Lichen diversity on Mt. Kilimanjaro

Kaasalainen, Ulla

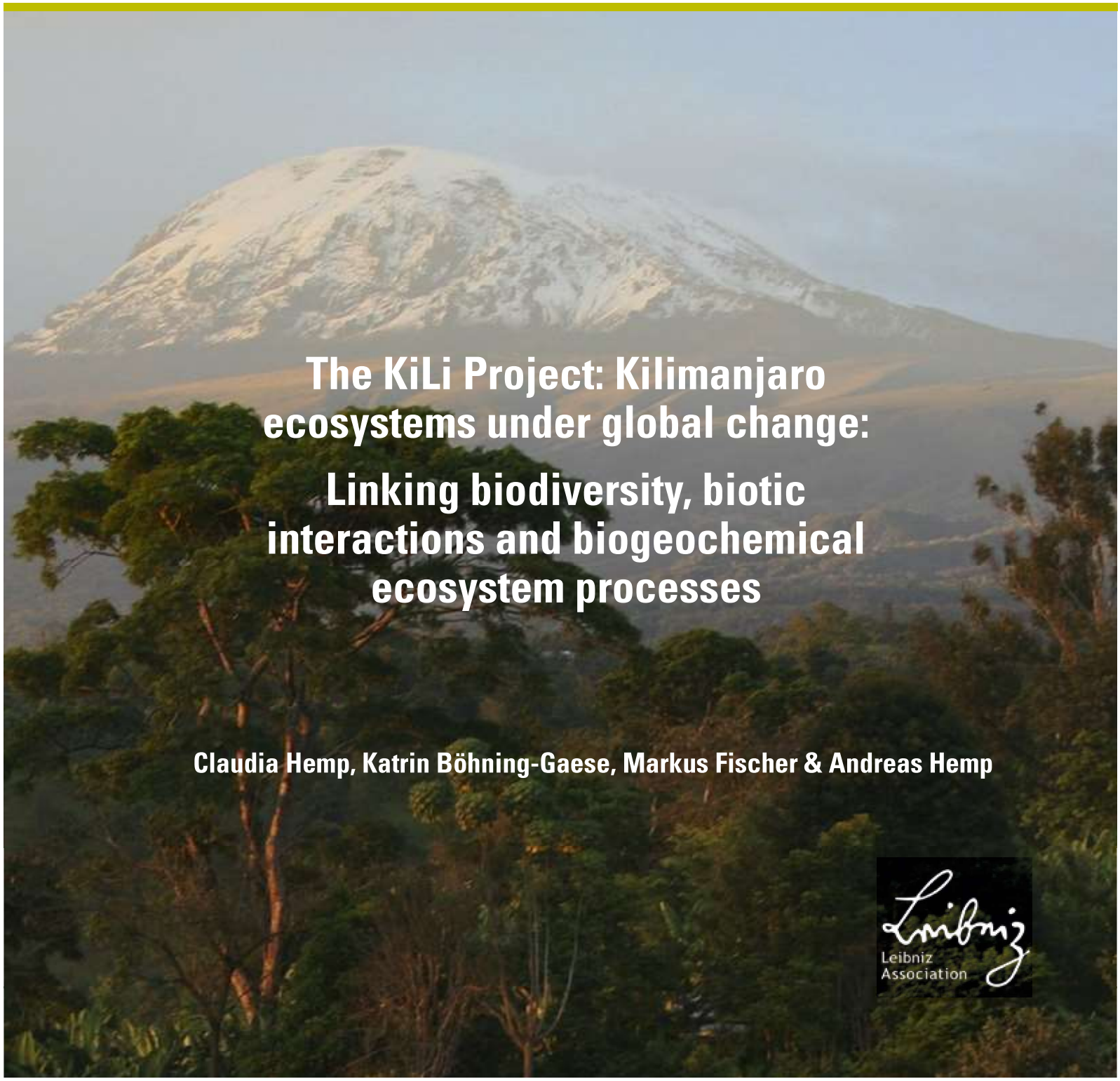
Senckenberg Gesellschaft für Naturforschung
2018-09-04

Kaasalainen , U , Hemp , A & Rikkinen , J 2018 , Lichen diversity on Mt. Kilimanjaro . in C Hemp , K Böhning-Gaese , M Fischer & A Hemp (eds) , The KiLi Project: Kilimanjaro ecosystems under global change : Linking biodiversity, biotic interactions and biogeochemical ecosystem processes . Senckenberg Gesellschaft für Naturforschung , Frankfurt am Main , pp. 74-75 .

http://hdl.handle.net/10138/309764

unspecified
publishedVersion

SENCKENBERG



The KiLi Project: Kilimanjaro ecosystems under global change:

Linking biodiversity, biotic interactions and biogeochemical ecosystem processes

Claudia Hemp, Katrin Böhning-Gaese, Markus Fischer & Andreas Hemp

Leibniz Association


Research Group
Kilimanjaro

Imprint

Publisher
Senckenberg Gesellschaft für Naturforschung,
Senckenberganlage 25, 60325 Frankfurt/Main, Germany

Authors
Claudia Hemp & Katrin Böhning-Gaese, Senckenberg Biodiversity and Climate Research Centre (SBiK-F), Senckenberganlage 25, 60325 Frankfurt (Main), Germany
Andreas Hemp, University of Bayreuth, Plant Systematics, Universitätsstr. 30, 95447 Bayreuth, Germany
Markus Fischer, University of Bern, Institute of Plant Sciences, Altenbergrain 21, 3013 Bern, Switzerland

Layout and Image Processing
Claudia Hemp
Petra Schwarzmann, www.ps-designwerkstatt.de

Printing and binding
bis500druck, Klicks GmbH, Ziegelhüttenweg 4, 98693 Ilmenau, Germany

ISBN 978-3-929907-96-4

www.senckenberg.de

Printed in Germany

This project was funded by the German Research Foundation (DFG)

The KiLi Project: Kilimanjaro ecosystems under global change: Linking biodiversity, biotic interactions and biogeochemical ecosystem processes

Claudia Hemp, Katrin Böhning-Gaese, Markus Fischer & Andreas Hemp

Senckenberg Gesellschaft für Naturforschung

Lichen diversity on Mt Kilimanjaro

by Ulla Kaasalainen, Andreas Hemp & Jouko Rikkinen

Lichens are mutualistic symbioses between lichen-forming fungi (mycobionts) and algae and/or cyanobacteria (photobionts). Most lichen mycobionts are specific in their photobiont choice and the local availability of compatible photobionts may limit their ability to disperse into new habitats. Lichens are an important component of the ecosystem and contribute significantly to biodiversity and biomass in many environments. They intercept and retain moisture, provide habitat and food for invertebrates, and contribute fixed nitrogen into the ecosystem, and often their ecological significance is pronounced towards extreme environments.

To provide the first account of lichen symbiont diversity in tropical mountain ecosystems and to elucidate the effects of human induced environmental change to lichen symbiotic organisms, specimens were collected from 65 sample plots situated on five replicate transects along the natural environmental gradient of the southern slope of Kilimanjaro. Sampled ecosystem types ranged from savanna through several forest zones to alpine heath vegetation, including also several ecosystem types disturbed by fire, logging or agriculture.

Fig. 1. Abundant lichen epiphytes (especially *Usnea* spp.) on tree trunks in *Erica* forest. (Photo: Jukka Korpelainen).

Fig. 2. Lichenologist at work among alpine *Helichrysum* vegetation. In such environment, lichens are often a prominent part of the vegetation, growing on rocks and, especially on more sheltered places, also on the ground. (Photo: Jukka Korpelainen).

Our results showed that clear differences existed in lichen biota between different ecosystem types. In more open and especially in the heavily disturbed low-elevation habitats, lichen abundance and diversity seemed to correlate primarily with the presence/absence of woody plants. Lichen taxa characteristic for these drier and warmer habitats included several genera of Physciaceae, certain specific species of Collemataceae, and for example the genus *Candelaria*. The lichens in such environments are often very small in size and grow closely adnate to their substrate.

Within the forest zones, light availability, moisture, and competition with other epiphytes like bryophytes had a clear impact in lichen abundance and species composition, and the species composition often varied also between the canopy and lower vegetation layers. Abundant taxa included for example *Parmotrema*, *Heterodermia*, *Leptogium* and several other cyanobacterial lichen species, *Hypotrachyna*, and *Usnea*. The most prominent lichens were found in *Erica* forest in 3200–4000 m altitude, where abundant epiphytes partly covered most of the other vegetation. Epiphytic taxa included especially *Usnea*, but in addition several foliose genera of Parmeliaceae

were common. Additionally, e.g. *Cladonia*, *Peltigera*, and *Stereocaulon* were found on the rocks and ground on the forest floor.
Even higher, above the tree line, lichens comprised a considerable proportion of the vegetation. Growing on rocks, ground, and occasional shrubs, many taxa like *Xanthoparmelia*, *Hypotrachyna*, *Usnea*, *Hypogymnia*, *Cladonia*, and *Stereocaulon* still thrived even in these harsh conditions.

This study was a collaboration of the KiLi Project (Subproject 4) and the Chiesa project, University of Helsinki, Finland.

Acknowledgements: This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 705777.

Fig. 1. Plot setup for the sapling inventory.

Natural forest regeneration at Mt Kilimanjaro

by Marion Renner, Andreas Hemp & Markus Fischer

Tropical forests show general broad scale patterns of biomass and diversity distribution. Changes of environmental factors or disturbances, natural as well as anthropogenic ones, can strongly affect the species distributions and thus these patterns. Especially tropical mountains are highly affected by the combined effect of climate change and land-use. With ongoing climate warming the dry and hot foothills of Mt Kilimanjaro might not support woody growth anymore and species might be pushed upwards. Furthermore, former logging and fires at higher elevation as well as ongoing land-use at lower elevation might have changed the abundance and diversity of woody species. However, only looking at the sapling layer holding the smallest and most sensitive stages of a tree`s life shows a glimpse into the future composition. The mismatch of species compositions between different canopy layers may indicate ongoing changes.
To fill this gap we investigated as first comprehensive study in East Africa the regeneration of woody species in six natural and seven anthropogenic disturbed habitat types along the elevational gradient of Mt Kilimanjaro. We recorded all woody stems between 25 and 130 cm in the 20 x 5 m core plots within each of the 65 plots of the KiLi Project. Overall we recorded 4846 small woody stems belonging to 110 species. The formerly logged *Ocotea* forest harboured the highest number of small stems, whereas savanna and lower montane forest harboured the highest number of species. The highest number of stems found on a plot was 602 and the highest number of species 19.
We found woody regeneration in all natural habitat types and on all plots, where woody species occur in higher canopy layers, except 2 subalpine *Erica trimera* plots. The number of small stems showed a hump shape distribution, peaking at mid elevation, and the number of species was decreasing with elevation. As both results are in line with already known patterns at Kilimanjaro, it seems, as climate change might not have shifted yet the overall distribution of woody species.
When comparing the regenerating stems with the higher canopy layers, we found that the sapling layer in the savanna bears up to almost the threefold amount of woody species than the higher canopy layers, however the communities were strongly differing, on some plots by 100%. This might indicate that safe sites for germination and establishment are sporadic and rare and that many stems die due to drought periods and browsing. Therefore, cli-