Scientific Journal for Damietta Faculty of Science **15**(2) 2025, 48-57
Doi: 10.21608/sjdfs.2025.377979.1229
ISSN Print 2314-8594
ISSN Online 2314-8616

https://sjdfs.journals.ekb.eg/

Land Use- Land Cover Utilization by Egyptian Fruit Bats at Nile Valley and Delta, Egypt

Reem El-Gamal[*1], Alaa El-Din Sallam[2], Rana O. Khayat[3] and Basma M. Sheta[1]

[1]Zoology Department, Faculty of Science, Damietta University, Damietta, Egypt
[2]Zoology Department, Faculty of Science, Suez Canal University, Ismailia, Egypt
[3]Biology Department, Faculty of Science, Umm Al-Qura University, Makkah, Saudi Arabia

Received: 22 April 2025 /Accepted: 20 June 2025

[*]Corresponding author's E-mail: reemibrahem_pg@science.suez.edu.eg

Abstract

This study investigates the spatial distribution and land cover utilization patterns of the Egyptian fruit bat (Rousettus aegyptiacus) across six governorates in the Nile Valley and Delta, Egypt. Using 15 km² buffer zones to represent the average nightly foraging range of breeding colonies, we analyzed land use/land cover (LULC) composition derived from ESRI 2020 Global Land Cover Data. Results revealed significant variability in LULC composition among governorates, with cropland dominating Menoufia and Ismailia, built-up areas prevalent in Giza, and water bodies most abundant in Damietta. A strong positive correlation (r = 0.995) was observed between mean bat body mass and the percentage of water bodies, highlighting the importance of water availability for this species. While the study is primarily descriptive due to limitations such as a single LULC observation per governorate and a small sample size for body mass analysis (n=6), it provides valuable insights into the adaptability of R. aegyptiacus to diverse landscapes, mainly agricultural and urban environments. These findings underscore the potential influence of water resources on body mass and suggest that cropland and urban areas may serve as important foraging habitats. Future research should focus on larger sample sizes and multi-year data collection to better understand the ecological drivers influencing R. aegyptiacus distribution and body condition, ultimately informing conservation strategies for this ecologically significant species.

Keywords: LULC (Land Use/Land Cover), Rousettus aegyptiacus, Habitat Selection, Buffer Zones, Foraging Range

Introduction

The Egyptian fruit bat (*Rousettus aegyptiacus*) is a large, widely distributed bat species native to Africa and the Middle East, renowned for its ecological significance as a primary seed disperser and pollinator (Ramírez-Fráncel et al., 2022). This species exhibits remarkable dietary flexibility, feeding on a wide range of fruits, including cultivated species like figs, dates, and guavas, as well as nectar and pollen. Consequently, *R. aegyptiacus* plays a vital role in maintaining ecosystem health, contributing to forest regeneration and the pollination of numerous plant species (Del Vaglio et al. 2011; Luĉan et al. 2016).

R. aegyptiacus is known for its adaptability to diverse habitats, ranging from natural environments such as woodlands, savannahs, and forests to anthropogenic landscapes including agricultural lands, orchards, and even urban parks (Hulva et al. 2012; Kafash et al. 2022; Majumdar et al. 2016; Roberts et al. 2016). These bats often form large, stable colonies, roosting in caves, rock crevices, buildings, and occasionally in dense foliage (Shehata et al. 2015). Their nightly foraging flights can extend up to 15 km, representing the average nightly foraging range and a significant area of influence on the surrounding ecosystem (Del Vaglio et al. 2011; Dechmann et al. 2010). The ability to utilize a variety of habitats and food sources has contributed to the widespread distribution of *R. aegyptiacus*, but it also exposes the species to a range of environmental pressures (Ramírez-Fráncel et al. 2022).

Despite their adaptability, *R. aegyptiacus* faces increasing threats from habitat loss and fragmentation caused by human activities such as agricultural expansion, urbanization, and persecution (Aziz et al. 2021; Frick et al. 2020). The conversion of natural habitats to monoculture farming reduces foraging opportunities and disrupts natural ecosystem processes. Urbanization, with its associated habitat destruction and light pollution, can fragment bat populations and alter their foraging behavior. Additionally, persecution due to perceived agricultural damage further threatens local populations (Aziz et al. 2021; Frick et al. 2020). Understanding the ecological factors influencing *R. aegyptiacus* habitat selection within their normal flight range is crucial for developing effective conservation strategies.

Land cover composition is a key determinant of habitat suitability for many wildlife species, including bats. The availability and spatial distribution of different land cover types, such as forests, agricultural lands, and urban areas, can directly impact bat foraging behavior, roosting site selection, and overall population dynamics (Meyer et al. 2015) For *R. aegyptiacus*, which exhibits a wide dietary range and adaptability to various landscapes, the relationship between land cover and habitat use within their normal flight range is particularly complex. . While previous studies have documented the presence of *R. aegyptiacus* in diverse habitats (Fleming and Racey 2010; Hutson et al. 1992), the specific land cover characteristics influencing their distribution and habitat selection in Egypt remain poorly understood.

The Nile Valley and Delta, the study's focal region, is one of Egypt's most agriculturally productive and densely populated areas. The region supports diverse land cover types, including croplands, urban areas, water bodies, and fragmented natural vegetation. However, rapid urbanization and agricultural expansion have led to habitat fragmentation, posing significant challenges for wildlife dependent on these ecosystems. This study aims to fill this gap by analyzing the land cover composition within the average nightly foraging range of *R. aegyptiacus* breeding colonies and examining potential factors influencing their body mass. By doing so, it contributes to a better understanding of the ecological requirements of *R. aegyptiacus* and informs conservation efforts for this important species in Egypt.

Material and method

Data Preparation

Morphometric and Roost Size Data: Data about mean body mass, forearm length, and tibia length were collected from a sample size of 10 bats per colony at each of the six study sites. Roost size estimates were also recorded.

Occurrence Point Data:

The precise geographical locations of *R. aegyptiacus* breeding colonies were determined using data obtained from previous field surveys, as detailed in (El-Gamal et al. 2025) from November 2022 to March 2024. These surveys, which covered six governorates across the Nile Valley and Delta, provided the occurrence records used in both the present study and our previous MaxEnt modeling effort. These colony locations were formatted as a shapefile, with each point representing a colony and containing accurate latitude and longitude coordinates. The occurrence point data was added to ArcGIS version 10.8.

Land Use/Land Cover (LULC) Data:

Land use/land cover data were acquired from the ESRI 2020 Global Land Cover Data. This dataset provided a classified representation of the land surface, categorizing land cover into six distinct classes: Bare ground, Built areas, Crops, Rangeland, Trees, and Water. The spatial resolution of the LULC data was 10 meters. The LULC data was added to ArcGIS version 10.8 for subsequent analysis.

Create Buffers

To assess the land cover composition within the average nightly foraging range of *R. aegyptiacus*, 15 km² circular buffer zones were generated around each documented breeding colony location. This buffer size was selected to represent the approximate average nightly foraging range of *R. aegyptiacus (Del Vaglio et al., 2011; Dechmann et al., 2010).* The "Buffer" tool within the Analysis toolbox of ArcGIS version 10.8 was used. The occurrence point layer was selected as the input feature, and a new polygon layer representing the buffer zones was created. The buffer distance was set to a fixed radius of 15 km².

Overlay Analysis

To determine the land cover composition within each buffer zone, the "Spatial Join" tool within the Analysis toolbox of ArcGIS version 10.8 was used. The buffer zone polygon layer was selected as the target feature, and the LULC data layer was selected as the join feature. The "Spatial Join" tool was used to add information about the LULC contained within each buffer polygon to the buffer layer's attribute table, ensuring all original buffer polygons were retained.

Analysis and Interpretation

Calculating Area:

A new field, "Area_sqkm" was added to the attribute table of the output buffer layer. The field calculator within ArcGIS version 10.8 was used to calculate the area of each polygon in square kilometers.

Summarize by LULC:

The "Summarize" tool within ArcGIS version 10.8 was used to calculate the total area (km²) of each land cover class within each buffer zone and across all buffer zones. The percentage of each land cover class within each buffer zone was calculated by dividing the area of each class by the total area of the buffer zone (15 km²) and multiplying by 100. The total area and percentage of each land cover class across all six governorates were also calculated. Mean percentages and standard deviations of land cover classes were calculated across the six governorates.

Data Analysis and Visualization:

The calculated area (km²) and percentage of each land cover class were tabulated for each governorate (Table 1). The total area and percentage of each land cover class across all six governorates were calculated (Table 2). Mean percentages and standard deviations of land cover classes were calculated across the six governorates (Table 3). The mean morphometric measurements (± SEM) of *R. aegyptiacus* and associated land cover percentages at six colony sites across Egypt (Table 4). The spatial distribution of land cover classes was visualized using a land use/land cover map (Figure 1). A pie chart was created to visualize the percentage of each land cover class within each governorate (Figure 2), facilitating a comparative analysis of land cover distribution across the study area

In R studio, correlation analysis was conducted to examine relationships between mean body mass, forearm length, tibia length, roost size, and land cover percentages using the cor() function. Linear regression models were constructed to assess the predictive power of morphometric and land cover variables on mean body mass and forearm length using the lm() function. Analysis of variance (ANOVA) and the Kruskal-Wallis test were performed to test differences in morphometric measures across governorates. Data was visualized using a pie chart generated in R using the ggplot2 package.

Results

The spatial distribution and composition of land cover types within 15 km² buffer zones surrounding *R. aegyptiacus* breeding colonies were investigated across six Egyptian governorates: Aswan, Damietta, Fayoum, Giza, Ismailia, and Menoufia. The geographical locations of these governorates within Egypt are presented in **Figure 1**, providing a fundamental spatial framework for the study. The overall land use/land cover (LULC) patterns for the study region are depicted in **Figure 1**, providing a spatial context for the subsequent analyses.

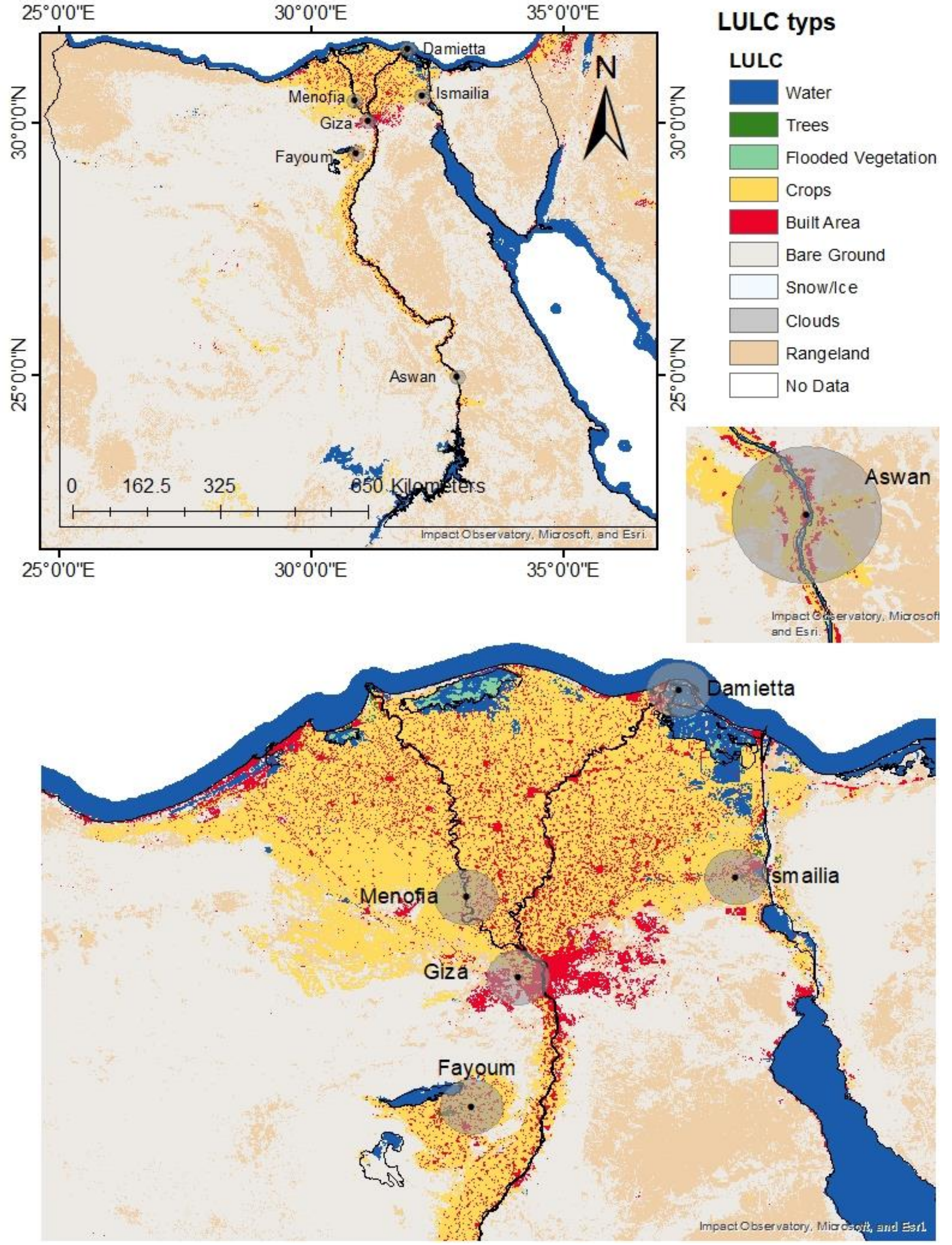

Figure 1: Distribution of land use/land cover types within 15 km² buffers around Egyptian fruit bat (Rousettus aegyptiacus) maternity roost, illustrating the landscape context of reproductive sites.

Table 2 presents the total area (km²) and percentage of each land cover type within the combined buffer zones across all six governorates. Cropland emerged as the dominant land cover, constituting 65.50% of the total buffered area (2029.61 km²). Build areas accounted for 24.70% (766.67 km²), followed by bare ground at 15.40% (477.30 km²). Rangeland, water, and trees represented smaller proportions of the total land cover, at 8.50%, 5.00%, and 0.60%, respectively.

Table 1: Land Cover Composition within 15 km² Buffer Zones by Governorate

Governorate	Water (%)	Trees (%)	Crops (%)	Built-up (%)	Bare Ground (%)	Rangeland (%)
Menoufia	1.76	0.10	85.62	11.21	0.21	1.09
Giza	1.80	0.00	22.97	51.57	20.06	3.58
Ismailia	1.79	1.26	55.74	17.12	10.73	13.36
Fayoum	5.68	1.04	76.44	12.88	3.52	0.44
Damietta	8.13	0.00	6.55	8.57	1.14	0.85
Aswan	2.69	0.16	39.96	7.16	31.90	18.10

A detailed breakdown of land cover composition within each governorate is presented in **Table 1**. This table provides the area (km²) and percentage of each land cover type within the 15 km² buffer zone for each governorate. **Figure 2** visually represents the percentage of each land cover type within each governorate, allowing for a direct comparison of land cover distribution among locations.

Figure 2 and **Table 1** reveal distinct patterns of land cover distribution. Menoufia exhibited the highest percentage of cropland (85.62%), followed by Ismailia (55.74%). Giza was dominated by building areas, constituting 51.57% of the buffered area. Aswan showed a significant proportion of bare ground (31.90%) and the highest percentage of rangeland (18.10%). Damietta had the highest percentage of water bodies (8.13%). Fayoum showed a moderate percentage of crops (76.44%). The spatial distribution of these land cover types, as shown in **Figure 1**, aligns with the patterns observed in **Table 1**.

The overall mean percentage and standard deviation (± SD) of land cover types across the six governorates are presented in **Table 3**. Cropland had the highest mean percentage (28.11%) but also exhibited the greatest variability (SD = 35.46%). This high variability corresponds to the distinct differences in cropland percentages observed across the governorates in **Figure 2** and **Table 1**, with Menoufia and Ismailia showing significantly higher proportions. The mean percentage of built-up areas (20.10%) in **Table 3** reflects the dominance of built-up areas in Giza, as observed in **Figure 2** and **Table 1**. The relatively low mean percentages of rangeland and trees in **Table 3** align with the low proportions observed in most governorates in **Figure 2** and **Table 1**.

Table 2: Total land cover composition within 15 km² buffer zones surrounding study sites, showing the total area (km²) and percentage of each land cover type. Cropland is the dominant land cover.

Type of Landcover	total area of each Landcover type within buffer zones km2	Percentage of Total Area
crops	2029.61211	65.50%
build areas	766.66714	24.70%
bare ground	477.298427	15.40%
rangeland	264.221532	8.50%
Water	154.444258	5.00%
Trees	18.079252	0.60%
Total	3100.32	100.00%

The dominance of cropland, as shown in **Table 2**, is further illustrated in **Figure 1** and **Figure 2**, where Ismailia and Menoufia exhibited particularly high percentages. The spatial distribution of build areas, as shown in **Figure 1**, corresponds to the high percentages observed in Giza, Ismailia, and Menoufia and the overall percentage in **Table 2**.

Table 3: Descriptive statistics showing the mean percentage and standard deviation for each land cover type across the six study governorates.

landcover	Mean Percentage (%)	Standard Deviation (%)
Bare ground	13.78	12.301738
building	20.104	18.880758
crops	28.106	35.458607
Rangeland	4.94	5.494834
trees	3.2338	3.33817
water	19.104	19.172588

Due to the inherent limitation of having a single percentage observation per land cover type within each governorate, further inferential statistical analyses were not feasible. Therefore, the results presented herein are primarily descriptive, focusing on the observed trends in land cover composition as visually represented in **Figure 1**, and **Figure 2**, and quantitatively summarized in **Table 1**, **Table 2**, and **Table 3**.

Table 4 presents the mean morphometric measurements (± SEM) of *R. aegyptiacus* and associated land cover percentages at six colony sites across Egypt. The data reveals variations in body mass, forearm length, head, body length and tibia length among the different governorates. Notably, Damietta exhibited the highest mean body mass (152.93 ± 3.99 g), while Menoufia had the lowest (103.75 ± 4.89 g).

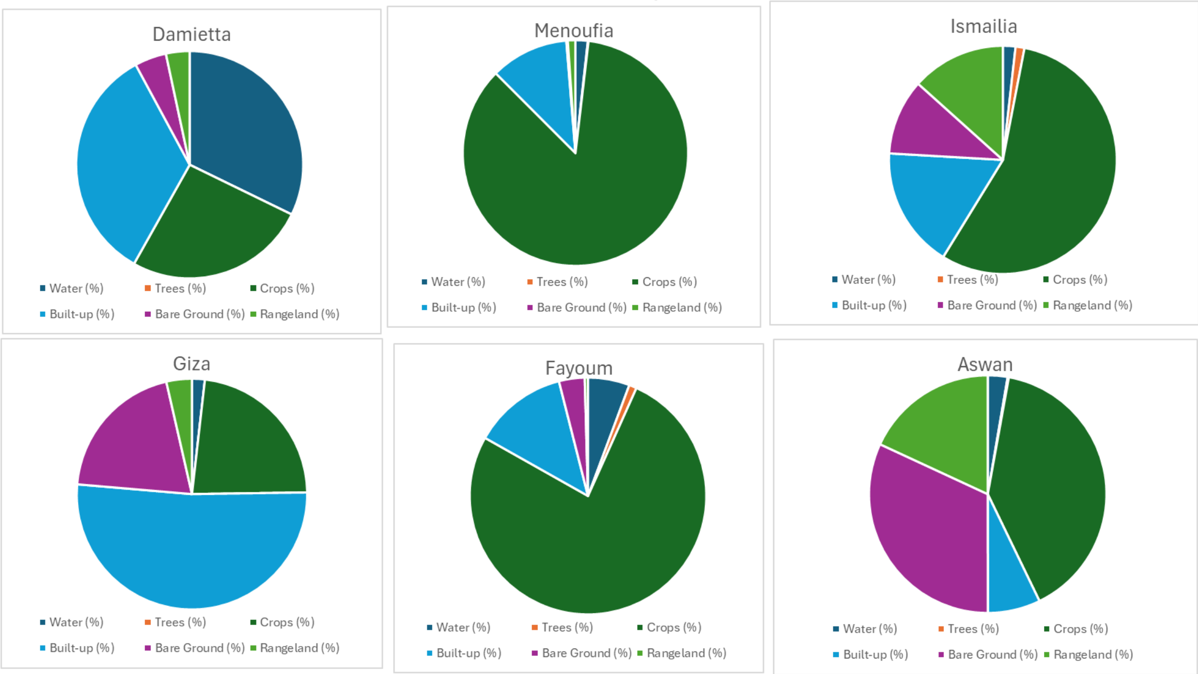

Figure 2 :Percentage of land cover types within 15 km² buffer zones surrounding Egyptian fruit bat (*Rousettus aegyptiacus*) breeding colonies.

Table 4: Mean Morphometric Measurements (± SEM) of Rousettus aegyptiacus and Associated Land Cover Percentages at Six Colony Sites Across Egypt. Symbol '*' indicates that at least one pairwise comparison for that variable was significant ($p < 0.05$) based on the post-hoc Tukey's HSD test. Sample size ten individuals at each site.

Governorate	Mean body size/mass (gm)	Forearm Length (mm)	Head (mm)	Body Length (mm)	Tibia Length (mm)	Roost size	Percentage Cropland	Percentage Building	Percentage Water
Damietta	152.93 ± 3.99*	96.07 ± 0.8*	47.02 ± 0.4*	171.2 ± 3.17*	28.16 ± 3.08*	2500	6.55	8.57	8.13
Menofia	103.75 ± 4.89	79.62 ± 1.36	42.23 ± 0.53	152.88 ± 1.89	33.8 ± 1.95	400	85.62	11.21	1.76
Ismailia	106.3 ± 11.95	89.78 ± 3.24*	42.85 ± 1.43	149.3 ± 5.87	39.66 ± 1.73	3000	55.74	17.12	1.79
Giza	106.11 ± 13.37	89.92 ± 1.66*	43.33 ± 0.71	147 ± 3.46	40.54 ± 1.17	1200	22.97	51.57	1.8
Faiyum	135.64 ± 4.04	95.01 ± 0.61*	45.9 ± 0.39*	155 ± 2.22	42.84 ± 0.56*	1400	76.44	12.88	5.68
Aswan	107.75 ± 4.6*	95.04 ± 1*	46.67 ± 0.43*	162.08 ± 2.97*	19.76 ± 0.76*	640	39.96	7.16	2.69

Statistical analyses, employing both ANOVA and Kruskal-Wallis tests, demonstrated a statistically significant difference in mean body mass among the governorates ($p<0.05$; Table 4). Subsequent post-hoc Tukey's HSD tests indicated that the mean body mass in Damietta was significantly greater than that observed in Menofia, Ismailia, Giza, and Aswan. Furthermore, Faiyum also presented significant differences in mean body mass when compared to other governorates.

Contrary to initial hypotheses, morphometric analyses also revealed statistically significant differences in forearm length, body length, and tibia length across the governorates ($p<0.05$; Table 4). Post-hoc Tukey's HSD tests identified significant pairwise differences for forearm length in Damietta, Ismailia, Giza, Faiyum, and Aswan. Similarly, significant differences in body length were detected in Damietta and Aswan, and for tibia length in Damietta, Faiyum, and Aswan, based on the post-hoc analysis.

Correlation analysis revealed a strong positive correlation ($r = 0.995$) between mean body mass and the percentage of water bodies. A moderate positive correlation ($r = 0.62$) was observed between mean body mass and forearm length. Weaker correlations were observed between body mass and other variables, including cropland percentage and roost size.

Due to the limited sample size, governorate roost sites (n=6), linear regression models encountered singularities and zero degrees of freedom, rendering them unreliable. Therefore, regression analysis did not yield meaningful results in this study.

Discussion

This study investigates the land cover utilization patterns of *R. aegyptiacus* across six governorates in the Nile Valley and Delta, Egypt, focusing on the relationship between land cover composition and body mass. The findings reveal significant variability in land cover types, with cropland dominating in Menoufia and Ismailia, built-up areas prevalent in Giza, and water bodies most abundant in Damietta. A strong positive correlation (r = 0.995) between mean body mass and the percentage of water bodies underscores the importance of water availability for this species (Adams and Hayes 2021). However, the lack of a clear relationship between cropland percentage and body mass suggests that other factors, beyond land cover composition, influence body condition.

Cropland and Body Mass

The absence of a correlation between cropland percentage and body mass may in bat populations, particularly for frugivorous species such as *R. aegyptiacus*, can be attributed to a confluence of interacting ecological and anthropogenic factors. First, the suitability and quality of cultivated crops as a food source for fruit bats are highly variable. Not all crops are metabolically beneficial or palatable to these species, and even preferred fruits demonstrate significant regional variation in nutritional value. Furthermore, the widespread application of pesticides in agricultural systems introduces contaminants into the bats' diet, potentially leading to direct toxicological effects, bioaccumulation, and subsequent impairment of physiological functions and energy reserves, thereby negatively impacting body condition. The designation of *R. aegyptiacus* as an agricultural pest in some regions also leads to direct human-induced mortality and disturbance, further complicating the relationship. Second, seasonal variability in fruit availability may influence foraging success, as crops may not be equally productive year-round. Third, competition among bats or other frugivorous species in high-cropland areas could reduce individual access to resources (Bachorec et al. 2020; Palmeirim et al. 1989). Finally, environmental stressors, such as human disturbance or light pollution, may offset the benefits of abundant cropland. These factors highlight the complexity of the relationship between agricultural landscapes and bat ecology, warranting further investigation (Luĉan et al. 2016).

Adaptability to Urban and Agricultural Landscapes

The prevalence of built-up areas in Giza demonstrates the adaptability of *R. aegyptiacus* to urban environments. This adaptability likely stems from the availability of artificial roosting sites and alternative food sources in anthropogenic landscapes. Similarly, the dominance of cropland in Menoufia and Ismailia suggests that agricultural areas provide critical foraging habitats. However, the high variability in cropland percentages across governorates indicates that *R. aegyptiacus* can thrive in diverse environmental conditions, further emphasizing its ecological flexibility (Hulva et al. 2012; Kafash et al. 2022; Majumdar et al. 2016; Roberts et al. 2016).

Role of Water Bodies

The strong correlation between water body percentage and *R. aegyptiacus* body mass suggests a critical role for water resources. While direct evidence linking water bodies to specific life cycle stages of this species in Egypt is limited, several hypotheses can explain this relationship. Firstly, water bodies provide essential drinking sources, particularly crucial in arid and semi-arid regions. Maintaining proper hydration directly influences physiological condition and thus body mass. Secondly, water bodies often support riparian vegetation, which can serve as foraging sites or corridors for bat movement. Thirdly, the presence of water may enhance insect abundance, providing an additional food source for *R. aegyptiacus* or attracting fruit bearing vegetation (Barclay et al. 2006). Furthermore, water bodies may influence bat behavior. For example, bats may concentrate on foraging activities near water sources to maximize resource availability. Proximity to water could also reduce foraging energy expenditure, allowing for better body condition. It is important to note that further targeted research is needed to definitively establish the specific mechanisms through which water bodies influence *R. aegyptiacus* ecology in Egypt. However, the strong correlation observed aligns with broader ecological principles emphasizing the importance of water resources for bat populations, particularly in dry regions (Luĉan et al. 2016). There are studies that have investigated methods of controlling populations of Egyptian fruit bats, due to them being considered a pest to fruit crops (Korine et al. 1999). These studies have investigated using water-based baits for population control (Taha and Soliman 2019). This highlights that these bats do utilize open water sources. This also highlights that their presence near water sources can bring them into conflict with humans, due to the proximity of farms and orchards to those water sources. water bodies provide essential drinking sources, which are crucial for survival in arid and semi-arid regions like Egypt. Maintaining proper hydration directly impacts physiological condition and thus supports healthy body mass. This need is particularly acute for lactating females, who have significantly increased water requirements to produce milk (Adams and Hayes 2008; Korine et al. 2004).

Conservation Implications

The findings underscore the importance of maintaining agricultural and urban habitats for *R. aegyptiacus*, particularly in regions where natural habitats are scarce. Protecting water bodies and mitigating human-wildlife conflicts, such as reducing persecution due to perceived agricultural damage, are critical for the species' long-term survival. Conservation strategies should focus on enhancing habitat quality and ensuring the availability of key resources, such as water and diverse food sources(Voigt and Kingston 2016).

Conclusion

In conclusion, this study provides valuable insights into the land cover utilization patterns of *R. aegyptiacus* in the Nile Valley and Delta, Egypt. The findings underscore the species' adaptability to diverse landscapes, particularly agricultural and urban environments, and highlight the importance of water availability for body condition. While the study is primarily descriptive due to limitations in sample size and data replication, it lays the groundwork for future research on the ecological drivers influencing *R. aegyptiacus* distribution and habitat selection. These findings have important implications for conservation strategies, particularly in regions experiencing rapid land cover change due to urbanization and agricultural expansion.

References:

Adams R A, Hayes MA (2008). Water availability and successful lactation by bats as related to climate change in arid regions of western North America. Journal of Animal Ecology, 77(6), 1115–1121. https://doi.org/10.1111/J.1365-2656.2008.01447.

Adams R A, Hayes MA (2021). The Importance of Water Availability to Bats: Climate Warming and Increasing Global Aridity. 105–120. https://doi.org/10.1007/978-3-030-54727-1_7

Del Vaglio M A, Nicolau H, Bosso L. (2011). Feeding habits of the Egyptian fruit bat Rousettus aegyptiacus on Cyprus island: a first assessment, 22(2), 281–289. https://doi.org/10.4404/Hystrix-22.2-4587

Aziz S A, McConkey K R, Tanalgo K, Sritongchuay T, Low M R., Yong J Y, Mildenstein T L, Nuevo-Diego C E, Lim V C, Racey P A (2021). The Critical Importance of Old-World Fruit Bats for Healthy Ecosystems and Economies. Frontiers in Ecology and Evolution, 9, 641411. https://doi.org/10.3389/FEVO.2021.641411/BIBTEX

Bachorec E, Horáček I, Hulva P, Konečný A, Lučan R K, Jedlička P, Shohdi W M, Řeřucha Š, Abi-Said M, Bartonička T (2020). Spatial networks differ when food supply changes: Foraging strategy of Egyptian fruit bats. PLoS ONE, 15(2), e0229110. https://doi.org/10.1371/JOURNAL.PONE.0229110

Barclay R M, Barclay L E, Jacobs D S (2006). Deliberate insectivory by the fruit bat Rousettus aegyptiacus. Acta Chiropterologica, 8(2), 549–553. https://doi.org/10.3161/1733-5329(2006)8[549: DIBTFB]2.0.CO;2

Dechmann D K N, Kranstauber B, Gibbs D, Wikelski M (2010). Group Hunting-A Reason for Sociality in Molossid Bats? PLOS one, 5(2), e9012. https://doi.org/10.1371/JOURNAL.PONE.0009012

El-Gamal R, El-Din Sallam A, Sheta B M (2025). Modeling The Spatial Distribution and Habitat

Suitability of The Egyptian Fruit Bat (Rousettus Aegyptiacus) In Egypt. Egyptian Journal of Zoology. https://doi.org/10.21608/EJZ.2025.349759.1128

Fleming T H, Racey P A (Eds.). (2010). Island bats: evolution, ecology, and conservation. University of Chicago Press.

Frick W F, Kingston T, Flanders J (2020). A review of the major threats and challenges to global bat conservation. Annals of the New York Academy of Sciences, 1469(1), 5–25. https://doi.org/10.1111/NYAS.14045

Hulva P, Marešová T, Dundarova H, Bilgin R, Benda P, Bartonička T, Horáček I (2012). Environmental margin and island evolution in Middle Eastern populations of the Egyptian fruit bat. Molecular Ecology, 21(24), 6104–6116. https://doi.org/10.1111/mec.12078

Hutson A M, Mickleburgh S P, Racey P A (1992). Old world fruit bats: an action plan for their conservation. Old World Fruit Bats: An Action Plan for Their Conservation. https://doi.org/10.2305/IUCN.CH.1992.SSC-AP.6.EN

Kafash A, Ashrafi S, Yousefi M (2022). Modeling habitat suitability of bats to identify high priority areas for field monitoring and conservation. Environmental Science and Pollution Research, 29(17), 25881–25891. https://doi.org/10.1007/S11356-021-17412-7/FIGURES/6

Korine C, Izhaki I, Arad Z (1999). Is the Egyptian fruit-bat Rousettus aegyptiacus a pest in Israel? An analysis of the bat's diet and implications for its conservation. Biological Conservation, 88(3), 301–306. https://doi.org/10.1016/S0006-3207(98)00126-8

Korine C, Speakman J, Arad Z (2004). Reproductive energetics of captive and free-ranging Egyptian fruit bats (Rousettus aegyptiacus). Ecology, 85(1), 220–230. https://doi.org/10.1890/02-0632

Luĉan R K, Bartoniĉka T, Jedliĉka P, Rerucha Š, Šálek M, Ĉížek M, Nicolaou H, Horáĉek I (2016). Spatial activity and feeding ecology of the endangered northern population of the Egyptian fruit bat (Rousettus aegyptiacus). Journal of Mammalogy, 97(3), 815–822. https://doi.org/10.1093/JMAMMAL/GYW014

Majumdar K, Majumder J, Datta B K (2016). Vegetation composition, structure and distribution status of trees used by two tropical fruit bat species in degraded habitats of Northeast India. Zoology and Ecology, 26(2), 63–76. https://doi.org/10.1080/21658005.2016.1148978

Meyer C F J, Struebig M J, Willig M R, Meyer C F J, Struebig M J, Willig M R (2015). Responses of Tropical Bats to Habitat Fragmentation, Logging, and Deforestation. Bats in the Anthropocene: Conservation of Bats in a Changing World, 63. https://doi.org/10.1007/978-3-319-25220-9_4

Palmeirim J M, Gorchoy D L, Stoleson S (1989). Trophic structure of a neotropical frugivore community: is there competition between birds and bats? Oecologia, 79(3), 403–411. https://doi.org/10.1007/BF00384321/METRICS

Ramírez-Fráncel L A, García-Herrera L V, Losada-Prado S, Reinoso-Flórez, G, Sánchez-Hernández A, Estrada-Villegas S, Lim B K, Guevara G (2022). Bats and their vital ecosystem services: a global review. Integrative Zoology, 17(1), 2–23. https://doi.org/10.1111/1749-4877.12552

Roberts S H, Jacobs M D, Clark R M, Daly C M, Tsimijaly L H, Rossizela R J, Prettyman S T (2016). A review of the Pteropus rufus (É. Geoffroy, 1803) colonies within the Tolagnaro region of southeast Madagascar – an assessment of neoteric threats and conservation condition. Madagascar Conservation & Development, 11(1). https://doi.org/10.4314/MCD.V11I1.7

Shehata M M, Chu D K, Gomaa M R, AbiSaid M, El Shesheny R, Kandeil A, Bagato O, Chan S M, Barbour E K, Shaib H S, McKenzie P P, Webby R J, Ali M A, Peiris M, Kayali G (2015). Surveillance for Coronaviruses in Bats, Lebanon and Egypt, 2013-2015. Int J Infect Dis, 39, 7–9. https://doi.org/10.1016/j.ijheh.2007.10.003

Taha A, Soliman S (2019). Effect of α-Chlorohydrin water-bait on the fertility of captive males of the Egyptian fruit-bat (Rousettus aegyptiacus) and the proper time for controlling its free-ranging populations in Egypt. Egyptian Journal of Aquatic Biology and Fisheries, 23(4), 227–237. https://doi.org/10.21608/EJABF.2019.53599

Voigt C, Kingston T (2016). Bats in the Anthropocene: conservation of bats in a changing world. https://doi.org/10.1007/978-3-319-25220-9.

الملخص العربي

عنوان البحث: استخدام الأراضي و الغطاء الأرضي بواسطة خفافيش الفاكهة المصرية في وادي النيل والدلتا، مصر

ريم الجمل*[١]، علاء الدين سلام[٢]، رنا الخياط[٣]، بسمة شتا[١]

[١]قسم علم حيوان-كلية العلوم-جامعة دمياط- مصر.
[٢]قسم علم حيوان-كلية العلوم-جامعة قناة السويس- مصر.
[٣]قسم البيولوجي-كلية العلوم-جامعة ام القري -السعودية.

تبحث هذه الدراسة في التوزيع المكاني وأنماط استخدام الغطاء الأرضي لخفاش الفاكهة المصري (Rousettus aegyptiacus) عبر ست محافظات في وادي النيل والدلتا، مصر. باستخدام مناطق عازلة بمساحة ١٥ كيلومترًا مربعًا لتمثيل متوسط نطاق البحث عن الطعام ليلاً لمستعمرات التكاثر، قمنا بتحليل تركيبة استخدام الأراضي/الغطاء الأرضي (LULC) المشتقة من بيانات الغطاء الأرضي العالمي لـ ESRI لعام ٢٠٢٠. كشفت النتائج عن تباين كبير في تركيبة استخدام الأراضي/الغطاء الأرضي بين المحافظات، حيث تهيمن الأراضي الزراعية على المنوفية والإسماعيلية، وتسود المناطق المبنية في الجيزة، بينما تكثر المسطحات المائية في دمياط. لوحظ وجود ارتباط إيجابي قوي (r = 0.995) بين متوسط كتلة جسم الخفاش ونسبة المسطحات المائية، مما يسلط الضوء على أهمية توافر المياه لهذا النوع. رغم أن الدراسة وصفية في المقام الأول نظرًا لقيود مثل رصد واحد لتأثيرات استخدام الأراضي على مستوى المحافظة، وصغر حجم العينة المستخدمة في تحليل كتلة الجسم (ن=٦)، إلا أنها تُقدم رؤى قيّمة حول قدرة خفاش الفاكهة المصري على التكيف مع بيئات متنوعة، لا سيما البيئات الزراعية والحضرية. تُبرز هذه النتائج التأثير المحتمل لموارد المياه على كتلة الجسم، وتشير إلى أن الأراضي الزراعية والمناطق الحضرية قد تُشكل موائل مهمة للبحث عن الطعام. ينبغي أن تُركز الأبحاث المستقبلية على عينات أكبر حجمًا وجمع بيانات على مدى سنوات متعددة لفهم العوامل البيئية المؤثرة على توزيع خفاش الفاكهة المصري وحالة جسمه بشكل أفضل، مما يُسهم في نهاية المطاف في وضع استراتيجيات للحفاظ على هذا النوع المهم بيئيًا.