Conservation and Ecosystem Services

Changes in rodent burrow abundance and distribution in grazing ecosystems of southern Russia under human-induced landscape transformation from the desert to steppe

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Rodents play an important role in rangelands through the engineering of extensive burrow systems, which provide key habitats for many animal and plant species. We have analyzed the long-term pattern of variation in the abundance and distribution of rodent burrows in grazing ecosystems of southern Russia under the landscape change from the desert to steppe caused by the drastic reduction of livestock after the collapse of the USSR in the early 1990s. We surveyed burrow distribution by counting burrow openings of each rodent species in 100-m segments of 19 3-km transects, totaling 57 km surveyed. We estimated burrow density, the length and the fraction of segments with and without burrows as measures of habitat quality, size, isolation, and connectivity. We performed surveys in 1980 ("the desert period") and repeated them in 2017 ("the steppe period"). We found drastic changes in the burrow abundance and distribution of keystone rodent species, as well as the evidences of desert habitat fragmentation and isolation caused by the expansion of tall-grass communities and overgrowing of sands. Burrows of the open-dwelling ground squirrel, *Spermophilus pygmaeus*, the dominant and keystone species during the desert period, almost disappeared from the rodent burrow complex by 2017, which indicates significant habitat loss. On the contrary, the burrows of the folivorous social vole, *Microtus socialis*, which was rare in 1980s, became abundant and ubiquitously distributed. Burrow density of the desert-dwelling psammophilous midday gerbil (*Meriones meridianus*), as well as the size of occupied patches decreased, while the inter-patch distance increased, indicating habitat fragmentation and isolation. Burrows of folivorous tamarisk gerbil (*Meriones tamariscinus*) were recorded only sporadically in both 1980 and 2017. The observed drastic changes in the rodent burrow complex, the keystone element of grazing ecosystems, can have long-term and important consequences for the dynamics of local rangelands and their sustainability.

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Julius-Kühn-Archiv

Jens Jacob, Jana Eccard (Editors)

6th International Conference of Rodent Biology and Management and 16th Rodens et Spatium

Potsdam, Germany, 3-7 September 2018

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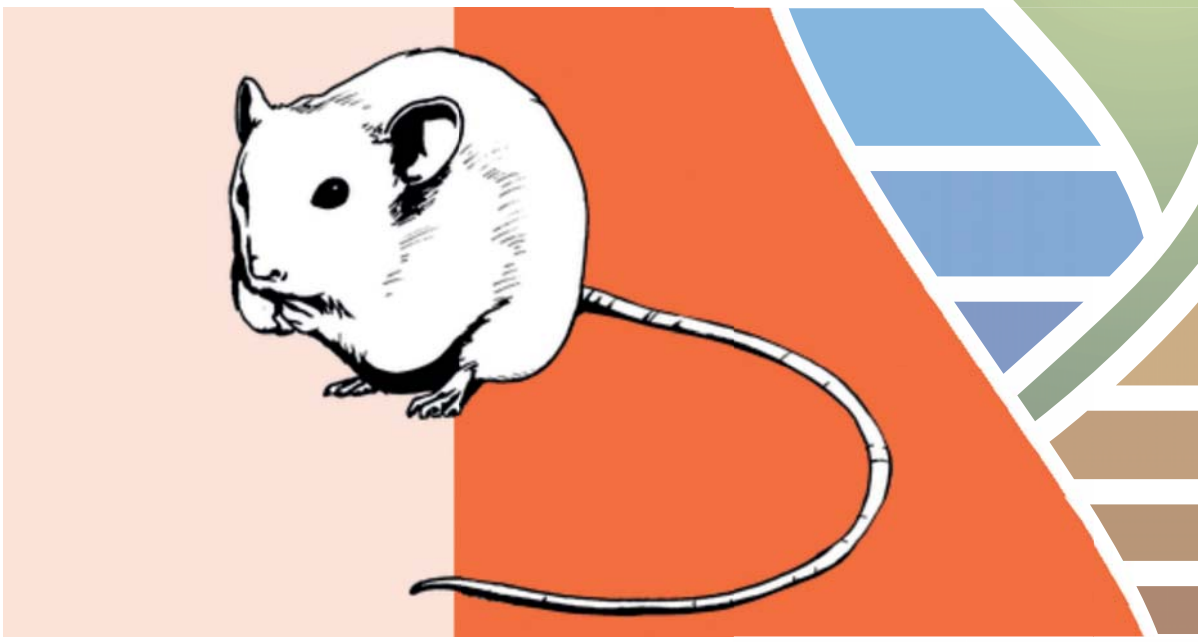

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Bibliografische Information der Deutschen Nationalbibliothek
Die Deutsche Nationalbibliothek verzeichnet diese Publikation
In der Deutschen Nationalbibliografie: detaillierte bibliografische
Daten sind im Internet über http://dnb.d-nb.de abrufbar.

ISSN 1868-9892
ISBN 978-3-95547-059-3
DOI 10.5073/jka.2018.459.000

Printed in Germany by Arno Brynda GmbH, Berlin.