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# Habitat Selection and Seed Dispersal by the Great Blue Turaco (*Corythaeola cristata*) in the Rainforests of Southern Cameroon

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## ABSTRACT

Tropical rainforests are biodiversity hotspots, where the seeds of 60%–90% of trees are dispersed by animals, yet movement data needed to understand the behaviors and habitat selection of tropical frugivores remain scarce. We GPS-tracked four great blue turacos (*Corythaeola cristata*) in the Dja Faunal Reserve of southern Cameroon and predicted spatial patterns of seed dispersal within each bird's home range, which covered up to 2.33 km<sup>2</sup>. Using integrated Step Selection Analyses, we related turaco movements to LiDAR-derived measurements of 3D vegetation structure and habitat type. One individual preferred areas of tall canopy height, whereas one preferred intermediate canopy height and avoided swamps and areas of greater vertical vegetation complexity. Seed dispersal patterns for the two turacos with the largest home ranges were predicted to be more diffuse, with local maxima almost an order of magnitude smaller than those with smaller home ranges. Although the great blue turaco is a common bird species throughout central African forests, this is the first study to characterize the species' movement ecology using telemetry. The observed individual variation in movement and habitat use underscores the need to track a broader range of species in central African landscapes, which are increasingly threatened by hunting, logging, habitat loss, and climate change.

## RÉSUMÉ

Les forêts tropicales humides sont des points chauds de la biodiversité, où les animaux dispersent les graines de 60%–90% des arbres, mais les données sur les déplacements nécessaires pour comprendre les comportements et la sélection de l'habitat des frugivores tropicaux restent rares. Nous avons suivi par GPS quatre touracos géants (*Corythaeola cristata*) dans la réserve de faune du Dja, au sud du Cameroun, et nous avons prédit les schémas spatiaux de dispersion des graines dans le domaine vital de chaque

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oiseau, qui couvrait jusqu'à 2.33 km<sup>2</sup>. En utilisant des analyses de sélection par étapes intégrées, nous avons relié les mouvements des touracos aux mesures dérivées du LiDAR de la structure de la végétation en 3D et du type d'habitat. Un individu préfère les zones où la hauteur de la canopée est élevée, tandis qu'un autre préfère une hauteur de canopée intermédiaire et évite les zones où la complexité verticale de la végétation est plus importante. Les modèles de dispersion des graines pour les deux touracos ayant les plus grands domaines vitaux ont été prédits comme étant plus diffus, avec des maxima locaux presque un ordre de grandeur plus petit que ceux des individus ayant des domaines vitaux plus petits. Bien que le grand touraco bleu soit une espèce d'oiseau commune dans toutes les forêts d'Afrique centrale, cette étude est la première à caractériser l'écologie des mouvements de l'espèce à l'aide de la télémétrie. La variation individuelle observée dans les déplacements et l'utilisation de l'habitat souligne la nécessité de suivre une gamme plus large d'espèces dans les paysages d'Afrique centrale, qui sont de plus en plus menacés par la chasse, l'exploitation forestière, la perte d'habitat et le changement climatique.

## 1 | Introduction

Animal movement data are necessary to understand the distribution of global biodiversity in space and time. This data is biased toward well-studied geographic regions, with proportionally few data from biodiverse tropical forests (Kays et al. 2022). The vast majority of animal species in tropical forests are missing basic movement information, such as home range size, which is essential to determine whether a species is threatened and inform effective conservation (Kays et al. 2022). Tracking animal movements in tropical regions helps reveal the effects of global change on tropical biodiversity (Doherty et al. 2021; Fell et al. 2023) and how animals shape their environment in turn through herbivory, seed dispersal, and other ecological roles (Russo et al. 2023; Tucker et al. 2021). Although recent research shows how large frugivores move and select resources in rainforests (Beirne et al. 2021; Russo, Nshom, et al. 2024), comparatively less is known about the movements of small frugivores (e.g., fruit bats and generalist birds) and their importance for seed dispersal in tropical landscapes (Fell et al. 2023; van Toor et al. 2019).

Several attributes of vegetation structure influence how animals find food and nesting resources and avoid risks such as predation and thermal stress (Davies et al. 2019; De Frenne et al. 2019; Russo, Nshom, et al. 2024; Wittemyer et al. 2019). These attributes are often revealed through Light Detection and Ranging (LiDAR), a remote sensing technique that uses light pulses to characterize 3D environments, measured from a scanner typically mounted on aircraft or an unoccupied aerial vehicle (Davies and Asner 2014). LiDAR has yielded insight into animal movements and habitat selection in tropical rainforest canopies, which, despite their rich assemblages of arboreal mammals, birds, herpetofauna, and insects, are among the least understood components of tropical ecosystems (Oliveira and Scheffers 2019; Scheffers and Williams 2018). These insights include evidence of the importance of lateral vegetation connectivity for Neotropical primates (McLean et al. 2016) and Bornean orangutans (Davies et al. 2017), but few studies have investigated the influence of canopy vegetation structure on animal movements in central African rainforests (Russo et al. 2025; Russo, Nshom, et al. 2024). Understanding how vegetation structure influences animal behavior is key to predicting ecological roles such as seed dispersal (Dehaut et al. 2024; Russo, Nshom, et al. 2024).

Great blue turacos (*Corythaeola cristata*) are large, arboreal birds that occupy all canopy strata in central African rainforests, and although they are common throughout their range, their movements

are poorly known (Okon et al. 2018, 2019; Sun, Ives, et al. 1997). Great blue turacos are found in tropical forests, villages, and gallery forests with dense canopy (Sun, Ives, et al. 1997). Although this species is among the largest frugivorous birds in central Africa—exceeded in size only by hornbills (Bucerotidae)—they have much smaller bills (width: 9.3 mm; Tobias et al. 2022) and feed mainly on smaller fruits (Sun, Moermond, and Givnish 1997). Great blue turacos also consume leaves, which comprise as much as 25% of the diet in some parts of their range (Sun, Moermond, and Givnish 1997; Sun and Moermond 1997). One previous study reported this species' movement behavior and seed dispersal capabilities based on follows in the montane forest of Rwanda (Sun, Ives, et al. 1997). However, tracking this species on foot would not be feasible in a closed canopy, lowland rainforest environment. Although listed as “Least Concern” by the International Union for Conservation of Nature (IUCN), great blue turacos are poached for the pet trade or for their feathers and parts (Nkengbeza et al. 2023). In spite of these threats, few published studies exist for great blue turaco (Okon et al. 2019; Sun, Ives, et al. 1997; Winiarska et al. 2024), and none have reported movement research based on telemetry. Great blue turacos often move through dense vegetation, flying slowly and walking along branches, so canopy structure is likely an important factor in their habitat preferences (Russo, Holbrook, et al. 2024; Sun, Ives, et al. 1997). Specifically, taller canopies could help keep turacos aloft, and they may seek fruits of small-seeded pioneer trees near canopy gaps. We expect turacos to disperse seeds among their preferred habitats.

In this study, we used GPS tracking to record great blue turaco movements for the first time. Our aims were to (1) relate turaco movements to vegetation structure and habitat type and (2) predict spatial patterns of seed dispersal in each bird's home range based on habitat selection, movement behavior, and gut passage times of seeds. Because turacos fly, glide, walk, and hop among branches throughout tree crowns, we expected vegetation structure to influence where they move and disperse seeds.

## 2 | Methods

### 2.1 | Study Site

We conducted this study in the Bouamir Research Site (25 km<sup>2</sup>), which lies near the center of Cameroon's Dja Faunal Reserve (3°11' N and 12°48' E). The Dja Reserve, covering 5260 km<sup>2</sup>, is a UNESCO World Heritage Site and the largest protected area in Cameroon. It supports a rich assemblage

of flora and fauna, including more than 312 plant, 100 mammal, and 360 bird species (Lejoly 1995; Sonké 1998; Sonké and Couvreur 2014). The region experiences two rainy (March to May and September to November) and two dry seasons per year (June to August and November to March). Vegetation in the Dja Reserve is Camerouno-Congolese, semi-deciduous forest consisting mainly of *terra firme* forest, swamps dominated by *Raphia* palms, monodominant forest of *Gilbertiodendron dewevrei*, and grassy peaks called inselbergs that sometimes contain isolated patches of forest (Lejoly 1995; Sonké 1998). A LiDAR survey conducted by an unoccupied aerial vehicle (UAV-LiDAR) for the entire 25 km<sup>2</sup> study area was completed in March 2022, during the transition from the major dry to minor rainy season, with a DJI Zenmuse L1 scanner, producing a point cloud density of 300 points \* m<sup>-2</sup> (Rodda et al. 2024).

## 2.2 | GPS Tracking

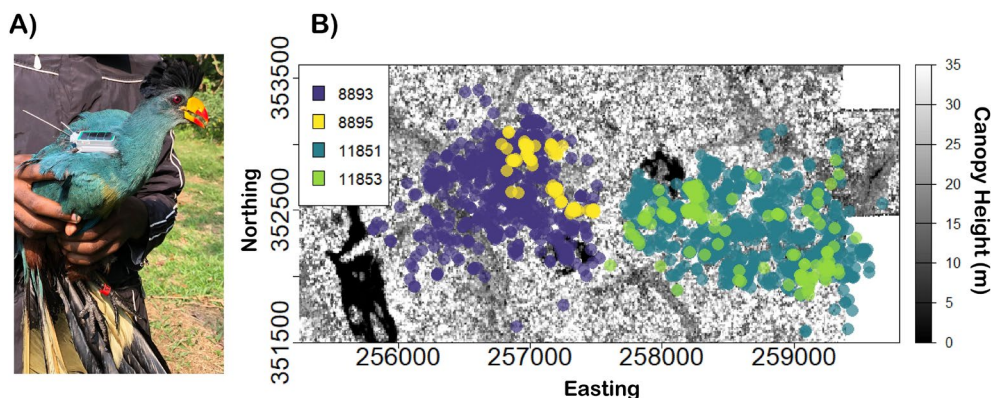
In June 2022 and May 2023, we captured four great blue turacos in pulley-mounted canopy mist nets (Russo, Holbrook, et al. 2024). Birds were either captured in front of a frequently visited *Musanga cecropioides* tree bearing fruits in an open area of the Bouamir research camp ( $n=2$ ) or incidentally during a capture attempt for other species, in a forest near an inselberg ( $n=2$ ). *M. cecropioides* is a pioneer tree species in disturbed habitats that can persist in mature rainforests (Sonké and Couvreur 2014) and produces fruit that comprise a large portion of the turaco diet (Okon et al. 2019). We tagged each turaco with a 25 g solar-powered GPS tag (e-obs, GmbH, Munich, Germany, [www.e-obs.de](http://www.e-obs.de); Figure 1A). Tag mass was under the maximum recommended 3% of body weight, which ranged from 865 to 970 g (Wilson et al. 2021). We attached tags using a backpack harness made from 1.12 cm (0.44") tubular Teflon ribbon (Bally Ribbon Mills; Kenward 2001). We captured and tagged turacos under a protocol approved by the University of California, Los Angeles Animal Research Committee (#2019-037-01). All field research for this project was permitted by Cameroon's Ministry of Scientific Research and Innovation (permit #15/MINRESI/B00/C00/C10/C13) and Ministry of Forestry and Wildlife (permit #1470/PRBS/MINFOR/SETAT/SG/DFAP/SDVEF/SC/ENJ). We could not determine the sex of each individual in the field because this species does not exhibit any external sex

characteristics (Krocak et al. 2022). All tags were programmed to record a GPS fix at 5 min intervals when fully charged and descend to a fix rate of 30 min, 2h, and 24h at successively lower battery levels. Tags were never fully charged beyond the first week of tracking, so most GPS locations were taken at a fix rate of 2h, 24h, or lower. Turacos were tracked for four to 30 months, and we recorded 84 to 919 GPS locations for each bird (Figure 1B).

## 2.3 | Habitat Selection

For each turaco, we tested for an effect of several 3D structural metrics on habitat selection using an integrated Step Selection Analysis (iSSA; Avgar et al. 2016). This analysis compares observed movement steps to randomly generated steps, where the end of each step represents selected or available habitat, respectively. Although iSSAs typically use a 10:1 ratio of random to observed steps, we used a 100:1 ratio due to the smaller sample size ( $n=4$  turacos; Thurfjell et al. 2014). The iSSAs are conditional logistic regression models that produce estimates of selection strength for each covariate, represented by a  $\beta$  coefficient. A habitat variable was considered to affect turaco habitat selection if the 95% confidence interval of its  $\beta$  coefficient did not overlap zero (Avgar et al. 2016; Thurfjell et al. 2014).

Predictors of habitat selection were derived from the UAV-LiDAR point cloud and were based on hypothesized relationships between vegetation structure and turaco movement behavior. Because turacos typically move below the upper canopy and walk along branches, we expected features of the mid-canopy to affect their movement decisions. We also frequently observed this species moving around and across canopy gaps. Accordingly, iSSA covariates included canopy height, a vertical complexity index, distance to canopy gaps of both small ( $\geq 50$  m<sup>2</sup>) and large area ( $\geq 500$  m<sup>2</sup>), and plant volume density at an intermediate vegetation stratum (15–20 m). After exploring habitat characteristics at used versus available locations (Figure S1), we modeled canopy height with a quadratic term to capture a potential nonlinear relationship (Fieberg et al. 2021). We also included habitat types in models, using a Random Forest model applied to a Sentinel-2 image to classify swamps dominated by *Raphia* palm species and “non-swamp,” which included *terra firme* forests, inselbergs,



**FIGURE 1** | Great blue turaco (A) tagged with a 25 g e-obs transmitter (Photo: Nicholas Russo). (B) Individual GPS points of each tagged bird (8893, 8895, 11851, and 11853) plotted over a 10m map of canopy height.

and rarer habitat types (Russo et al. 2025). To avoid multicollinearity, we only included covariates in each model that were not highly correlated (Pearson's correlation coefficient  $< |0.6|$ ). For example, we only included one metric of vertical complexity. All covariates are described in detail in previous studies from the same location (Russo et al. 2025; Russo, Nshom, et al. 2024).

Prior to analyses, we resampled turaco movement tracks to 2-h intervals between relocations because the GPS tags did not remain well-charged for most of the birds' tracking periods, resulting in few relocations with finer temporal resolution. We also considered 2 h the minimum temporal resolution necessary to estimate seed dispersal patterns because gut passage times of seeds for a related species of turaco rarely exceed 2 h (Sun, Moermond, and Givnish 1997). We fit an integrated Step Selection Analysis (iSSA) model to each bird's movement steps using the "fit\_issf" function in the "amt" R package (Signer et al. 2019). Due to a model convergence issue resulting from too few observations, we dropped the categorical term for "swamp" habitat from iSSAs for two turacos (IDs: 8895, 11853). We validated all models with used-habitat calibration (UHC) plots, which use  $k$ -fold cross validation to predict distributions of habitat variables at locations selected by turacos and then compare predicted to observed values (Fieberg et al. 2018) for this procedure, we used 80% of turaco locations as a training sample and 20% as a test sample to simulate 1000 distributions of all habitat variables.

## 2.4 | Seed Dispersal

Because an animal's home range size is expected to influence the maximum distance it can disperse seeds, we estimated the 95% home range area of each turaco by applying a weighted autocorrelated Kernel Density Estimator (wAKDE) to each turaco's GPS locations using the "ctmm" R package (version 1.2.0; Calabrese et al. 2016). We estimated spatial patterns of seed dispersal by turacos based on methods presented in (Russo, Nshom, et al. 2024). We modeled a redistribution kernel of each bird based on selection strength for each covariate included in the iSSA, a gamma distribution fit to the bird's step lengths, and a von Mises distribution fit to its turn angles (Signer et al. 2024). Based on the redistribution kernel, we simulated 100 movement paths of 10 steps, with a step duration of 60 min. Although this time interval does not match the interval used in iSSAs, seed dispersal estimates were difficult to interpret when we simulated turaco movements with 2 h time steps, and so we assumed step selection would not differ substantially at 1 h steps. Each simulated path originated in the center of the bird's home range, which was estimated using a minimum convex polygon in the "adehabitatHR" R package (version 0.4.22; Calenge et al. 2008). We generated probabilities of seed deposition along the length of each movement simulation based on a gamma distribution of gut passage times of seeds, where the shape and scale correspond to estimates based on the largest seeds fed to a related species (Rwenzori turaco; *Gallirex johnstoni*; Sun, Ives, et al. 1997). We used these estimates because gut passage time experiments do not exist for great blue turaco (Sun, Ives, et al. 1997). Due to the coarse temporal resolution of tracking data used in iSSA models (2 h), we

used the tree species with the greatest mean gut passage time (*Ilex mitis*) recorded in Sun, Ives, et al. (1997) to predict seed dispersal patterns by great blue turaco. We modeled spatial patterns of seed dispersal as a Poisson point process with intensity  $\lambda$ , using the "spatstat" R package (version 3.2-1; Baddeley and Turner 2005). We selected the bandwidth ( $\sigma$ ) for the kernel density estimate of  $\lambda$  using the "bw.ppl" function, which uses likelihood cross-validation. The product was a map of spatial probabilities of seed dispersal surrounding the center of each turaco's home range, based on the bird's habitat selection and movement behavior, as well as the estimated gut passage time of large seeds in the turaco diet.

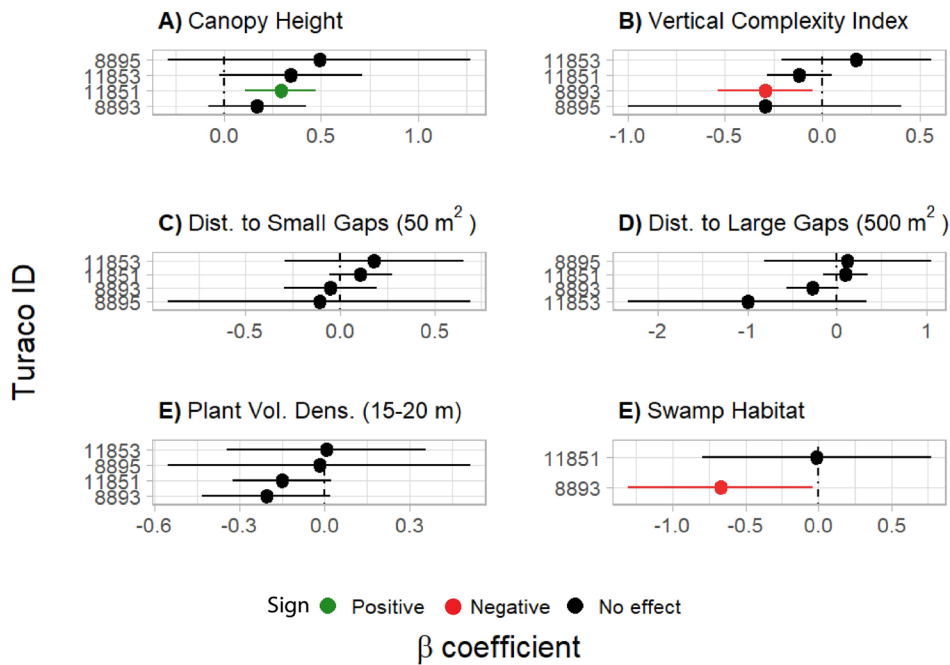
## 3 | Results

### 3.1 | Habitat Selection

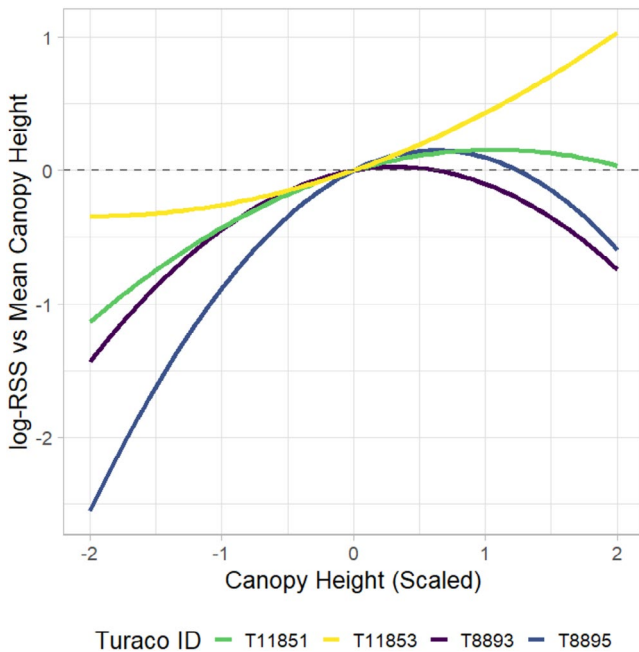
One turaco (ID: 11851) preferred areas of taller canopy height (conditional logistic regression:  $p = 0.001$ ; Figure 2A), and one turaco (ID: 8893) preferred areas of intermediate canopy height, as exhibited by a nonlinear relationship (conditional logistic regression:  $p = 0.006$ ; Figure 3). One turaco (ID: 8893) selected areas of lower vertical complexity (conditional logistic regression:  $p = 0.018$ ), and the other three turacos did not show a preference for vertical complexity. No turacos exhibited a habitat preference with respect to distance from the nearest canopy gap of small ( $\geq 50 \text{ m}^2$ ) or large ( $\geq 500 \text{ m}^2$ ) area or plant volume density in the 15–20 m height range (Figure 2C–E, respectively). Two turacos (ID: 8893 and 11,851) tended to select regions of lower plant volume density in the 15–20 m height range. One turaco (ID: 8895) did not exhibit a preference for any of the habitat variables; its tag also yielded 84 GPS locations, the fewest of the tracked birds (Table S1). Of the two turacos that encountered the three habitats (forest, swamp, inselberg) with enough regularity for habitat type to be included in the model, only one (ID: 8893) preferred areas away from swamps (conditional logistic regression:  $p = 0.038$ ; Figure 2F). Used-habitat calibration plots indicated that variables included in each iSSA model were generally well-calibrated and appropriate for drawing inference about turaco habitat selection, based on the extent of overlap between the observed distribution of each habitat variable and the 95% confidence envelope of predicted distributions, albeit with occasional instances of underestimated selection strength (Figures S2–S5).

### 3.2 | Seed Dispersal Probabilities

We estimated smaller home range sizes for birds tagged in the Bouamir research camp (0.57 and 1.39  $\text{km}^2$  for birds 8895 and 8893, respectively; Figure S6A,B) compared to those tagged near an inselberg (1.96 and 2.33  $\text{km}^2$  for birds 11851 and 11853, respectively; Figure S6C,D). However, we retrieved few GPS locations for the turaco with the smallest estimated range (ID: 8895). We estimated seed dispersal probabilities radiating from the center of each turaco's home range (Figure 4). For the two turacos tagged within the Bouamir Research Station, a large open area next to a stream and swamp, seed deposition probabilities had a local maximum of  $\lambda > 1.0 \text{ e}^{-04}$ . In contrast,



**FIGURE 2** | Turaco selection for habitat covariates ( $\beta$  coefficient) at 10m resolution, based on 100 random steps, including (A) canopy height, (B) vertical complexity index, (C) distance to canopy gaps  $\geq 50\text{m}^2$ , (D) distance to canopy gaps  $\geq 500\text{m}^2$ ; (E) plant volume density 15–20m from the ground, and (F) swamp habitat. Points represent beta coefficient estimates and lines represent 95% confidence intervals. The dotted line at  $x=0$  represents absence of selection. Note that the range of values in each axis differs for each plot.



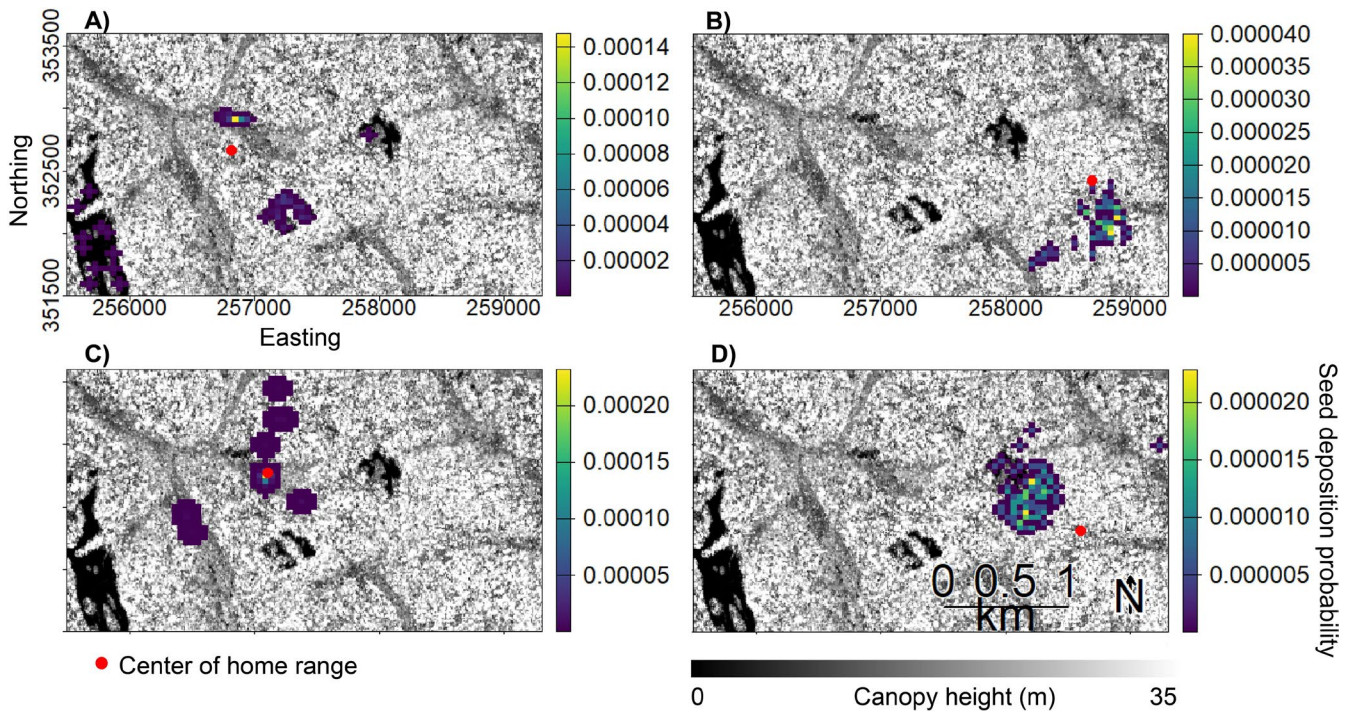
**FIGURE 3** | Relative Selection Strength (RSS) for canopy height, a metric indicating selection for canopy height relative to the mean value in habitats available to the animal. The dotted line at  $y=0$  represents an absence of selection relative to the mean, and  $x=0$  represents mean canopy height.

the local maximum probability of seed deposition based on habitat selection by two other turacos tagged near a forest-inselberg ecotone was nearly an order of magnitude smaller ( $\lambda = 2.0\text{--}4.0 \times 10^{-5}$ ).

#### 4 | Discussion

In the first GPS telemetry study of great blue turacos, we found that four individuals of this species exhibited limited home ranges and few consistent habitat preferences in a mature rainforest of southern Cameroon. Tracked individuals moved among all major habitat types in the study area, including large canopy gaps, dense rainforests, and swamps. One individual exhibited a preference for areas of taller canopy, while another preferred areas of medium canopy height. Predicted seed dispersal patterns either exhibited a strong local maximum or appeared more diffuse, reflecting movement behavior and habitat selection differences among individuals. Although the sample size of this study was small ( $n=4$ ), the data and results show great blue turacos of mature rainforests using different habitats across small home ranges and help alleviate a large data gap in animal movement tracking from central Africa (Fell et al. 2023; Kays et al. 2022).

The four turacos in this study exhibited few consistent preferences for attributes of 3D vegetation structure, with canopy height being a strong predictor for turacos with  $> 800$  GPS locations. The importance of taller canopies for one bird and intermediate canopy height for another bird likely reflects the arboreal lifestyle of this species. Because turacos require perches and often move laterally among branches, they were rarely observed over open areas. However, lateral connectivity did not appear to affect turaco movement decisions because none of the turacos appeared to avoid canopy gaps. Indeed, it was common to observe turacos visiting fruiting trees at the edge of large canopy gaps in the study area, such as inselbergs and the research camp. In addition, we did not observe a significant effect of plant volume density at mid-canopy height (15–20m) on turaco habitat



**FIGURE 4** | Seed deposition probabilities based on habitat selection by four monitored turaco individuals: (A) Turaco ID=8893; (B) Turaco ID=11851, (C) Turaco ID=8895, (D) Turaco ID=11853.

selection, despite their habit of walking and hopping among branches below the upper canopy. Turacos have semi-zygodactyl feet, meaning they can shift their fourth digit forward and backward in a way that may help them climb or walk among branches (Botelho et al. 2015). This unusual mode of locomotion, combined with the species' short, slow flights, highlights the importance of describing the consequences of their movements through vegetation.

Unlike other seed dispersers in Cameroon's rainforests, such as hornbills (Russo, Nshom, et al. 2024) and fruit bats (Russo et al. 2025), turacos never undertook long-distance movements, instead using their limited home range intensively. These movement patterns suggest the species is primarily a central-place forager (Abrahms et al. 2017) and may partly explain why tracked individuals exhibited few preferences for specific habitat characteristics within the home range (van Moorter et al. 2015). Feeding behaviors may also be a stronger driver of turaco habitat selection than vegetation structure itself. Indeed, we observed two of the turacos tracked in this study (8893 and 8895) visiting the same fruiting trees multiple times during the tracking period, including *M. cecropioides* and *Greenwayodendron suaveolens*. These findings align with previous acoustic evidence that the species is sedentary (Winiarska et al. 2024), as well as evidence from our Cameroon study site that fruiting trees can serve as foci for seed dispersal by large birds and mammals (Clark et al. 2004). When predicting seed dispersal patterns based on turaco movement behaviors, the individuals with smaller home ranges (ID: 8893 and 8895) exhibited local maxima representing greater probability of seed deposition in intensively used areas. These seed deposition patterns also reflect fast gut passage times of seeds in the diet (< 3 h for the largest seeds; Sun, Ives, et al. 1997). To maximize the use of movement data toward these predictions, we assumed habitat selection would not differ

strongly between 1- and 2-h movement steps—tracking techniques with greater temporal resolution may yield more detailed predictions of how movement behavior, seed size, and gut passage times interact to define the role of great blue turacos as seed dispersers in central African forests.

Although turacos are large birds, their limited gape size and preference for small-seeded fruits (e.g., *M. cecropioides* and *G. suaveolens*) may indicate an important role in enabling pioneer tree species to establish in disturbed habitats. Animal-dispersed trees incur tradeoffs in the quantity and quality of fruits they produce, such that trees span a continuum of producing abundant, smaller-seeded fruits or investing nutrients in fewer, large-seeded fruits (Howe and Smallwood 1982). Small seeds often pass through the intestinal tract of birds faster than large seeds, which can limit their potential dispersal distance (Abraham et al. 2021; Holbrook and Smith 2000). One study estimated gut passage times of seeds in an experiment involving Rwenzori turaco, finding relatively short passage times (< 3 h) for both large and small seeds in the diet (Sun, Ives, et al. 1997). These findings, combined with the limited home range area of individuals tracked in our study for up to 30 months, indicate that turacos may disperse large quantities of small seeds to a variety of habitat types, albeit over limited distances. Using a wide variety of habitats may ensure that some seeds arrive in areas suitable for germination (Schupp 1993; Schupp et al. 2010). Small-seeded trees are typically light-demanding during germination and recruitment and efficient colonizers of canopy gaps (Zambrano et al. 2020), and as dispersers, turacos may ensure that early successional tree species arrive in regenerating habitats, such as logged forests (Sullivan et al. 2024). Continued research on the movements of smaller frugivores, including generalist birds that overlap in diet with the great blue turaco, promises

to shed light on potential tree recruitment patterns in central African forests.

Tracking more individuals would lend further insight into the ecological roles of great blue turacos, as well as individual variation in habitat selection. Our small sample ( $n=4$ ) provides a first glimpse of the movement behaviors of a common bird species whose movements have never before been tracked with GPS, but we caution against generalizing these results to the population- or species-level. Tracking more turacos with finer temporal resolution may reveal stronger habitat preferences, as well as potential differences based on age and sex. Although we could not determine the sex of individuals in this study without processing blood samples (Krocak et al. 2022), such information may be useful in interpreting differences in movement behaviors among individuals due to reproductive roles (Séchaud et al. 2021). Older, more experienced birds may also use more predictable routes among preferred locations than younger birds (Aikens et al. 2024). More intricate characterizations of turaco movement would be possible with greater GPS tag performance; in our study, solar charging of tags was limited, likely because turacos tend to spend long periods in dense vegetation, and the GPS fix rate rarely remained greater than one location per day. This issue did not arise in previous research tracking hornbills—a high canopy bird species—using the same tags (Russo, Nshom, et al. 2024). With tracking data of finer temporal resolution, seed dispersal models may be more reliable, especially because great blue turaco activity peaks near dawn and dusk (Winiarska et al. 2024). In generating our seed dispersal models, we assumed that habitat selection would not differ strongly when considering time steps of 1 versus 2 h, so we encourage the development and use of tracking technology that can limit temporal gaps in movement tracks. Although we also recommend research that increases the number of individuals tracked, we caution that conventional mist-netting methods can be largely ineffective for capturing this slow-moving species, and great blue turacos are very sensitive to capture and processing (Russo, Holbrook, et al. 2024).

Tracking a wide variety of seed dispersers in central Africa is important for future research documenting the effects of climate and land use change on the region's biodiversity, structure, and carbon storage (Fell et al. 2023; Osuri et al. 2016). Large movement data repositories such as Movebank have made tracking data more discoverable for broad-scale analyses (Beumer et al. 2025; Kays et al. 2022). Such analyses have shown how animal movement distances (Tucker et al. 2018) and diel activity (Gaynor et al. 2018) vary in response to anthropogenic impacts at continental and global scales, as well as across taxa. We expect the data and results presented here to contribute to similar research involving multiple taxa. This is the first study reporting the movements of the great blue turaco, a common bird of central Africa, and we encourage continued research on poorly documented wildlife in tropical landscapes.

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#### Author Contributions

Antoine S.A. Tekam, Nicholas J. Russo, António Ferraz, Nicolas Barbier, Martin Wikelski, Elsa M. Ordway, Sassan Saatchi, and Thomas B. Smith conceptualized the study. Bonaventure Sonké and Vincent Deblauwe supervised the study. Antoine S.A. Tekam and Nicholas J.

Russo carried out further research to refine the methods. Antoine S.A. Tekam, Nicholas J. Russo, and Thomas B. Smith provided substantial materials, resources, and funding. Antoine S.A. Tekam, Nicholas J. Russo, Docas L. Nshom, António Ferraz, and Nicolas Barbier collected the data; Antoine S.A. Tekam and Nicholas J. Russo analyzed the data. Antoine S.A. Tekam drafted the manuscript with the support of Nicholas J. Russo. All authors reviewed the final draft.

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#### Conflicts of Interest

The authors declare no conflicts of interest.

#### Data Availability Statement

The data used in this study and script necessary to perform analyses are available on GitHub: <https://github.com/nicholasjrusso/turaco/tree/main>.

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## Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** [btp70153-sup-0001-Supinfo.docx](#).