

Wildlife population trends from camera trap data: a Bornean sun bear case study

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The **Tropical Defaunation Hub** compiles mammal and bird survey data from across Indonesia, to better understand how biodiversity has changed over space and time. Here, we outline 3 ways we can use these datasets to provide useful information for conservation, in addition to answering broader questions about wildlife trends and defaunation.

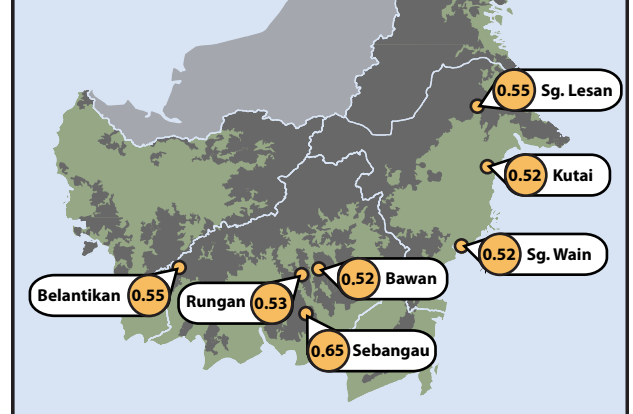
Bear bycatch in camera surveys

Sun bears are declining across much of their former range, and are now absent from many areas of Southeast Asia. Kalimantan remains a stronghold for the smaller Bornean subspecies (*Helarctos malayanus euryspilus*), but population status remains unclear following years of deforestation and forest degradation. Persecution and the wildlife trade are also growing threats to bears. The 2019 Sun Bear Action Plan seeks research into population status, habitat suitability and threats to help prioritise sun bear conservation efforts.

To better understand bear population trends we utilised camera-trap data from seven sites surveyed by Borneo Nature Foundation in Central and East Kalimantan. Fieldwork was undertaken between 2012 and 2016 in protected and unprotected sites in lowland forest. Study design varied amongst sites, but all cameras were >1 km apart. Since 2008 BNF and Universitas Palangkaraya have also undertaken annual camera surveys in the Sebangau peat swamps, giving us an opportunity to monitor mammal populations at that site over time.

Sun bear occupancy in camera trap sites of Kalimantan

Shaded areas show the probable extant range (IUCN, 2017).



1 Multi-site occupancy & habitat use

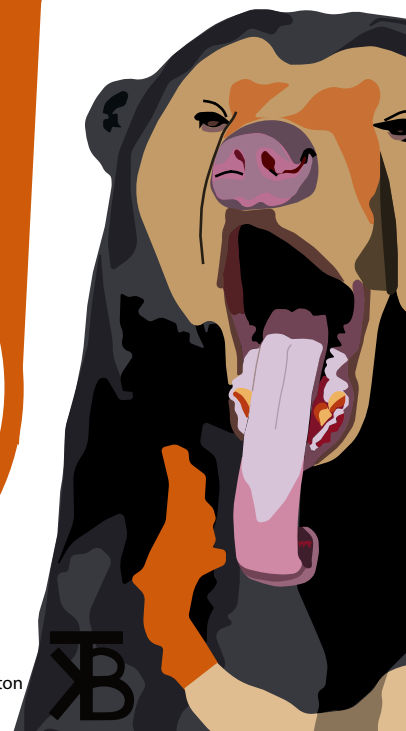
To generate information on sun bear habitat use we applied advanced Bayesian occupancy models. We took a single species single-season approach, limiting camera sample periods to 90-days to meet assumptions of population closure. Some cameras inevitably failed before the 90-days ended, giving varying sampling periods. Detection/non-detection data were combined into 5-day sampling occasion replicates, resulting in 4-18 sampling occasions per site. The analysis included 27,043 camera trap nights over 375 locations.



Bornean sun bears caught on camera.



Future analyses will use data from more sites within a multi-species framework, which can provide useful information even for rare species. This way we can confidently assess population status over multiple sites, which can tell us whether sites are adequately managed, and whether further conservation actions are needed.

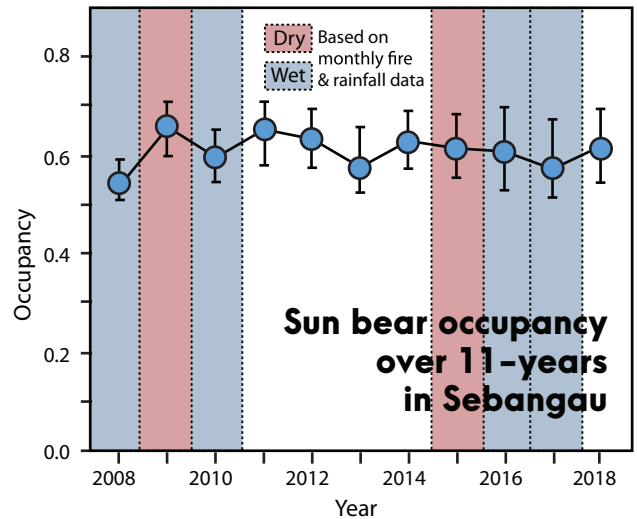


2 Population monitoring over time

Camera-trap surveys have been undertaken annually in the Sebangau peat swamp forest since 2008, giving >10 years of bear population information. As effort and placement differed between years, cameras were mapped and pooled into 750m² grid cells to maximise the number of sites repeated across the years.

Again analyses were applied to 90-day periods and 5-day sampling occasions during each dry season, resulting in 3-19 occasions per site. The 11-years of sampling yielded 14,793 CTN, and 94 sun bear detections in 22 cells. This time we applied multi-season models, which use information from the previous year to estimate occupancy over time, thereby providing more insights than a single-season approach.

Sun bear occupancy was broadly consistent over the 11-year period, ranging from 0.54 in 2008 to a peak of 0.67 a year later. Importantly, occupancy does not appear to have changed significantly in response to drought and fire years in the surrounding peatland, indicating that Sebangau continues to support a substantial sun bear population.

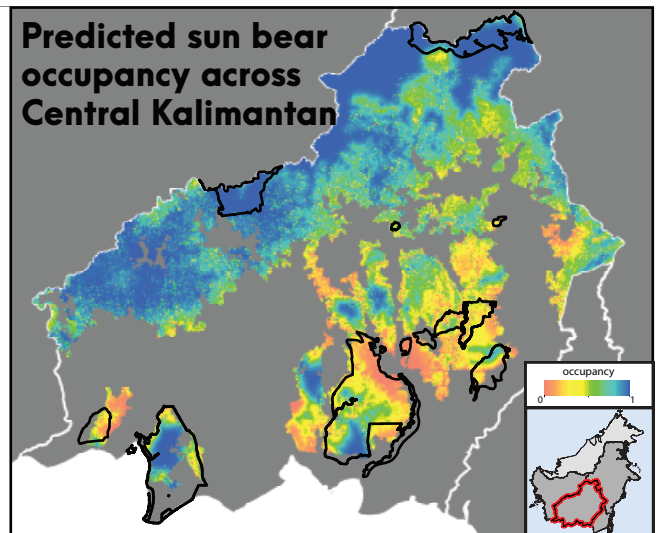


3 Predicting & mapping habitat use

Spatial information can be linked to inventory data to help explain wildlife population changes, and predict species occurrence in new areas. To do this we extracted non-correlated environmental (forest cover, biomass, distance to oil palm plantations, fire radiative potential) and anthropogenic variables (human population density, human accessibility) from mapped data within 200m of each camera.

The most important predictors of sun bear occupancy were forest biomass (i.e. a measure of habitat quality), and human accessibility (i.e. a measure of threat). Bears are more prevalent in high biomass forests (typically lesser disturbed) further from settlements and roads, reflecting social and environmental factors affecting populations.

Based on this information we can extrapolate occupancy across landscapes using the mapped variables, and predict where in Kalimantan is likely to support substantial sun bear populations. At smaller scales, these predictions can be valuable to inform whether certain areas of parks or reserves support more wildlife than others.



References

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We need you! Our analyses are only as good as the data that informs them. Our next steps are to improve the modelling with data from more sites to give us the spatial coverage we need to make stronger predictions and estimate population numbers. Please get in touch if you would like to contribute survey data to the network.

To be able to make longer term population predictions we need more temporal data for the analyses. These need only be two time points, although the more the better. Between 2020 and 2025 we can help resurvey many of the sites in the network, both in Kalimantan, but also in other parts of Indonesia.

We are also compiling datasets for Sumatra, Sulawesi, Java and Papua, and can help translate the outputs into information useful for contributors, so get in touch to find out how we can work together!

The Tropical Defaunation Hub is funded by the UK Leverhulme Trust to study the patterns and drivers of defaunation in Indonesia. It is a partnership between University of Kent, Universitas Indonesia and a network of conservation organisations. Contact m.truebig@kent.ac.uk for more information.