

## Citizen's Perception on Eco-friendly Lifestyle for Conserving Endangered Oriental White Stork and Crested Ibis Bird Species in Japan – Case Studies in Toyoka, Sado and Konosu Cities

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### ABSTRACT

This study aims to find out the relationship between an eco-friendly lifestyle and the attitude towards conservation of endangered Oriental White Stork and Japanese Crested Ibis bird species in Toyooka, Sado, and Konosu cities in Japan. Citizens were surveyed to assess their willingness to spend an eco-friendly lifestyle to protect the above-mentioned endangered bird species through questionnaire surveys. Ecological Mind Evaluation Scale (EM Evaluation scale) developed by Tanaka and Joh (2012) based on Hirose model and Bandura's research on Self Efficacy was applied in this research. This Ecological Mind Evaluation Scale includes 10 factors and it was applied to develop the questionnaire survey. The factor analysis was undertaken based on 4 groups of questionnaire results; environmental awareness, attitude towards environmental conservation, environmental consciousness and self-efficacy. Factor analysis was performed using the varimax method and sample data set comprised 686 valid responses from the three study sites. The KMO values were over 0.80 indicating the sampling was adequate. According to the factor analysis Sado city scored high for environmental awareness and environment consciousness. Toyooka city scored high on self-efficacy and environmental consciousness. Konosu city was compared with the Toyooka and Sado cities, where more advanced habitat conservation activities are already implemented. Findings displayed that the citizens in Konosu city had low awareness about these bird conservation activities, however, they are willing to contribute in such activities in the future. Thus, this study demonstrated that by engaging in environmentally friendly lifestyles, the citizens can contribute to habitat conservation of endangered bird species.

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## 1. Introduction

The Oriental White Stork (*Ciconia boyciana*) is a large white bird with black wing feathers. It has a red skin around the eye, whitish iris, and a black bill. The female bird is slightly smaller than the male, and young birds are white with orange bills (John, 1992). This species can be found in Japan, Manchuria, Korea, and Siberia, and it prefers to live in marshes, pond edges, coastal belts, and other wetlands. As apex predators in their habitats, they play a crucial role (Naito and Hiroshi, 2007). However, due to habitat loss and overhunting, the Oriental White Stork has been listed as an endangered species on the IUCN Red List (Bird Life International, 2018). The growth of paddy cultivation and the heavy use of chemicals severely affected their breeding grounds, leading to their extinction from their habitats. This bird species once became extinct in Japan in 1971, but there have been reintroduction efforts since then. Figure 1 displays a picture of the Oriental White Stork.



**Figure 1**

Oriental White Stork  
Photography by Author



**Figure 2**

Japanese Crested Ibis  
Source: Japan Atlas Nature

The Japanese Crested Ibis is a large white-plumaged bird native to Eastern Asia. It has a partially bare head showing red skin and a dense white plume on the back of the neck. It is the only living member of the genus *Nipponia* (Mie, 2012). This bird was originally found in Russia, Japan, and China. However, it has become extinct from most of its range, with only a natural population remaining in Shaanxi, China (Birds Life International, 2018). The last wild Crested Ibis in Japan died in 2003, but reintroduction efforts began in 2008. This bird is also a predator, and its extinction from its homelands was primarily caused by overhunting, excessive use of pesticides, limited range, and winter starvation (The Japan Times, 2022). Currently, Japan and Korea are the only countries outside China that are actively conserving this bird species. Figure 2 displays a picture of the Japanese Crested Ibis.

Currently, movements for these birds' restoration are spreading throughout Japan, following successes in Toyooka and Sado Island. However, a barrier to these movements is the impact of human land use and the built environment. Rapid urbanization in these areas over the last century has had a significant negative effect on biodiversity, resulting in the extinction of valuable flora and fauna from ecosystems. The built environment, which includes human-

made infrastructure such as rivers, buildings, roads, and agricultural landscapes, has particularly impacted the natural habitats. Encroachment of the built environment onto natural habitats has led to habitat loss and fragmentation. Additionally, the built environment brings humans and wildlife into closer proximity, increasing the potential for conflicts that further contribute to the extinction of valuable flora and fauna from the ecosystem.

Moreover, the built environment has the potential to negatively impact the overall health of ecosystems, especially with the continuous increase in population and the excessive use of harmful chemicals in agriculture. These factors have resulted in a reduction in biodiversity within ecosystems.

Efforts have been made to reintroduce and conserve these bird species in Japan. By integrating green infrastructure development in the built environment and captive-breeding programs, undertaken by the Ministry of Environment, local governments, and NGOs, have been implemented to restore the populations of the Oriental White Stork and the Japanese Crested Ibis. Successful examples include the Oriental White Stork reintroduction program in the Toyooka basin, Hyogo Prefecture, and the Japanese Crested Ibis reintroduction in Sado Island, Niigata Prefecture.

In Toyooka City, the Oriental White Stork has become a symbol of the region and a biodiversity indicator. The city has implemented captive-breeding and reintroduction programs, along with various initiatives to restore the bird's natural environments, such as alternative and balanced rice farming schemes and the development of ecotourism hotspots. As a result, Toyooka City has become one of the top 100 green destinations in the world, with approximately 270 Oriental White Storks now flying in its skies (Japan Travel, 2022).

In Sado Island, the reintroduction of the Japanese Crested Ibis began as a citizen's movement through voluntary activities. Subsequently, the government provided support for the project, and habitat conservation efforts were initiated. The Ministry of Environment has also planned to introduce the bird to mainland areas and is currently accepting applications for habitat-building projects (Nippon.com, 2022).

In Konosu City, which has recently attempted to reintroduce the Oriental White Stork, collaborative works based on the successful experiences of Toyooka and Sado cities have been initiated. Raising awareness among citizens and farmers, improving the habitat environment, and promoting environmental education and conservation efforts are essential steps in reintroducing the Oriental White Stork to Konosu City.

It is essential to draw lessons from successful conservation projects and engage citizens in habitat conservation activities to ensure the long-term survival of these bird species. The impact of the built environment needs to be mitigated through sustainable land use practices, as well as by increasing public awareness of environmental conservation. Therefore, this study focuses on examining how urban residents can actively support green infrastructure from a regional planning perspective. The aim is to

determine the extent to which residents living in the built environment can positively influence the local natural environment through eco-friendly lifestyles, and how their awareness of such lifestyles can be enhanced through educational activities. This research will contribute to understanding the inseparable relationship between the city's-built environment and the surrounding natural environment, which provides a variety of ecosystem services to the urban setting.

In Japan, the development of green infrastructure holds significant importance in the pursuit of a sustainable society. For instance, the improvement of river infrastructure for flood control and the preservation of agricultural lands with stormwater retention functions are crucial aspects. An example of green infrastructure adopting a hybrid approach with nature restoration efforts can be observed in the Maruyama River, located in Toyooka City, Hyogo Prefecture. As part of flood control measures, wetlands are being created in the riverbed space to restore Oriental White Stork, which is integral to the river cross-section expansion. Additionally, the Watarase Reservoir Area in the Kanto region is an internationally recognized wetland under the Ramsar Convention on Wetlands, serving a flood control function. It is also one of the most significant sites for Oriental White Stork restoration in Japan. Another important consideration is that Storks display relatively low fear of humans. Therefore, there is a desire to develop tourist facilities that enable urban residents to become acquainted with storks in close proximity to the built environment of the city. This approach aims to foster a stronger connection between people and nature, promoting conservation efforts and enhancing public appreciation for these bird species.

## 2. Literature Review

During the past few decades, numerous studies have been conducted on the extinction, reintroduction, and continuation of conservation programs for bird species. This chapter provides an overview of relevant literature related to this study, emphasizing the importance of the built environment.

Kikuchi (2003) addressed critical issues concerning the conservation of the Oriental White Stork. He emphasized the necessity of raising awareness about the symbiotic relationship between humans and these bird species, dispelling misconceptions that storks trample and steal rice. Kikuchi highlighted that bird conservation encompasses two aspects: the biological protection of Oriental White Storks and the environmental issues that arise from human-bird coexistence. He also noted that the presence of Oriental White Storks promotes an ecological lifestyle that benefits both humans and other creatures in the ecosystem.

Nakajima et al. (2006), Ezaki et al. (2012), and Naito et al. (2007) emphasized the importance of paddy fields and rivers as crucial habitats for the Oriental White Stork. These birds rely on these areas for their diet, which consists of small wetland animals such as fish, frogs, and insects. However, the use of agrochemicals in paddy fields poses a significant threat to their survival as it affects their food sources. Farmers often hesitate to reduce agrochemical usage to support stork regeneration. On this issue, Onuma and Yamamoto (2009) highlighted that adopting pesticide-free farming

practices to protect the paddy ecosystem can also bring economic benefits to farmers, positively impacting the regional economy.

Regarding reintroduction activities, Honda (2016) pointed out that citizens in respective areas hold a positive view of the Oriental White Stork. Their acceptance of these birds as environmental assets and regional symbols stems not from economic interests or direct benefits to their daily lives, but rather from an appreciation of their ecological significance.

Honda (2008, 2016) investigated the consciousness of citizens in Toyooka and Sado cities six and ten years after the reintroduction of the Oriental White Stork and Japanese Crested Ibis, respectively. In both cities, a relatively high percentage of the population recognized the importance of practicing environmentally conscious living, such as reducing waste and conserving energy, to successfully reintroduce a natural habitat for these birds.

Ryan et al. (2001) revealed that providing appropriate volunteer programs is essential for sustaining motivation in conservation activities. Additionally, Bruyere and Rappe (2007) identified seven major motivating factors for citizen involvement in environmental conservation through principal component analysis (PCA): helping the environment, learning about the natural environment, socializing with like-minded individuals, expressing personal values, project organization, work experience and career development, and improving areas used by volunteers for recreational purposes. They suggested that developing programs based on these motivating factors can attract a larger number of volunteers and facilitate their engagement in conservation activities.

Measham and Barnett (2008) highlighted six motivations for environmental volunteers and classified volunteer activities into five modes: activism, education, environmental monitoring, natural restoration, and sustainable living. They emphasized the importance of treating volunteers as supporting members rather than ordinary laborers, promoting community education as a vital aspect of environmental volunteer groups.

Liarakou et al. (2011) stated that volunteer activities in environmental conservation are influenced by both external and internal factors. External factors include social and cultural influences and organizational operations, while internal factors include motivation, environmental knowledge, previous experiences, attitudes, and locus of control. Among these, internal factors play a dominant role. The concept of locus of control is particularly useful for understanding the motivation behind activities aimed at revitalizing Oriental White Stork habitats. Liarakou et al. noted that individuals with an internal locus of control are more likely to take action, while those with an external locus of control may feel overwhelmed by the complexity and global scope of environmental issues. To encourage citizens' participation, it is important to cultivate an internal locus of control.

In the conservation activities for the Oriental White Stork and Japanese Crested Ibis, citizen consciousness has been recognized as

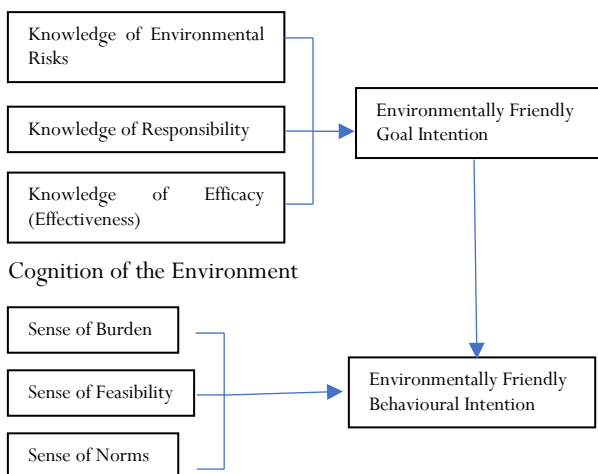
a crucial factor for the future (Honda 2008). Consequently, this study focuses on the significance of activities that raise citizens' environmental consciousness to encourage their involvement in conservation efforts. The study examines how general environmental awareness relates to understanding of conservation activities and the willingness to participate in such initiatives. Liarakou et al. (2011) suggest that a combination of various internal motivations serves as the driving force behind actions, such as participating in revitalization activities.

To establish a link between environmentally conscious behavior and awareness of existing environmental problems, this research incorporates three theories and models developed by Hirose in 1994, Tanaka and Joh in 2012, and Bandura in 1977.

### 2.1 Hirose Model of Environment Conscious Behavior

Yukio Hirose conducted research in 1994 to explore the determinants of environmentally conscious behavior. The study aimed to propose a tentative model of environment-conscious behavior and identify the factors influencing energy and water conservation, recycling, and detergent usage. Hirose's model suggests that there are two phases in the decision-making process of environmentally conscious behavior: "goal intention of a pro-environmental lifestyle" and "behavior intention of environment-conscious behavior." Each phase comprises three factors, as depicted in Figure 3, which presents a general model illustrating the factors and interrelationships between environmentally conscious behavior and its determinants. In this study, the Hirose model of environmentally conscious behavior was adapted to develop the research questionnaire.

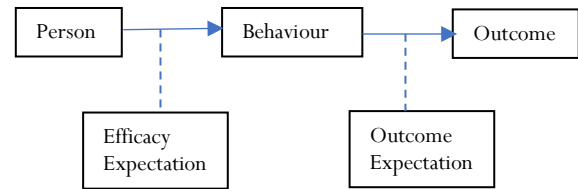
#### Assessment of Environmental Behavior



**Figure 3** A General Model of Factors and Interrelationships Between Environmentally Conscious Behavior and its Determinants

### 2.2 Self-Efficacy Theory by Albert Bandura

The self-efficacy theory posits that psychological processes play a role in creating and strengthening expectations of personal efficacy. Efficacy expectations, different from response-outcome expectancies, involve individuals' beliefs in their ability to successfully execute the required behavior to achieve desired outcomes. While outcome expectancies refer to estimates of the consequences of a particular behavior, efficacy expectations focus on individuals' confidence in their own capabilities to perform the necessary activities. Figure 4 illustrates the distinction between outcome and efficacy expectations. In this study, the self-efficacy theory was employed, and 10 factors were selected to develop a new evaluation scale. Based on this scale, a questionnaire was created and used for the field survey in the selected study areas.



**Figure 4** Difference Between Efficacy Expectation and Outcome Expectation

### 2.3 Ecological Mindset Evaluation Scale by Mikiya Tanaka and Hitoshi Joh

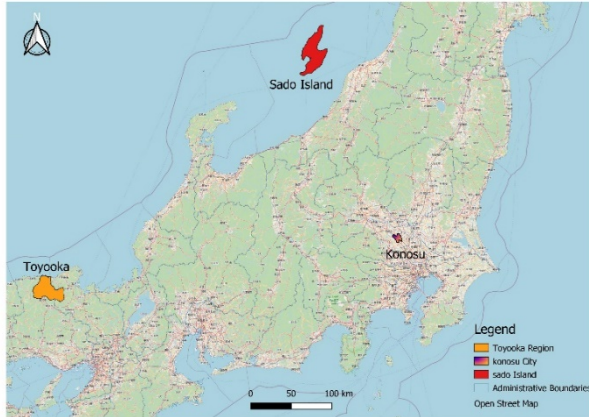
The purpose of this study conducted by Mikiya Tanaka and Hitoshi Joh was to develop an ecological mindset evaluation scale, referred to as the EM scale, to assess the environmental awareness and behavior of the general population. The development of this scale drew upon the revised Human Community Creation Scale (HC Scale) by Moriguci in 2009, the Hirose Model, and Bandura's self-efficacy theory. The EM scale consists of 10 factors, incorporating six factors from the Hirose Model and two factors from Bandura's Self-Efficacy theory. Additionally, two new factors, "Attitude" and "Behavior," were introduced by Tanaka and Joh, replacing the "Environmentally friendly goal intention" and "Environmentally friendly behavioral intention" from the Hirose model.

In this study, the same EM scale was employed to compare the environmentally conscious behavior and its influence on participation in Oriental White Stork conservation efforts across three cities. While successful reintroduction of the Oriental White Stork and Japanese Crested Ibis has already been achieved in the Toyooka Basin and Sado Island, the research aims to learn from these regions and improve awareness and environmental education initiatives in Konosu City. By utilizing insights from these theories and models, the study seeks to contribute to the promotion of sustainable behaviors and increased engagement in the conservation efforts related to these bird species.

### 3. Methodology

#### 3.1 Study Area

The study was carried out in 3 cities of Japan. They are Toyooka, Sado and Konosu cities. Figure 5 displays the locations of these selected areas.



**Figure 5** Study Area  
Source: Prepared by Author

Toyooka is located in Northern part of Hyogo prefecture. The city has an estimated population of 78 348. The total area of the city is 697.55 km<sup>2</sup> (Toyooka city official statistics, 2022). Sado island is located in Niigata prefecture. It is an island with 854.8 km<sup>2</sup>. Konosu is a city in Saitama prefecture. The city has an estimated population of 117 99. The total area of the city is 67.44 km<sup>2</sup> (GIS/National Land Information, 2014).

#### 3.2 Method

##### 3.2.1 The Ecological Mind Evaluation Scale

The Ecological Mind Evaluation Scale (EM Scale) developed by Tanaka and Joh (2012) based on the model and theory by Hirose (1994) and Bandura (1977) which were explained under literature chapter was applied in this research. This evaluation scale has 10 factors. Table 1 displays the EM scale with evaluation groups and the factors under each group.

**Table 1:** Modified EM Evaluation Scale

Evaluation Group	Factors	Theory referred
Environmental Awareness	Effectiveness	Based on Hirose Model (1994)
	Sense of risk	
	Sense of responsibility	
Behavioural Evaluation	Sense of burden	Based on Hirose Model
	Sense of feasibility	
	Sense of norms	
Environmental Consciousness and Environmental Conscious Behavior	Attitude Behaviour	these two factors were redefined by

		Tanaka and Joh (2012)
Self-Efficacy	Efficacy expectation	Based on Self Efficacy theory explained by Bandura (1977)
	Outcome expectation	

##### 3.2.2 Developing the Questionnaire

The purpose of this research is to see how people educationally understand the relationship between general environmental issues and habitat conservation. Using the EM evaluation scale, 30 questions were set covering three types of environmental issues; household wastewater management, solid waste disposal mechanisms, and energy conservation. These environmental issues were selected since they mainly affect the quality of environment causing threat to the biodiversity of the study areas. The questions were made to find out the degree of interest in the participation of endangered bird protection activities, as well as their intentions to purchase rice grown in Oriental White Stork-friendly paddy fields. These questions implied the thoughts and behaviour of citizens related to protection efforts of Oriental White Stork and Japanese Crested Ibis. However, the survey questions intentionally avoided directly asking questions about environmental consciousness on biodiversity, which was the goal of this research.

In terms of questions regarding protection efforts for the Oriental White Stork and Japanese Crested Ibis, four questions were set to understand the participants'

1. degree of interest in conservation activities,
2. support for the said activities,
3. intention to purchase farming products that support these activities, and
4. intention to participate in these activities.

Altogether, there were 34 questions in the questionnaire sheet to study about the citizens' awareness on the reintroduction of these bird species and their general awareness on the environmental issues.

##### 3.2.3 Conducting the Survey

The developed questionnaire was used to undertake the survey in the selected 3 study sites. The purpose of the survey was to analyse the citizens' awareness on the reintroduction of these bird species and their general awareness on the environmental issues. Based on their responses, the relationship between their awareness about general environmental issues, the influence of said awareness on protection activities, and the increase of the Oriental White Stork and Japanese Crested Ibis populations in Sado, Toyooka, and Konosu was analysed. Survey distribution, collection, and dates are displayed in Table 2.

**Table 2:** Details of Questionnaire Survey

	No. of Questionnaire Distributed	No. of Questionnaire Collected	% Collected	Date
Toyooka	500	343	68.6	Dec.14- Dec.16, 2012
Sado	500	224	44.8	Jan.16- Jan.18, 2013
Konosu	500	237	47.4	Feb.1- Feb.4,2013

### 3.2.4 Factor Analysis

Factor analysis was conducted to analyze the EM evaluation scale, and the corresponding factor values can be found in Table 3. The EM model posits that ten distinct factors influence four evaluation group variables: environmental awareness, attitude towards environmental conservation, environmental consciousness, and self-efficacy. The questionnaire consisted of 30 observed variables related to perceptions and attitudes towards environmental issues. The aim of the factor analysis was to demonstrate that these observed variables align with the ten hypothesized factors in the model. Specifically, the analysis aimed to calculate ten factor scores to compare residents' attitudes across the three study sites.

Separate factor analyses were conducted for each of the four evaluation groups. Based on the model's hypotheses, three factors were specified for Environmental Awareness, three factors for Behavioral Evaluation, two factors for Environmental

Consciousness and Environmental Awareness combined, and two factors for Self-efficacy.

The decision to extract the factors of the model as latent factors, rather than directly observed variables, was motivated by the need to validate the model. Given that the questionnaire was targeted at the general public, it was believed that using straightforward, everyday questions to explore whether latent factors are commonly manifested in relation to perceptions of various environmental issues (such as water quality, waste problems, and energy problems) would be more appropriate than directly addressing latent factors.

Factor analysis was performed using the varimax method, utilizing a sample data set comprising 686 valid responses from the three study sites. Observed variables with low commonality were excluded from the analysis. The Kaiser-Meyer-Olkin (KMO) values for the four factor analyses were 0.82 for Environmental Awareness, 0.73 for Behavioral Evaluation, 0.81 for Environmental Consciousness and Environmental Awareness combined, and 0.80 for Self-efficacy. These KMO values indicate that the sampling was adequate.

To compare the three study sites, factor scores of ten were computed for each of the four evaluation groups, as specified by the model. The factor scores for each subject were then averaged within the three study sites to obtain means. These means were subsequently examined for significant differences through an analysis of variance.

**Table 3:** Sample Questions of Modified EM Evaluation Scale and Their Factor Values

Criteria	No.	Questions	Factor 1	Factor 2	Factor 3
			<b>Effectiveness (Efficacy)</b>	<b>Sense of Risk</b>	<b>Sense of Responsibility</b>
Environmental Awareness	Q13	Influence of the lifestyle to increase waste generation in the future.	-0.15	-0.58	0.10
	Q15	Even if the ocean and rivers are polluted, it won't have an impact on me.	-0.18	-0.74	0.09
	Q20	Turning off the lights at home won't have much of an effect on the environment.	-0.35	-0.57	0.07
	Q22	Energy conservation is more effective at commercial facilities (convenience stores, supermarkets, etc.) than at residences.	-0.43	-0.10	0.34
	Q26	Consumers who buy and use products are not responsible for the increase in waste.	-0.40	-0.13	0.17
	Q27	I don't think household wastewater purification will help local streams to be clean.	-0.69	-0.25	0.15
	Q29	I don't think my personal effort to decrease waste will protect the environment.	-0.63	-0.29	0.08
	Q24	Industrial wastewater is more responsible for local river pollution than general household wastewater.	-0.26	-0.14	0.96
Contribution rate			18.34	17.59	13.83
			<b>Factor 4</b>	<b>Factor 5</b>	<b>Factor 6</b>
			<b>Sense of burden</b>	<b>Sense of feasibility</b>	<b>Sense of social norms</b>
Behavioral Evaluation	Q16	Energy conservation won't become effective because there are few methods for it.	-0.76	-0.25	-0.01
	Q17	Awareness of energy savings at home is annoying even it lowers my electricity bill.	-0.73	-0.22	-0.03

	Q25	It's annoying to wash high-waste products such as mayonnaise every time after using them.	-0.31	-0.28	0.19
	Q21	It is difficult to cooperate in the household wastewater purification, because I don't know how to properly dispose cooking waste and leftover food.	-0.19	-0.43	0.03
	Q23	Recycling paper at home is difficult because I have nowhere to store it.	-0.15	-0.73	-0.01
	Q28	Collecting and taking out empty cans and packing paper for recycling is annoying.	-0.40	-0.49	0.15
	Q10	I think families consider their kitchen and laundry household waste.	-0.13	-0.04	0.79
	Q18	I think families want to save energy used at home.	0.10	0.06	0.38
	Q30	Recycling resource waste by families or neighbors is a positive thing.	-0.07	-0.14	0.31
	Q11	With the development of new natural energy, we will not run out of energy in the future.			
Contribution rate			16.24	13.04	10.23
			<b>Factor 7</b>	<b>Factor 8</b>	
			<b>Attitude</b>	<b>Behavior</b>	
Environmental consciousness and environmentally conscious behavior	Q12	I want to keep energy conservation in mind in my daily life for the future because of energy problems.	-0.63	-0.28	—
	Q14	If local municipalities develop purification plans for household waste, I want to help.	-0.57	-0.23	—
	Q19	I want to try my best to reduce waste.	-0.57	-0.26	—
	Q7	To protect river water, I come up with new ways to cook and do laundry.	-0.21	-0.53	—
	Q8	I refuse excess packaging at convenience stores and department stores.	-0.24	-0.56	—
	Q9	I think of the environment when buying electronics and choose energy-saving models.	-0.31	-0.59	—
Contribution rate			20.73	19.17	—
			<b>Factor 9</b>	<b>Factor 10</b>	
			<b>Efficacy expectations</b>	<b>Outcome expectations</b>	—
Self-efficacy	Q4	I'm aware of the environment in my daily life and can frequently turn off lights in my home.	-0.63	-0.20	—
	Q5	I think of the environment and can try not to create more waste.	-0.79	-0.28	—
	Q6	I can properly and thoroughly dispose of cooking oil by wiping it up, etc.	-0.55	-0.24	—
	Q1	I can reduce my electric bill by buying energy-saving appliances.	-0.19	-0.57	—
	Q2	I can reduce the labor required by not buying disposable products and reducing waste.	-0.32	-0.61	—
	Q3	I can protect local rivers by purification of household wastewater from the kitchen and laundry.	-0.21	-0.69	—
Contribution rate			24.98	22.41	—

4. Results

4.1 Survey Results on the Awareness of Oriental White Stork and Japanese Crested Ibis Protection Activity

(1) Degree of interest

The degree of interest was particularly high in Toyooka, followed by Sado and Konosu, (Figure 6). Negative answers such as “Not very interested” and “No interest” constituted 20% of all responses in Konosu, however, such responses were extremely low in Toyooka and Sado.

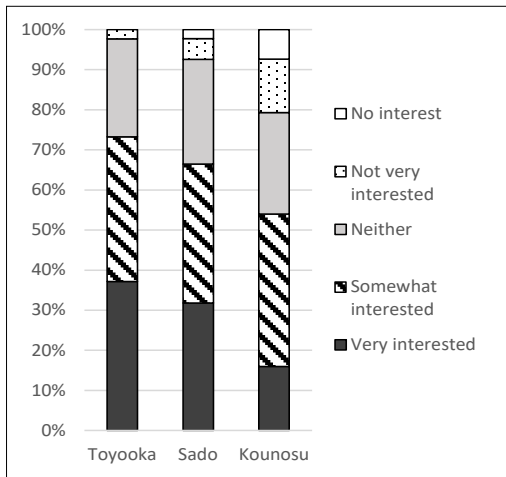


Figure 6 Interest on Oriental White Stork and Japanese Crested Ibis Reintroduction Activities

(2) Degree of support

All three cities demonstrated a high degree of support (Figure 7). The value was higher than the positive responses for the degree of interest. Comparatively, many respondents in Sado and Konosu answered, “Neither.” Although few people in Sado are unaware of the Japanese Crested Ibis, many citizens of Konosu are unaware of activities supporting the Oriental White Stork

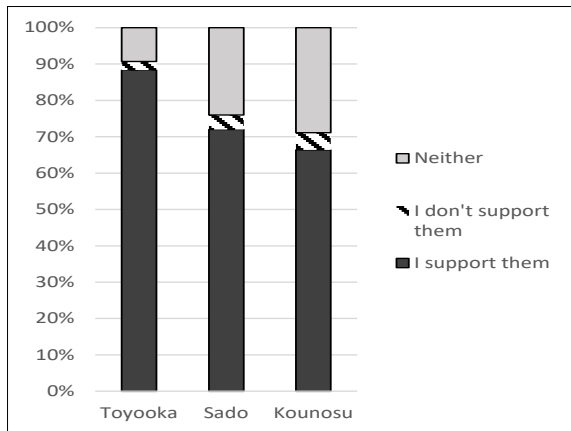


Figure 7 Degree of Support of Oriental White Stork/Japanese Crested Ibis Reintroduction Activities in the Three Cities.

(3) Consumption of Ecofriendly Agricultural Products

Regarding the purchase of agricultural products from farmlands which support Oriental White Stork protection, Toyooka had the highest purchase rate, followed by Sado and Konosu (Figure 8). Compared to Toyooka and Sado, only a few people in Konosu had previously purchased these products. This could be due to the low distribution of Oriental White Stork-friendly rice in this area. However, when counting the number of people who want to purchase said products, However, when considering the number of residents who wanted to try these products, the corporative awareness was same in all three cities.

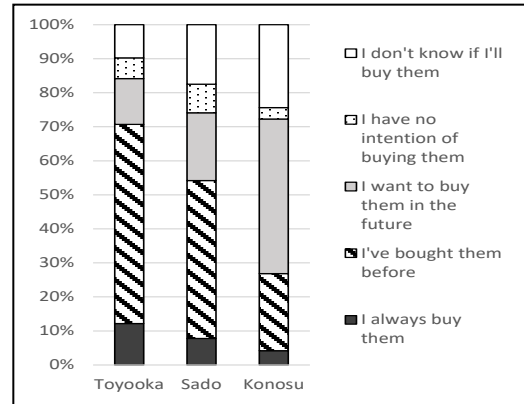


Figure 8 Consumption of Eco-friendly Agricultural Products in three Cities

(4) Degree of Participation in Conservation Activities

Toyooka had the highest degree of participation in conservation activities, followed by Sado and Konosu (Figure 9). A few respondents in Konosu had previously participated in said activities, and the city continues to lag behind in terms of substantial conservation activities. The survey did not inquire about the frequency of participation, however, fewer respondents had practical experience with participation in these activities than those who had purchased environmentally friendly agricultural products.

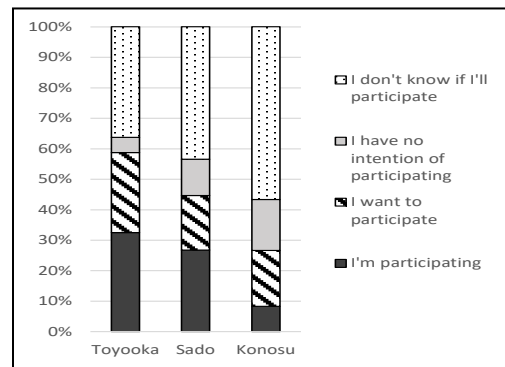


Figure 9 Degree of Participation in Conservation Activities



4.2 EM Evaluation Scale Analysis Results

The valid responses collected from Toyooka, Sado and Konosu for the factor analysis were 267, 192 and 227 respectively. The results of the factor analysis were displayed in table 3. To compare the three cities, their factor score average values were utilized. In terms of Oriental White Stork and Japanese Crested Ibis habitat conservation, the influence of local government and environmental group activities upon public awareness, attitudes, and activities had to be clarified; thus, the data from city residents were only taken into consideration. Respondent samples included 87 people in Toyooka, 178 people in Sado, and 152 people in Konosu. Comparison of the factor score average value of those respondents was conducted on each factor within four categories: environmental awareness, attitude towards environmental conservation, environmental consciousness, and self-efficacy. The difference between means of three sites was tested by ANOVA. No significant differences were found in sense of responsibility (environmental awareness, Figure 10) and outcome expectation (self-efficacy, Figure 11).

• Environmental Awareness

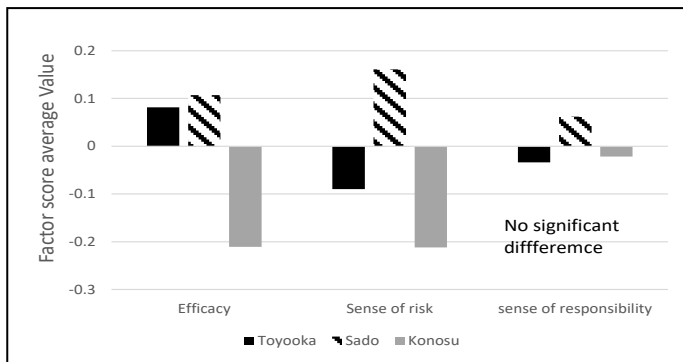


Figure 10 Factor Score for Environmental Awareness

With a cumulative contribution rate of 49.76%, the explanation of the three factors is considered valid. The sense of effectiveness and environmental risk among the three cities, Toyooka, Sado, and Konosu, exhibited a statistically significant difference ( $\alpha < .001$ ). However, the sense of responsibility did not display a significant difference ( $\alpha = .660$ ). Toyooka and Sado had a comparatively high value for efficacy, but Konosu had a comparatively low trend ( $\alpha < .001$ ). Sado had the highest sense of environmental risk, Toyooka had a comparatively low trend, and Konosu had the lowest sense of risk (Figure 8).

• Behavioural Evaluation

Three factors had a cumulative contribution rate of 39.51%, and only those three factors had a low value (Figure 9).

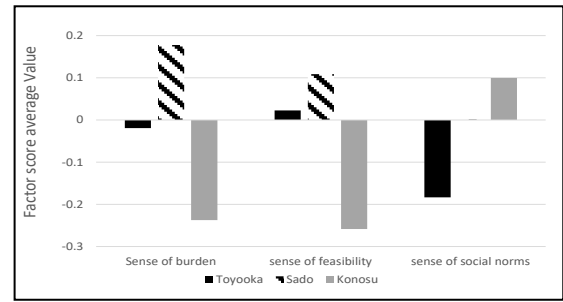


Figure 11 Factor Score for Attitude Towards Environmental Conservation

The sense of burden, feasibility, and social norms in the three cities, Toyooka, Sado, and Konosu exhibited a statistically significant difference ( $\alpha < .001$ ,  $\alpha = .046$  (social norms)). Sado had the lowest sense of burden, Konosu had the highest sense of burden, and Toyooka lays between the two. Sado tended to have a high sense of feasibility compared to Toyooka and Konosu. Toyooka had a particularly low sense of social norms. Sado, however, had an average sense of social norms. Konosu had a comparatively high value, indicating that local families and neighbours have a strong tendency to consider the environment when conducting their daily lives. In Konosu, environmental public awareness activities such as eco-friendly lives and related social norms have begun to take root. In Toyooka, the sense of social norms is low, which demonstrates that Toyooka is not trying to mirror environmental ethics from other societies in terms of their awareness of environmental protection.

• Environmental Consciousness and Environmental Conscious Behavior

Two factors had a relatively low value and a cumulative contribution rate of 39.90%. The semantic compositions of the two factors followed the hypotheses and were validated (Figure 12)

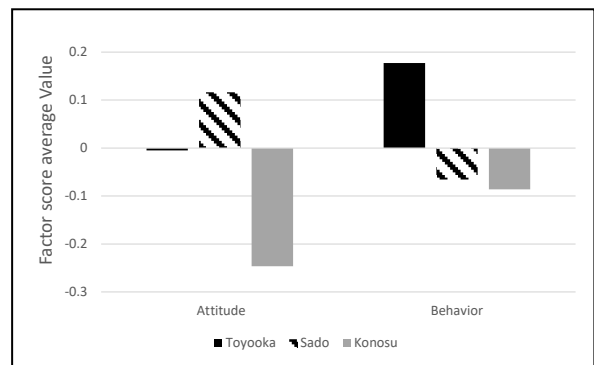


Figure 12 Factor Score Environmental Consciousness

Environmental consciousness in Toyooka, Sado, and Konosu were significantly different ( $\alpha < .001$ ,  $\alpha = .013$ ). Sado had a comparatively high level of environmental consciousness, but Toyooka had a highest level of environmental conscious behaviour. In Toyooka, strong expectations and belief in

environmentally conscious behaviour were demonstrated. Although environmental consciousness was high in Sado, said behaviour was noticeably lower than in Toyooka

- **Self-Efficacy**

Two factors had a cumulative contribution rate of 47.40% and were considered generally valid. The semantic compositions of the two factors followed the hypotheses and were validated (Figure 13)

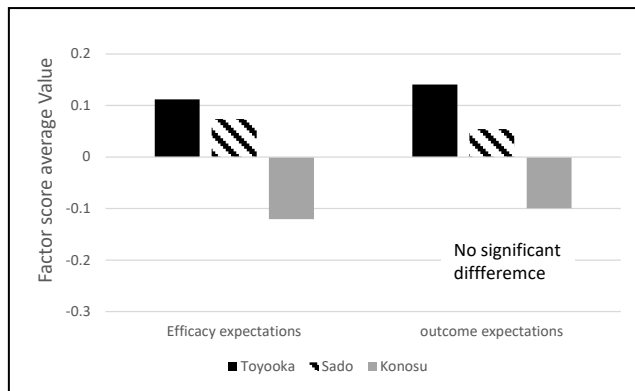


Figure 13 Factor Score for Self-Efficacy

Efficacy expectations were significantly different in the three cities ( $\alpha=.041$ ). They were slightly higher in Toyooka than in Sado, while Konosu tended to have lower efficacy expectations than the other two cities. No significant difference was determined for outcome expectations ( $\alpha=.066$ ), but Toyooka had a higher average value than Sado, and Konosu tended to be the lowest.

## 5. Discussion

### 5.1 Comparison of Awareness in Three Cities on Activities to Protect the Oriental White Stork and Japanese Crested Ibis

#### (1) Interest and support

When comparing the results of degree of interest and support, all three cities produced a high number of affirmative responses in terms of support. The increase of societal interest in environmental issues and the sense of social norms likely influenced these results, and some responses may have included support that does not involve any direct personal change. In the future, rather than focusing on people with negative views towards environmental conservation efforts, the majority of people who answered affirmatively should be targeted, and plans to create new activities with high participation should be investigated.

#### (2) Purchase of Agricultural Products And Participation In Activities

Both Toyooka and Sado had a high number of people who had purchased environmentally friendly agricultural products, but Konosu had half the number of people who had done so. However, when including the number of residents who wanted to try these products, the cooperative awareness was the same in all three cities. The availability of environmentally friendly agricultural products remains low in Konosu; thus, increasing the supply of these products will likely improve results. However, the percentage of people who continually purchased environmentally friendly agricultural products was low as 10% in Toyooka and Sado. These products cost more than generic rice, and the desire to contribute may be satisfied by one-time purchase. Thus, purchasing these products may be the first step towards public participation in conservation activities, it is also important to expand the range of environmentally friendly agricultural products, meet the needs of consumers, and develop ways to add value in order to allow the continuous purchase of these expensive products.

### 5.2 Comparison of Environmental Awareness among Three Cities based on the EM Evaluation Scale

Sado scored high in sense of efficacy and sense of risk under environmental awareness. Although Toyooka scored high for sense of efficacy, it scored low for sense of risk. Although there was no significant difference, Sado had the highest average value for sense of responsibility. Konosu had low scores for all items, and there was a particularly large gap in its sense of efficacy and sense of risk compared to Toyooka. This is probably due to the level of understanding of environmental issues provided by education, as evidenced by the high awareness in Sado due to comprehensive environmental action plans and their sense of environmental risk. Konosu is conducting public awareness activities such as Ecolife Day, but plans are necessary to deepen the understanding of the importance and effectiveness of daily energy conservation and solid and liquid waste disposal.

The questions regarding attitudes towards environmental conservation Sado exhibited a high value for sense of burden and sense of feasibility, Toyooka an average level, and Konosu a very low value. The results in Sado indicate a high awareness of both environmental issues and personal standards. Interestingly, Konosu exhibited a strong sense of social norms, while Toyooka had a very low value. Social norms involve rules set by society or people aside from oneself, which appear in the form of pressure to form ethical attitudes regarding environmental issues. Environmental awareness activities may have increased such awareness in Konosu. There is no clear reason why Toyooka has a low sense of social norms when there is a high degree of awareness of Oriental White Stork conservation activities, but in terms of environmental initiatives, the behaviours caused by these attitudes are unlikely to have been instigated by outside rules.

The self-efficacy results demonstrated that, in terms of environmental awareness and attitude towards environmental conservation, Sado's awareness was high, but contrary to "efficacy expectations," Toyooka had a higher value. Although there was no significant difference, Toyooka had a high average

value among the outcome expectations. A striking difference in environmental consciousness and environmentally conscious behaviour was found between Sado and Toyooka. Environmental consciousness was high in Sado, while environmentally conscious behaviour was particularly high in Toyooka. Konosu exhibited low values for both categories. When comprehensively comparing Sado and Toyooka, Sado displays more awareness, while Toyooka displays more behaviour. In Sado, in terms of environmental awareness and attitude towards environmental conservation, focus upon the level of recognition of personal ethics and environment is high. Konosu had a relatively low score compared to Toyooka and Sado, but it is also characterised by a high sense of social norms within the behavioural evaluation.

It is important to make awareness programs on green infrastructure development with the urbanization in such sensitive areas. Green infrastructure, which includes natural and semi-natural areas with environmental features, plays a vital role in preserving biodiversity, maintaining the natural environment, and improving the health of citizens (Biodiversity, 2023). Therefore, in order to reintroduce and preserve these two species of birds, it is crucial to prioritize the development of green infrastructure in urban areas.

One of the barriers to effectively integrating green infrastructure with the built environment is the limited understanding of ecosystems and the benefits of green infrastructure. Many people may not be aware of the positive impact that green spaces can have on the environment and their own well-being. Additionally, poor spatial planning regulations and conflicts between economic development and environmental preservation can hinder the successful integration of green infrastructure (Biodiversity, 2023).

To address these challenges and promote the conservation of the Oriental White Stork and Japanese Crested Ibis, it is essential to conduct a series of awareness programs in the selected study areas. These programs should aim to educate the local communities about the value of green infrastructure development and its significance in protecting these bird species. By raising awareness about the benefits of green infrastructure, such as enhancing biodiversity, improving air and water quality, and providing recreational opportunities, residents can become active participants in conservation efforts.

Furthermore, the awareness programs should emphasize the importance of proper spatial planning and the need to balance economic development with environmental considerations. By promoting sustainable development practices and demonstrating how green infrastructure can coexist with urbanization, it is possible to overcome conflicts between economic growth and the preservation of natural habitats.

Overall, raising awareness about green infrastructure development and its role in protecting the Oriental White Stork and Japanese Crested Ibis is crucial for their conservation. By conducting targeted awareness programs and addressing barriers such as limited understanding, lack of awareness, and conflicts, it is possible to foster a sense of responsibility and engagement

among residents, ultimately contributing to the long-term preservation of these bird species in urban environments.

### **5.3 Relationship between Environmental Awareness and Awareness of Habitat Conservation Activities based on the EM Evaluation Scale**

The relative gap between the three cities was confirmed via the EM evaluation scale for environmental awareness and awareness on conservation activities and initiatives. In terms of the degree of interest in conservation initiatives, degree of support for them, purchasing environmentally friendly agricultural products, and awareness to participate in conservation activities, the evaluation score for all categories from highest to lowest, was Toyooka, Sado, and Konosu. Several items among the three cities had differing trends in their evaluation levels according to the EM evaluation scale. Konosu exhibited several low EM evaluation scale levels and had a low awareness of conservation efforts.

Toyooka had a higher level of awareness than Sado. Sado had high values for environmental awareness, attitude towards environmental conservation, and environmental consciousness, however, Toyooka had the highest level of self-efficacy and environmental consciousness than Sado or Konosu. Social norms, self-awareness, self-efficacy and environmentally conscious behaviour are important for encouraging participation in Oriental White Stork and Japanese Crested Ibis conservation efforts.

Habitats for Oriental White Stork and Japanese Crested Ibis can currently be found in both Toyooka and Sado. In Toyooka the Oriental White Stork can be seen frequently. According to Honda (2016), the observation of the Oriental White Stork is connected to positive recognition of reintroduction projects. By creating an environment that allows residents to reap the benefits of conservation activities in their daily lives, locals realise that their efforts to protect these birds are not a waste, which is connected to the improve their sense of self-efficacy.

Although such efforts have been commenced in Konosu, yet there are no improvements on captive breeding (stork breeding has initiated from 2022.) or the release of the Oriental White Stork to the wild, and there are few reports of these Storks are flying in the city. In order to receive continuous support for Oriental White Stork habitat conservation activities from residents, plans are required to raise their sense of self-efficacy. Because Konosu residents have a high level of awareness of social norms related to environmental issues, however, it is not sufficient to raise awareness of conservation efforts. In terms of Oriental White Stork habitat conservation, it is required to foster more participation in support activities, and give more educational opportunities describing the purpose of conservation, to the citizens of the area.

## **6. Conclusion**

This research study attempted to clarify the psychological mechanism by which people are motivated to engage in environmental conservation activities to protect the Oriental White Stork and Japanese Crested Ibis. The study was conducted

mainly based on the questionnaire surveys carried out in the selected three cities, Toyooka, Sado and Konosu. The questionnaire was prepared based on the EM Evaluation scale which was developed by Tanaka and Joh. The questionnaire had 34 questions covering four major sections; environmental awareness, attitude towards environmental conservation, environmental consciousness and self-efficacy. The questions basically focussed on energy conservation, solid waste disposal mechanisms and liquid waste disposal mechanisms and it was found that there are significantly different attitudes among people in Toyooka, Sado, and Konosu.

Toyooka exhibited a high level of awareness regarding the Oriental White Stork and Japanese Crested Ibis habitat conservation efforts. In Toyooka, the municipal government plays a leading role in conducting initiatives for facility maintenance, agriculture, tourism, and education. These initiatives have allowed residents to see the results of Oriental White Stork projects in their daily lives, which fosters sympathy. According to Honda (2008), Oriental White Stork was originally a local bird in Toyooka, and that information has triggered the reintroduction of these Storks to the Toyooka as a “local bird”. City residents can support habitat conservation efforts such as canal dredging, weeding, and pesticide-free/chemical-fertiliser-free farming methods simply by purchasing the eco-friendly rice. Social norms are not only a source of pressure from others to personally contribute, but also connect the desire to protect Stork habitat to protect their living environment, which is an important factor of self-awareness and environmental awareness. The EM evaluation analysis for Toyooka residents demonstrated a low sense of risk, low environmental awareness, and low attitude towards environmental conservation, however, the self-efficacy and the environmental consciousness were high, indicating a connection to their high awareness of conservation efforts.

In Sado, resident associations and the municipal government are cooperating in Japanese Crested Ibis captive breeding, wild breeding initiatives, and habitat preservation activities. Moreover, these activities are helpful to expand the number of participating residents in such activities. EM evaluation analysis for Sado residents found high score for the environmental awareness, attitude towards environmental conservation, and for environmental consciousness. However, the sense of self-efficacy was not higher as in Toyooka. Thus, future studies should investigate plans to increase residents’ desire to personally contribute to these activities.

However, Konosu displays a lower score for most of the EM evaluation scale factors showing that Konosu is still at the initial stage of awareness about the endangered bird species and the knowledge about the value of protecting them by adopting eco-friendly lifestyles. Thus, it is required to pay a high attention to Konosu city to create eco-friendly lifestyles there in order to create safe environment to the endangered bird species by considering the lifestyles and other bird promotion campaigns in Toyooka and Sado regions.

There were such initiatives at the past, for example, in 2017,

Konosu established the eco-change point system: As city residents participate in environmental conservation activities such as local clean-up events, depending on their contribution to such activities, they were entered into a lottery to receive rice. The municipality uses town planning funds to purchase eco-friendly rice from farmers who are supporting Oriental White Stork conservation efforts, which means that city residents indirectly support farmers by participating in conservation activities.

Thus, this study investigated the relationship between regional awareness on the Oriental White Stork and Japanese Crested Ibis habitat conservation efforts and general environmental awareness of city residents in their daily lives. The findings of this study highlight the importance of green infrastructure development as a key factor in protecting biodiversity and endangered flora and fauna. Green infrastructure encompasses the blue and green components in land use, providing crucial habitats for various species. However, with the process of urbanization, green spaces are gradually being encroached upon by brown and grey land use components, resulting in a decline in biodiversity and disrupting the balance of ecosystems. Therefore, it is imperative to prioritize the built environment to ensure the protection of wildlife species like the Oriental White Stork and Japanese Crested Ibis on Earth. Moreover, this research reveals that citizen engagement in eco-friendly lifestyles can significantly contribute to the conservation of habitats for the Oriental White Stork and Japanese Crested Ibis. By adopting sustainable practices and making conscious choices in their daily lives, individuals can play an active role in preserving the natural environments necessary for these bird species to thrive.

By emphasizing the importance of green infrastructure development, this study underscores the need for concerted efforts to create a harmonious balance between urbanization and the preservation of biodiversity. It is crucial to raise awareness among city residents about the significance of green spaces and the role they play in supporting diverse ecosystems and protecting endangered species. By promoting a deeper understanding of the benefits of green infrastructure, citizens can be encouraged to participate in conservation activities and take steps towards sustainable living.

This research contributed to understand the psychological mechanism hidden beneath the general answers on consciousness and attitudes towards environmental conservation by applying the modified EM evaluation scale. Further researches are required in terms of developing the regional conservation strategy, considering residents’ participation with their intrinsic mindsets.

In conclusion, this study highlights the interplay between regional awareness of habitat conservation efforts for the Oriental White Stork and Japanese Crested Ibis and general environmental awareness in urban areas. The development of green infrastructure stands as a vital strategy to protect biodiversity and preserve the habitats of these bird species. By fostering citizen engagement and promoting eco-friendly lifestyles, individuals can actively contribute to the conservation and restoration of their natural environment, ensuring the long-term survival of these iconic birds.

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