List of Tables

579 **Table 1** Characteristics of the biocrusts and underneath soil.

Biocrusts	Soil layer	Cover (%)	Thickness (cm)	Biomass (g cm^{-2})	Organic matter content (g kg^{-1})	Polysaccharide content (μg mg^{-1})	Soil bulk density (g cm^{-3})	Clay (%)	Silt (%)	Sand (%)
Lichens	Biocrust layer	84.6 ± 4.4	0.63 ± 0.12	0.89 ± 0.07	0.91 ± 0.08	2.28 ± 0.04	1.32 ± 0.03	1.67 ± 0.13	13.59 ± 2.21	84.74 ± 4.62
	Underneath soil	-	-	-	0.32 ± 0.02	0.72 ± 0.02	1.63 ± 0.03	1.09 ± 0.12	9.31 ± 1.44	89.60 ± 2.75
moss	Biocrust layer	90.6 ± 2.3	1.20 ± 0.25	2.82 ± 0.51	1.25 ± 0.07	3.82 ± 0.03	1.25 ± 0.05	2.04 ± 0.21	20.51 ± 2.56	77.45 ± 5.31
	Underneath soil	-	-	-	0.45 ± 0.03	1.24 ± 0.02	1.52 ± 0.08	1.92 ± 0.19	16.11 ± 1.57	81.97 ± 7.43

580 * Different letters in the same column indicate significant differences at the probability level of 0.05.

581 **Table 2** Soil hydraulic parameters of biocrusts under the different disturbance conditions (mean values ± S.E., n = 3).

Biocrust type	Pressure head	Disturbance	i_{ini} (mm min^{-1})	i_c (mm min^{-1})	S (mm min$^{-1/2}$)	$K(h)$ (mm min^{-1})	λ_c (mm)	λ_m (mm)
Lichen biocrusts	-3 cm	Undisturbed	1.81 ± 0.06 bc	1.03 ± 0.06 c	0.59 ± 0.14 bc	1.02 ± 0.07 b	1.06 ± 0.39 b	10.55 ± 5.12 b
		Trampled	2.66 ± 0.99 ab	1.50 ± 0.20 b	2.44 ± 0.70 a	1.27 ± 0.09 b	12.60 ± 5.38 b	1.32 ± 0.90 b
		Scraped	3.30 ± 0.17 a	1.83 ± 0.10 a	1.17 ± 0.27 b	1.75 ± 0.13 a	2.83 ± 1.29 b	4.55 ± 2.39 b
	-6 cm	Undisturbed	1.84 ± 0.10 bc	1.09 ± 0.12 c	0.48 ± 0.04 bc	1.07 ± 0.12 b	0.64 ± 0.13 b	12.62 ± 2.78 b
		Trampled	1.95 ± 0.21 b	1.26 ± 0.25 bc	0.79 ± 0.24 bc	1.23 ± 0.24 b	1.23 ± 0.47 b	9.96 ± 5.35 b
		Scraped	3.35 ± 0.25 a	1.91 ± 0.15 a	1.02 ± 0.09 bc	1.86 ± 0.16 a	1.81 ± 0.38 b	4.60 ± 1.23 b
	-12 cm	Undisturbed	1.69 ± 0.11 bc	0.35 ± 0.03 de	0.31 ± 0.00 c	0.34 ± 0.03 d	0.84 ± 0.17 b	9.64 ± 2.04 b
		Trampled	2.25 ± 0.65 ab	0.41 ± 0.11 de	0.49 ± 0.17 bc	0.40 ± 0.11 cd	1.48 ± 0.64 b	8.06 ± 3.91 b
		Scraped	3.09 ± 0.24 ab	0.64 ± 0.03 d	0.75 ± 0.01 bc	0.61 ± 0.03 c	2.85 ± 0.28 b	2.64 ± 0.26 b
Moss biocrusts	-3 cm	Undisturbed	0.74 ± 0.17 c	0.16 ± 0.02 e	0.24 ± 0.11 c	0.15 ± 0.02 de	1.82 ± 0.97 b	14.86 ± 11.70 b
		Trampled	1.84 ± 0.27 bc	0.27 ± 0.01 e	0.22 ± 0.05 c	0.27 ± 0.02 de	0.62 ± 0.38 b	21.96 ± 8.30 b
		Scraped	1.61 ± 0.39 bc	0.51 ± 0.11 de	0.51 ± 0.38 bc	0.49 ± 0.09 cd	2.34 ± 2.23 b	79.44 ± 59.40 a
	-6 cm	Undisturbed	1.25 ± 0.11 bc	0.12 ± 0.02 e	0.16 ± 0.07 c	0.12 ± 0.02 de	1.25 ± 0.63 b	60.91 ± 56.82 ab
		Trampled	1.08 ± 0.25 bc	0.17 ± 0.01 e	0.17 ± 0.03 c	0.17 ± 0.01 de	0.51 ± 0.06 b	14.96 ± 2.00 b
		Scraped	1.27 ± 0.32 bc	0.35 ± 0.12 de	0.68 ± 0.35 bc	0.32 ± 0.09 de	4.20 ± 2.97 b	4.38 ± 1.94 b
	-12 cm	Undisturbed	0.86 ± 0.14 bc	0.05 ± 0.01 e	0.35 ± 0.06 c	0.04 ± 0.01 e	14.91 ± 5.67 b	0.67 ± 0.24 b
		Trampled	0.91 ± 0.05 bc	0.05 ± 0.00 e	0.37 ± 0.02 c	0.04 ± 0.00 e	8.57 ± 0.46 b	0.87 ± 0.05 b
		Scraped	2.29 ± 0.99 ab	0.12 ± 0.05 e	0.93 ± 0.41 bc	0.07 ± 0.01 e	38.25 ± 27.41 a	0.49 ± 0.21 b

582 **Table 3** *P* values from the three-way ANOVA to test the influences of biocrust type and disturbance as well as their interaction effects on soil hydraulic parameters.

Effects	i_{ini} (mm min^{-1})	i_c (mm min^{-1})	S (mm min$^{-1/2}$)	$K(h)$ (mm min^{-1})	λ_c (mm)	λ_m (mm)
Biocrusts	<0.001**	<0.001**	<0.001**	<0.001**	0.111	0.118
Head	0.682	<0.001**	0.051	<0.001**	0.048*	0.255
Disturbance	<0.001**	<0.001**	0.004**	<0.001**	0.354	0.734
Biocrusts × Head	0.888	<0.001**	0.002**	<0.001**	0.015*	0.236
Biocrusts × Disturbance	0.336	0.006**	0.019*	0.002**	0.204	0.735
Head × Disturbance	0.358	0.064	0.064	0.040*	0.354	0.277
Biocrusts × Head × Disturbance	0.545	0.551	0.121	0.712	0.646	0.338

583 Note. i_{ini}, initial infiltration rate; i_c, steady-state infiltration rate; S, sorptivity; $K(h)$, unsaturated hydraulic conductivity at h pressure head; K_s, saturated hydraulic conductivity; λ_c, macroscopic

584 capillary length; λ_m, microscopic pore radius. *Effect is significant at .05 level of probability. **Effect is significant at .01 level of probability.

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586 **Table 4** van Genuchten parameters for the biocrusted and non-biocrusted soils examined (mean values ± S.E., n = 3).

Biocrust type	Disturbance treatment	K_s (mm min^{-1})	θ_s	α_{VG} (cm^{-1})	n
Lichen biocrusts	Undisturbed	0.34 ± 0.02 ab	0.24 ± 0.02 b	0.05 ± 0.00 b	2.83 ± 0.14 b
	Trampled	0.61 ± 0.32 a	0.27 ± 0.01 ab	0.06 ± 0.02 ab	3.65 ± 0.78 ab
	Scraped	0.44 ± 0.06 ab	0.22 ± 0.01 b	0.04 ± 0.00 b	4.45 ± 0.05 a
Moss biocrusts	Undisturbed	0.11 ± 0.09 b	0.25 ± 0.03 ab	0.07 ± 0.03 ab	3.08 ± 0.83 ab
	Trampled	0.22 ± 0.02 ab	0.31 ± 0.02 a	0.10 ± 0.00 a	1.98 ± 0.04 b
	Scraped	0.35 ± 0.10 ab	0.23 ± 0.03 b	0.09 ± 0.02 ab	2.02 ± 0.16 b
ANOVA					
Biocrusts (B)		P = 0.064	P = 0.019*	P = 0.018*	P = 0.006**
Disturbance (D)		P = 0.378	P = 0.115	P = 0.535	P = 0.680
B × D		P = 0.589	P = 0.245	P = 0.826	P = 0.041*

589 **Table 5** Regional difference in the effects of biocrust disturbance on soil water infiltrability (in increasing order of annual precipitation).

Locations	Climate (annual precipitation in mm)	Soil texture	Biocrust type	Disturbance type	Measured parameters	Disturbance effects on infiltration	References
Central-Western Negev Desert	Hyper arid (90)	Sand	Cyanobacteria	Scalping	Infiltration rate	Increasing under tension; no significant effect under ponding	Eldridge et al. (2000)
Western Negev Desert	Hyper arid (95)	Sand	Cyanobacteria	Goat trampling	Runoff yield	Decreasing	Kidron (2016)
Mojave Desert	Arid (101)	Sand; loamy sand	Cyanobacteria	Trampling	Infiltration rate	Decreasing	Herrick et al. (2010)
Tengger Desert	Arid (191)	Sand	mosses	Removal	Infiltration rate	Increasing	Coppola et al. (2011)
Northern Negev Desert	Semiarid (200)	Sandy loam	cyanobacteria; algae; lichens; mosses	Scraping; car track	Hydraulic conductivity	Decreasing under scraping; increasing under car track	Zaady et al. (2013)
Tabernas Desert	Semiarid (200-235)	Silty loam; sandy loam	Cyanobacteria; lichens; mosses	Scraping; trampling	Infiltration rate	Decreasing under trampled; increasing under scraped	Chamizo et al. (2012)
Colorado Plateau	Semiarid (215)	Loamy sand	Cyanobacteria; cyanolichens	Scraping; trampling	Runoff coefficient	Decreasing	Faist et al. (2017)
Colorado Plateau	Semiarid (215)	Loamy sand	Cyanobacteria; cyanolichens	Scraping; trampling	Runoff yield	Increasing under trampled; decreasing under scraped	Barger et al. (2006)
Southeastern Spain	Semiarid (220-235)	Silty loam; sandy loam	Cyanobacteria	Trampling; removal	Runoff coefficient	No effects under trampled; decreasing under removed	Cantón et al. (2020)
Western New South Wales	Semiarid (244)	Sand	Cyanobacteria; lichens; mosses	Livestock trampling	Infiltration rate	Increasing	Bowker et al. (2013)

Northern Chihuahuan Desert	Semiarid (250)	Sandy clay loam	Cyanobacteria	Trampling	Infiltration depth	Increasing	Chung et al. (2019)

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