

Distribution patterns of the Intermediate Cross-backed Grasshopper *Dociostaurus brevicollis* (Eversmann, 1848) (Orthoptera: Acrididae) across the Asian steppes

V. D. Zharkov¹, N. S. Baturina¹, V. V. Molodtsov¹, M. G. Sergeev^{1, 2}

¹ Novosibirsk State University, Novosibirsk, Russia

² Institute of Systematics and Ecology of Animals, Novosibirsk, Russia

INTRODUCTION & AIM

Dociostaurus brevicollis (Fig. 1) is mainly associated with dry grasslands of Eurasia. In Asia, it is distributed from the Ural Mts. to the eastern parts of Mongolia and from the southern edges of the forest life zone up to the southern boundaries of the semi-deserts (Fig. 2). The species is often extremely abundant and may be important pest. The aim of this presentation is to discuss some possible shifts of the *D. brevicollis* distribution relative to global warming and local ecosystem transformations.



Figure 1. *Dociostaurus brevicollis*. Male in the Kulunda steppe (South Siberia) (Photo M.G. Sergeev)

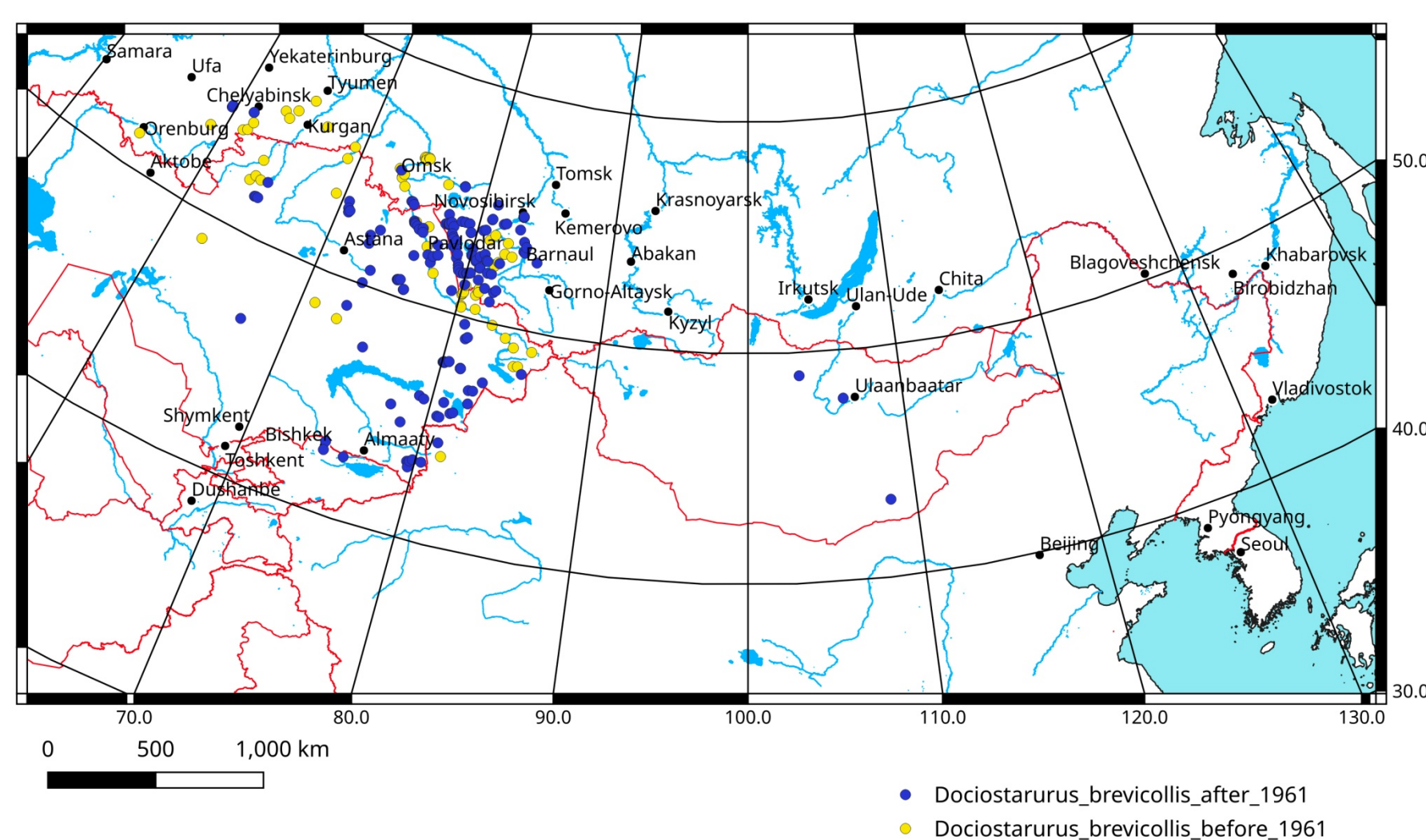


Figure 2. Distribution of *Dociostaurus brevicollis* over the Asian steppes (yellow – data before 1961, blue – in 1961–2024)

METHOD

The data on the species distribution were collected in 1976–2024. The data from all applicable publications and the collections of the Zoological Institute (Saint Petersburg, Russia), Novosibirsk State University, and the Institute of Systematics and Ecology of Animals (Novosibirsk, Russia) were used. The localities with geographic coordinates (229) were included in the database. The species distribution models were generated on the basis of two different approaches (the maximum entropy and ellipsoid ecological niches). The actual and predicted bioclimatic variables were used for the contemporary period and the periods 2021–2040 and 2041–2060 (the CNRM-ESM2-1 global model and the 3–7.0 Shared Socioeconomic Pathway) (WorldClim 2 at <https://worldclim.org>). The AUC (the area under the receiver operating characteristic curve) value was counted for sets of 25 replicates with cross-validation to estimate accuracy. The MaxEnt models were generated with the following parameters: features—auto, output format—cloglog, and regularization multiplier = 1. The 'ellipsenm' models were produced only for 6 bioclimatic uncorrelated variables. 25 replicates were also counted, the method was covmat and the level used to produce the ellipsoids was 99%.

RESULTS & DISCUSSION

In the steppes of West Siberia, the species abundance is usually high, sometimes it may be extreme. The comparative analysis of the species distribution until 1960 and from 1961 shows no evident shifts with the exception of the right (eastern) side of the Ob River where the species began to spread in the 1970s (Fig. 2). The analysis of the models unveils that the areas with optimal conditions may remain almost the same until the middle of the 21st century (Fig. 3), but the levels of suitability will slightly decrease and some new areas with applicable environments will appear in the southern parts of Central Siberia. The map produced on the basis of the ellipsoid model is very similar to the MaxEnt model.

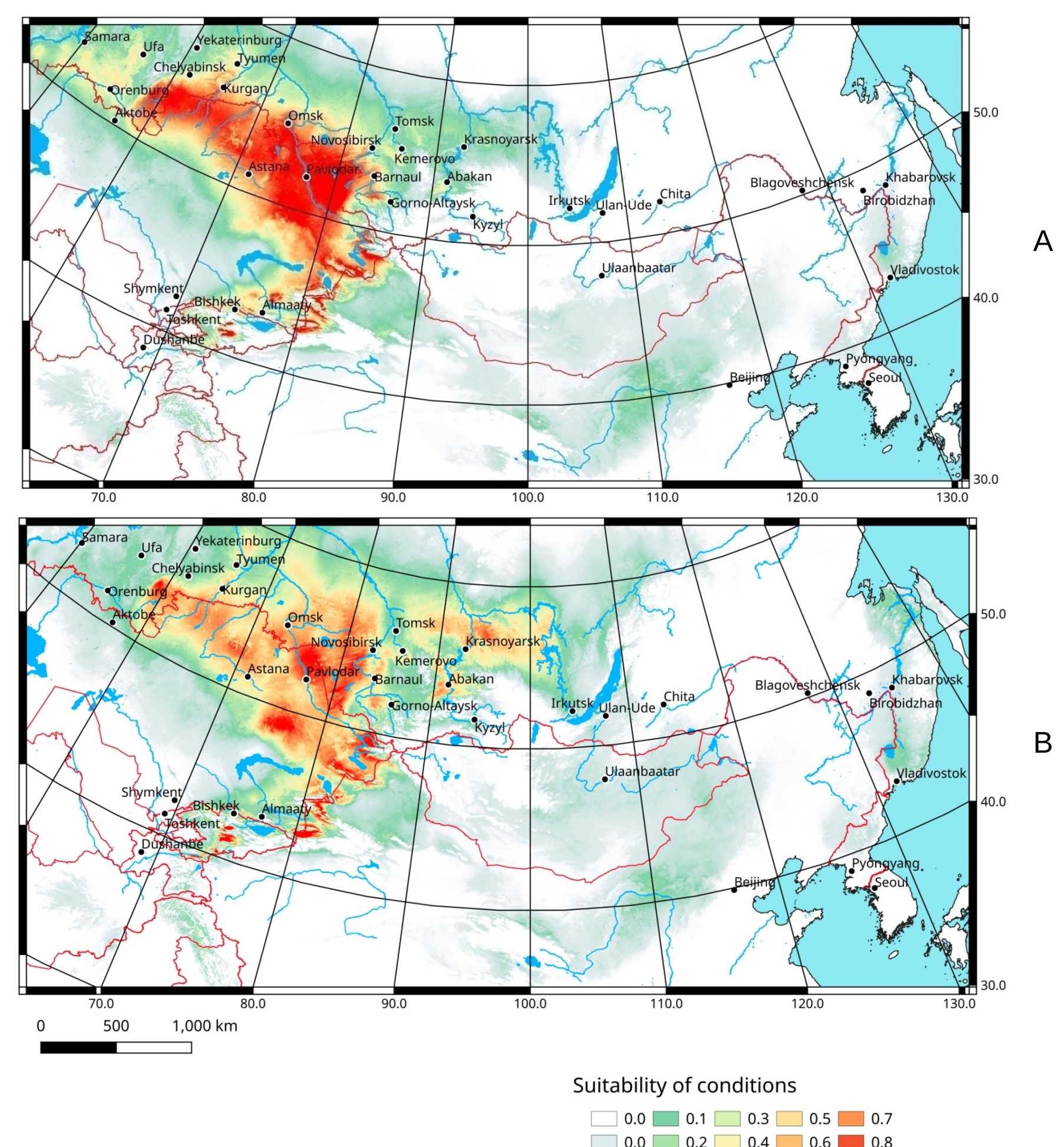


Figure 3. Predicted probabilities of suitable conditions for *Dociostaurus brevicollis* across the Asian steppes: (A) — contemporary period; (B)— forecasts for 2041–2060 (AUC = 0.955)

CONCLUSION

Dociostaurus brevicollis is distributed very similarly to other abundant steppe grasshoppers studied. Its range is mainly inside the forest-steppes, steppes and semi-deserts life zones. The possible shifts are very moderate. No significant changes of the range boundaries are predicted except some possible shifts in the southern parts of Central Siberia. The main trend is decreasing of areas suitable of the species.

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