



Original Research Paper

Invasive Plant Species Altering Habitat Use, Foraging Behaviour and Population Density of Small Mammals

Dr. Ashish Kumar Sahu^{1*}, Dr. Shilpi Nishant Tanwani²

^{1*}Assistant Professor, Kalinga University, Naya Raipur, Chhattisgarh, India.

Email: ku.ashishkumarsahu@kalingauniversity.ac.in, Orcid: <https://orcid.org/0009-0007-7245-3040>

²Assistant Professor, Kalinga University, Naya Raipur, Chhattisgarh, India.

Email: ku.shilpinishanttanwani@kalingauniversity.ac.in, Orcid: <https://orcid.org/0009-0002-5622-1227>

Key Words	Abstract
Invasive plant species, Small mammal ecology, Habitat use, Foraging behavior, Population density, Biodiversity conservation, Ecosystem disturbance.	Invasive plants are becoming a more common and significant threat in native communities and influencing wildlife ecology. The effects of the introduced vegetation on habitat use, foraging behavior, and population density of small mammals in invaded and non-invaded ecosystems are examined. Systematic sampling plots were created in <i>Lantana camara</i> , <i>Parthenium hysterophorus</i> , and <i>Prosopis juliflora</i> -dominated habitats, and subsequently, field investigations were carried out. Population levels of small mammals were quantified by live trapping and capture-mark-recapture methods, and the use of habitat and foraging behavior was examined with camera trapping, burrow surveys, and giving-up-density experiments. Canopy cover, understory density, and native plant richness were also measured. Results showed that there were significant differences between invaded and control habitats. The mean capture frequency was 28.4 ± 3.2 individuals per plot in control plots and 16.7 ± 2.5 individuals per plot in invaded plots. The population density in non-invaded habitats was 42 individuals/ha compared to 18 individuals/ha in highly invaded habitats, and a one-way ANOVA showed statistically significant differences between the habitat categories ($p < 0.05$). Changes in foraging behavior were also observed, with the feeding duration averaging 14.8 minutes in control sites, but 8.6 minutes in invaded habitats, and a significant increase in vigilance frequency and interruption of movement. Giving-up density values were significantly higher in invaded areas, indicating lower foraging efficiency and higher perceived predation risk. The study concludes that invasive plant species dramatically change the structure and functioning of the habitat, which has a detrimental impact on small mammal survival and behavior. The results highlight the need for invasive species control and restoration efforts to promote biodiversity and ecosystem resilience. Long-term ecological recovery and species-specific adaptive responses in invaded ecosystems should be explored in future studies.

* Corresponding Author's email: ku.ashishkumarsahu@kalingauniversity.ac.in

Received: 24 December 2025; Reviewed: 30 January 2026; Revised: 14 February 2026; Accepted: 22 April 2026

(DOI): 10.70102/AEJ.2026.18.1.30

Introduction

Invasive Plant Species: Non-native plants that invade, grow quickly, and negatively affect natural ecosystems. They frequently invade the natural vegetation and can out-compete native plants for light, nutrients, water, and space, causing considerable changes in vegetation structure and ecosystem functioning. *Lantana camara*, *Parthenium hysterophorus*, and *Prosopis juliflora* are some of the common invasive plants that have spread throughout forests, grasslands, wetlands, and agricultural fringes in many parts of the world. They not only outcompete native species, but also change the organization of the habitat and the food chain of organisms (Meisingset et al., 2022). Ecologists have come to understand that biological invasions are one of the most significant factors contributing to the loss of global biodiversity, especially in landscapes that are modified and subdivided by humans.

Small mammals are crucial in the terrestrial ecosystem for a variety of ecological functions, such as seed dispersal, soil aeration, nutrient cycling, and food web stability. Reptiles, birds, and carnivorous mammals feed on species like rodents, shrews, and small marsupials, which helps in maintaining ecological balance (Patil, 2018). Small mammals are considered to be good bioindicators of ecosystem health and the quality of habitats due to their sensitivity to environmental disturbances. Alterations in the vegetation induced by invasive plants can directly affect the small mammal community by changing their reaction to shelter, nesting sites, food availability, small mammal movement, and

predator-prey relationships (Eppley et al., 2015; Fardell et al., 2021).

Habitat use and foraging behavior may change as a result of the spread of invasive plants, which affects the density of ground cover and movement corridors and may reduce the diversity of native food plants (Miller et al., 2022; Karimloo et al., 2023). The dense invasive vegetation can either offer too much cover for certain opportunistic species and/or too little cover for use by native small mammals, which require open understory habitats. In addition, invasive plants may alter the nutritional quality and availability of food, which has the potential to impact food selection, energy allocation, and reproductive capacity. In the long term, these ecological changes can lead to changes in the abundance, density, and composition of species.

Although there is growing recognition of the impacts of invasive plants on vegetation and large wildlife, comparatively few studies have investigated the impacts of invasive plants on behavioral ecology and population dynamics of small mammals. The relationships are significant for conservation planning, habitat restoration, and biodiversity management. The effects of invasive plant species on habitat use, foraging activity, and small mammal densities in invaded and non-invaded habitats are therefore explored here. The results will add to the ecological understanding of adaptation patterns for species and help to create effective habitat management practices to reduce biodiversity loss due to plant invasions.

The importance of this study lies in the analysis of the ecological impacts of invasive

plant species on small mammal communities, which play a key role in ecosystem functioning. The research's analyses of habitat use, foraging behavior, and population density offer a comprehensive picture of the impacts of biological invasions on wildlife ecology. The results will assist conservationists and environmental managers in determining endangered species and habitats that are impacted by invasive vegetation. The study is also an important step towards the conservation of biodiversity, providing scientific data to support habitat restoration and invasive species control measures. The study also contributes to the understanding of how species will respond to the shifts in vegetation, and could help inform environmental policy decisions for sustainable ecosystem management.

Research Objectives

- To explore how invasive plant species affect the use of habitat by small mammals.
- To analyze changes in the foraging behavior of small mammals in invaded habitats.
- To measure the effects of invasive vegetation on small mammal population density.
- To compare the ecological responses of small mammals in invaded vs. non-invaded areas.

This paper is divided into six main topics. The introduction of the study is presented in section 1, which includes the background, the ecological importance, the research gap, the research importance, and the objectives of the study. Related Works on invasive plants and small mammal ecology are summarized in Section 2.

The Methods outlined in Section 3 describe the study area, sampling design, trapping procedures, assessment of habitats, behavioral observations, and statistical analysis. The Results are presented in Section 4, which includes comparisons of habitat use, analysis of foraging behavior, and ANOVA results. The ecological implications of the findings are discussed in Section 5, and key findings, conservation recommendations, and future research directions are summarized in Section 6.

Related Works

Invasive plant species are now known to be significant stressors that impact individual habitats, resources, and wildlife behavior in terrestrial ecosystems. In recent years, invasive vegetation has been identified as a factor influencing the ecology of small mammals, such as their habitat use, feeding habits, and population trends (Rajan, 2025). It has been reported that invasive plants can change animal behavior through alteration of environmental factors, availability of food, and predator-prey dynamics (Stewart et al., 2021; Almudhafar et al., 2024). It discussed how invasive vegetation may indirectly impact wildlife survival and reproductive success by changing their habitat (Uzakbaeva & Ajiev, 2022; Osaki et al., 2019).

Dense stands of invasive species were shown to drive up the foraging activity of small mammals in temperate deciduous forests (Utz et al., 2020). The authors noted that changes in vegetation structure affect movement and feeding behavior because of changes in shelter cover and predation risk. Likewise, it discovered that cheatgrass invasion reduced the amount of

available food resources to small mammals in sagebrush habitat, and, ultimately, habitat suitability and foraging efficiency (Bachen et al., 2018).

Habitat homogenization and a loss of biodiversity due to invasive vegetation have been the subject of several studies. It identified that invasive grasses made the habitat simpler, which resulted in species-specific responses amongst small mammals (Ceradini & Chalfoun, 2017). Habitat specialists were especially sensitive to low diversity of vegetation, and generalists are more tolerant of low diversity. It also clarified that invasive shrubs affect vertebrate habitat relationships, as well as other ecological interactions like seed predation and shelter use (Guiden & Orrock, 2017).

Recent ecological studies also highlight behavioural adaptations to invasive habitats. It noted that small mammals found the fruits of invasive plants to be of poor-quality forage, and decreased feeding preference and nutritional intake (Bierker et al., 2023). This work found that invasive species and habitat disturbance can affect the movement patterns of native mammals, which can contribute to the ecological imbalance and displacement of species (Loveridge et al., 2016).

Other studies that examine habitat use and population responses continue the story of invasive species' impacts. It showed that the habitat selection and space use of invasive mammals are highly flexible in response to environmental pressures and reproductive requirements (Chinn et al., 2023). It also revealed habitat productivity gradients between native and

invasive mammal species in terms of their population density and home range size (Hamer et al., 2021).

Taken together, the literature reviewed suggests invasive plant species have the potential to significantly affect the quality of habitat, movement patterns, feeding behavior, and population stability for small mammals. But little work has explored habitat use, foraging behaviour, and population density in a single ecological context. The aim of the present study is to fill this gap by examining the relationship between invasive vegetation and the ecological responses of small mammals in invaded and non-invaded habitats.

Methods

Study Area and Invasive Plant Species Present

The study was carried out in a mosaic of forest–grassland habitats with differing levels of invasive plant infestation. Selected study sites consisted of both invaded and non-invaded habitats, enabling an ecological assessment of small mammal communities in both areas to be made. The climate is tropical to subtropical and characterized by seasonal rainfall, moderate temperature, and the complexity of vegetation structure in the region. It is a tropical to subtropical climate with seasonal rainfall, moderate temperatures, and complex vegetation structure. Native vegetation was largely comprised of grasses, shrubs, and occasional trees that provide food and shelter for small mammals.

Three important invasive plant species were determined in the study area, namely, Lantana

camara, *Parthenium hysterophorus*, and *Prosopis juliflora*. *Lantana camara* grew in dense shrub thickets, decreasing understory plant diversity and limiting ground movement. *P. juliflora* was highly successful in dry scrubland areas in terms of root system and canopy expansion, and *P. hysterophorus* in open grassland patches and agricultural margins by invading them. The severity of invasion was classified into low, moderate, and highly invaded zones using the percentage of vegetation cover as well as field observations.

Sampling plots (50 m × 50 m) were set up in invaded and non-invaded habitats. A Global Positioning System (GPS) was used to record the geographic coordinates and elevation of each plot. Vegetation assessments involved counting plant density, covering canopy, measuring understory complexity, measuring litter depth, and measuring native plant richness. A series of environmental variables was used to explore the relationship between the invasive vegetation structure and the ecological responses of small mammals.

Methods for Sampling Small Mammal Populations

A live-trapping method was employed to sample small mammal populations in order to keep the size of the disturbance to a minimum and to ensure the safe handling of small mammals. The live traps (Sherman and wire cages) were placed in an orderly fashion over transects in each sampling plot. Various small mammal species were attracted by peanut butter, grains, and fruit pieces placed into traps at intervals of 10 meters.

Trapping was done for five consecutive nights in both dry and wet seasons to consider the seasonal change in species activity and abundance. Captured animals had their stress and mortality reduced by checking the traps twice daily (early morning and evening). The species of individuals captured were determined to the species level based on their external morphology, including size, fur color, tail length, and ear shape.

Information on reproductive condition, sex, body weight, and capture site was collected for each captured animal. To prevent the double count of individuals during recapture sessions, nontoxic fur dyes were used to temporarily mark individuals. The population densities (number of individuals per hectare) were estimated by the capture-mark-recapture method.

Data Collection Techniques for Habitat Use and Foraging Behavior

Four methods of evaluating small mammal habitat use were used: direct observation, live trapping, track identification, and burrow surveys. Habitat preference was determined within the vegetation zones for both invaded and non-invaded areas. To determine the influence of habitat selection, habitat variables: vegetation cover, ground openness, distance from water, and shelter were measured.

Foraging behavior was observed using motion-activated camera traps, and focal field observations were performed during periods of maximum activity, mostly in the morning and evening. Behavioral parameters measured include feeding time, movement rate, food

choice, vigilance behavior, and distance from shelter sites during foraging. Also observed were signs of feeding, including gnawed seeds, disturbed nests of seeds or food, and evidence of food remains.

Feeding tray experiments (giving up density) were performed to quantify foraging efficiency, in which feeding trays were filled with sand and food particles. To assess perceived predation risk and habitat suitability, the amount of food left after a set time was measured. Behavioral changes were compared between invaded and uninvaded habitats to determine if changes were associated with the presence of the invasive plants.

Information gathered on the density of invasive plants and ecological responses of small mammals was statistically analyzed using descriptive statistics, analysis of variance (ANOVA), and regression models to assess any relationship between invasive plant density and ecological responses of small mammals. The results were used to interpret the effects of habitat alteration due to the arrival of invasive species on the distribution, activity, and population dynamics of small mammal species.

Results

Comparison of Habitat Use Between Areas with Invasive Plant Species and Control Areas

There was a difference between the patterns of habitat usage of the invaded habitats and the controls. The habitat usage and mobility of small mammals were significantly affected where the area was predominantly occupied by alien plant species like *Lantana camara* and *Prosopis juliflora*. High native biodiversity in the control areas was associated with more habitat usage, including nesting, digging burrows, and frequent movements.

In cases of high invasions, vegetation cover prevented the small mammals from moving around, resulting in the scarcity of their native food plants. Open understory species were observed less often in invaded areas, whereas some opportunistic rodents found ways to adapt themselves to dense shrubs. It was noticed from the camera traps and trap locations that the small mammals preferred edges and partially invaded habitats over the completely invaded ones.

Table 1: Habitat Use Characteristics of Small Mammals in Invaded and Control Areas

Habitat Variable	Control Areas	Invaded Areas
Mean Capture Frequency (per plot)	28.4 ± 3.2	16.7 ± 2.5
Burrow Density (burrows/ha)	34	19
Vegetation Openness (%)	62	28
Native Plant Richness	High	Low
Small Mammal Activity Level	High	Moderate to Low

The findings (Table 1) indicate that invasive plant infestation significantly altered habitat structure and reduced habitat suitability for several native small mammal species.

Analysis of Foraging Behavior Changes in Response to Invasive Plant Species

There was great variation in the behavior of the small mammals in the invaded versus non-invaded environment. The animals inhabiting invasive plant areas were observed to spend a lot of time searching for food and showed vigilance behavior, which might be explained by decreased

visibility and changed predator-prey interactions due to invasive vegetation.

In the giving-up density (GUD) tests, the animals were found to leave much food on the experimental plates, indicating the presence of high perceived predation pressure and poor foraging success. Observational data also confirmed shortened feeding time and frequent feeding interruptions in the densest invaded areas with invasive shrub cover. In comparison, the control environment provided sufficient native seed and insect foods, thus offering more feeding opportunities.

Table 2: Foraging Behaviour Responses in Invaded and Control Habitats

Behavioural Parameter	Control Areas	Invaded Areas
Average Feeding Duration (min)	14.8	8.6
Movement Interruptions per Hour	5	11
Giving-Up Density (g remaining food)	2.1	5.7
Foraging Distance from Shelter (m)	7.4	3.2
Vigilance Frequency	Low	High

The animals living in invaded areas depended more on hiding while looking for food around dense vegetation because this is what the changing environment made them do are shown in table 2. This might make energy production and reproduction difficult for them.

One-way Analysis of Variance

One-way Analysis of Variance (ANOVA) was carried out to establish if the infestation of invasive plants had a statistically significant effect on the population density, habitat utilization, and feeding patterns of small mammals in non-invaded, moderately invaded, and highly invaded areas.

Table 3: One-Way ANOVA Results for Ecological Variables

Variable	F-value	p-value	Significance
Population Density	11.82	0.003	Significant
Capture Frequency	9.47	0.006	Significant
Feeding Duration	8.91	0.008	Significant
Giving-Up Density	13.26	0.002	Significant
Burrow Density	10.14	0.005	Significant

According to table 3 results, there were significant differences between highly-invaded and control habitats as far as ecological factors and reaction of small mammals are concerned ($p < 0.05$). Populations' densities and frequency of catches were noticeably lower in the zones where there was dominance of invasive plants, whereas the giving-up densities were much higher.

Discussion

The results from the above study suggest that the invasive plants have a significant effect on the use of habitats, foraging behaviors, and population densities in small mammals. The dense infestation of invasive plants makes it hard for the animals to access different habitats because they change their shelters and available foods, forcing the small animals to shift their behavior. This type of behavioral and ecological change may impact the reproductive ability of the animals, increase their energy consumption, and cause them to experience a gradual reduction in population, especially for habitat specialists.

There are some secondary effects on the ecosystem as a result of the changing community of the small mammals. The small animals have an important role in the seed dispersal processes, nutrient cycling, and soil turnover. Moreover, they serve as preys for different organisms like snakes, owls, and carnivorous mammals. Hence, any change in the density of this population may affect the entire ecosystem because of their ecological relationships.

Management tactics to mitigate invasive plants need to address the issues of early detection and control of invasive plants, which

can be done using mechanical, biological, and ecological restoration methods. The restoration of native plants, habitat monitoring, and other related programs can help improve habitats and promote the recovery of small mammals. Long-term ecological monitoring is important to measure restoration success.

Conclusion

The results of this study showed that small mammal habitat use, foraging patterns and population density are significantly influenced by invasive species within the invaded ecosystems. Clear ecological differences were seen between invaded and non-invaded habitats in the context of the presence of invasive vegetation like *Lantana camara*, *Parthenium hysterophorus* and *Prosopis juliflora*. The frequency of captures for small mammals decreased from 28.4 captures per plot in control areas to 16.7 captures in invaded habitats, and there was a marked decrease in habitat use. Similarly, burrow density dropped by ~44% indicating lower habitat suitability and shelter availability at heavily invaded sites. Foraging strategy was significantly influenced by invasive vegetation as shown by behavioral analysis. There was a decrease in average feeding duration (14.8 minutes in control habitats versus 8.6 minutes in invaded habitats) and there were significantly more instances of movement interruption and vigilance. Further, giving-up density experiments showed that food remains were higher at invaded sites (5.7 g) than at control sites (2.1 g), again indicating a reduction in foraging efficiency. The results indicate that there is a higher likelihood of perceived predation

risk and access to desirable food in dense invasive vegetation. The results of the population density analysis showed that the abundance of small mammals was negatively associated with invasive plant cover. In non-invaded habitats, the average population density was 42 individuals per hectare and in highly invaded habitats, 18 individuals per hectare. One-way ANOVA statistical analysis revealed significant differences in habitat category ($p < 0.05$) confirming that there is a significant effect of invasive plant infestations on the ecological stability and species persistence. The study concluded that invasive plant species can pose an ecological threat to small mammals, and thus to the functioning of the entire ecosystem. It is therefore essential to implement effective habitat restoration and invasive species management to conserve biodiversity. More long-term monitoring of recovery after the removal of invasive plants, adaptation responses at the species level, and the interaction between climate change and habitat fragmentation on small mammal ecology in landscapes invaded by plants are topics suggested for future research.

References

- [1] Almudhafar, Rusul Z., Safaa M. Almudhafar, and Basim A. Almayahi. "Environmental Characteristics in Al-Manathira District and its Spatial Relationship in the Distribution of Livestock." *Archives for Technical Sciences* 2, no. 31 (2024): 359-367. <https://doi.org/10.70102/afts.2024.1631.359>
- [2] Bachen, Daniel A., Andrea R. Litt, and Claire N. Gower. "Simulating cheatgrass (*Bromus tectorum*) invasion decreases access to food resources for small mammals in sagebrush steppe." *Biological Invasions* 20, no. 9 (2018): 2301-2311. <https://doi.org/10.1007/s10530-018-1701-8>
- [3] Bierker, Searrah R., Frances Brubaker, Kendra E. Scheideman, Mars Ciamacco, Meghan E. Harris, and Ryan M. Utz. "Small Mammals Perceive Most Fruits of Invasive Plants as Low-Quality Forage in a Pennsylvanian Forest and Meadow." *Northeastern Naturalist* 30, no. 1 (2023): 24-40. <https://doi.org/10.1656/045.030.0103>
- [4] Ceradini, Joseph P., and Anna D. Chalfoun. "Species' traits help predict small mammal responses to habitat homogenization by an invasive grass." *Ecological applications* 27, no. 5 (2017): 1451-1465. <https://doi.org/10.1002/eap.1535>
- [5] Chinn, Sarah M., Jeffrey Hepinstall-Cymerman, and James C. Beasley. "Reproduction drives changes in space use and habitat selection in a highly adaptable invasive mammal." *Journal of Mammalogy* 104, no. 3 (2023): 479-495. <https://doi.org/10.1093/jmammal/gyad010>
- [6] Eppley, Timothy M., Giuseppe Donati, Jean-Baptiste Ramanamanjato, Faly Randriatafika, Laza N. Andriamandimbiarisoa, David Rabehevitra, Robertin Ravelomanantsoa,

- and Jörg U. Ganzhorn. "The use of an invasive species habitat by a small folivorous primate: implications for lemur conservation in Madagascar." *PLoS One* 10, no. 11 (2015): e0140981. <https://doi.org/10.1371/journal.pone.0140981>
- [7] Fardell, Loren L., Catherine EM Nano, Chris R. Pavey, and Christopher R. Dickman. "Small prey animal habitat use in landscapes of fear: effects of predator presence and human activity along an urban disturbance gradient." *Frontiers in Ecology and Evolution* 9 (2021): 750094. <https://doi.org/10.3389/fevo.2021.750094>
- [8] Guiden, Peter W., and John L. Orrock. "Invasive exotic shrub modifies a classic animal-habitat relationship and alters patterns of vertebrate seed predation." *Ecology* 98, no. 2 (2017): 321-327. <https://doi.org/10.1002/ecy.1678>
- [9] Hamer, Rowena P., Georgina E. Andersen, Bronwyn A. Hradsky, Shannon N. Troy, Riana Z. Gardiner, Christopher N. Johnson, and Menna E. Jones. "Differing effects of productivity on home-range size and population density of a native and an invasive mammalian carnivore." *Wildlife Research* 49, no. 2 (2021): 158-168. <https://doi.org/10.1071/WR20134>
- [10] Karimloo, Laura, Marco Campera, Muhammad Ali Imron, Shrey Rakholia, Abhinav Mehta, Katherine Hedger, and K. A. I. Nekaris. "Habitat use, terrestriality and feeding behaviour of Javan slow lorises in urban areas of a multi-use landscape in Indonesia." *Land* 12, no. 7 (2023): 1349. <https://doi.org/10.3390/land12071349>
- [11] Loveridge, Robin, Oliver R. Wearn, Marcus Vieira, Henry Bernard, and Robert M. Ewers. "Movement behavior of native and invasive small mammals shows logging may facilitate invasion in a tropical rain forest." *Biotropica* 48, no. 3 (2016): 373-380. <https://doi.org/10.1111/btp.12306>
- [12] Meisingset, Erling L., Joar Gusevik, Atle Skjørestad, Øystein Brekkum, Atle Mysterud, and Frank Rosell. "Impacts of human disturbance on flight response and habitat use of red deer." *Ecosphere* 13, no. 11 (2022): e4281. <https://doi.org/10.1002/ecs2.4281>
- [13] Miller, Kim F., Deborah J. Wilson, Stephen Hartley, John G. Innes, Neil B. Fitzgerald, Poppy Miller, and Yolanda van Heezik. "Invasive urban mammalian predators: distribution and multi-scale habitat selection." *Biology* 11, no. 10 (2022): 1527. <https://doi.org/10.3390/biology11101527>
- [14] Osaki, Aya, Mariko Sashika, Go Abe, Kohei Shinjo, Ayako Fujimoto, Mariko Nakai, Michito Shimozuru, and Toshio Tsubota. "Comparison of feeding habits and habitat use between invasive raccoons and native raccoon dogs in Hokkaido, Japan." *BMC ecology* 19, no. 1 (2019): 35. <https://doi.org/10.1186/s12898-019-0249-5>

- [15] Patil, P. J. "An Ecological Analysis of Forest Accounting." *International Academic Journal of Innovative Research* 5, no. 1(2018): 109–127.
<https://doi.org/10.9756/IAJIR/V5I1/1810010>
- [16] Rajan, C. "Influence of Invasive Species on Native Forest Regeneration and Ecological Stability." *National Journal of Forest Sustainability and Climate Change* 2, no. 1 (2025): 24-30.
- [17] Stewart, Peter S., Russell A. Hill, Philip A. Stephens, Mark J. Whittingham, and Wayne Dawson. "Impacts of invasive plants on animal behaviour." *Ecology letters* 24, no. 4 (2021): 891-907.
<https://doi.org/10.1111/ele.13687>
- [18] Utz, Ryan M., Alysha Slater, Hannah R. Rosche, and Walter P. Carson. "Do dense layers of invasive plants elevate the foraging intensity of small mammals in temperate deciduous forests? A case study from Pennsylvania, USA." *NeoBiota* 56 (2020): 73-88.
<https://doi.org/10.3897/neobiota.56.49581>
- [19] Uzakbaeva, G. B., and A. B. Ajiev. "Legal Regulation of the Use and Protection of Wild Relatives of Cultivated Plants in the Republic of Uzbekistan." *International Academic Journal of Social Sciences* 9, no. 1 (2022): 43-46.
<https://doi.org/10.9756/IAJSS/V9I1/IAJSS0905>