

From the Perspective of A Little Squirrel, Looking at the Big City

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ABSTRACT

This paper explores how urban squirrels can be used as indicators of various urban conditions from the perspective of small squirrels. Squirrels are adorable wild animals, and their habits and survival methods are essential for humans to live in harmony with them. Scientific studies have shown that urban squirrels can reflect the quality of the urban ecological environment, the health of the ecosystem, the state of environmental pollution, climate change, and the harmonious coexistence of man and nature. Squirrels need suitable habitats, adequate food and water, and their behaviour and habits can provide a wealth of information about the health of urban ecosystems. In addition, squirrels are very sensitive to environmental pollution, and their health status and behavioral changes can be used as early warning signs of urban environmental pollution. By observing the squirrel's reproductive cycle and food storage behavior, we can also understand the impact of climate change on urban ecosystems.

KEYWORDS

Squirrel; Urban Ecology; Environmental Pollution; Climatic Change.

1. INTRODUCTION

The section headings are in boldface capital and lowercase letters. Second level headings are typed as part of the succeeding paragraph (like the subsection heading of this paragraph).

Have you ever encountered a squirrel in the city? Did you know that squirrels have become an indicator reflecting various urban conditions? Do you want to coexist peacefully with these wild squirrels in the city?

Squirrels are adorable wild animals, and in order for us to coexist harmoniously, it is worth learning about their habits and ways of survival. I hope that through this article, everyone can see that squirrels, as a wild population, are gradually urbanizing and playing an important role in cities. They can help urban planners and environmentalists better understand and manage urban ecosystems, promoting the sustainable development of cities.

Scientific research has found that squirrels in cities can reflect the quality of urban ecological environment, the health of urban ecosystems, the status of environmental pollution, climate change, and the harmonious coexistence of humans and nature.

2. URBAN ECOLOGICAL ENVIRONMENT QUALITY:

Specifically, squirrels need suitable habitats, sufficient food, and water sources, so their numbers and distribution can serve as indicators of urban green space quality. If squirrels can reproduce in large

numbers and live long-term in the city, it indicates that the ecological environment quality of the city is relatively high and suitable for the survival of squirrels and other wildlife.

- Suitable habitat: Squirrels require suitable habitats such as parks, green spaces, and gardens with dense tree cover. These places provide stable and safe living environments for squirrels. Understanding more about the utilization of urban habitats by squirrels can be used for urban planning, animal welfare protection, and controlling squirrel populations in urban environments. (Partial text excerpt from Squirrel Research PPT - Advantages of squirrels in the city)

- Adequate food: Squirrels are omnivores, and their main food sources include nuts, seeds, fruits, tree bark and buds, fungi, and insects. Green spaces and parks in the city, if they can provide abundant food, will help the long-term survival of squirrels.

- Water source: Squirrels need a stable water source to sustain life. Water bodies in the city such as lakes, rivers, and artificial water features can provide necessary water sources for squirrels.

Scientists tracked and recorded the activities of red-bellied squirrels in the green spaces of a city to study their behaviors and habitat characteristics. The study was conducted using the focal animal sampling method and continuous recording method from July 2015 to June 2016 at the Shanghai Zoo. The selective analysis of the red-bellied squirrel on different water sources distances results in a "available-utilized" discriminant analysis: The red-bellied squirrel tends to be active within 0-30m from a water source; randomly appears in habitats 30-120m away from the water source; avoids habitats 120-150m away from the water source (this text is excerpted from a research PowerPoint on squirrels' selective preference for different distances from water sources)

Table 1. The Selectivity of Different Water Distance by Red-bellied Squirrels

Spacing of water	Expected proportion use (n=273)	Actual proportion used (n=160)	Observation number	Bailey confidence interval		selectivity
				P-	P+	
0~30	0.494	0.700	247	0.506	0.631	+
30~60	0.183	0.193	81	0.140	0.239	o
60~90	0.128	0.087	49	0.076	0.157	o
90~120	0.106	0.012	31	0.043	0.109	o
120~150	0.087	0.006	25	0.007	0.045	-

3. URBAN ECOSYSTEM HEALTH:

The behavior and habits of squirrels living in cities can also provide us with a wealth of information about the health of urban ecosystems.

- Population size and diversity: The population size and diversity of squirrels are important indicators for assessing the health of urban ecosystems. A healthy ecosystem typically supports a diverse population of squirrels. If the population of squirrels decreases or the diversity decreases, it may indicate that the ecosystem is being polluted.

- Food chain and ecological balance: Squirrels play an important role in urban ecosystems, as they are not only part of the food chain, but also help maintain ecological balance through activities such as seed dispersal and pollen transfer. Squirrels are important dispersers of plant seeds and pollen. Through their behavior, they help plants reproduce and thrive in different locations, maintain plant diversity, and promote ecosystem restoration and stability.

For example: (1) Squirrel and oil vine. Researchers from the Institute of Zoology, Chinese Academy of Sciences, led by Xiao Zhishu, published a paper in the journal Integrative Zoology, revealing the phenomenon of red-bellied squirrels and other rodents providing a "one-stop intimate service" for the pollination and seed dispersal of *Vernicia fordii*. This study confirms the effectiveness of rodents as double mutualists in providing pollination and seed dispersal services for the same plant. (This paragraph and chart are excerpted from the Squirrel Science Research PPT - Squirrels provide "dual services" of pollination and seed dispersal for oil hemp.)



(a) (b) (c)

Figure 1. (a) Flowers on old stems of oil hemp and their structure (photographed by Guiqing Yu in the Hupingshan Nature Reserve, Hunan). (b) The fruit pods of the oil hemp are full of fruits (photographed by Zhishu Xiao in Dujiangyan, Sichuan), (c) Wild squirrel searching for food among the trees

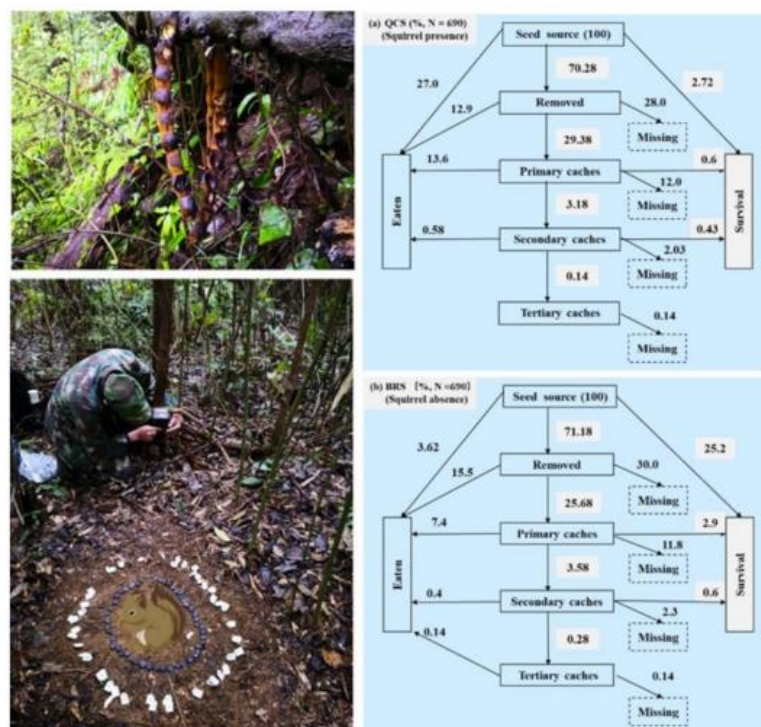


Figure 2. Rodents' feeding and dispersal of *Echinops oleifera* seeds (a. squirrels present in the area; b. squirrels absent in the area)

For example: (2) Squirrel and pine tree. Many squirrels prefer pine seeds. After eating their fill, they spare no effort in storing pine seeds for future needs. Many pine seeds are stored very scattered. Those forgotten pine seeds may grow into big trees in the future. This is an important way for plant seeds to spread through animal transmission. (Excerpt from Squirrel Research PPT - Squirrels and Pine Trees)

4. ENVIRONMENTAL POLLUTION STATUS:

Squirrels are very sensitive to environmental pollution, especially air and water pollution. Therefore, the health condition and behavioral changes of squirrels can serve as early warning signals for urban environmental pollution. By observing the health status of squirrels living in the city, we can detect urban environmental issues earlier and take corresponding measures in a timely manner.

- Air pollution: Squirrels are very sensitive to air pollution, especially to harmful substances in the air such as sulfur dioxide, nitrogen oxides, and particulate matter. These pollutants can affect the respiratory system of squirrels, leading to difficulty breathing, coughing, and other health issues. In addition, air pollution can also affect the food sources of squirrels, as pollutants can deposit on plants and trees, affecting their growth and health.

- Water pollution: Squirrels are also very sensitive to water pollution. Polluted water sources can affect the drinking water safety of squirrels, leading to poisoning and other health issues. Water pollution can also affect the habitat of squirrels, as polluted water bodies can disrupt ecosystems, affecting the survival of plants and other animals.

5. CLIMATE CHANGE STATUS:

The breeding cycle and food storage behavior of squirrels can reflect the impact of climate change. By observing these behavioral changes in squirrels, we can understand the impact of climate change on urban ecosystems.

- Breeding Cycle: Climate change has a significant impact on the breeding cycle of squirrels. For example, with rising temperatures, the breeding period of squirrels may advance. This change may be due to environmental changes caused by rising temperatures, with the growing season of plants advancing, leading to an earlier food supply for squirrels, thereby affecting the physiological and behavioral patterns of squirrels.

- Food storage behavior: The food storage behavior of squirrels is also affected by climate change. Climate change may lead to changes in food supply, which could affect the storage behavior of squirrels. For example, a warm winter may disrupt the hibernation time of squirrels, causing them to need more food reserves to survive the winter. In addition, climate change may also affect the food sources of squirrels, requiring them to search for and store food more frequently.

6. THE COEXISTENCE OF HUMANS AND NATURE:

The interaction between squirrels and humans can also reflect the state of harmonious coexistence between humans and nature.

- A certain organism can only exist in a specific type of ecological environment, which is known as an ecological indicator species. People use these ecological indicator organisms to indicate and assess the types and characteristics of natural environments. We can consider squirrels as an ecological indicator species. They come to the city's parks, green spaces, and other areas to live and thrive, indicating that the ecological environment there is suitable for their survival.

- If squirrels can move freely in the city without disturbance, it indicates that urban residents have a strong awareness of protecting wild animals such as squirrels, and humans and nature can coexist harmoniously in the city.

Squirrels are adorable wild animals, and in order for us to coexist harmoniously, it is worth learning about their habits and ways of survival. I hope that through this article, everyone can see that squirrels, as a wild population, are gradually urbanizing and playing an important role in cities. They can help

urban planners and environmentalists better understand and manage urban ecosystems, promoting the sustainable development of cities.

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