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Grand Design for Reintroduction of the Oriental White Stork[1]

*** Hyogo Prefectural Board of Education[2] and Hyogo Park of the Oriental White Stork[3] (Translated by Yasuo Ezaki[4] and Junko Sagara[5])**

Preface

It has now become widely known both within this country and abroad that Hyogo Prefectural Government has been pursuing a project to re-introduce Oriental White Stork *Ciconia boyciana* in Toyooka City.

Hyogo Park of the Oriental White Stork (HPOWS) started experimental release of the Oriental White Stork (OWS) in 2005 based on the "Oriental White Stork Reintroduction Promotion Plan[1)]" (hereinafter referred to as "Promotion Plan") adopted in March 2003. The released storks established themselves out in the fields, and a successful breeding in 2007 produced the first fledgling.

Successful breeding is continuing and the size of the OWS population out in the fields (hereinafter referred to as "managed population" because it is helped by articial feeding as described later) has reached 39 at the end of 2010.

The term "reintroduction" used here includes both "reintroduction[2)]" of species once extinct from the wild and "re-establishment" of a population[3)].

The last wild population of Japanese OWS that inhabited Tajima District including Toyooka City became extinct in 1971. Although a strain[4)] of domestic population was captured there before extinction and attempts of captive breeding continued for about 20 years, they also became extinct without producing any offspring.

The success was brought about in 1989 by a pair of storks transferred from Russia, and since then the size of the captive population grew over 100. This led to the commencement of experimental release in 2005.

The experimental release was conducted based on the Promotion Plan described above. This plan states its basic strategy consisting of 1) maintenance/advancement of genetic diversity, 2) improvement of environment which supply storks their preferable habitat, 3) coordination of relevant organizations, 4) promotion of education for local people, and 5) employment of the method of adaptive management[5)]. It was determined also that science and practice on reintroduction should be done after the experimental release.

Owing to the objectives of reintroduction and based on the history of OWS in Japan, this Grand Design reviews the outcomes of science and/or academic studies on the stork reintroduction during these 5 years, and presents the short-term and mid-term targets that are indispensable to the achievement of a full-fledged reintroduction. The ultimate goal of the stork reintroduction is also given here. It can be positioned as an advanced example of the IUCN[6)] Guidelines for Re-introduction[7)] (IUCN 1998) published in 1995.

This Grand Design is a product mainly of the scientific/academic studies done by HPOWS, and I hope it to be reflected in OWS reintroduction projects in other cities and towns that are in cooperative relationship with HPOWS.

In the process of drawing up this Grand Design "The Oriental White Stork Reintroduction Measures Committee" consisting of academic experts made deliberations in a series of meetings. We are grateful to the members of the committee that provided valuable comments from the viewpoint of their expertise as well as all other persons involved.

Satoshi Yamagishi

Director, Hyogo Park of the Oriental White Stork

The objective of the Oriental White Stork Reintroduction

1. Significance of reintroduction

The Oriental White Stork *Ciconia boyciana* is a large carnivorous avian species that is distributed only in the

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[2] 5-10-1, Shimoyamatedori, Chuo-ku, Kobe, Hyogo Pref., 650-8567 Japan

[3] 128, Shounji, Toyooka, Hyogo Pref., 668-0814 Japan

[4] Graduate School of Regional Resource Management, University of Hyogo/Division of Research, Hyogo Park of the Oriental White Stork, 128, Shounji, Toyooka, 668-0814 Japan

[5] CTI Engineering Co., Ltd. 3-21-1 Nihombashi-Hamacho, Chuoku, Tokyo, 103-8430 Japan

* E-mail: kounotori@stork.u-hyogo.ac.jp

Far East. This species, native to Japan, is positioned at the top of the food-web in the wetland ecosystem[8]. The stork has evolved within the biological community[9] of the Japanese archipelago with intermittent genetic exchange[10] with the continent.

Reintroduction of this extinct wild species has its substantial meaning in promoting recovery of the biological community endemic to Japan, particularly that of Tajima District in the near past and in regaining the healthy ecosystem. The success of this project will supply a clear vision for reintroduction of other endangered species and restoration of regional biological communities, which will lead to sustainable management[11] of the regional ecosystem.

As can be seen in this case, it is indisputable that the real meaning of recovery of biodiversity is the restoration of the biological community that is justified by the history of the region, because organisms have evolved in the regional biological community and the evidence and desirable environmental objectives can only be found in the regional history.

2. Significance of introduction into the human living environment

Re-introductions of avian species so far conducted in other countries were almost all in large area without human habitation, and differ greatly from the case of OWS, the introduction into human living environment. It requires coexistence between humans and storks to which acceptance by the local community is indispensable.

The foraging habitat of OWS is mainly rice paddy fields, for wildlife an alternative to wetlands in the floodplain[12] and hence friction with farmers is unavoidable to a certain level. Thus it is difficult for a local community in the present time to accept the OWS reintroduction unless the cost associated with such friction incurred to the farmers is exceeded by the physical and/or mental benefits that the OWS reintroduction brings about.

The history of rice cultivation in Japan extends back a few thousand years, thus it is assumed that these frictions had historically been resolved through some measures, or farmers might have either accepted the situation or resigned themselves. It means that the reintroduction of OWS is not only a challenge in terms of science but also a challenge that requires advances in awareness and new values for the local people. Projects of engineering on rivers, rice paddy fields, Sato-yama woods and new businesses that promote economy of local communities can boost the challenges.

The positioning of OWS as an iconic symbol that supplies local people the pride and identity of the Tajima District will create new values, bring about economic and spiritual benefits to the community, and thereby promote community development with virtuous cycles both of the environment and economy.

Therefore, reintroduction of the Oriental White Stork is not only an effort for recovery and revitalization of nature but also an effort for community development, and provides a clear vision for the realization of sustainable and reciprocal societies all over the world.

History of the Oriental White Stork (from extinction to protection and reintroduction)

1. Former inhabitation

It is believed that OWS has been an inhabitant of Japan since the ancient time. The footprint of a stork has been discovered (Nara National Research Institute for Cultural Properties 2011) from the ruins of rice paddy fields of the early Yayoi period (about 2,400 years ago). The historical product records (Yasuda 1987) suggest that OWS was widely distributed from Tohoku to Kyushu in Edo period. In Meiji era, reliable breeding records (Blakiston and Pryer 1878, Niwa 1892) are found in several areas of the country.

2. From extinction to protection

After the ban on hunting ended in Meiji era, OWS disappeared from many parts of Japan except for Tajima District in Hyogo Prefecture and Wakasa District in Fukui Prefecture due to overexploitation.

Hyogo Prefectural Government began its efforts to protect OWS under public-private cooperation. And the "Special Natural Monument Oriental White Stork Protection Support Association (later Tajima Oriental White Stork Preservation Association)" was established. However domestic breeding came to an end after the last fledging in Fukui Prefecture in 1961, and the Japanese native OWS population became extinct in 1971.

3. Conservation of species

Hyogo Prefectural Government and Toyooka City

established the Oriental White Stork Aviculture Center (currently Protection and Breeding Center of HPOWS) in 1964 financially supported by the Agency for Cultural Affairs, and have been working on captive protection and breeding (establishment of captive population) of OWS since.

Captive breeding proved to be extremely difficult, and the last wild bird in captivity died in 1986. Tama Zoological Park in Tokyo succeeded in captive breeding for the first time in Japan in 1988, and successful breeding started in 1989 at the Oriental White Stork Aviculture Center by a pair transferred from Russia in 1985.

Due to the increase in size of the captive population, Hyogo Prefectural Government began to develop the OWS Reintroduction Plan in 1992, and started to examine re-introduction of storks into Tajima region, the historical place. The "IUCN Guidelines for Re-introduction" was followed when implementing the project.

4. Towards reintroduction

Hyogo Prefectural Government established HPOWS in 1999 as the key institute of the scientific research for reintroduction. HPOWS has conducted researches and scientific studies on OWS while training storks to fly in the field. Improvement of natural and social environment has been advanced in parallel.

OWS lives near human residence mainly in regions with rice paddy fields. In Tajima District, OWS was called "Tsuru (meaning cranes)" by local people and a popular existence among them, but at the same time regarded by some others as a nuisance ruining rice paddies. Thus, they have long been deeply connected with human livelihood, beloved and despised, and coexisted with people in the region.

The Promotion Plan adopted in 2003 established the fundamental policy, which says "We promote reintroduction of the Oriental White Stork by creating a region where people and nature can coexist, based on the recognition that the environment where storks can live is also safe and secure for humans."

Moreover, just after the establishment of the plan, the Liaison Committee for Reintroduction of Oriental White Stork was established. Under the leadership of the Committee, measures towards sustainable development of the region putting axis on the reintroduction of OWS are being promoted with participation and cooperation of diverse entities including the regional residents, organizations, scientists/scholars and the government.

Inhabitation and extinction in Toyooka region

1. Former environment

1-1) Nest locations

According to the records from 1914 to 1935 (Iwasa 1936a, b) and of 1960s (Matsushima Personal communication), OWS nested on the slope of hills looking down the rice paddy fields (Fig. 1).

Furthermore, all nests were built on red pines taller than 10 m with diameter at breast-height larger than 40 cm (Table 1).

(2) Foraging site

Survey on memories of local people supplies information which suggests that the past wild population used to forage rice paddies, rivers, streams and ditches (Table 2).

(3) Prey animals

Survey on memories of local people revealed that the past wild population used to hunt not only freshwater fish such as loach, crucian, carp, catfish, and eel but also frogs, mud snails and locusts. It indicates that OWS not only captured aquatic animals represented by fish but also wide range of terrestrial animals.

At that time, rice paddies were not yet developed into consolidated farmland, so various freshwater fish could still enter into the paddies for spawning. Verbal evidences from residents stated that "one could hear the sound of loaches going under water in the paddies", thus the amount of prey available at that time could have been enormous and completely different from the current situation.

2. Changes of environment in 1960–70s and reasons of extinction

2-1) Nest locations

The red pines on the hills that were used as nesting trees were largely logged during the World Water II (Sakamoto 1966). However, verbal evidences (Matsushima Personal communication) indicate that the OWS population still all nested on red pines on the hilly slopes from 1960s to 70s.

2-2) Foraging site

There has not been significant change in the landforms or land uses in Toyooka region. The area of rice paddies,

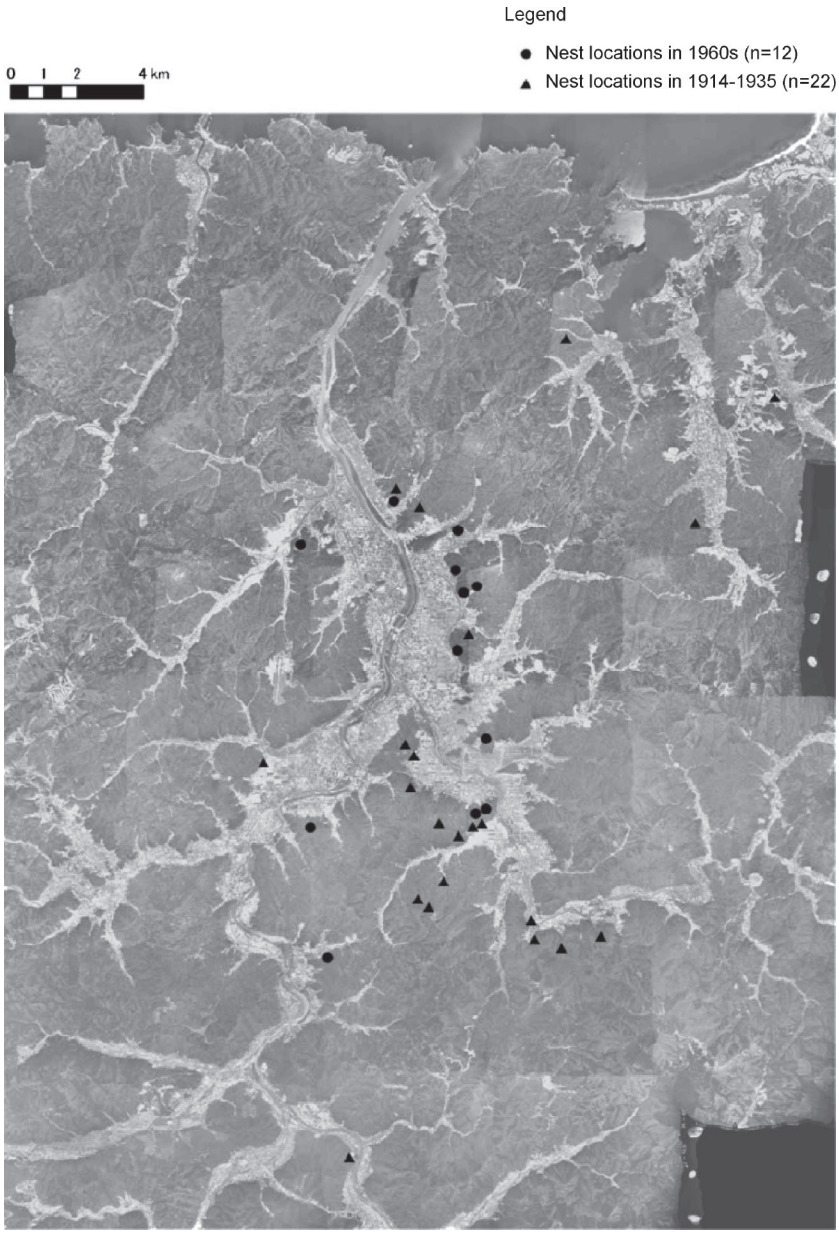

Fig. 1. Nest-site records for the past wild population of the Oriental White Stork.

Table 1. Size of nesting trees, all red pine, for cases recorded in 7 villages in 1958. Names of villages are those in 1958.

	Fukuda	Yamamoto	Kamata	Kamishozakai	Kinashi	Tadachi	Ozaki
Diameter (cm)	57.3	Unknown	47.8	Unknown	66.9	38.2	Unknown
Tree Height (m)	13.5	10.0	11.5	10.0	10.0	12.5	10.0

Table 2. Memories of local people on the habitat and behaviour of the wild stork from 1930's to 1960's. Information was collected by asking local people and multiple answers were given from each person. Blanks indicate impossible combination of habitat and behaviour.

Behaviour	Paddy fields	Rivers	Streams	Ditches	Trees	Power poles	Strange info	Others	Total
Foraging	496	126	40	50			177	43	932
Resting	27	11	1	1	55	0		17	112
Nesting				0	154	9	47	30	240
Others	35	12	1	0	26	2		37	113
Total	558	149	42	51	235	11	224	127	1,397

Table 3. Haplotypes of the Oriental White Stork. There exist 21 haplotypes on the continent and the number of storks that belong to each type are given. Data in the upper two lines for the past wild populations were obtained from skins by Murata *et al*. (2004) and "Toyooka" and "Others" are for captive populations. Blanks indicate zero.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Before1945				1											3	1	1					6
1961–86														11								11
Present	3	43	16	18	30	69				24								2		2	2	237
Toyooka	1	35	1	1	7	26				7								1			2	98
Others	1	5	15	17	16	18				3								1		2		85
Released	8	3			6	10				3												27
Fledged	8				1	15				11												27
	5																					

considered to be the main foraging ground, has not been reduced significantly.

2–3) Uses of pesticide

At the time, strong pesticide was used in large quantities. Some residents have stated that large amount of animals in rice paddies were found dead after the chemical herbicide treatment. It can be suspected that the amount of prey animals was rapidly decreasing. Moreover, a case of OWS anatomy (Muto and Suzuki 1967) evidenced the death cause of the stork to be mercury poisoning.

2–4) Genetic diversity

There are 21 haplotypes[13] so far identified for OWS (Murata et al. 2004). There were at least four haplotypes existing during the period of early Showa to prior to the World Water II (before 1945), but there was only one haplotype just before the extinction (1961–86; Table 3). Thus, the genetic diversity[14] had significantly been reduced over the years.

2–5) Causes of extinction

The above information strongly suggests that the causes that triggered the extinction of OWS were the pesticide contamination of prey animals and losses in genetic diversity. These two causes may not have been necessarily independent from one another, and the first may have influenced the second. In other words, 1) the pesticide contamination of prey animals reduced food for OWS and toxic material accumulated within the bodies of the storks, resulting in lowered breeding rate and increased mortality. As a result, 2) storks reduced in numbers, and genetic deterioration caused by losses in genetic diversity and appearance of detrimental gene due to inbreeding further aggravated the situation.

It is highly probable that by the time the conservation movement started in 1955, OWS was already caught in the spiral of extinction[15].

Research outcomes obtained during the experimental release period

1. Release to breeding

1–1) Experimental release

Twenty-seven storks were released between 2005 and 2010, and among them 5 died, 4 were captured, and 1 went missing since 2009. There exist 17 released storks remaining in Toyooka region at the end of 2010 Fiscal Year (Table 4).

1–2) Settlement of released storks

Most of the released storks have settled in Toyooka. Ten of them left Toyooka for a short period and moved within Japan but returned to Toyooka finally (Fig. 2).

A pair of storks form a territory[16] and their behaviours to defend the areas surrounding their nest sites are frequently observed not only during the breeding season[17] but also during the non-breeding season.

1–3) Breeding out in the fields

The first pair was established in 2006 and laid eggs but did not succeed in breeding. However, in 2007 a pair succeeded in fledging a chick out in the fields for the first time after 46 years from the last breeding in the wild. Thereafter multiple pairs succeed in breeding every year (Table 5).

Table 4. Number of storks released, dead and surviving for each fiscal year.

Category of birds	2005	2006	2007	2008	2009	2010	Total
Released	7	9	5	2	2	2	27
Dead	0	1	0	0	1	3	5
Captured	2	0	1	0	0	1	4
Missing	0	0	0	0	1	0	1
Surviving at the end of FY	5	13	17	19	19	17	17

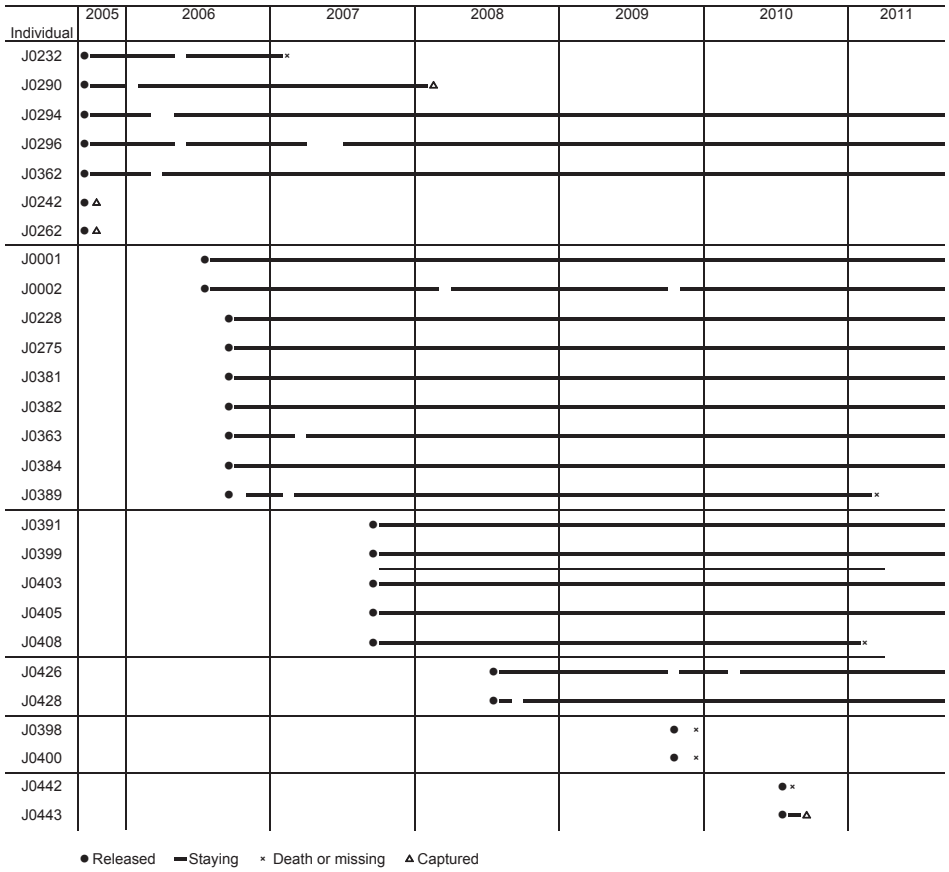

Fig. 2. Stay of released storks within Toyooka Basin. Gaps between solid lines indicate that the bird was absent from Toyooka.

Table 5. Breeding out in the fields.

Number of	2006	2007	2008	2009	2010	Total
Pairs	1	2	5	6	7	–
Eggs	2	6	20	32	33	93
Hatchling	0	2	13	14	18	47
Fledgling	0	1	8	9	9	27

Table 6. Survival of young storks after fledging.

Number of	2006	2007	2008	2009	2010	Total
Fledglings	0	1	8	9	9	27
birds dead	0	0	1	2	2	5
birds missing	0	0	0	1	0	1
Surviving at the end of FY	0	1	8	14	21	21

2. Fledging and formation of the “managed population” out in the fields

2-1) Fledging

Since the first breeding attempt in 2006, 27 chicks fledged out in the fields in 5 years by 2010. Among them 5 have died and one has been missing since January 2010. As of the end of the fiscal year of 2010, 21 storks are surviving out in the fields (Table 6).

2-2) Formation of the “managed population”

A wild male stork suspected to have come from the continent stayed from 2002 to 2006. Since 2006 another wild individual (female) began to fly into Toyooka intermittently. As a result, 17 released storks, 21 individuals that fledged out in the fields, and 1 wild stork, 39 storks

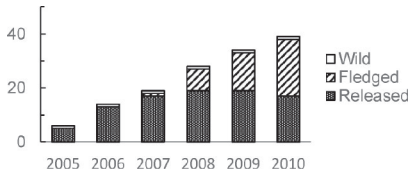

Fig. 3. Changes in number of storks in Toyooka region.

in total form the “managed population” in Toyooka.

In 2009 the wild female and a released male formed a pair, and produced offspring the next year in 2010. It was a milestone event in a sense that new gene were introduced into the gene pool[18] of the domestic OWS population.

Average number of fledglings contributing to the increase of the population size is 5.4/year (27 storks/5 years). On the other hand, the average number of deaths

that reduces population size is 2.0/year (10 storks/5 years). Thus, the population size in Toyooka is gradually increasing (Fig. 3).

3. Social Structure of the Oriental White Stork

3-1) Territory

There is a famous photograph that makes one think that the basic social structure of OWS is flock. It played an important role before the experimental release in motivating the local community towards reintroduction of storks (Fig. 4).

A similar group was recorded in autumn of 2008 and 2009, but it was observed only for one day and 4 days, respectively. Thus, they are now considered to have been temporary "gatherings"[19] but not flocks.

Moreover, most of the storks forming this gathering were evidenced to be young floaters[20] before maturing, younger than 4 years old, due to their leg-bands.

Holding a pair-territory is necessary for breeding. Thus it can be concluded that "the basic social structure of OWS is the territorial system."

Position information of pairs (ARGOS data[21]) were plotted on a map. By using the minimum convex polygon method[22] it was revealed that 90% of the recorded locations within the home range[23] were distributed within a 2 km radius circle from their nests. Thus the size of the territory is supposed to be of a minimum radius of 2 km.

3-2) Distribution of territories

There were 7 territories within Toyooka Basin in 2010. The average distance between nests was 2.7 km. Drawing a 2 km radius circle centering at each nests shows that much of the areas of 5 territories in the Central Toyooka overlapped greatly (Fig. 5). In the breeding season of 2011, 5 territories existed in the Toyooka Basin due to the death of 2 territorial males in February and March of 2011, respectively.

3-3) Situation of self-support and problems

Twelve storks are displayed in an open cage within the estate of HPOWS, kept flightless by regular feather clipping to which fixed amount of live fish is provided every afternoon.

There are free-ranging storks that come to this open cage and take away the food provisioned for the caged storks. By counting number of days in a month each of such kind of storks come to the cage, it has been revealed that not only the floaters but also breeding birds that have territories come to HPOWS frequently during the non-breeding season (Fig. 6).

On the other hand, various stakeholders[24] provide food regularly or intermittently, especially during the breeding season. Thus, the current success of breeding out in the fields is achieved relying on such artificial food supply. In other word, the population have "not yet achieved self-support", and this is the major problem that should be conquered towards full-fledged reintroduction in the future.

Fig. 4. A famous photo, August 1960, at Izushi River in Toyooka, Hyogo Prefecture (provided by Fujikougeisha).

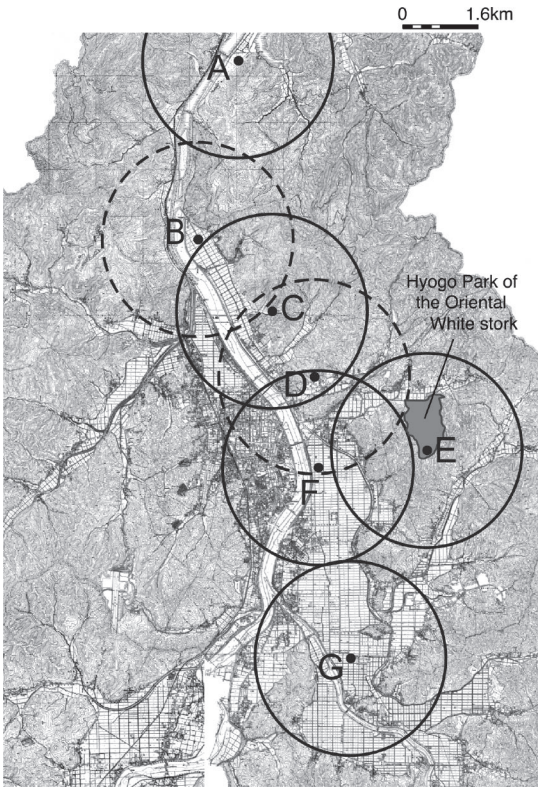

Fig. 5. Distribution of pair territories in 2010. The two circles drawn by dotted lines are the territories disappeared by the end of 2010 due to the death of the pair male.

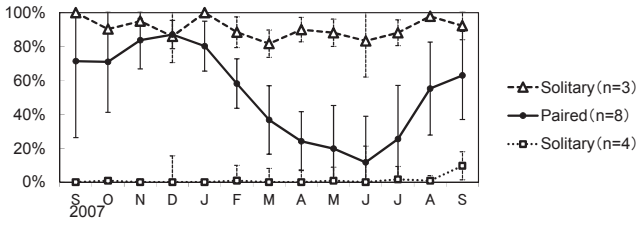

Fig. 6. Seasonal change in dependence on the food provisioning for caged flightless storks by free-ranging storks. Percent of days in a month coming to the cage and foraged are shown for 8 paired birds and 7 solitary birds, 4 of which were not dependent on the feeding.

4. Analysis of nesting site

4-1) Topography and habitat[25]

Past records of OWS as an inhabitant or a migrant is distributed all over Japan. A potential habitat analysis using GIS[26] suggests that the topography necessary for the habitat of OWS includes combination of rivers and rice paddy fields located near the coastline and appropriate interspersion of hills on flatland (Mitsuhashi Unpublished).

Furthermore, habitat analysis in a smaller scale on the past nest distribution in Tajima District has revealed that storks nested in the hilly areas within 500m from the edge of the lowland, defined as a slope of less than 3 degrees.

4-2) Artificial nest-towers as nest site

Wild storks in the past nested on red pines, however when experimental release began numerous artificial nest-towers were prepared by various stakeholders. As a result, 79% of nesting (19/24) was conducted on these artificial nest-towers (Table 7). They clearly contribute to successful breeding, thus it can be said that artificial nest-towers are important nest sites for the storks in the present time, and they can be used hereafter also.

Telegraph poles and electric pylons are often used by storks. However, due to the risk of interference to power supply and also of electrification of storks, nests above power poles are subject to removal as soon as they are found.

Table 7. Frequency distribution of nest sites after the experimental release. Actual number of nests are given.

Nest site	2006	2007	2008	2009	2010	Total
Artificial nest-towers	1	2	4	4	8	19
Above cages	0	0	1	1	0	2
Above power poles	0	0	0	1	2	3

4-3) Foraging habitat

The 1,600 hours of tracking of a wild male stork migrating from the continent in 2002 revealed that time spent in rice paddy fields and rivers occupy 29% and 20 % of total time respectively, thus these two are considered to be important foraging habitats for OWS. He spent most of his time in paddy fields from early spring to summer, and in rivers from autumn to winter (Table 8).

4-4) Prey animals

Although most of the prey (93%) hunted by released storks could not be identified due to general difficulties associated with field observations, part of them (7%) were identified in 1,231 cases, and of them 707 (57%) represented fish and 411 (33%) represented amphibians such as frogs. Furthermore, reptiles (snakes) were recorded in one case and small animals including insects in 112 cases (Table 9). Considering the low probability of identifying small animals, it is possible that invertebrates such as insects are underestimated. Since this result does not contradict with the past memories of the residents, it can be concluded that OWS is a generalist[27] among carnivorous species that takes wide range of animals including not only fish and amphibians but also terrestrial animals.

4-5) Prey abundance

Prey abundance surveys were conducted on biomass[28] in rice paddies, rivers and water ditches from 2001 to 2004. But as the relationship between the prey availability for storks and the biomass is not clear, it is not possible to draw a scientific conclusion on the deficiency of prey availability.

4-6) Reasons of breeding failure

Among 93 eggs laid in the field in five years, 66 eggs did not arrive at fledging because eggs were either infertile, damaged or subject to predation. Fledging rate per egg was 0.29 (27/93) (Table 10).

Table 8. Percent of time spent by a wild stork in each of the foraging habitats. Asterisks are added to major feeding habitats.

Month	Rice paddies	Rivers	Streams	Ditches	Others	Observation time
July 2003	*54.2	2.6	0.0	1.7	41.4	83 h 31 m
Aug 2003	0.0	6.2	0.0	2.7	91.1	67 h 01 m
Sept 2003	14.9	*27.1	4.2	5.5	48.3	68 h 13 m
Oct 2003	5.0	*53.2	0.0	0.0	41.8	127 h 45 m
Nov 2003	16.9	*20.4	0.4	3.1	59.2	227 h 48 m
Dec 2003	16.2	*58.8	0.0	1.1	23.9	193 h 31 m
Jan 2004	22.6	*34.8	0.0	0.0	42.6	206 h 05 m
Feb 2004	*18.8	11.5	0.0	0.6	69.1	198 h 58 m
March 2004	*43.2	4.3	0.1	19.1	33.3	211 h 56 m
April 2004	*20.2	14.7	0.8	29.2	35.2	66 h 41 m
May 2004	*29.1	4.9	0.0	0.0	65.9	31 h 40 m
June 2004	*50.2	11.0	0.0	0.0	38.8	53 h 38 m
July 2004	*82.8	8.1	0.0	0.0	0.9	28 h 49 m
Total	28.8	19.8	0.4	4.8	46.1	1,565 h 36 m

Table 9. Prey animals hunted by released storks. Actual number of prey items are given.

Month	Fishes	Amphibians	Reptiles	Insects, etc.	Others	Total
September	4	4	0	3	121	132
October	4	15	1	31	4,084	4,135
November	10	1	0	0	4,897	4,908
December	291	5	0	26	2,938	3,260
January	291	1	0	16	80	388
February	6	0	0	0	24	30
March	47	4	0	22	1,973	2,046
April	10	3	0	8	169	190
May	43	306	0	6	1,359	1,714
June		36	0	0	97	133
July	1	36	0	0	365	402
Total	707	411	1	112	16,107	17,338

Table 10. Breeding success and mortality factor.

Number of	2006	2007	2008	2009	2010	Total
Eggs laid	2	6	20	32	33	93
Fledglings	0	1	8	9	9	27
Offspring dead	2	5	12	23	24	66
Eggs infertile	0	3	0	1	2	6
Eggs damaged	0	0	2	5	5	12
Eggs depredated	0	0	0	6	2	8
Chicks dead within nest	0	1	4	5	7	17
Chicks depredated	0	0	1	0	0	1
Reason unknown	2	1	5	6	8	22

Among the 44 cases where the causes of death are known, predation is not so high, accounting for about 20% (9/44 eggs). These cases occurred while the parent birds left their nests due to disturbance such as human interference. Predation did not occur while the parents were at their nests.

Furthermore, there were no cases where fledged chicks in the wild were depredated. The 5 cases where the fledglings died had causes such as traffic accidents. There have also been no predation cases among adult birds in this population.

There were two cases of egg damage and one case of chick dying in the nest. These were caused by attacking of nests by neighbouring pairs. It shows that intraspecific

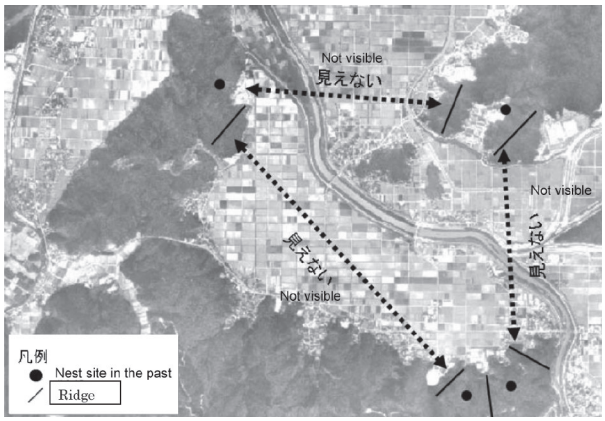

Fig. 7. An example of nest distribution in the past wild population.

aggression of OWS is much violent that can cause death. Such aggressiveness has been recognized among captive population as well, and thus it is possible that intraspecific relationship significantly influence breeding success for the top carnivore like OWS.

4-7) Nest location of neighbours in the past wild population

Past wild population nested on hilly slopes surrounded by small scale ridges, thus it is highly possible that nests were located in a way so that neighbours could not see each other (Fig. 7).

Appropriate positioning of nest locations and territories will be required that alleviates intraspecific aggression of this species.

5. Changes in the perception of local people in Toyooka

5-1) Public perception in 1960–70s

Local people had complicated images about OWS, sometimes recognizing them as nuisance and at other times having positive images represented by "celebratory" or "beautiful." Just before extinction, conservation policies were widely implemented by public and private entities, and such efforts resulted in breaking away from the nuisance image. The positive public image of OWS probably has been strongly influenced by the conservation policy since the 19th century (probably since Edo period).

5-2) 2010 Public Survey

In the survey conducted among the residents of Izu Village of Toyooka in 2010, no respondent had negative images for OWS. About 70% answered that they have images such as "celebratory", "rare", "proud", and "symbolic of ecological recovery."

Furthermore 80% of respondents answered that after the start of nesting by storks in their local area, they began to give more attention to nature in their region and more consideration to their local community, and they became to wish that their children and grandchildren would remain in their region.

Table 11. Trampling of seedlings of rice plant by the Oriental White Stork.

	2005	2006	2007
No of steps in rice paddies (A)	15,594	3,598	6,921
Time spent in rice paddies (B)	657	251	567
Number of seedlings trampled (C)	38	25	17
Probability of trampling (C/A)	1/410	1/144	1/407

This result indicates that communities no longer consider OWS as nuisance and they are now accepting the stork as part of their communities. The existence of storks seems to have created affection and pride for their communities among local people.

5-3) Changes in the perception of farmers

Tajima District Administration office of Hyogo Prefecture, Toyooka City and HPOWS jointly conducted surveys on the trampling of rice plant seedlings from 2005 to 2007 (Toyooka Nourin Suisan Shinko Jimusho 2008). The result revealed that trampling rate is as low as 0.2 to 0.7% (Table 11), and 75% of seedlings trampled recovered to the same level as those not trampled. This scientific result proved that the damage caused by OWS is minimal and is considered to have contributed to alleviating the old perception of the farmers: "OWS is nuisance that trample seedlings of the rice plant."

6. Points of attention for reintroduction based on the outcomes of the experimental release

As experimental release of OWS has been conducted only in Hyogo Prefecture, the fruits, although still limited, is compiled as "Points of Attention for Reintroduction of the Oriental White Stork" (see appendix).

Required conditions and past efforts for successful reintroduction

1. Required conditions for inhabitation of OWS

Hereby we have treated topography, habitat, nest-site, foraging-site, prey-species, prey-availability, predator and genetic diversity as the 8 minimum factors to be considered for achieving inhabitation of OWS. Among them, the biggest problems to be solved in order to achieve success-

Table 12. Temporal change in river wetland area (ha). The values in 2019 are those that planned.

	1898	1950	2002	2005	2007	2009	2019
Existing	281	154	81.3	81.8	72.4	70.7	67.7
For flood control	0	0	0	2.7	39.5	49.6	128.2
For restoration	0	0	0	0	4.2	4.2	27.2
Total	281	154	81.3	84.5	116.1	124.5	223.1

ful reintroduction can be narrowed down to just two; namely prey-availability and genetic diversity. Other factors have not changed since the times of the past wild population; or originally do not have significant impact such as predators; or are not serious problems at least in the present time such as pesticide. Nest-site can be supplied artificially at least in the present time.

1-1) Prey availability

Compared to the time before the age of Land Reclamation Project for rice fields (conducted in 1970s to 80s), OWS's foraging habitats such as shallow waters in rivers, ditches and rice paddies now have much less biomass of prey animals, although available now is only the general empirical fact that aquatic animals represented by freshwater fish have diminished drastically all over Japan since then. It is also the fact, on the other hand that we cannot show any scientific evidences of shortage of food for storks.

The undeniable fact at present is that the existing OWS population is dependent on artificial feeding.

1-2) Genetic diversity

Currently, majority of the captive storks of HPOWS belong to limited number of haplotypes. Furthermore, there is a significant bias in number of individuals from family to family. Thus there is a need to actively exchange storks with institutions within and outside of Japan, and enhance the genetic diversity of the captive population.

Moreover, there is a need to promote scientific analysis of nuclear DNA of OWS where the studies are quite limited. The advance of study in this field will allow us to understand the present state of genetic diversity of OWS and will enable effective enhancement and maintenance of genetic diversity of the captive population.

In turn, it will become the underlying resource to enhance the genetic diversity of the "managed population."

1-3) Intraspecific relationship

The ecological and behavioural information available from the existing population of OWS and the past map of nest distribution suggest that the important factor that should be taken into consideration for the establishment of the genuinely wild population is the conspecifics as competitors, especially the neighbouring breeding pairs.

Table 13. Temporal changes in number of fish ladders for paddy field.

2002	2003	2004	2005	2006	2007	2008	2009
6	50	88	89	93	106	106	106

1-4) Value creation and consensus building

In order to ensure that these required conditions are met, consensus building and cooperation among stakeholders are inevitable. Creation of diverse values revolving around reintroduction of storks can boost such effort, and lead to realization of sustainable society that can coexist with OWS. Then, the important issues are the development of human resources that can cooperate with sympathy for the reintroduction efforts and promotion of community development. Introduction of effective social framework is required also.

2. Past efforts towards reintroduction

Civil engineering projects aiming at nature restoration of rivers, and ecological farming[29] fruiting as brand-rice have helped the establishment of the existing population of OWS.

2-1) River projects

As a result of river projects practiced by the Ministry of Land, Infrastructure, Transport and Tourism and the Govemment of Hyogo Prefecture, river wetland available to storks recovered to 44% of Meiji-era (late 1890s) by 2009. Now there is a plan of increasing the wetland further by 2019 (Table 12).

Fish ladders in rice paddy fields[30] have also been installed (Table 13), and not only fish but also crustacean species are known to use them.

However, there is no evidence if this is contributing to enhance the quantity of prey animals within the paddy fields. Further promotion of measures to increase fish

abundance together with implementation of usual surveys on prey amount is necessary.

2-2) Ecological farming

"Farming Method that helps Oriental White Stork (hereafter, OWS farming method)", one of the ecological farming methods, has been promoted by Toyooka Fisheries Office, Tajima District Administration Office, Hyogo Prefecture and Toyooka Agriculture Improvement Promotion Center. The area of farmland where OWS farming method is applied has been increasing steadily and has reached approximately 350 ha in FY2010 (Table 14). The rice produced by OWS farming method is recognized as an ecological brand rice and has generated a high additional value.

According to the results of the 2008 survey targeting farmers implementing the OWS farming method, farmers find additional value in their agricultural products, giving them a strong incentive to practice the method. Furthermore, almost 90% of the respondents said that they had interests in landing of OWS on their own farmland, or recovery of the healthy ecosystem and nature conservation. It appears that multifaceted and non-economic values are being generated among them.

Based on data of two storks that are almost free from artificial feeding, although there is no significant trend of their landing in the paddy fields with ecological farming (Table 15), storks tend to spend longer time in the fields with ecological farming (Table 16). Perhaps the ecological farming methods can be effective in attracting storks.

Furthermore, significant increase in prey biomass during the summer time was found in rice paddy fields where ecological farming is applied compared to those with conventional farming method[31] (Table 17).

2-3) Social activities

In Toyooka region, efforts towards realization of sustainable society that can coexist with OWS are being pro-

Table 14. Temporal changes in area (ha) of farmland that applies "OWS Farming Method" in Tajima District.

Crop	2003	2004	2005	2006	2007	2008	2009	2010
Rice	0.7	1.8	50.5	111.8	197.7	234.5	278.9	304.4
Soy beans	0.0	0.0	0.0	0.0	0.0	19.0	41.1	52.3

Table 15. Frequency of landing on the paddy field with ecological and conventional methods by 2 released storks. Expected values calculated from the relative area are given in parentheses.

Individual ID	Ecological farming	Conventional farming	Chi-square test
J0363	43 (34)	401 (410)	NS
J0384	67 (54)	523 (536)	NS

Table 16. Time (min.) spent foraging on the paddy field with ecological and conventional methods by 2 released storks. Expected values calculated from the relative area are given in parentheses.

Individual ID	Ecological farming	Conventional farming	Chi-square test
J0363	2,124 (1,283)	14,780 (15,621)	$P<0.001$
J0384	1,709 (1,246)	11,820 (12,283)	$P<0.001$

Table 17. Number of species, density (/0.75m^2) and biomass (mg) of aquatic animals found in paddy fields with different farming methods.

Method	May		June		July	
	Species/density	Biomass	Species/density	Biomass	Species/density	Biomass
Conventional	15/314	1,011	16/875	3,370	155/664	2,774
Ecological						
Pesticide-reduced	9/9,699	13,677	9/6,316	15,584	15/2,555	7,219
Pesticide-free	8/2,456	1,773	11/6,518	15,845	15/7,678	9,772

moted, and positive cycles are to be generated between environment and economy.

(1) Consensus building

"Liaison Committee for Reintroduction of the Oriental White Stork" established in 2003 is consisted of 28 institutions/organizations based on the recognition that reintroduction is an issue that has to be addressed by community as a whole, and provides a platform for stakeholders to jointly address the issues of nature recovery and restoration.

(2) Value creation

Coverage of OWS by media increased the visibility of the name "Toyooka."

Since the start of experimental release, HPOWS attracted 300,000 visitors annually, and OWS has become an influential resource of tourism for the local community. According to a study by an environmental economist (Onuma and Yamamoto 2009), the economical effect of OWS tourism in Toyooka is estimated as approximately 1 billion yen per year, contributing greatly to the regional economy. Since many of the visitors are repeaters, this effect is expected to continue into the future. The reintroduction of OWS are considered as a good example where conservation of biodiversity and economy are well balanced.

(3) Establishment of new lifestyles and cultures

Interactions with OWS has promoted various activities among people to revisit natural environment surrounding them: e.g. rice paddy fields and Satoyama woods (secondary woods characteristic to Japan).

There are many people who observe the released storks and collect their own records. There are people that conduct surveys of aquatic organisms in wetlands and rice paddy fields. Moreover, abandoned fields with poor economic value are now being developed into habitats of OWS through cooperation between the local community and organizations outside of Toyooka.

These civil activities are the results of the new relationship between humans and nature that was promoted by reintroduction project. It can be said that new lifestyles and new cultures are being created with the reintroduction of OWS.

(4) Advertisement

Through a number of conferences and meetings, many researchers and stakeholders from within and outside of Japan joined together in Toyooka, where the fruits of OWS reintroduction and the project itself have been broadcasted widely.

(5) Change of view in local people

Various local organizations such as administration offices and parties of local people have been praised and received prizes for their contribution to the development of community and/or to conservation of environment. These external evaluations are thought to be generating pride and affection among local people for their native places.

Target Setting

In accordance with IUCN's guidelines which state that "re-introductions are generally long-term projects that require the commitment of long-term financial and political support", and based on the scientific fruits obtained so far, the future targets towards full-scale reintroduction of OWS is set as follows.

1. **Short-term Target "Establishment of a stable and genuinely wild population and its management"**

1-1) Maintenance of the stork population in Toyooka Basin and captive population

The breeding pairs and their territories (7 pairs) established during the experimental release period should be maintained.

(1) Among the 7 pairs that bred in 2010, males of 2 pairs died. Current floaters in the field are young birds before maturation. Thus, releases of adult male storks are needed soon.

(2) For the release, appropriate birds should be selected from the captive population of HPOWS, the genetic diversity of which should be maintained through exchanges with other institutions having captive storks.

(3) Wild or the managed populations always have the risk of drastic reduction in number due to environmental changes. Hence sustainable management of captive population is important.

1-2) Gradual escape from artificial feeding

As the current managed population is dependent on the artificial feeding both in individual maintenance[32] and breeding, it cannot be called a "genuinely wild population." It is required to attempt gradual escape from the

artificial feeding. Currently, the relationship between shortage of prey animals and dependency on artificial feeding is not clear. But, appropriate strategy should be adopted that brings about improvement in prey availability for storks by civil engineering as well as doing feeding operations as described below.

(1) Changes of the feeding method for the captive birds in the open cage where flightless storks are displayed (and free-ranging birds visit to forage every day)

(2) Stop of feeding to a specified pair that started at the time of the experimental release

(3) Clarifying the food availability to the storks in the current foraging habitats (e.g. paddy fields, rivers) and improving the feeding environment based on the scientific concepts and skills of ecological engineering[33]. To be more precise, select a river system as a model case, and distribute breeding and refugee sites for aquatic animals represented by fresh-water fish so as to allow them to move freely between rivers and paddy fields, and then the prey animal populations are made sustainable. It will also be needed to cope with conservation and restoration of wetland ecosystems on the landscape level.

1-3) Appropriate arrangement of territories

Nest-towers now are located in a way that results in significant overlaps between territories in the central region of Toyooka. Thus, nests and territories should be rearranged appropriately.

(1) Appropriate arrangement of territories that leads to decrease of intraspecific aggression

The home range of OWS is at least an area of 2km radius circle from the nest. The arrangement of territories that does not generate overlapping of territories should be examined.

(2) Experimental and gradual movement of nest-towers

Artificial nest-towers should be moved towards the hillside, the place where wild storks nested in the past. By that practice pairs of the neighboring nests cannot see each other directly.

The two kinds of efforts mentioned above (escape from artificial feeding and territory rearrangement) require careful discussions and agreement with various kinds of stakeholders that have supported the experimental release practiced by HPOWS and the managed stork population. It is clear that appropriate monitoring is required with those practices. The results of monitoring should become available for scientific feedback which will then lead to further planning and practice of adaptive management.

1-4) Expanding from Toyooka region population to Tajima District population

In order to establish stable and genuinely wild population, current breeding population limited to Toyooka Basin should be expanded to the surrounding areas. The nest distribution before 1930s represented in the past map will suggest us a lot in establishing the local populations in Tajima District. The current number of pairs can be doubled to 14 to 15 pairs when the population is successfully expanded. The historical nest locations are considered as potential nest sites. The efforts to establish new breeding pairs in these areas will be practiced in cooperation with the regional stakeholders.

1-5) Joint research for establishment of breeding populations outside of Hyogo Prefecture

In order to arrive at the mid-term target mentioned below, of establishing breeding populations in the areas outside of Hyogo Prefecture, HPOWS will promote joint research based on science with other regional entities.

1-6) Sustainable human resource development

The reintroduction project so far has been supported not only by the administration offices but also various stakeholders functioning in Toyooka region. In order to ensure achievement of the future targets, it is required to keep active participation of these human resources and at the same time educate future leaders. The research institutions such as HPOWS together with various stakeholders will need to cooperate to establish some educational organizations that grow up the career of reintroduction in the future, and continuously reproducing human resources.

1-7) Creation of a system of wisdom for community development

It is necessary to exchange diverse knowledge for developing local communities that allow coexistence with nature, by taking advantage of the wide range of networks between researchers, engineers and specialists held by HPOWS. Creation of a system of wisdom original for each locality is to be structured.

1-8) Promotion of consensus building

Methods of building consensus among stakeholders will be developed while implementing the efforts mentioned above.

2. **Mid-term Target "Establishment of a domestic meta-population structure of storks"**

Following the establishment of a stable Tajima District population within Hyogo Prefecture, expected is the establishment of multiple breeding populations in regions outside of Hyogo Prefecture.

2-1) Establishment of domestic meta-population

A meta-population is defined as "a group of spatially separated populations of a same species that are linked genetically by intermittent individual exchanges." Like the wild female that flew from the continent and was incorporated into the current gene pool of Toyooka Basin population, individual storks from other populations join a population once in a few years. This will lead to enhancement of genetic diversity of the population, and at the same time the different populations maintain a unity that shares common characters of the species. The existence of spatially isolated populations and genetic exchanges among them lead to sustainable existence of a species.

2-2) Promotion of potential habitat analysis

According to the historical records of migrating and breeding storks, and the results of potential habitat analysis, it is possible that new populations are established in other regions of this country. The breeding grounds can be either regions where multiple pairs have their territories in a group, or only a pair breeds spatially isolated from other populations.

Further analysis of potential habitats will make it possible to scientifically determine which of the two targets (group or single) to be set for each region. But, this will become possible only after the decisions and preparations are made by the implementing agency of the region where the new population is to be established. And negotiations with the Agency for Cultural Affairs that manages OWS as the national natural monument is indispensable.

It is hoped that the joint researches by HPOWS with regions outside of Hyogo, included in the achievement of the short-term target, will become the milestone for achieving this mid-term target.

Goal of Reintroduction

1. Establishment of a stable meta-population structure

Undoubtedly, the standard goal of reintroduction is the "establishment of a stable meta-population structure." When new populations are established in many regions, making the Toyooka Basin population as the domestic source[34], intermittent genetic exchange with continental population will naturally occur, which will lead to establishment of the meta-population structure connecting the continent and Japan.

2. Realization of a sustainable local community that coexists with the Oriental White Stork

The societal goal of the reintroduction project is "realization of a sustainable local community that coexists with OWS." Continuous production of diverse values around OWS through collecting the wisdom of diverse stakeholders such as the community residents, organizations, academic experts, governments and non-profit organizations, etc. will lead to an appropriate balance between nature recovery/restoration and community development. This will lead to establishment of a sustainable community that coexists with OWS.

3. Oriental White Stork to become a common species

The goal of reintroduction is to make OWS, currently classified as Category IA (critically endangered) (Ministry of Environment 2002) under the Law for the Conservation of Endangered Species of Wild Fauna and Flora, and is at a risk of extinction worldwide (IUCN 2011), to become a common species. This may cause some transformation in Tajima District, especially in Toyooka, where OWS has become an icon and a symbol for pride of the region owing to its rareness. Although the transformation certainly is a result of the glorious success of reintroduction, this problem will have to be overcome sometime in the future. Of course it is needless to say that the first successful reintroduction of OWS will be engraved in history as the pride of Hyogo Prefecture and Tajima District centered upon Toyooka City. The science and practice aiming at reintroduction and conservation of OWS practiced in Tajima District so far is a challenging attempt, not only domesti-

cally but also internationally. If OWS becomes a common species one day, the history and the efforts by the people concerned will shine gloriously more than ever before.

Concluding Remarks

March 2013 is the 60th year anniversary since the designation of OWS to national natural monument in March 1953.

There are only few scientific studies on wild populations of OWS and thus its ecology is still not known very well. The design of reintroduction of OWS thus cannot but use adaptive management approach as was described in the promotion plan.

It should be noticed finally that in making up this Grand Design we needed to refer to so many affairs: ecology and behaviour of OWS that were evidenced for the first time after the experimental release, societal/environmental changes caused by many kinds of improvements, and awareness raising activities implemented in parallel with the reintroduction project. Adaptive management approach can be based solely on the evaluation of what has been done before. Plans are to be promoted in future by feeding back the knowledge and evaluating results so far achieved and accumulated.

Glossary

1) Oriental White Stork Reintroduction Promotion Plan–Formulated by the "Liaison Committee for Reintroduction of the Oriental White Stork" (chaired by the Director General of the Tajima District Administration Office of the Hyogo Prefecture), in order to establish the basic principles for the reintroduction of the Oriental White Stork and set out the direction for promoting the effort
2) re-introduction–An attempt to introduce a species in an area which was once part of its historical distribution range, but from which it has been extirpated or become extinct
3) population–A group of organisms of a species that interbreed and live in an area
4) strain–A group of individuals across generations that are related genetically
5) adaptive management–A framework to improve a methodology through setting a target, implementing experimental trials to achieve the target, and assessing the result
6) IUCN (International Union for Conservation of Nature and Natural Resources)–A global conservation network established in order to make political recommendations, promote awareness raising activities and assist conservation organizations for conservation of natural environment and realization of sustainable use of natural resources
7) Guidelines for Re-introduction–Policy guidelines drafted by the Re-introduction Specialist Group of the IUCN's Species Survival Commission (SSC) in response to the increasing occurrence of re-introduction projects worldwide, and consequently, to the growing need for specific policy guidelines to help ensure that the re-introductions achieve their intended conservation benefit, and do not cause adverse side-effects of greater impact
8) ecosystem–Ecological concept of nature that compares biological community and its abiotic environment as a material circulation system
9) biological community–A group of organisms living in a specific area connected through diverse relationships represented by the prey-predator interaction
10) genetic exchange–Flow of genes through mating
11) sustainable management–Sustainable conservation and management
12) floodplain–Plains or wetlands created by sediment deposits caused by flooding of rivers
13) haplotype–In a narrow sense, it represents mitochondrial DNA polymorphism. The mitochondrial DNA is stable because of no recombination, thus haplotype is utilized to reveal the maternal linkage of a group
14) genetic diversity–Diversity among individuals of the same species of organisms from the perspective of genetics
15) spiral of extinction–The process of extinction progress in a spiral manner while multiple elements intertwine with each other
16) territory–An area defended by an individual or a group of animals
17) breeding season–A season when an animals mate, build nests, lay eggs (or give birth) and care for their offspring
18) gene pool–A whole body of genes that can be mixed

in a region. A population is considered to be a group of genes

19) flock and gathering–A spatial assemblage of two or more individuals with unified behaviour is a flock, and one without that is a gathering

20) floater–Solitary individuals that live close to the breeding territory or in other areas

21) ARGOS data–A database of location data, etc. which are transferred from transmitters (attached to storks) to polar orbit satellites and receiving stations, which can be utilized through internet

22) minimum convex polygon method–A method to define an area by linking the outermost recorded positions of animals

23) home range–An area of inhabitation where an individual animal moves around usually

24) stakeholder–Individuals and organizations that have vested interests or are socially related

25) habitat–Place and its environment that an individual or a population use for living, in general it has a specific spatial structure that is unique to each species

26) GIS (Geographic Information System)–A technology that enables integrated management and processing, and visual display of data with location information (spatial data), enabling advanced analysis and quick decision making

27) generalist–It is also called an euryphagous animal. An animal that feed on variety of organisms

28) biomass–Quantity of organisms in an area represented by weight or volume

29) ecological farming–A farming method with more than 30% reduction of chemical fertilizers and pesticides compared to the conventional farming in order to promote sustainability of natural cyclic functions of farming while reducing the impacts of them to the environment

30) paddy field fish ladder–A ladder for fish installed on water channels so that fish can run into paddy fields. It is installed in order to conserve the biodiversity of fish, etc. in the paddy field areas

31) conventional farming method–A general farming method in terms of quantity and frequency of fertilizers and pesticides utilized by majority of producers in the region

32) individual maintenance–Maintaining a condition in which an individual animal can maintain its health and behave in a normal manner

33) ecological engineering –Concepts and skills that contribute to improvement of environment for organisms taking advantage of ecological theories and civil engineering

34) source–A population where the number of individuals increase in the meta-population and that becomes the origin for spreading of individuals into other populations

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Appendices

Points of Attention for Reintroduction of the Oriental White Stork

Objectives

Following points of attention were compiled based on the systematic knowledge gained through the experience of OWS experimental release in Hyogo Prefecture. Please note that those who wish to apply them will have to discuss thoroughly with Hyogo Prefecture and obtain permission from the Agency for Cultural Affairs and the Ministry of Environment.

Locational Requirement

1. Historical inhabitation records

It is desirable to select historical nesting sites

2. Flight records of the Oriental White Stork

It is desirable that there are landing records of wild individuals or individuals released from other regions

3. Natural Environment

The following conditions will have to be met

3-1) Potential

(1) Topographic condition

There should be topographic characteristics that meet the conditions for the settlement of the Oriental White Stork

(2) Habitat condition

There should be spatial structures that offer nesting, feeding and roosting sites within the area with the topographic conditions outlined in a)

(3) Enough evidential information should be available for determining a) and b)

3-2) Potential for improvements (possibility of improving the environmental potential)

(1) There should be plans to establish preferable nest sites

(2) There should be plans to improve foraging conditions and to increase the food availablity through civil engineering methods

4. Social environment

The following conditions have to be met

4-1) Understanding and cooperation of the public should be obtained for coexistence with the Oriental White Stork

4-2) Ecological farming aiming at enhancement of biodiversity is being promoted

4-3) Adequate environmental education for enhancement of biodiversity and conservation of rice paddy ecosystem is being conducted

4-4) Adequate cooperation with local government is available for promotion of reintroduction

4-5) Adequate cooperation with scientists represented by professional ecologists is available for promotion of reintroduction

Action Plan

Short and mid-term action plans need to be developed for release, settlement, breeding, population management, environmental improvement, establishment of social system, etc.

Funding

The following types of funding need to be assured with a long time span

1) Funding for improvement of environment

2) Funding for stork transportation

3) Funding for establishment and maintenance of release bases (in case of the soft-release)

4) Funding for captive breeding, habituation and treatment of storks

5) Funding for monitoring storks out in the fields

6) Funding for promotion of coexistence with the local community including environmental education

7) Funding for securing human resources and training

Human Resources

The following human resources need to be secured

1) Personnel for captive breeding and habituation

2) Personnel for capturing and rescuing storks

3) Personnel for research and data analysis

4) Personnel for joint promotion with communities including environmental education

Facilities

The following facilities should be prepared as needed

1) Captive breeding facility and that as the release point in some cases

It is desirable that there are wetlands or paddy fields

with ecological farming as the foraging ground existing in the vicinity of the facility
2) Habituation facility
3) Rescue facility
4) Research and data analysis facility

Knowledge and Technologies

The implementing entity of reintroduction will need to acquire the following knowledge and techniques in an organized manner. Trainings should be offered from specialized institutions (Hyogo Park of the Oriental White Stork (HPOWS), Tama Zoological Park of Tokyo) and government organizations (Toyooka City, etc.)

1) Knowledge and techniques for captive breeding and habituation
2) Knowledge and techniques for capture
3) Knowledge and techniques for retention
4) Knowledge and techniques for monitoring
5) Knowledge and techniques for data analysis
6) Knowledge and techniques for cooperation with regional community

Legislative Procedures

The Oriental White Stork is being protected as national natural monument under the Law for Protection of Cultural Properties (Agency for Cultural Affairs), and as critically endangered species under the Law for the Conservation of Endangered Species of Wild Fauna and Flora (Ministry of Environment). Transportation, captive breeding, release, capture or management of storks in the reintroduction efforts require legal permission in advance

Process of the development of the Grand Design for the Oriental White Stork Reintroduction (by the Oriental White Stork Reintroduction Megsures Committee)

February 23, 2011: The First Meeting on
- · Results of experimental release and its evaluation
- · Full-fledged reintroduction (establishment of sustainable wild population)

April 19, 2011: The Second Meeting on
- · Outline of the Grand Design
- · Establishment of quantitative targets

May 10, 2011: The Third Meeting on
- · Preliminary draft of the Grand Design

June 27, 2011: The Fourth Meeting on
- · Draft of the Grand Design

Operational Guidelines of the Oriental White Stork Reintroduction Measures Committee

(Establishment)

Article 1 The Oriental White Stork Reintroduction Measures Committee (hereinafter referred to as the "Conference") shall be established in order to make deliberations regarding scientific knowledge on the reintroduction of the Oriental White Storks implemented by the Hyogo Park of the Oriental White Stork and promote full-fledged reintroduction

(Functions)

Article 2 The Committee shall make deliberations on the following matters:
(1) Matters related to the principles of releasing the Oriental White Stork
(2) Guidance and advices for captive breeding and release of the Oriental White Stork
(3) Other matters necessary to realize full-fledged reintroduction of the Oriental White Stork

(Organization)

Article 3 The Committee shall be consisted of 10 members or less listed in the attached table
2. The members of the Committee are those with academic expertise and are appointed by the Superintendent of Education, Hyogo Prefectural Board of Education

(Chair)

Article 4 A Chair shall be assigned for the Committee
2. The Chair shall be selected from the members of the Committee
3. The Chair shall oversee the activities of the Committee and represent the Committee
4. In cases where there were accidents to the Chair or when the Chair is absent, a member appointed by the Chair in advance will replace the Chair in undertaking his/her duties.

(Meetings)

Article 5 Meetings shall be convened by the Chair
2. Persons other than the members of the Committee shall be requested to participate in the meetings in

cases where the Chair determined it necessary.

(Honorarium)

Article 6 Honorarium, specified separately, shall be provided when a member engaged in duties of the Committee including its meetings.

(Travel Expenses)

Article 7 Travel expenses, specified separately, shall be provided to members when attending meetings or traveling in order to engage in duties of the Committee

(Administrative Matters)

Article 8 Administrative matters of the Committee shall be conducted by the Division of Social Education of the Hyogo Prefectural Board of Education, in cooperation with the Hyogo Park of the Oriental White Stork.

(Auxiliary Provision)

Article 9 Items not listed above and those that need to be specified for the operation of the Committee shall be defined separately.

Supplementary Provisions

(Effective Date)

1. This operational guidelines shall become effective as of January 1, 2011.

(Expiration of the guidelines)

2. This operational guidelines shall expire as of December 31, 2011.

(Special clause for convening meetings)

3. The first meeting to be convened under these operational guidelines shall be convened by the Chief of Division of Social Education of the Hyogo Prefectural Board of Education, regardless of provision in the first paragraph of Article 5.

Member List of the Oriental White Stork Reintroduction Measures Committee

Hiroaki Iwaisaki, Kyoto University
Shuichi Kitoh, University of Tokyo
Shingo Miura, Waseda University (Chair)
Kiyoshi Nagai, Tama Zoological Park, Tokyo
Yoshihiro Hayashi, Yamashina Institute for Ornithology
Yukihiro Shimatanai, Kyushu University
Shigeru Yasuda, Hyogo Institute of Agricultural and Fishery Community
Yoshihiro Yamamoto, Hyogo College of Medicine