Investigating Microhabitat Selection of Natterjack Toads in Lignite Mining Areas

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Optimizing Pioneer Species Secondary Habitats

Background

- Mining sites provide important refuges for pioneer species such as the natterjack toad (*Epidalea calamita*)
- Recultivation of follow-up landscapes largely produces unsuitable habitats
- Areas ascribed to pioneer species conservation must be managed optimally to maintain source populations
- Dispersal of juvenile anurans maintains functional connectivity and stepping stone habitats should be designed based on juvenile habitat preference

Study aims

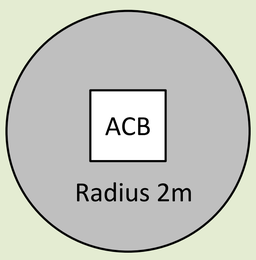
This study targets habitat characteristics which are linked to natterjack toad **juvenile survival** and **functional connectivity** to help optimizing habitat management.

Therefore, we

i. determine **size-dependent (micro)habitat selection** and track **individual movement** to identify terrestrial habitats that increase landscape permeability

ii. identify **favourable microclimate** for juvenile activity and survival

Methodology: Survey Terrestrial Microhabitats



Survey methodology

- Circular plots (n = 80) with an artificial coverboard (ACB) positioned in different microhabitats (Fig 1c) are surveyed for 2 minutes per person
- Juveniles are counted, toads with a SVL ≥ 20mm are measured, sexed and marked individually using photographs to identify recaptures

Microclimate and –habitat

- Temperature and relative humidity are recorded in a subset of 18 plots belonging to different microhabitat types
- Microhabitat structures, vegetation cover and soil properties are estimated in fixed categorical steps
- Hourly microclimate is modelled using plot characteristics and empirical air temperature and humidity measured at the closest weather station

Fig. 2: *Microhabitat equipped with artificial coverboard & iButton® DS1923 dataloggers.*

Planned statistical analysis

- Size-dependent microhabitat selection (size classes: < 25mm, 25-45mm, > 45mm) will be modelled using **multi-season occupancy models,** thereby accounting for imperfect detection
- Microtopography and distance to breeding ponds with successful metamorphosis are additional predictors for microhabitat occupancy

Study Area

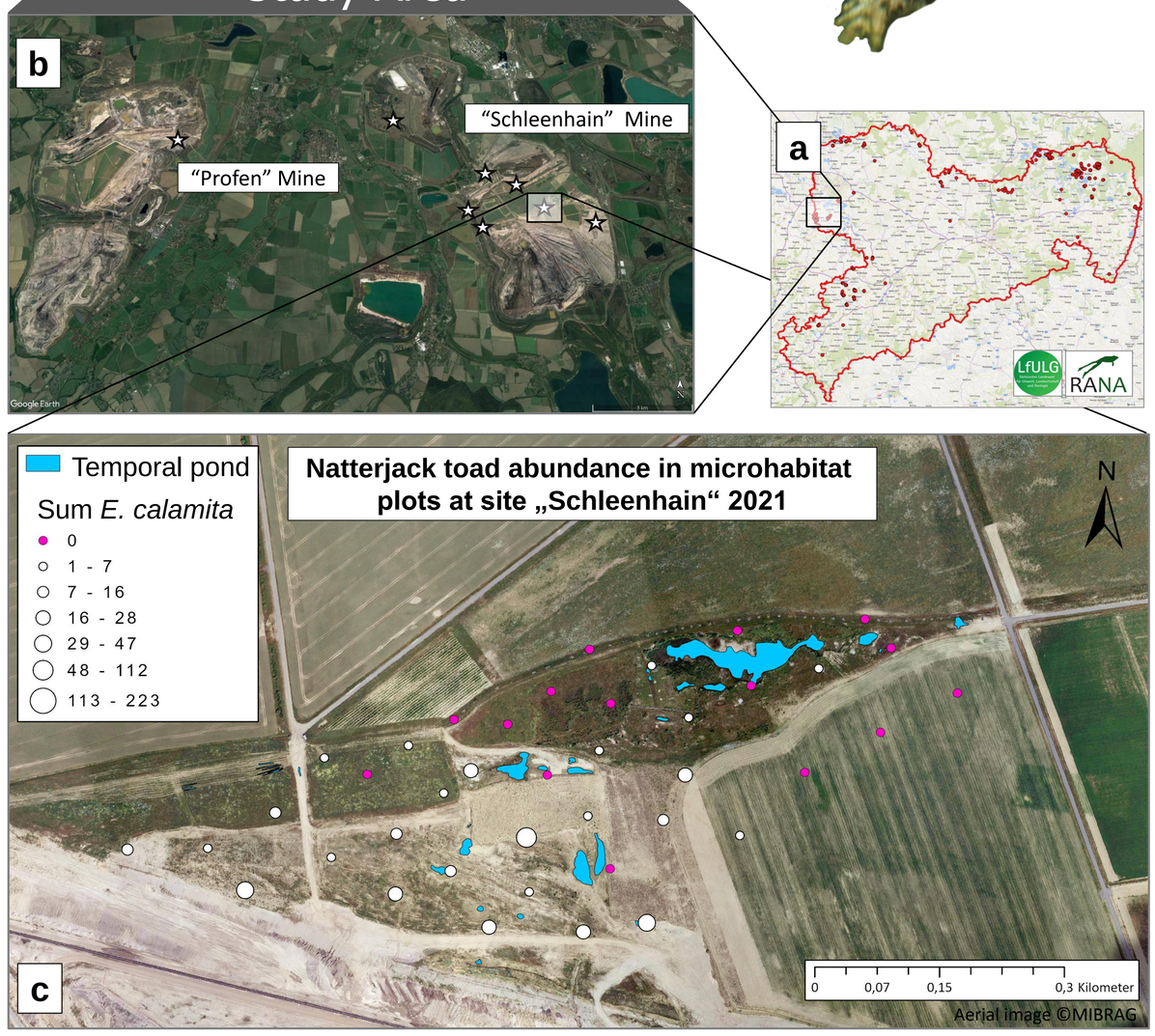


Fig. 1: (a) *E. calamita distribution in Saxony (●),* ***(b)*** *studied breeding areas (☆) in southern Leipzig district and* ***(c)*** *plot positions (n = 40) and yearly abundance at Schleenhain*

Preliminary Results

Juvenile abundance and habitat preference

- Extreme climatic differences in 2021 (very wet) and 2022 (drought) led to **divergent breeding activity and metamorphosis rates:**

2021: 11 (site “Schleenhain”) and 13 (site “Profen”) ponds with successful metamorphosis

2022: 3 and 4 ponds

- A near complete **lack of juveniles** was detected **in 2022,** where only 2 out of 272 (0.7%) toads had an SVL < 20mm, while it was 802 out of 1280 (62.7%) in 2021 (see Fig. 3)
- Generally, natterjack toads of all size avoided densely vegetated (Fig. 1c and Fig. 4)

Recaptures and movements

- 166 out of 748 captures (SVL > 20 mm) were recaptures, with divergent **rates per site** (**25.6%** “Schleenhain**”, 9%** “Profen”)
- Toads showed a **high site fidelity** over the eight week sampling period in summer, as only 14 movements between capture and recapture occurred (max 367m, min 10m, mean 93.8m)

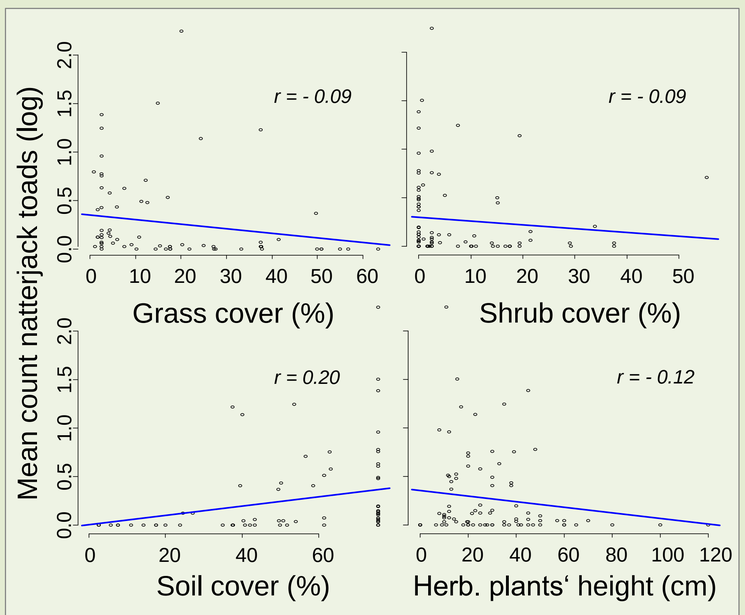
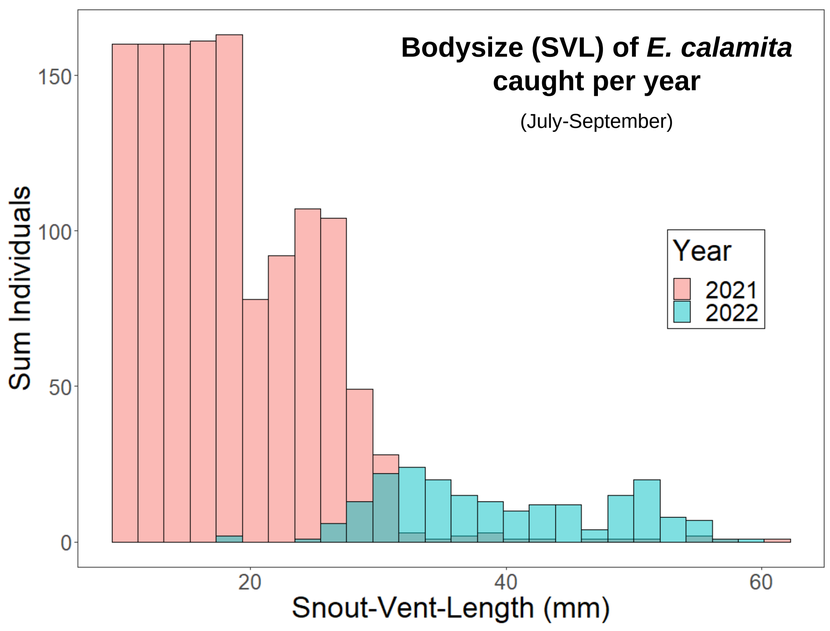


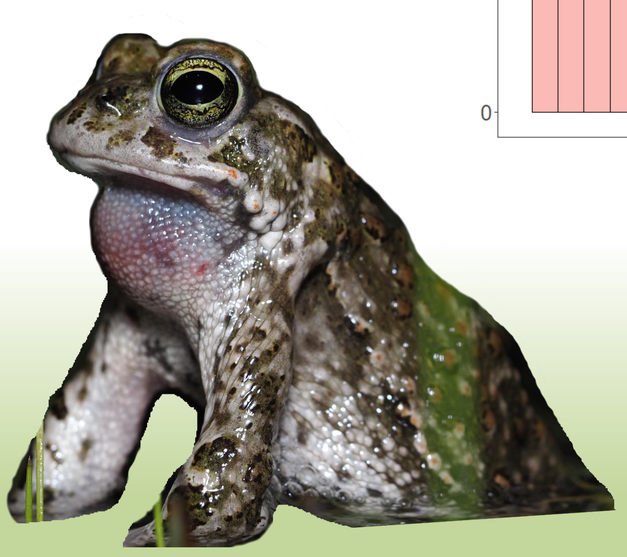
Fig. 4: *Mean natterjack toad abundance in 80 plots in 2021 and 2022 depending on selected microhabitat parameters*

Discussion

- Weather-related **fluctuation in toad abundance and activity** may mask patterns of toad habitat selection
- Multi-season occupancy models must account for weather conditions and for **false negative counts** in densely vegetated plots
- Correlation between habitat characteristics and summed up toad abundance was weak, but **preferences for sparsely vegetated microhabitats** become visible
- Conservation corridors implemented during mine recultivation must address these preferences to guide dispersing juveniles and sustain functional connectivity

Fig. 3: *Natterjack toads’ body size measured during standardized surveys in 2021 (n = 1280) and 2022 (n = 272). Juvenile toads with SVL < 20 mm were not measured but equally assigned to size classes from 10-20 mm in 2 mm-steps.*





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