

# Adjustment of Payments for Ecological Benefits in Traditional Agricultural Areas: Case Study on SADO Island, Japan

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**Abstract:** To date, theories of eco-compensation and biological restoration have been popular, and some models in developed countries are treated as good examples. Here, we not only focus on Japan, but also pay more attention to challenges during this process. Based on a long-term field study on Sado Island, a less developed region in Japan, we attempt to describe how the government carries out environmental remediation towards the reintroduction of ibis (Species name) into the wild, and the conflict between ibis habitat restoration and farm management. We discuss the underlying reasons for this conflict and the negative effect on regional development. We follow policy improvements of the local government and related supplementary help carried out to fix the mismatch between the payment for ecological benefits and that lost by farmers in the pre-period. We conclude that the coordination of interest among different social groups is the key for success in ecological restoration and compensatory measures have to be made to meet the actual needs of the local groups. This case study in Japan can be applied to similar regions with poor environments and urgent environment restoration needs in China.

**Key words:** biological restoration; conflict between humans and nature; payment for ecological benefit (PEB); reintroduction of ibis; Japan

## 1 Introduction

Environmental conservation and ecological restoration are controversial and important topics, in that human beings are suffering from a series of ecological problems such as resource depletion, environmental pollution and desertification of land that are caused by improper behavior such as predatory exploitation or arbitrary destruction of natural resources. Against this background, a series of scientific themes such as biodiversity and ecosystem function, ecosystem management, ecological risks and security, and the ecological responses and effects of global change have attracted much attention in the fields of geography (e.g. Maano 2003; Schroeder 1999), economics (e.g. Hannon 1998; Nuppenau 2002) and bionomics (e.g. Bradshaw and Bekoff 2000; Katherine and Moore 2001) in Japan, the USA and Europe. In China, ecological protection

has been determined to be a basic national policy. Many large scale environmental conservation and restoration projects have already been implemented across the country, for which many scientific issues in ecosystem research are urgently needed (Fu 2010).

It has long been a major topic how to scientifically and rationally coordinate the relationship between economic development and environmental protection, most of which focuses on developing countries. Some authors argue that environmental degradation is a kind of state behavior (Muldavin 1997; Zhang and Wen 2008), while others suggest that state environmental governance inflicts economic harm on undeveloped regions and local residents (Maikhuri *et al.* 2001; Cao *et al.* 2010). These illustrate the conflict between economic development and ecological conservation in developing countries. But what of the situation in developed countries? Is it perfect? Are there

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experiences that the developing world can learn from? To answer these questions, this study concentrates on Japan.

In the past, many researchers applauded the Japanese environmentally sound development model based on study of secondary and tertiary industries and urban life (Uchiyama 2002; Van Berkel, Fujita, Hashimoto and Geng 2009; Chen 2009), but little attention was paid to undeveloped regions such as mountain areas and isolated islands. These studies mainly used second hand data and statistical analyses to describe the general picture and state benefits and lacked cognitive and behavioral studies of the individual. To compensate for the shortcomings of previous studies, we carried out a periodic field study from 2006 to 2008 on Sado Island. Based on questionnaires and interviews we illustrate the difficulties of ecological conservation and restoration from the perspective of farmers and provide new thoughts to resolve these difficulties. We aim to provide policy references to governments at all levels and contribute to local environmental conservation and ecological remediation in under-developed agricultural regions.

## 2 The last habitat of the Japanese crested ibis (*Nipponia nippon*): Sado Island

Sado Island is located in the Sea of Japan, west of the Japanese mainland (Honshu). It is the sixth largest island in terms of area, following Okinawa Island and excluding the Northern territories, and its total area is 857 km<sup>2</sup>. The island consists of two parallel mountain ranges running roughly southwest to northeast enclosing a central plain. The plain is called Kuninaka and is the most populated area (Fig. 1).

By the end of 2008 forests and grassland covered 73.7% of the total area of Sado Island, and the proportion even reaches 90% if one includes cultivated land and water area (Fig. 2). This means that Sado Island is a rich natural environment. The island is also one of the main rice-producing regions in Japan and large paddy fields make it an ideal feeding ground for birds (Otake 2010).

Sado Island is the last natural habitat of the Japanese crested ibis. Japanese crested ibis was an internationally

protected bird and was special Japanese natural treasure before it disappeared from the wild in 2003. In the early 19th century, many crested ibises lived in China, the Korean Peninsula, Japan and Russia, but since then they have been increasingly disappearing. Since 2003, the Chinese species has become the only ibis left in the world (Fig. 3).

In Japan there are three main reasons for the decline and even disappearance of crested ibises (Inui 2007): (i) excessive hunting; (ii) a decrease in the number of large nesting trees due to logging; and (iii) geographical shrinking of the feeding grounds. Ibises eat frogs, small fish and other aquatic animals. But in the same periods of economic growth, the streams and paddy fields where these animals lived were also badly damaged by the uncontrolled use of agrichemicals and chemical fertilizers.

In order to reintroduce the bird to the wild the Japanese Government has been carrying out an artificial breeding program since the 1980s. After nearly 20 years of research and repeated failures, under close mutual cooperation with Chinese scientists, Japan adopted a pair of Chinese ibises, and the egg they produced hatched in Sado in 1999. After long preparation ten hand-reared Chinese Crested Ibises were released in Sado Island in September 2008.

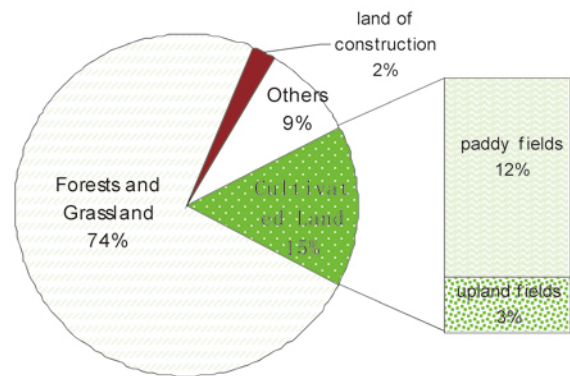


Fig. 2 Land characteristics on Sado Island (2008). Source: The annual report of government of Sado in 2009.

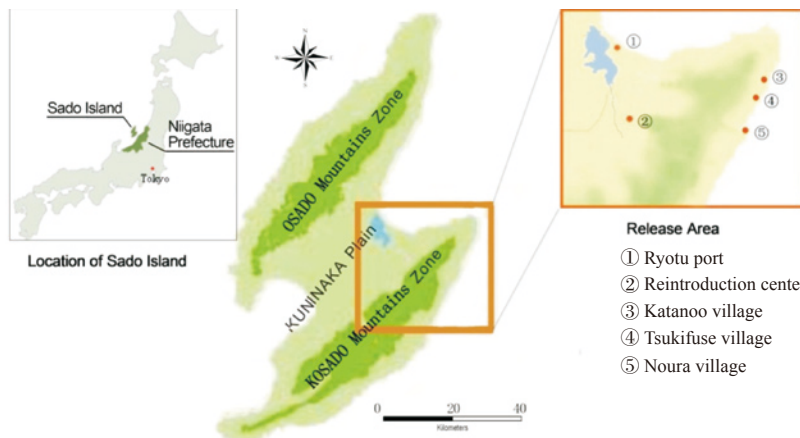


Fig. 1 Map of study area.



Fig. 3 Geographical change of the crested ibis' natural habitat.

Source: Collar, Andreev, Chan, Crosby, Subramanya and *et al.* 2001

### 3 Public and private cooperation for the reintroduction of ibis

In order for the released ibises to be able to adapt to nature again, the public and private sectors in Japan have cooperated over a long period of time. In Sado especially, the government and local residents have carried out ecological restoration and environmental management to create a good environment for the crested ibis. The Japanese Ministry of the Environment, Niigata Prefecture, to which

Sado city belongs, launched the “Reintroduction Propulsion Program” in 2005. The program explicated the final aim of the reintroduction of the crested ibis to the wild, which is to realize the harmonious development of humans and nature, and subsequently to achieve sustainable development. This program will also boost Sado’s international reputation and revitalize the entire area. This program indicates that cooperation between different sectors and areas is an indispensable method of making the reintroduction of the ibis happen (Fig. 4).

After this program was announced, the government and other individuals contributed to developing ibis habitat on Sado Island in order to prepare for the release of birds into the wild. In 2007 and 2008, all projects to do with the ibis carried out by the Niigata Prefecture received 953 million JPY of public funds. Sado city also plans to invest 5.96 billion JPY over ten years from 2005 to 2014 (Su and Akinobu 2009).

The government built a Reintroduction Center for acclimatization in 2004. In 2007, 15 candidate birds for reintroduction were released and trained there. The training included: (i) how to forage; (ii) how to fly; (iii) how to escape predators; (iv) social skills; and (v) breeding training (Yamagishi 2009). During the training period, all 12 mature birds (over two years old) paired up, of which four pairs nested and laid eggs and one pair fledged two chicks.

In the private sector, dozens of environmental NGOs have been founded in Sado City. They have been tackling the introduction of EFF (EFF) and transforming abandoned rice paddies into foraging areas in the East of the Kosado Mountains Zone, the release point (Fig. 1). The activities have spread to 150 sites in 24 areas, with 70.2 ha of intentionally flooded paddy fields in winter (Yamagishi 2009).

### 4 Conflict caused by the reintroduction of ibis to the wild

#### 4.1 Survey methods

In order to accurately monitor changes in the environment,

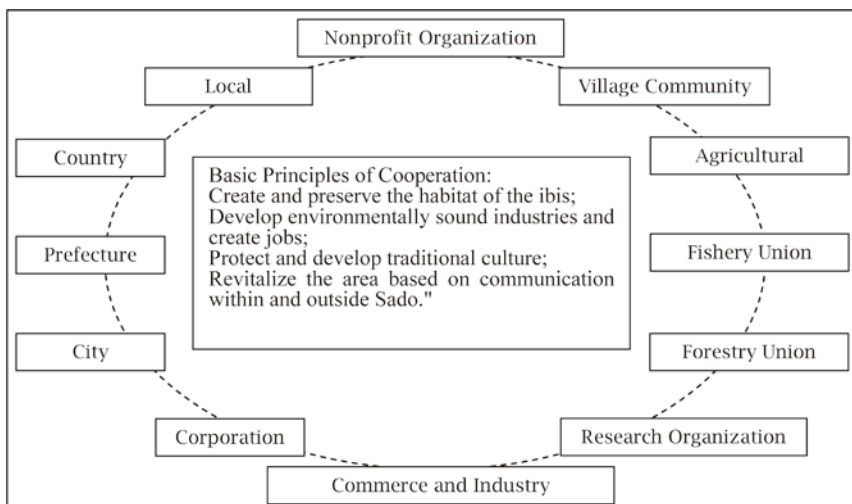


Fig. 4 The Framework of Cooperation for the reintroduction of the ibis to the wild.

society and daily life of local residents during the process of ibis reintroduction, the INUI Research Group of Dokkyo University carried out dozens of field surveys in the East of the Kosado Mountains Zone (the release point on Sado Island) from 2002–2008. This series of studies includes land use, farm management in farm households and the attitude of the local residents to ibis reintroduction, covering more than a dozen villages. This paper focuses on three villages, Katanoo, Tsukifuse and Noura, during 2006–2008 (Fig. 1). One hundred and twenty-eight households were interviewed.

The remainder of this paper is organized as follows. First, we illustrate the attitude of local residents to the reintroduction of the ibis. Then, based on interviews with farmers who are less willing to cooperate, we investigate the underlying causes of conflict between ibis habitat restoration and farm management. Last, we interpret the influence of this conflict in the case study on changes in terraced paddy fields, which are treated as the foundation of regional agricultural development and can also be used as ibis feeding grounds.

Table 1 the attitudes of residents towards the reintroduction of the ibis.

Attitude	Reasons
Positive (57%)	(Have great significance to the conservation of biodiversity (65%) Have great significance to ibis breeding and growing (37%) Will help revitalize SADO Island (35%) Contribute to the protection of the environment (33%) Bring about positive economic effects (17%) Improve the local tourism industry (17%) Contribute to the development of EFF (3%) Others (4%)
Neutral (27%)	Have little knowledge about ibis reintroduction (52%) Have reasons for both supporting and opposing this program (35%) Have no idea about the relationship between this program and themselves (14%) Have no interest in the ibis (12%) Others (13%)
Negative (11%)	Wild ibis will be harmful to growth of crops (50%) Have no ability to carry out EFF (46%) Waste of tax funds through reintroduction of ibis (40%) Wild ibis affects daily life (37%) Reintroduction of the ibis produces no positive effects for themselves (16%) Normal life will be disturbed by increasing tourist numbers (9%) Others (12%)

Notes: “%” rounded to the nearest whole number, multiple answers.

#### 4.2 The conflict between ibis habitat restoration and farm management

The Japanese Ministry of the Environment has set a target of establishing 60 birds in the wild in an area of 20 000 ha in the Eastern Kosado Mountain Zone by 2015. It is an ambitious target, for there are many pieces that need to be put in place before the birds can be released including: (i) securing an area and environment sufficient for the birds to feed, (ii) ensuring that the area is protected, (iii) preparing roosting forests and nesting trees. What is more, this program requires the understanding and cooperation of local residents, particularly farmers (Chikatsuji 2007).

In order to discover the attitude of local residents in the three villages mentioned above, we asked them whether they supported the program of reintroduction. Altogether, 57% have a positive attitude towards this, 11% have a negative attitude, and others are neutral (Table 1). There are two main reasons for residents having a positive attitude. One is that they would like to protect the biodiversity and environment through this program, another is that this program can also contribute to economic and social development in Sado. For residents who are more negative, they are afraid of how the wild ibis may affect their daily lives. The vast majority, 90%, of these residents are farmers, because wild ibises may cause difficulties for their farm production.

#### 4.3 Causes of conflict between ibis and farmer

Uncontrolled use of chemical fertilizers and agrichemicals is one of the main reasons for the extinction of the Japanese crested ibis. In order to secure feeding grounds for ibises, farm households were being encouraged to carry out EFF, which means reduced applications of these chemicals. However, several types of chemicals which are mildly toxic and comparatively less harmful to the environment are permitted. Nevertheless, this EFF causes serious damage to local agriculture.

First, EFF has a larger demand for labor resources. Fig. 5 compares the demanding labor time of field work between EFF and conventional farming (CF) based on the data that we collected in the questionnaire. We can see that farmers had to weed and control pests by hand in EFF which leads

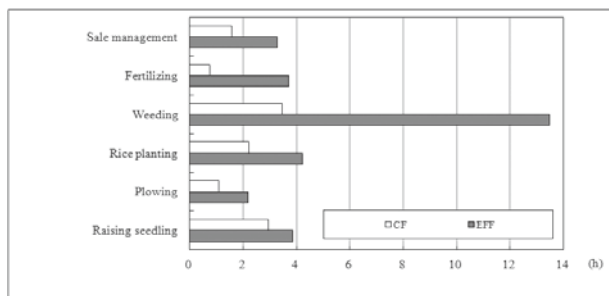


Fig. 5 Comparison of labor time between two farming methods.

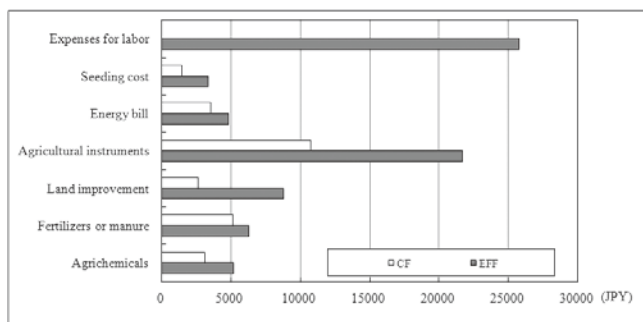


Fig. 6 Comparison of primary production cost of two farming methods.

to longer working time, since pesticides are less used. Some even spent a lot of time on making compost. Overall, the average working hour of EFF is 2.36 times of that of CF. The statistical data shows that agricultural labor has reduced by some 25% during the period between 1995 and 2008 while the proportion of laborers older than 65 increased from 65% to 80%. Based on the survey in Sado, we found that the aging of the agricultural labor force is caused by young people leaving Sado to Honshu for nonagricultural industry.

Second, EFF lead to a decrease in interest for famers (Fig. 6). The cost of fertilizing, energy, crop-dusting, instruments, seeding, land improvement of EFF was 23%, 37%, 66%, 102%, 127%, 234% higher than that for CF, respectively. What is more, labor expenses were even higher. In CF all the work could be finished inside a family, but EFF demanded longer working hours than a family could bear. Some families had to employ others to undertake the heavy field work. All these added extra costs for each farm households. The whole cost each ha of CF was 40550 JPY while that of EFF was 126080JPY, which means that the cost of each farm household increased by two times after adopting EFF.

Finally, we compared the return and cost of rice farming before and after EFF in Sado (Table 2). After carrying out EFF, fertilizer and pesticide usage was largely reduced and the price of organic rice increased as well. Rice yields decreased by 16.1%, but the return each ha increased. However, the overall profit of each farmer reduced because of the doubling of production costs.

Table 2 Analysis of returns and expenses from rice farming in Sado.

Item	Unit	CF	EFF
a. Rice yields	(kg 0.1ha <sup>-1</sup> )	562	484
b. Rice price	(JPY kg <sup>-1</sup> )	260	420
c. Output (a×b)	(JPY 0.1ha <sup>-1</sup> )	146120	203280
d. Cost	(JPY 0.1ha <sup>-1</sup> )	40550	126080
e. Subvention	(JPY 0.1ha <sup>-1</sup> )	0	24000
f. Net operating income (c-d+e)	(JPY 0.1ha <sup>-1</sup> )	105570	101200

Based on the survey in Sado in 2009.

From the Reintroduction Propulsion Program in 2005, each farm household could get subvention from Japanese government as eco-compensation. By 2008, the amount was 24000JPY per 0.1ha, less that the increase in production costs.

#### 4.4 Negative impacts of the conflict between ibis and farmer

The local society is experiencing trouble caused by conflict between ibis habitat restoration and farm management. The greatest problem is that paddy fields are being abandoned, although they are very important to human beings and nature.

According to estimates, an adult ibis needs 150 to 200 g of food per day. This means that 4.4 t of food are needed if the target of establishing 60 birds in the wild by 2015 is to be achieved. If the ibis is to rely only on small animals in paddy fields, 500 ha are needed (Inui 2009). There are currently more than 7000 ha of paddy fields in Sado. Does this mean that the target of 60 birds is to be easily achieved? The answer is probably not a simple one.

As seen in Fig. 7, the area of paddy fields in Sado declined by 2500 ha from 1990 to 2008, and those remaining cannot be used entirely for ibis feeding grounds, since the ibis only lives in mountain areas far removed from human beings (Inui 2008). Further, 60% of the total area of paddy fields in Sado is located in Kuninaka Plain alone, so only terraced fields in the mountains can function as feeding grounds for the ibis. However, these terraced paddy fields are abandoned and idle.

Terraced paddy fields also have great significance for the production and life of humans. They can be used for agricultural production and fulfill other functions. For example, they help to conserve water and soil, to control geological hazards, to protect biodiversity and preserve rural landscapes. However, terraced fields are difficult to cultivate fully mechanically, which means that the production cost is higher than that of flat fields. According to our questionnaire data, the main reason for the abandonment of terraced paddy fields is a lack of labor (Table 3).

This is related to ibis protection. EFF for the benefit of the ibis involves a high demand on labor, and there is not enough labor in farm households. Therefore, farm households have to reduce their agricultural scale, and so the terraced paddy fields with high production costs are abandoned first. This is not good for substantial agricultural development, and also has a negative influence on the reintroduction of the ibis.

#### 4.5 The adjustment of PEB and other aid from the local government

The reintroduction of the ibis to the wild is the most famous biological restoration in the 21st century in Japan. However, our survey found that local farmers were against it for a long time and biocompensation lagged behind that expected. In order to improve the situation, Sado city claimed more

financial support from the national government and adjusted the compensation in 2009.

First of all, the amount of the subvention was heightened. From April 2009, the subvention to EFF was doubled, which would be equal or higher than the profit gap between EFF and CF. In other words, the economic profit loss of each farm household was recompensed fully by the government and the most important reason farmers had against the reintroduction of the ibis to the wild was removed.

Then several measures were taken to lower production costs. The Sado Government established a public fund to monitor and adjust the price of agricultural material, such as greenhouse film, fertilizer, and pesticides special to EFF. Meanwhile, SADO city and agricultural cooperative coinvested to open one-stop service centers for supplying, marketing and distributing the above-mentioned agricultural materials. The reduction of circulation links also lowered production costs.

Sado city and the agricultural cooperative coestablished an organic crops certification system with “Hometown of Ibis” as a registered trade mark in April 2009, which raised the procurement price of certificated crops. Meanwhile, they strengthened publicity in major cities in Japan and cooperated with large supermarkets to increase the marketing of this brand.

Another strategy was business model promotion, namely the adoption of terraces. Terraces were normally organized by the farmers inside Sado Island, while people outside of the island were encouraged to adapt the terraces by Sado city. These people needed to give farmers money as adoption payments and did field work during the busy season and so they got some farm products during the harvest as well.

The strategies above meant that the area of environmental friendly rice was increased from 1600 ha (25 % of the total rice area) in 2008 to 2600 ha (42 % of the total rice area) in 2010.

### 5 Conclusion and discussion

This case study from Sado shows that biological and environmental issues are a growing concern but are still faced with challenges. The reasons are multiple, such as unsound economic policies, the over importance of the authorities and the ignorance of the local citizens’ appeal for a better physical life. All these lead to the conscious or unconscious confrontational behavior of residents which in turn results in the deterioration of ecological environments.

The coordination of interest among different social groups is a key for the success of ecological restoration and conservation and PEB is recognized as an effective method. However, the implication of PEB is currently in the exploratory stage in most counties. Compensatory measures have to meet the actual needs of the local groups and financial compensation is currently the most common way for environmental conservation and ecological remediation domestically and internationally. The situation in Sado highlights that direct financial compensation to farmers only is not enough. It may protect basic livelihoods, but it does not provide a fundamental solution to the problem. In addition more work could be done such as building regional brands and strengthening human resource support to solve the problem.

Table 3 Reasons for abandonment of terraced paddy fields.

Items	Percent(%)
Labor scarcity	86
Poor land condition	58
Nobody to accept the idle land	33
Bad traffic condition	31
Bird and animal damage	29
Abandoned farming	11
Others	12

Notes: “%” rounded to the nearest whole number, multiple answers.  
Source: Authors’ questionnaire carried out in 2006–2008.

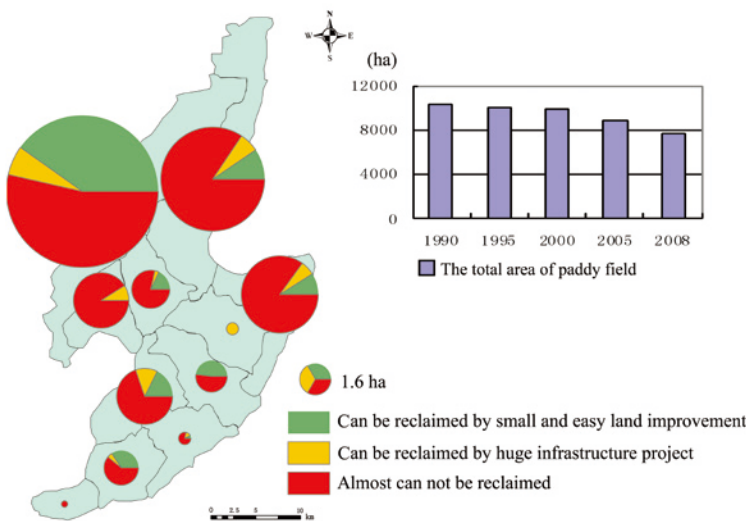


Fig. 7 Changes to paddy fields and the distribution of abandoned land.

Source: The annual report of agriculture, forestry and fisheries division of Sado in 2009.

This study area is a traditional agricultural area with poor economic development and low income levels in Japan. When the country attempted to promote harmonious development between man and nature, this region became a national key ecological protection area. There are a lot of similar regions in China. In 2011, the Chinese government issued a Major Function Oriented Zoning Plan, which classified 25 regions as national level high-intensity limits for industrialization, urbanization, and ecological function areas. These 25 regions are lag economically and have weak industries. Residents there have low living standards. They are similar with Sado and will face similar problems and challenges when carrying out EFF.

In order to ensure the smooth implementation of ecological remediation, the benefit needs to be shown to the public upfront. Then residents can see the significance of ecological remediation. Residents in ecological protection areas should enjoy the results of national development as much as possible, with increasing financial compensation for environmental protection. Finally, economic, social and legal means should be used to find ways of compensation suitable to each region, and therefore to balance the unfair distributions among people and regions.

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## 传统农区生态修复中的经济补偿探讨——以日本佐渡岛为例

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**摘要:** 当前, 生态修复和生态补偿的相关理论在发达国家较为盛行, 也有许多值得借鉴的模式。本文以日本为研究对象, 重点研究了在推行生态修复和生态补偿过程中的经验教训。基于长时间在日本佐渡岛上的实地调研和深度访谈, 从微观的视角分析在各级政府积极推进朱鹮生息环境修复的背景下, 以农户为主体的区域居民的意识 and 行为, 揭示了区域环境整治和农户农业经营之间的矛盾。通过深入比较传统农业经营和环境友好型农业经营在经济效益上的差异, 阐明了农户反对朱鹮野化放飞和生态修复的必然性。从而提出为了尽快扭转发展中国家区域间、群体间生态效益及相关经济效益分配不公平的局面, 利用经济、社会政策以及法律手段, 寻求切合区域实际、各具特色的生态补偿方式的重要性。

**关键词:** 生态修复; 人地矛盾; 生态补偿机制; 朱鹮野化放飞; 日本