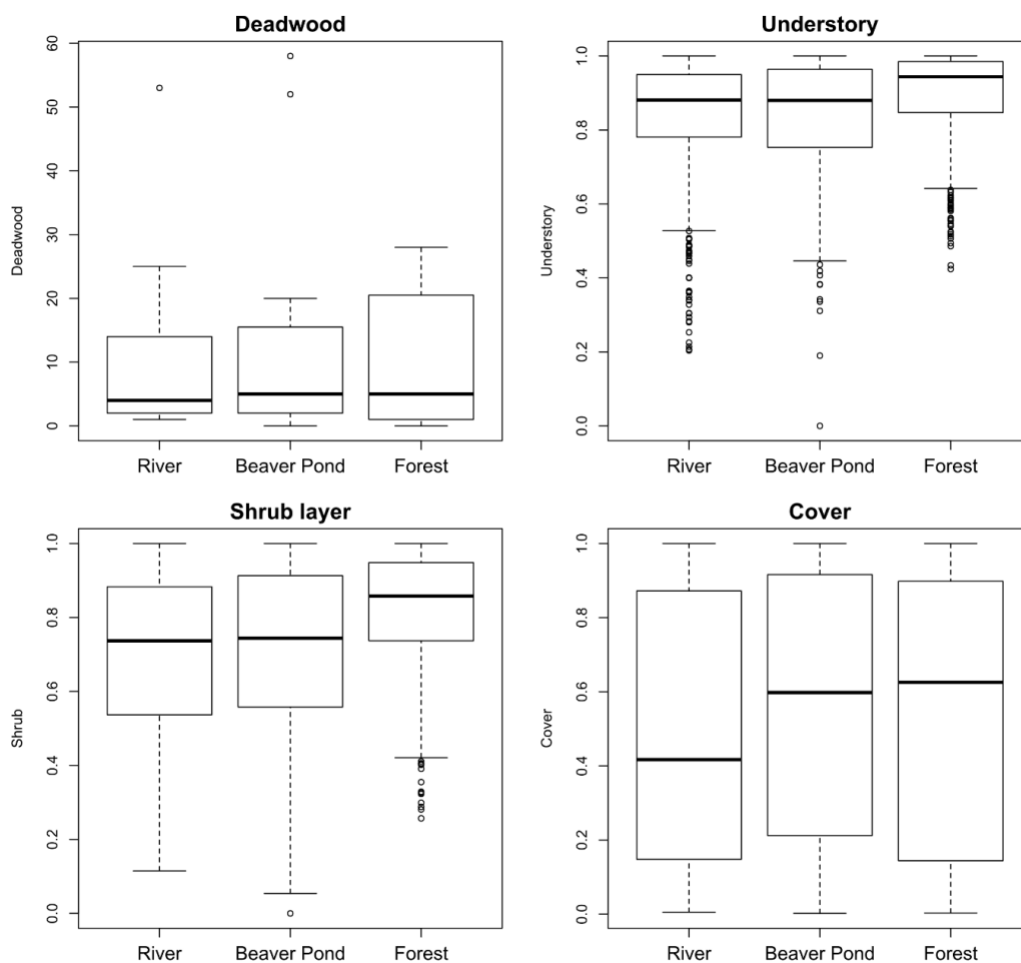


## Supplementary Material

# A biodiversity boost from the Eurasian beaver (*Castor fiber*) in Germany's oldest national park

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**Supplementary Figure 1.** Environmental features at the river, beaver pond and forest plots derived from full waveform LiDAR data (see method section of the main manuscript). Deadwood: Volume of trees classified as dead [ $\text{m}^3/\text{ha}$ ], Understory: understory vegetation cover 0.5–2 m above ground [%], Shrub layer: midstory vegetation cover 2–10 m above ground [%], Cover: overstory vegetation cover 10–60 m above ground [%].

## Details on species sampling method

**Plants:** We performed vegetation relevés on plots with a size of 100m<sup>2</sup> (10 by 10m squares) in August. The plots were placed directly at the edge of the beaver pond, the river and at a randomly placed position in an adjacent forest, with similar tree cover in a distance of at least 200m. All soil-dwelling species of the tree layer, shrub layer, ground vegetation layer, and moss layer were assessed. Nomenclature of plants follows (Wisskirchen and Haeupler 1998). The total cover of vertical layers and the cover of individual species was visually estimated to the nearest 10% according to Londo (1976).

**Spider, True bugs, Beetles:** One flight-intersection trap was installed 2 to 5 m from the beaver pond, river and in the randomly selected plot in the adjacent forest (see also plants). The flight-intersection trap was constructed of two plexiglass panes arranged at right angles. The plexiglass panes had a size of 40 by 60 cm. Underneath the insects were guided to a collecting jar that was filled with a 3 % copper sulfate solution and an odorless soapy solution. Each single trap was equipped with a rain cover to avoid overflow. Two pitfall traps were installed 2 to 5 m from the beaver pond, river and in the randomly selected plot in the adjacent forest (see also plants). For pitfall trapping, two ground-level plastic cups were stacked inside each other (half-liter PLA cups; diameter, 95 mm; height, 151.2 mm). The inner cup was filled with a 3 % copper sulfate solution and an odorless soapy solution. Each single trap was equipped with a rain cover to avoid overflow. The traps were emptied on a monthly basis beginning end of Mai until end of September (5 times). After each trap-emptying event, we transferred all collected insect individuals into 70% ethanol for later pre-sorting into spiders, true bugs, beetles, other and subsequent species identification by external specialists. From these taxonomic groups, all individuals were identified to species level.

**Birds:** Were sampled by point – stop counts. Trained operators were placed at fixed points at the closest possible distance to the water edge for beaver ponds and rivers and at plot center for forest plots. In order to minimize background noise from running water, points were selected at the maximum distance from both the dam and the incoming stream; great care was taken in selecting spots with concealing cover, to avoid disturbance. From April to June, five 15-days sampling intervals were established; within a single interval, all plots were sampled in 4-5 days chosen according to weather conditions (sunny with no wind). Following the literature, sampling started between sunrise and 11.00; the same plot was sampled at different times in different sampling intervals. In each sampling occasion, a plot was sampled for 13-minutes, recording each singing species and the minimum number of individuals.

**Small vertebrates:** Were recoded as bycatch of pitfall traps used to sample spider, true bugs and beetles. Placement of traps, handling and operational time were the same (see above).

**Bats:** Batcorder 2.0 (<https://ecoobs.de/>) were equipped with 8 – 16 GB SD cards and batteries. Home-made wooden poles were used as supports; the poles (2.50 m long) were hammered in the ground for approximately 40cm, batcorders were pointed upwards and a small inset allowed to regulate the inclination between 35 and 45 degrees. One recorder per plot was placed; in beaver ponds and river plots, they were placed along the water edge. The same block (beaver pond plus its river and forest control areas) was sampled during the same night. Recordings were only started when there was no rain or strong wind and the night temperature was above 5 degrees Celsius. The

sampling season was May – September, and recordings took place once per month. The recording period started at 19.00 and ended at 7.00.

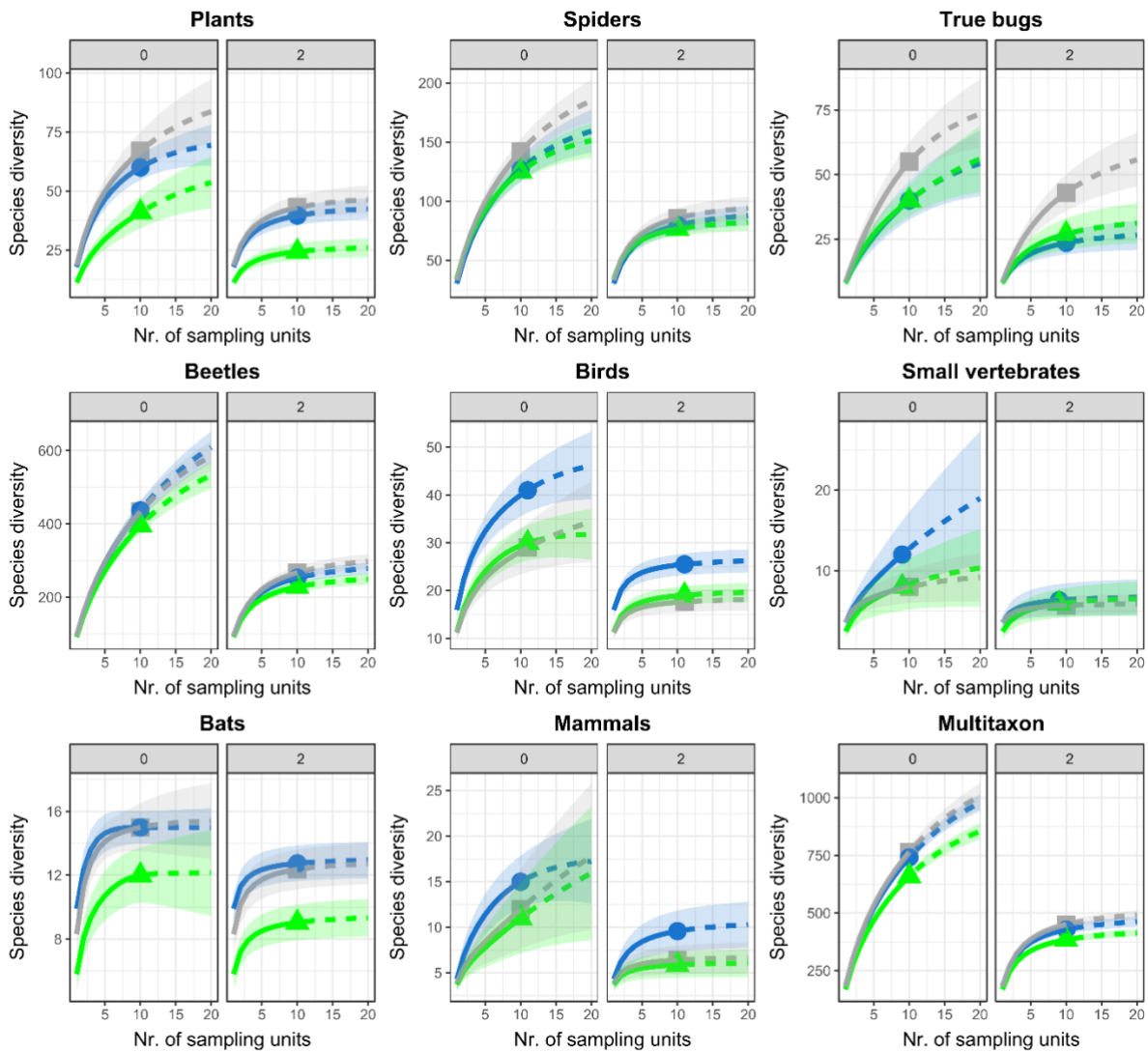
**Mammals:** 30 camera traps (Cuddeback C123) with white flash were simultaneously placed, one per each plot, and set to take pictures. At the beaver ponds and rivers, cameras were placed parallel to the water edge at an average distance of 5 meters. The field of view was 55 degrees, trigger speed was <0.25s, and the height around 80cm. The cameras were placed towards North; disturbing vegetation was occasionally cut inside the field of view. Consecutive pictures of the same species within 5 minutes were considered as the same event.

**Supplementary Table 1.** Number of species and relative percentage for each German Red List category in the three habitats compared to the total number of species found in the habitat. \*Species of conservation concern were defined as any species not listed as “Least Concern” or “Data Deficient”.

	Beaver Pond		River		Forest	
	Species	%	Species	%	Species	%
<i>Extinct</i>	1	0.1	0	0	0	0
<i>Critically Endangered</i>	1	0.1	2	0.3	0	0
<i>Endangered</i>	7	1	8	1	7	1.1
<i>Vulnerable</i>	18	2.5	15	2	15	2.3
<i>Threatened of uncertain extent</i>	15	2	9	1.2	13	2
<i>Extremely Rare</i>	6	0.8	7	0.9	6	0.9
<i>Near Threatened</i>	28	3.9	26	3.5	22	3.4
<i>Least Concern</i>	589	81.4	603	81.4	530	83.2
<i>Data Deficient</i>	11	1.5	12	1.6	13	2
<i>Not assessed</i>	47	6.5	58	7.8	31	4.9
<i>Total</i>	723	100	740	100	637	100
<i>Total of conservation concern*</i>	76	10.4	67	9	63	9.8

**Supplementary Table 2.** Differences in the community composition between the three studied habitat types for the eight studied taxonomic groups (Bray–Curtis dissimilarity, ADONIS analyses). Bold values indicate significance ( $P < 0.05$ ).

Taxonomic group	Beaver pond – River		Beaver pond – Forest		River – Forest	
	Adj. P-value	Partial R <sup>2</sup>	Adj. P-value	Partial R <sup>2</sup>	Adj. P-value	Partial R <sup>2</sup>
Plants	0.16	0.06	<b>0.002</b>	0.12	<b>0.01</b>	0.12
Spiders	0.17	0.05	<b>0.002</b>	0.13	<b>0.009</b>	0.07
True bugs	<b>0.02</b>	0.09	<b>0.002</b>	0.18	<b>0.009</b>	0.08
Beetles	<b>0.002</b>	0.09	<b>0.001</b>	0.15	<b>0.01</b>	0.07
Birds	<b>0.002</b>	0.14	<b>0.001</b>	0.21	0.17	0.07
Small vertebrates	0.29	0.08	0.2	0.04	0.73	0.02
Bats	0.78	0.02	<b>0.008</b>	0.19	0.06	0.09
Mammals	0.12	0.10	<b>0.01</b>	0.13	0.25	0.06



**Supplementary Figure 2.** Sample-based Rarefaction- Extrapolation curves for beta diversity (Hill number = 0: species richness; 2 = inverse of Simpson’s concentration index) up to double the actual sample size; transparent shading represents 95% confidence intervals; solid symbols indicate the actual sample size. Blue: Beaver Pond; Grey: River; Green: Forest.