL

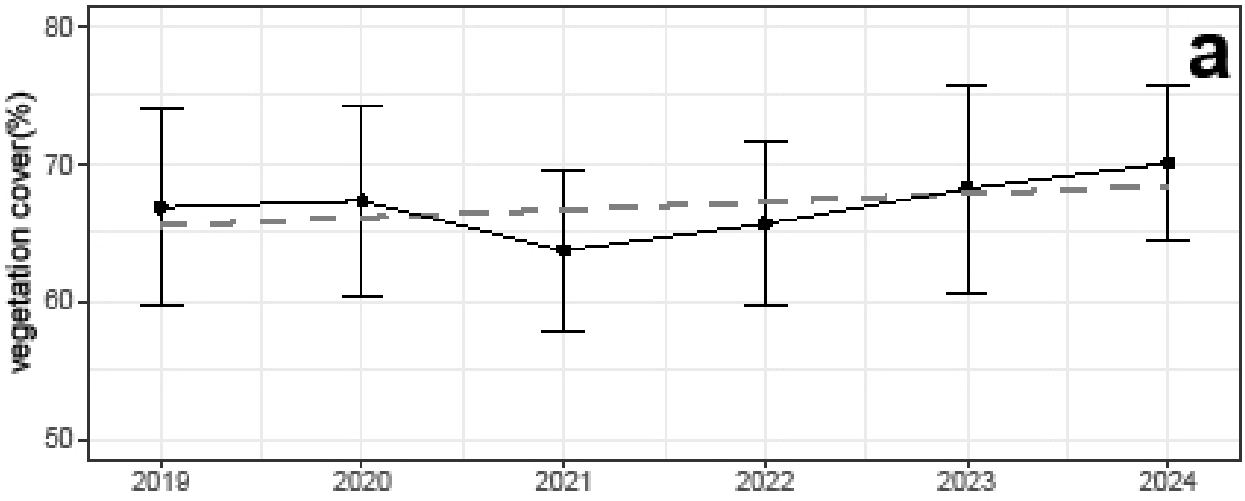
GOVISUMBER

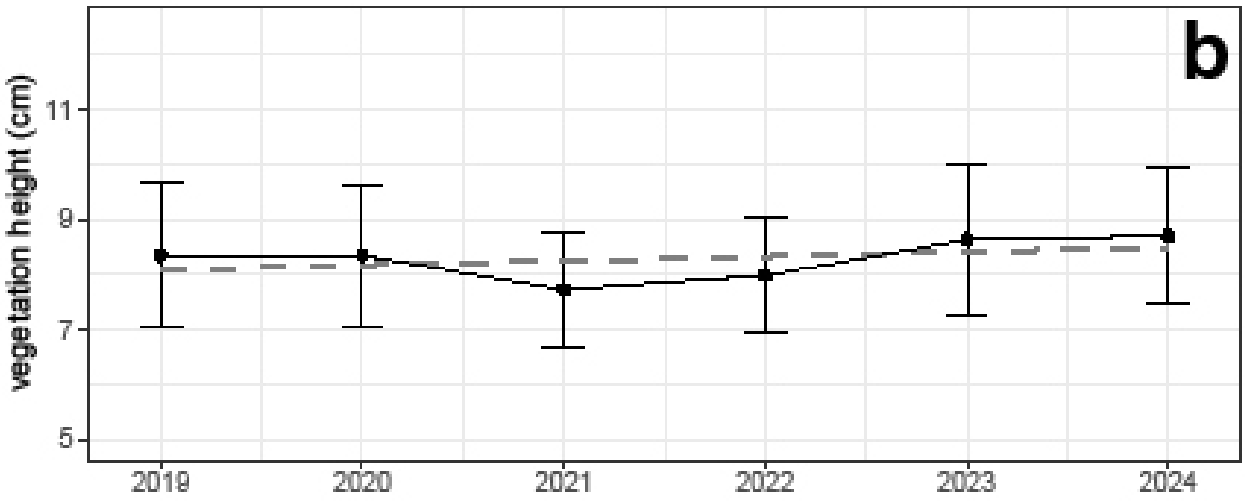
ANNUAL RATE OF VEGETATION VOLUME CHANGE

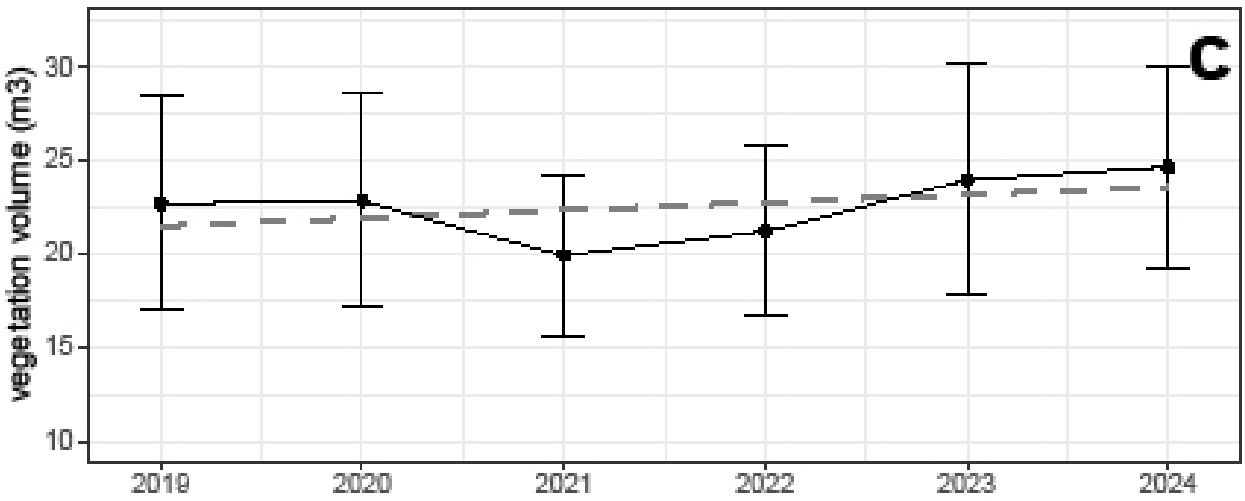


GOVISUMBER

AVERAGE VEGETATION TRENDS







STATE OF THE STEPPE 2025 - AIMAG LEVEL

GOVISUMBER

PIXELS WITH PERSPECTIVE: UNDERSTANDING THE SOCIAL DATA

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

Soum	Degraded	Improved	No Change	NA	Total
Bayantal	8	3	3	6	20
Sumber	11	0	3	8	22
Aimag Total	19	3	6	14	42

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

Soum	No	Yes	Total
Bayantal	18	2	20
Sumber	13	9	22
Aimag Total	31	11	42

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

Soum	No	Yes	Total
Bayantal	7	13	20
Sumber	9	13	22
Aimag Total	16	26	42

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

Soum	Equal	Moved more last year	Moved more this year	Total
Bayantal	9	5	5	20
Sumber	14	4	4	22
Aimag Total	23	9	9	42

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

Soum	Equal	Greater distance	Less distance	NA	Total
Bayantal	6	9	2	3	20
Sumber	7	12	3	0	22
Aimag Total	13	21	5	3	42

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

Soum	No	Yes	NA	Total
Bayantal	9	10	1	20
Sumber	9	11	2	22
Aimag Total	18	21	3	42

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

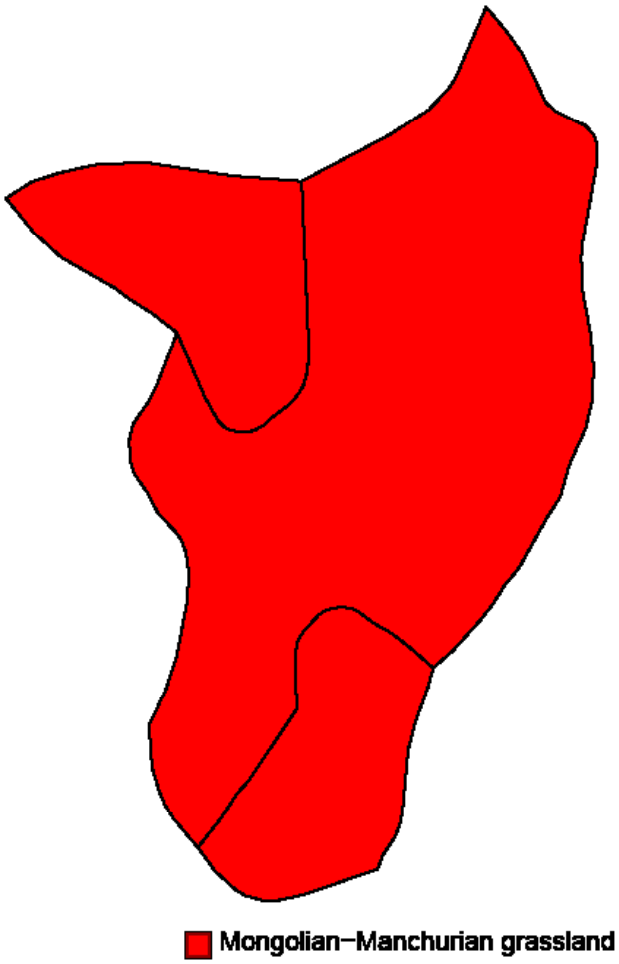
Soum	No	Yes	NA	Total
Bayantal	9	10	1	20
Sumber	13	7	2	22
Aimag Total	22	17	3	42

GOVISÜMBER 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 esitmating the slope of a linear model for each vegeation charcteristic value and year. This can be interpreted as the average amount of increasing (blue) or decreasing (red) vegetation seen within the study period.

GOVISÜMBER SOUM VEGETATION TREND FIGURES |

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

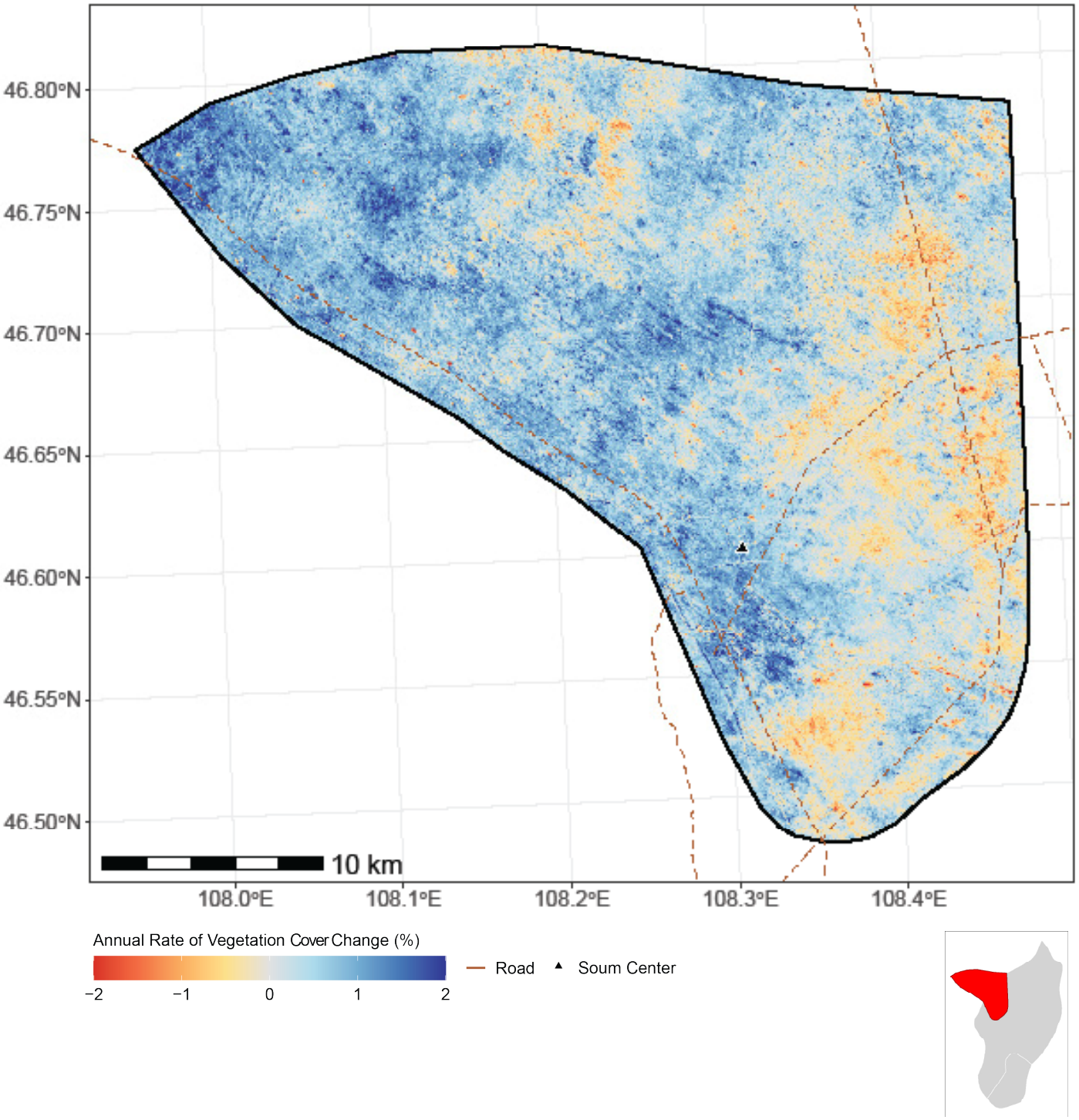


Govisümber soum Map | The extent of each soum that falls within the Mongolian-Manchurian grassland ecoregion defined by the World Wildlife Fund is in red.

STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANTAL SOUM

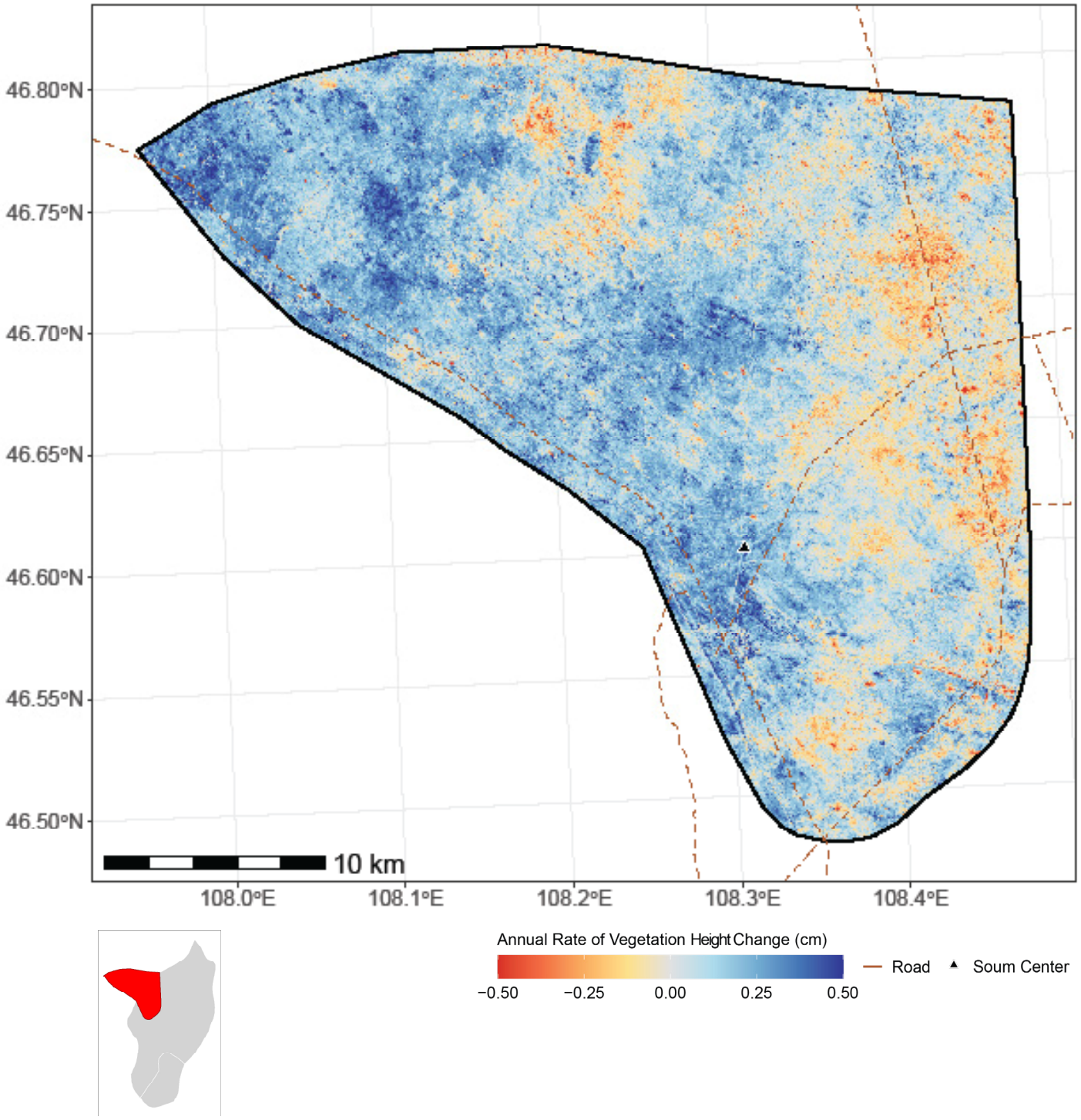
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANTAL SOUM

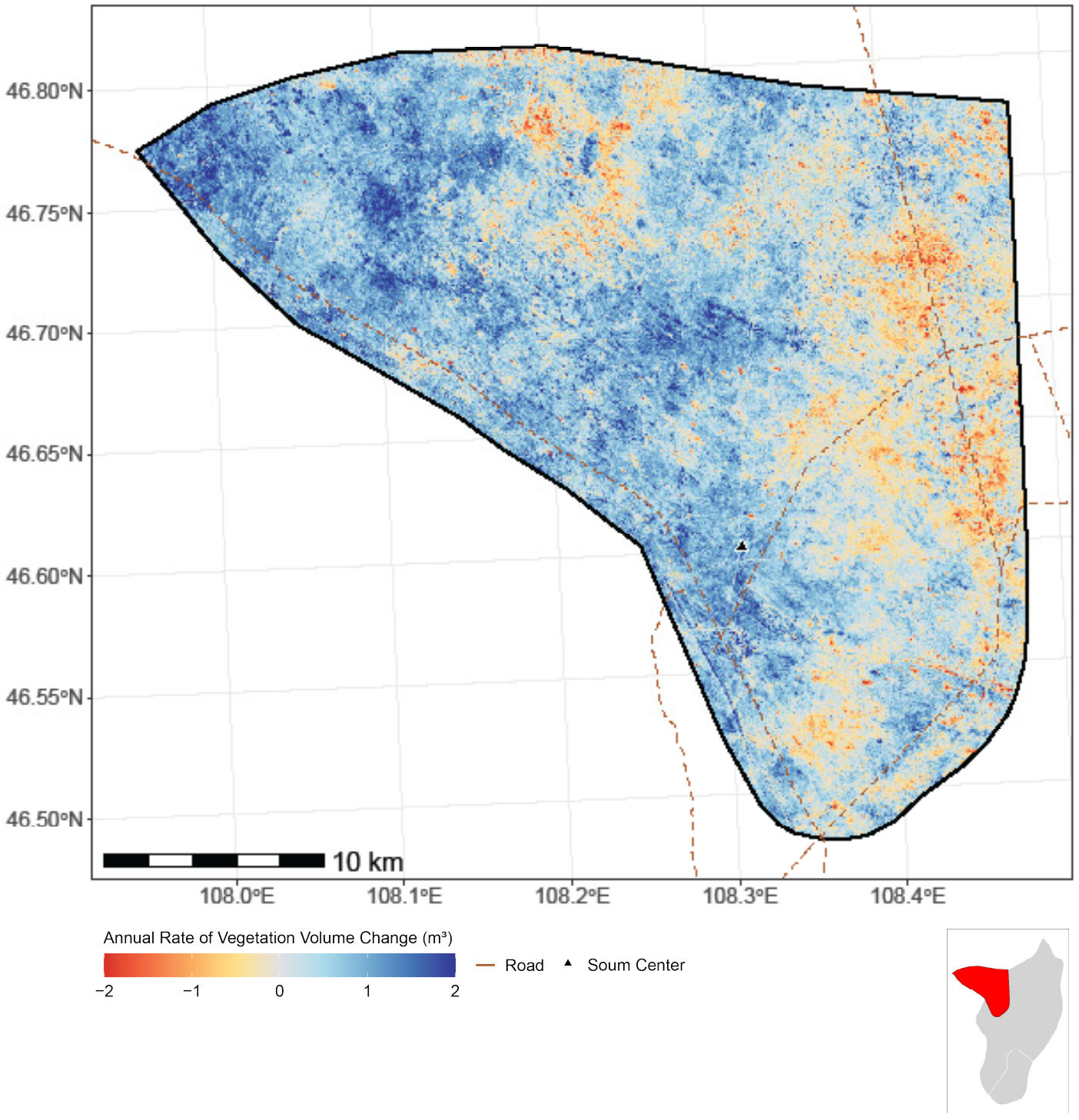
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANTAL SOUM

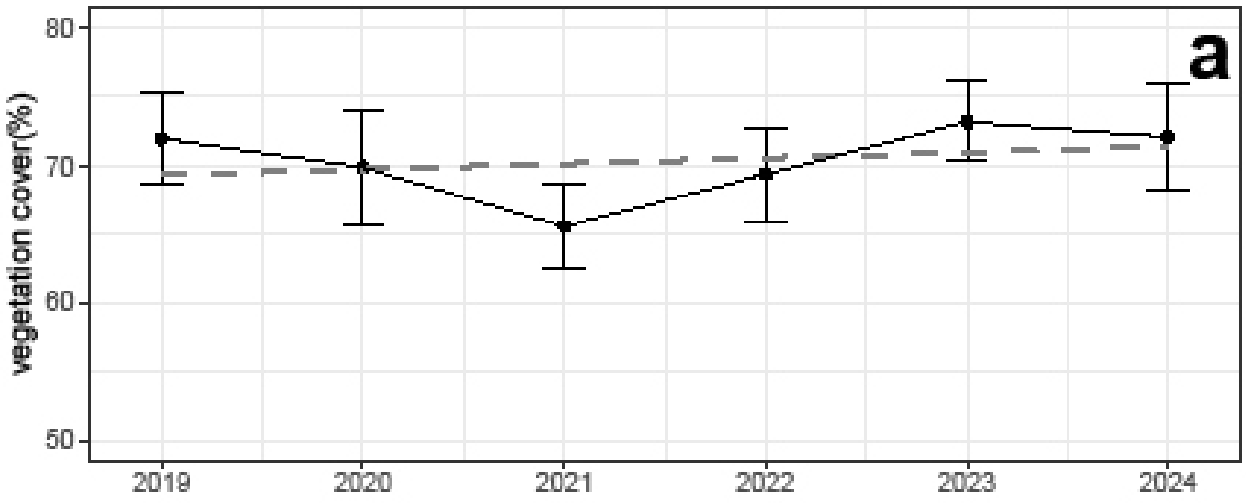
ANNUAL RATE OF VEGETATION VOLUME CHANGE

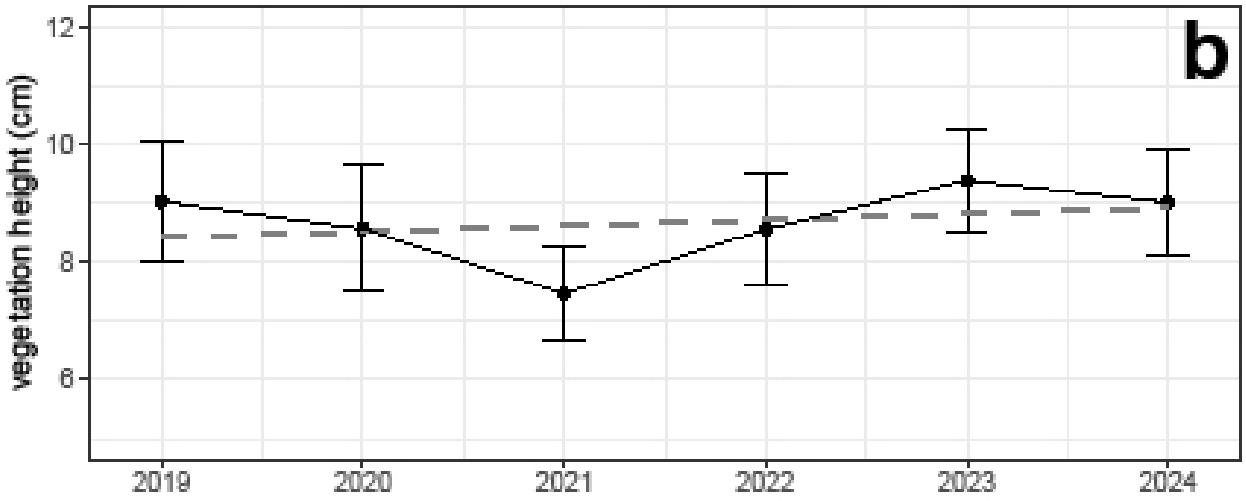


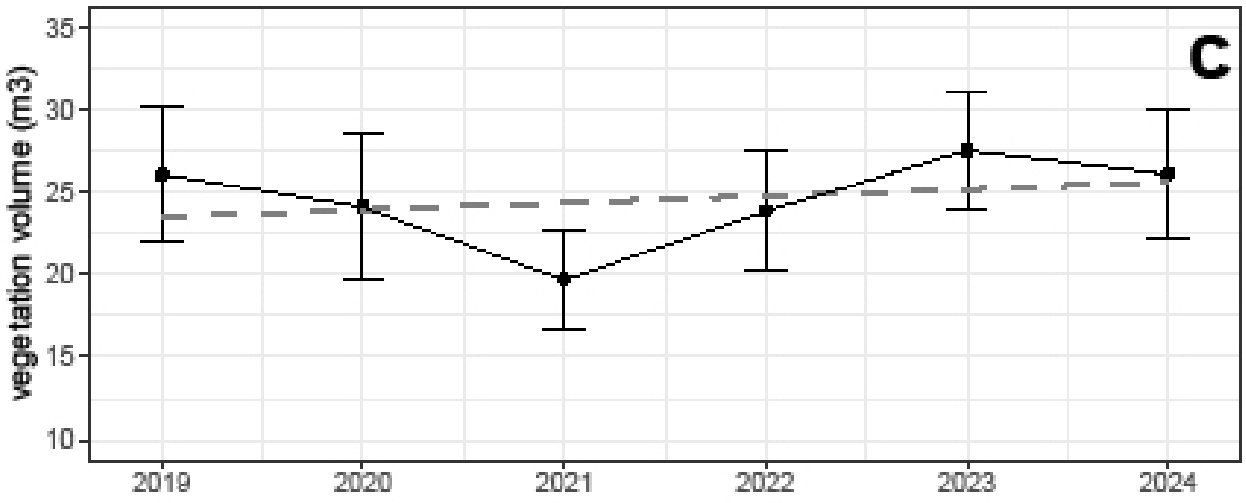
STATE OF THE STEPPE 2025 - SOUM LEVEL

BAYANTAL SOUM

VEGETATION TRENDS



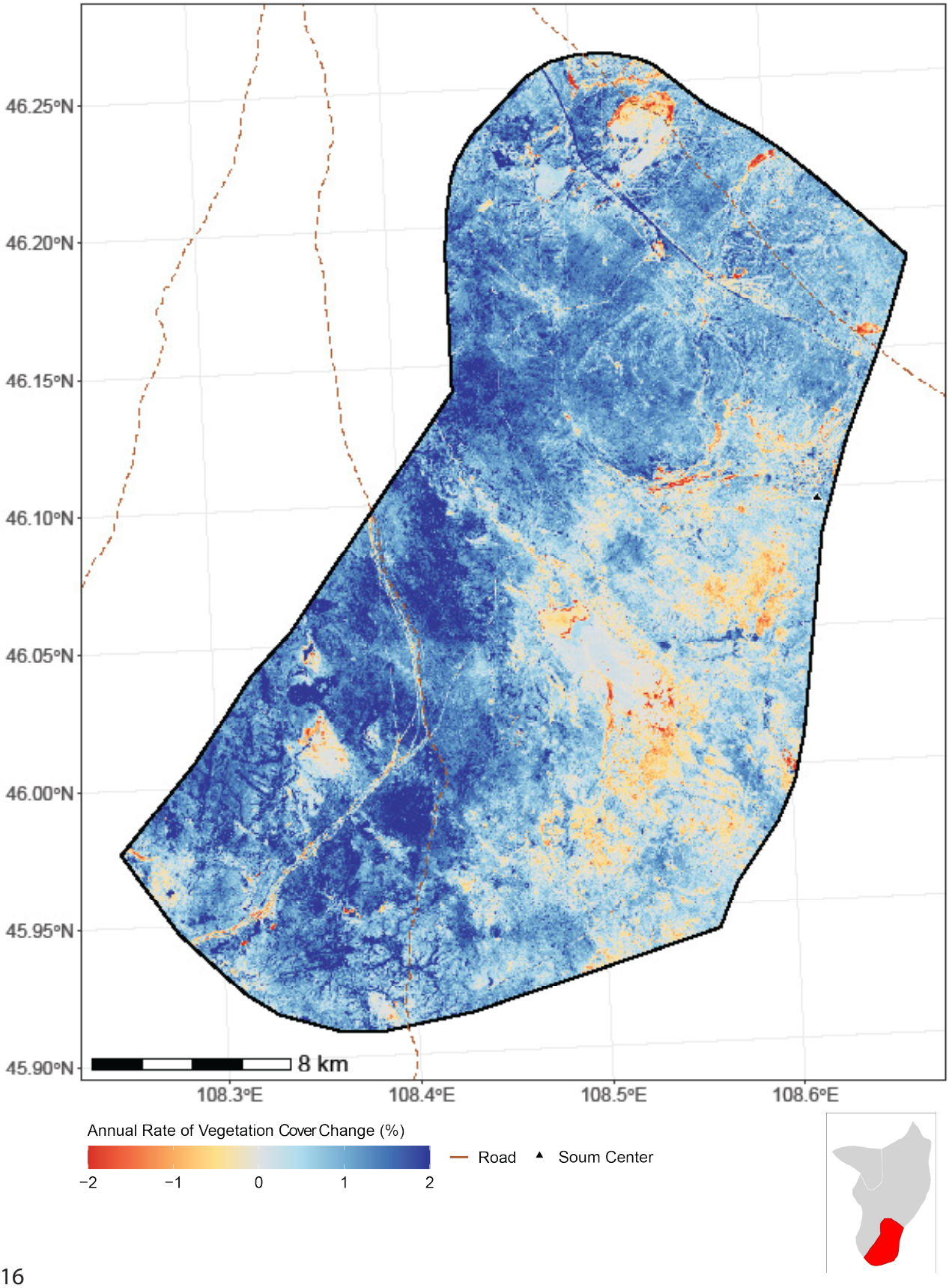




STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

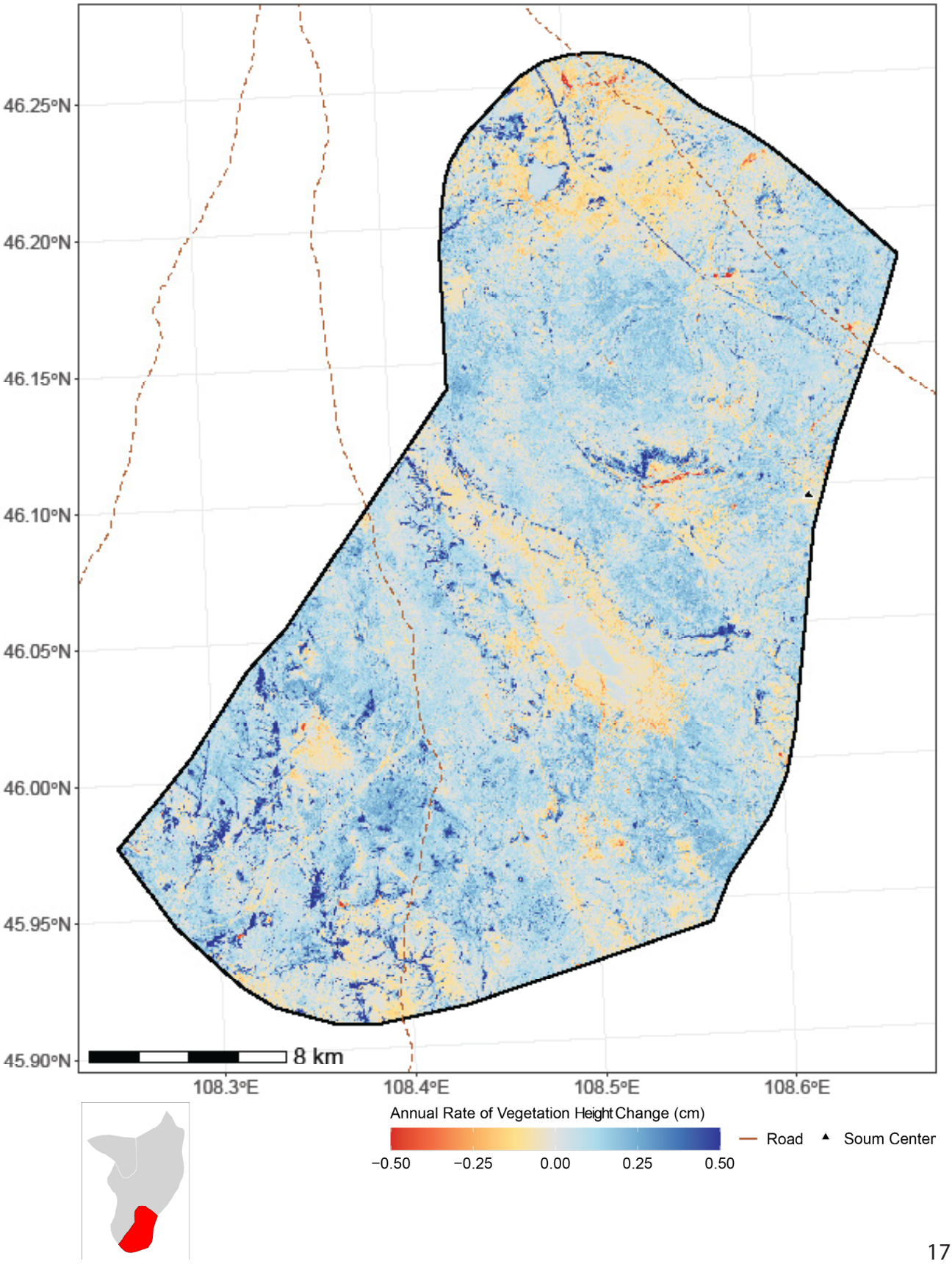
ANNUAL RATE OF VEGETATION COVER CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

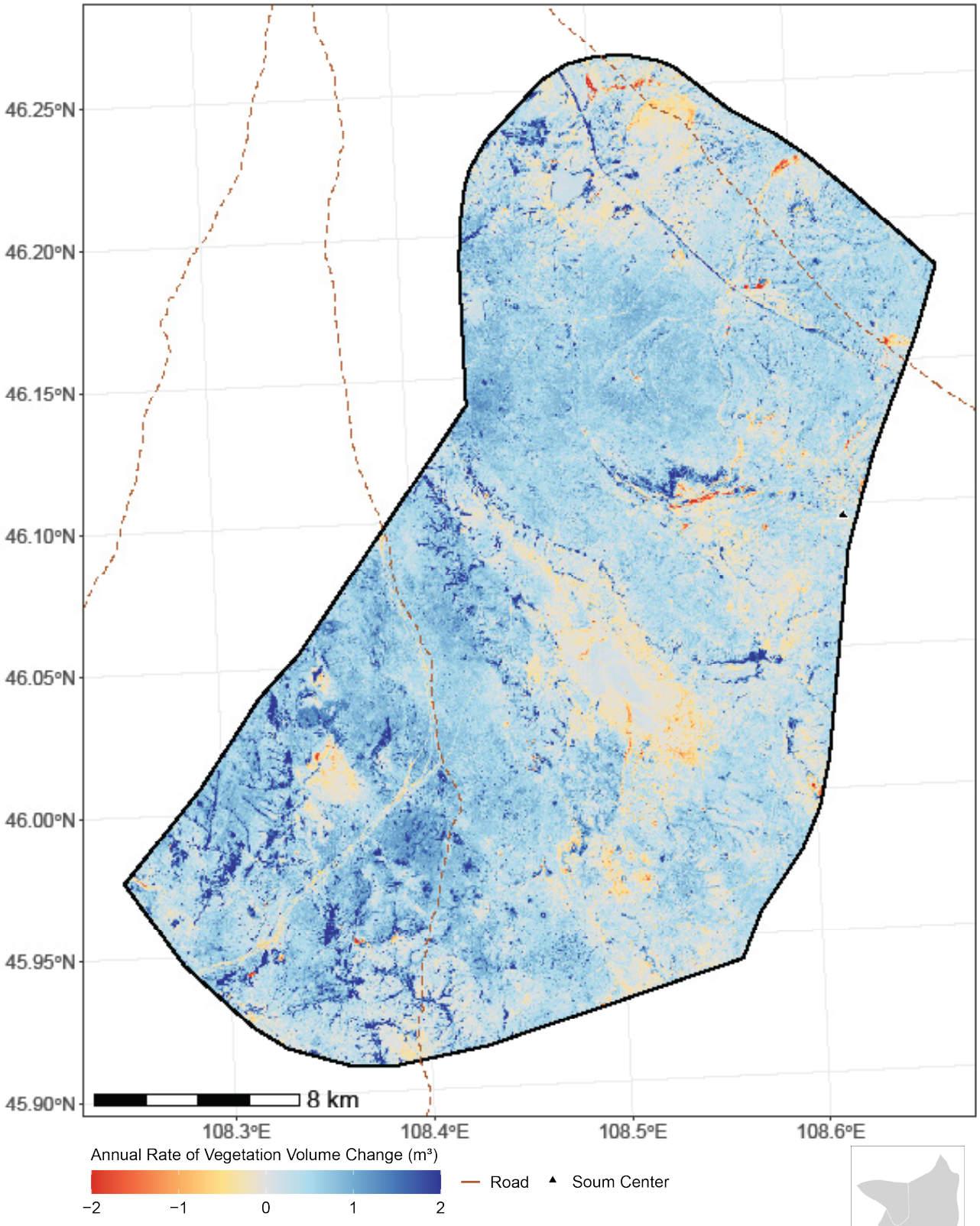
ANNUAL RATE OF VEGETATION HEIGHT CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

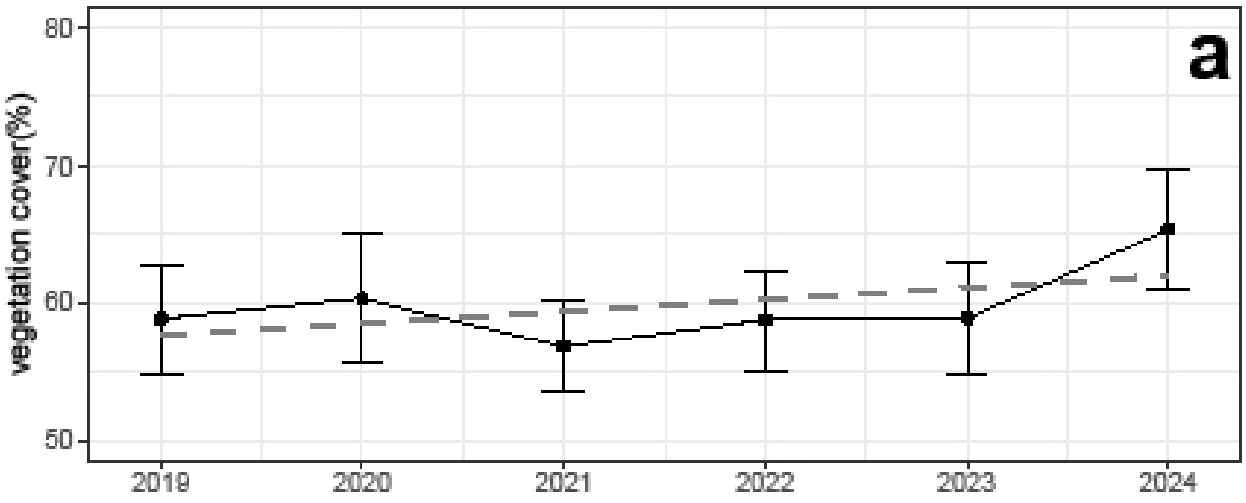
ANNUAL RATE OF VEGETATION VOLUME CHANGE

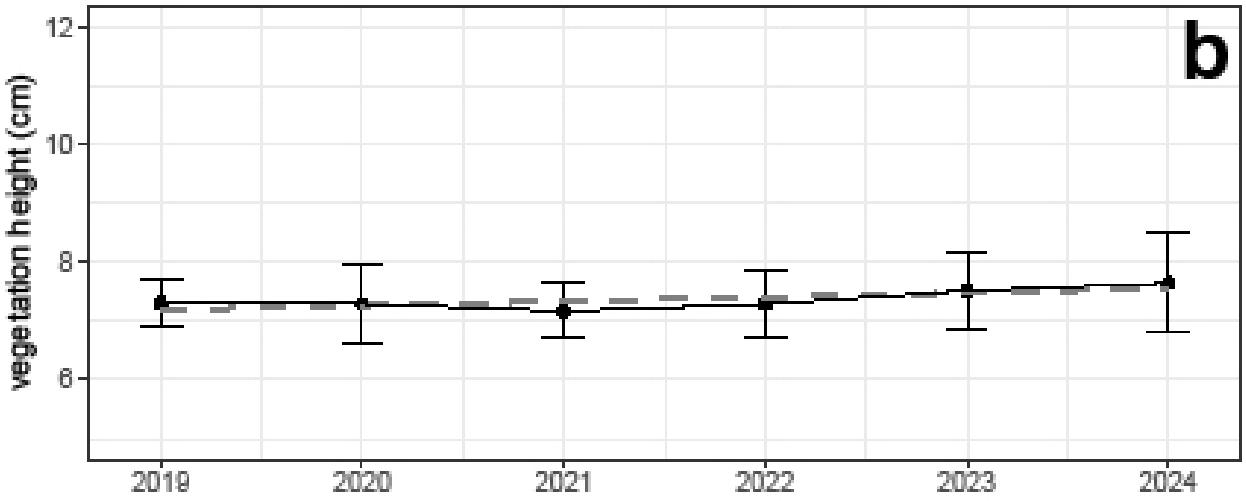


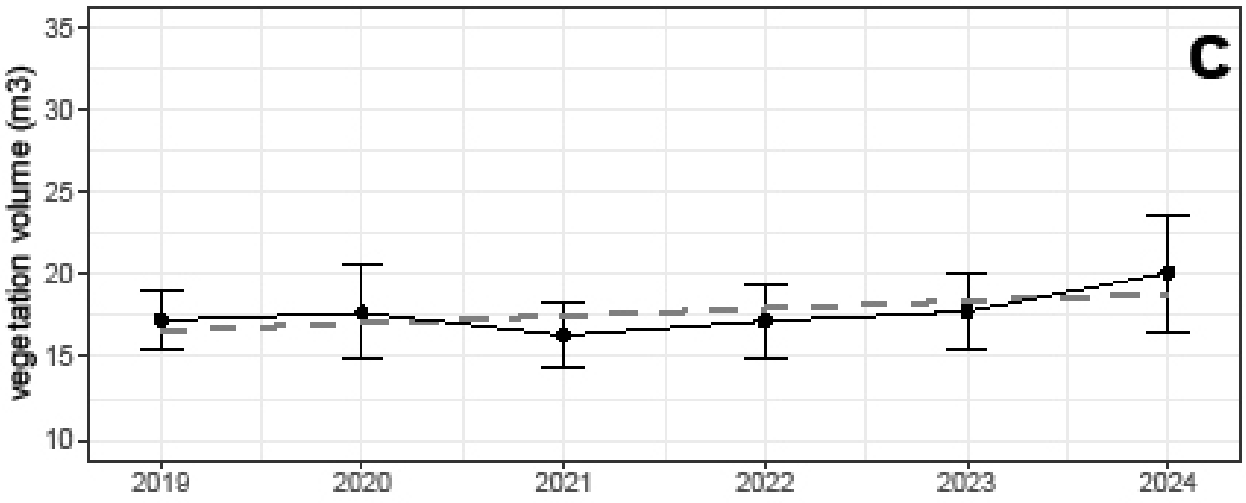
STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

VEGETATION TRENDS



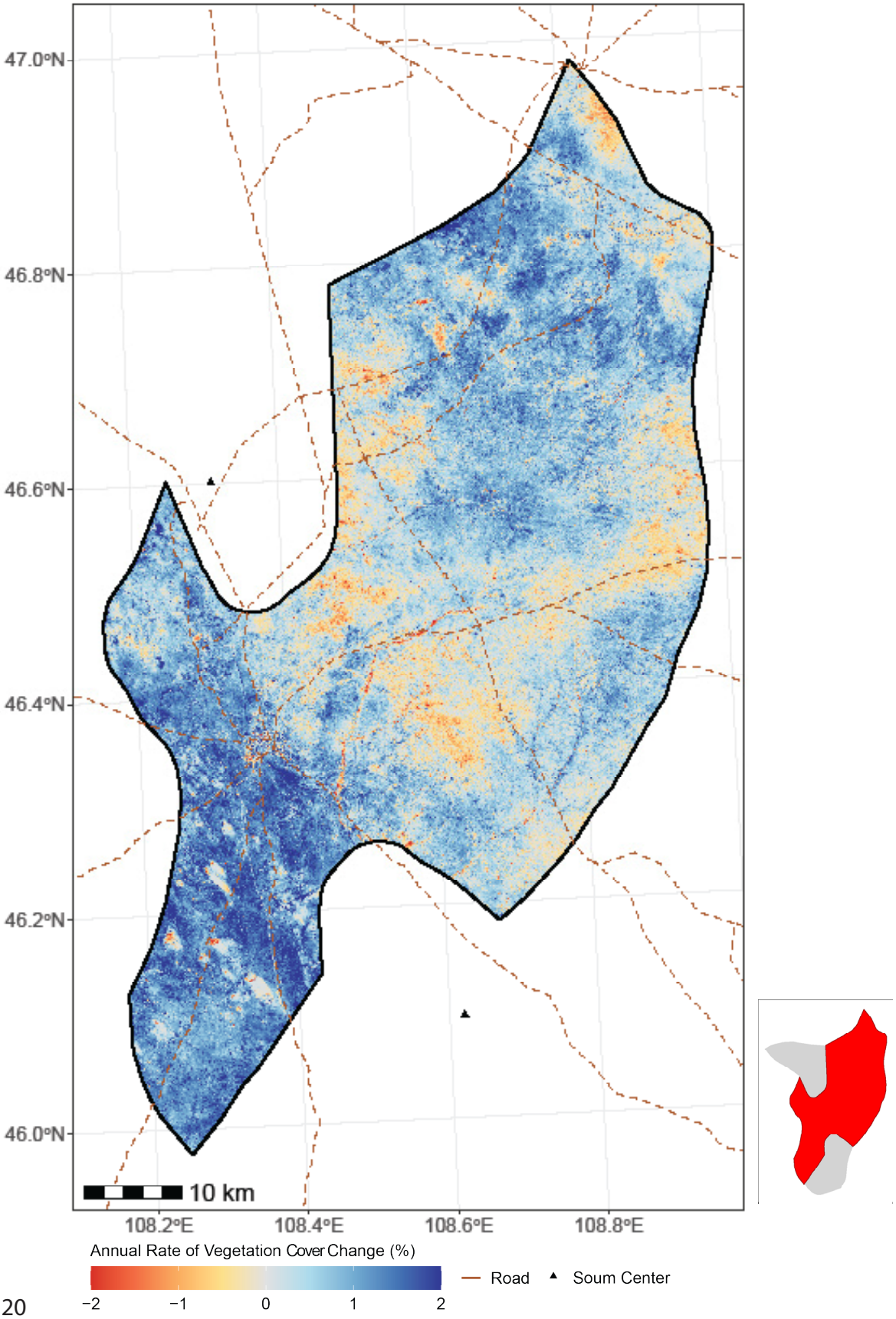




STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

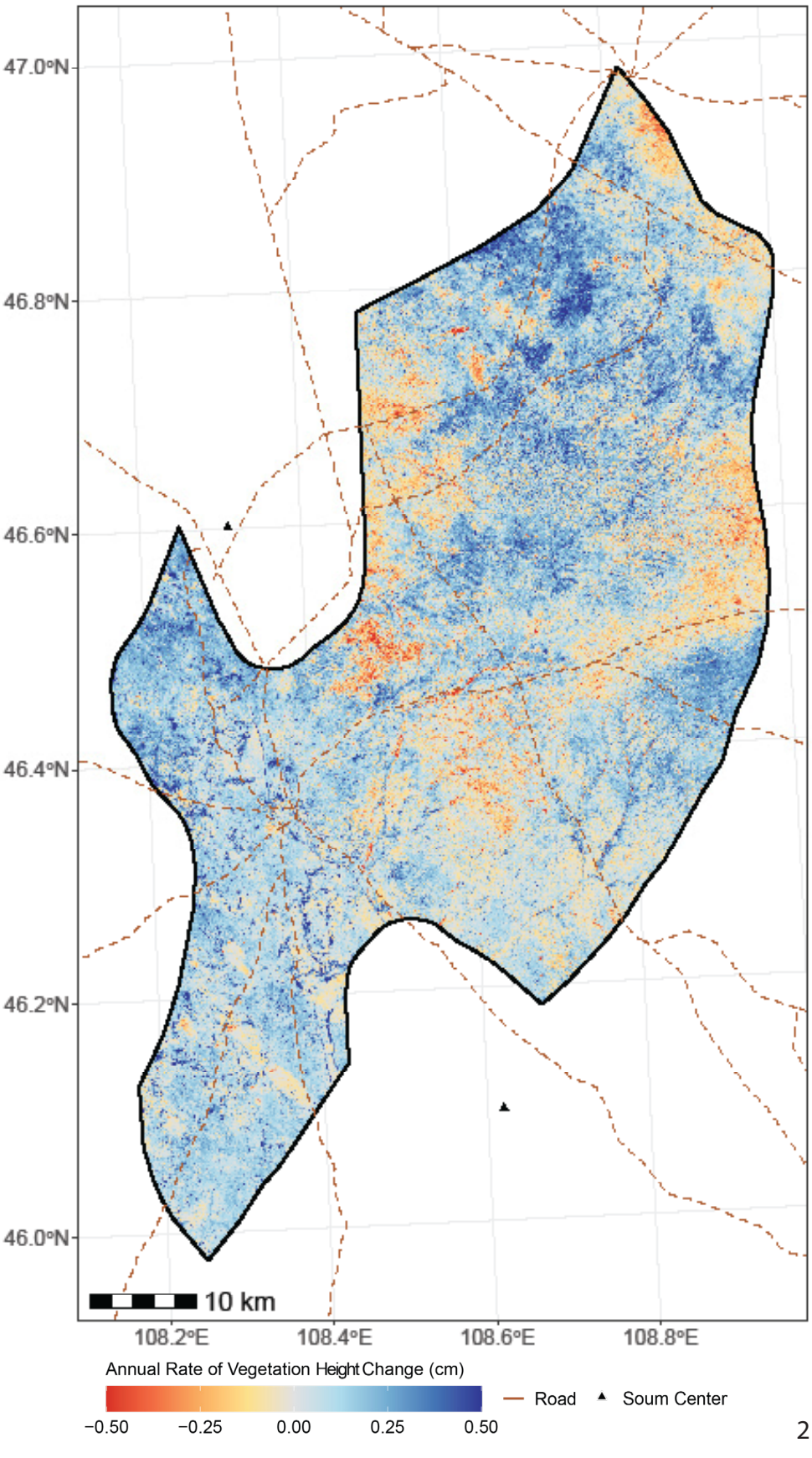
ANNUAL RATE OF VEGETATION COVER CHANGE

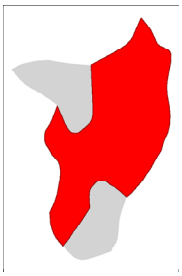


STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

ANNUAL RATE OF VEGETATION HEIGHT CHANGE

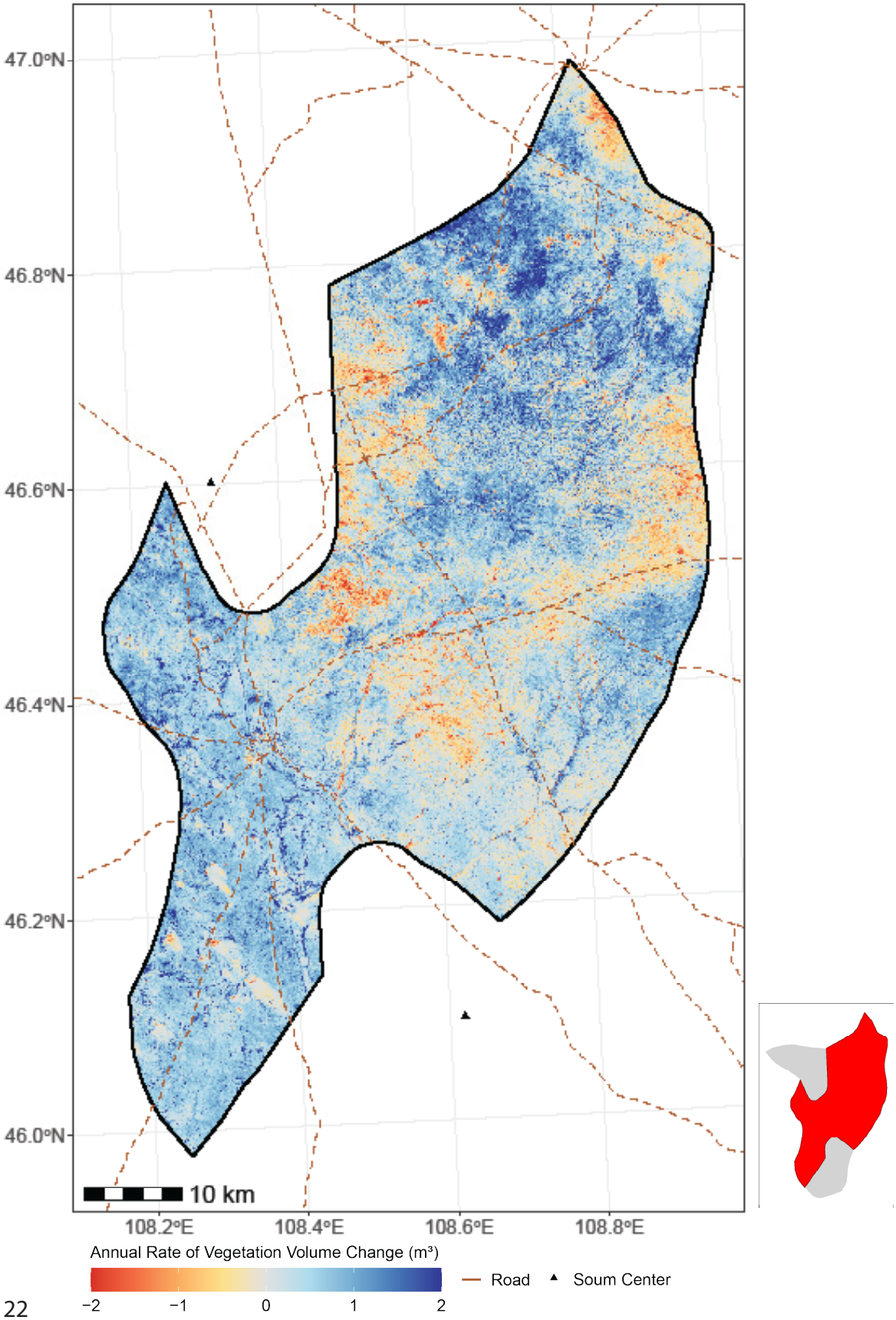




STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

ANNUAL RATE OF VEGETATION VOLUME CHANGE



STATE OF THE STEPPE 2025 - SOUM LEVEL

SHIVEEGOVI SOUM

VEGETATION TRENDS